



# MEGATAXA

4

## Untold diversity: the astonishing species richness of the Notodelphyidae (Copepoda: Cyclopoida), a family of symbiotic copepods associated with ascidians (Tunicata)

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## Table of Contents

Abstract.....	5	Genus <i>Notopterophorus</i> Leuckart, 1859.....	135
Introduction.....	6	<i>Notopterophorus micropterus</i> Sars G. O., 1921.....	136
Material and Methods.....	7	<i>Notopterophorus auritus</i> (Thorell, 1859).....	142
Systematics.....	7	<i>Notopterophorus elongatus</i> Buchholz, 1869.....	142
Diagnosis of family Notodelphyidae Dana, 1853.....	7	<i>Notopterophorus papilio</i> Hesse, 1864.....	142
<i>Bathynotodelphys</i> gen. nov. ....	8	<i>Notopterophorus glabrus</i> sp. nov. ....	142
<i>Bathynotodelphys defayae</i> gen. et sp.nov. ....	9	Genus <i>Gunenotophorus</i> Buchholz, 1869.....	145
<i>Pronotodelphys</i> gen. nov. ....	13	<i>Gunenotophorus globularis</i> Buchholz, 1869.....	145
<i>Pronotodelphys caledonica</i> gen. et sp. nov. ....	14	<i>Gunenotophorus spinipes</i> Schellenberg, 1922.....	148
Genus <i>Notodelphys</i> Allman, 1847.....	18	<i>Gunenotophorus antennularis</i> sp. nov. ....	151
<i>Notodelphys agilis</i> Thorell, 1859.....	19	Genus <i>Botachus</i> Thorell, 1859.....	154
<i>Notodelphys allmani</i> Thorell, 1859.....	20	Key to genera of “ <i>Botachus</i> group”.....	155
<i>Notodelphys aurantiaca</i> Stock, 1970.....	23	<i>Botachus cylindratus</i> Thorell, 1859.....	155
<i>Notodelphys caerulea</i> Thorell, 1859.....	26	Supplementary description of female associated with <i>A. mentula</i>	
<i>Notodelphys echinata</i> Monniot C., 1961.....	26	from Le Havre (Atlantic). ....	155
<i>Notodelphys elegans</i> Thorell, 1859.....	31	Supplementary description of female associated with <i>Ascidia</i>	
<i>Notodelphys prasina</i> Thorell, 1859.....	33	<i>muricata</i> from Corsica. ....	155
<i>Notodelphys reducta</i> Illg & Dudley, 1961.....	33	Supplementary description of male associated with <i>A. mentula</i>	
<i>Notodelphys tenera</i> Thorell, 1859.....	36	from Corsica. ....	158
<i>Notodelphys parva</i> Schellenberg, 1922.....	36	<i>Botachus major</i> sp. nov. ....	158
<i>Notodelphys steinitzi</i> Stock, 1967.....	37	Genus <i>Goniodelphys</i> Buchholz, 1869.....	163
<i>Notodelphys weberi</i> Stock, 1950.....	41	<i>Goniodelphys indica</i> sp. nov. ....	163
<i>Notodelphys cuspis</i> sp. nov. ....	44	<i>Goniodelphys nosybensis</i> sp. nov. ....	168
Genus <i>Paranotodelphys</i> Schellenberg, 1922.....	48	Genus <i>Notopterophoroides</i> Schellenberg, 1922.....	171
<i>Paranotodelphys saccata</i> Stock, 1967.....	48	<i>Notopterophoroides armadillo</i> Schellenberg, 1922.....	171
<i>Paranotodelphys scutiformis</i> Schellenberg, 1922.....	49	<i>Notopterophoroides baliense</i> sp. nov. ....	178
<i>Paranotodelphys nodulosa</i> sp. nov. ....	53	<i>Notopterophoroides quadridentatum</i> sp. nov. ....	179
<i>Paranotodelphys polycarpae</i> sp. nov. ....	57	<i>Notopterophoroides tripartitum</i> sp. nov. ....	182
<i>Paranotodelphys stenosa</i> sp. nov. ....	61	<i>Notopterophoroides deplanatum</i> sp. nov. ....	185
<i>Paranotodelphys bidentata</i> sp. nov. ....	61	<i>Ooishillgia</i> gen. nov.....	188
<i>Paranotodelphys bisetata</i> sp. nov. ....	64	<i>Ooishillgia tokiokai</i> (Ooishi and Illg, 1973) comb. nov. ...	188
<i>Paranotodelphys tuberculata</i> sp. nov. ....	69	Genus <i>Microra</i> Monniot C., 1983.....	191
<i>Paranotodelphys patagonica</i> sp. nov. ....	72	<i>Microra angulata</i> Monniot C., 1983.....	191
<i>Paranotodelphys molgulae</i> sp. nov. ....	76	Genus <i>Periproctia</i> Stock, 1967.....	194
Genus <i>Notodelphyopsis</i> Schellenberg, 1922.....	79	<i>Periproctia stocki</i> sp. nov. ....	194
<i>Notodelphyopsis falcifera</i> Schellenberg, 1922.....	80	<i>Periproctia acutirostris</i> sp. nov. ....	197
<i>Notodelphyopsis longicaudata</i> sp. nov. ....	82	<i>Periproctia latirostris</i> sp. nov. ....	202
<i>Notodelphyopsis gemina</i> sp. nov. ....	85	<i>Periproctia bisetigera</i> sp. nov. ....	203
<i>Notodelphyopsis deplanata</i> sp. nov. ....	89	<i>Periproctia spissa</i> sp. nov. ....	206
Genus <i>Pygodelphys</i> Illg, 1958.....	92	<i>Periproctia angusta</i> sp. nov. ....	209
<i>Pygodelphys antarctica</i> (Schellenberg, 1922).....	93	<i>Periproctia obtusa</i> sp. nov. ....	211
<i>Pygodelphys novaeseelandiae</i> (Schellenberg, 1922).....	96	<i>Periproctia longirostris</i> sp. nov. ....	214
<i>Pygodelphys inflata</i> sp. nov. ....	98	<i>Periproctia biunguifera</i> sp. nov. ....	217
<i>Pygodelphys chilensis</i> sp. nov. ....	101	<i>Periproctia spinata</i> sp. nov. ....	220
Genus <i>Pachypygus</i> Sars G. O., 1921.....	105	<i>Periproctia horrida</i> sp. nov. ....	223
<i>Pachypygus gibber</i> (Thorell, 1859).....	105	<i>Periproctia onchopodata</i> sp. nov. ....	227
<i>Pachypygus macer</i> Illg, 1958.....	110	<i>Periproctia hexachaetata</i> sp. nov. ....	228
<i>Pachypygus curvatus</i> Ooishi, 1961.....	114	<i>Periproctia laticaudata</i> sp. nov. ....	231
<i>Pachypygus tumidus</i> sp. nov. ....	117	<i>Periproctia obtusispinata</i> sp. nov. ....	235
<i>Pachypygus tenuirostris</i> sp. nov. ....	120	<i>Periproctia robusta</i> sp. nov. ....	236
<i>Pachypygus papillosus</i> sp. nov. ....	123	Genus <i>Bonnierilla</i> Canu, 1891.....	239
<i>Pachypygus exilis</i> sp. nov. ....	126	<i>Bonnierilla acollaris</i> Schellenberg, 1922.....	239
<i>Pachypygus stomozae</i> sp. nov. ....	129	<i>Bonnierilla altera</i> Stock, 1967.....	242
<i>Pachypygus bisetiger</i> sp. nov. ....	132	<i>Bonnierilla mollia</i> Ho, 1984.....	245
		<i>Bonnierilla similis</i> Illg & Dudley, 1961.....	247

<i>Bonnierilla iboensis</i> sp. nov. ....	250	<i>Notopygus</i> gen. nov. ....	391
<i>Bonnierilla reniformis</i> sp. nov. ....	254	<i>Notopygus unispinatus</i> gen. et sp. nov. ....	391
<i>Bonnierilla eurypodata</i> sp. nov. ....	258	<i>Notopygus trispinatus</i> gen. et sp. nov. ....	395
<i>Bonnierilla rugosa</i> sp. nov. ....	261	<i>Notopygus minutispinatus</i> gen. et sp. nov. ....	399
<i>Bonnierilla tenuipedis</i> sp. nov. ....	264	<i>Chelipygus</i> gen. nov. ....	400
<i>Bonnierilla cheliphora</i> sp. nov. ....	264	<i>Chelipygus bulbosus</i> gen. et sp. nov. ....	403
<i>Bonnierilla tahitiensis</i> sp. nov. ....	269	<i>Chelipygus dinardensis</i> gen. et sp. nov. ....	406
<i>Bonnierilla quadridens</i> sp. nov. ....	272	Genus <i>Sesir</i> Stock, 1967 .....	409
<i>Bonnierilla dinardensis</i> sp. nov. ....	275	<i>Sesir parvipes</i> Stock, 1967 .....	409
<i>Nobinerilla</i> gen. nov. ....	278	<i>Sympygus</i> gen. nov. ....	410
<i>Nobinerilla alata</i> gen. et sp. nov. ....	279	<i>Sympygus punctatus</i> gen. et sp. nov. ....	413
<i>Nobinerilla filipes</i> (Stock, 1967) comb. nov. ....	279	<i>Vaoda</i> gen. nov. ....	416
<i>Nobinerilla exilipes</i> gen. et sp. nov. ....	285	<i>Vaoda depressa</i> gen. et sp. nov. ....	416
<i>Nobinerilla mammillata</i> gen. et sp. nov. ....	285	<i>Gosbia</i> gen. nov. ....	420
<i>Nobinerilla ovata</i> gen. et sp. nov. ....	290	<i>Gosbia pusilla</i> gen. et sp. nov. ....	421
<i>Nobinerilla minuta</i> gen. et sp. nov. ....	293	Genus <i>Thoracodelphys</i> Stock, 1967 .....	421
<i>Nobinerilla paucisetata</i> gen. et sp. nov. ....	296	<i>Thoracodelphys tertius</i> sp. nov. ....	424
Genus <i>Doropygopsis</i> Sars, 1921 .....	299	<i>Thoracodelphys quadriseta</i> sp. nov. ....	427
<i>Doropygopsis novemsetifera</i> (Schellenberg, 1922) ....	299	<i>Thoracodelphys longiseta</i> sp. nov. ....	427
Genus <i>Doropygella</i> Sars, 1921 .....	303	<i>Thoracodelphys depressa</i> sp. nov. ....	432
<i>Doropygella thorelli</i> (Aurivillius, 1882) .....	303	<i>Thoracodelphys caledonica</i> sp. nov. ....	435
<i>Doropygella calla</i> sp. nov. ....	307	<i>Thoracodelphys papuensis</i> sp. nov. ....	438
<i>Doropygella corsensis</i> n. sp. ....	310	Genus <i>Bysone</i> Stock & Humes, 1970 .....	441
Genus <i>Doropygus</i> Thorell, 1859 .....	313	<i>Bysone brevicaudatus</i> sp. nov. ....	441
Group A (maxillule with 4 setae on exopod and 3 setae on endopod) .....	313	<i>Bysone bidens</i> sp. nov. ....	444
<i>Doropygus globosus</i> Jones, 1974 .....	313	Genus <i>Lonchidiopsis</i> Vanhöffen, 1917 .....	447
<i>Doropygus kerguelensis</i> Schellenberg, 1922 .....	319	<i>Lonchidiopsis hartmeyeri</i> Vanhöffen, 1917 .....	447
<i>Doropygus tuberculatus</i> sp. nov. ....	323	<i>Lonchidiopsis replicata</i> sp. nov. ....	451
<i>Doropygus reticulatus</i> sp. nov. ....	326	Genus <i>Remex</i> Monniot C., 1983 .....	454
<i>Doropygus caribbensis</i> sp. nov. ....	329	<i>Remex obesus</i> Monniot C., 1983 .....	454
<i>Doropygus tenuicaudatus</i> sp. nov. ....	332	<i>Doroixys</i> -group of genera .....	458
<i>Doropygus gracilis</i> sp. nov. ....	336	Genus <i>Doroixys</i> Kerschner, 1879 .....	459
<i>Doropygus adenensis</i> sp. nov. ....	339	<i>Doroixys uncinata</i> Kerschner, 1879 .....	460
Group B (maxillule with 3 setae on exopod and endopod) .....	339	<i>Doroixys ooishiae</i> sp. nov. ....	463
<i>Doropygus antarcticus</i> sp. nov. ....	339	<i>Doroixys manadoensis</i> sp. nov. ....	463
<i>Doropygus martiniquensis</i> sp. nov. ....	344	<i>Doroixys acutirostris</i> sp. nov. ....	466
<i>Doropygus elongatus</i> sp. nov. ....	347	<i>Doroixys parvicaudata</i> sp. nov. ....	469
<i>Doropygus rotundus</i> sp. nov. ....	350	<i>Doroixys atlantica</i> sp. nov. ....	472
Group C (maxillule with 4 setae on exopod and 2 setae on endopod) .....	353	<i>Doroixys amicta</i> sp. nov. ....	475
<i>Doropygus pulex</i> Thorell, 1859 .....	353	<i>Doroixys gryphina</i> sp. nov. ....	478
<i>Doropygus nasutus</i> sp. nov. ....	357	<i>Doroixys nodulosa</i> sp. nov. ....	478
<i>Doropygus monniotorum</i> sp. nov. ....	361	<i>Doroixys fijiensis</i> sp. nov. ....	483
<i>Doropygus leptobranchius</i> sp. nov. ....	364	<i>Doroixys obesa</i> sp. nov. ....	486
<i>Doropygus flexus</i> Gotto, 1975 .....	367	<i>Doroixys pilosa</i> sp. nov. ....	486
<i>Doropygus humilis</i> Stock, 1967 .....	369	<i>Doroixys bifurcata</i> sp. nov. ....	491
<i>Doropygus parahumilis</i> sp. nov. ....	371	<i>Pentachaetus</i> gen. nov. ....	494
<i>Doropygus breviuncinatus</i> sp. nov. ....	374	<i>Pentachaetus spinatus</i> gen. et sp. nov. ....	494
<i>Doropygus rectiuncinatus</i> sp. nov. ....	376	<i>Pentachaetus palauensis</i> gen. et sp. nov. ....	498
<i>Doropygus pinguis</i> Ooishi, 1962 .....	382	<i>Pentachaetus longisetatus</i> gen. et sp. nov. ....	498
<i>Doropygus depressus</i> Stock, 1967 .....	382	<i>Diceratus</i> gen. nov. ....	503
Group D (maxillae with 3 setae on exopod and 2 setae on endopod) .....	385	<i>Diceratus unidentatus</i> gen. et sp. nov. ....	503
<i>Doropygus corsu</i> sp. nov. ....	385	<i>Prodoixys</i> gen. nov. ....	506
<i>Doropygus callosus</i> sp. nov. ....	388	<i>Prodoixys antarctica</i> gen. et sp. nov. ....	507
		<i>Prodoixys bathybia</i> gen. et sp. nov. ....	510
		<i>Notoixys</i> gen. nov. ....	510
		<i>Notoixys heardensis</i> gen. et sp. nov. ....	512

<i>Notoixys hirsuta</i> gen. et sp. nov. ....	515	Brief description of female associated with <i>Eudistoma</i> sp. in Madagascar. ....	610
<i>Notoixys ovata</i> gen. et sp. nov. ....	517	Genus <i>Janstockia</i> Boxshall & Marchenkov, 2005 .....	614
<i>Notoixys planiceps</i> gen. et sp. nov. ....	520	<i>Janstockia clavelinae</i> sp. nov. ....	614
<i>Borixys</i> gen. nov. ....	523	<i>Janstockia dasicephala</i> sp. nov. ....	616
<i>Cystixys</i> gen. nov. ....	523	Genus <i>Ooneides</i> Chatton & Brément, 1915 .....	619
<i>Cystixys globosa</i> gen. et sp. nov. ....	524	<i>Ooneides californica</i> sp. nov. ....	619
Genus <i>Loboixys</i> Ooishi, 2006.....	527	<i>Hamaticoxa</i> gen. nov. ....	621
<i>Loboixys sibogae</i> sp. nov. ....	528	<i>Hamaticoxa nuda</i> gen. et sp. nov. ....	621
<i>Loboixys pilosa</i> sp. nov. ....	530	<i>Adrodelphys</i> gen. nov. ....	621
<i>Loboixys palauensis</i> sp. nov. ....	533	<i>Adrodelphys tectifera</i> gen. et sp. nov. ....	623
<i>Loboixys similis</i> sp. nov. ....	536	<i>Phyllodelphys</i> gen. nov. ....	623
<i>Loboixys tetramera</i> sp. nov. ....	539	<i>Phyllodelphys capensis</i> gen. et sp. nov. ....	625
<i>Ammonixys</i> gen. nov. ....	539	<i>Lissodelphys</i> gen. nov. ....	627
<i>Ammonixys quadridens</i> gen. et sp. nov. ....	541	<i>Lissodelphys guadeloupensis</i> gen. et sp. nov. ....	628
<i>Ctenixys</i> gen. nov. ....	542	<i>Lissodelphys tahitiensis</i> gen. et sp. nov. ....	629
<i>Ctenixys pusilla</i> gen. et sp. nov. ....	544	<i>Nodoscarus</i> gen. nov. ....	631
Genus <i>Demoixys</i> Illg & Dudley, 1961 .....	547	Key to species of <i>Nodoscarus</i> gen. nov. ....	631
<i>Demoixys depressa</i> sp. nov. ....	547	<i>Nodoscarus bretoni</i> gen. et sp. nov. ....	633
<i>Demoixys compressa</i> sp. nov. ....	549	<i>Nodoscarus curvus</i> gen. et sp. nov. ....	635
<i>Demoixys cornuta</i> sp. nov. ....	551	<i>Nodoscarus scutatus</i> gen. et sp. nov. ....	636
<i>Ademoixys</i> gen. nov. ....	554	<i>Nodoscarus rectus</i> gen. et sp. nov. ....	636
<i>Gallincola</i> gen. nov. ....	554	<i>Nodoscarus latirostris</i> gen. et sp. nov. ....	638
<i>Gallincola bisetatus</i> gen. et sp. nov. ....	555	<i>Nodoscarus dakarensis</i> gen. et sp. nov. ....	642
<i>Gallincola major</i> gen. et sp. nov. ....	555	<i>Nodoscarus compressus</i> gen. et sp. nov. ....	642
<i>Scoliosoma</i> gen. nov. ....	558	<i>Nodoscarus senisetatus</i> gen. et sp. nov. ....	645
<i>Scoliosoma haplomerosum</i> gen. et sp. nov. ....	560	<i>Nodoscarus quadrisetatus</i> gen. et sp. nov. ....	645
<i>Scoliosoma dimerosum</i> gen. et sp. nov. ....	563	<i>Haplostatus</i> Illg & Dudley, 1961.....	645
<i>Contoura</i> gen. nov. ....	566	<i>Haplostatus dakarensis</i> sp. nov. ....	646
<i>Contoura globosa</i> gen. et sp. nov. ....	566	<i>Chilodelphys</i> gen. nov. ....	648
<i>Contoura elliptica</i> gen. et sp. nov. ....	568	<i>Chilodelphys cerasta</i> gen. et sp. nov. ....	648
<i>Unimeria</i> gen. nov. ....	570	<i>Scaridelphys</i> gen. nov. ....	650
<i>Unimeria longipedata</i> gen. et sp. nov. ....	570	<i>Scaridelphys papillata</i> gen. et sp. nov. ....	650
<i>Mecodelphys</i> gen. nov. ....	572	<i>Scaridelphys deplanata</i> gen. et sp. nov. ....	650
<i>Mecodelphys edentatus</i> gen. et sp. nov. ....	572	<i>Socotradelphys</i> gen. nov. ....	653
Genus <i>Campopera</i> Schellenberg, 1922 .....	574	<i>Socotradelphys unipedata</i> gen. et sp. nov. ....	653
<i>Campopera magellanica</i> sp. nov. ....	575	<i>Aplodelphys</i> gen. nov. ....	653
<i>Campopera caribbensis</i> sp. nov. ....	577	<i>Aplodelphys conica</i> gen. et sp. nov. ....	654
<i>Tubipedia</i> gen. nov. ....	580	Genus <i>Achelidelphys</i> Lafargue & Laubier, 1977 .....	655
<i>Tubipedia anisocladia</i> gen. et sp. nov. ....	580	<i>Achelidelphys bifida</i> sp. nov. ....	656
<i>Procampodelphys</i> gen. nov. ....	582	Discussion.....	657
<i>Procampodelphys bidentatus</i> gen. et sp. nov. ....	583	Acknowledgements.....	657
<i>Procampodelphys nodosus</i> gen. et sp. nov. ....	586	References.....	657
<i>Procampodelphys unipedatus</i> gen. et sp. nov. ....	586		
<i>Janius</i> gen. nov. ....	588		
<i>Campodelphys</i> gen. nov. ....	590		
<i>Campodelphys hirsutus</i> gen. et sp. nov. ....	591		
<i>Campodelphys bullatus</i> gen. et sp. nov. ....	591		
<i>Campodelphys stocki</i> gen. et sp. nov. ....	597		
<i>Campodelphys ancylcephalus</i> gen. et sp. nov. ....	598		
<i>Campodelphys seticoxus</i> gen. et sp. nov. ....	600		
Genus <i>Scolecodes</i> Illg, 1958.....	603		
<i>Scolecodes pugetensis</i> sp. nov. ....	603		
<i>Scolecodes rectus</i> sp. nov. ....	605		
<i>Scolecodes helcinus</i> sp. nov. ....	608		
Brief description of female associated with <i>Eudistoma</i> sp. in New Caledonia.....	608		

## Abstract

Detailed study of the Monniot collection of copepods belonging to the family Notodelphyidae has revealed an extraordinary diversity of novel taxa. With rare exceptions notodelphyids live in association with ascidians and the Monniot collection was built up over several decades of field collecting and taxonomic research on the ascidian hosts by Drs Claude & Françoise Monniot (MNHN, Paris). This paper describes a total of 178 new species of notodelphyids from ascidian hosts and 37 new genera are established: *Bathynotodelphys*

**gen. nov.**, *Pronotodelphys* **gen. nov.**, *Ooishillgia* **gen. nov.**, *Nobinerilla* **gen. nov.**, *Notopygus* **gen. nov.**, *Chelipygus* **gen. nov.**, *Sympygyus* **gen. nov.**, *Vaoda* **gen. nov.**, *Gosbia* **gen. nov.**, *Pentachaetus* **gen. nov.**, *Diceratus* **gen. nov.**, *Prodoroixys* **gen. nov.**, *Notoixys* **gen. nov.**, *Borixys* **gen. nov.**, *Cystixys* **gen. nov.**, *Ammonixys* **gen. nov.**, *Ctenixys* **gen. nov.**, *Ademoixys* **gen. nov.**, *Gallincola* **gen. nov.**, *Scoliosoma* **gen. nov.**, *Contoura* **gen. nov.**, *Unimeria* **gen. nov.**, *Mecodelphys* **gen. nov.**, *Tubipedia* **gen. nov.**, *Procampodelphys* **gen. nov.**, *Janius* **gen. nov.**, *Campodelphys* **gen. nov.**, *Hamaticoxa* **gen. nov.**, *Adrodelphys* **gen. nov.**, *Phyllodelphys* **gen. nov.**, *Lissodelphys* **gen. nov.**, *Nodoscarus* **gen. nov.**, *Diblastus* **gen. nov.**, *Chilodelphys* **gen. nov.**, *Scaridelphys* **gen. nov.**, *Socotradelphys* **gen. nov.**, and *Aplodelphys* **gen. nov.** Prior to this study the Notodelphyidae comprised exactly 200 valid species classified in 46 genera, a mean species richness of 4.3 species per genus. After the addition of the new taxa described here, the family now comprises 378 species in 83 genera, a mean species richness of 4.6 species per genus. Generic diagnoses are provided for all genera represented in the collection and the availability of a wider range of taxa has allowed certain generic boundaries to be better defined, resulting in transfers of species between genera and the recognition of 16 new combinations. A further 51 existing species are also reported, and brief supplementary notes or full redescriptions are provided as appropriate.

**Key words:** taxonomy, new genera, new species, ascidian hosts, symbiotic copepods

## Introduction

The family Notodelphyidae was established by Dana in 1853 but notodelphyids discovered in the second half of the nineteenth and early twentieth centuries were placed into a total of three different families. Brady (1878) established the Doropyginae as a new subfamily to accommodate the genera *Doropygus* Thorell, 1859, *Botachus* Thorell, 1859 and *Notopterophorus* Leuckart, 1859. Brady characterised the Notodelphyinae as having dorsoventrally flattened bodies, six expressed urosome somites in both sexes, 10- to 15-segmented antennules (geniculate in the male), and caudal rami armed with long plumose setae. In contrast, he characterised the Doropyginae as having more-or-less bilaterally compressed bodies, short 8- to 10-segmented antennules (non-geniculate in the male), and curved caudal rami armed with small spines. In his landmark studies on the fauna of Norway, Sars (1921) accepted both these taxa at the family level, although he noted a “rather close relationship” between them. He included only two genera in the Notodelphyidae: *Notodelphys* Allman, 1847 and *Agnathaner* Canu, 1892, whereas he recognized a total of ten genera in the Doropygidae: *Bonniერიella* Canu, 1891, *Botachus*, *Doropygus*, *Doropygopsis* Sars, 1921, *Doropygella* Sars, 1921, *Goniodelphys* Buchholz,

1869, *Gunenotophorus* Buchholz, 1869, *Doroixys* Kerschner, 1879, *Notopterophorus*, and *Pachypygyus* Sars, 1921. Schellenberg (1922) recognized the notodelphyid affinities of *Lonchidiopsis* Vanhöffen, 1917 and created additional new genera including *Notodelphyopsis* Schellenberg, 1922, *Notopterophoroides* Schellenberg, 1922, *Paranotodelphys* Schellenberg, 1922, and *Campopera* Schellenberg, 1922. Lang (1948) continued to recognize both the Doropygidae and Notodelphyidae as valid families. However, in his important review, Illg (1958) did not accept the family Doropygidae as valid and he included all genera previously assigned to this family in the Notodelphyidae.

The third family was the Ophioseididae proposed by Chatton & Brément (1915) to accommodate taxa characterised by more highly transformed bodies and by the lack of at least one pair of mouthparts. They included only three genera in their new family, *Ophioseides* Hesse, 1864, *Brementia* Chatton & Brément, 1915, and *Ooneides* Chatton & Brément, 1915. New genera were added subsequently including *Prophioseides* Chatton & Brément, 1915 and *Scolecimorpha* Sars, 1926 however, Illg (1958) recognized that this proposed family was a heterogeneous assemblage that could not be considered to represent a monophyletic group, and he therefore included the genera previously placed in the Ophioseididae as members of the Notodelphyidae. More recent discoveries of intermediate new genera, such as *Pholeterides* Illg, 1958 and *Haplostatus* Illg & Dudley, 1961, provide additional evidence in support of Illg’s (1958) conclusion.

Stock (1993) established a new subfamily, the Adenaplostomatinae, of the family Ascidiolidae to accommodate a new monotypic genus, *Adenaplostoma* Stock, 1993, based on material from a compound ascidian, *Didemnum hiopaa* Monniot C. & Monniot F., 1987, collected in New Caledonia. Boxshall & Halsey (2004) transferred *Adenaplostoma* to the Notodelphyidae, and the subfamily Adenaplostomatinae is not recognized, becoming a synonym of the Notodelphyidae.

The modern treatment of the family Notodelphyidae became firmly established after Illg’s (1958) revision and the inclusion of the known genera previously assigned to the Notodelphyidae, the Doropygidae and the Ophioseididae. Illg (1958) recognized a total of 28 genera as valid and considered two further genera, *Salpicola* Richiardi, 1880 and *Ophioseidus* Bate, 1864, to be indeterminable. [Subsequently Bocquet & Stock (1961) considered that the correct name of the latter was *Ophioseide* Hesse, 1864.] The family has grown considerably, with Boxshall & Halsey (2004) listing a total of 46 valid genera. Two of these, *Agnathaner* and *Kystodelphys* Monniot C., 1963, are based on males which is problematic given that the vast majority of the descriptive studies of notodelphyid species are based on the females. One species of *Agnathaner*, *A. minutus* Canu, 1892, was shown by Hippeau-Jacquotte (1980) to be the atypical male stage of *Pachypygyus*

*gibber* (Thorell, 1859). Four other genera were listed as genera inquirenda in Boxshall & Halsey (2004); *Campopera*, *Dysgenopsyllus* Nicholls, 1944, *Salpicola* and *Sphaerotherylacus* Sluiter, 1884.

Notodelphyids are typically found living in association with solitary and compound ascidians. Many notodelphyid species are considered to be commensals, inhabiting the pharynx or atrium of their ascidian host and, presumably, sharing the food material brought in by the host. In a few cases where the host-symbiont relationship has been more thoroughly investigated the notodelphyid can be considered to be parasitic, such as *Kystodelphys drachi* Monniot C., 1963 which is known only from males that are found within cysts in the branchial circulatory sinuses of its hosts. Similarly, the highly transformed vermiform *Scolecodes huntsmani* (Henderson, 1930) lives in the subendostylar blood vessels of its hosts, surrounded by a cyst of host origin (Dudley, 1968).

Notodelphyids exhibit variable levels of host specificity: many species are restricted to a single host species but others have been reported from numerous species belonging to different host families (Illg & Dudley, 1961). Most notodelphyids occur in solitary ascidians but Dudley & Solomon (1966) provided a key to the species described by that time from compound ascidian hosts. Rarely notodelphyids occur on octocorals: one species each of *Thoracodelphys* Stock, 1967, *Paranotodelphys*, *Demoixys* Illg & Dudley, 1961 and *Bysone* Stock & Humes, 1970 were described from the octocoral *Rhytisma fulvum* (Forskål, 1775) (as *Parerythropodium fulvum*) by Stock & Humes (1970).

## Material and Methods

The copepod specimens examined in this study were collected by Claude and Françoise Monniot (Museum National d'Histoire Naturelle, Paris) during their decades of distinguished systematic research on ascidians. The ascidian hosts of these copepods were collected during research campaigns undertaken all over the world. The copepods were extracted from their hosts and then stored in the MNHN collections and kindly made available for study by Danielle Defaye (MNHN). All collected copepods were preserved in 70–80% ethanol. For microscopic observation, the copepods were immersed in lactic acid for at least 10 minutes and dissected. Dissected appendages were observed using the reverse slide method of Humes & Gooding (1964). Drawings were made with the aid of a microscope equipped with a drawing apparatus. Lengths of copepod specimens and measurements of appendages are mostly based on a single dissected specimen of each species. Body lengths were measured along the middle axis of body. The lengths of the appendage segments are the average of the longest and shortest margins. Type and some other voucher specimens have been deposited in the

Museum National d'Histoire Naturelle, Paris: copepod registration numbers have the prefix MNHN-IU. Host names were provided by Claude and Françoise Monniot and have been cross checked against those in WoRMS (WoRMS Editorial Board, 2020). Some individual ascidian hosts are stored in the MNHN, Paris and their registration numbers have the prefix MNHN-IT.

The terminology adopted in this paper follows Huys & Boxshall (1991), although some minor modifications have been made to take into account the transformations in body morphology exhibited within the Notodelphyidae. Illg (1958) discussed at some length the composition of the prosome and urosome exhibited within the family, highlighting how some genera displayed a more gymnoplean construction (with the fifth pedigerous somite incorporated into the prosome) while others appeared typically podoplean (with the fifth pedigerous somite forming the first division of the urosome). The most striking apomorphy for the family is the expansion of the fourth pedigerous somite, the posteriormost somite of the prosome in the Podoplea, to form a dorsal brood pouch in the female, within which the developing eggs are incubated. The following fifth pedigerous somite, ancestrally the first urosomite in the Podoplea, is at least partially incorporated into the brood pouch on the dorsal side in all notodelphyid females and is completely fused in many. Even partial incorporation into the brood pouch obscures the ancestral prosome-urosome articulation. As a result the observable urosome in notodelphyid females is commonly 5-segmented, comprising the genital somite and four free abdominal somites. We refer to this tagma in females as the free urosome; the male retains the typical 6-segmented urosome found across the Podoplea. The term metasome is used for the tagma comprising the first to fourth pedigerous somites, especially when these somites are partly or completely fused.

## Systematics

### Diagnosis of family Notodelphyidae Dana, 1853

Body form of adult female varying from cycloform with fourth pedigerous somite expanded to form brood pouch to highly transformed, vermiform or globular and lacking expressed external segmentation. Cephalosome and first to third pedigerous somites primitively free. Fourth pedigerous somite typically inflated dorsally and laterally forming large internal brood pouch overhanging urosome dorsally: brood pouch at least partly incorporating fifth pedigerous somite. Pedigerous somites often partially or completely fused and containing expanded internal brood pouch in vermiform taxa. Urosome up to 6-segmented in female; genital and first abdominal somites free, or fused to form genital double-somite; abdomen varying from 4 free somites to completely fused and incorporated into

unsegmented trunk. Genital apparatus comprising single copulatory pore on ventral surface of genital somite or double-somite and paired gonopores on dorsolateral surface. Male typically cyclophiform with 4 free pedigerous somites in prosome plus 6-segmented urosome: genital apertures paired, located on ventral surface of genital somite. Caudal rami primitively with 6 setae.

Rostrum typically well developed, often forming fleshy lobe; reduced in some taxa. Antennule varying from 15-segmented to unsegmented lobe; segmental homologies (based on *Notodelphys allmani* Thorell, 1859): segment 1 (I-II) double, segment 2 (III-V) compound, segment 3 (VI-XI) compound, segment 4 (XII-XIV) compound, segment 5 (XV-XVI) double, segments 6 (XVII) to 14 (XXV) free, apical segment (XXVI-XXVIII) compound. Male antennule primitively geniculate with 2 compound segments distal to geniculation representing XXI-XXIII and XXIV-XXVIII; secondarily non-geniculate in many genera. Labrum variable. Antenna with coxa and basis separate or fused; endopod rarely 3-segmented, typically 2-segmented due to fusion of ancestral second and third segments; first segment with 1 seta, second with up to 5 setae, third with curved distal claw plus up to 5 setae; exopod represented by 1 or 2 setae on outer margin of basis, or absent; antenna often reduced, sometimes lacking. Mandible biramous, comprising coxa typically with well developed gnathobase and distal palp; palp consisting of basis armed with 1 seta, 2-segmented endopod, and indistinctly 4-segmented exopod or with exopodal segments fused; exopodal setation formula 1, 1, 1, 2 setae or reduced; endopodal segments 1 and 2 with maximum of 4 and 10 setae, respectively. Mandible sometimes lacking palp or completely absent. Maxillule biramous, comprising 3-segmented protopod bearing 1-segmented exopod and 2-segmented endopod; precoxa with well developed arthrite bearing up to 10 elements; coxa with endite bearing 1 seta and 2 setae on outer surface of segment representing epipodite; basis with group of up to 4 setae, representing endites; endopod armed with up to 7 setae; exopod armed with up to 4 setae. Maxillule often reduced, sometimes lacking. Maxilla 5-segmented; syncoxa armed with groups of 4, 1, 2, 3 setae representing praecoxal and coxal endites; basis with well developed claw plus 1 or 2 setae; endopod 3-segmented; armed with 1, 1, 4 elements; setation often reduced. Maxilliped primitively 3-segmented; syncoxal setation formula 0, 0, 5, 5; basis with 1 large seta; endopod 1-segmented and armed with maximum of 1, 3 elements. Maxilliped often reduced or absent in transformed genera.

Swimming legs 1 to 4 biramous, typically with 3-segmented rami and joined by intercoxal sclerites. Legs 1 to 4 often reduced, sometimes absent in genera with transformed females; legs forming fleshy processes in *Bremenia*-group of genera. Inner seta on basis of leg 1 and inner coxal seta on legs 1 to 4 primitively present. Spine and seta formula typically as follows (based on *Notodelphys allmani*):

	Coxa	Basis	Exopod	Endopod
leg 1	0-1	1-1	I-1; I-1; III,I,4	0-1; 0-1; 1,2,3
leg 2	0-1	1-0	I-1; I-1; III,I,5	0-1; 0-2; 1,2,3
leg 3	0-1	1-0	I-1; I-1; III,I,5	0-1; 0-2; 1,2,3
leg 4	0-1	1-0	I-1; I-1; II,I,5	0-1; 0-2; 1,2,2

Setation elements of all legs often reduced or lost in transformed genera; legs 1 to 4 sometimes lacking in females. Female fifth leg 2-segmented, comprising protopodal segment with outer basal seta and exopodal segment bearing up to 2 setae. Male fifth leg 2-segmented, comprising protopodal segment bearing outer basal seta and exopod with 2 setae. Leg 6 represented by 2 setae on genital operculum of female; by 3 setae on genital operculum of male. Eggs retained inside dorsal/dorsolateral incubatory pouch formed by modification of fourth pedigerous somite; incubatory pouch often expanded throughout first to fourth pedigerous somites.

**Remarks.** The family Notodelphyidae includes all genera previously assigned to the Notodelphyidae, the Doropygidae and the Ophioseididae, as well as the genus *Adenaplostoma* (formerly placed in the Ascidicolidae as a monotypic subfamily by Stock, (1993)). Currently the family comprises exactly 200 valid species classified in a total of 46 valid genera (Walter & Boxshall, 2020). It also contains numerous taxa inquirenda. For example, in a series of papers Hesse (1866a, b; 1869) alone described 21 species of *Doropygus* from the coast of France, all of which were classed as indeterminable by Illg (1958).

### *Bathynotodelphys* gen. nov.

**Diagnosis.** Female body bilaterally compressed with internal brood pouch extending from anterior margin of fourth pedigerous somite backwards, out over anterior half of urosome. Fifth pedigerous somite incorporated into brood pouch of female. Free urosome 5-segmented in female consisting of genital somite and 4 abdominal somites; 6-segmented in male. Rostrum well-developed, plate-like. Female antennule 9-segmented: segmental fusion pattern I-II, III-XI, XII-XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV, XXV, XXVI-XXVIII. Male antennule 10-segmented; non-geniculate, segmental fusion pattern I-II, III-XI, XII, XIII, XIV, XV-XVI, XVII, XVIII-XX, XXI-XXIII, XXIV-XXVIII. Antenna consisting of coxa, basis, and 3-segmented endopod bearing terminal claw; exopod represented by 1 large and 1 minute seta. Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and 4 and 10 setae on first and second segments, respectively. Maxillule with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented with 2 or 3 setae on first segment and 4 setae on second. Maxilla indistinctly 6-segmented, but with precoxa and



coxa separated by incomplete suture; enditic formula 4, 1, 2, 3; basis with claw plus 2 setae; 3-segmented endopod with setal formula 1, 1, 4. Maxilliped 3-segmented and armed with 9 or 10 setae on first segment, 1 on second and 4 on third. Legs 1–4 biramous with 3-segmented rami; armature formula:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 consisting of protopod fused with somite and well-developed free exopodal segment armed with 2 elements (1 spine and 1 seta).

**Type species.** *Bathynotodelphys defayae* gen. et sp. nov. by original designation.

**Etymology.** The generic name is a combination of *Bath-* (“deep” in Greek) and the existing generic name *Notodelphys*. It refers to the deep-water habitat of the new genus.

**Remarks.** This new genus exhibits numerous plesiomorphies, many of which are shared with the genus *Archinotodelphys* Lang, 1949. However, in possessing an internal brood pouch in the female and a free exopod of leg 5 armed with only 2 armature elements, the new genus cannot be placed in the family Archinotodelphyidae. Its affinities lie more strongly with the Notodelphyidae. The new genus shares many similarities with the type genus *Notodelphys* Allman, 1847, but the retention of a 3-segmented endopod of the antenna is a major difference, since species of *Notodelphys* are characterised by a 2-segmented endopod in which the ancestral second and third endopodal segments are fused to form a compound distal segment. This is a significant difference which supports the establishment of the new genus to accommodate *B. defayae* gen. et sp. nov., described below. The incomplete fusion of the precoxa and coxa of the maxilla, as exhibited by the new species, is an additional plesiomorphic state relative to that exhibited by species of *Notodelphys* which is characterised by the fusion of the precoxa and coxa of the maxilla to form a syncoxa.

***Bathynotodelphys defayae* gen. et sp. nov.**

(Figs. 1–3)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21212), paratypes (intact 6 ♀♀ and 2 ♂♂, MNHN-IU-2014-21213), and dissected paratypes (1 ♀ and 1 ♂) from *Culeolus anonymus* Monniot F. & Monniot C., 1976, Vema Cruise, Argentine Basin, South Atlantic (44°33’S, 49°19’W), “Vema”, Stn V 17–81, depth 5329–5332 m, 27 May 1961.

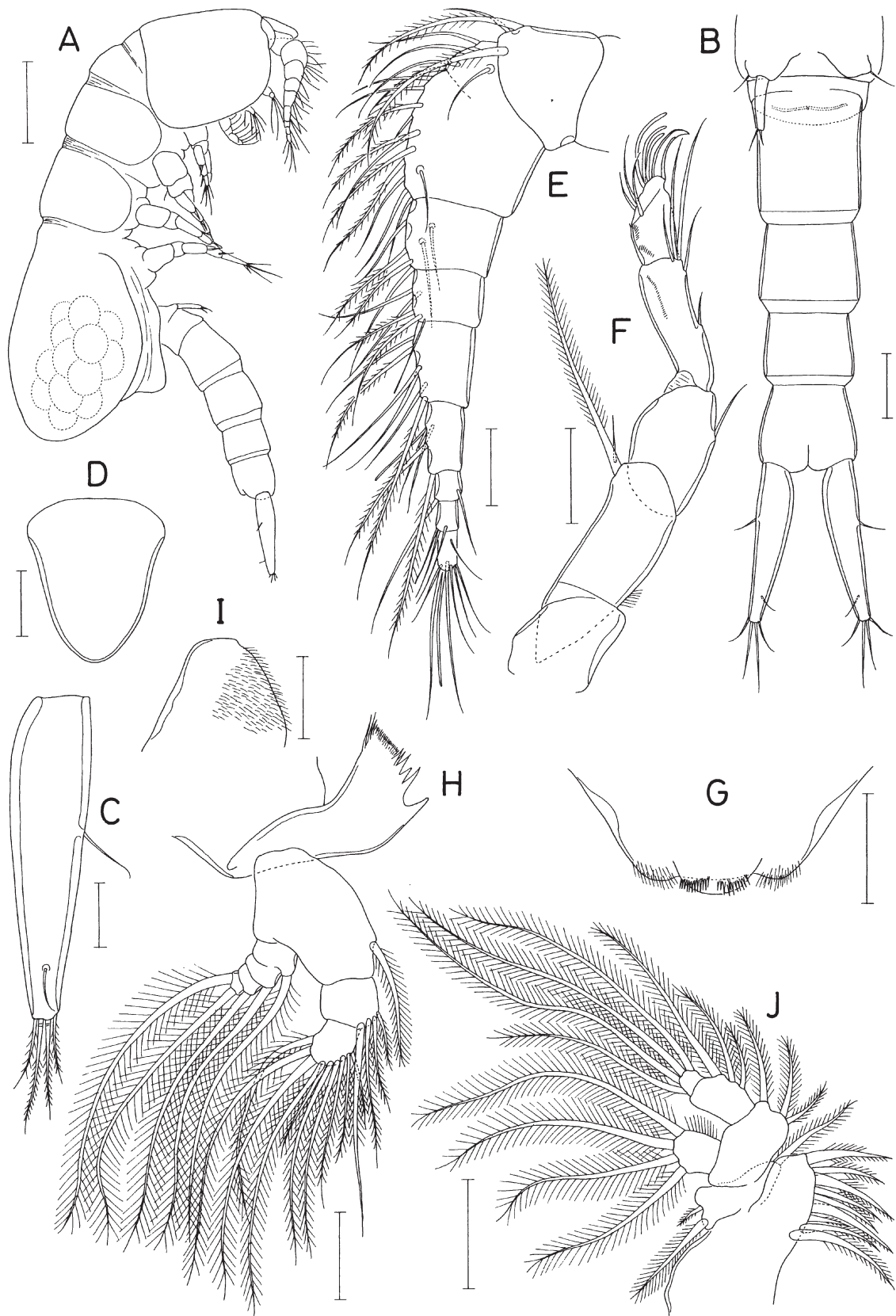
**Etymology.** The new species is named in honour of Dr. Danielle Defaye who made the Monniot collection

of copepods associated with ascidians available to the authors for study, resulting in the present work.

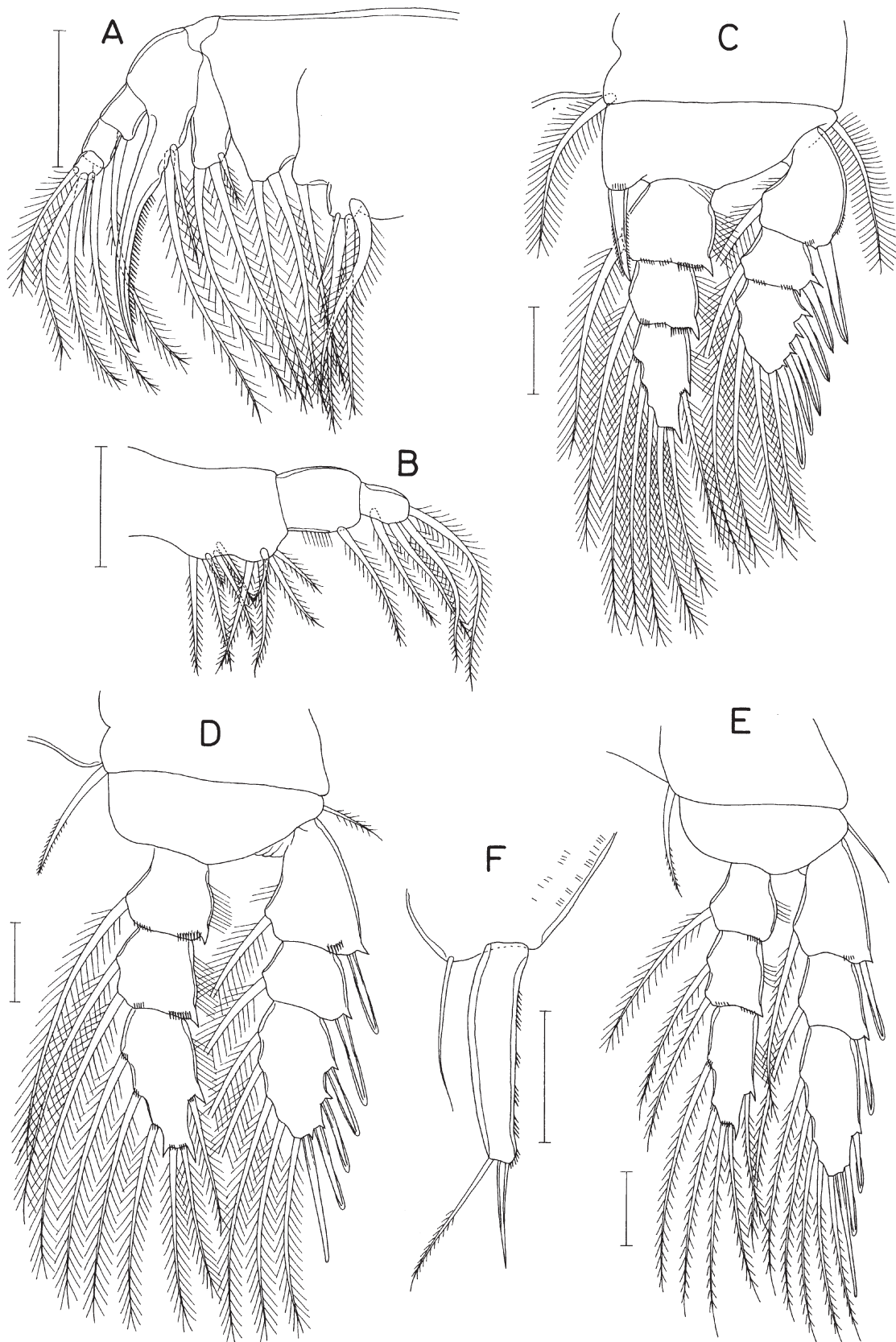
**Description of female.** Body (Fig. 1A) laterally compressed: body length 4.40 mm in dissected specimen. Cephalosome broader than first to third pedigerous somites. Second and third pedigerous somites each with well-developed dorsal tergite. Fourth pedigerous somite forming small brood pouch, much shorter than anterior part of prosome, incorporating fused fifth pedigerous somite. Free urosome (Fig. 1B) 5-segmented: genital somite short; suture between genital and first abdominal somites distinct on dorsal surface but obscure ventrally. First to fourth free abdominal somites 364×345, 284×320, 218×287, and 255×313 µm, respectively. Caudal rami elongate and slightly divergent; each ramus (Fig. 1C) constricted basally and tapering distally, widest at proximal one-fifth, about 4.1 times as long as wide (502×124 µm) and armed with 6 small setae; 4 distal setae pinnate and remaining 2 setae naked; outer lateral seta positioned at 42% of ramus length.

Rostrum (Fig. 1D) 255×215 µm, well-defined at base, tapering towards rounded apex. Antennule (Fig. 1E) gradually narrowing distally, 9-segmented with segmental fusion pattern as in generic diagnosis; armature formula 3, 17, 6, 4+aesthetasc, 6, 4+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; about half of setae pinnate (as figured). Antenna (Fig. 1F) 5-segmented, consisting of coxa, basis and 3-segmented endopod: coxa short and unarmed: basis with 1 long pinnate seta and 1 minute naked seta at distal outer corner representing exopod; ornamented with tuft of setules proximally on inner margin: endopod 3-segmented; first segment with 1 seta on inner margin; second segment about 2.7 times as long as wide, armed with 5 setae (1 on middle of inner margin and 4 at inner distal corner); third segment about 0.6 times as long as second, 1.8 times as long as wide, armed with 6 setae (3 distal setae blunt at tip) plus small terminal claw, about 0.6 times as long as segment.

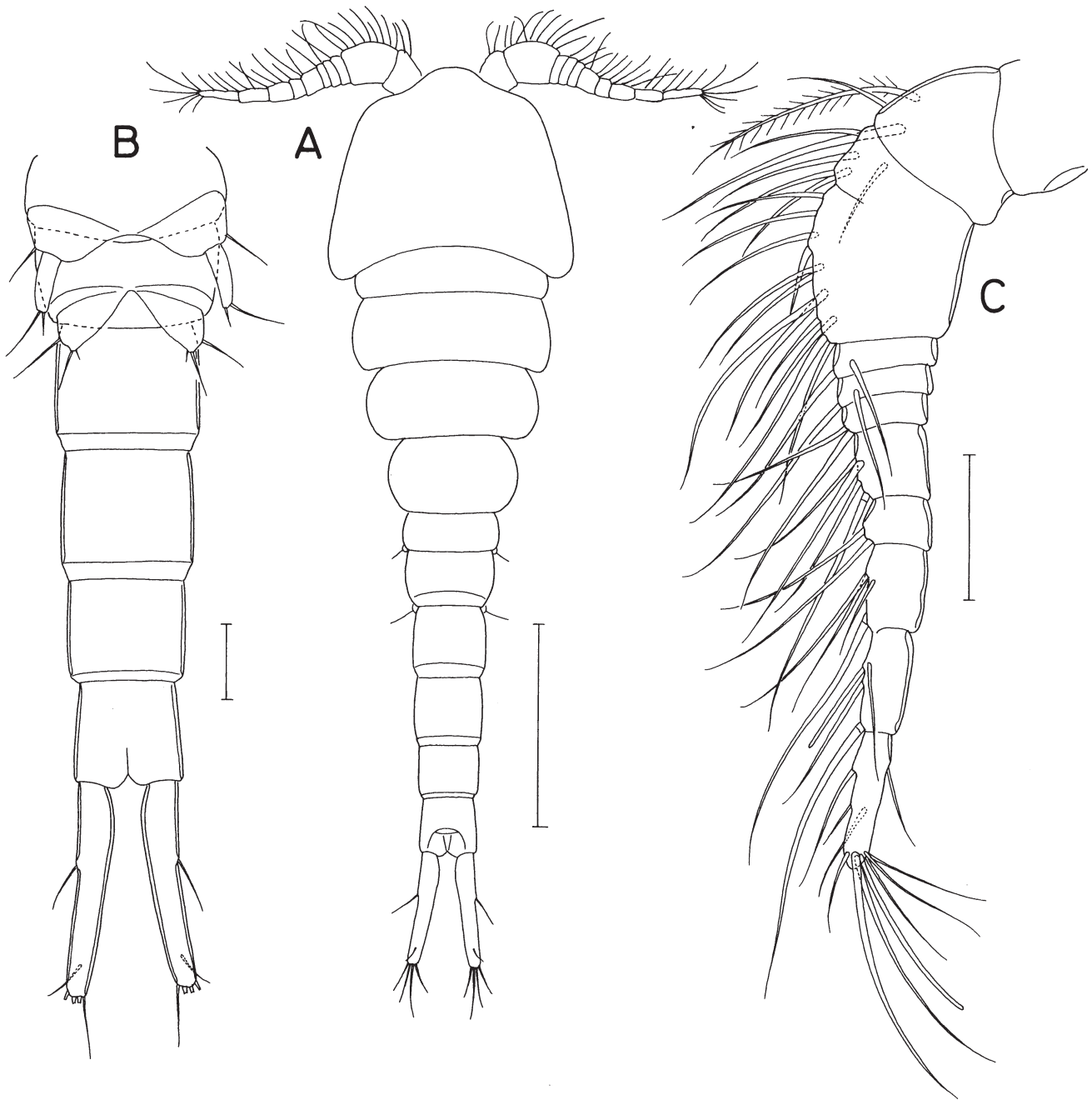
Labrum (Fig. 1G) with rounded, setulose posterolateral corners and spinulose posteromedian lobe. Mandible (Fig. 1H) with 6 teeth and 2 small proximal setae on cutting margin of coxal gnathobase; basis with 1 seta subdistally on medial margin; exopod 4-segmented and armed with 1, 1, 1, and 2 setae on first to fourth segments, respectively (all 5 setae equal in length): endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 1I) as simple lobe bearing setules on medial surface. Maxillule (Fig. 1J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented with 2 or 3 setae on medial margin of first segment and 4 setae on second segment. Maxilla (Fig. 2A) indistinctly 6-segmented; first segment (precoxa) with 4 and 1 setae on proximal and distal endites, respectively; second segment (coxa) incompletely articulated from first, armed with 2 and 3



**FIGURE 1.** *Bathynotodelphys defayeeae* gen. et sp. nov., female. A, habitus, lateral; B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C–H, J, 0.1 mm; I, 0.05 mm.



**FIGURE 2.** *Bathynotodelphys defayeeae* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.1 mm.



**FIGURE 3.** *Bathynotodelphys defayae* gen. et sp. nov., male. A, habitus, dorsal; B, urosome, ventral; C, antennule. Scale bars: A, 0.5 mm; B, C, 0.1 mm.

setae on proximal and distal endites, respectively: basis with strong claw bearing spinules along concave margin, plus 2 setae; endopod slender, 3-segmented with 1, 1, and 4 setae on first to third segments, respectively; one of 4 setae on third segment small. Maxilliped (Fig. 2B) 3-segmented and armed with 10, 1, and 4 setae on first to third segments, respectively; all setae pinnate.

Legs 1–4 biramous with 3-segmented rami (Fig. 2C–E). Spines on outer margin of exopods slender and fringed with membrane bilaterally in distal half. Inner distal spine on basis of leg 1 fringed with spinules, 106

$\mu\text{m}$  long, slightly longer than first endopodal segment. Inner coxal seta of legs 2–4 stiff and spiniform. Armature formula as in generic diagnosis. Leg 5 (Fig. 2F) consisting of protopod and free exopod; protopod incorporated into fifth pedigerous somite, armed with naked outer distal seta; exopodal segment elongate, about 4.3 times as long as wide ( $167 \times 39 \mu\text{m}$ ), ornamented with spinules along inner margin and armed distally with 1 slender spine ( $82 \mu\text{m}$  long) and 1 weakly pinnate seta ( $118 \mu\text{m}$  long).

**Description of male.** Body (Fig. 3A) dorsoventrally depressed, tapering distally. Body length 2.20 mm.

Prosome-urosome division indistinct. Urosome (Fig. 3B) 6-segmented: fifth pedigerous somite (first urosomite) shorter than genital somite: genital somite 131×247 µm, with well-developed paired genital opercula ventrally: 4 abdominal somites 167×196, 173×182, 135×160, and 135×145 µm, respectively. Caudal ramus about 5.6 times as long as wide (224×40 µm); outer lateral seta positioned at 40% of ramus length.

Rostrum as in female. Antennule 10-segmented; non-geniculate, segmental fusion pattern as in generic diagnosis; armature formula 3, 17, 2, 2, 2, 4, 2, 4, 3+aesthetasc, and 10+aesthetasc; one seta on first segment pinnate, all other setae naked. Antenna as in female.

Labrum, maxilla, and legs 1–4 as in female. Mandible with 9 setae on second endopodal segment. Maxillule with 2 or 3 setae on first endopodal segment, as in female.

Leg 5 (Fig. 3B) protopod articulated from fifth pedigerous somite; free exopodal segment about 3.2 times as long as wide (80×25 µm). Leg 6 represented by 3 setae on genital operculum, innermost seta small.

**Remarks.** The sexual dimorphism in antennular segmentation of the new genus is unique. In the female segments XII to XIV are fused whereas in the male they are free; segment XVII is incorporated into a compound segment XVII–XX in the female but segment XVII is separate from XVIII–XX in the male. More distally, segments XXIV and XXV are free in the female but incorporated into a compound apical segment XXIV–XXVIII in the male. So although the male of *B. defayae* **gen. et sp. nov.** does not retain geniculate antennules in the male, the fusion pattern of its distal segments XXIV to XXVIII probably represents a vestige of the original pattern associated with the possession of a geniculate antennule.

This species was found in deep water at a depth of 5329–5332 m in the Argentine Basin.

### *Pronotodelphys* **gen. nov.**

**Diagnosis.** Female body with modified prosome comprising cephalosome, free first to third pedigerous somites (first somite largely concealed), and dorsal brood pouch incorporating fourth and fifth pedigerous somites (as typical for *Notodelphys*). Free urosome of female 5-segmented, but genital and first abdominal somites indistinctly defined. Male urosome 6-segmented. Antennule 13-segmented in female; segmental fusion pattern: I–II, III–XI, XII–XIV, XV–XVI, XVII–XVIII, XIX, XX, XXI, XXII, XXIII, XXIV, XXV, XXVI–XXVIII. Male antennule geniculate, 12-segmented; segmental fusion pattern: I–II, III–V, VI–XI, XII, XIII, XIV, XV–XVI, XVII, XVIII, XIX–XX, XXI–XXIII, XXIV–XXVIII. Antenna consisting of coxa, basis, and 2-segmented endopod; basis with 1 inner seta plus 2 outer setae representing exopod; distal endopodal segment

compound. Mandible with biramous palp armed with 5 setae on exopod, and 4 + 10 setae on first and second endopodal segments, respectively. Maxillule with 2-segmented endopod bearing 3 and 4 setae on first and second segments, respectively. Maxilla 5-segmented; syncoxa with endite formula 3 + minute seta, 1, 2, and 3; basis with claw plus 2 setae; endopod with setal formula 1, 1, and 4. Maxilliped 4-segmented; first segment with 9 setae; second segment unarmed; third and fourth segments with 5 setae in total. Legs 1–4 biramous with 3-segmented rami: armature formula as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 with left and right protopods fused to form broad transverse plate; free exopodal segment with 2 setal elements.

**Type species.** *Pronotodelphys caledonica* **gen. et sp. nov.** by original designation.

**Other included species:** *Pronotodelphys villosa* (Ooishi, 1962) **comb. nov.** (originally described as *Notodelphys agilis villosus*)

**Etymology.** The generic name is the combination of *pro-* (“before” in Greek) and the generic name *Notodelphys*. It alludes to the relatively primitive features exhibited by the new genus relative to the genus *Notodelphys*.

**Remarks.** The new genus belongs in the family Notodelphyidae and is a close relative of the type genus *Notodelphys*. However, *Pronotodelphys* **gen. nov.** exhibits plesiomorphic states of the mandible, maxillule, and maxilliped relative to the type genus, as follows: (1) the maxillary endopod is armed with 7 setae, whereas a maximum of 5 setae is reported from all species of *Notodelphys*; (2) the maxilliped is 4-segmented and armed with 9, 0, 3, and 2, or 9, 0, 2, and 3 setae on the first to fourth segments, respectively. In contrast, the maxilliped of *Notodelphys* is invariably 3-segmented and is armed with between 8 and 10 setae on the first segment, a single seta on the second, and between 2 to 4 setae on the third; and (3) the mandible is armed with 10 setae on the second endopodal segment, whereas in species of *Notodelphys* it carries a maximum of 9 setae, with the sole exception of *N. weberi* Stock, 1950 which also carries 10 setae (Stock, 1950). The combination of these differences suggests that the new genus diverged early, at the base of the lineage leading to *Notodelphys* and may well represent the sister group of the type genus. These differences justify the establishment of a new genus, *Pronotodelphys* **gen. nov.**, distinct from *Notodelphys*. The fusion of the protopods of the fifth leg pair to form a transverse plate is a characteristic apomorphy of the new genus.

In a redescription of *Notodelphys agilis villosus* Ooishi, 1962 based on newly collected specimens from

Korean waters, Kim (2012) elevated this subspecies to species rank, as *Notodelphys villosus*. In the original description of *N. agilis villosus*, Ooishi (1962) described the maxilliped as 3-segmented with a setation pattern of 9, 0, and 5 on the first to third segments, respectively. However, after examination of additional material, Kim (2014) recognized that the maxilliped was 4-segmented with a setation pattern of 9, 0, 3, and 2. During the course of the present study, we re-examined additional material of the same species and confirmed Kim's (2014) observations. This species shares the 4-segmented maxilliped with *Pronotodelphys caledonica* **gen. et sp. nov.**, and we here transfer Ooishi's species to the new genus as *Pronotodelphys villosa* (Ooishi, 1962) **comb. nov.**

***Pronotodelphys caledonica* gen. et sp. nov.**

(Figs. 4–6)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21214) from *Ascidia munda* Sluiter, 1898, New Caledonia, MUSORSTOM 4 CC 147, New Caledonia, Grand Passage, N/O “Vauban” (19°33.8'S, 163°38.5'E), depth 46 m, Bouchet & Richer de Forges-IRD coll., 13 September 1985; paratype (♀, dissected and figured, MNHN-IU-2014-21215) from *A. munda*, Baie des Citrons, New Caledonia, September 1985.

**Additional material.** 1 ♀, 1 ♂ (both dissected; male figured) from *Ascidia tapuni* Monniot C. and Monniot F., 1987, Îlot Maître, New Caledonia, Stn NC 16, depth 3–8 m, Monniot coll., 12 September 1985.

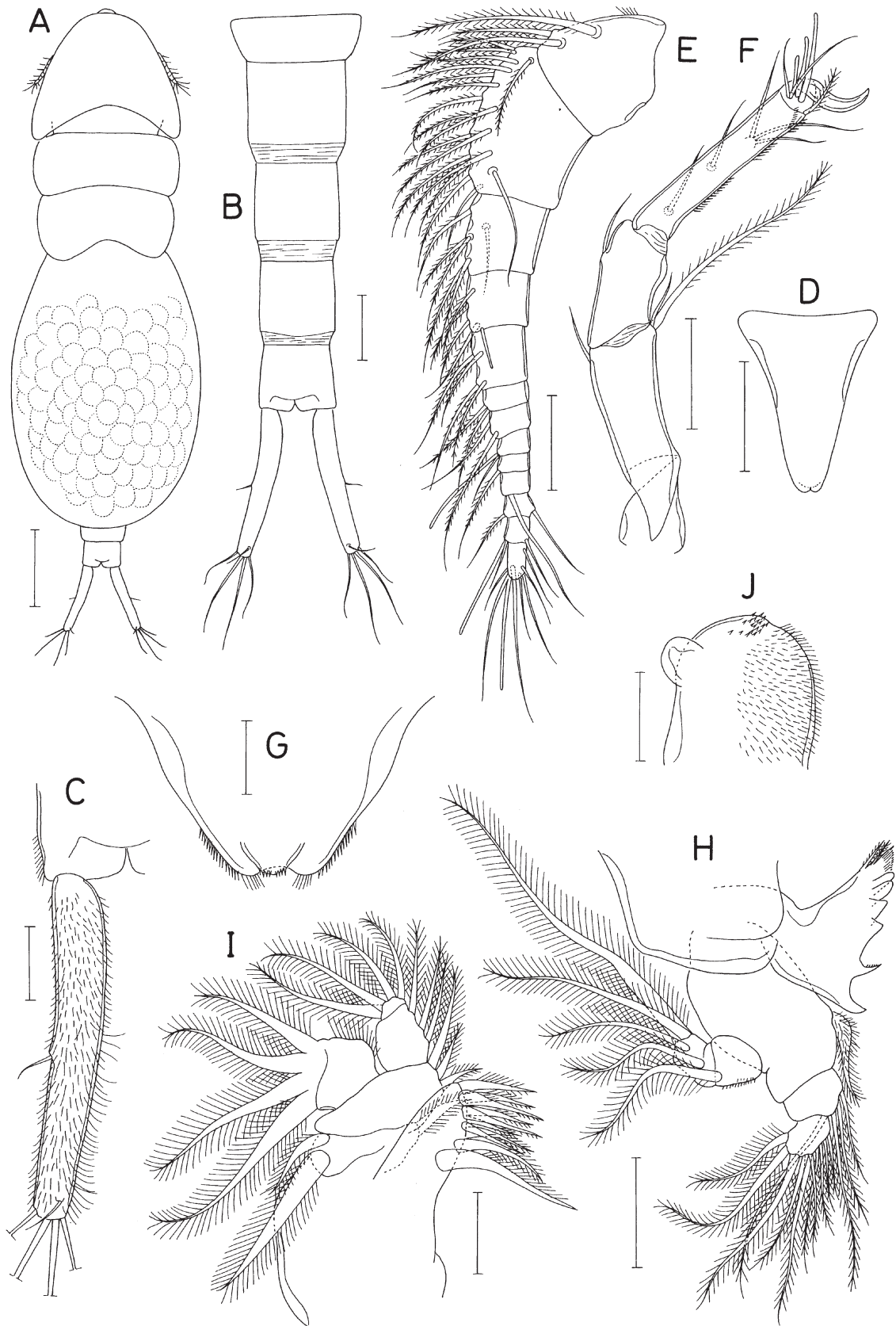
**Etymology.** The name of the new species is from the name of the type locality, New Caledonia.

**Description of female.** Female body (Fig. 4A) comprising cephalosome, free first to third pedigerous somites, and dorsal brood pouch incorporating fourth and fifth pedigerous somites. First pedigerous somite lacking distinct tergite and largely concealed; second and third pedigerous somites each with well-developed tergite; third pedigerous somite with concave posterior margin. Fourth pedigerous somite forming oval brood pouch incorporating fused fifth pedigerous somite. Free urosome (Fig. 4B) slender, consisting of genital and 4 abdominal somites, with only anal somite clearly visible in dorsal view. Suture between genital and first abdominal somites distinct dorsally but obscure ventrally. Genital somite short, 145×415 µm; 4 abdominal somites 320×298, 305×265, 255×240, and 196×240 µm, respectively. Anal somite ornamented with setules posteriorly on lateral surfaces. Caudal rami slender (473×72 µm) and slightly divergent; each ramus (Fig. 4C) about 6.6 times longer than wide; densely ornamented with thin, hair-like setules on all surfaces: armed with 6 setae, setae naked or weakly pinnate; outer lateral seta located about at mid-length of ramus.

Rostrum (Fig. 4D) 161×130 µm, tapering distally towards weakly bilobed tip. Antennule (Fig. 4E) 13-segmented with segmental fusion pattern as in generic diagnosis; armature formula 3, 18, 6, 4+aesthetasc, 4, 2, 2, 1+aesthetasc, 1, 1, 2, 2+aesthetasc, and 7+aesthetasc; setae on proximal segments mostly pinnate, setae on distal segments mostly naked (as figured). Antenna (Fig. 4F) consisting of coxa, basis and 2-segmented endopod: coxa short, unarmed; basis with 1 inner distal seta plus 2 unequal outer distal setae representing exopod; larger exopodal seta as long as second endopodal segment and pinnate, smaller seta naked and about 0.25 times as long as larger: first endopodal segment with 1 seta on inner margin; compound distal endopodal segment slender, more than 5 times as long as wide, with terminal claw plus 11 setae (3 of distal setae with blunt tips).

Labrum (Fig. 4G) steeply tapering posteriorly and ornamented with minute spinules on distal part of lateral margins and on posterior margin of semicircular posteromedian lobe, and with setules both sides of posterior margin. Mandible (Fig. 4H) with coxal gnathobase cutting margin conspicuously broad and bearing 6 teeth and 2 small setae; proximal 4 teeth blunt; second distal tooth acutely pointed, ornamented with minute spinules along proximal margin: palp consisting of basis, exopod, and 2-segmented endopod; basis with 1 plumose and proximally expanded seta on medial margin; exopod with 5 setae, distalmost seta distinctly larger than other 4, first exopodal segment ornamented with minute spinules proximally on inner surface: endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 4J) as small lobe produced into semicircular lobule at outer distal corner, with patch of spinules apically plus dense cover of setules on medial surface. Maxillule (Fig. 4I) with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 (2 shorter proximal and 1 long distal) on medial margin of basis; exopod with 4 setae distally; endopod 2-segmented with 3 setae on medial margin of first segment and 4 setae on second segment. Maxilla (Fig. 5A) 5-segmented; syncoxa with 3 + 1 small seta, 1, 2, and 3 setae on first to fourth endites, respectively; basis with smooth claw plus 2 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 5B) 4-segmented, armed with 9, 0, 2, and 3 setae on first to fourth segments, respectively; setae on third segment pectinate along proximal margin; small fourth segment bearing 1 naked and 2 pinnate setae.

Legs 1–4 biramous with 3-segmented rami. Outer seta on basis pinnate in leg 1, but naked in legs 2–4. Inner distal spine on basis of leg 1 (Fig. 5C) 79 µm long, shorter than first endopodal segment; second outer spine of third exopodal segment distinctly shorter than first and third spines. Outer margin of first endopodal segment ornamented with spinules in leg 2 (Fig. 5D) but with setules in legs 1, 3 and 4. First endopodal segment of legs 3 (Fig. 5E) and 4 elongate. Outer setae on exopods of legs



**FIGURE 4.** *Pronotodelphys caledonica* gen. et sp. nov., female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, paragnath. Scale bars: A, 0.5 mm; B, 0.2 mm; C–F, H, 0.1 mm; G, I, J, 0.05 mm.

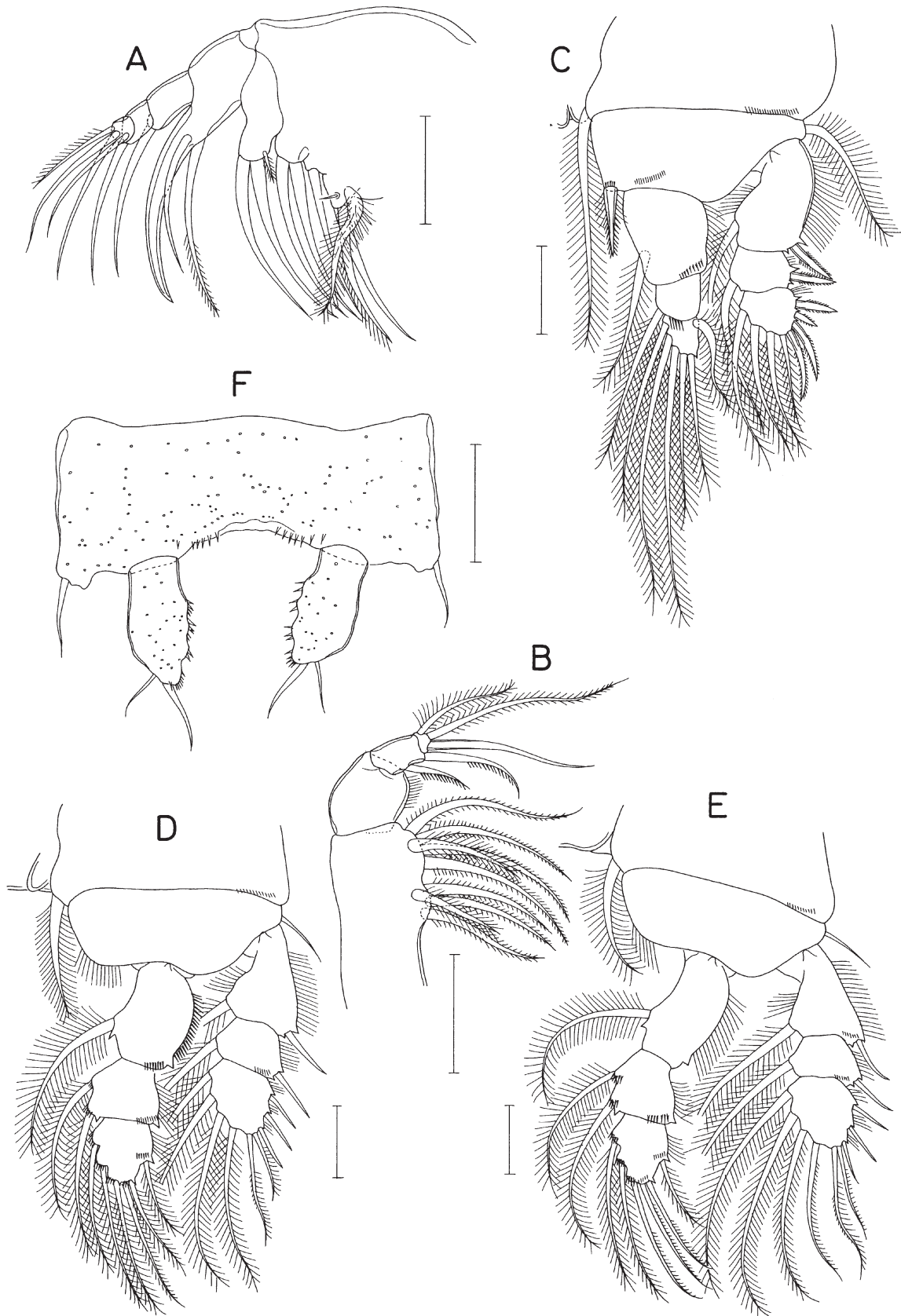
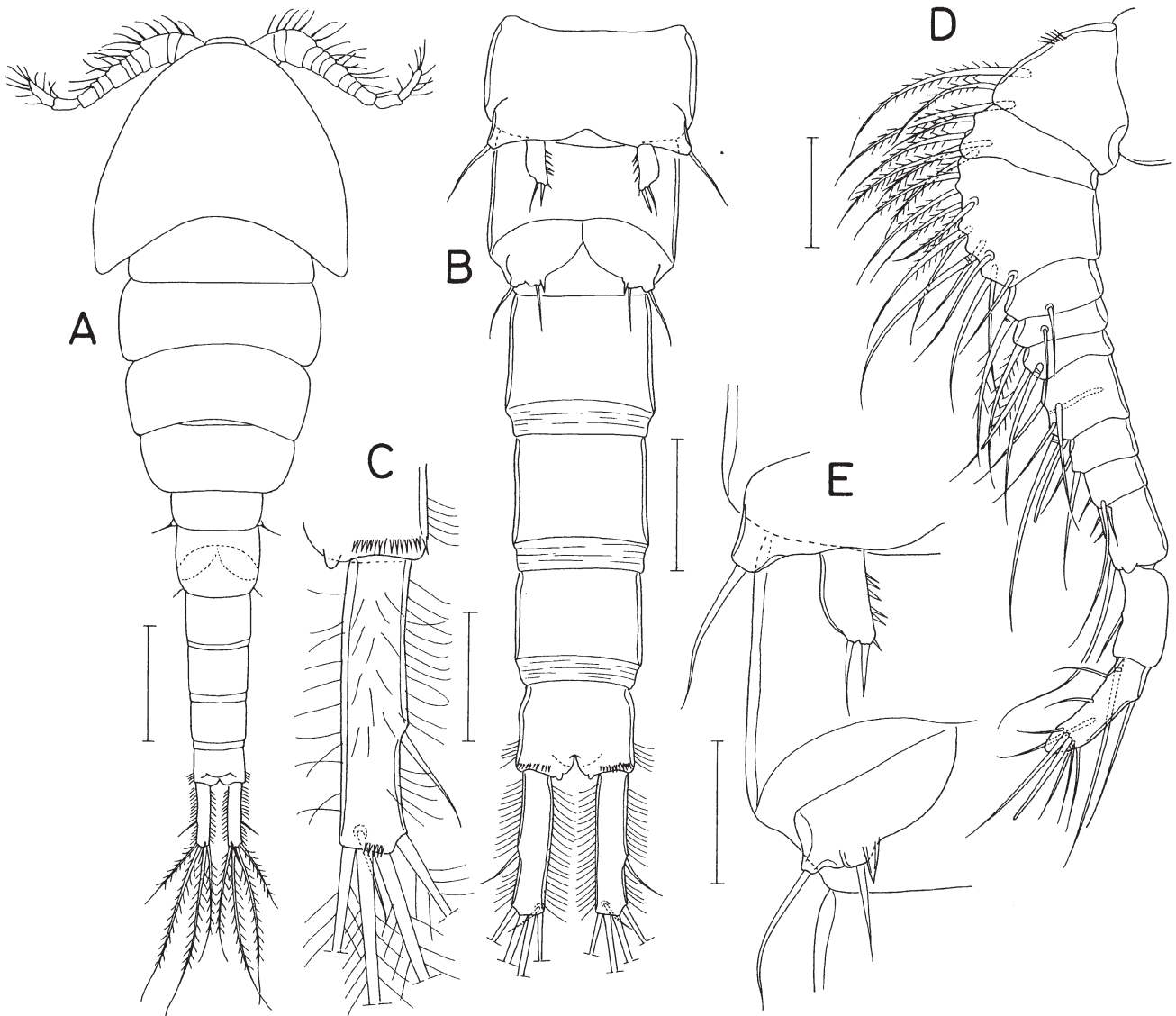


FIGURE 5. *Pronotodelphys caledonica* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, left and right leg 5. Scale bars: 0.1 mm.





**FIGURE 6.** *Pronotodelphys caledonica* gen. et sp. nov., male. A, habitus, dorsal; B, urosome, ventral; C, left caudal ramus, ventral; D, antennule; E, legs 5 and 6. Scale bars: A, 0.2 mm; B, 0.1 mm; C–E, 0.05 mm.

2–4 stiff, spiniform. Armature formula for legs 1–4 as in generic diagnosis. Leg 5 (Fig. 5F) consisting of protopod and exopod both ornamented with numerous setules on surfaces (dots on Fig. 5F indicate insertions of setules). Left and right protopods fused medially to form broad plate bearing naked outer basal seta on each posterolateral corner and ornamented with irregular spinule row along mid-posterior margin; paired exopods free, exopodal segment elliptical, armed distally with 1 spiniform seta and 1 smaller, thin seta; ornamented with about 10 spinules along inner margin.

**Description of male.** Body (Fig. 6A) cyclopiform, narrowing posteriorly. Cephalosome distinctly broader than free pedigerous somites. Urosome (Fig. 6B) 6-segmented: fifth pedigerous somite free, clearly defined anteriorly

and posteriorly,  $89 \times 163 \mu\text{m}$ ; genital somite  $116 \times 145 \mu\text{m}$ , with parallel lateral margins; 4 free abdominal somites gradually shorter,  $107 \times 115$ ,  $102 \times 104$ ,  $85 \times 96$ , and  $67 \times 91 \mu\text{m}$ , respectively. Anal somite ornamented with row of spinules on posteroventral margin and paired papilliform tubercles on inner posteroventral margin (Fig. 6B, C). Caudal ramus (Fig. 6C) about 4.5 times longer than wide ( $108 \times 24 \mu\text{m}$ ), ornamented with sparse setules on all surfaces and with scattered spinules along posteroventral margin; outer lateral seta located at 60% of ramus length.

Rostrum as in female. Antennule (Fig. 6D) 12-segmented, segmental fusion pattern as in generic diagnosis; geniculate between tenth (XIX–XX) and eleventh (XXI–XXIII) segments; seventh segment with partial suture on ventral surface; armature formula 3, 5,

12, 2, 2, 2, 4+aesthetasc, 2, 2, 4, 2, and 9+aesthetasc; terminal segment blunt at tip. Antenna as in female.

Mouthparts and legs 1–4 also as in female. Leg 5 (Fig. 6E) protopod fused with somite, lacking ornamentation of spinules; free exopodal segment about twice as long as wide (35×17 μm) with straight inner margin; spiniform distal seta shorter than outer seta. Leg 6 (Fig. 6E) represented by 2 setae and 1 spiniform process on genital operculum.

**Remarks.** The type species differs from *P. villosa* in the setation pattern of the 4-segmented maxilliped: in the type species *P. caledonica* **gen. et sp. nov.** the pattern is 9, 0, 2, and 3, whereas in *P. villosa* it is 9, 0, 3, and 2. This difference serves to separate the two congeners. In addition, the proportions of the caudal ramus are significantly different between the two species: the caudal rami are about 4.5 times (Ooishi, 1962) to 4.6 times (Kim, 2012) longer than wide in *P. villosa*, but about 6.6 times longer than wide in *P. caledonica* **gen. et sp. nov.** These differences are sufficient to justify the establishment of the new species.

### Genus *Notodelphys* Allman, 1847

**Diagnosis.** Female body with dorsal brood pouch formed by fourth pedigerous somite and largely incorporating fused fifth pedigerous somite. Free urosome 5-segmented in female consisting of genital somite and 4 abdominal somites; 6-segmented in male. Rostrum well-developed. Female antennule typically 15-segmented: segmental fusion pattern I-II, III-V, VI-XI, XII-XIV, XV-XVI, XVII, XXVIII, XIX, XX, XXI, XXII, XXIII, XXIV, XXV, XXVI-XXVIII; segmentation reduced in some species by additional fusions. Male antennule typically 10-segmented; geniculate or non-geniculate according to species; segmental fusion pattern of 10-segmented antennule I-II, III-XI, XII, XIII, XIV, XV-XVI, XVII, XVIII-XX, XXI-XXIII, XXIV-XXVIII. Antenna typically consisting of coxa, basis, and 2-segmented endopod with compound distal segment (representing fused second and third ancestral segments) bearing terminal claw; exopod typically represented by 2 setae. Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and maximum of 4 and 10 setae (typically 9) on first and second endopodal segments, respectively. Maxillule with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented with 1 and 4 setae on first segment and second segments, respectively; unsegmented in some species. Maxilla indistinctly 5-segmented, syncoxal enditic formula 4, 1, 2, 3, or reduced; basis with claw plus 1 or 2 setae, 3-segmented endopod with setal formula 1, 1, 3/4. Maxilliped 3-segmented and armed with 8, 9 or 10 setae on first segment, 1 on second and typically 3

on third (rarely 2 or 4 setae). Legs 1–4 biramous with 3-segmented rami; armature formula typically:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 consisting of protopod fused to, or separate from, somite and free exopodal segment armed with 2 elements (1 spine and 1 seta).

**Type species.** *Notodelphys allmani* Thorell, 1859, by subsequent designation (see Remarks).

**Remarks.** The genus *Notodelphys* was established by Allman (1847) to accommodate a new species *N. ascidicola* Allman, 1847 based on material taken from the branchial chamber of “*Ascidia communis*“ collected at a number of localities. This species was subsequently recorded by Baird (1850) from coastal waters around the United Kingdom and Ireland. Thorell (1859) described seven new species of *Notodelphys* but considered that Allman’s species was indeterminable, and he adopted one of his newly described species, *N. allmani* Thorell, 1859, as the type species of the genus. Brady (1878) also considered that Allman’s (1847) original description and figures were inadequate to characterise *N. ascidicola* and commented that it was probable that Allman’s material consisted of a mixture of several species of *Notodelphys*. Brady (1878) also suggested that some of the figures undoubtedly referred to another genus, *Ascidicola* Thorell, 1859 (family Ascidiolidae), and he followed Thorell (1859) in discarding the specific name *ascidicola* and adopting *N. allmani* Thorell, 1859 as the type species. Sars (1921) and Illg (1958) also concluded that *Notodelphys ascidicola* Allman, 1847 was an indeterminable species and adopted *N. allmani* as the type species. Since 1859 all major contributors to the taxonomy of *Notodelphys* have followed Thorell (1859) in discarding the specific name *ascidicola* and recognizing *N. allmani* Thorell, 1859, including Buchholz (1869), Brady (1878), Aurivillius (1882), Scott, T. (1888), Carus (1885), Koehler (1890), Canu (1891), Norman & Scott, T. (1906), Sars (1921), Schellenberg (1922), Lang (1948), Stock (1950, 1951), Illg (1958), Bocquet & Stock (1960), Illg & Dudley (1961, 1965), Dudley (1966), and Gotto (1993). Whilst this action should formally have been submitted as a Case to the International Commission on Zoological Nomenclature, we also adopt the 150-year old practice of recognizing *N. allmani* Thorell, 1859 as the type species in the interests of nomenclatural stability.

*Notodelphys* is the second largest genus in the family, currently comprising 29 valid species (Walter & Boxshall, 2020).

*Notodelphys agilis* Thorell, 1859

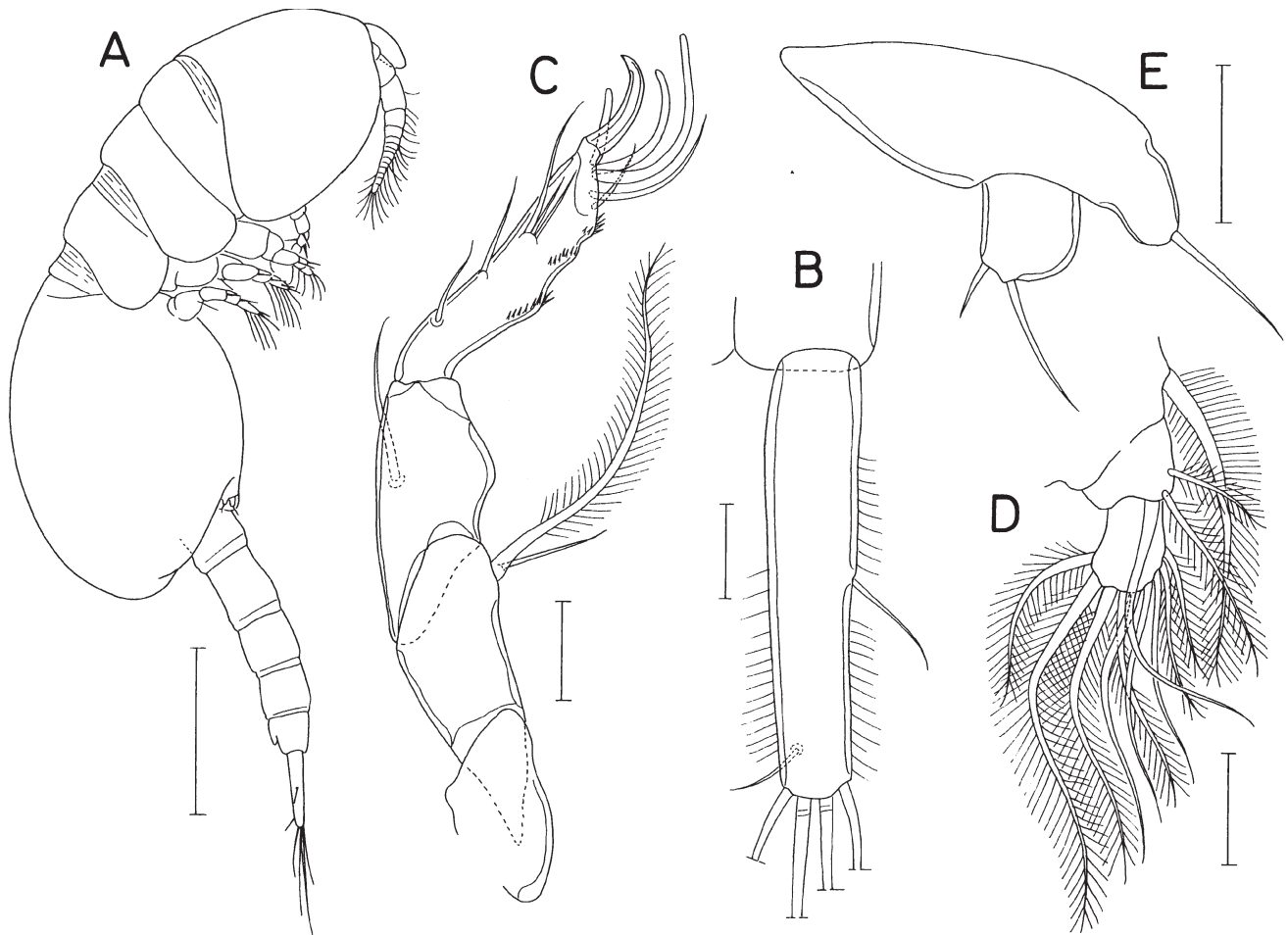
(Fig. 7)

**Material examined.** 6 ♀♀ (MNHN-IU-2018-1749) from *Molgula socialis* Alder, 1863, Wimereux, Atlantic coast of France; 1 ♀ (MNHN-IU-2018-1750) from *Molgula bleizi* (Lacaze-Duthiers, 1877), Morgat, Atlantic coast of France; 8 ♀♀, 9 ♂♂ (MNHN-IU-2018-1751) and 1 dissected ♀ from *Molgula scutata* Millar, 1955, WALDA CM1; 9 ♀♀ (MNHN-IU-2018-1752) and 1 dissected ♀ (figured) from *Corella parallelogramma* (Müller, 1776), Kristineberg, Sweden.

**Diagnostic characters of female.** Body (Fig. 7A) of dissected specimen 2.96 mm long. Caudal ramus (Fig. 7B) 242×52 µm, about 4.7 times as long as wide and about 1.7 times as long as anal somite; ornamented with hair-like setules on both inner and outer margins, setules on inner margin very fine, almost invisible; outer lateral seta located in middle of ramus. Rostrum longer than wide, with pair of nipple-shaped tubercles apically. Antennule 14-segmented. Antenna (Fig. 7C) with exopod represented by 1 large pinnate seta and 1 vestigial seta

on basis; compound distal endopodal segment about 3.8 times as long as wide. Mandibular endopod (Fig. 7D) 2-segmented, armed with 3 setae on first segment and 9 setae on second; largest distalmost seta on first segment and 3 mediobasal setae on second segment naked, other setae pinnate. Maxillary endopod incompletely 2-segmented, armed with 1 and 4 setae on first and second segments, respectively. Maxilliped 3-segmented, armed with 10, 1, and 3 setae on first to third segments, respectively. Leg 5 (Fig. 7E) protopod broad, unornamented, with outer distal process not longer than exopod, tipped with 1 naked seta; free exopodal segment about 1.1 times longer than wide (32×30 µm), sub-quadrate and without basal constriction, inner and outer margins parallel, armed with 1 small and 1 longer seta, both naked.

**Remarks.** *Notodelphys agilis* was first described by Thorell (1859) based on material associated with four different hosts (*Ascidia mentula* Müller, 1776, *Ciona intestinalis* (Linnaeus, 1758) (as *Ascidia canina*), *Ascidiella aspersa* (Müller, 1776), and *Corella parallelogramma*) collected off the coast of Sweden. These same four ascidian species apparently serve as hosts



**FIGURE 7.** *Notodelphys agilis* Thorell, 1859, female. A, habitus, lateral; B, left caudal ramus, ventral; C, antenna; D, endopod of mandible; E, leg 5. Scale bars: A, 0.5 mm; B–E, 0.05 mm.

to a total of seven different species of *Notodelphys*, all of which are still regarded as valid (*N. agilis*, *N. allmani*, *N. caerulea* Thorell, 1859, *N. elegans* Thorell, 1859, *N. prasina* Thorell, 1859, *N. rufescens* Thorell, 1859, and *N. tenera* Thorell, 1859). Given the co-occurrence of these congeneric species both geographically and in terms of host associations, it is not surprising that there has been historic confusion over the identities of some of them. The original descriptions lacked detail and the morphological concepts of some of Thorell's species have gradually been fixed by subsequent accounts. The most important contribution was that of G.O. Sars (1921) who redescribed all seven species. His redescription of *N. agilis* established the modern concept of this species, as recognized by Illg (1958) in his overview of the family Notodelphyidae.

The character states exhibited by our specimens conform to the illustrations of Sars (1921). In his original description, Thorell (1859) characterised *N. agilis* by two major features: the caudal rami are twice as long as the anal somite and the outer lateral seta on the caudal ramus is positioned at the mid-length. In contrast to his text, Thorell's illustration (Thorell, 1859: Fig. 6F3) shows a caudal ramus at most 1.7 times as long as the anal somite, a similar proportion to our specimen (1.67:1) and also similar to the specimen illustrated by Sars (1921: Pl. XVII, fig. 3F), which has caudal rami measuring 1.5:1. Confusingly, the exopod of the antenna is illustrated as comprising 2 subequal large setae in Thorell's original description, whereas the antennal exopod of our specimens and that illustrated by Sars is represented by a large and a small seta. However, according to Monniot (1981) the small exopodal seta on the antenna in *N. agilis* is variable in length, ranging between 15 and 37% of the length of the large seta, but still showing a clear length difference between the two setae. One possible explanation for this discrepancy is that Thorell (1859) illustrated the antenna of a different specimen belonging to another co-associated species of *Notodelphys*, given that the four type hosts of *N. agilis* also served as hosts to another six congeneric species. We have followed Sars (1921) in our morphological concept of *N. agilis*.

The ascidians *Molgula bleizei* and *M. scutata* are reported here as new host records of *N. agilis*.

### *Notodelphys allmani* Thorell, 1859

(Fig. 8, 9)

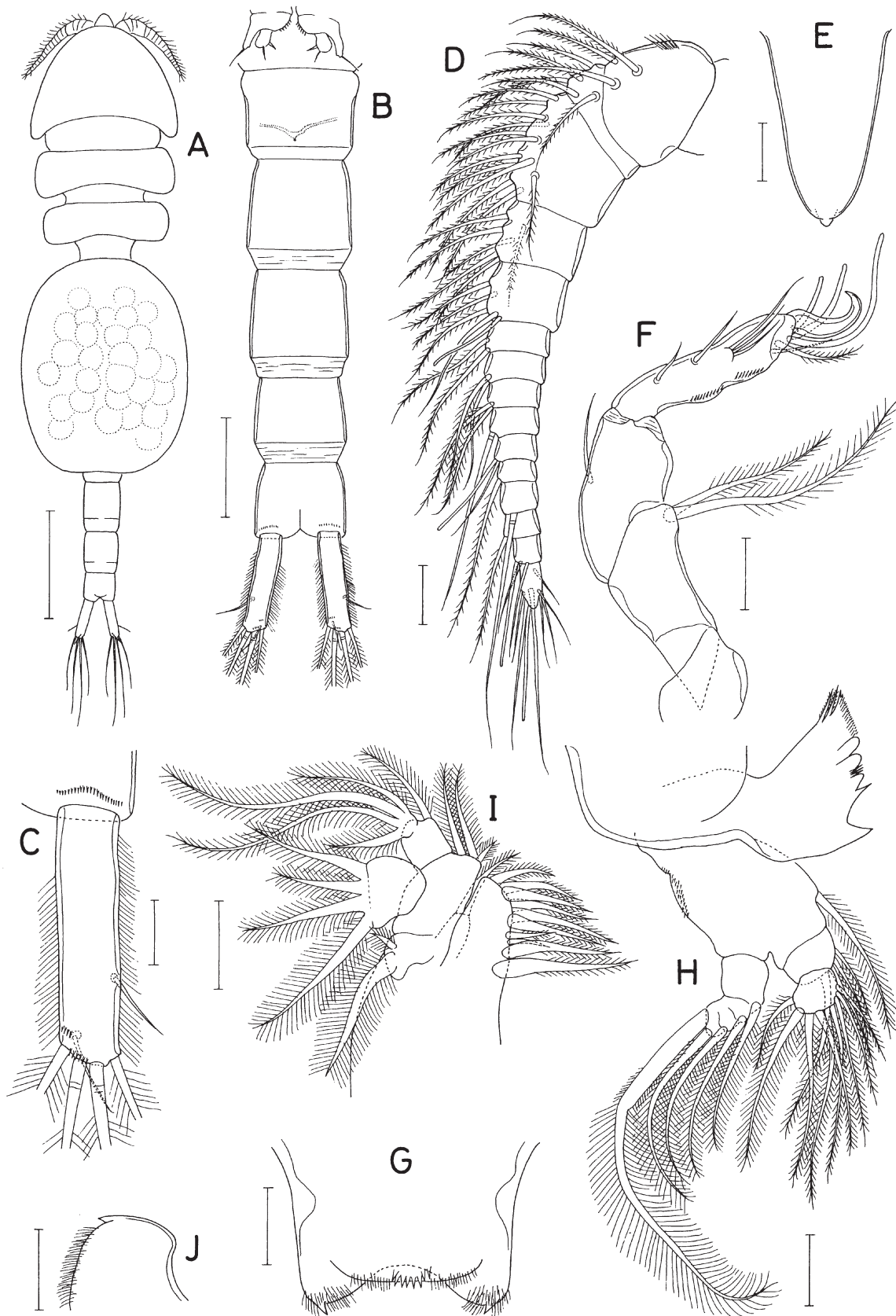
**Material examined.** 1 ♀, 1 ♂ (MNHN-IU-2018-1753) from *Cystodytes senegalense* Monniot F., 1969, Dakar, Senegal; 9 ♀♀ (MNHN-IU-2018-1754) from unknown host, Bizerte, North coast of Tunisia; 7 ♀♀, 1 ♂ (MNHN-IU-2018-1755) and 1 dissected ♀ (figured) from *Ascidella aspersa* (Müller, 1776), Israel; 3 ♀♀, 3 ♂♂ (MNHN-IU-2018-1756) from *A. aspersa*, Porto Munzio, Italy; 1 ♀

(MNHN-IU-2018-1757) from *A. aspersa*, Roscoff, France, 1878; 1 ♀ (MNHN-IU-2018-1758) from *Ascidia mentula* (Müller, 1776), Roscoff 1878; 3 ♀♀ (MNHN-IU-2018-1759) and 1 dissected ♀ from *A. mentula*, Dinard, France; 2 ♀♀, 2 ♂♂ (MNHN-IU-2018-1760) and 1 dissected ♀ from *Ascidia conchilega* Müller, 1776, Sanit-Vaast-La-Hougue, France, 30 August 1996; 1 ♀ (MNHN-IU-2017-2163) from *A. aspersa*, MEDITS 2016, Stn M16-6 (43°25.64'N, 4°04.01'E), depth 32 m, 31 May 2016; 8 ♀♀ (MNHN-IU-2017-2166) from *A. aspersa*, MEDITS 2016, Stn M16-2 (43°20.98'N, 4°19.64'E), depth 32–33 m, 31 May 2016.

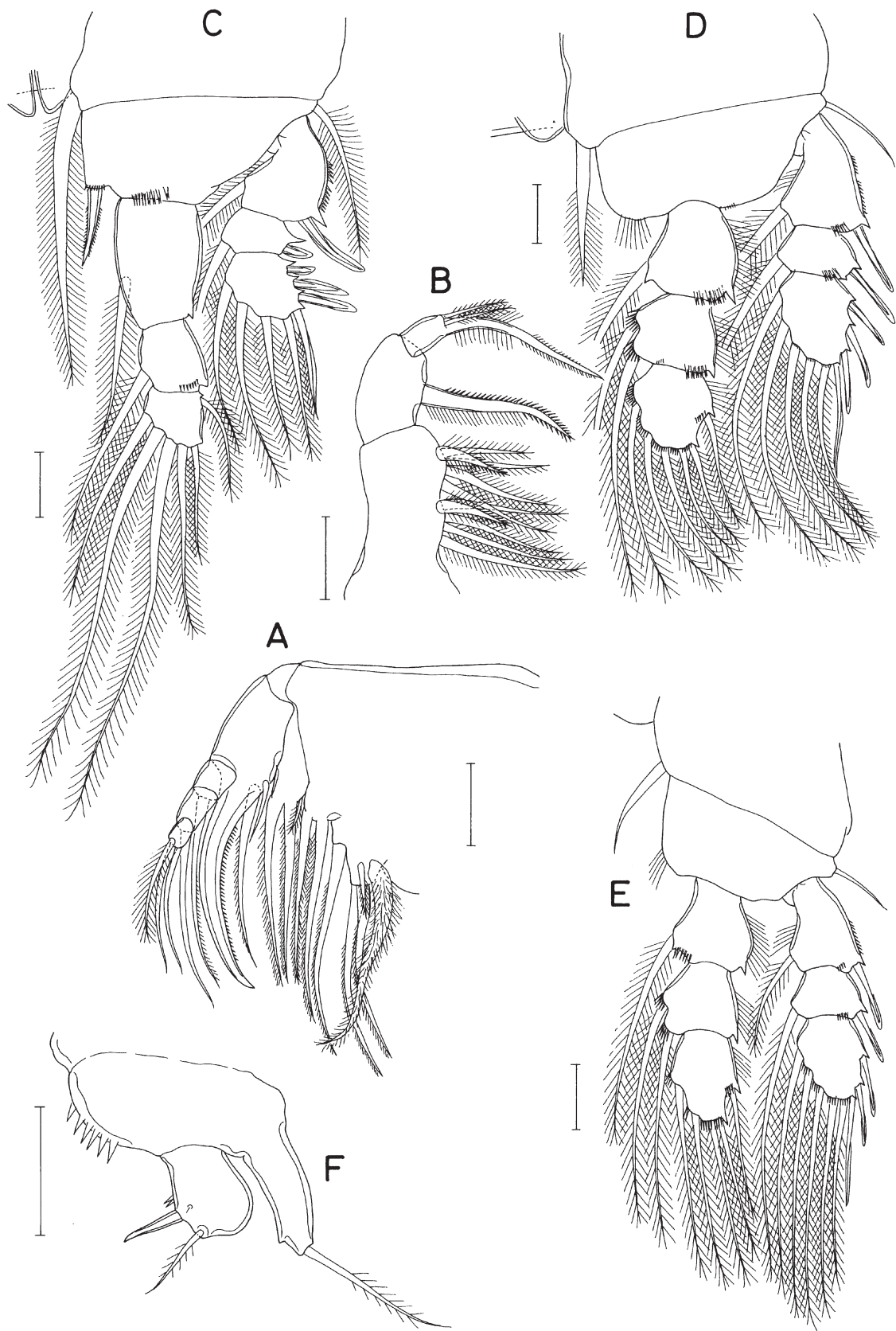
**Supplementary description of female.** Body (Fig. 8A) slightly dorsoventrally depressed. Body length of dissected specimen 2.90 mm (largest observed specimen 4.35 mm). First pedigerous somite narrower than other pedigerous somites, lacking dorsal tergite. Tergites of second and third pedigerous somites well defined. Fourth pedigerous somite forming brood pouch, longer than wide with rounded corners; fifth pedigerous somite largely incorporated into brood pouch. Free urosome (Fig. 8B) 5-segmented, consisting of genital and 4 abdominal somites: genital somite 182×240 µm; 4 free abdominal somites 222×211, 218×200, 171×185, and 153×185 µm, respectively. Anal somite ornamented with transverse row of fine spinules posteroventrally, near base of caudal rami (Fig. 8C). Caudal ramus (Fig. 8C) about 3.9 times as long as wide (200×51 µm) and about 1.3 times as long as anal somite, ornamented with setules along parallel inner and outer margins 2 ventral rows of minute spinules at inner distal corner; armed with 6 setae, outer lateral seta naked and positioned at 67% of ramus length; dorsal seta (seta VII) naked, other 4 distal setae pinnate.

Rostrum (Fig. 8E) about 1.5 times longer than wide, tapering distally with nipple-shaped median process at apex. Antennule (Fig. 8D) 15-segmented; armature formula 3, 5, 12, 6, 4+aesthetasc, 2, 2, 2, 1, 1+aesthetasc, 1, 1, 1, 2+aesthetasc, and 7+aesthetasc; most of setae pinnate (as figured); distal seta on ninth (XX) and twelfth (XXIII) segments annulated at base. Antenna (Fig. 8F) 4-segmented; short coxa unarmed; basis with 2 large pinnate setae representing exopod, shorter seta about 0.7 times length of longer; first endopodal segment with 1 inner seta; compound distal endopodal segment about 3.6 times longer than wide (129×36 µm), ornamented with 2 rows of fine spinules on outer margin; armed with terminal claw plus 10 setae (arranged as 1, 1, 3, 2, and 3).

Labrum (Fig. 8G) slightly narrowing distally; posterolateral protuberances ornamented with denticles and setules; median posterior margin convex and ornamented with several spinules in middle and setules on both sides. Mandible (Fig. 8H) consisting of coxa and biramous palp; coxal gnathobase with 5 major teeth and 2 setae, second distal tooth acutely pointed; basis with 1 seta on medial margin and patch of minute spinules on proximal outer surface; exopod with 5 setae, terminal



**FIGURE 8.** *Notodelphys allmani* Thorell, 1859, female. A, habitus, dorsal; B, urosome, ventral; C, left caudal ramus, ventral; D, antennule; E, rostrum; F, antenna; G, labrum; H, mandible; I, maxillule; J, paragnath. Scale bars: A, 0.5 mm; B, 0.2 mm; C–J, 0.05 mm.



**FIGURE 9.** *Notodelphys allmani* Thorell, 1859, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

seta about twice as long as other 4 setae; 2-segmented endopod armed with 4 setae on first segment and 9 setae on second. Paragnath (Fig. 8J) as small lobe, hirsute on medial surface, with dentiform process medio-distally. Maxillule (Fig. 8I) armed with 10 setae (including 2 small ones) on precoxal arthrite, 1 seta on coxal endite, 2 setae on epipodite; basis with 3 setae on medial margin, proximal seta much smaller than distal 2; exopod with 4 setae distally; endopod incompletely 2-segmented with 1 seta on first segment and 4 setae on second. Maxilla (Fig. 9A) 5-segmented; syncoxa (first segment) with 10 enditic setae (arranged as 4, 1, 2, and 3); basis with strong claw bearing minute spinules along concave margin, plus 2 unequal setae; 3-segmented endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 9B) 3-segmented and armed with 10, 1, and 3 setae on first to third segments; larger seta on third segment spiniform and fused to segment at base.

Legs 1–4 biramous with 3-segmented rami (Fig. 9C–E); first exopodal segment with spinules on outer surface, those on leg 1 larger than in other 3 legs; inner coxal seta pinnate in legs 1–3, but naked in leg 4; outer seta on basis pinnate in leg 1, but naked in legs 2–4. Minute bifurcate spinules present at junction between basis and endopod of leg 1 and on distal border of first and second endopodal segments of legs 2 and 3. Leg 1 with inner distal spine on basis 60 µm long and spinulose along margins. First endopodal segment of leg 1 about 1.4 times longer than wide (95×67 µm). Outer spines on exopods of legs 1–4 with membranous fringes. Armature formula for legs 1–4 as in generic diagnosis.

Leg 5 (Fig. 9F) consisting of broad protopod and free exopod. Protopod indistinctly delimited from brood pouch at base, with digitiform outer distal process about 45 µm long bearing pinnate seta at tip; ornamented with dentiform process subdistally on inner margin, and 6 to 9 spinules proximally on inner margin. Exopodal segment 36×31 µm, outer distal margin expanded, strongly convex; armed with 1 smooth inner subdistal spine and 1 weakly pinnate distal seta; ornamented with 2 to 4 small spinules on inner margin near base of spine.

**Remarks.** *Notodelphys allmani* is the most common species of *Notodelphys* and has been found in association with more than ten species of solitary ascidians (Gotto, 1993). It is difficult to distinguish from its closely related congener, *N. rufescens*. In his original description Thorell (1859) differentiated between the two species by the ornamentation on the outer surface of the first exopodal segment of leg 1: spinulose in *N. allmani* versus smooth in *N. rufescens*. However, subsequent authors seemed unable to confirm this difference between the two species. Sars (1921) stated that the caudal rami were twice as long as the anal somite in *N. allmani* but less than twice in *N. rufescens* and that the outer lateral seta on the caudal ramus is located further from the apex in *N. rufescens*. These and other minor differences mentioned by Sars

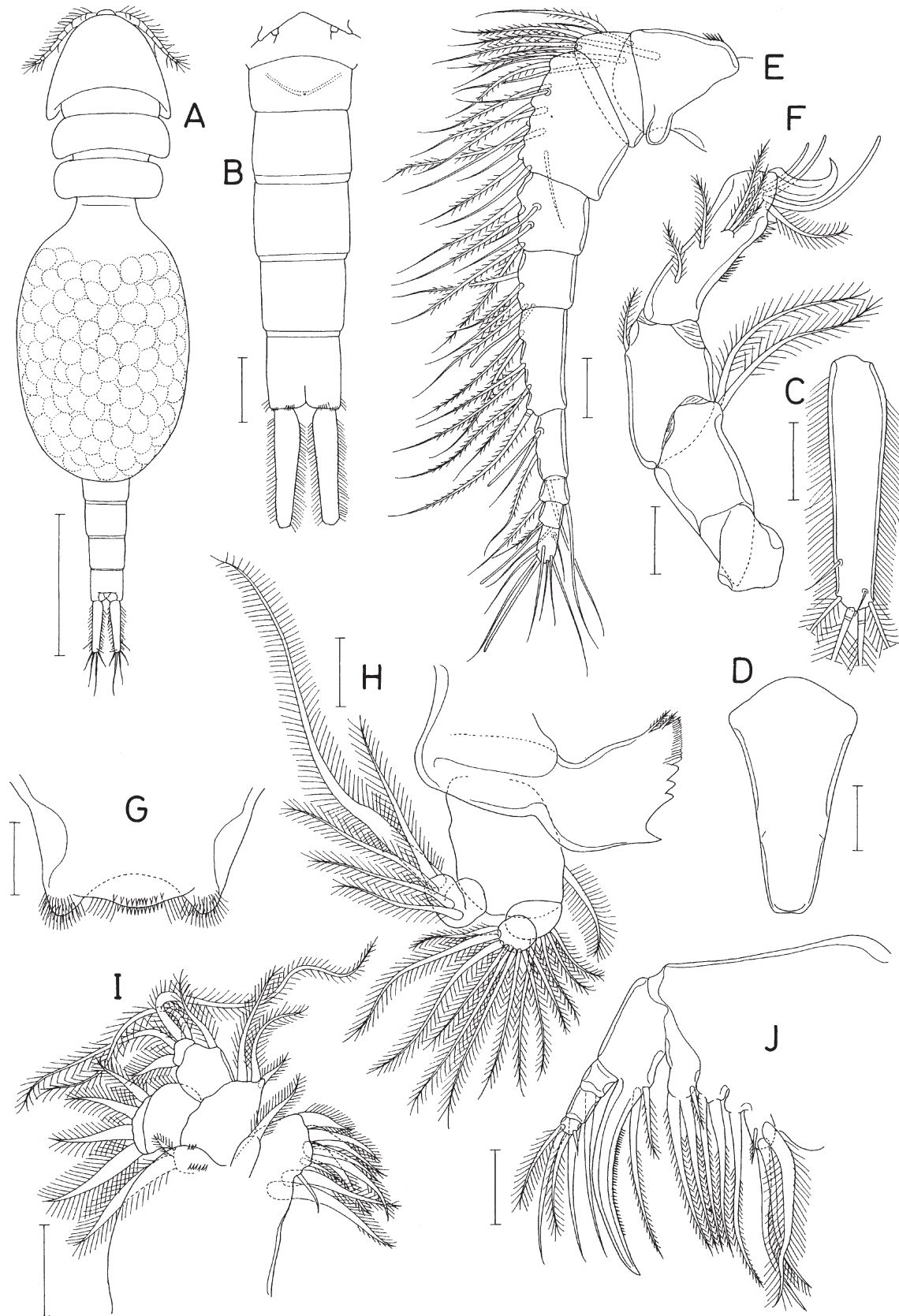
(1921) could not, however, be confirmed by reference to his illustrations of the two species. Stock (1951) considered that the position of the outer lateral seta on the caudal ramus is a reliable character for distinguishing the two species, but he did not clarify the correct position of the seta in these species. Bocquet & Stock (1960) used the armature of leg 5 exopod to distinguish the two species: the exopod bearing 2 long setae in *N. allmani* against 1 long seta and 1 short, strong seta in *N. rufescens*.

In our specimens examined above: (1) the caudal ramus is about 4 times as long as wide and about 1.3 to 1.4 times as long as anal somite; (2) the outer lateral seta of the caudal ramus is positioned at 67% of ramus length; (3) the first exopodal segment of leg 1 is ornamented with spinules on the outer surface (and this is visible as a patch of spinules when the leg is viewed from lateral aspect); and (4) the exopod of leg 5 is slightly longer than wide and armed with 1 inner spine and 1 distal seta and the seta is only slightly longer than the spine. No significant variability in these four characters was exhibited by our material and all of these characters can be observed without dissection of the specimens. All of these specimens were identified as *N. allmani* because the first exopodal segment of leg 1 is ornamented with spinules on outer surface, as defined by Thorell (1859). We consider that *N. rufescens* is probably a variant of *N. allmani* but we do not propose a formal synonymy.

#### *Notodelphys aurantiaca* Stock, 1970 (Figs. 10, 11)

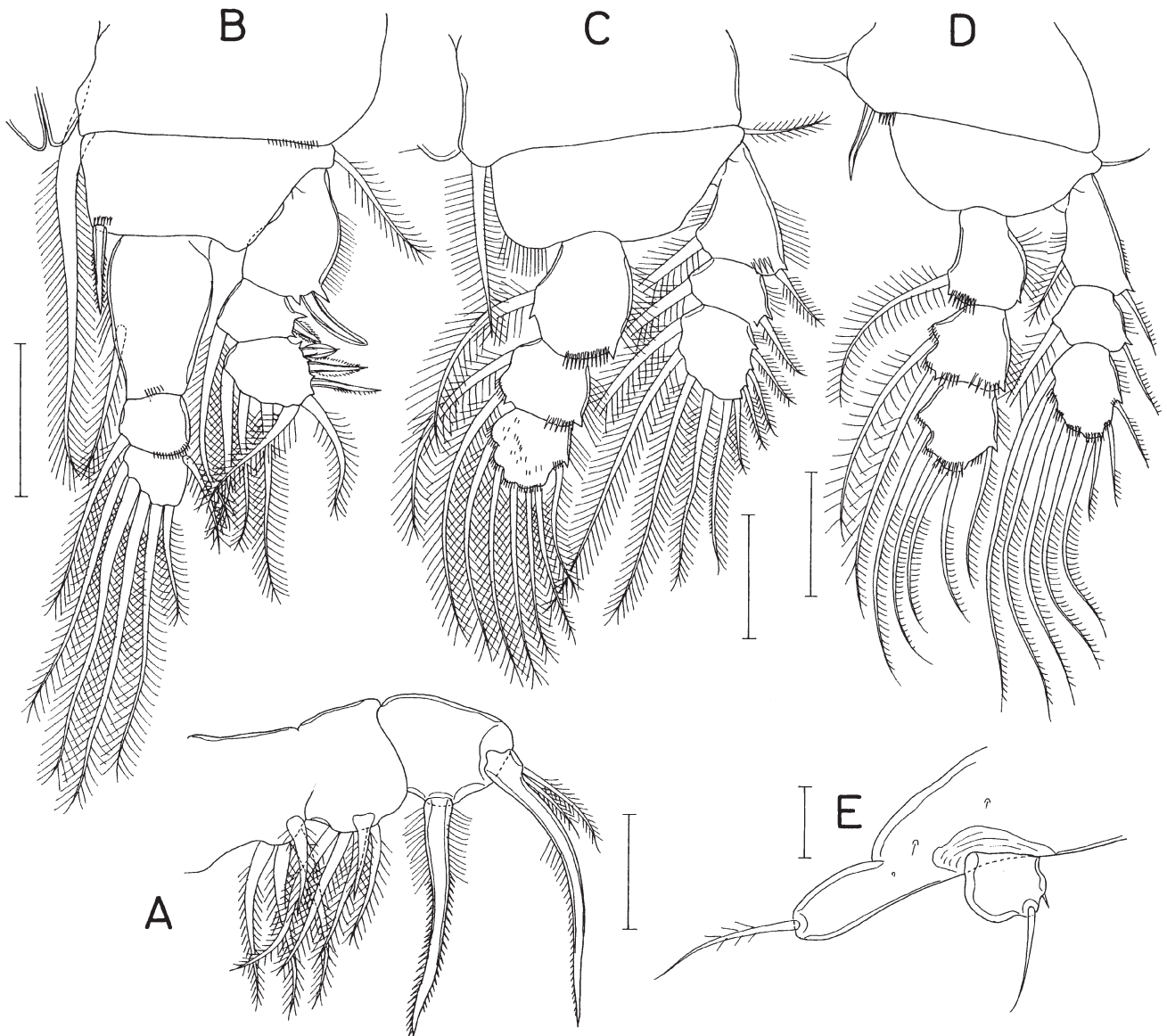
**Material examined.** 2 ♀♀, 2 ♂♂ (MNHN-IU-2018-1761) and 1 dissected ♀ from *Ascidia curvata* (Traustedt, 1882), Guadeloupe, No. 18; 1 ♀ (MNHN-IU-2018-1762) and 1 dissected ♀ (figured) from *A. curvata*, Riviere salee, Guadeloupe, February 1985.

**Supplementary description of female.** Body (Fig. 10A) 4.56 mm long. Cephalosome wider than long. Fifth pedigerous somite completely incorporated into brood pouch. Free urosome (Fig. 10B) 5-segmented: genital somite 175×320 µm, shorter than 4 free abdominal somites 233×313, 240×302, 233×265, and 225×233 µm, respectively, each wider than long. Anal somite ornamented with fine spinules on posteroventral margin and few setules near posterolateral corner. Caudal ramus (Fig. 10C) gradually narrowing distally, densely setulose on both inner and outer margins; outer lateral seta located subdistally at 78% of ramus length. Rostrum (Fig. 10D) elongate, 184×100 µm, with truncated apex. Antennule 505 µm long, 10-segmented (Fig. 10E), segmental fusion pattern as follows: I-II, III-V, VI-XI, XII-XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV, XXV, XXVI-XXVIII; armature formula 3, 5, 12, 6, 4+aesthetasc, 7, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae on proximal segments mostly pinnate (as figured). Antenna (Fig. 10F)



**FIGURE 10.** *Notodelphys aurantiaca* Stock, 1967, female. A, habitus, dorsal; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 1 mm; B, 0.2 mm; C, 0.1 mm; D–J, 0.05 mm.





**FIGURE 11.** *Notodelphys aurantiaca* Stock, 1967, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, left leg 5, ventral. Scale bars: A, 0.05 mm; B–D, 0.1 mm; E, 0.02 mm.

rather stout with short unarmed coxa; basis with 2 equally large pinnate setae representing exopod; first endopodal segment with 1 subdistal seta on inner margin; compound distal endopodal segment  $133 \times 44 \mu\text{m}$ , 3.2 times as long as wide, with 9 setae (arranged as 1, 1, 3, 1, and 3) plus strong terminal claw; 3 distal setae on second endopodal segment naked and blunt at tip.

Labrum (Fig. 10G) with denticles on middle of posterior margin and setules on produced posterolateral corners. Mandible (Fig. 10H) with 4 teeth on coxal gnathobase; basis with 1 seta on inner margin; exopod with 5 setae, distal seta much larger than others; endopod with 4 setae on first segment and 9 setae on second. Maxillule (Fig. 10I) with 10 setae on precoxal arthrite, 1 seta on

coxal endite, 2 unequal setae on coxal epipodite; basis with 1 short proximal and 2 longer distal setae on inner margin; exopod indistinctly 2-segmented, with 4 setae on distal segment; endopod distinctly 2-segmented, with 1 seta on proximal segment and 4 setae on distal segment, outermost seta markedly shorter than other 3. Maxilla (Fig. 10J) consisting of syncoxa, basis, and 3-segmented endopod; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites, respectively; basis carrying strong claw with fine spinules along concave margin, plus 2 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively, one of setae on third segment minute. Maxilliped (Fig. 11A) 3-segmented; armature formula 9, 1, and 3.

Legs 1–4 with 3-segmented rami. Leg 1 (Fig. 11B)

with straight inner distal spine on basis; first endopodal segment about 1.5 times as long as wide, longer than distal 2 segments combined. Leg 2 (Fig. 11C) identical to leg 3 in armature formula. Leg 4 (Fig. 10D) with inner spine (rather than seta) on coxa; inner seta on first exopodal segment small, as long as outer seta on same segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-0; I-1; III, 5	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-1; 1, 2, 3
Leg 4	0-I	1-0	1-1; 101; 2, 1, 5	0-1; 0-1; 1, 2, 2

Leg 5 (Fig. 11E) small, located on posteroventral surface of brood pouch, consisting of incorporated protopod and free exopod. Protopod with 1 seta tipped on elongate lateral process. Exopodal segment 19×23 µm, wider than long, about half as long as lateral process of protopod, and armed with 1 naked seta and 1 rudimentary seta. Leg 6 absent.

**Remarks.** Our specimens from Guadeloupe are identified as *N. aurantiaca* because the first endopodal segment of leg 1 is elongated, about 1.5 times longer than wide, the lateral process of the protopod of leg 5 is elongate (distinctly longer than wide), and the exopod of leg 5 is sub-rectangular. These distinctive character states are all typical of *N. aurantiaca*. Stock's (1970) material was collected from *Ascidia interrupta* Heller, 1878 at Curaçao in the Caribbean Sea.

### *Notodelphys caerulea* Thorell, 1859 (Fig. 12)

Syn.: *Notodelphys hatlassae* Monniot C., 1981 new synonym.

**Material examined.** 2 ♀♀ (MNHN-IU-2015-3) and 1 dissected ♀ (figured) from *Ascidia virginea* Müller, 1776, Gulf of Gascogne, EVOHE, Stn 236, October–November 2009; 1 ♀ (MNHN-IU-2015-11) from *A. virginea*, Gulf of Gascogne, EVOHE 09, Stn 112, October–November 2009.

**Supplementary description of female.** Body (Fig. 12A) 2.97 mm long. Free urosome 5-segmented: anal somite (Fig. 12B) 168×198 µm. Caudal ramus (Fig. 12B) 238×68 µm, about 3.5 times longer than wide and 1.4 times as long as anal somite, covered by fine setules more densely on outer and inner surfaces than on dorsal and ventral surfaces; outer seta located at 60% of ramus length.

Rostrum (Fig. 12C) elongated, tapering towards pointed apex. Antennule 15-segmented. Antenna (Fig. 12D) with 2 large subequal setae on basis representing exopod.

Mandible (Fig. 12E) with 4 major teeth on coxal gnathobase, second distal tooth acute; endopod with 3

setae on first segment and 9 setae on second. Maxillule (Fig. 12F) with 10 setae on precoxal arthrite, 1 seta on coxal endite, 2 unequal setae on coxal epipodite, 3 setae (including small proximal seta) on inner margin of basis, and 4 setae on exopod; endopod 2-segmented with 1 inner seta on first segment and 4 setae on second segment. Maxilla (Fig. 12G) with 4, 1, 2, and 3 setae respectively on first to fourth endites of syncoxa; basis with strong claw plus 2 setae; endopod with 1, 1, and 4 setae, respectively, on first to third segments; one of setae on third endopodal segment small, setule-like. Maxilliped 3-segmented with 10, 1, and 3 setae, respectively, on first to third segments.

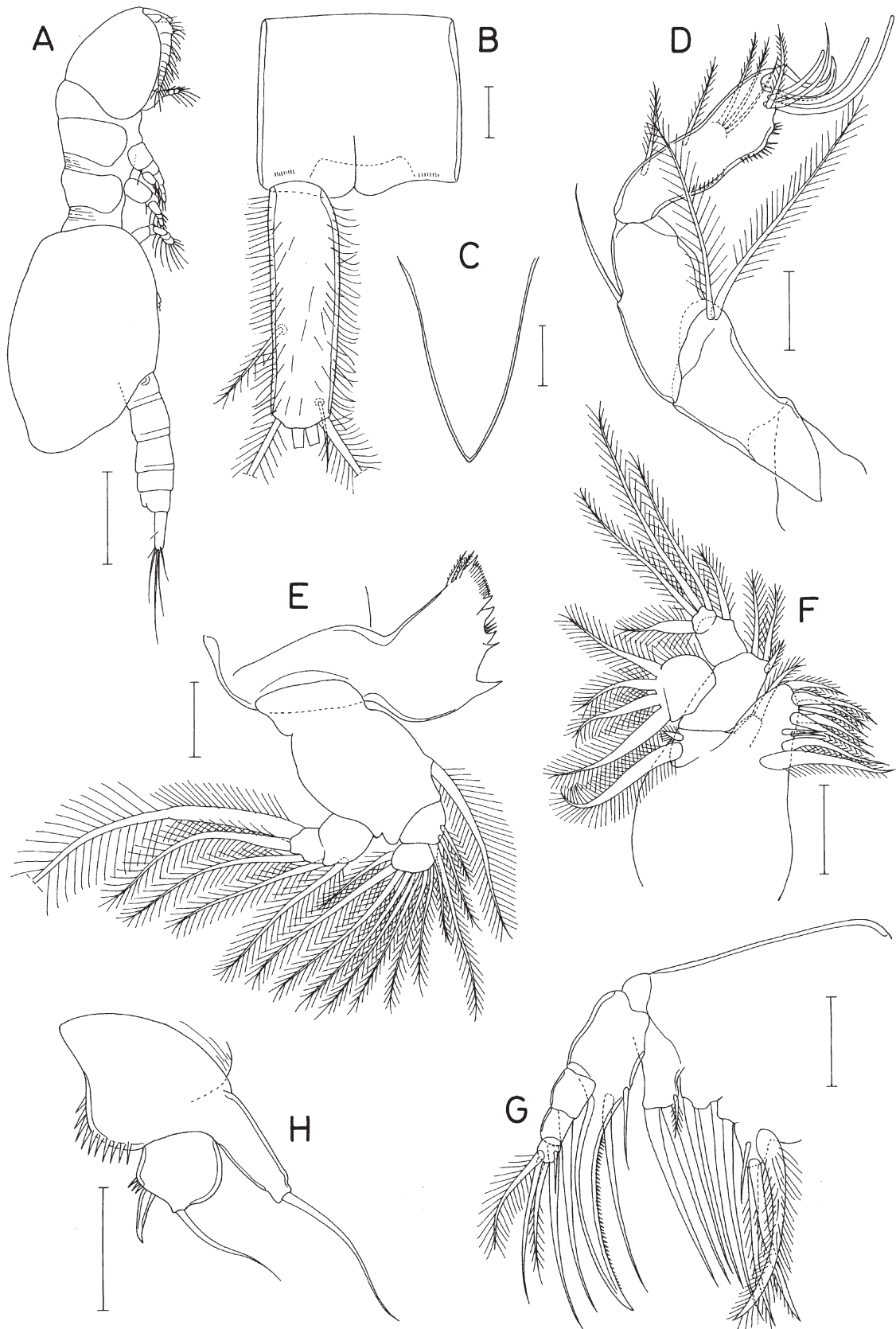
Legs 1–4 as in generic diagnosis. Leg 5 (Fig. 12H) 2-segmented. Protopod defined from somite at base, produced into elongated lateral process tipped by naked seta and ornamented with about 10 spinules along distal inner margin. Exopodal segment 31×35 µm, armed with 1 spine and 1 naked seta and ornamented with 3 or 4 spinules on inner margin near base of spine.

**Remarks.** When describing *Notodelphys hatlassae* Monniot, 1981, Monniot (1981) apparently overlooked *N. caerulea* as he did not make comparisons between these two species despite their close similarity. The form of leg 5 in these two species, as illustrated by Thorell (1859), Sars (1921), Monniot (1981), and in the present account (Fig. 12H), does not differ significantly. In addition, the position of the lateral seta on the caudal ramus, the proportional lengths of the caudal ramus and anal somite, and the shape of the rostrum are all identical in the present material and in Monniot's specimens. These two species also utilize the same host, *Ascidia virginea*. *Notodelphys hatlassae* Monniot, 1981 is here treated as a junior subjective synonym of *N. caerulea* Thorell, 1859.

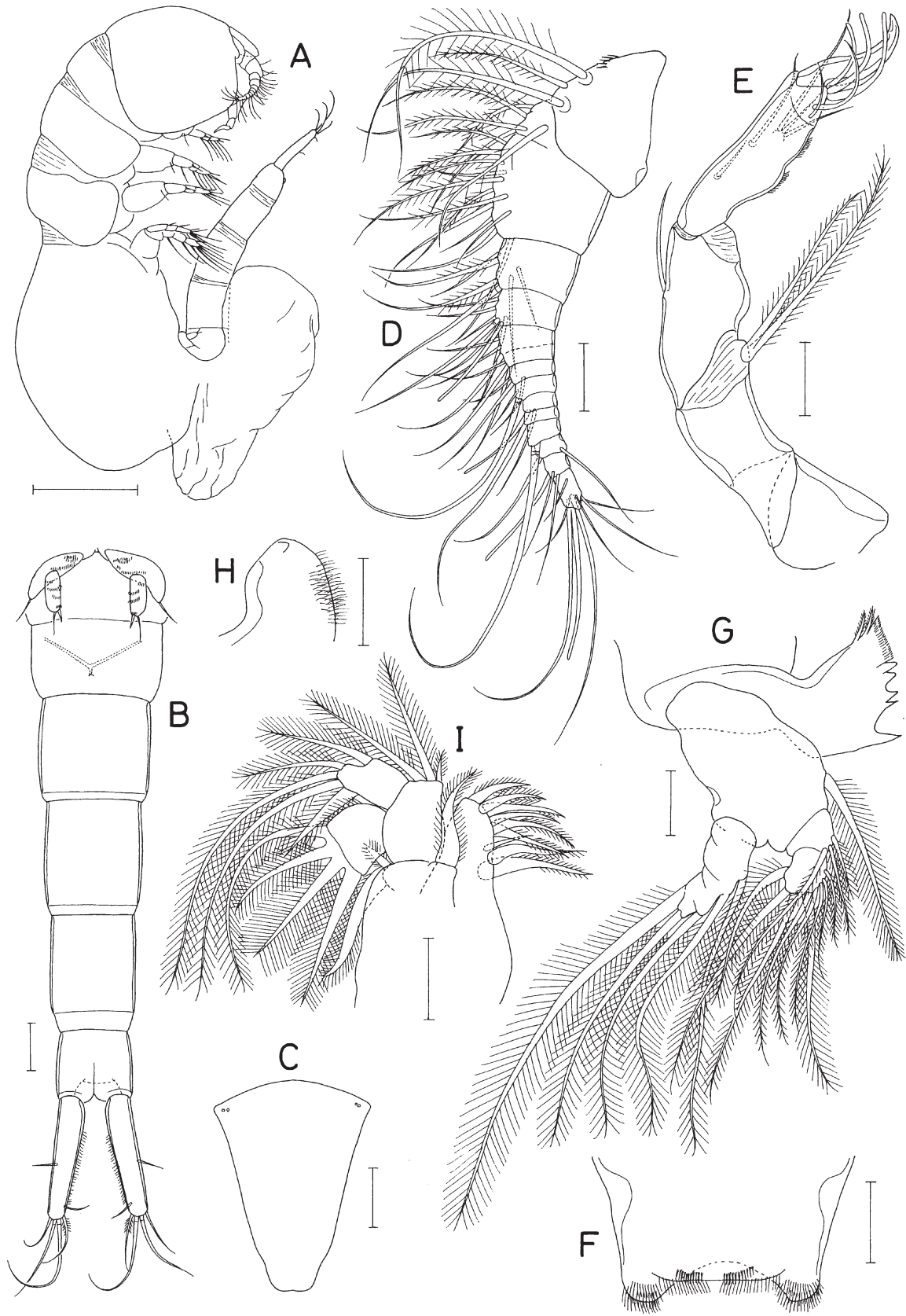
### *Notodelphys echinata* Monniot C., 1961 (Figs. 13–15)

**Material examined.** 1 copepodid V (MNHN-IU-2018-1763) from *Microcosmus polymorphus* Heller, 1877, Banyuls, France; 1 ♀ (dissected) from *M. nudistigma* Monniot C., 1962, Portugal; 1 ♀ (MNHN-IU-2018-1764) from *M. polymorphus*, Portugal; 11 ♀♀, 4 ♂♂ (MNHN-IU-2018-1765) from *M. polymorphus*, Dakar, Senegal, collected by Leung Tack, 1966–1969; 2 ♀♀ (MNHN-IU-2018-1766) from *M. polymorphus*, Dakar, Senegal; 1 ♀, 1 ♂ (MNHN-IU-2018-1767) and dissected 1 ♀, 1 ♂ (figured) from *M. polymorphus*, Dakar, 1966–1968.

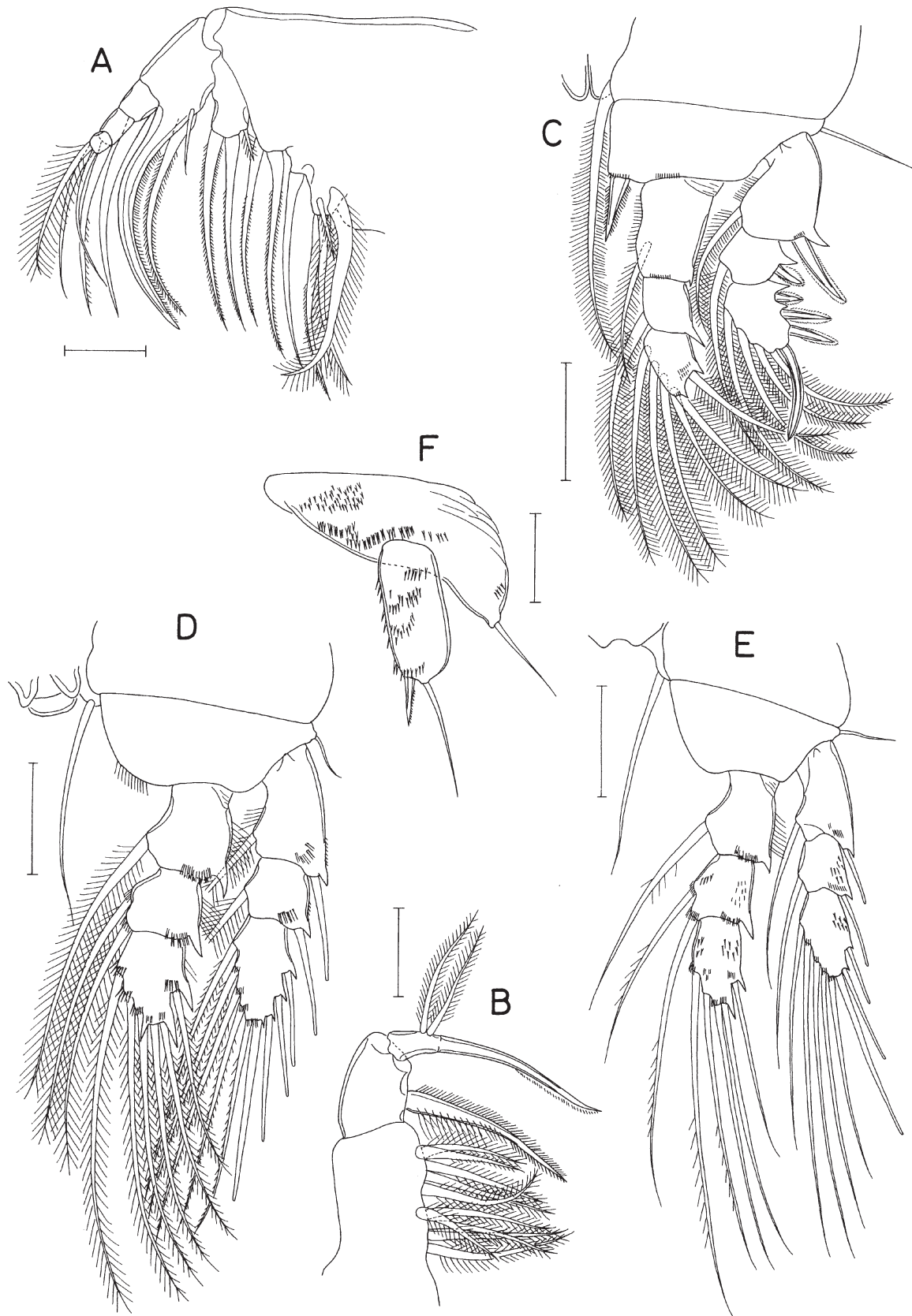
**Supplementary description of female.** Body (Fig. 13A) about 3.7 mm long. Free urosome (Fig. 13B) 5-segmented; genital and 4 free abdominal somites 159×280, 221×238, 245×200, 245×182, and 141×164 µm. Caudal ramus about 4.6 times longer than wide (270×59 µm), setulose along inner margin; armed with 6 setae, outer lateral seta located at 55% of ramus length.



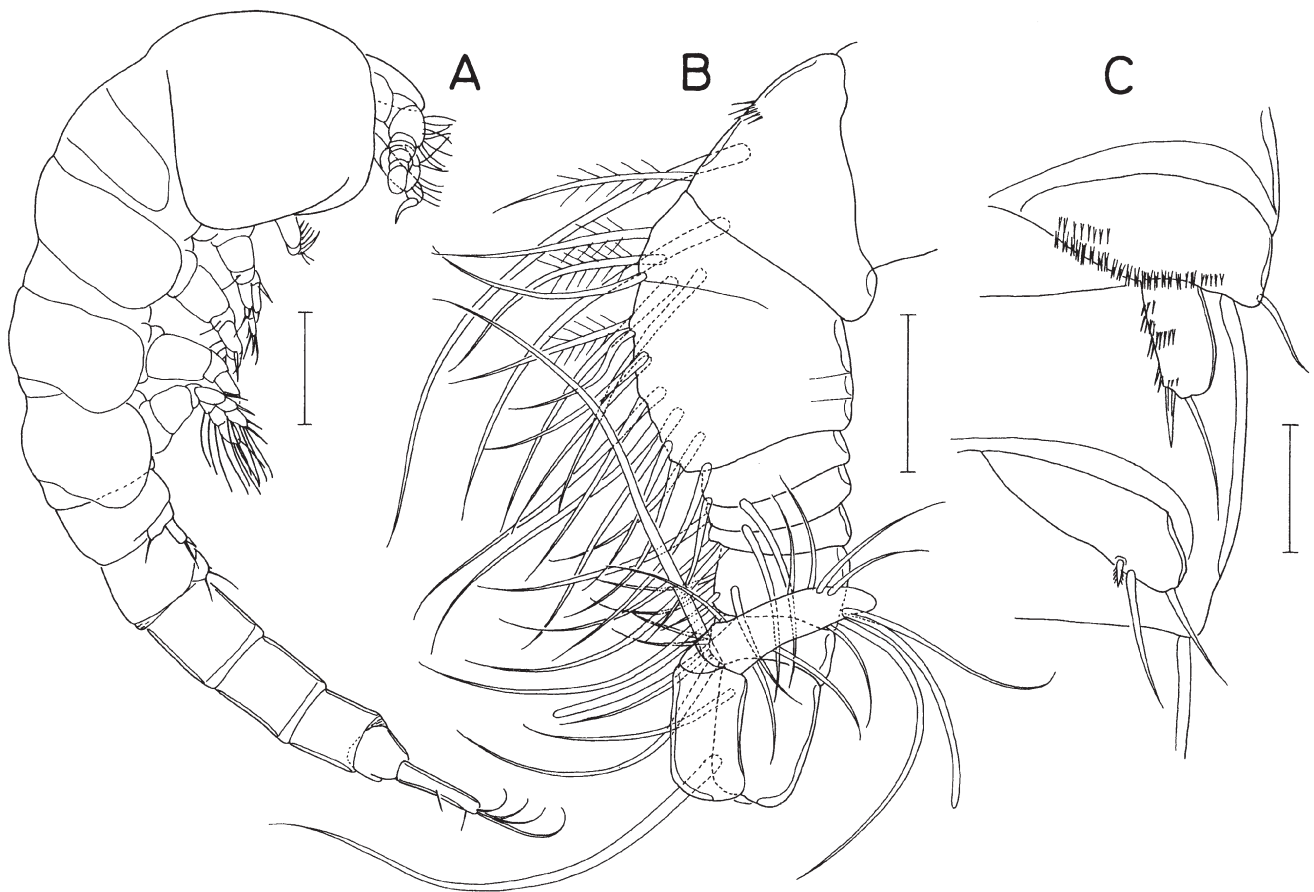
**FIGURE 12.** *Notodelphys caenulea* Thorell, 1859, female. A, habitus, right; B, anal somite and caudal ramus, dorsal; C, rostrum; D, antenna; E, mandible; F, maxillule; G, maxilla; H, right leg 5, ventral. Scale bars: A, 0.5 mm; B–H, 0.05 mm.



**FIGURE 13.** *Notodelphys echinata* Monniot, 1961, female. A, habitus, right; B, urosome, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C–I, 0.05 mm.



**FIGURE 14.** *Notodelphys echinata* Monniot, 1961, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, F, 0.05 mm; C, D, E, 0.1 mm.



**FIGURE 15.** *Notodelphys echinata* Monniot, 1961, male. A, habitus, right; B, antennule; C, left legs 5 and 6. Scale bars: A, 0.2 mm; B, C, 0.05 mm.

Rostrum (Fig. 13C) tapering towards truncate apex. Antennule (Fig. 13D) 345  $\mu$ m long and 13-segmented; segmental fusions I-II, III-XI, XII-XIV, XV-XVI, XVII-XVIII, XIX, XX, XXI, XXII, XXIII, XXIV, XXV, XXVI-XXVIII; armature formula 3, 17, 6, 6+aesthetasc, 6, 3, 2, 2, 1, 1, 2, 2+aesthetasc, and 7+aesthetasc; fifth segment (XVII-XVIII) with subdivision on ventral surface; longer setae on proximal segments pinnate (as figured). Antenna (Fig. 13E) with short unarmed coxa; basis with 2 subequal setae representing exopod; first endopodal segment with seta on inner margin; compound distal endopodal segment 3.1 times longer than wide, armed with terminal claw plus 10 setae (arranged as 1, 1, 3, 2, and 3).

Labrum (Fig. 13F) with setulose posterolateral lobes and linear mid-posterior margin ornamented with spinules and setules. Mandible (Fig. 13G) with 5 teeth (second distal tooth acutely pointed) and 2 setae on coxal gnathobase; basis with 1 seta on medial margin; exopod obscurely segmented, armed with 5 setae, distalmost seta distinctly larger than others; endopod with 3 and 9 setae on first and second segments, respectively. Paragnath (Fig. 13H) with denticle apically and setules on medial surface. Maxillule (Fig. 13I) with 9 setae on precoxal arthrite, 1 seta on on coxal endite, 2 setae on coxal epipodite, 3

setae (proximal seta much smaller than distal 2) on medial margin of basis; 4 setae distally on exopod and 5 setae on endopod. Maxilla (Fig. 14A) 5-segmented; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites, respectively; basis with large claw plus 2 setae; 3-segmented endopod with 1, 1, and 3 setae, respectively. Maxilliped (Fig. 14B) 3-segmented and armed with 10, 1, and 3 setae on first to third segments, respectively; seta on second segment and 1 seta on third segment spiniform.

Legs 1–4 with 3-segmented rami; armature formula as in generic diagnosis. Inner seta on coxa of leg 1 (Fig. 14C) plumose, those of legs 2–4 naked. Inner distal spine on basis of leg 1 distinctly shorter than first endopodal segment and spinulose along both margins; distalmost spine on third exopodal segment curved. Outer spines on exopods of legs 2–4 setiform, elongate and smooth (Fig. 14D, E).

Leg 5 (Fig. 14F) protopod ornamented with numerous fine spinules on ventral surface, armed with naked seta on tip of stout outer distal process; exopodal segment sub-rectangular, well-developed, about 2.3 times longer than wide (82 $\times$ 36  $\mu$ m), spinulose on ventral surface: armed with 1 spine (27  $\mu$ m long) and 1 naked seta (61  $\mu$ m long).

**Supplementary description of male.** Body (Fig. 15A) curved ventrally, 1.90 mm long. Urosome 6-segmented. Caudal ramus about 4.1 times longer than wide (160×39 µm).

Rostrum as in female. Antennule (Fig. 15B) 10-segmented; geniculate between eighth (XIX-XX) and ninth (XXI-XXIII) segments; armature formula 3, 17, 2, 2, 2, 5+aesthetasc, 4, 2, 1, and 10+aesthetasc. Antenna, mouthparts, and legs 1–4 as in female.

Leg 5 (Fig. 15C) similar to that of female; protopod with less pronounced outer distal process; exopodal segment about twice as long as wide (47×24 µm). Leg 6 represented by 2 naked setae and 1 small spinulose, spiniform seta on genital operculum (Fig. 15C).

**Remarks.** The type material of this species was obtained from the ascidian *Microcosmus polymorphus* collected off the French Mediterranean coast (Monniot, 1961). Our specimens from Dakar display the key characteristic features of *N. echinata*, including the 13-segmented antennule, the naked setiform outer spines on the exopods of legs 2–4, and the well-developed leg 5 exopod which is spinulose and more than twice as long as wide. However, there are some minor differences: in his

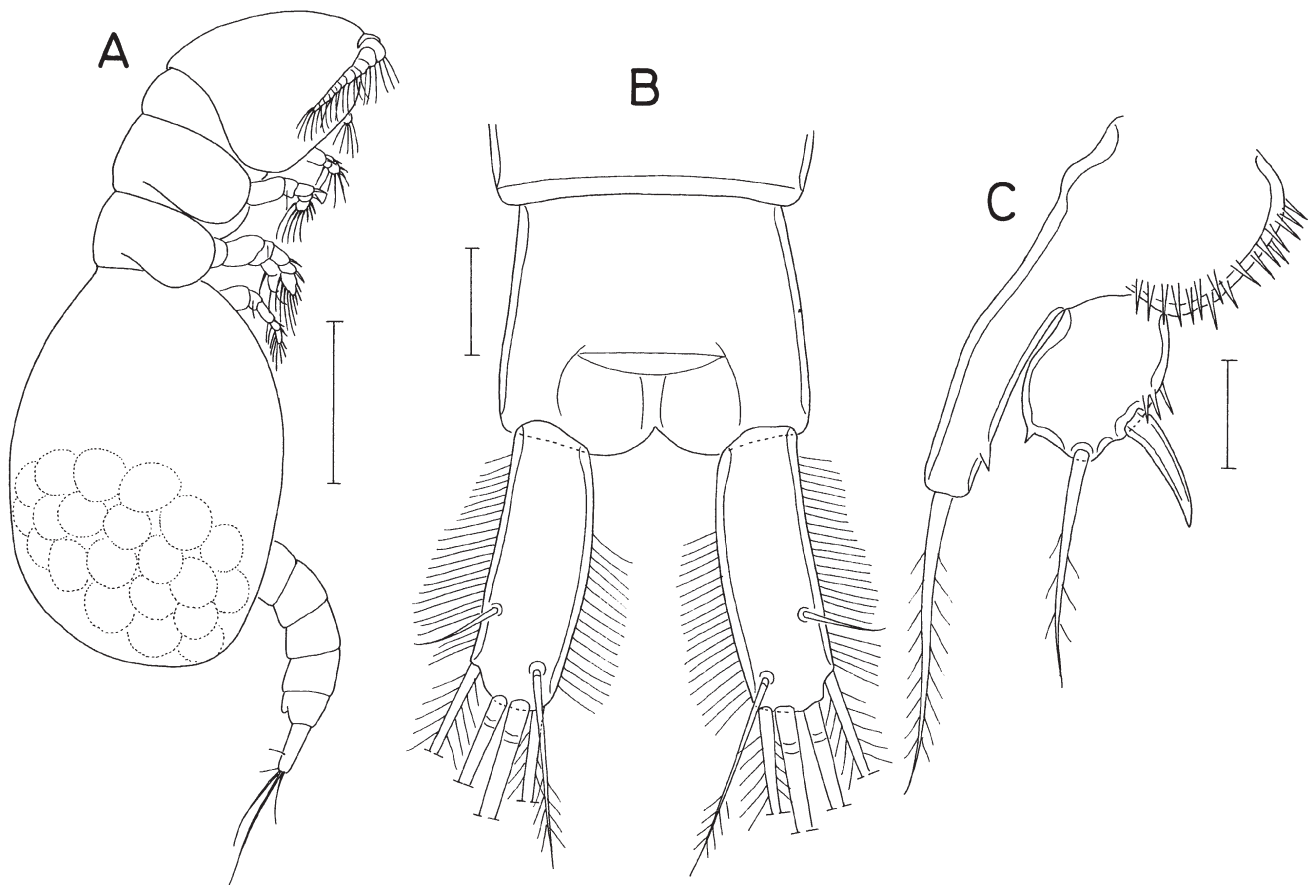
original description Monniot (1961) described the caudal ramus as 6 times longer than wide and 1.5 times longer than the anal somite, the second endopodal segment of the mandible was armed with 10 setae, and the maxilla had 3 setae (2 large and 1 small) on the first endite of the syncoxa. In contrast, in the specimens from Dakar the caudal ramus is only 4.6 times longer than wide and 1.9 times longer than the anal somite, the second endopodal segment of the mandible is armed with 9 setae, and the maxilla has 4 setae (3 large and 1 small) on the first endite of the syncoxa. We consider that these discrepancies can probably best be interpreted as geographical variation and that our specimens can be identified with confidence as *N. echinata*.

***Notodelphys elegans* Thorell, 1859**

(Fig. 16)

**Material examined.** 11 ♀♀, 7 ♂♂ (MNHN-IU-2018-1768) and 1 dissected ♀ (figured) from *Ciona intestinalis* (Linnaeus, 1758), Adriatic Sea.

**Diagnostic characters of female.** Body (Fig. 16A)

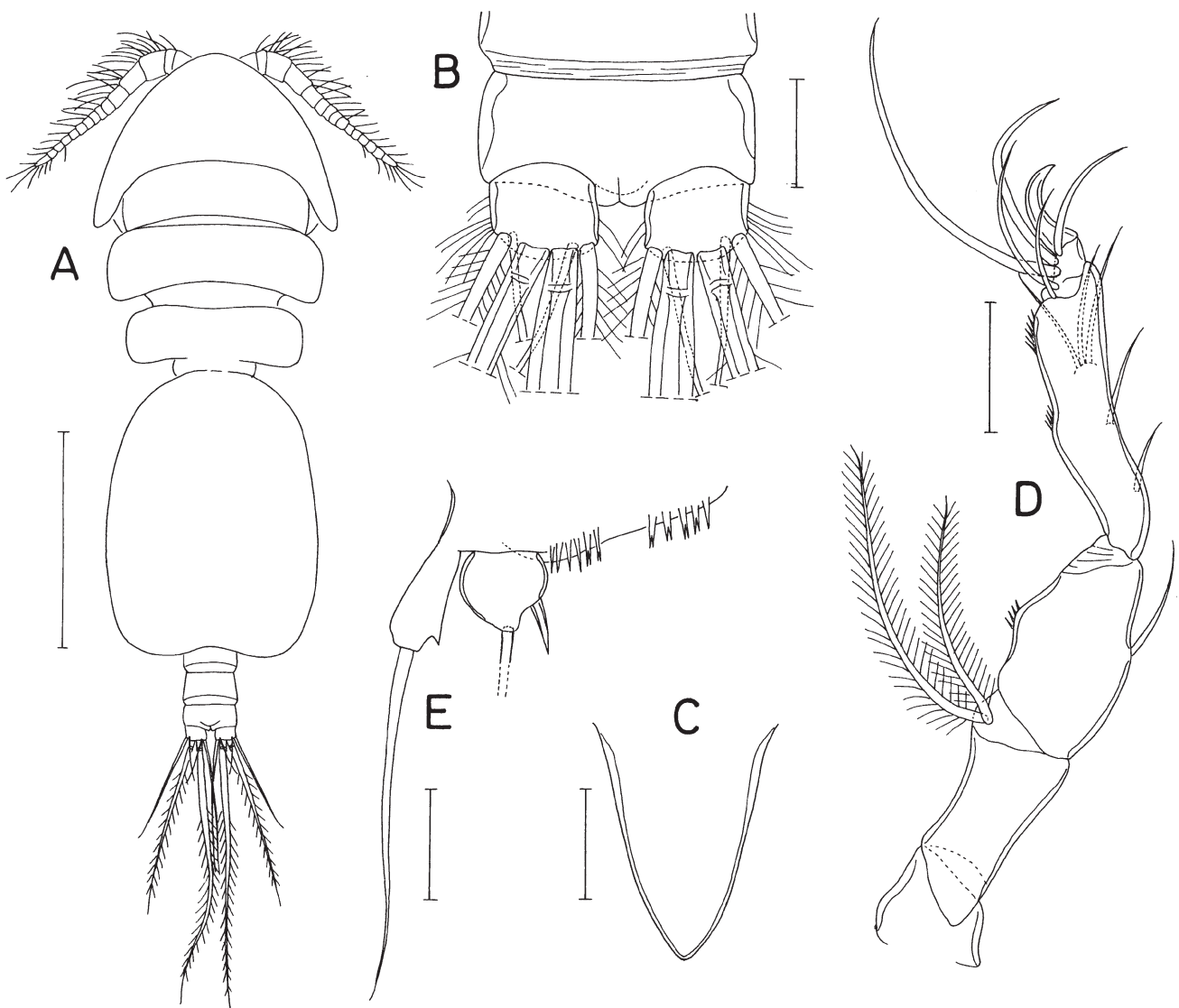


**FIGURE 16.** *Notodelphys elegans* Thorell, 1859, female. A, habitus, right; B, anal somite and caudal rami, dorsal; C, leg 5. Scale bars: A, 0.5 mm; B, 0.05 mm; C, 0.02 mm.

of dissected female 2.50 mm long. Caudal rami (Fig. 16B) widely separated from one another, about 2.9 times longer than wide ( $132 \times 45 \mu\text{m}$ ) and about 1.1 times longer than anal somite ( $118 \times 145 \mu\text{m}$ ), and setulose on both outer and inner margins; outer lateral seta located at 67% of ramus length. Rostrum longer than wide, tapering towards angular apex. Antennule 15-segmented. Antenna rather stout with 2 equal exopodal setae; compound distal endopodal segment about 3 times longer than wide. Mandibular endopod with 3 and 9 setae on first and second segments, respectively. Maxillule indistinctly 2-segmented with 1 and 4 setae on first and second segments, respectively. Maxilla 5-segmented; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites, respectively; basis with claw plus 2 setae; endopod 3-segmented with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped with 10, 1, and 3 setae on first to third segments, respectively. Legs 1–4

as typical for genus. Leg 5 (Fig. 16C) protopod with about 15 spinules scattered irregularly along inner margin and with elongate outer extension bearing plumose seta at tip and 1 subdistal tooth on inner margin; exopodal segment subcircular, about 1.3 times as long as wide ( $32 \times 25 \mu\text{m}$ ), armed with 1 spine and 1 plumose seta; ornamented with 1 denticle distally on outer margin and 3 spinules on inner margin near base of spine.

**Remarks.** As Sars (1921) noted, the caudal ramus is about 3 times longer than wide and only slightly longer than the anal somite, and the outer lateral seta on the ramus is positioned subdistally. In addition, the protopod of leg 5 has an elongate digitiform outer process and distinctly spiniferous inner margin, and the exopodal segment is suboval with a strong inner spine. These characteristic features of *N. elegans* are present in our material from the Adriatic Sea. The species was originally reported



**FIGURE 17.** *Notodelphys prasina* Thorell, 1859, female. A, habitus, dorsal; B, anal somite and caudal rami, ventral; C, rostrum; D, antenna; E, leg 5. Scale bars: A, 0.5 mm; B–D, 0.05 mm; E, 0.02 mm.



from Swedish waters (Thorell, 1859) and its known distribution extends from Scandinavia, along the coast of northwestern Europe and into the Mediterranean (Illg, 1958; Illg & Dudley, 1961).

### *Notodelphys prasina* Thorell, 1859

(Fig. 17)

**Material examined.** 1 ♀, 2 ♂♂ (MNHN-IU-2017-2160) and 1 dissected ♀ (figured) from *Polycarpa pomaria* (Savigny, 1816), MEDITS 2016, Stn M16-2 (43°20.98'N, 4°19.64'E), depth 32–33m, 31 May 2016.

**Diagnostic characters of female.** Body (Fig. 17A) small, 1.61 mm long. Abdominal somites much shorter than wide. Caudal ramus (Fig. 17B) shorter than wide (44×48 µm) and shorter than anal somite (52×126 µm); all caudal setae positioned distally.

Rostrum (Fig. 17C) tapering towards angular tip. Antennule 15-segmented. Two exopodal setae of antenna (Fig. 17D) subequal in length.

Mandibular endopod with 4 and 9 setae on first and second segments, respectively. Endopod of maxillule 2-segmented with 2 and 3 setae on first and second segments, respectively. Maxilla with 3 setae on first endite of syncoxa and with 3 setae on terminal segment of endopod. Maxilliped armed with 10, 1, and 3 setae on first to third segments, respectively.

Leg 5 (Fig. 17E) protopod broad, ornamented with about 10 spinules along inner margin and prominent outer process with subdistal tooth on inner margin; exopodal segment 15×16 µm, subcircular, shorter than outer process of protopod, and armed with 1 spine and 1 seta.

**Remarks.** This distinctive species is unique in the genus in having short caudal rami. They are shorter than wide in *N. prasina* whereas in all other known species of *Notodelphys* the caudal rami are at least 1.6 times longer than wide. This species has a similar distribution to the preceding species, extending from Scandinavia, along the coast of northwestern Europe and into the Mediterranean (Illg, 1958; Illg & Dudley, 1961).

### *Notodelphys reducta* Illg & Dudley, 1961

(Fig. 18)

**Material examined.** 25 ♀♀ (MNHN-IU-2018-1769) from *Molgula helleri* Drasche, 1884, Tarente (= Taranto, Italy); 7 ♀♀ (MNHN-IU-2018-1770) and dissected 1 ♀, 1 ♂ from *Molgula occulta* Kupffer, 1875, Montpellier, Mediterranean coast of France; 2 ♀♀ (MNHN-IU-2018-1771) and 1 dissected ♀ from *Molgula appendiculata* Heller, 1877, Palombaggia, Corsica; 1 ♀ (MNHN-IU-2017-2170) from *M. appendiculata*, MEDITS 2015 Stn T70, (42°08.5'N, 3°11.45'E), depth 41 m.

**Diagnostic characters of female.** Body (Fig. 18A)

of dissected specimen 2.33 mm long. Caudal ramus (Fig. 18B, C) about 3.3 times longer than wide (144×44 µm) and about 1.3 times longer than anal somite (112×139 µm) (Fig. 18B), ornamented with setules on outer margin; outer lateral seta located at 62% of ramus length.

Rostrum tapering, as long as wide, with weakly bilobed apex. Antennule 15-segmented, but articulation between second and third segments incomplete. Antennary exopod represented by 2 large pinnate setae of subequal lengths; compound distal endopodal segment about 4 times longer than wide.

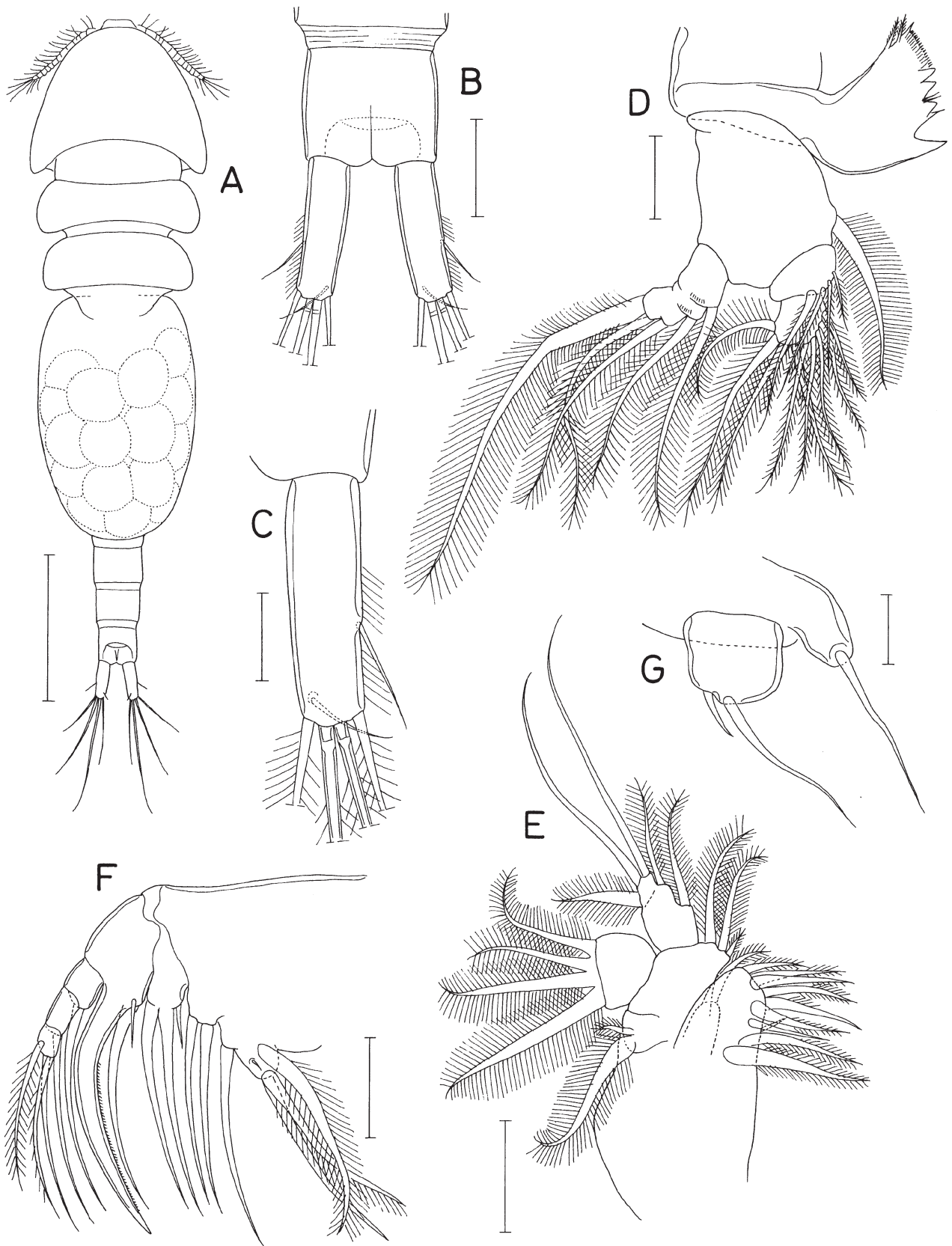
Labrum with prominent posterolateral protuberances; posteromedian lobe broad, setulose on both sides and with several spinules in middle. Mandibular endopod with 4 and 9 setae on first and second segments, respectively (Fig. 18D). Maxillule (Fig. 18E) with 10 setae on precoxal arthrite; endopod with trace of articulation, armed with total of 5 setae (2 distal seta longer and naked). Maxilla (Fig. 18F) 5-segmented; syncoxa with 3 setae and 1 minute setule on first endite; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped 3-segmented and armed with 10, 1, and 3 setae on first to third segments, respectively.

Exopods of legs 2–4 armed only with setae; setae on outer margins of exopods bluntly tipped. Leg 5 (Fig. 18G) protopod smooth, not defined from ventral surface of somite; outer protopodal process shorter than exopod; free exopodal segment quadrate 27×29 µm, with 2 unequal setae.

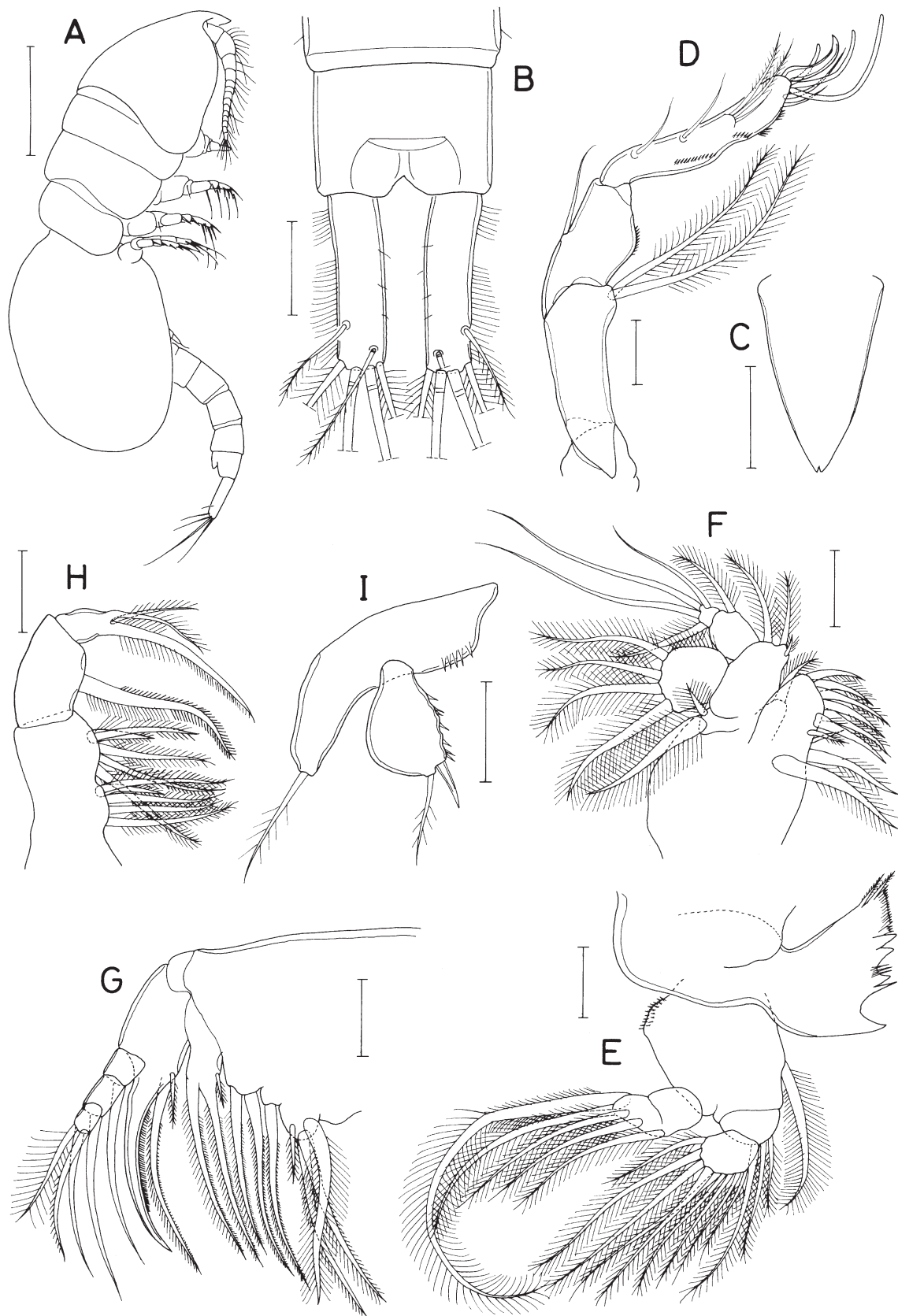
**Male.** Body 1.73 mm long. Urosome 6-segmented: anal somite with several wart-like tubercles distally on dorsal and ventral surfaces. Caudal ramus about 3.2 times longer than wide, setulose on outer margin, with several wart-like tubercles in distal third of ventral surface. Antennule 10-segmented, geniculate between eighth and ninth segments; terminal segment with blunt tip. Leg 6 represented by 2 setae and 1 inner subdistal setule on genital operculum.

**Remarks.** *Notodelphys reducta* was first described by Illg & Dudley (1961) from the French Mediterranean coast. Subsequently, this copepod was reported also from Naples, Italy (Illg & Dudley, 1965). In both cases the host was *Molgula appendiculata* (as *Ctenicella appendiculata*) and *N. reducta* is the only known copepod associate of this ascidian. The ascidians *M. helleri* and *M. occulta* are reported here for the first time and constitute new host records for *N. reducta*.

Illg & Dudley (1961) mentioned that this species differed from every known species of *Notodelphys* in the reduction of the protopod of leg 5. We infer that this description refers to the lack of a basal articulation between the protopod of leg 5 and the somite, as observed in our specimens, as well as the relatively small size of the outer protopodal process bearing the outer basal seta.



**FIGURE 18.** *Notodelphys reducta* Illg & Dudley, 1961, female. A, habitus, dorsal; B, anal somite and caudal rami, ventral; C, left caudal ramus, ventral; D, mandible; E, maxillule; F, maxilla; G, leg 5. Scale bars: A, 0.5 mm; B, 0.1 mm; C–F, 0.05 mm; G, 0.02 mm.



**FIGURE 19.** *Notodelphys tenera* Thorell, 1859, female. A, habitus, right; B, anal somite and caudal rami, dorsal; C, rostrum; D, antenna; E, mandible; F, maxillule; G, maxilla; H, maxilliped; I, leg 5. Scale bars: A, 0.5 mm; B, C, 0.1 mm; D–I, 0.05 mm.

*Notodelphys tenera* Thorell, 1859  
(Fig. 19)

**Material examined.** 1 ♀, 3 ♂♂ (MNHN-IU-2018-1772) from *Ascidia obliqua* Alder, 1863, middle of fjord, Kristineberg, Sweden; 1 ♀ (dissected and figured) from *A. obliqua*, Norway, Norbi Stn CP11, depth 300 m.

**Diagnostic characters of female.** Body (Fig. 19A) of dissected specimen 3.0 mm long. Caudal ramus (Fig. 19B) rectangular, about 3.6 times longer than wide (193×53 µm) and 1.4 times longer than anal somite, setulose along outer margin; outer lateral seta positioned at 75% of ramus length.

Rostrum (Fig. 19C) tapering, about 1.5 times as long as wide, minutely bifurcate at apex. Antennule 15-segmented. Antenna (Fig. 19D) with 2 equally large setae on basis representing exopod; compound distal endopodal segment slender, about 5 times as long as wide; terminal claw small, about 1/3 as long as segment.

Mandible (Fig. 19E) with patch of fine spinules proximally on outer surface of basis; endopod armed with 3 and 9 setae on first and second segments, respectively. Maxillule (Fig. 19F) with 10 setae on precoxal arthrite; endopod distinctly 2-segmented with 1 and 4 setae on first and second segments, respectively; 3 of distal setae on second endopodal segment naked. Maxilla (Fig. 19G) 5-segmented; syncoxal armature elements 4, 1, 2, and 3 setae on first to fourth endites, basis with claw plus 2 setae, and with 1, 1, and 3 setae on first to third endopodal segments. Maxilliped (Fig. 19H) 3-segmented and armed with 10, 1, and 3 setae on first to third segments, respectively.

Leg 1 basis with short inner distal spine less than half as long as first endopodal segment; exopod distinctly shorter than endopod; first exopodal segment with several spinules on outer margin; first endopodal segment about 1.6 times longer than wide. Spines on outer margin of exopods of legs 2–4 slender, smooth, and straight.

Leg 5 (Fig. 19I) protopod distinctly articulated from ventral surface of pedigerous somite, ornamented with 4 or 5 spinules on inner distal margin, outer distal process slightly shorter than exopod and tipped with pinnate seta; free exopodal segment bulbous, narrowed proximally, about 1.7 times longer than wide (61×37 µm), with convex outer margin and almost straight inner margin bearing 6 or 7 spinules; distal armature comprising inner spine and outer seta about as long as segment

**Remarks.** The characteristic shape of the free exopodal segment of leg 5 in the female allows this species to be easily identified. This species has a distribution ranging from Scandinavia in the North to the Mediterranean (Illg, 1958).

*Notodelphys parva* Schellenberg, 1922  
(Fig. 20)

**Material examined.** 3 ♀♀, 1 ♂ (MNHN-IU-2018-1773) and 2 dissected ♀♀ from *Herdmania momus* (Savigny, 1816), Ibo P. 5, coral reef, Mozambique, 10 November 1995.

**Diagnostic characters of female.** Body (Fig. 20A) dorsoventrally depressed, 1.47 mm long. Brood pouch sub-quadrangle, longer than wide. Free urosome short, 5-segmented. Caudal ramus rectangular, about 1.9 times longer than wide (125×65 µm), densely covered with transparent scales on dorsal and ventral surfaces (scales not illustrated on Fig. 20A), setulose along inner and outer margins; armed with 6 setae, all located distally.

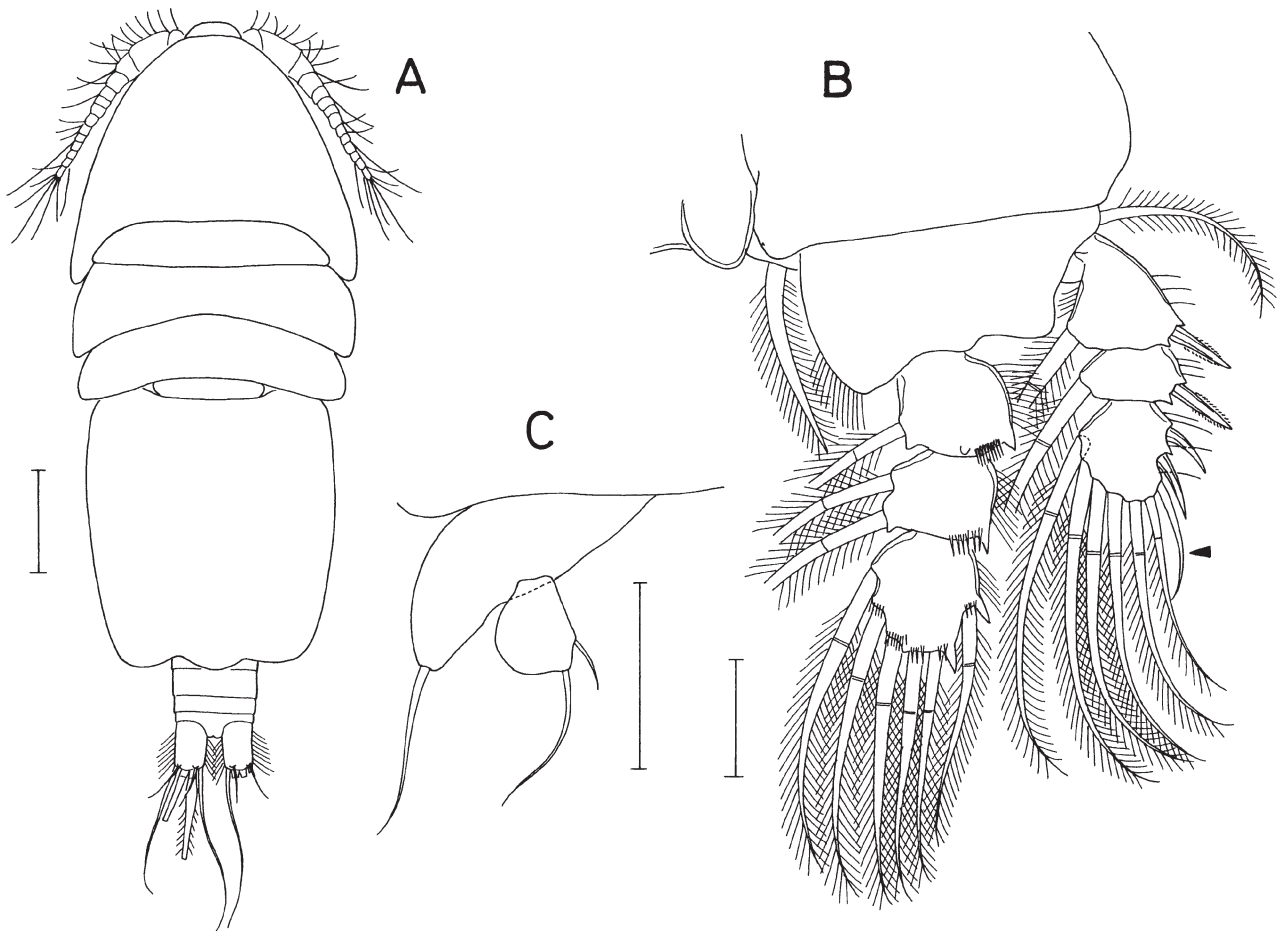
Antennule 15-segmented. Antenna with exopod represented by 2 subequal setae; compound distal endopodal segment extremely elongate, about 10 times longer than wide (191×19 µm).

Mandibular gnathobase with 5 teeth, second distal tooth tri- or quadricuspidate; exopod armed with 5 setae and endopod with 2 and 9 setae on first and second endopodal segments, respectively. Maxillule as usual for genus; with 10 setae on precoxal arthrite, 3 setae on medial margin of basis, and 5 setae on unsegmented endopod. Maxilla typical for genus, with 3 setae on first endite of syncoxa and 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped with 9, 1, and 3 setae on first to third segments, respectively.

Inner distal spine of basis of leg 1 smooth and as long as first endopodal segment. Legs 2 (Fig. 20B) and 3 unusual in having 2 spines and 7 setae on third exopodal segment; almost all setae on these legs with defined breaking plane at proximal quarter, except outer subdistal seta. Leg 5 (Fig. 20C) protopod with broad, tapering outer distal process tipped with naked seta; free exopodal segment slightly longer than wide (26×20 µm), with roundly protruded outer margin and 2 unequal, naked setae.

**Remarks.** The presence of 2 spines and 7 setae, rather than the typical 4 spines and 5 setae as usual, on the third exopodal segment of both legs 2 and 3 is the most characteristic feature of this species. The dense ornamentation of transparent scales on the caudal rami of *N. parva* is also found in *N. steinitzi* Stock, 1967 and Stock (1967) provided detailed comparisons between these two species.

This species was originally described from the Gulf of Suez living in association with *Herdmania momus* (as *Pyura momus*) and *Polycarpa ehrenbergi* Hartmeyer, 1916 (Schellenberg, 1922). Subsequently, Stock (1967) recorded *N. parva* from *Herdmania momus*, an unidentified species of the family Pyuridae, and from *Didemnum candidum* Savigny, 1816 collected in the Red Sea.



**FIGURE 20.** *Notodelphys parva* Schellenberg, 1922, female. A, habitus, dorsal; B, leg 2; C, leg 5. Scale bars: A, 0.2 mm; B, C, 0.05 mm.

***Notodelphys steinitzi* Stock, 1967**  
(Figs. 21–23)

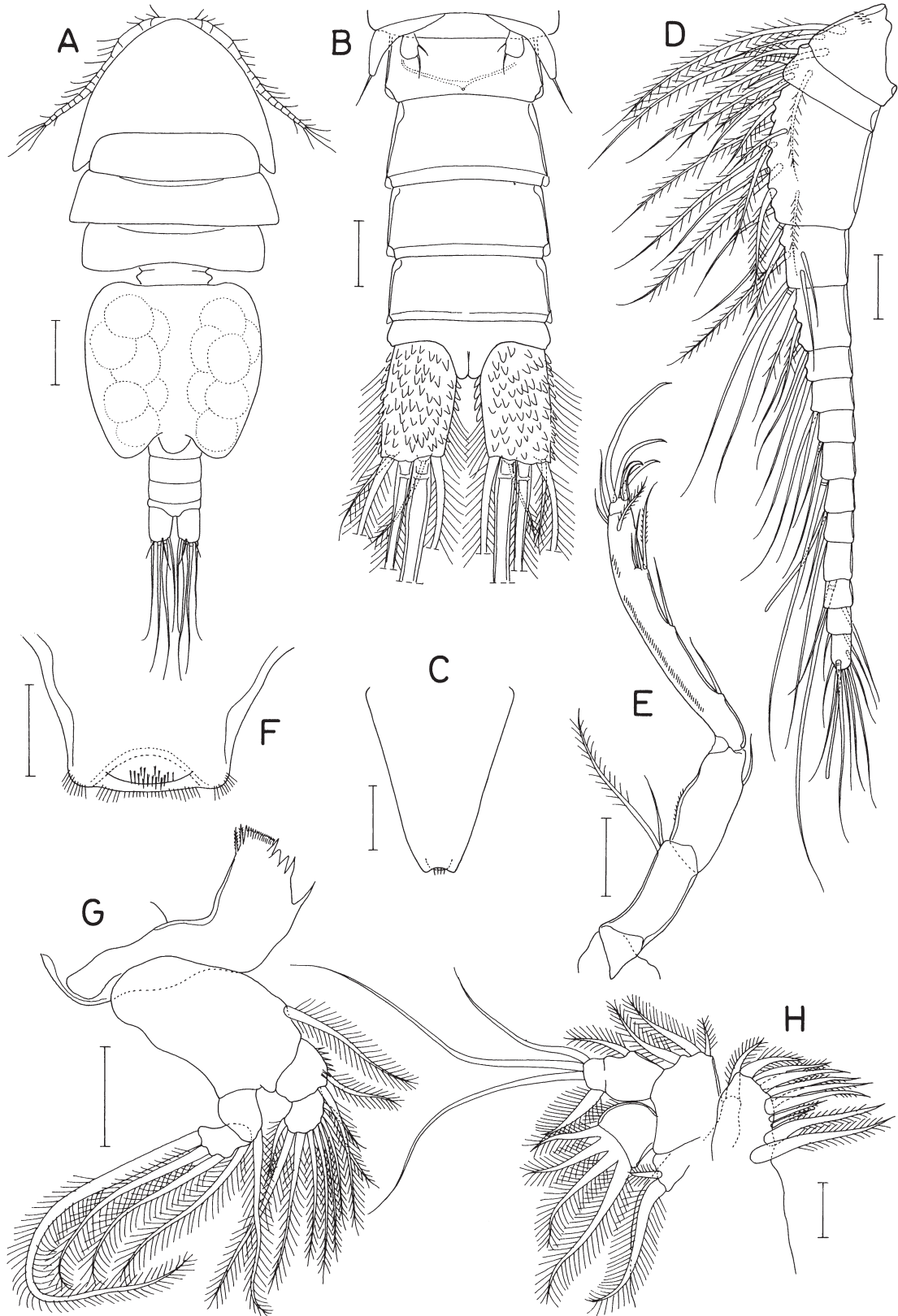
**Material examined.** 12 ♀♀, 2 ♂♂ (MNHN-IU-2018-1774) and dissected 1 ♀, 1 ♂ (figured) from *Ascidia fictile* Monniot C., 1997, Madagascar, Plante coll.; 1 ♀, 1 ♂ (MNHN-IU-2018-1775) from *A. fictile*, MUA 20, Nosy Be, Madagascar, Laboute coll.; 3 ♀♀, 3 ♂♂ (MNHN-IU-2018-1776) from *A. fictile*, MUA 20, Nosy Be, Madagascar, Laboute coll.

**Supplementary description of female.** Body (Fig. 21A) dorsoventrally depressed, 1.62 mm long. First pedigerous somite narrower than other prosomal somites: tergites of second and third pedigerous somites with angular posterolateral corners. Brood pouch wider than long, slightly narrowing distally, with weakly convex lateral margins. Free urosome (Fig. 21B) consisting of genital somite and 4 abdominal somites, 45×125, 67×127, 58×127, 51×127, and 45×127 μm, respectively; lateral margins of abdomen parallel. Caudal ramus about 1.7 times as long as wide (91×55 μm), rectangular, surface covered by dense ornamentation of transparent scales

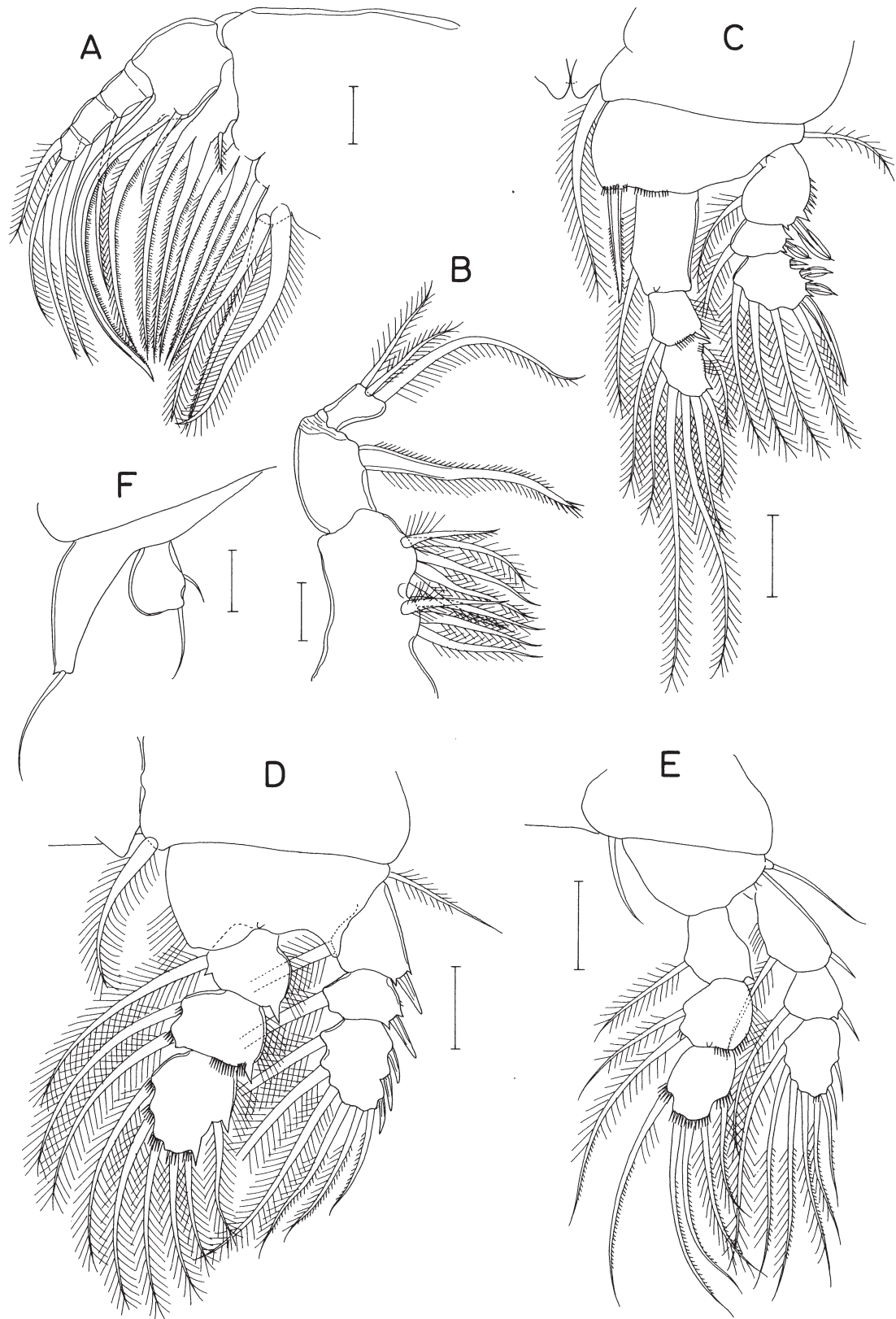
and thin setules; armed with 6 pinnate setae, all located distally.

Rostrum (Fig. 21C) tapering, longer than wide, with truncate, slightly concave distal margin bearing spinulose lobe. Antennule (Fig. 21D) slender, longer than cephalosome, 15-segmented; armature formula 3, 6, 12, 6, 4, 2, 2, 2, 1, 1+aesthetasc, 1, 1, 2, 2, and 7+aesthetasc; most of setae on proximal 5 segments pinnate, other setae on distal segments naked (as figured). Antenna (Fig. 21E) slender, with short, obscure coxa; basis with long pinnate seta and short naked setae representing exopod; first endopodal segment slightly shorter than basis, with 1 seta subdistally on inner margin and fine spinules on outer margin; compound distal endopodal segment elongate, about 7.6 times as long as wide (174×23 μm), ornamented with longitudinal row of minute spinules along outer margin: armed with small terminal claw and 11 setae (grouped as 1, 1, 3, 1, 2, and 3), distal 3 of which claw-like, pointed at tip.

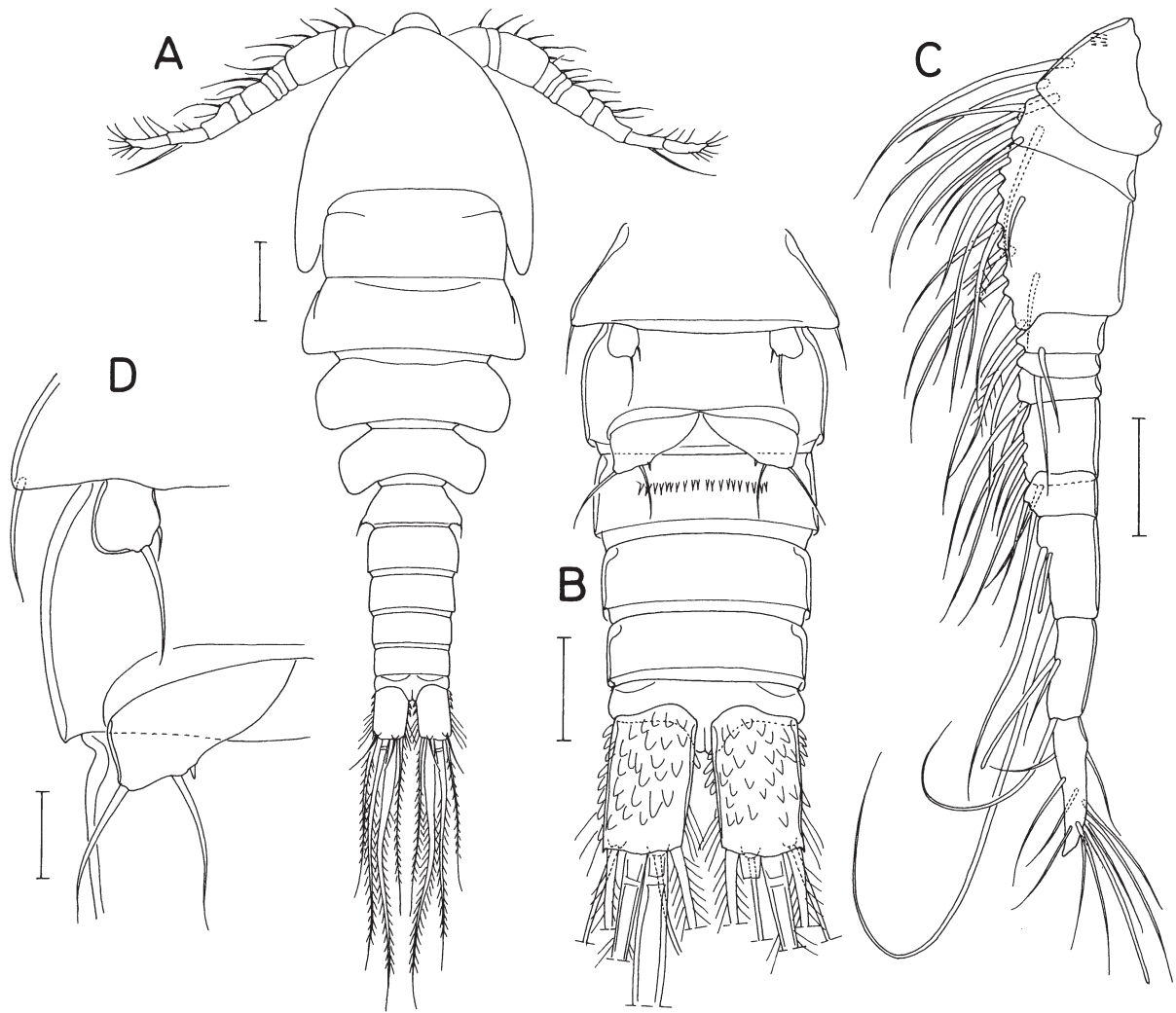
Labrum (Fig. 21F) narrowing distally, setulose along posterior margin, with indistinct posteromedian lobe bearing fine spinules. Mandible (Fig. 21G) with 5 teeth



**FIGURE 21.** *Notodelphys steinitzi* Stock, 1967, female. A, habitus, dorsal; B, urosome, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule. Scale bars: A, 0.2 mm; B–G, 0.05 mm; H, 0.02 mm.



**FIGURE 22.** *Notodelphys steinitzi* Stock, 1967, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, F, 0.02 mm; C–E, 0.05 mm.



**FIGURE 23.** *Notodelphys steinitzi* Stock, 1967, male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, legs 5 and 6. Scale bars: A, 0.1 mm; B, C, 0.05 mm; D, 0.02 mm.

(distal 2 acutely pointed) and 2 proximal setae on coxal gnathobase; basis with 1 seta on medial margin; exopod 2-segmented with 1 and 4 setae on first and second segments, respectively, distalmost seta distinctly longer than others; endopod with 2 and 9 setae on first and second segments, respectively; first endopodal segment ornamented with spinules on medial margin. Maxillule (Fig. 21H) armed with 10 setae on arthrite, 1 seta on coxal endite, 2 setae on epipodite, and 3 setae (proximal one smaller) on medial margin of basis; exopod with 4 setae, all apparently united at base; endopod incompletely 2-segmented and armed with 1 and 4 setae on first and second segments, respectively, 3 distal setae longer and naked. Maxilla (Fig. 22A) 5-segmented; syncoxa with 9 enditic setae, arranged as 3, 1, 2, and 3; basis with long, strongly arched claw plus 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped

(Fig. 22B) 3-segmented and armed with 9, 1, and 3 setae on first to third segments, respectively.

Legs 1–4 biramous with 3-segmented rami (Fig. 22C–E). Inner seta on coxa and outer seta on basis pinnate in legs 1–3 but naked in leg 4 (Fig. 22E). Number of armature elements as usual for genus, but exopod of leg 4 armed only with setiform elements. Inner distal spine on basis of leg 1 straight, narrow, and as long as first endopodal segment.

Leg 5 (Fig. 22F) 2-segmented; protopod broad but short, with smooth, tapering outer distal process tipped with 1 naked seta; exopod about 1.2 times longer than wide ( $22 \times 19 \mu\text{m}$ ), distinctly shorter than outer distal process of protopod, with narrow base, convex outer margin, and armed with shorter inner margin seta and longer distal seta, both setae naked.

**Supplementary description of male.** Body (Fig.



23A) narrower than female, 916 µm long. Tergites of second to fourth pedigerous somites with rounded posterolateral corners. Urosome (Fig. 23B) 6-segmented: fifth pedigerous somite free, 132 µm wide; genital and 4 abdominal somites 64×121, 45×112, 38×105, 35×100, and 36×97 µm, respectively. First abdominal somite ornamented with transverse row of spinules in middle of ventral surface. Caudal ramus about 1.7 times as long as wide (73×42 µm), armed and ornamented as in female.

Rostrum as in female. Antennule (Fig. 23C) 11-segmented, segmental fusion pattern: I-II, III-V, VI-XI, XII, XIII, XIV, XV-XVII, XVIII, XIX-XX, XXI-XXIII, XXIV-XXVIII: geniculate between ninth (XIX-XX) and tenth (XXI-XXIII) segments; armature 3, 5, 12, 2, 2, 2, 5, 2, 2+aesthetasc, 2+aesthetasc, and 10+aesthetasc; nearly all setae naked. Antenna, mouthparts, and legs 1–4 as in female.

Leg 5 (Fig. 23D) represented by 1 seta on posterolateral corner of fifth pedigerous somite and free exopodal segment, 18×16 µm, shaped as in female. Leg 6 (Fig. 56D) represented by 2 equal, naked setae and 1 minute, inner spinule on posterior margin of genital operculum.

**Remarks.** Stock (1967) described this species as an associate of *Phallusia nigra* Savigny, 1816 (as *Ascidia nigra*) collected on the Red Sea coast in the Dahlak Archipelago and in the Sheikh Said Channel near Massawa, Ethiopia. Most of the features given in his description are confirmed from our specimens except the plumosity of some of the setae on certain appendages. The dense covering of transparent scales on the caudal rami was overlooked by Stock (1967). *Ascidia fictile* is a new host record for this copepod and its discovery in Madagascan waters represents a significant extension of its known range along the Indian Ocean coast of East Africa.

### *Notodelphys weberi* Stock, 1950

(Figs. 24, 25)

**Material examined.** 1 ♀ (dissected and figured) from *Ascidia canaliculata* Heller, 1878, Knysna, South Africa, February 1996.

**Supplementary description of female.** Body (Fig. 24A) depressed, 2.94 mm long. First pedigerous somite only slightly narrower than second and third pedigerous somites. Brood pouch longer than wide, 1.04×0.87 mm with weakly convex lateral margins; fifth pedigerous somite completely fused to brood pouch. Free urosome (Fig. 24B) 5-segmented; genital and abdominal somites 177×259, 218×266, 227×257, 182×232, and 150×205 µm, respectively. Caudal ramus about 3.3 times as long as wide (208×63 µm), setulose along inner and outer margins, and armed with 6 pinnate setae; outer lateral seta positioned at 67% of ramus length.

Rostrum (Fig. 58A) longer than wide, tapering

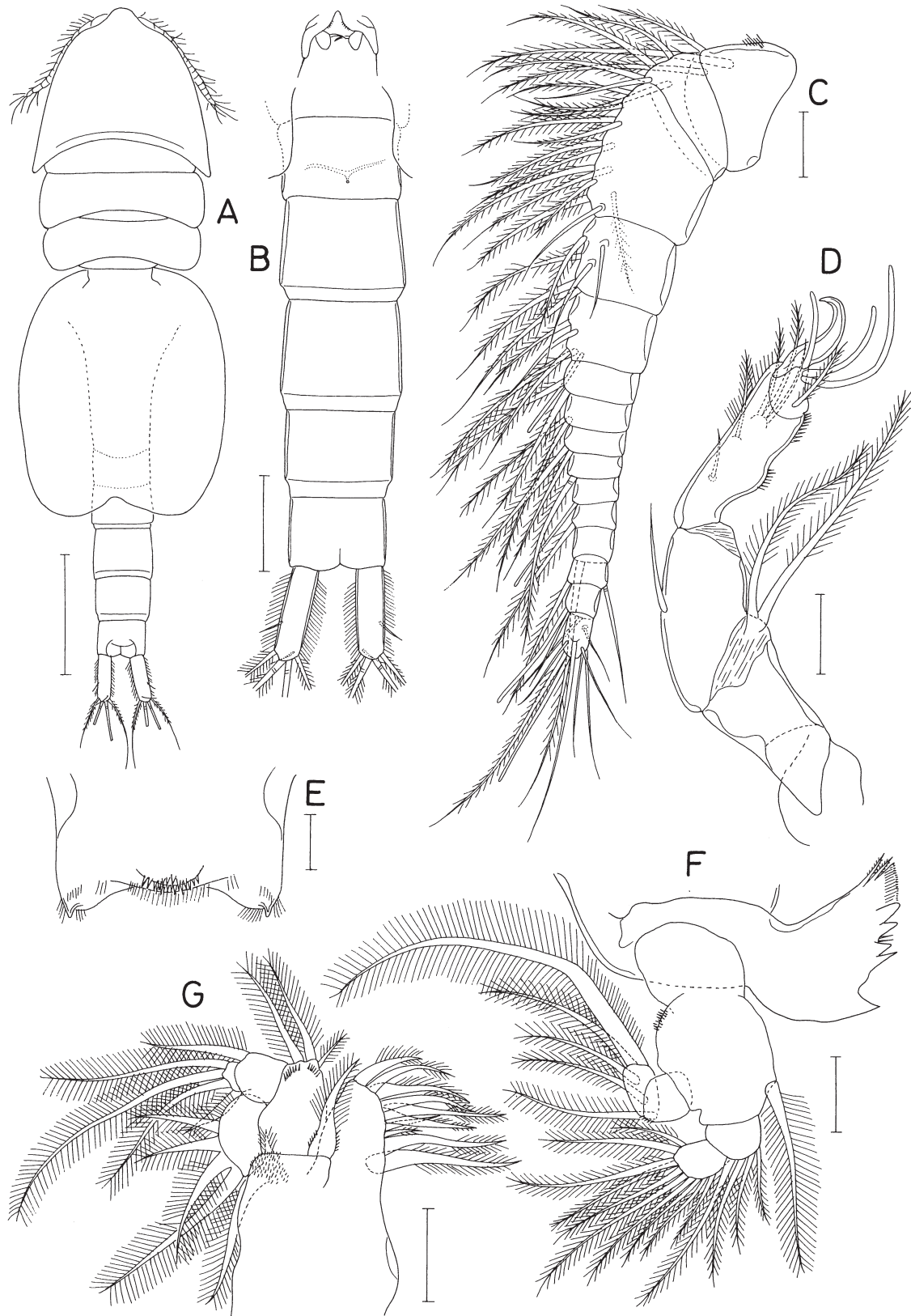
to small apical lobe. Antennule (Fig. 24C) shorter than cephalosome, 15-segmented; armature formula 3, 5, 12, 6, 4+aesthetasc, 2, 2, 2, 1, aesthetasc, 1, 1, 2, 2+aesthetasc, and 7+aesthetasc; most of setae pinnate (as figured). Antenna (Fig. 24D) rather stout; coxa short, unarmed; basis broadening distally, with 2 subequal pinnate exopodal setae; first endopodal segment with naked seta on inner margin; compound distal endopodal segment about 3 times longer than wide (118×38 µm), ornamented 2 rows of fine spinules on outer margin and setules on distal half of inner margin; armed with terminal claw plus 9 setae (arranged as 1, 1, 3, 1, and 3 (3 distal setae blunt at tip)).

Labrum (Fig. 24E) with concave posterior margin bearing scattered rows of setules, dentiform process at each posterolateral corner, and shallow spinulose posteromedian lobe. Mandible (Fig. 24F) with 5 teeth (2 distal ones acutely pointed) and 2 setae on coxal gnathobase; basis armed with 1 seta on medial margin and patch of minute spinules on outer margin; exopod 2-segmented with 1 and 4 setae on first and second segments, respectively, distalmost seta large, about twice as long as adjacent seta; endopod 2-segmented with 4 and 10 setae on first and second segments, respectively. Paragnath with angular process medio-distally and setules on medial margin. Maxillule (Fig. 24G) with 10 setae on arthrite, 1 seta on endite, 2 unequal setae on epipodite, ornamented with patch of minute spinules near base of smaller epipodal seta; basis with 3 setae on medial margin (proximal one much smaller than distal 2) and row of fine spinules on medial side; exopod with 4 setae distally; endopod 2-segmented with 1 and 4 pinnate setae on first and second segments, respectively. Maxilla (Fig. 25B) 5-segmented; syncoxa with 10 setae grouped as 4, 1, 2, and 3; basis with strong curved claw plus 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 25C) 3-segmented and armed with 10, 1, and 4 setae on first to third segments, respectively; proximal seta on third segment sigmoid, weakly cuticularized.

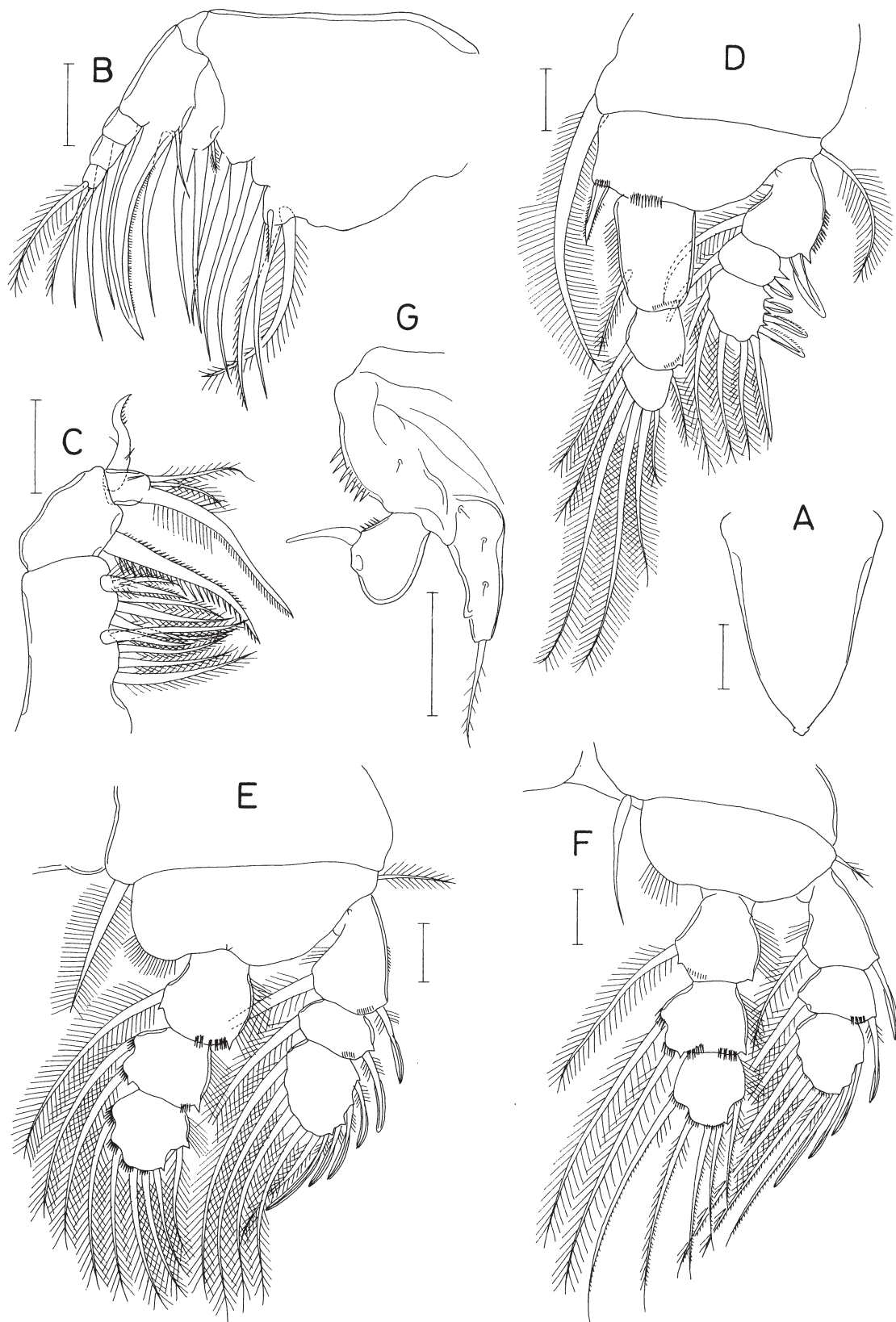
Legs 1–4 biramous with 3-segmented rami (Fig. 25D–F); armature formula as in generic diagnosis. Inner coxal seta large in leg 1 and naked in leg 4. Inner distal spine on basis of leg 1 small, about half as long as first endopodal segment. Outer spines on exopods of legs 2–4 slender but ornamented with membrane distally on both margins.

Leg 5 (Fig. 25G) 2-segmented; protopod obscurely defined at base, with 7 spinules on inner margin, and tapering outer distal process (59×24 µm) bearing denticle subdistally on inner margin and weakly pinnate apical seta; free exopodal segment longer than wide (36×30 µm), roundly protruded on outer distal margin, armed with 1 spine and probably 1 seta (missing but scar present), and ornamented with minute spinules on inner margin.

**Remarks.** Although *N. weberi* was incompletely characterised by Stock (1950), our single female is



**FIGURE 24.** *Notodelphys weberi* Stock, 1950, female. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, antenna; E, labrum; F, mandible; G, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C–G, 0.05 mm.



**FIGURE 25.** *Notodelphys weberi* Stock, 1950, female. A, rostrum; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: 0.05 mm.

identified as *N. weberi* partly on the basis of shared morphological details such as the presence of 4 and 10 setae on the first and second endopodal segments of the mandible, and the ornamentation of spinules along the inner margin of the protopod of leg 5, but also after consideration of the host. Our female was collected from the type host species and from the type locality and, in addition, the ascidian host *Ascidia canaliculata*, has never been known to serve as host for any other species of notodelphyid copepod. The presence of 4 setae on the third segment of the maxilliped is a unique feature of *N. weberi* in the genus *Notodelphys*, although this feature was not mentioned in the original description (Stock, 1950).

This species is similar in body form to *N. steinitzi* and *N. parva*, but it is markedly larger, with a body length of between 2.94 mm in our female and 4.2 mm in Stock's type specimen of *N. weberi*.

### *Notodelphys cuspis* sp. nov.

(Figs. 26–28)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21216), allotype (intact ♂, MNHN-IU-2014-21217), paratypes (intact, 5 ♀♀, 1 ♂, MNHN-IU-2014-21218), and dissected paratypes (1 ♀, 1 ♂; figured) from *Molgula occulta* Kupffer, 1875 (MNHN-IT-2008-5629 = MNHN S3/MOL.A/42), Dakar, Senegal, Stn 58-4-2B (depth 43–44 m) & 58-2-19B (depth 12 m), IFAN coll., 1966–1969.

**Etymology.** The name is derived from the Latin *cuspi* (= a point), referring to the tooth-like, spinous process on the inner distal corner of the basis of leg 1.

**Description of female.** Body (Fig. 26A) 2.76 mm long. Prosome consisting of cephalosome and first to third free pedigerous somites, with fourth pedigerous somite forming inflated brood pouch. Fifth pedigerous somite fused to thin-walled brood pouch. Free urosome (Fig. 26B) 5-segmented, consisting of genital and 4 abdominal somites: dimensions 127×233, 196×236, 211×215, 160×191, and 127×164 µm, respectively. Anal somite distinctly narrower than preceding somites. Caudal ramus (Fig. 26C) about 2.9 times longer than wide (145×50 µm) and 1.14 times longer than anal somite, densely setulose along outer and inner margins, armed with 6 pinnate setae; outer lateral seta positioned at 58% of ramus length.

Rostrum (Fig. 26D) 150×144 µm, tapering from broad basal region to rounded apex. Antennule (Fig. 26E) 360 µm long and 15-segmented; articulation between second (III-V) and third (VI-XI) segments incomplete; armature formula 3, 5, 12, 4, 4+aesthetasc, 2, 2, 2, 1, 2, 1, 1, 2, 2+aesthetasc, and 7+aesthetasc; 3 setae (2 on first and 1 on second segment) pinnate, all other setae naked (as figured); seta on ninth (derived from segment XX) and twelfth segments (derived from XXIII) annulated at base. Antenna (Fig. 26F) 4-segmented; coxa short and

unarmed; basis with 2 outer pinnate setae representing exopod (shorter seta about 65% length of longer one); first endopodal segment with 1 seta on inner margin; compound distal endopodal segment about 3.8 times as long as wide (121×32 µm), armed with terminal claw and 10 setae (arranged as 1, 1, 3, 2, and 3 from proximal to distal) and ornamented with 3 rows of spinules on outer surface; terminal claw small, about one-third length of segment; 3 distal setae bluntly tipped.

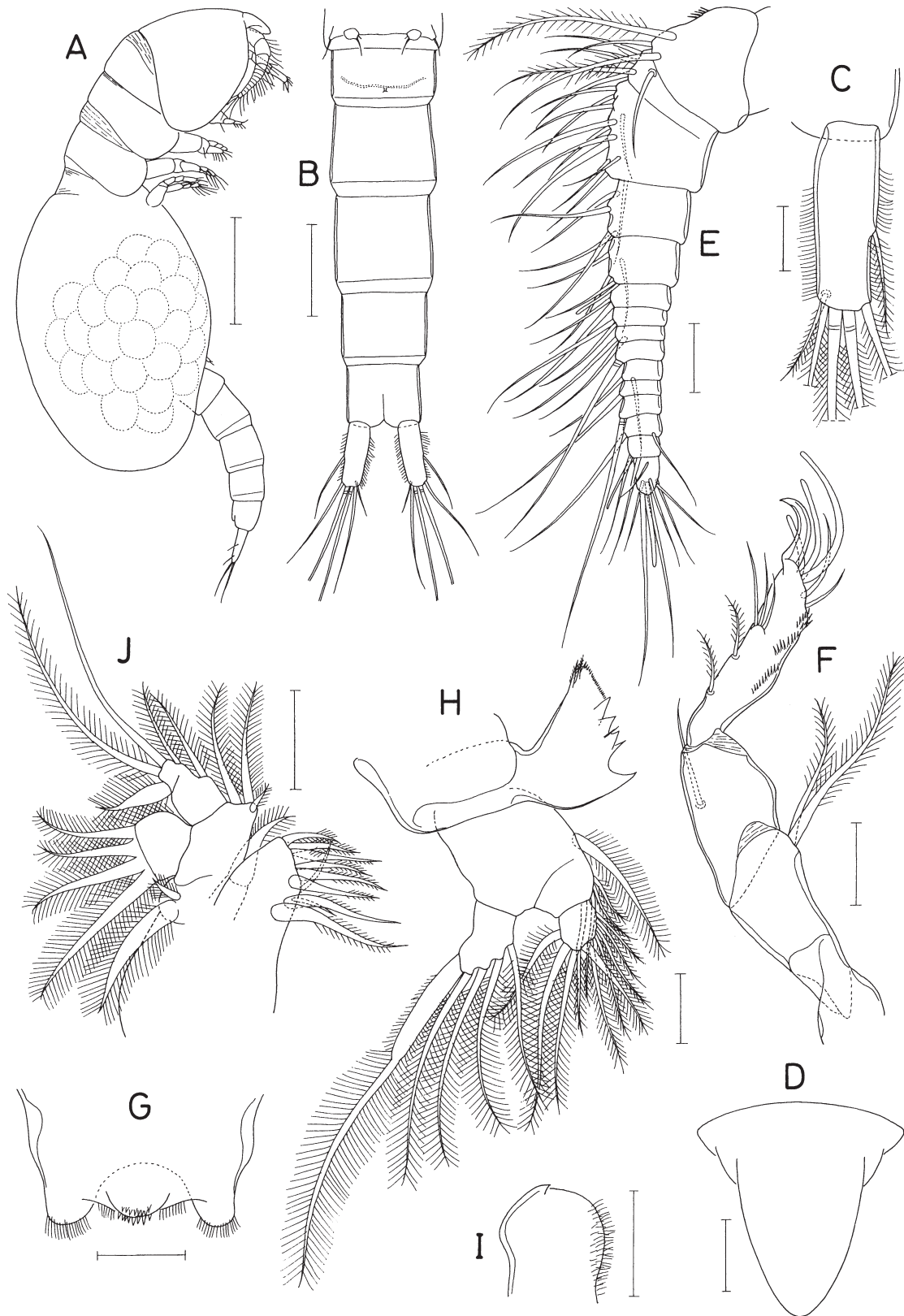
Labrum (Fig. 26G) setulose along posterior margin, with protruding posterolateral corners and convex, spinulose mid-posterior lobe. Mandible (Fig. 26H) with 5 pointed teeth and 2 setae on coxal gnathobase; basis with 1 seta on medial margin; exopod unsegmented with 5 setae, distalmost seta markedly larger than others; endopod indistinctly defined from basis, armed with 4 and 9 setae on first and second segments, respectively. Paragnath (Fig. 27I) lobate, with denticle apically and setules on medial margin. Maxillule (Fig. 26J) armed with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 (proximal seta much smaller than distal 2) on medial margin of basis, 4 on exopod; endopod indistinctly 2-segmented, with 1 seta on first segment and 4 on second segment; longest distal seta on second segment naked, outer seta broad proximally. Maxilla (Fig. 27A) 5-segmented; syncoxa with 9 setae, grouped as 3 + minute seta, 1, 2, and 3 on first to fourth endites; basis with strong curved claw and 1 seta; endopod slender, with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 27B) 3-segmented; first segment armed with 10 setae, 2 of which shorter and broader; second segment with 1 spiniform seta; third segment narrow and armed 1 large spiniform seta and 1 small naked seta.

Legs 1–4 with 3-segmented rami. Outer seta on basis short and naked in all legs (Fig. 27C, E, F). Leg 1 basis broad with projecting inner distal corner tipped with denticle originating internally (Fig. 27C, D) plus small, naked inner distal seta (not spine); third exopodal segment armed with 3 spines and 5 setae (terminal spine transformed to slightly curved seta); first endopodal segment as long as wide, not elongated. Legs 2–4 exopods armed only with setae; all outer setae naked. Armature formula for legs 1–4 as follows:

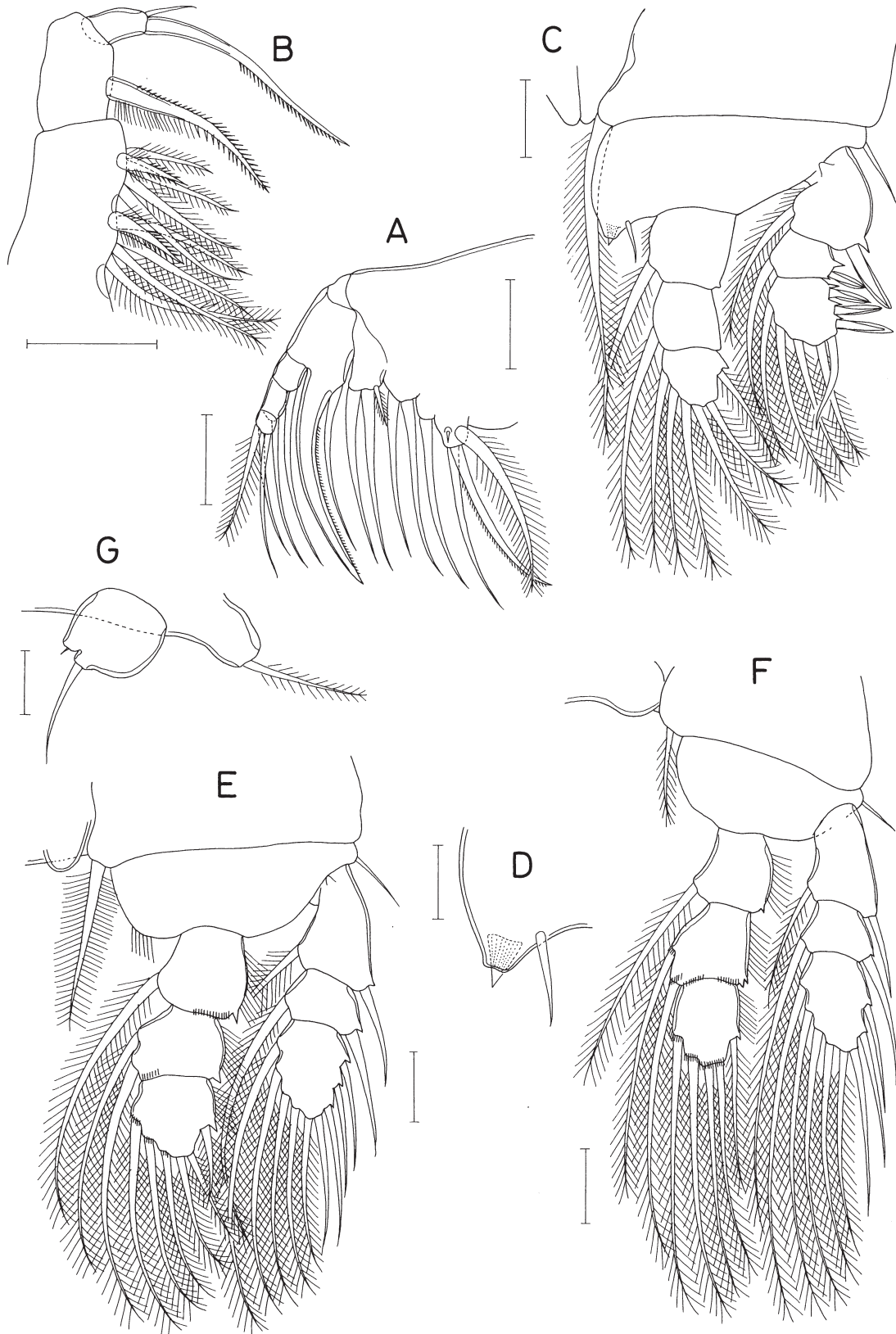
	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	I-1; I-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 27G) protopod fused to brood pouch, not articulated at base, with blunt outer process tipped with pinnate seta; free exopodal segment quadrate (28×28 µm) with minute, rudimentary inner subdistal seta and naked distal seta; no spinules present on protopod or exopod.

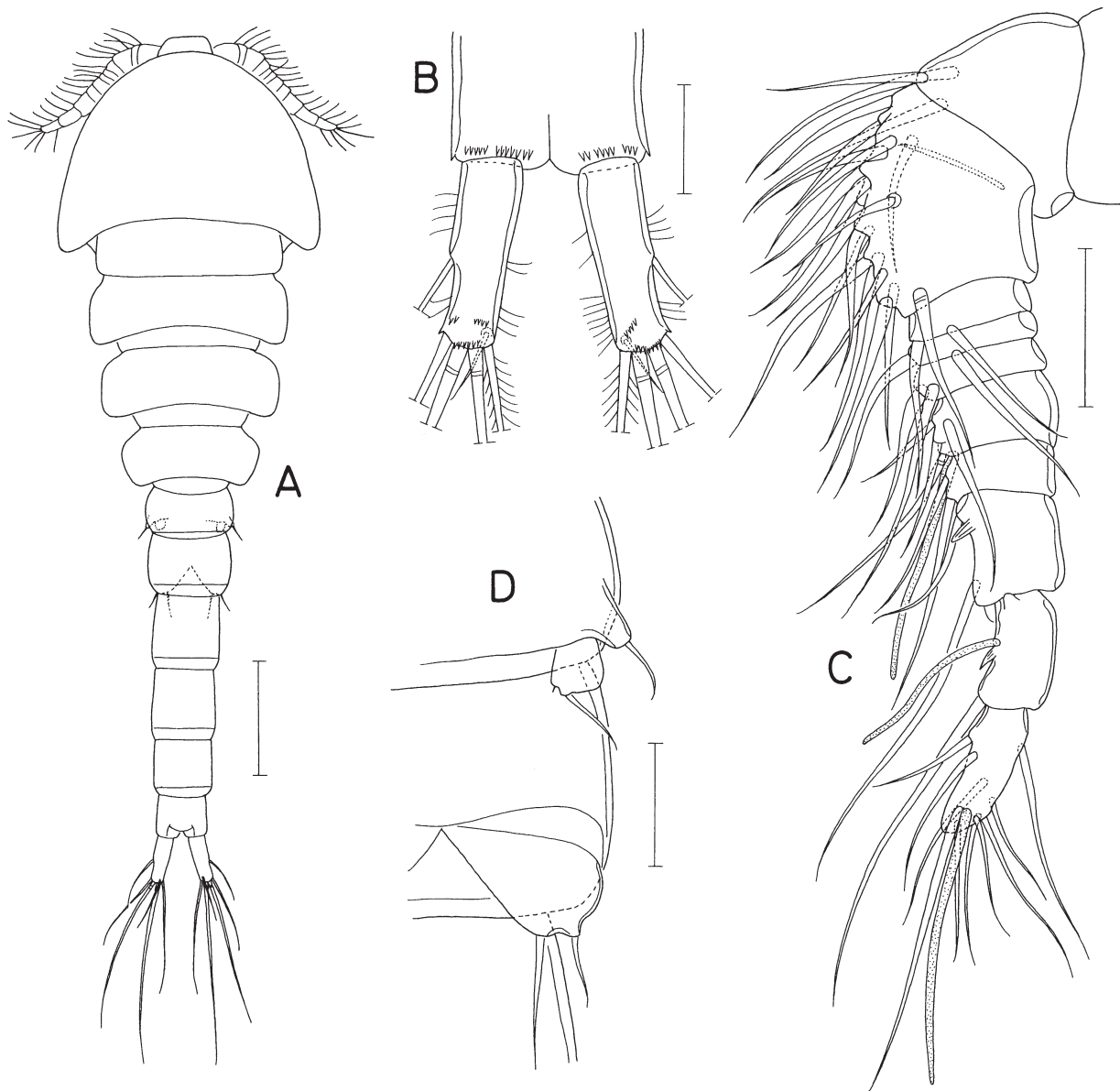
**Description of male.** Body (Fig. 28A) narrow, 1.48 mm long. Cephalosome 316×464 µm, distinctly broader



**FIGURE 26.** *Notodelphys cuspis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C–J, 0.05 mm.



**FIGURE 27.** *Notodelphys cuspis* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, inner distal corner of basis of leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A–C, E, F, 0.05 mm; D, G, 0.02 mm.



**FIGURE 28.** *Notodelphys cuspis* sp. nov., male. A, habitus, dorsal; B, caudal rami, ventral; C, antennule; D, legs 5 and 6. Scale bars: A, 0.2 mm; B–D, 0.05 mm.

than following somites. First pedigerous somite slightly narrower than second pedigerous somite. Urosome 6-segmented, cylindrical, ventrally curved posteriorly. Anal somite ornamented with row of small spinules along posteroventral border (Fig. 28B). Caudal ramus (Fig. 28B) about 3.1 times longer than wide, with small spinules distally and subdistally on ventral surface; setules sparse on outer and inner margins.

Rostrum as in female. Antennule (Fig. 28C) 10-segmented and geniculate between eighth and ninth segments; second segment with trace of articulation proximally; armature formula 3, 17, 2, 2, 2, 4+aesthetasc,

2, 2, 1+aesthetasc, and 10+aesthetasc; eighth and ninth segments each with fused setal element forming dentiform process on anterior margin. Antenna, mouthparts, and legs 1–4, including basis of leg 1, as in female.

Leg 5 (Fig. 28D) similar to that of female. Leg 6 (Fig. 28D) represented by 2 naked setae of unequal length on distal margin of genital operculum.

**Remarks.** This species is characterised by two unique features. The third segment of the maxilliped is armed only with 2 setae, whereas the great majority of *Notodelphys* species carry 3 setae on the third segment of the maxilliped. The only exceptions are *N. weberi* and *N. cuspis* sp. nov.,

with the former carrying 4 setae on this segment and the latter only 2 setae. In the new species, the basis of leg 1 is armed with a small seta instead of a spine, and a small spinous process is present at the inner distal angle: such a configuration is unknown elsewhere in the genus.

### Genus *Paranotodelphys* Schellenberg, 1922

**Diagnosis.** Female body with internal brood pouch extending from anterior margin of fourth pedigerous somite backwards and incorporating fifth pedigerous somite. Free urosome 5-segmented in female consisting of genital somite and 4 abdominal somites; 6-segmented in male. Rostrum well-developed, variable in form. Female antennule typically 9-segmented: segmental fusion pattern I-II, III-XI, XII-XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV, XXV, XXVI-XXVIII; but with maximum of 11 segments (see below). Male antennule typically 9-segmented and non-geniculate; segmental fusion pattern of 9-segmented antennule I-II, III-XI, XII-XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV, XXV, XXVI-XXVIII. Antenna typically consisting of coxa, basis, first endopodal segment with or without inner seta; compound distal segment (representing fused second and third ancestral segments) bearing terminal claw; some species with allobasis (comprising basis and fused first endopodal segment); exopod represented by 2 setae. Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and typically with 2 or 3 and 7 to 9 setae on first and second segments, respectively; rarely with 4 and 10 setae as in *P. molgulae* n. sp. Maxillule with 7 to 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 1 to 3 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented or unsegmented, armed with total of 4 to 6 setae. Maxilla 5-segmented, syncoxal enditic formula 3/4, 1, 2, 3, or reduced; basis typically with 3 setal elements (1 claw-like); 3-segmented endopod with setal formula 1, 1, 3. Maxilliped 2- or 3-segmented; first segment armed with 9 setae; second segment typically unarmed, with bulbous swelling distally; third segment with 2 or 3 setae; distal segments fused in some species. Legs 1–4 biramous with 3-segmented rami; armature formula typically:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-0/1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Inner coxal seta on leg 4 lost in some species. Leg 5 consisting of 2 papillae, each bearing single seta element, rarely with exopodal papilla defined as small free segment.

**Type species.** *Paranotodelphys scutiformis* Schellenberg, 1922 by original designation.

**Remarks.** The main feature differentiating *Paranotodelphys* from *Notodelphys* is the reduced form of the female fifth leg, which comprises 2 small papillae each bearing an apical setal element. The outer papilla carries the outer protopodal seta and the inner papilla represents the exopod. In some species the exopodal papilla is defined as a distinct segment. In contrast, the fifth leg of *Notodelphys* species always retains a free exopodal segment bearing 2 setal elements, while the protopodal segment can be either distinct or incorporated into the somite.

There are also differences in the segmentation of the female antennule, which is typically reduced in *Paranotodelphys* species compared to *Notodelphys* species, but there is some overlap in the expression of this character: the female antennule is typically 9-segmented in *Paranotodelphys* species compared to typically 15-segmented in *Notodelphys* species (Fig. 30), but the former genus includes species with an 11-segmented antennule (e.g. *P. polycarpae* sp. nov.) whereas the latter includes species with as few as 10 segments (e.g. *N. aurantiaca*). Many species of *Paranotodelphys* have an allobasis on the antenna compared to separate basis and first endopodal segments as in *Notodelphys* species, but a few *Paranotodelphys* species retain these segments as separate (e.g. *P. scutiformis*). The ranges of states exhibited by other mouthparts are similar in *Paranotodelphys* and in *Notodelphys* species, although the maxilla of the former typically has 3 setae on the basis (one of which may be claw-like in some species) whereas in the latter the basis typically bears a well developed curved claw plus 2 setae.

The genera *Paranotodelphys* and *Notodelphyopsis* are closely related and share many character states. The main difference between them is in the urosomal segmentation of the female: the free urosome is 5-segmented in the former genus and 4-segmented in the latter (Illg, 1958; Marchenkov & Boxshall, 2003). The urosome comprises the genital somite plus four free abdominal somites in *Paranotodelphys*, whereas it comprises a genital double-somite and three free abdominal somites in *Notodelphyopsis*. *Paranotodelphys illgi* Marchenkov & Boxshall, 2003 and *P. unguifer* Kim & Moon, 2010 both exhibit the *Notodelphyopsis*-type urosome and therefore these two species are here transferred to the genus *Notodelphyopsis* as *Notodelphyopsis illgi* (Marchenkov & Boxshall, 2003) **comb. nov.** and *Notodelphyopsis unguifer* (Kim & Moon, 2010) **comb. nov.**

### *Paranotodelphys saccata* Stock, 1967

(Fig. 29)

**Material examined.** 1 ♀ (dissected) from *Polycarpa* sp., Red Sea, collected during the 19<sup>th</sup> Century.

**Supplementary description of female.** Body (Fig. 29A) 3.68 mm long. Prosome 5-segmented, but



articulations between somites obscure, represented by transverse constrictions. First to third pedigerous somites without defined epimera. Brood pouch large, completely incorporating fifth pedigerous somite and comprising more than half of total body length. Free urosome (Fig. 29B) 5-segmented, gradually narrowing posteriorly; somites 136×248, 161×230, 152×220, 121×196, and 94×162 µm, respectively. Caudal ramus (Fig. 29C) tapering, about 2.2 times as long as wide (109×49 µm), armed with 6 setae; all setae short (= less than width of ramus); outer lateral seta positioned at 48% of ramus length.

Rostrum (Fig. 29D) slightly longer than wide, weakly tapering, with rounded distal margin. Antennule (Fig. 29E) 9-segmented; segmental fusion pattern as in generic diagnosis; first 2 segments broader than more distal segments; third segment (XII-XIV) with trace of articulation on one surface; armature formula 3, 20, 7, 6, 4, 4+aesthetasc, 4, 4+aesthetasc, and 7+aesthetasc; all setae naked except 2 on first segment. Antenna (Fig. 29F) robust, consisting of coxa, allobasis and compound endopodal segment; coxa short and unarmed; allobasis inflated, convex along inner margin and ornamented with 2 transverse rows of setules on inner side: exopod represented by 1 pinnate seta and 1 short naked seta (short seta 0.6 times as long as longer one); compound endopodal segment about 2.5 times as long as wide (68×27 µm), armed with terminal claw and 11 setae (arranged as 1, 4, 1, 2, and 3), pinnate outer subdistal seta conspicuously broader than other setae; terminal claw more than half length of segment.

Labrum hirsute on subdistal and distal surfaces, with slightly concave posterior margin. Mandibular basis fused with first endopodal segment, setulose along outer margin, with 1 seta at middle of medial margin and 2 setae at inner-distal corner; free second endopodal segment armed with 8 setae; exopod with 5 setae, distalmost seta much larger than other 4. Maxillule (Fig. 29G) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis (proximal 2 small), 4 on small exopod, and 6 on endopod; endopod subdivided into proximal part bearing 2 medial setae and short distal part bearing 4 setae. Maxilla 5-segmented; syncoxa with 10 enditic setae grouped 4, 1, 2, and 3; basis with 3 setae, distal seta stiff; endopod armed with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 29H) armed with 9, 0, and 3 setae on first to third segments, respectively; second segment with bulbous swelling distally; third segment small, obscurely articulated at base.

Legs 1–4 with 3-segmented rami. Spines on outer margin of exopods well-developed, strong, as figured in original description (Stock, 1967). Inner distal spine on basis of leg 1 longer than first endopodal segment. Armature formula for legs 1–4 as in generic diagnosis.

Leg 5 (Fig. 29B) represented by pair of small setae on ventral surface of brood pouch near base of free urosome.

**Male.** Not found.

**Remarks.** Stock (1967) stated that a patch of ‘cilia’ was found near the tip of the caudal ramus. Careful observation of our specimen, revealed this to be opaque internal tissue within the caudal ramus, rather than a patch of setules.

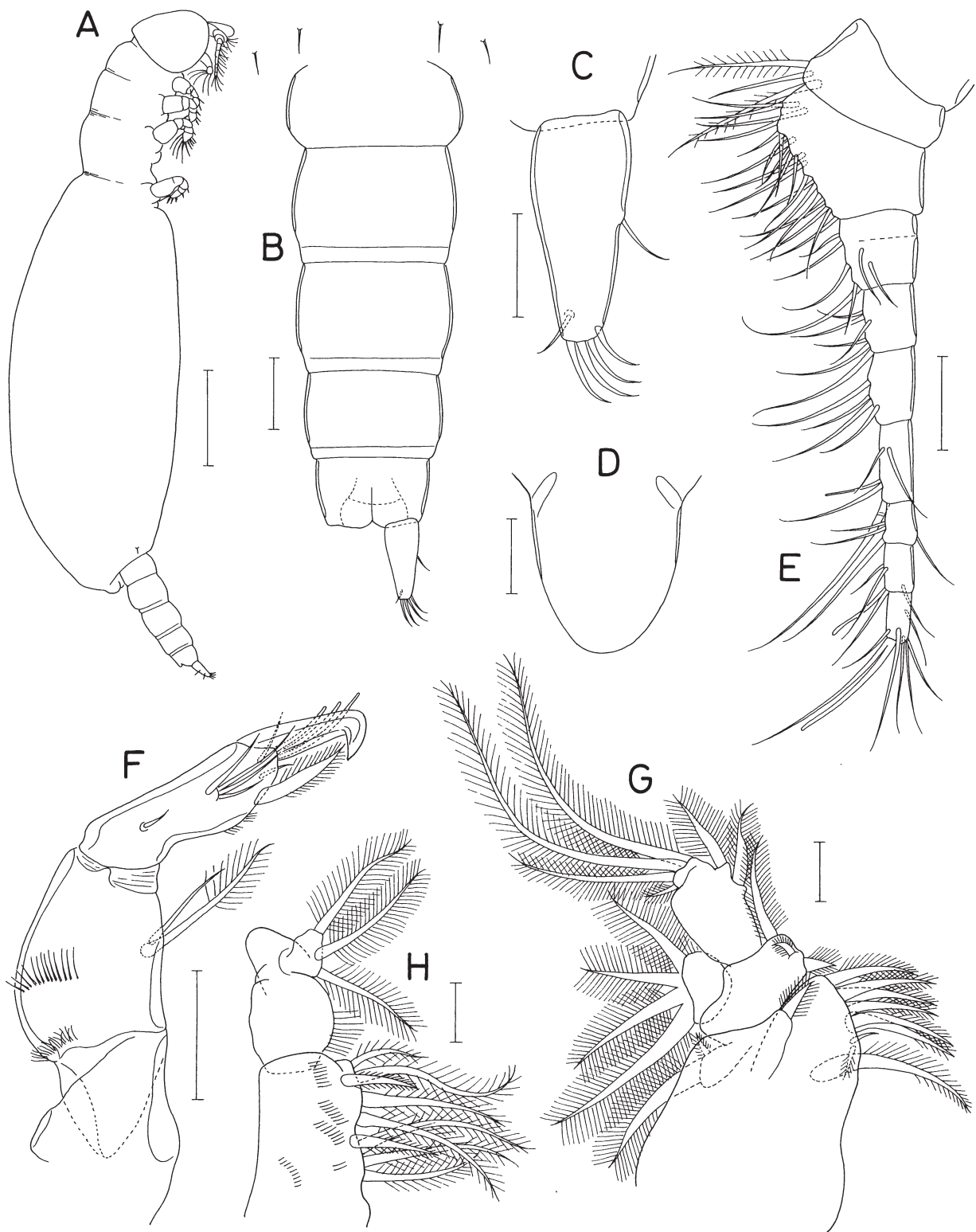
The interpretation of the segmentation pattern of the antennule presented here is based on setation counts as well as on comparison with the segmental fusion patterns exhibited in related species and other genera within the family Notodelphyidae (Fig. 30). The setation pattern allows the segmental fusions to be elucidated in the more proximal segments up to the sixth segment (which is identified as XXI-XXIII because it carries the long distal seta, articulated at its base, that is a reliable marker for segment XXIII). By comparison with congeners (Fig. 30), the next two segments should be XXIV and XXV, but each carries 2 additional elements: XXIV typically has 1 anterior and 1 posterior seta (see Boxshall & Huys, 1998), but here has 2 additional setae on the anterior margin; XXV would typically carry 1 seta and 1 aesthetasc anteriorly and 1 seta posteriorly, but also carries 2 additional setae on the anterior margin. There are also 2 additional setae present on the second compound segment (III-XI) which carries 20 setae rather than a maximum of 18 as would be expected (2 each from the 9 incorporated segments), and the third segment (XII-XIV) carries 1 additional seta. These appear to be novel elements since they are not present in any of the species of *Notodelphys* described here, nor in either of the relatively plesiomorphic new genera, *Bathynotodelphys* **gen. nov.** and *Pronotodelphys* **gen. nov.**, proposed above.

### *Paranotodelphys scutiformis* Schellenberg, 1922

(Figs. 31, 32)

**Material examined.** 1 ♀ (dissected) from *Phallusia obesa*, Vanuatu, Stn 581, Debitus coll., 1996.

**Supplementary description of female.** Body (Fig. 31A) dorsoventrally depressed, 2.09 mm long, with relatively large prosome and small urosome. Prosome with parallel lateral margins. Cephalosome short, 385×618 µm, with concave posterodorsal margin. First pedigerous somite short, lacking epimera. Second and third pedigerous somites with well-developed epimera, 138×618 and 153×611 µm, respectively. Fourth pedigerous somite forming brood pouch incorporating fifth pedigerous somite, about 1.9 times as long as wide (1171×611 µm), with rounded posterior margin. Free urosome (Fig. 31B) 5-segmented; somites much wider than long, 42×141, 53×124, 47×108, 44×92, and 45×82 µm, respectively. Anal somite telescoped into third abdominal somite in observed specimen; anal operculum well-developed, extending beyond posterior margin of somite (Fig. 31C). Caudal ramus (Fig. 31C) short, about 1.3 times longer



**FIGURE 29.** *Parantodelphys saccata* Stock, 1967, female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, maxillule; H, maxilliped. Scale bars: A, 0.5 mm; B, 0.1 mm; C–F, 0.05 mm; G, H, 0.02 mm.

	I - II		III - V			VI - XI					XII - XIV			XV - XVI			XVII - XIX			XX			XXI - XXIII			XXIV - XXV			XXVI - XXVIII				
<i>Ancestral segments</i>																																	
<i>Notodelphys allmani</i>	3	5	12			6	4+ae	2	2	2	1	2+ae	1	1	1+	2+ae	7+ae																
<i>Bathynotodelphys</i>	3	17			6	4+ae	6			4+ae	1+	2+ae	7+ae																				
<i>Pronotodelphys</i>	3	18			6	4+ae	4	2	2	1+	1	1	1+	2+ae	7+ae																		
<i>Paranotodelphys polycarpae</i>	3	21			3	2	3	5+ae	7			5+ae	4	4+ae	8+ae																		
<i>P. saccata</i>	3	20			7	5+ae	4			4+ae	4	4+ae	7+ae																				
<i>Notodelphyopsis gemina</i>	3	17			6	4+ae	4			2+ae	1+	2+ae	7+ae																				
<i>Pygodelphys antarctica</i>	3	17			6	3+ae	1	3			2+ae	1+	2+ae	7+ae																			
<i>Doropygopsis novemsetifera</i>	3	17			5	7*	10			9*	3	4+ae	7+ae																				

**FIGURE 30.** Schematic comparison of antennular segmentation patterns in selected notodelphyid taxa. Roman numerals mark ancestral segments, Arabic numerals indicate number of setae on each segment/compound segment. ae = aesthetasc. Supernumerary setae are identified by reference to the observed maximum setal number known within the Copepoda (see Boxshall & Huys, 1998). Supernumerary setae are present on segments III–XI, XII–XIV, XV–XVI, XXIV and XXV of *Paranotodelphys polycarpae*, on segments III–XI, XII, XV–XVI, XXI–XXIII, XXIV, XXV and XXVI–XXVIII of *P. saccata*, and on segments XVII–XX, XXI–XXIII, XXIV, and XXV of *Doropygopsis novemsetifera*.

\* The total setal counts on these segments of *Doropygopsis novemsetifera* probably include a setiform aesthetasc.

than wide (45×34 μm), armed with 6 setae (setae II and III omitted in Fig. 31C) and ornamented with 2 dorsal setules and short, tapering tube pore (indicated by arrowhead).

Rostrum (Fig. 31D) directed posteriorly, tapering towards blunt apex. Large triangular tubercle present posterior to rostrum (Fig. 31D). Antennule slender; segmentation and setation not observed due to damage. Antenna (Fig. 31E) slender: coxa obscure; basis with 2 large pinnate exopodal setae of equal length; endopod 2-segmented; first segment with 1 inner seta; compound distal segment elongate, about 5 times longer than wide, and armed with 10 setae plus terminal claw about one-third as long as segment.

Labrum (Fig. 31F) with straight posterior margin bearing setules. Mandible (Fig. 31G) consisting of coxa and palp: coxa with 4 teeth and 1 seta on gnathobase; palp consisting of basis, exopod and endopod; basis with setules on outer and medial margins and armed with 1 seta on medial margin; exopod with 5 setae, distalmost markedly larger than other 4; endopod 2-segmented and armed with 2 and 7 setae on first and second segments, respectively; suture line obscure between basis and first endopodal segment. Maxillule (Fig. 31H) with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial

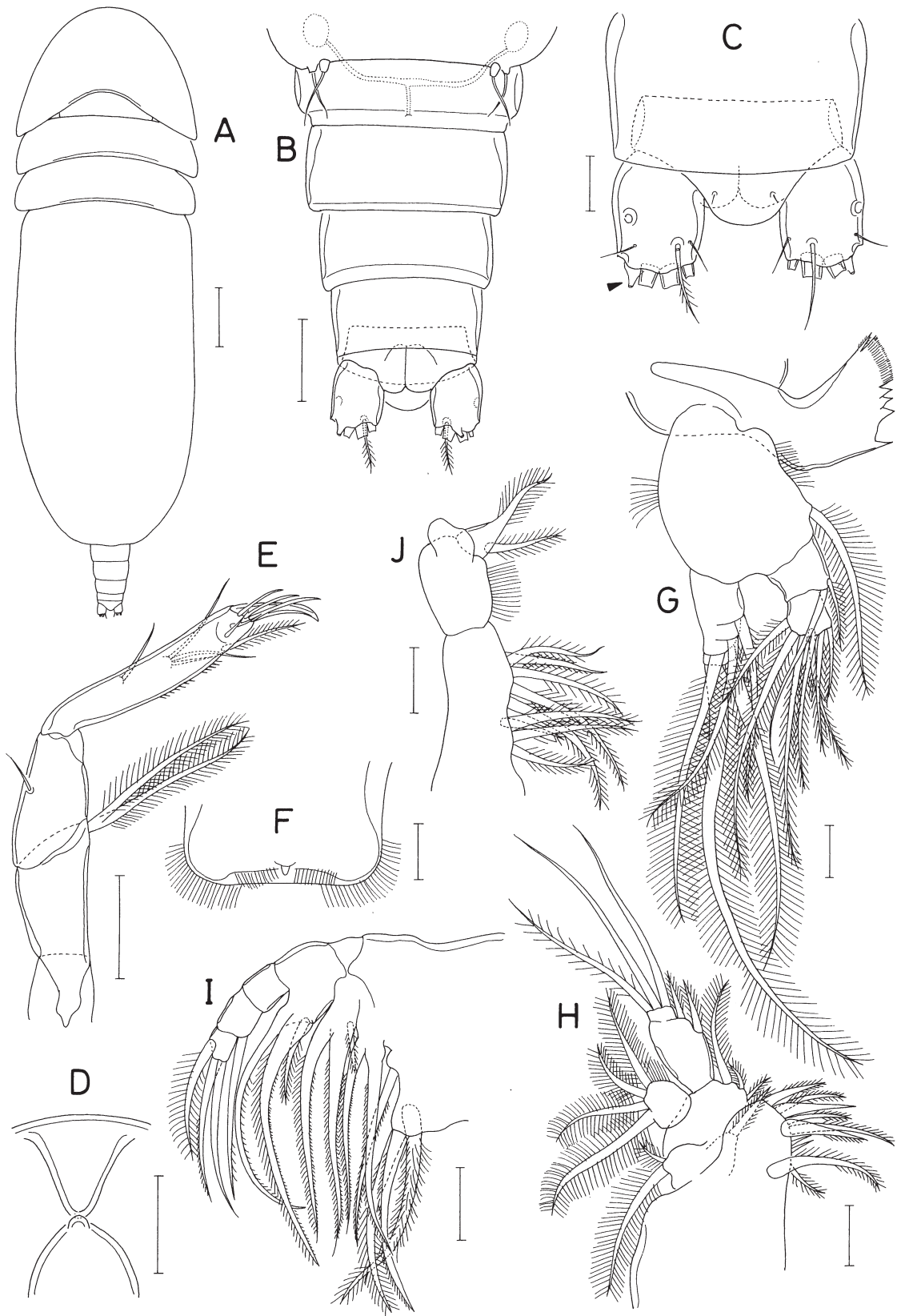
margin of basis (2 small proximal and 1 larger distal), 4 on small exopod, and 5 on incompletely 2-segmented endopod (2 on first and 3 on second segment). Maxilliped (Fig. 31J) with 9, 0, and 2 setae on first to third segments; second segment with prominent bulbous swelling distally; third segment small, tapering, 1 seta fused with segment, lacking articulation at base.

Leg 1–4 with 3-segmented rami; coxa narrow; basis obliquely elongated. Inner coxal seta pinnate in leg 1 (Fig. 32A) and leg 3, but naked in leg 2 (Fig. 32B) and leg 4. Outer seta on basis small and naked in legs 1 and 4 but pinnate in legs 2 and 3. Armature formula as in generic diagnosis although third exopodal segment of leg 4 not observed due to damage.

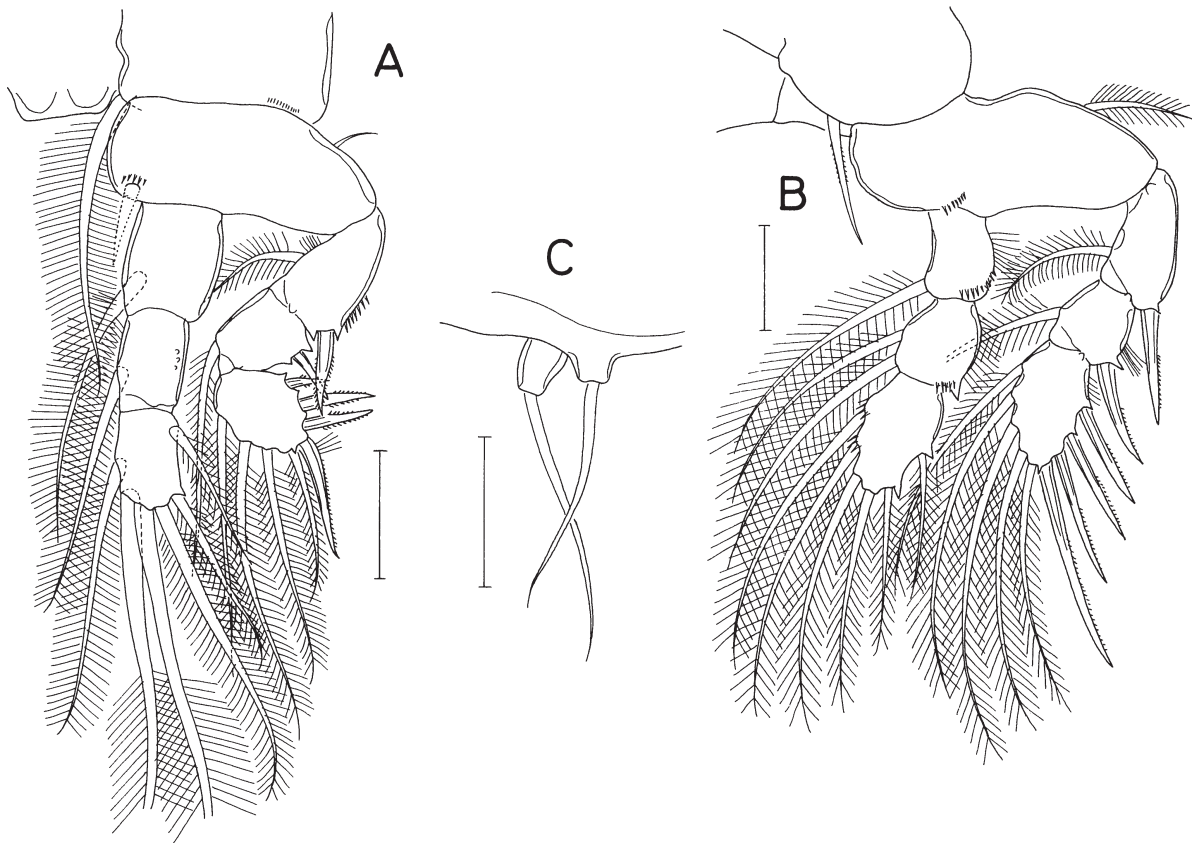
Leg 5 (Figs. 31B, 32C) represented by 2 knobs on posterior margin of brood pouch, each tipped by naked seta, inner (exopodal) knob articulated at base.

**Male.** Not found.

**Remarks.** This is the type species of the genus (Illg, 1958). This single female from Vanuatu is tentatively identified as *P. scutiformis* on the basis of the following shared characteristics: the prosome of the female has parallel lateral margins and the caudal ramus is short, only slightly longer than wide (1.25 times longer than wide,



**FIGURE 31.** *Paranotodelphys scutiformis* Schellenberg, 1922, female. A, habitus, dorsal; B, urosome, ventral; C, anal somite and caudal rami, dorsal; D, rostrum; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Scale bars: A, 0.2 mm; B, D, E, 0.05 mm; C, F–J, 0.02 mm.



**FIGURE 32.** *Paranotodelphys scutiformis* Schellenberg, 1922, female. A, leg 1; B, leg 2; C, leg 5. Scale bars: A, B, 0.05 mm; C, 0.02 mm.

according to Schellenberg, 1922) and as long as anal somite.

***Paranotodelphys nodulosa* sp. nov.**

(Figs. 33–35)

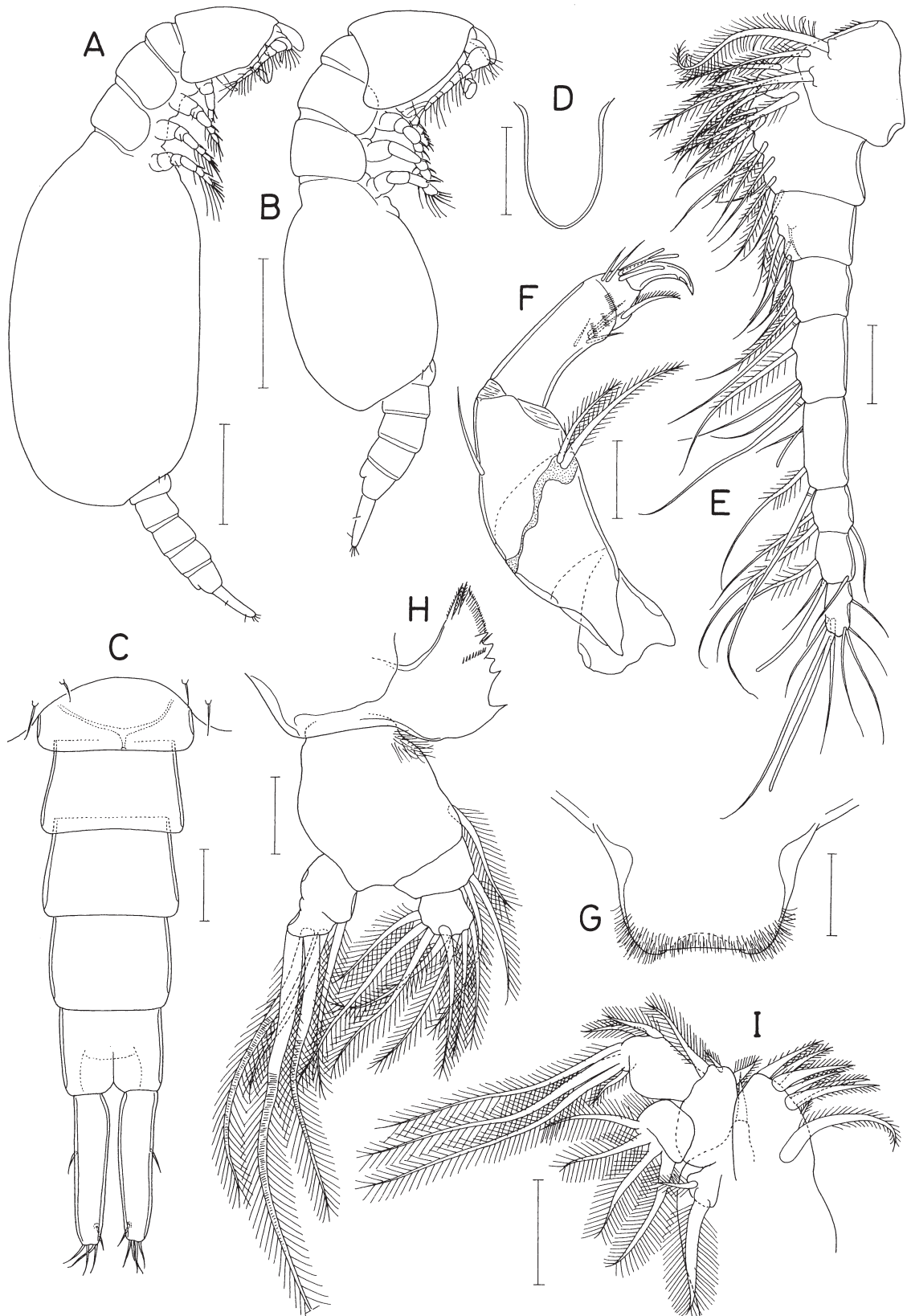
**Type material.** Holotype (intact ♀, MNHN-IU 2014-21219), allotype (intact ♂, MNHN-IU-2014-21220), and dissected paratypes (1 ♀ and 1 ♂; figured), from *Microcosmus helleri* Herdman, 1881, CRRF OCDN 2256-M, Mactan Island, Cebu, the Philippines (10°15.62'N, 123°59.11'E), depth 10m, 15 February 1994.

**Etymology.** The name of the new species refers to the presence of nodules on the caudal rami of the male.

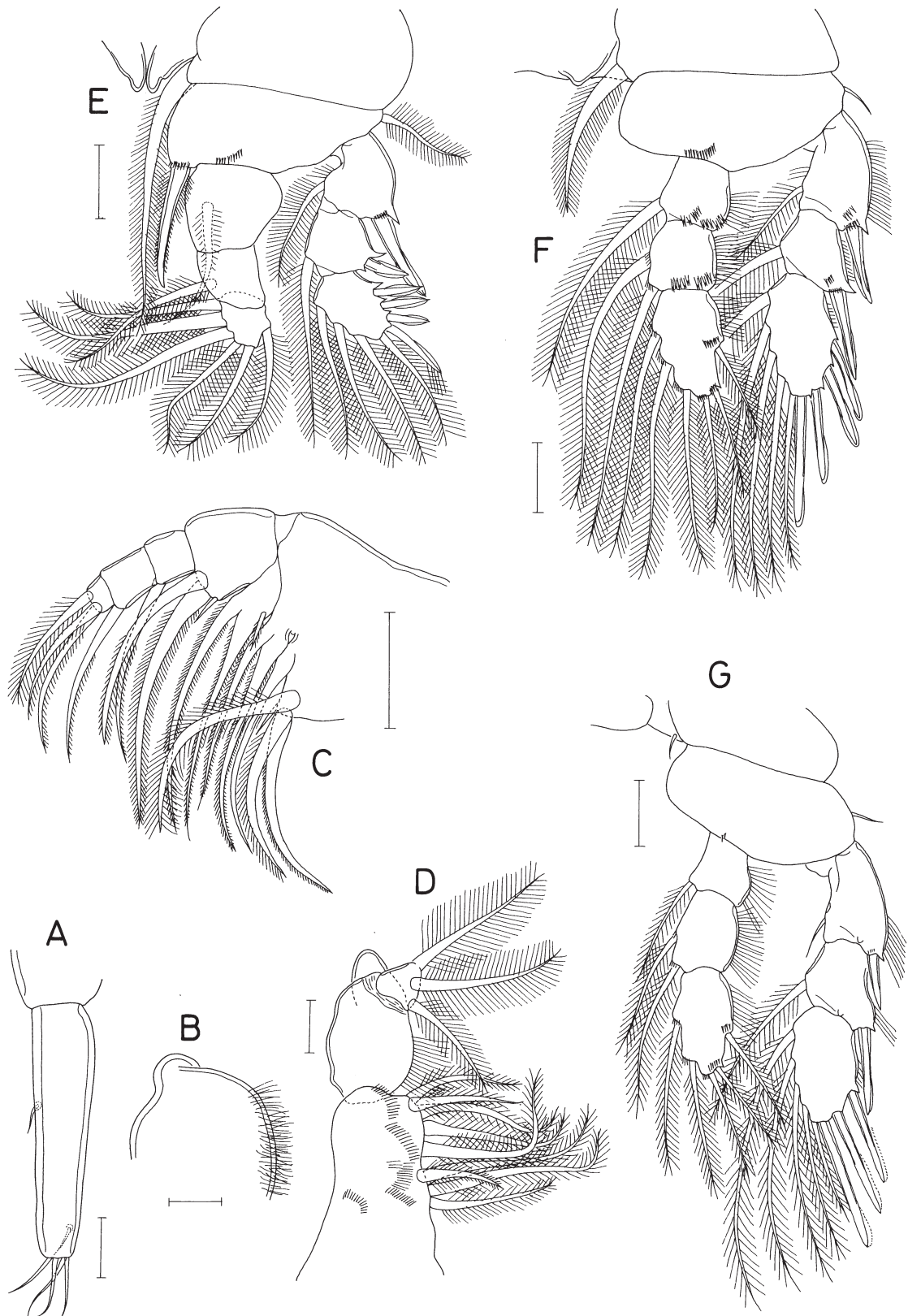
**Description of female.** Body (Fig. 33A, B) consisting of broad cephalosome and 3 pedigerous somites, all dorsoventrally depressed, expanded brood pouch, and narrow, cylindrical urosome. First to third pedigerous somites each with well-developed dorsal tergite. Body length 3.78 mm in fully grown adult (holotype, Fig. 33A) and 2.45 mm in dissected young adult with only partially expanded brood pouch (Fig.

33B). Brood pouch formed by fourth pedigerous somite, incorporating fused fifth pedigerous somite. Free urosome (Fig. 33C) 5-segmented, gradually narrowing posteriorly: comprising genital and 4 abdominal somites 97×221, 121×200, 136×194, 136×189, and 121×145 μm, respectively. Caudal rami (Fig. 33C) directed posteriorly; each ramus (Fig. 66A) about 4.1 times longer than wide (211×52 μm) and armed with 6 small setae, all naked and not longer than ramus width; outer lateral seta positioned at 40% of ramus length.

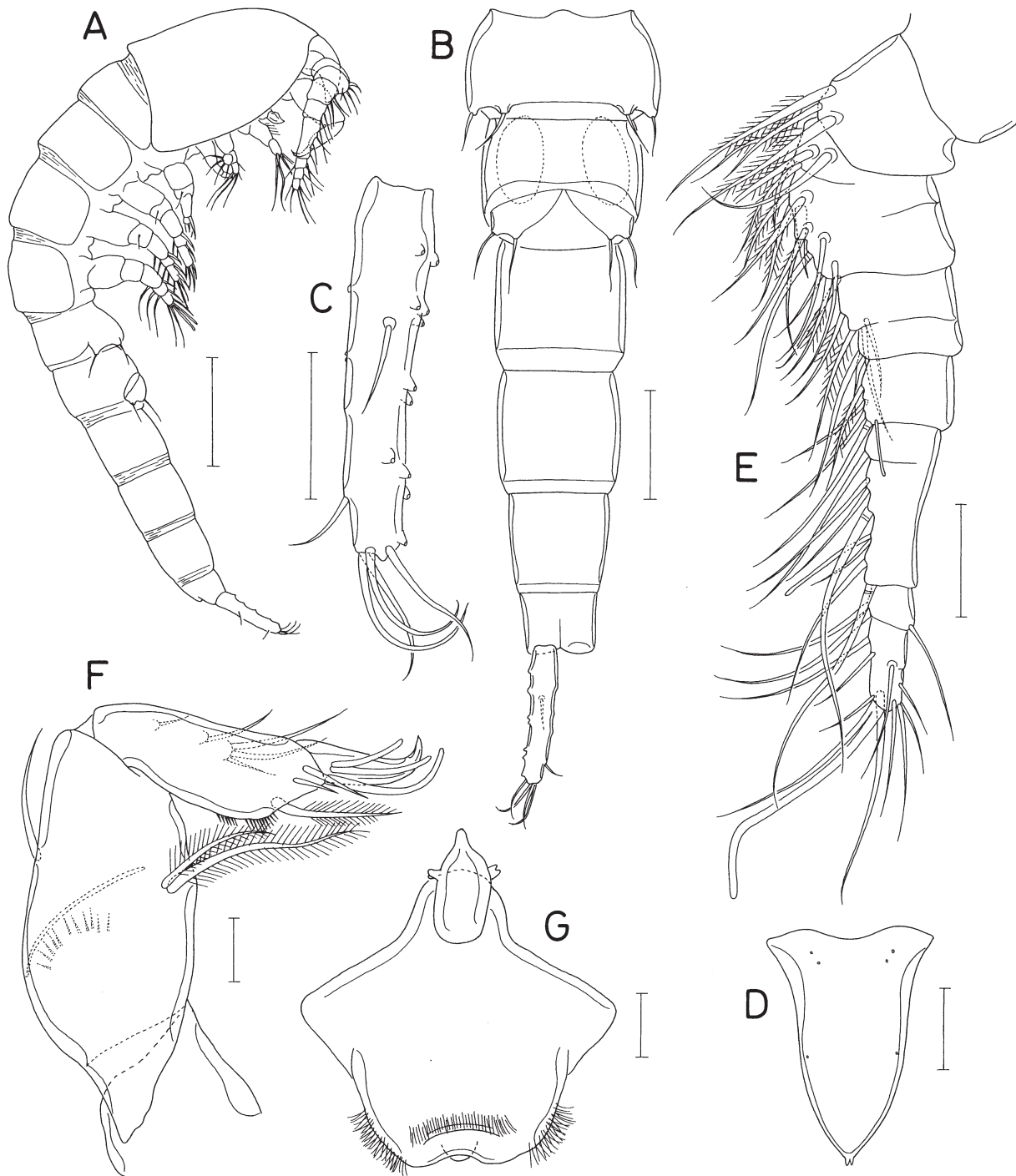
Rostrum (Fig. 33D) longer than wide, with parallel lateral margins and rounded apex. Antennule (Fig. 33E) gradually narrowing distally and 9-segmented; armature formula 3, 17, 6, 4, 4, 3+aesthetasc, 3, 3+aesthetasc, and 7+aesthetasc; setae generally pinnate; distal seta on fourth, fifth and sixth segments annulated at base. Antenna (Fig. 33F) 4-segmented; short coxa unarmed; basis with 2 unequal, pinnate setae representing exopod (shorter seta 0.6 times as long); first endopodal segment demarcated from basis by non-sclerotized groove, with 1 seta on inner margin; compound distal endopodal segment about 2.9 times as long as wide (111×38 μm) and ornamented with 3 rows of minute spinules in distal region; armed with 10



**FIGURE 33.** *Paranotodelphys nodulosa* sp. nov., female. A, fully grown adult, right; B, young adult, right; C, urosome, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, B, 0.5 mm; C, 0.1 mm; D–I, 0.05 mm.



**FIGURE 34.** *Paranotodelphys nodulosa* sp. nov., female. A, right caudal ramus, ventral; B, paragnath; C, maxilla; D, maxilliped; E, leg 1; F, leg 2; G, leg 4. Scale bars: A, C, E–G, 0.05 mm; B, D, 0.02 mm.



**FIGURE 35.** *Paranotodelphys nodulosa* sp. nov., male. A, habitus, right; B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum. Scale bars: A, 0.2 mm; B, 0.1 mm; C–E, 0.05 mm; F, G, 0.02 mm.

small setae plus terminal claw about one-third as long as segment.

Labrum (Fig. 33G) densely hirsute posteriorly, with weakly concave posterior margin. Mandible (Fig. 33H) consisting of coxa and biramous palp: coxal gnathobase with 5 teeth and 2 proximal setae on cutting edge and ornamented with row of minute spinules near second

proximal tooth on dorsal surface: basis with 1 seta subdistally and patch of setules proximally on medial margin: exopod unsegmented; armed with 5 setae, distal most seta markedly larger than other 4; endopod 2-segmented and armed with 2 and 8 setae on first and second segments, respectively. Paragnath (Fig. 34B) with rounded outer distal process and dense setules on medial surface. Maxillule (Fig. 33I)



with 8 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis (proximal 2 small); exopod with 4 setae distally; endopod unsegmented with 6 setae (2 medial and 4 distal). Maxilla (Fig. 34C) 5-segmented; syncoxa with 4 (including 1 small), 1, 2, and 3 setae on first to fourth endites, respectively; basis with 1 small naked and 2 large setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 34D) 3-segmented, with 9, 0, and 3 setae on first to third segments, respectively; first segment ornamented with several row of fine spinules; second segment with prominent bulbous swelling distally and ornamented with row of long setules on medial margin.

Legs 1–4 with 3-segmented rami (Fig. 34E–G). Inner coxal seta large in legs 1 and 2, but rudimentary in legs 3 and 4. Outer seta on basis of legs 2–4 also rudimentary. Leg 1 with large inner distal spine on basis, 85 µm long, distinctly longer than first endopodal segment, setulose proximally and spinulose distally. Outer spines on exopods well-developed. Outer margin of exopod of leg 1 smooth but those of legs 2–4 setulose. Inner seta on first exopodal segment of leg 4 rudimentary. Armature formula for legs 1–4 as in generic diagnosis. Leg 5 (Fig. 33C) represented by pair of small setae on ventral posterior margin of brood pouch, near base of free urosome.

**Description of male.** Body (Fig. 35A) curved ventrally. Body length 1.53 mm. Cephalosome broader than cylindrical remaining part of body. Urosome (Fig. 35B) 6-segmented, with free fifth pedigerous somite: urosomites 100×182, 114×152, 120×123, 114×114.93×93, and 57×72 µm, respectively. First to third abdominal somites each about as long as wide. Caudal ramus (Fig. 35C) armed with 6 naked setae and ornamented with about 10 papillae along outer margin, each papilla with pore at tip.

Rostrum (Fig. 35D) tapering towards minutely bifid apex. Antennule (Fig. 35E) non-geniculate, indistinctly 9-segmented, but articulations incomplete between third and fourth and between sixth and seventh segments; armature formula 3, 17, 4, 2, 4+aesthetasc, 1, 6+aesthetasc, 3, and 10+aesthetasc. Antenna (Fig. 35F) more stout than in female and consisting of coxa, allobasis and compound distal endopodal segment; allobasis with trace of articulation between basis and first endopodal segment and ornamented with spinules near middle; free endopodal segment about twice as long as wide, with 11 setae.

Labrum (Fig. 35G) with large tubercle proximally bearing 3 nipple-shaped processes (1 apical and 2 subdistal lateral); posterior margin slightly concave, with small mid-posterior lobe. Other mouthparts and legs 1–4 as in female.

Leg 5 (Fig. 35B) represented by 2 separate ventral setae on rear margin of somite. Leg 6 (Fig. 35B) represented by 2 setae on distal margin of genital operculum.

**Remarks.** The genus *Paranotodelphys* currently contains ten valid species (Walter & Boxshall, 2020).

This new species shares the possession of 3 setae on the terminal segment of the maxilliped with five congeners: *P. constricta* Illg, 1970, *P. furcifera* Stock, 1967, *P. gracilis* Schellenberg, 1922, *P. longicaudata* Schellenberg, 1922, and *P. saccata*. The first three of these species all have either 1 or 2 setae on the medial margin of the basis of the maxillule and are, therefore, easy to distinguish from the new species which has 3 setae. *Paranotodelphys nodulosa* **sp. nov.** is readily distinguishable from *P. longicaudata* because the latter species has very long caudal rami in the female, about 3 times longer than the anal somite compared to only about 1.7 times as long in the new species. It differs from *P. saccata* in the form of the female antenna: in *P. saccata* the basis and the first endopodal segment of the antenna are fully fused to form an allobasis with no trace of any suture marking the plane of fusion, and the seta originally derived from the first endopodal segment is lost, whereas in the new species the basis and first endopodal segment are still separated by a large non-sclerotized groove and the segmental seta is still present. Schellenberg (1922) described *P. scutiformis* as having 2 or 3 setae on the terminal segment of the maxilliped, but it can be distinguished from the new species by the presence of 7 setae on the second endopodal segment of the mandible (8 in the new species) and only 5 setae on the endopod of the maxillule (6 in the new species). These differences are sufficient to justify the establishment of the new species.

The new species also possesses novel additional setae on two of the distal antennule segments in the female (Fig. 30). The sixth segment (XXI–XXIII) provides the reference point as it carries the aesthetasc derived ancestrally from XXI and the articulated seta derived from XXIII. The seventh segment (XXIV) carries 1 additional seta on the anterior margin (rather than 2 additional setae as in *P. saccata*), and the eighth segment (XXV) similarly carries only 1 additional seta on the anterior margin (rather than 2 as in *P. saccata*). Even more additional setae are present in *P. polycarpae* **sp. nov.** (see below). The segmentation of the male antennule is very unusual because the ancestral articulation (XX to XXI) marking the geniculation in neocopepodans (Boxshall & Huys, 1998) is not expressed: instead it lies within the compound seventh segment (XVIII–XXIII).

#### *Paranotodelphys polycarpae* **sp. nov.**

(Figs. 36, 37)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21221), paratype (intact ♀, MNHN-IU-2014-21222), and dissected paratype (♀, figured) from *Polycarpa nigricans* Heller, 1878, Ibo, Mozambique, depth 0–20 m, Monniot coll., 11 November 1995.

**Additional material.** 2 ♀♀ (MNHN-IU-2018-1777) (slender form) collected along with type material.

**Etymology.** The name of the new species is derived from the generic name of the type host.

**Description of female.** Body (Fig. 36A) curved ventrally, 2.62 mm long. First to third pedigerous somites with weakly developed dorsal tergites. Brood pouch 1.33×0.68 μm in lateral view, longer than anterior body somites combined. Free urosome (Fig. 36B) cylindrical and 5-segmented: genital somite 80×175 μm; 4 free abdominal somites gradually narrowing 125×155, 127×143, 109×127, and 95×117 μm, respectively. Caudal ramus (Fig. 37A) narrowing distally, widest across proximal quarter, about 4.1 times longer than wide (167×41 μm) and 1.8 times longer than anal somite; armed with 6 small setae, outer lateral seta positioned at 37% of ramus length, and subdistal seta (seta VII) at 75% of ramus length.

Rostrum (Fig. 36C) shield-shaped, 109×65 μm, weakly tapering, and well-defined from cephalosome, with scattered minute setules on ventral (anterior) surface. Antennule (Fig. 36D) 11-segmented; segmental fusions I-II, III-XI, XII, XIII, XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV, XXV, XXVI-XXVIII; suture lines between third to fifth segments distinct only on dorsal surface; armature formula 3, 21, 3, 2, 2, 6, 7, 5+aesthetasc, 4, 4+aesthetasc, and 8+aesthetasc; 2 setae on first segment pinnate, other setae naked (as figured). Antenna (Fig. 36E) robust, consisting of unarmed coxa, allobasis, and compound distal endopodal segment; allobasis inflated, armed with 2 equal, pinnate setae representing exopod near middle of outer margin and ornamented with transverse row of fine spinules on inner side; trace of partial suture present near base of exopodal setae; exopodal setae fused to each other at base; free endopodal segment about 2.5 times longer than wide (76×31 μm) and ornamented with row of spinules on outer margin; armed with terminal claw plus 11 setae (arranged as 1, 1, 3, 1, 2, and 3), outer subdistal seta on endopod pinnate, other setae naked; terminal claw about half as long as segment.

Labrum densely setulose distally; free posterior margin concave. Mandible (Fig. 36F) with 5 teeth and 2 proximal setae on coxal gnathobase; needle-like spinule present between 2 proximal teeth; basis with 1 seta and setules on medial margin; exopod unsegmented with 5 setae (3 large and 2 smaller); endopod with 2 and 8 setae on first and second segments, respectively. Paragnath not observed. Maxillule (Fig. 36G) with 8 setae on precoxal arthrite (1 small), 1 seta on coxal endite, 2 setae on epipodite, 3 setae on medial margin of basis; small exopod with 4 distal setae; endopod unsegmented, with 6 setae (3 distal setae longer than other 3). Maxilla (Fig. 37B) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 36H) 3-segmented, armed with 9, 0, and 3 setae on first to third segments, respectively; second segment ornamented with setules on medial margin and with slight swelling at outer distal corner.

Legs 1–4 (Fig. 37C–F) biramous with 3-segmented rami. Inner coxal seta large and pinnate in legs 1 and 2, but rudimentary in legs 3 and 4. Outer seta on basis of legs 2–4 small and naked. Inner seta on first exopodal segment of leg 4 rudimentary. Inner distal spine on leg 1 basis 52 μm long, longer than first endopodal segment. Armature formula for legs 1–4 as in generic diagnosis.

Leg 5 (Fig. 36B) represented by 2 small papillae each tipped with single minute seta.

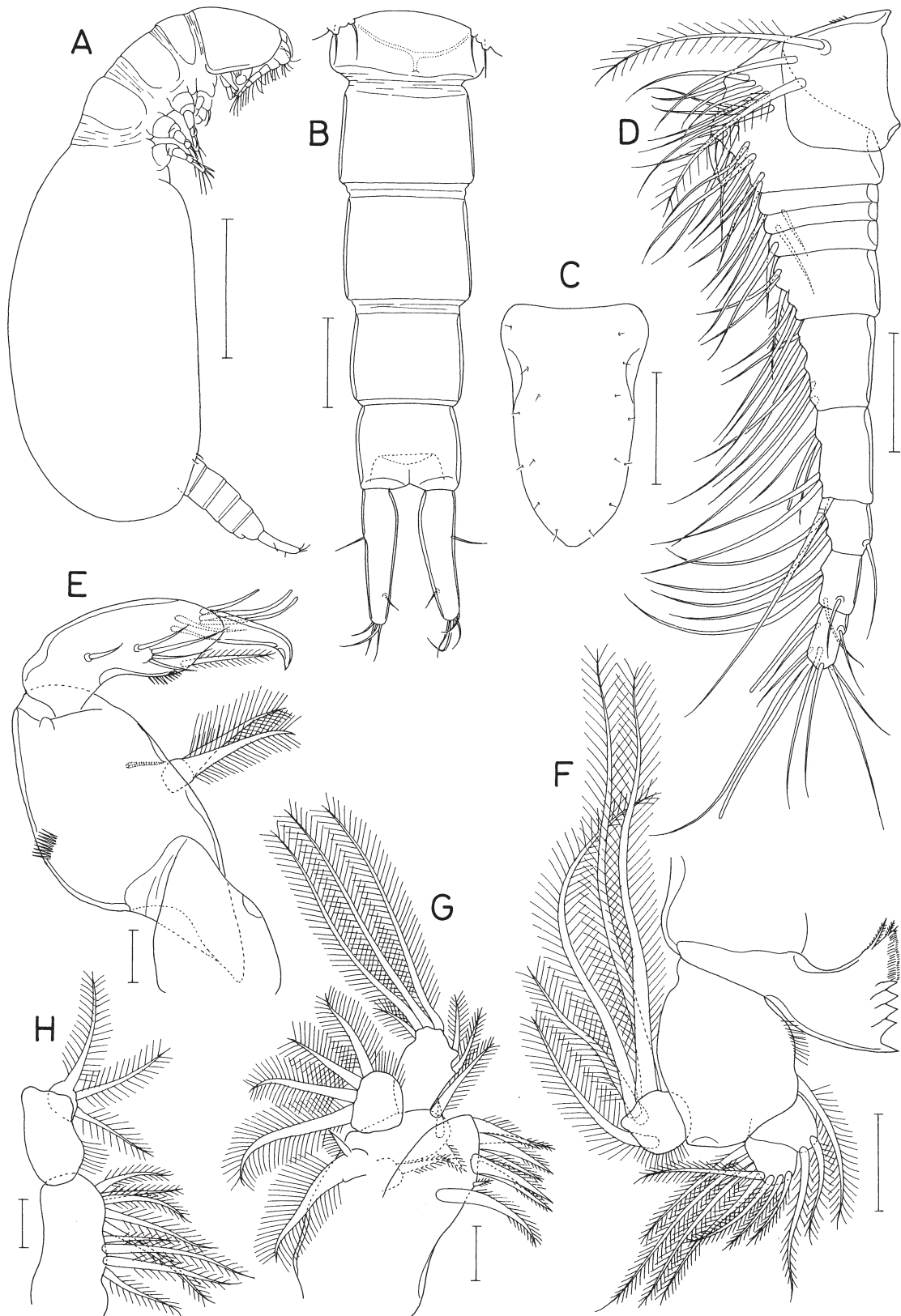
**Description of slender-form female.** Body 2.54 mm long in dissected specimen. Brood pouch more slender than in typical form. Urosome (Fig. 37G) similar to that of typical form but caudal ramus (Fig. 37H) about 3.2 times longer than wide (108×34 μm) and about 1.5 times longer than anal somite, with thick cuticular wall. Antennule, antenna, mouthparts, and legs 1–5 as in typical form.

**Male.** Unknown.

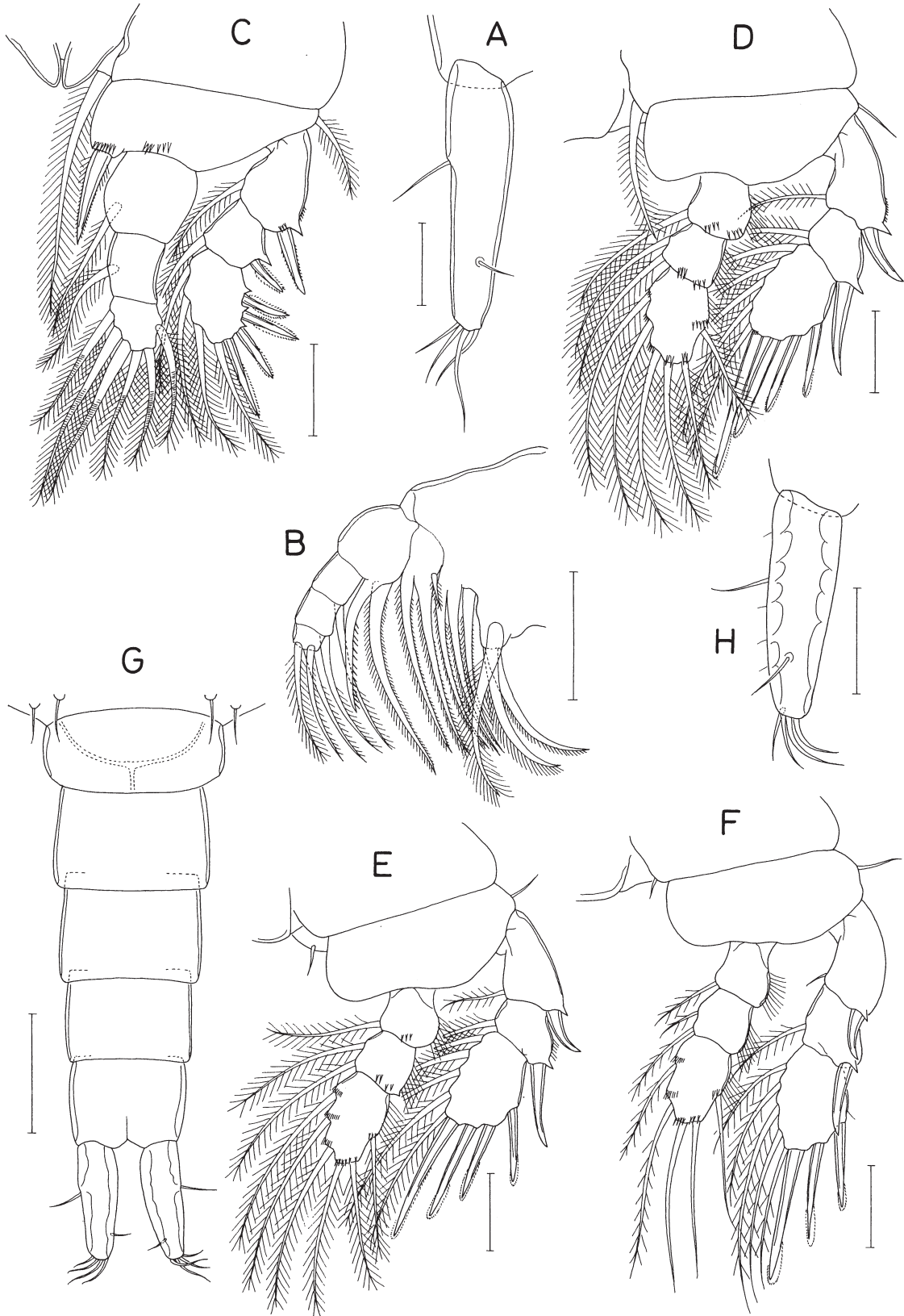
**Remarks.** Two of the five observed females were different in body shape from the three type specimens. These two specimens have a narrower brood pouch and shorter caudal rami. The caudal rami of the slender-form female are about 3.2 times longer than wide and 1.5 times as long as anal somite, in contrast to about 4.1 and 1.8 times, respectively, found in the dissected paratype. These differences are recorded here, but because no other morphological differences were found between the types and the slender form, we are treating them as belonging to the same species.

Only two congeneric species, *P. saccata* and *P. furcifera*, are known to have the first endopodal segment of the antenna fully incorporated into an allobasis leaving only one free segment (the compound distal endopodal segment), as in the new species. *Paranotodelphys saccata* differs from the new species in having relatively shorter caudal rami and in having 2 unequal exopodal setae on the antenna. It also differs in the segmentation of the female antennule since the new species has 11 segments whereas *P. saccata* has 10 segments according to Stock (1967), although we found 9 segments in the material examined in the present account. *Paranotodelphys furcifera* is very similar to the new species. Based on comparison with the original description (Stock, 1967), the main differences are the prominent, digitiform distal swelling on the second segment of the maxilliped (this distal swelling is very weakly expressed in the new species), the lack of the inner seta on the coxa of leg 4 (this seta present in the new species, although it is small), and the penultimate segment of the female antennule carries only 1 seta (compared to 4 setae plus an aesthetasc in the new species). These differences are sufficient to justify the establishment of the new species.

Again, there are additional setae present on the distal segments of the female antennule in the new species (Fig. 30): the second segment (III-XI) carries 3 additional setae, the third segment (XII) carries 1 additional seta, the sixth segment (XV-XVI) carries 1 additional seta, the eighth



**FIGURE 36.** *Paranotodelphys polycarpae* sp. nov., female. A, habitus, right; B, urosome, ventral; C, rostrum; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilliped. Scale bars: A, 0.5 mm; B, 0.1 mm; C, D, F, 0.05 mm; E, G, H, 0.02 mm.



**FIGURE 37.** *Paranotodelphys polycarpae* sp. nov., female. A, left caudal ramus, dorsal; B, maxilla; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, urosome of slender-type female; H, left caudal ramus of slender-type female, dorsal. Scale bars: A–F, H, 0.05 mm; G, 0.1 mm.

segment (XXI–XXIII) carries 1 or 2 additional setae on the anterior margin, the ninth (XXIV) and tenth (XXV) each carry 2 additional anterior margin setae, and the apical segment carries 1 additional seta.

***Paranotodelphys stenosa* sp. nov.**

(Figs. 38, 39)

**Type material.** Holotype (intact ♀, MNHN-IU-2009-5054), paratypes (5 intact ♀♀, MNHN-IU-2014-21223), and dissected paratypes (2 ♀♀, figured) from *Ecteinascidia diaphanis* Sluiter, 1886 (MNHN-IT-2008-3823 = MNHN P2/ECT/108), Blue Water mangrove channel, Gam Island, West Papua, Indonesia (0°29.164'S, 130°39.865'E), depth 0.5 m, CRRF BMC, L.J. Bell & LE. Martin coll., 07 December 2007.

**Etymology.** The name is derived from the Greek *sten* (= narrow), alluding to the narrow body shape of the new species.

**Description of female.** Body (Fig. 38A, B) slender, 2.20 mm long in dissected specimen; with mean body length of 2.05 mm (1.61–2.58 mm) based on 7 specimens. Cephalosome and anterior three pedigerous somites dorsoventrally depressed. First pedigerous somite lacking epimera. Second and third pedigerous somites each with well-developed, posterolaterally extended epimera. Brood pouch incorporating fifth pedigerous somite elongate, cylindrical, 1277×400 µm, more than twice as long as anterior part of prosome. Free urosome (Fig. 38C) 5-segmented, 48×128, 46×108, 48×104, 44×94, and 77×90 µm, respectively: anal somite slightly wider than long; other 4 urosomites much wider than long. Caudal rami divergent and elongate; each ramus about 9 times longer than wide (285×31 µm) and about 3.7 times as long as anal somite, densely setulose along inner margin; armed with 6 setae, innermost distal seta (seta VI) pinnate, other setae naked; outer lateral seta located at 28% of ramus length.

Rostrum (Fig. 38D) triangular, longer than wide, 92×73 µm, well-defined from cephalosome, with angular apex. Antennule (Fig. 38E) 9-segmented, but second segment subdivided by partial suture line; armature formula 3, 17, 6, 4+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; aesthetascs thin, difficult to distinguish from setae; about half of setae pinnate. Antenna (Fig. 38F) 4-segmented; coxa unarmed; exopod represented by 2 small pinnate setae of equal length at outer distal corner of basis; first endopodal segment slightly expanded laterally, armed with 1 seta on outer side; compound distal endopodal segment about 2.9 times longer than wide (63×22 µm), gradually broadening distally; armed with 10 setae and short terminal claw, about one-third as long as segment.

Labrum (Fig. 39A) densely setulose posterolaterally, with concave posterior margin and small posteromedian

lobe. Mandible (Fig. 38G) with 5 teeth and 2 small proximal setae on coxal gnathobase, distalmost tooth acutely pointed and accompanied by small denticle on distal margin of gnathobase (Fig. 39B); basis with 1 seta on medial margin and 1 rounded tubercle proximally on outer margin (indicated by arrowhead in Fig. 38G); exopod indistinctly 2-segmented, first segment with 1 seta and row of setules; second segment with 4 setae, distalmost seta markedly larger; endopod 2-segmented, with 2 and 8 setae on first and second segments, respectively; articulation incomplete between basis and first endopodal segment. Maxillule (Fig. 38H) with 7 setae on precoxal arthrite, 1 seta on coxal endite, 2 setae on epipodite, 3 setae on medial margin of basis; small exopod with 4 distal setae; endopod unsegmented, with 6 setae (3 distal setae longer than other 3). Maxilla (Fig. 39C) as usual for genus, with 3 setae on first endite of syncoxa and 1, 1, and 3 setae, respectively, on first to third segments of endopod. Maxilliped (Fig. 39D) with 9, 0, and 3 setae on first to third segments, respectively; first segment ornamented with few rows of minute spinules distally; second segment with weak outer distal swelling and long setules on medial margin; third segment small and incompletely articulated from second segment.

Legs 1–4 with 3-segmented rami (Fig. 39E–G). Inner coxal seta pinnate in legs 1 and 2, small and pinnate in leg 3, and rudimentary in leg 4. Outer seta on basis of legs 2–4 small and naked. Inner distal spine on basis of leg 1 large, longer than first endopodal segment, with minute spinules on both margins. Outer distal spine on first exopodal segment of legs 1–4 and second exopodal segment of legs 2–4 strong and slightly curved outwards. Distal spine on third exopodal segment of leg 1 stout and pinnate along outer margin. Spines on third exopodal segment of legs 2–4 pectinate along outer margin. Armature formula for legs 1–4 as in generic diagnosis.

Leg 5 (Fig. 39H) represented by 2 papillae on posteroventral border of brood pouch, each tipped with small, naked seta.

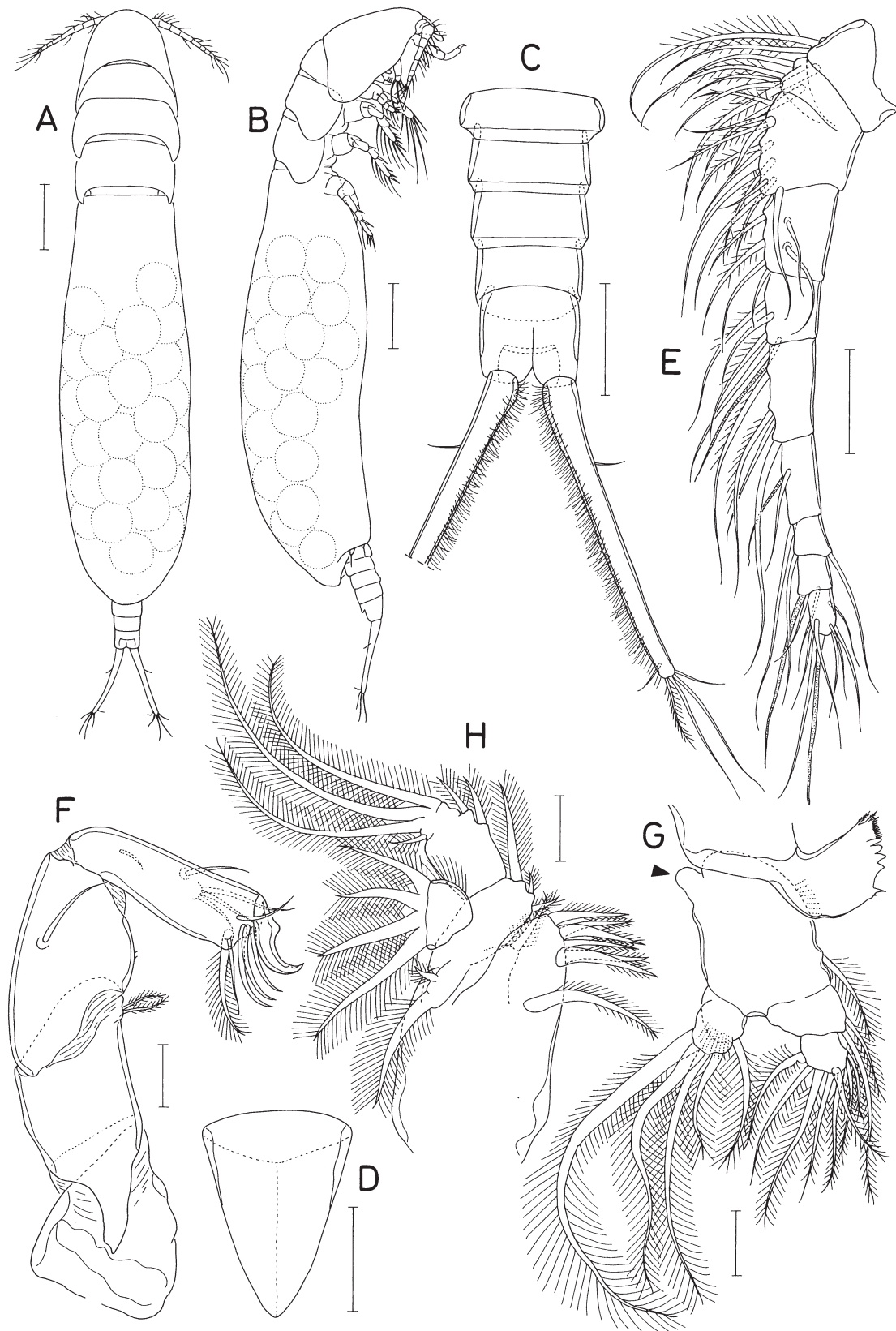
**Male.** Unknown.

**Remarks.** This species may be characterised by the extremely long caudal rami which are about 9 times as long as wide and 3.7 times as long as the anal somite. These proportions differ from all known congeners. The possession of 2 small exopodal setae of equal length on the antenna and the prominent proximal tubercle on the outer margin of the mandibular basis are additional diagnostic features of the new species.

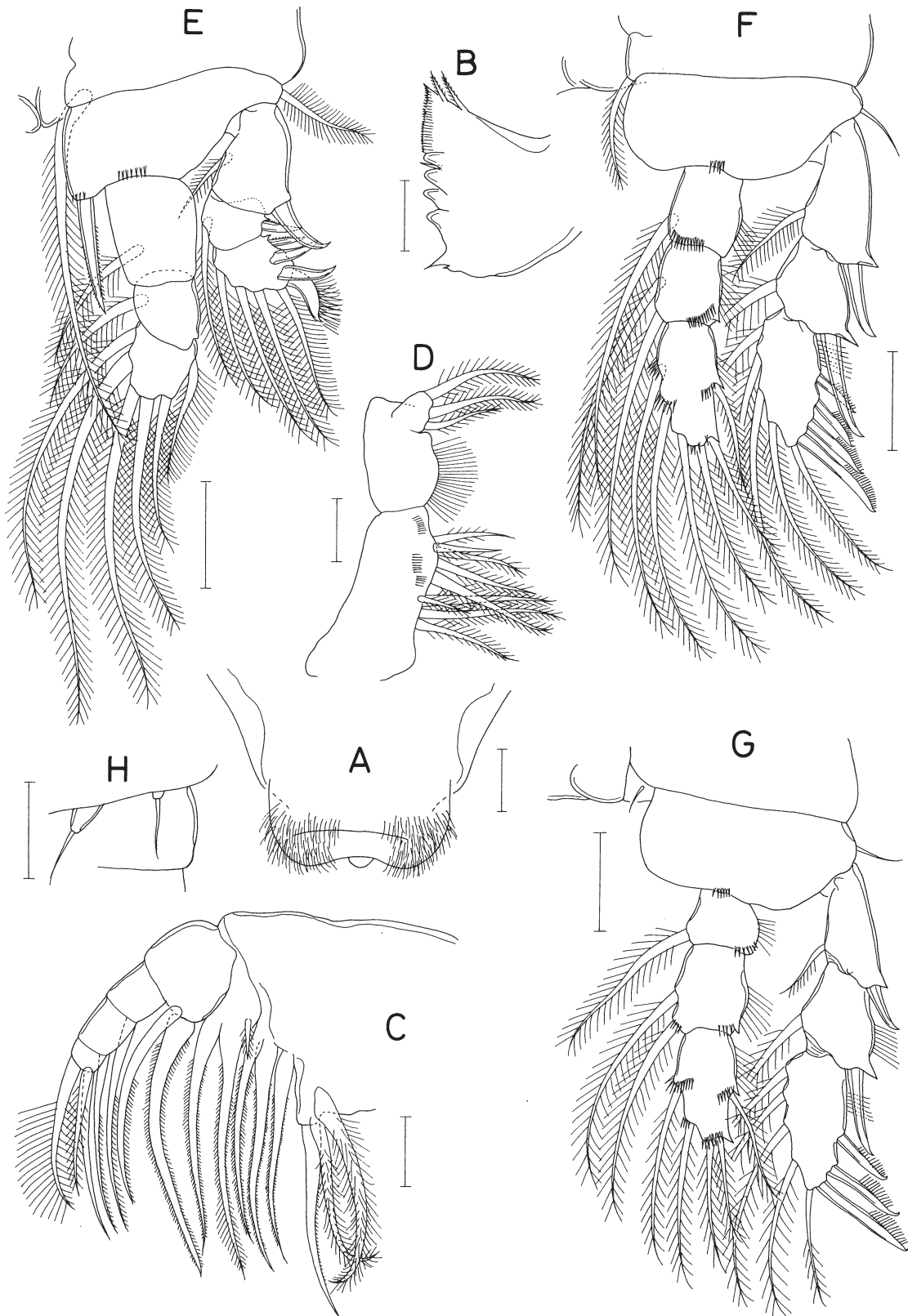
***Paranotodelphys bidentata* sp. nov.**

(Figs. 40, 41)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21224) from *Pseudodistoma aureum* (Brewin, 1957) (MNHN-IT-2008-7326 = MNHN



**FIGURE 38.** *Paranotodelphys stenosa* sp. nov., female. A, habitus, dorsal; B, habitus, right; C, urosome and left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, mandible, showing outer tubercle on basis (arrowhead); H, maxillule. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D, E, 0.05 mm; F–H, 0.02 mm.



**FIGURE 39.** *Parantodelphys stenosa* sp. nov., female. A, labrum; B, coxal gnathobase of mandible; C, maxilla; D, maxilliped; E, leg 1; F, leg 2; G, leg 4; H, leg 5. Scale bars: A–D, 0.02 mm; E–H, 0.05 mm.

A1/PSE/67), Baluan, Papua New Guinea (02°02.27'S, 147°17.97'E), CRRF OCDN 8852-H, 22 June 2003.

**Additional material.** 1 ♀ (dissected) from *Rhopalaea crassa* (Herdman, 1880), Papua New Guinea (09°07.50'S, 149°23.54'E), depth 7 m, 22 January 2002.

**Etymology.** The name of the new species refers to the presence of a pair of tooth-like processes on the apex of the rostrum.

**Description of female.** Body (Fig. 40A, B) narrow, 1.50 mm long. Cephalosome wider than free pedigerous somites. Dorsal tergites of second and third pedigerous somite weakly developed. Brood pouch elongated oval, 591×302 µm, about twice as long as wide, slightly longer than anterior part of prosome: fifth pedigerous somite completely fused to brood pouch. Free urosome (Fig. 40C) slender, 5-segmented; 35×88, 57×65, 50×56, 47×56, and 57×64 µm, respectively. Anal somite gradually broadening posteriorly. Caudal ramus (Fig. 40C) about 5.9 times longer than wide (135×23 µm) and about 2.4 times longer than anal somite, setulose on ventral surface, bearing 6 thin, thread-like setae, longest one (seta V) more than 3 times longer than caudal ramus; outer lateral seta located about at midlength of ramus.

Rostrum (Fig. 40D) nearly semicircular, 54×62 µm, bidentate at apex. Antennule (Fig. 40E) 9-segmented; armature formula 3, 18, 6, 3+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked except 2 pinnate setae on third segment. Antenna (Fig. 40F) 4-segmented; short coxa unarmed; basis with 2 equal, pinnate setae representing exopod; first endopodal segment with 1 naked seta on inner margin; compound distal endopodal segment about 2.8 times as long as wide (45×16 µm), slightly broadening distally, with 11 setae plus short terminal claw, less than half length of segment.

Labrum (Fig. 41A) densely hirsute around posterior margin; with small posteromedian lobe located on ventral surface. Mandible (Fig. 40G) with 5 teeth on coxal gnathobase, distalmost tooth acutely pointed, and with needle-like spinule between proximal 2 teeth; basis with 1 seta on distal medial margin, stout proximal tubercle on outer margin, and ornamented with setules on both margins; exopod 2-segmented, with 2 and 3 setae on first and second segments, respectively, outer terminal seta large, more than twice as long as second longest adjacent seta; endopod almost fused with basis, with 2 and 8 setae on first and second segments, respectively. Maxillule (Fig. 40H) with 7 setae on arthrite, 1 on coxal endite, 2 on coxal epipodite, and 3 on medial margin of basis, proximal 2 setae much smaller than distal seta; exopod with 4 distal setae; endopod unsegmented with 3 large distal and 3 smaller lateral setae. Maxilla (Fig. 41B) 5-segmented with 9 enditic setae on syncoxa (arranged as 3, 1, 2, and 3), 3 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 41C) 3-segmented with 9, 0, and 3 setae on first to third segments; second segment with outer bulbous swelling

and setulose along medial margin; articulation obscure between distal 2 segments.

Legs 1–4 with 3-segmented rami. Leg 1 (Fig. 41D) with patch of minute spinules on anterior surface of coxa; exopod strongly flexed laterally; distal spine on third exopodal segment densely plumose on all margins; third endopodal segment expanded, with enlarged distal setae. Inner seta on coxa large and pinnate in leg 1, naked in leg 2, small and naked in leg 3, and absent in leg 4. Outer seta on basis pinnate in leg 1 but naked in legs 2–4. Inner distal spine on basis of leg 1 as long as first endopodal segment, 37 µm long, ornamented with fine spinules on margins. Spines on first and second exopodal segments of legs 2–4 strong, claw-like and curved outwards; those on second exopodal segment of legs 2 and 3 large, extending beyond distal margin of third exopodal segment. Outer spine on third exopodal segment of legs 2–4 pectinate distally on outer margin. Armature of legs 1–4 as usual for genus, except inner seta on coxa of leg 4 absent.

Leg 5 (Fig. 40C) represented by 2 small papillae each tipped with small seta.

**Male.** Unknown.

**Remarks.** The following outstanding features serve to characterise the new species: (1) the caudal setae are long and thread-like; (2) the distalmost spine on the third exopodal segment of leg 1 is densely plumose; (3) the third endopodal segment of leg 1 is expanded and has enlarged distal setae; and (4) the outer spines on the first and second exopodal segments of legs 2–4 are large and claw-like. These characteristics seem to be unique to the new species within the genus.

### *Paranotodelphys bisetata* sp. nov.

(Figs. 42, 43)

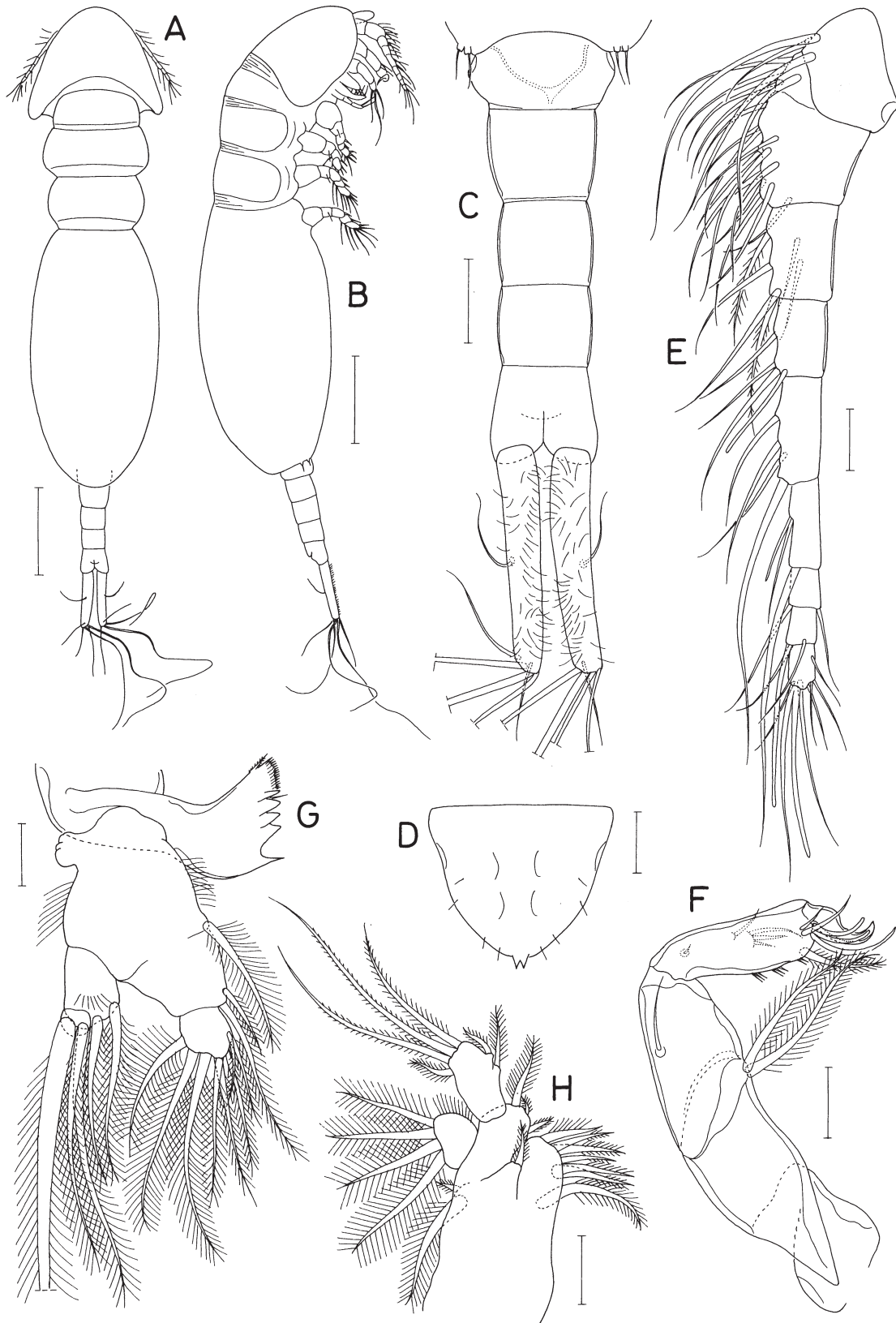
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21225) and dissected paratype (♀, figured) from *Ecteinascidia nexa* Sluiter, 1904, on seaweed, Ibo, Mozambique, Monniot coll., November 1995.

**Additional material.** 1 ♀ (dissected) from *Perophora multiclathrata* (Sluiter, 1904), Ibo, Mozambique, Monniot coll., 09 November 1995.

**Etymology.** The name of the new species refers to the presence of only two setae on the terminal segment of the maxilliped.

**Description of female.** Body (Fig. 42A, B) moderately stout, 1.33 mm long. Cephalosome only slightly wider than following pedigerous somites. Brood pouch expanded, oval, 577×409 µm, about 1.3 times as long as anterior part of body, nearly circular in lateral view. Free urosome (Fig. 42C) 5-segmented, gradually narrowing posteriorly; genital and 4 abdominal somites 64×125, 58×100, 51×86, 55×80, and 55×71 µm, respectively. Caudal rami (Fig. 42C) slightly divergent; each ramus narrowing evenly towards tip, about 4.2 times





**FIGURE 40.** *Paranotodelphys bidentata* sp. nov., female. A, habitus, dorsal; B, habitus, right; C, urosome and caudal rami, ventral; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule. Scale bars: A, B, 0.2 mm; C, 0.05 mm; D–H, 0.02 mm.

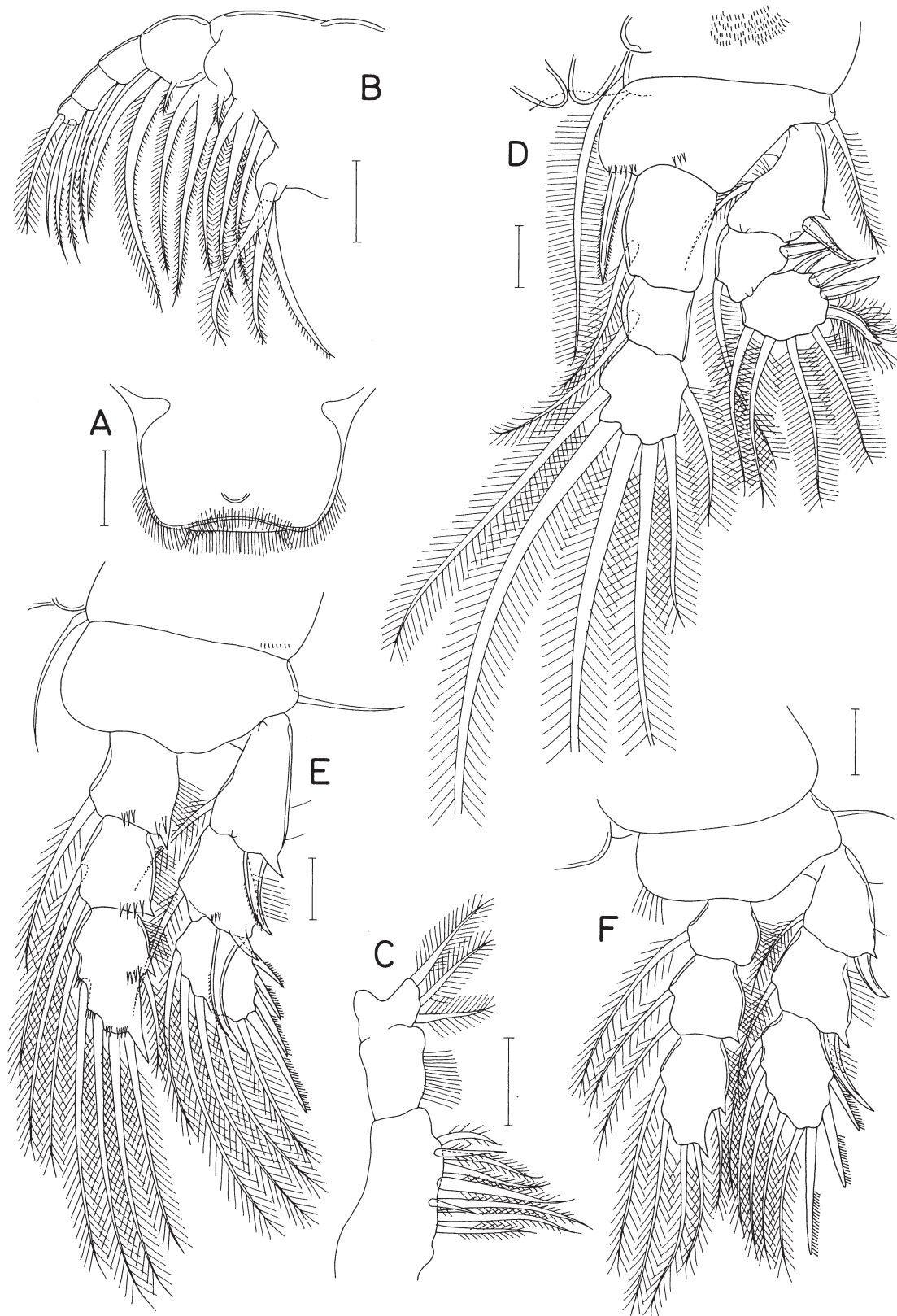
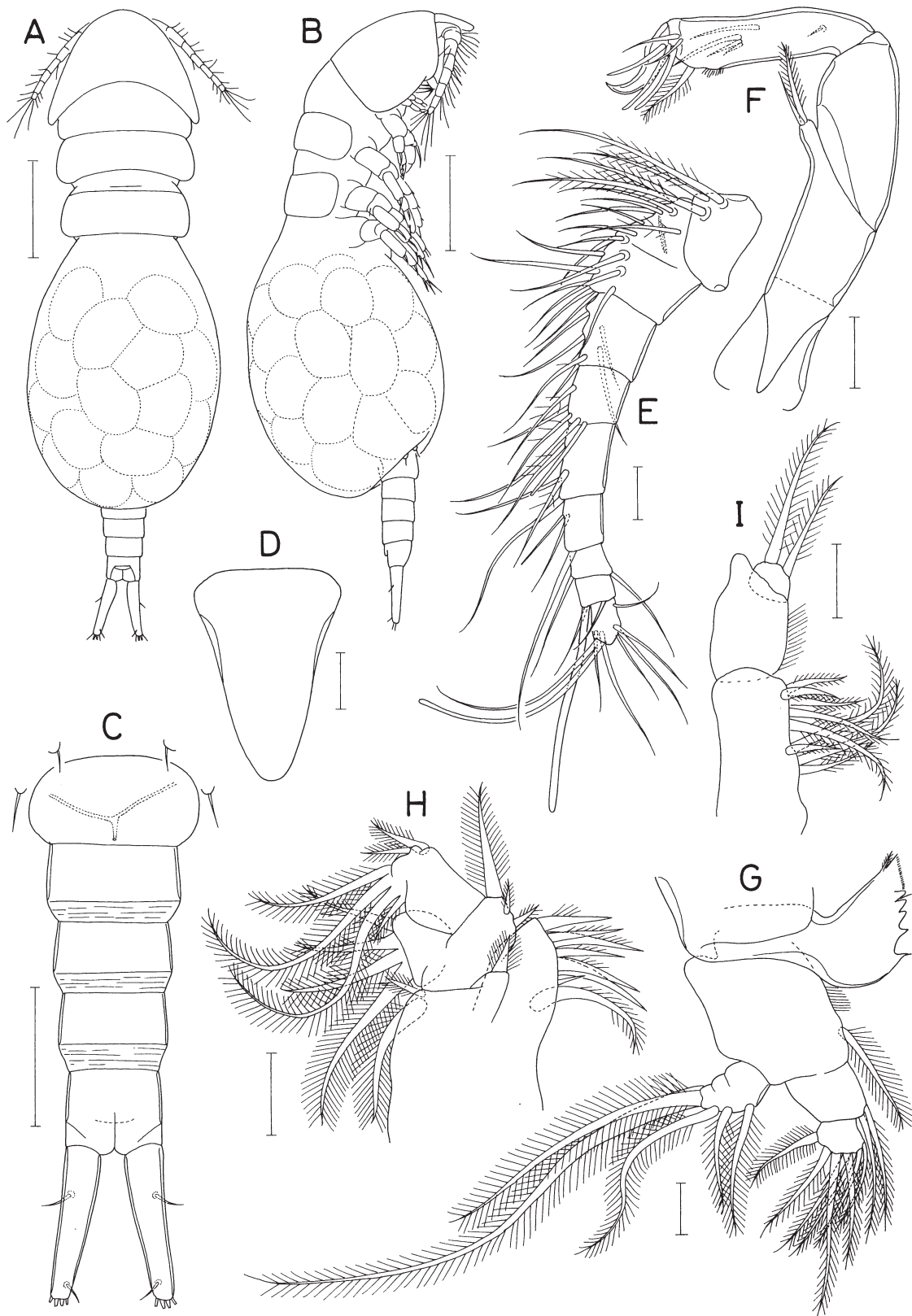
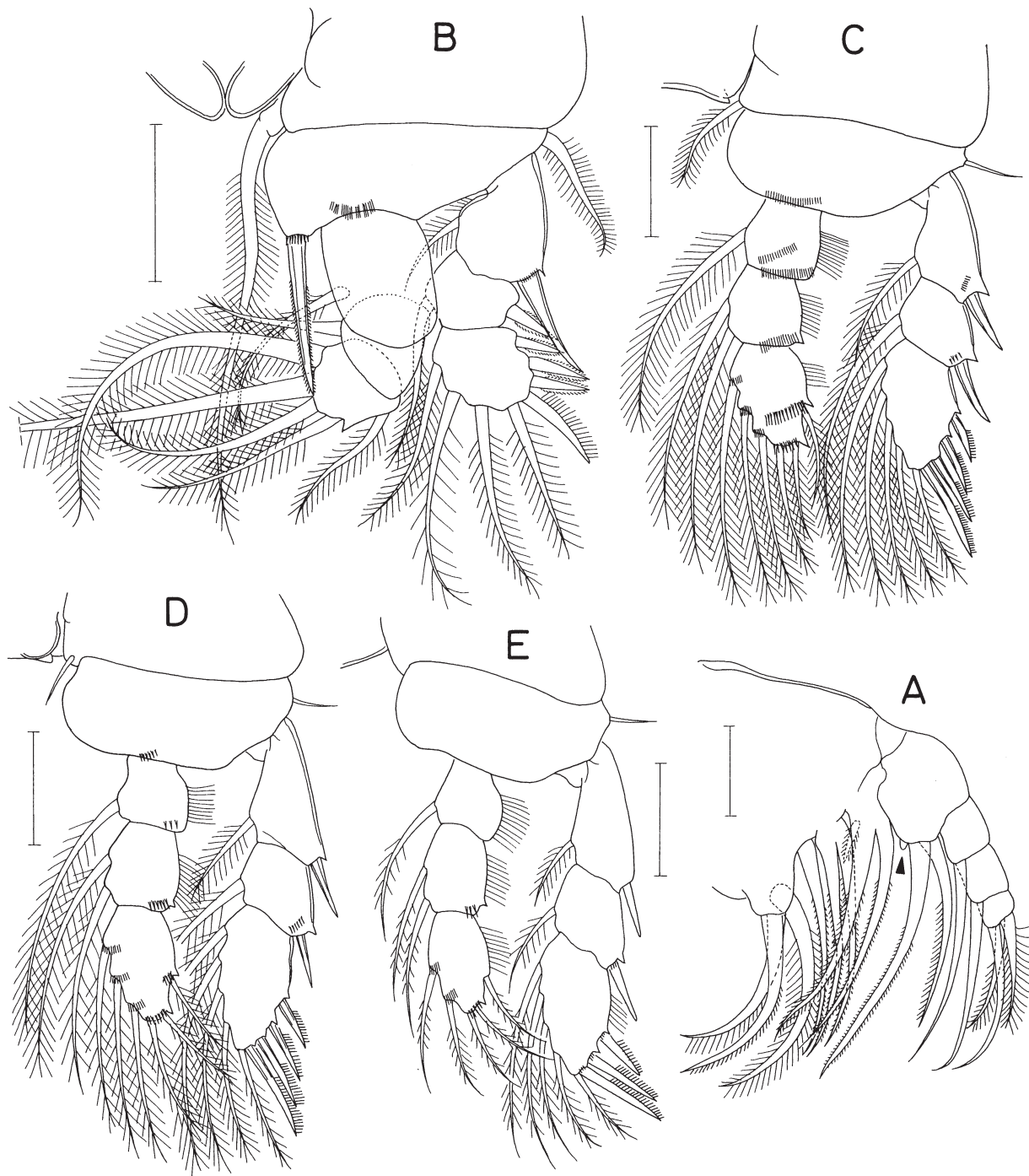


FIGURE 41. *Paranotodelphys bidentata* sp. nov., female. A, labrum; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4. Scale bars: 0.02 mm.



**FIGURE 42.** *Paranotodelphys bisetata* **sp. nov.**, female. A, habitus, dorsal; B, habitus, right; C, urosome, vental; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D–I, 0.02 mm.



**FIGURE 43.** *Paranotodelphys bisetata* **sp. nov.**, female. A, maxilla showing small knob on basis (arrowhead); B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: A, 0.02 mm; B–E, 0.05 mm.

longer than wide ( $114 \times 27 \mu\text{m}$ ) and twice as long as anal somite; armed with 6 setae, outer lateral seta positioned at 34% of ramus length.

Rostrum (Fig. 42D) tapering,  $75 \times 52 \mu\text{m}$ , articulated at base, with rounded apex. Antennule (Fig. 42E) 9-segmented; armature formula 3, 9, 6, 4+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; proximal segments not expanded; several setae pinnate (as figured); second segment with trace of subdivision. Antenna (Fig.

42F) 4-segmented; coxa short, unarmed; basis distally with 1 pinnate seta and 1 smaller naked seta representing exopod, 26 and  $18 \mu\text{m}$  long, respectively, lengths less than distal width of basis; first endopodal segment unarmed; compound distal endopodal segment about 3.4 times longer than wide ( $55 \times 16 \mu\text{m}$ ); armed with 9 setae plus terminal claw about half as long as segment.

Labrum destroyed, not examined. Mandible (Fig. 42G) with 5 teeth and 1 small proximal seta on coxal

gnathobase; distalmost tooth acutely attenuated; needle-like spinule present between 2 proximal teeth; basis with broad proximal protuberance on outer margin, plus 1 subistal seta and row of setules on medial margin; exopod with 5 setae, distal seta distinctly larger than other 4; endopod incompletely articulated from basis, with 2 and 8 setae on first and second segments, respectively. Maxillule (Fig. 42H) with 8 setae on arthrite, 1 on coxal endite, 2 on epipodite; basis with 2 small proximal and 1 large distal setae on medial margin; exopod with 4 setae distally; endopod unsegmented with 6 setae. Maxilla (Fig. 43A) 5-segmented; syncoxa with 9 enditic setae 9 (3, 1, 2, 3), 2 setae on basis, and 1, 1, and 3 on first to third endopodal segments, respectively; basis with small additional knob (indicated by arrowhead in Fig. 43A) possibly vestige of seta. Maxilliped (Fig. 74I) 3-segmented and armed with 9, 0, and 2 setae on first to third segments, respectively; second segment with bulbous swelling at outer distal corner and ornamented with setules on medial margin.

Legs 1–4 (Fig. 43B–E) with 3-segmented rami. Inner seta on coxa large in leg 1, smaller and pinnate in leg 2, small and naked in leg 3, and lacking in leg 4. Outer seta on basis pinnate in leg 1, small and naked in legs 2–4. Inner distal spine on basis of leg 1 52 µm long, much longer than first endopodal segment, with spinules on margins. Outer spine on first exopodal segment of leg 1 large, extending to middle of third exopodal segment. Outer spines on first exopodal segment of leg 1, and on first and second exopodal segments of legs 2–4 smooth, without ornamentation. Spines on third exopodal segment of legs 2–4 pectinate along distal half of outer margin. Armature formula for legs 1–4 as in generic diagnosis except for absence of inner coxal seta of leg 4.

Leg 5 (Fig. 42C) represented by 2 papillae, each tipped with minute seta.

**Male.** Unknown.

**Remarks.** The new species can be compared with its five congeners bearing only 2 setae rather than 3, on the third segment of the maxilliped. These five species are *P. engeli* Stock, 1967, *P. phallusiae* (Gurney, 1927), *P. procax* Stock and Humes, 1970, *P. scutiformis*, and *P. villosus* Ooishi, 1963. These can be distinguished from the new species as follows: in *P. engeli* the caudal ramus is strongly tapering and about twice as long as wide; the exopod of the antenna is represented by 2 subequal pinnate setae; and leg 4 has an inner coxal seta, whereas in the new species the caudal ramus is about 4.2 times longer, the exopodal setae differ markedly in length, and leg 4 lacks the inner coxal seta.

In *P. phallusiae* the female body length is 2.12 mm, the brood pouch is elongated, the exopod of the antenna is represented by 2 equal setae, the second endopodal segment of the mandible is armed with 7 setae, and the endopod of the maxillule is armed with 4 setae. In contrast the new species is much smaller (1.33 mm) and the brood pouch is oval, the exopodal setae differ markedly in

length, the second endopodal segment of the mandible is armed with 8 setae, and the endopod of the maxillule is armed with 6 setae.

*Paranotodelphys procax* has caudal rami that are hirsute along the inner margin whereas in the new species these margins are smooth. The exopod of the antenna is represented by 2 very unequal setae in *P. procax* with the longer seta more than 3 times the length of the shorter. Also both these setae are naked according to Stock & Humes (1970). In the new species the longer seta is pinnate and less than 50% longer than the shorter naked seta.

In *P. scutiformis* the body is dorsoventrally depressed, the prosome has parallel lateral margins and the caudal rami are very short (about 1.3 times longer than wide and about equal in length to the anal somite), whereas in the new species the brood pouch is markedly wider than the rest of the prosome and the caudal rami are about 4.2 times longer than wide and about twice the length of the anal somite. There are additional differences in limb setation: for example the second endopodal segment of the mandible is armed with 7 setae in *P. scutiformis* (8 in the new species) and the endopod of the maxillule has 5 setae (6 in the new species).

Finally, in *P. villosus* the brood pouch is elongated, the caudal rami are extremely elongate, 11 times as long as wide (Ooishi, 1963) and have a densely hirsute inner margin, the exopod of the antenna is represented by 2 long, pinnate setae, and leg 4 has an inner coxal seta. All of these character states differ from those exhibited by the new species.

The female antennule does not display any additional setal elements on the distal segments.

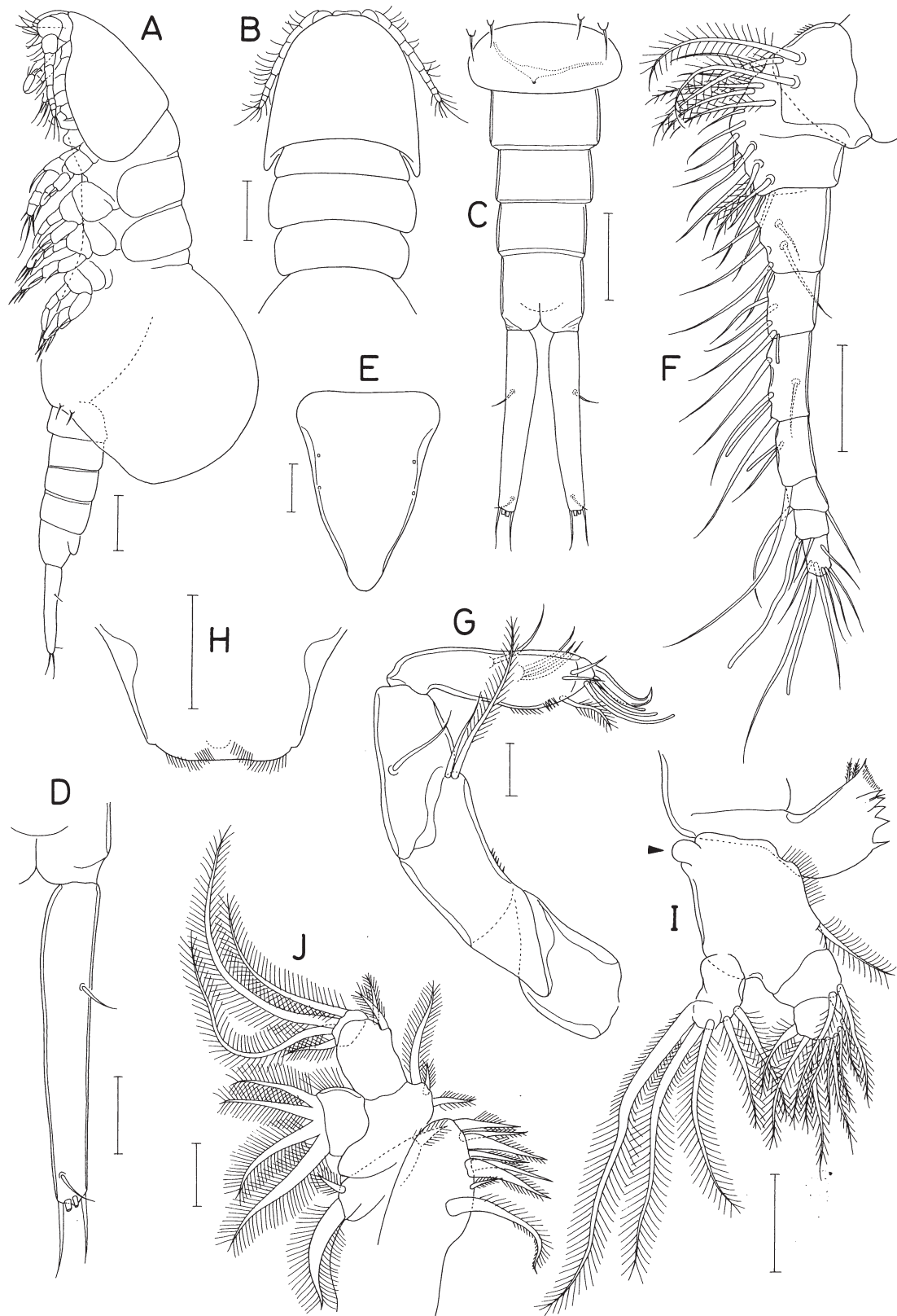
### *Paranotodelphys tuberculata* sp. nov.

(Figs. 44, 45)

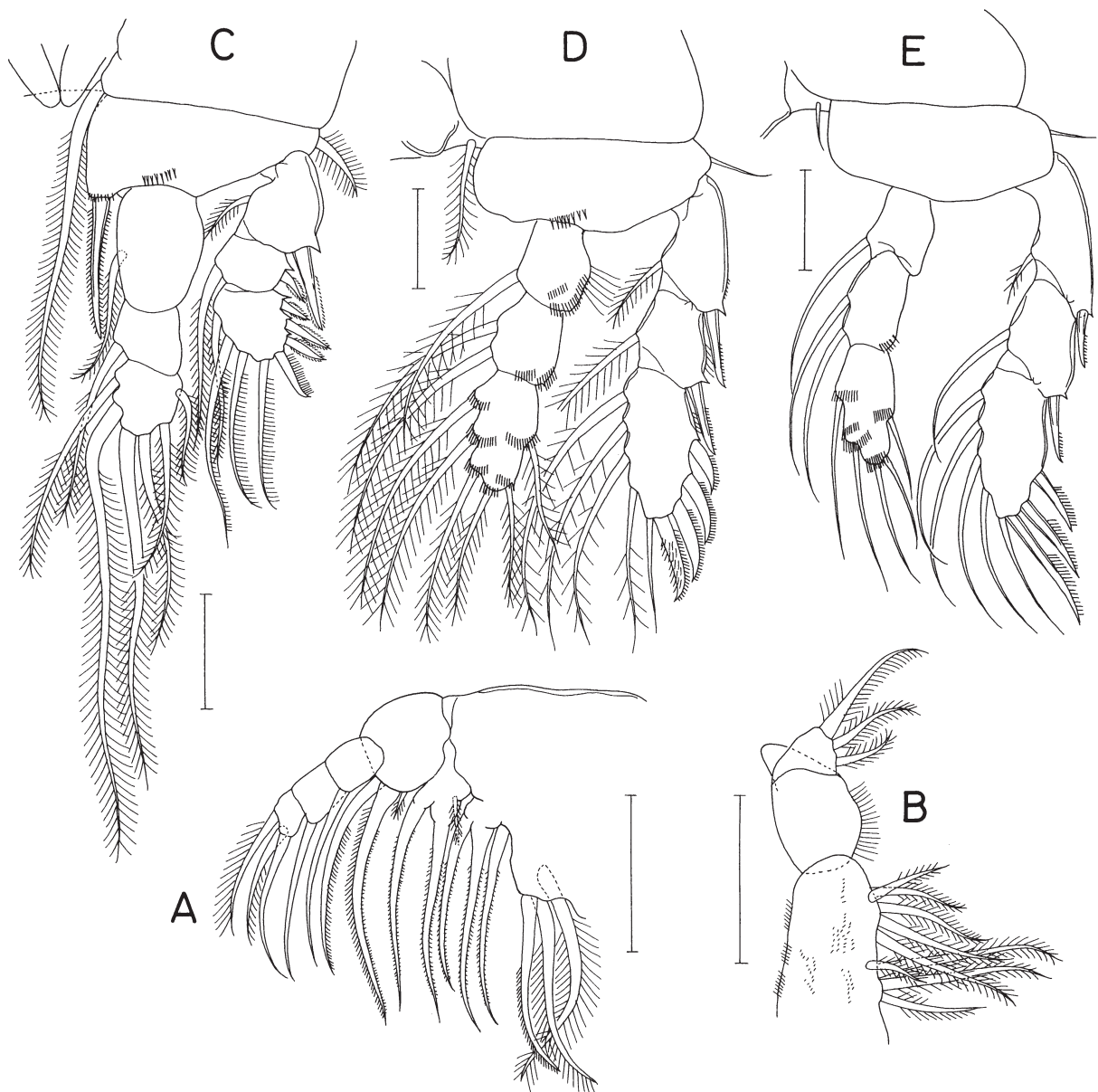
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21226), paratype (intact ♀, MNHN-IU-2014-21227), and dissected paratype (♀, figured) from *Ecteinascidia aequale* Monniot C., 1987 (MNHN-IT-2008-3815 = MNHN P2/ECT/43), Îlot Maître, New Caledonia, Monniot coll., 1985.

**Etymology.** The name of the new species refers to the presence of a tubercle located proximally on the outer margin of the mandibular basis.

**Description of female.** Body (Fig. 44A) similar in form to preceding species (*P. bisetata* sp. nov.). Body length 1.29 mm. Posterolateral corners of cephalosome extended posteriorly (Fig. 44B). First pedigerous somite slightly narrower than second and third pedigerous somites. Brood pouch oval in dorsal view, but circular in lateral view (Fig. 44A). Free urosome (Fig. 44C) slender, 5-segmented; genital and 4 free abdominal somites gradually narrowing posteriorly 82×175, 68×125, 61×111, 59×102, and 84×97 µm, respectively. Caudal ramus (Fig.



**FIGURE 44.** *Parantodelphys tuberculata* sp. nov., female. A, habitus, left; B, anterior part of prosome, dorsal; C, urosome, ventral; D, right caudal ramus, dorsal; E, antennule; G, antenna; H, labrum; I, mandible showing outer tubercle on basis (arrowhead); J, maxillule. Scale bars: A–C, 0.1 mm; D, F, H, I, 0.05 mm; E, G, J, 0.02 mm.



**FIGURE 45.** *Parantodelphys tuberculata* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4. Scale bars: 0.05 mm.

44D) about 5.9 times as long as wide ( $205 \times 35 \mu\text{m}$ ), smooth; armed with 6 setae, outer lateral seta positioned at 33% of ramus length.

Rostrum (Fig. 44E) tapering strongly,  $82 \times 59 \mu\text{m}$ , articulated at base from cephalosome, with blunt apex. Antennule (Fig. 44F) slender, 9-segmented; first and second segments slightly broadened; armature formula 3, 17, 6, 4+aesthetasc, 4+aesthetasc, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; several setae on first and second segments pinnate (as figured); suture line between first 2 segments obscure. Antenna (Fig. 44G) 4-segmented; coxa unarmed; basis with several minute spinules on outer margin and armed with 2 unequal setae

representing exopod, long pinnate seta and naked seta, half length of pinnate seta; first endopodal segment with 1 seta on inner side; compound distal endopodal segment about 3 times as long as wide; armed with 9 setae plus slender terminal claw, less than half as long as segment.

Labrum (Fig. 44H) simple, with setule rows along posterior margin. Mandible (Fig. 44I) with 5 teeth and 2 small proximal setae on coxal gnathobase, distalmost tooth acutely pointed; needle-like spinule present between 2 proximal teeth; basis with prominent proximal tubercle on outer margin (arrowhead in Fig. 44I), armed with 1 seta on subdistal medial margin and ornamented with setules on medial margin; exopod with 5 unequal setae, outer distal

seta much larger than others; endopod 2-segmented with 2 and 8 setae on first and second segments, respectively; outer distal seta on second endopodal segment slightly swollen at base. Maxillule (Fig. 44J) with 8 setae on arthrite, 1 on coxal endite, 2 on coxal epipodite; basis with 3 setae (2 small proximal and 1 larger distal) on medial margin; exopod with 4 setae distally; endopod distinctly 2-segmented with 2 small setae on medial margin of first segment and 4 setae on second segment, outermost seta much smaller than other 3; all setae on maxillule pinnate. Maxilla (Fig. 45A) 5-segmented; armed with 9 setae on syncoxa (arranged as 3, 1, 2, and 3), 3 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 45B) 3-segmented, with 9, 0, and 3 setae on first to third segments, respectively; first segment ornamented with minute spinules on all surfaces; second segment with setules on medial margin and produced into bulbous swelling at outer distal corner.

Legs 1–4 with 3-segmented rami (Fig. 45C–E). Inner seta on coxa becoming shorter from legs 1 to 4, pinnate in legs 1–3, and naked in leg 4. Outer seta on basis pinnate in leg 1 but naked in legs 2–4. Inner distal spine on basis of leg 1 much longer than first endopodal segment, 62  $\mu\text{m}$  long, and spinulose on margins. Distal spine and setae on third exopodal segment of leg 1 and outer spines on exopod of legs 2–4 pectinate along outer margin. Spines on third exopodal segment of leg 2 broadened. Inner seta on first exopodal segment of leg 4 small but pinnate; all other setae on leg 4 naked. Armature formula for legs 1–4 as in generic diagnosis.

Leg 5 (Fig. 44C) represented by 2 papillae on posterior border of brood pouch, each tipped with 1 tiny seta.

**Male.** Unknown.

**Remarks.** In the genus *Paranotodelphys* the exopod of the antenna is represented by a pair of setae and in most known species these setae are equal or subequal in length. However, in a few species these two setae differ markedly in size, the shorter one being at most half the length of the other, as in the new species. The new species shares this feature with *P. procox* and *P. nodulosa* **sp. nov.** but differs from them as follows: *P. procox* has densely hirsute caudal rami, only 2 setae (3 setae in the new species) on the third segment of the maxilliped, and an unsegmented maxillulary endopod. In the new species the caudal rami are smooth and the maxillulary endopod is distinctly 2-segmented. In *P. nodulosa* **sp. nov.** the female has a strongly tapering rostrum, both exopodal setae of the antenna are pinnate (cf. the smaller one is naked in the new species), and the coxa of leg 4 lacks an inner seta (seta present in the new species).

The precise format of the exopodal setae on the antenna is unknown in *P. gracilis* and *P. longicauda*, both described by Schellenberg (1922), but these species are distinguishable from the new species by other characters. *Paranotodelphys gracilis* has a larger body (2.2–2.5

mm, according to Schellenberg, 1922), a “2-segmented maxilliped” and longer abdominal somites which are as wide as long, whereas *P. longicauda* has an elliptical brood pouch and caudal rami which are 3 times as long as the anal somite (cf. about 2.4 times longer in the new species). These differences are sufficient to justify the establishment of a new species.

***Paranotodelphys patagonica* sp. nov.**

(Figs. 46–48)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21228), paratypes (2 intact ♀♀, MNHN-IU-2014-21229), and dissected paratypes (1 ♀, 1 ♂, figured) from *Ascidia meridionalis* Herdman, 1880 (MNHN-IT-2008-1110 = MNHN P5/ASC.A/4), Calypso expedition 1961–1962, NE Mar del Plata, Argentina (37°36'S, 54°46'W), depth 740 m, B. Métévier coll., 29 December 1961.

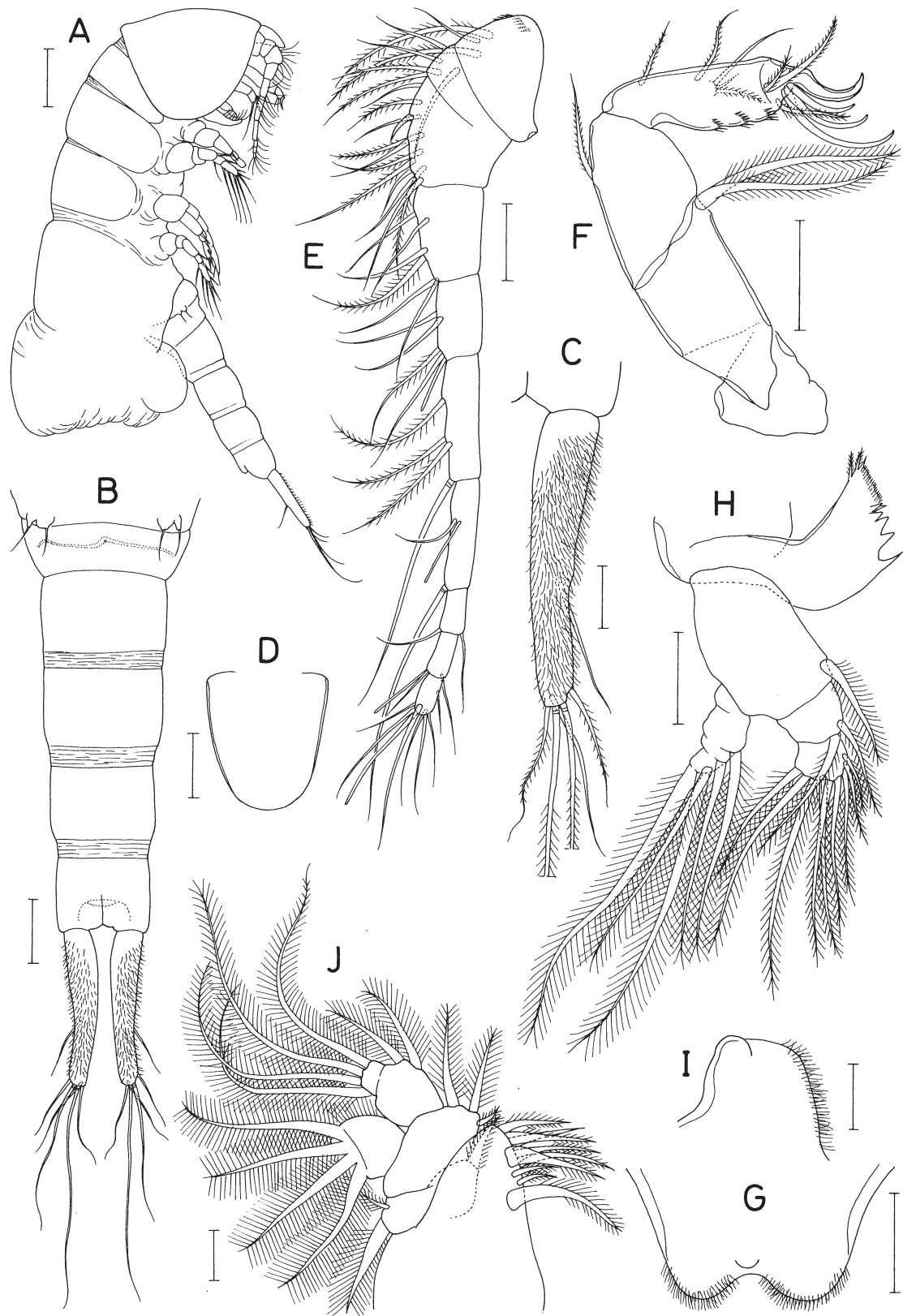
**Etymology.** The name of the new species refers to the type locality.

**Description of female.** Body (Fig. 46A) moderately stout and bilaterally compressed. Body length 2.10 mm. Cephalosome with well developed dorsal shield: first to third pedigerous somites each with distinct dorsal tergite. Free urosome (Fig. 46B) cylindrical, 5-segmented: genital somite short, 73×262  $\mu\text{m}$ ; 4 abdominal somites 145×200, 153×192, 145×164, and 113×149  $\mu\text{m}$ , respectively. Caudal ramus (Fig. 46C) about 5.3 times longer than wide (239×45  $\mu\text{m}$ ) and more than twice as long as anal somite; distal 40% narrower than proximal 60%; ventral surface densely covered by setules; armed with 6 setae, 4 distal setae pinnate; outer lateral seta located at 60% of ramus length; longest terminal seta (seta V) longer than caudal ramus, but other 5 setae shorter than ramus.

Rostrum (Fig. 46D) spatulate, 107×95  $\mu\text{m}$ , slightly longer than wide, with broadly convex distal margin. Antennule (Fig. 46E) slender, 9-segmented; armature formula 3, 17, 6, 4+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; second segment partially subdivided into proximal region bearing 5 setae and distal region bearing 12 setae; about half of setae on first to fifth segments pinnate (as figured); distalmost seta on fifth (XVIII–XX) and sixth (XXI–XXIII) segments annulated at base. Antenna (Fig. 46F) rather stocky, 4-segmented; coxa short and unarmed; basis with 2 equally large, pinnate setae representing exopod (setae as long as distal endopodal segment); first endopodal segment with 1 seta on subdistal inner margin; compound distal endopodal segment, 77×29  $\mu\text{m}$ , ornamented with 3 rows of spinules on outer surface; armed with 11 setae (grouped as 1, 1, 3, 2, 1, and 3) plus slender terminal claw, about half as long as segment.

Labrum (Fig. 46G) with deeply concave, setulose posterior margin. Mandible (Fig. 46H) with 5 teeth and 2 small setae on coxal gnathobase; distalmost tooth acutely





**FIGURE 46.** *Paranotodelphys patagonica* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C–H, 0.05 mm; I, J, 0.02 mm.

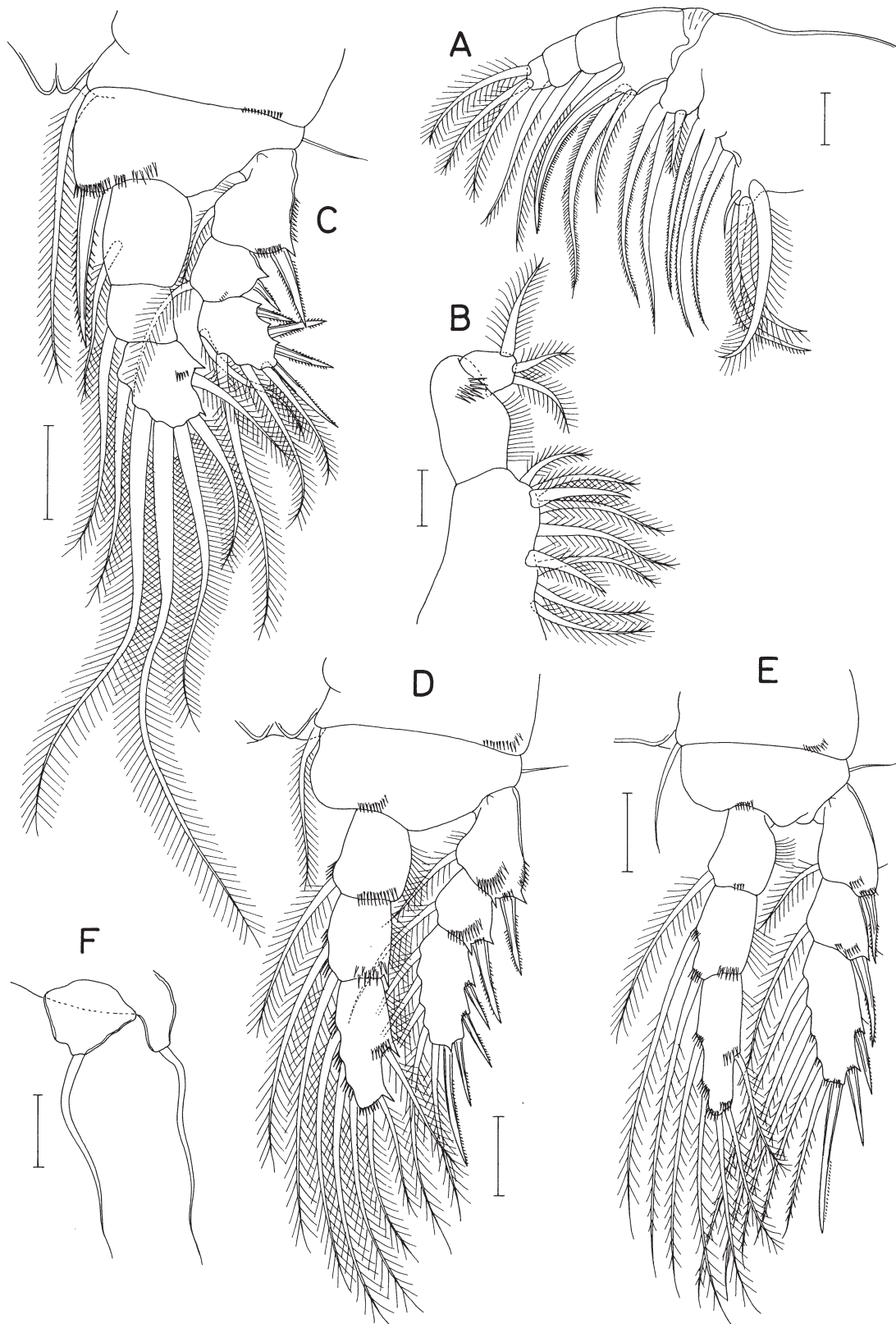
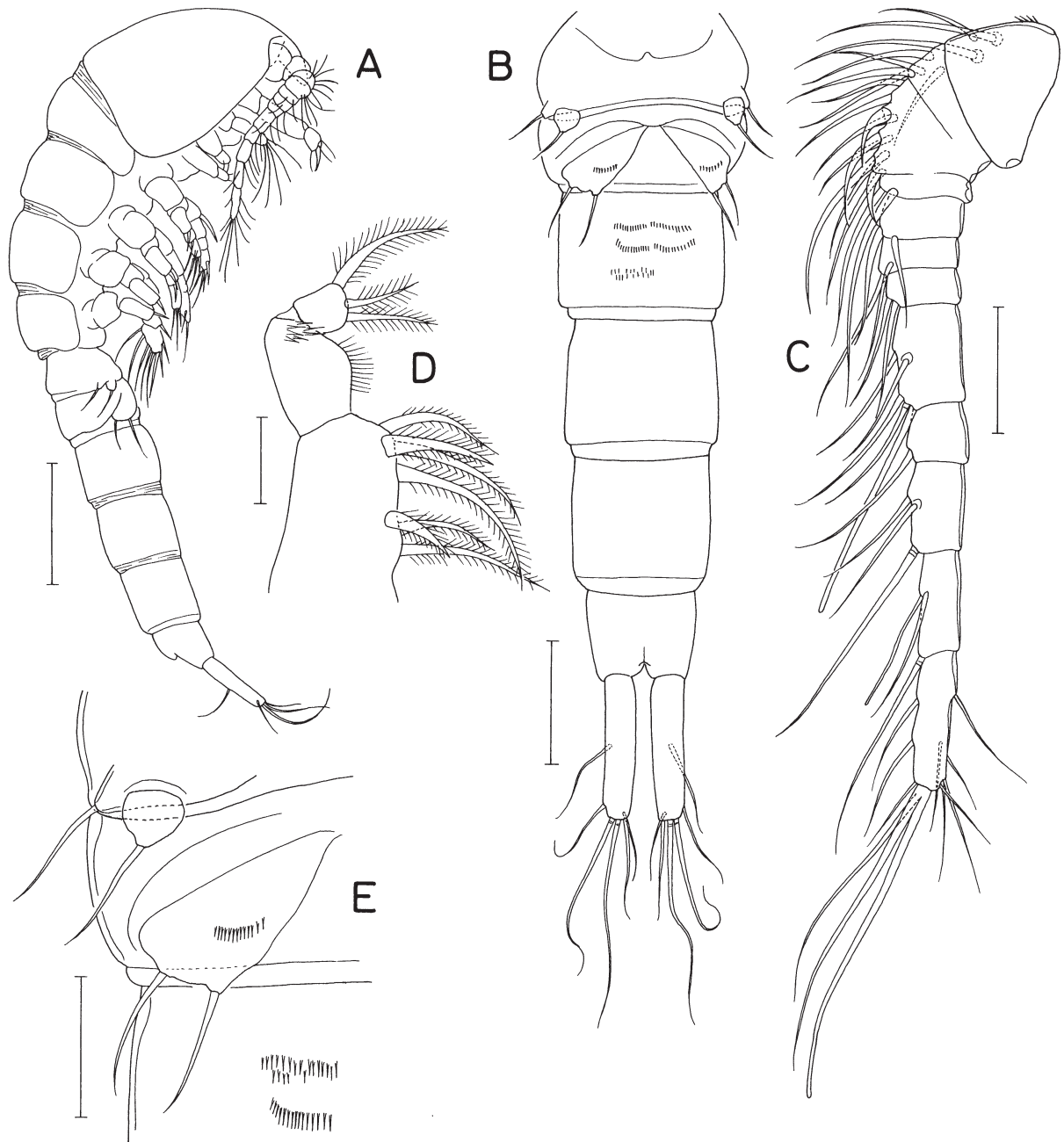


FIGURE 47. *Paranotodelphys patagonica* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, F, 0.02 mm; C–E, 0.05 mm.



**FIGURE 48.** *Parantodelphys patagonica* sp. nov., male. A, habitus, right; B, urosome, ventral; C, antennule; D, maxilliped; E, legs 5 and 6. Scale bars: 0.2 mm; B, 0.1 mm; C, E, 0.05 mm; D, 0.02 mm.

pointed and proximalmost tooth bifurcate; basis with 1 subdistal seta on medial margin; exopod with 5 setae, 2 distal setae longer than other 3; endopod 2-segmented and armed with 2 and 9 setae on first and second segments, respectively. Paragnath (Fig. 46I) with blunt lobe at outer distal corner and ornamented with dense setules on medial margin. Maxillule with 9 setae on arthrite, 1 on coxal endite, 2 on coxal epipodite; basis with 1 small proximal and 2 longer distal setae on medial margin; exopod with 4 setae distally; endopod incompletely 2-segmented, with 2 setae on first segment and 4 subequally

long setae on second segment. Maxilla (Fig. 47A) 5-segmented; syncoxa with 10 setae (4, 1, 2, and 3), basis with 2 setae plus slender claw, 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 47B) 3-segmented, with 9, 0, and 3 setae on first to third segments respectively; second segment ornamented with setules on medial margin, patch of spinules distally, but lacking outer distal bulbous swelling.

Legs 1–4 with 3-segmented rami (Fig. 47C–E). Inner coxal seta pinnate in legs 1–3, naked in leg 4. Outer seta on basis in all swimming legs small and naked. Inner distal

spine on leg 1 basis 83  $\mu\text{m}$  long, extending to posterior margin of second endopodal segment, spinulose on both margins; 2 inner subdistal setae on third endopodal segment of leg 1 enlarged. Armature formula for legs 1–4 as in generic diagnosis.

Leg 5 (Fig. 47F) represented by protopod and small free exopod; protopod fused to brood pouch, bearing outer distal process tipped with 1 naked seta; exopodal segment wider than long, strongly tapering, 21 $\times$ 26  $\mu\text{m}$ , with 1 naked seta apically.

**Description of male.** Body (Fig. 48A) curved ventrally. Body length 1.43 mm. Urosome (Fig. 48B) 6-segmented: comprising free fifth pedigerous somite 177  $\mu\text{m}$  wide, short genital somite, 73 $\times$ 173  $\mu\text{m}$ , ornamented with transverse row of fine spinules on ventral surface of genital operculum (Fig. 48E), and four abdominal somites 105 $\times$ 139, 114 $\times$ 127, 109 $\times$ 115, and 75 $\times$ 91  $\mu\text{m}$ , respectively. First abdominal somite ornamented with 3 transverse rows of fine spinules on ventral surface. Anal somite distinctly narrower than third abdominal somite. Caudal ramus about 4.4 times longer than wide (120 $\times$ 27  $\mu\text{m}$ ); outer lateral seta located at midlength of ramus.

Rostrum as in female. Antennule (Fig. 48C) 10-segmented; armature formula 3, 17, 2, 2, 2, 4+aesthetasc, 1, 3, 2+aesthetasc, and 11+aesthetasc; second segment subdivided by partial suture lines; segmental fusion pattern I-II, III-XI, XII, XIII, XIV, XV-XVI, XVII, XVIII-XX, XXI-XXIII, XXIV-XXVIII. Antenna as in female.

Labrum, mandible, paragnath, maxillule, and maxilla as in female. Maxilliped (Fig. 48D) armed with 7 (3+4) setae on first segment; second segment ornamented with patch of spinules distally, as in female.

Legs 1–4 with same armature formula as in female, but 2 inner subdistal setae on third endopodal segment of leg 1 not enlarged. Leg 5 (Fig. 48E) similar to that of female, but outer distal process of protopod less prominent; free exopodal segment 20 $\times$ 22  $\mu\text{m}$ . Leg 6 (Fig. 48E) represented by 2 equal, naked setae on genital operculum.

**Remarks.** Several species of *Paranotodelphys* are known to have hirsute caudal rami that are densely ornamented with fine setules on the ventral or inner surfaces. These species are *P. procax*, *P. villosus*, *P. stenosa* **sp. nov.**, and *P. bidentata* **sp. nov.** and each can be readily differentiated from the new species. The new species has 3 setae on the distal segment of the maxilliped whereas there are only 2 setae in *P. procax*. Both *P. villosus* and *P. stenosa* **sp. nov.** have elongated caudal rami (more than 10 times longer than wide in the former and about 9.2 times longer in the latter), whereas the new species has caudal rami that are only about 5.3 times longer than wide. The long, thread-like caudal setae and the broad rostrum of *P. bidentata* **sp. nov.** serve to differentiate it from the new species which has short caudal setae and narrow pointed rostrum.

The patch of spinules located distally on the second segment of the maxilliped, the presence of 9 setae on

the second endopodal segment of the mandible, and the presence of a distinct (although small) free exopodal segment of leg 5 are all unique characteristics within the genus, serving as diagnostic features of the new species.

### *Paranotodelphys molgulae* sp. nov.

(Figs. 49, 50)

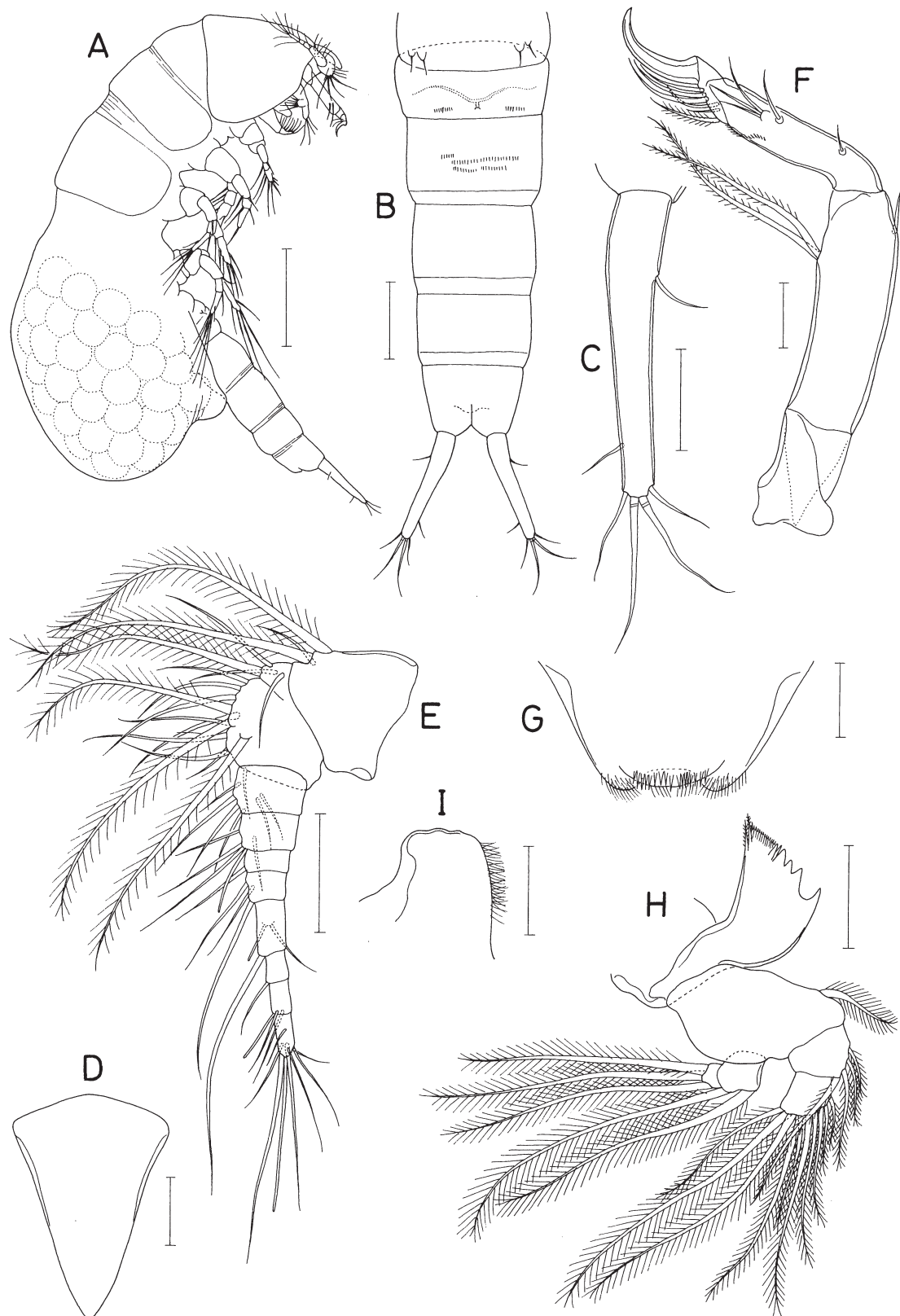
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21230) from *Molgula pyriformis* Herdman, 1881 (MNHN-IT-2008-5729 = MNHN S3/MOL.A/149), Cruise 721 of HERO, Tierra del Fuego, Argentina (54°34'S, 064°10'W), depth 73 m, January 1952.

**Etymology.** The new species takes its name from the generic name of the type host.

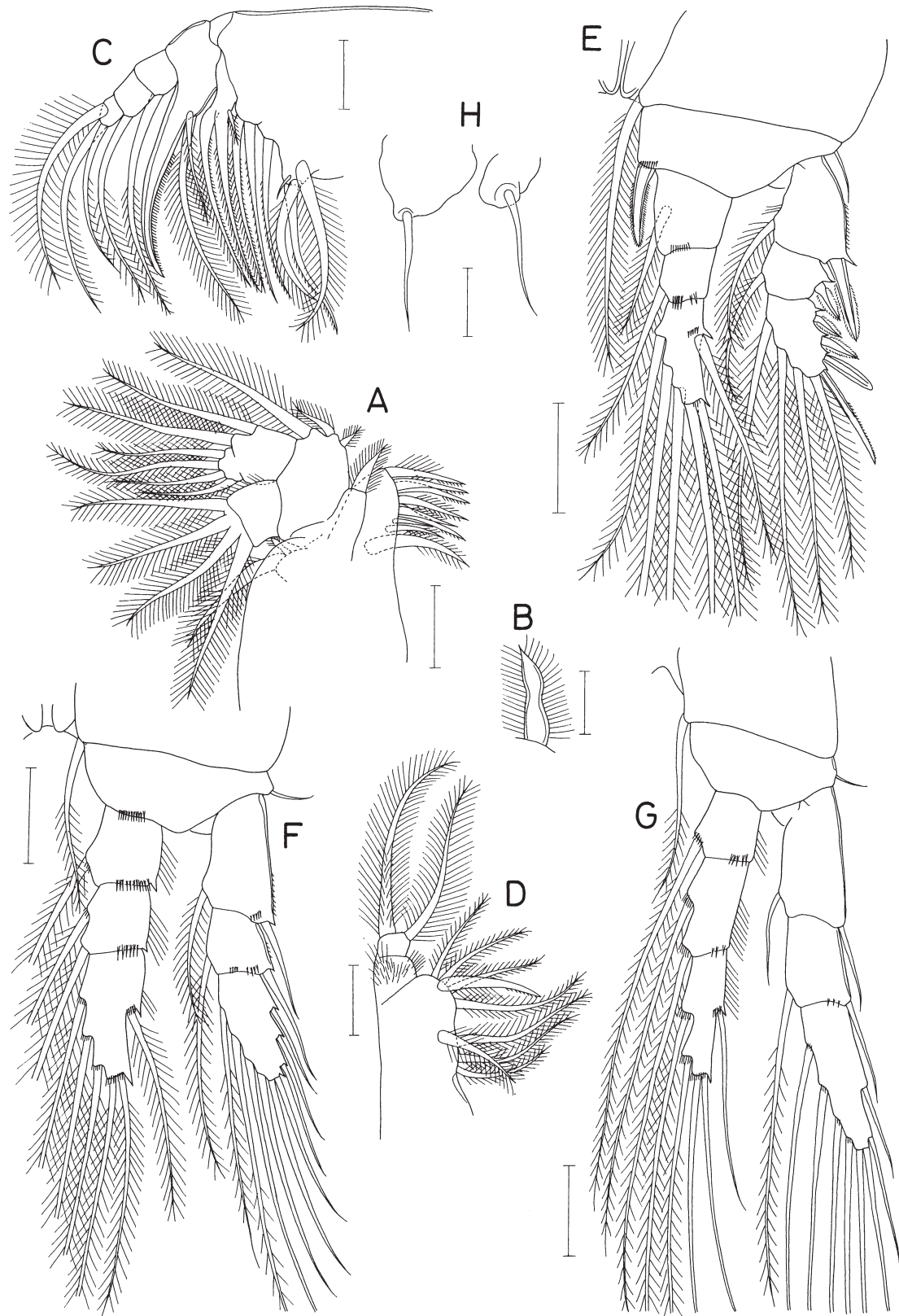
**Description of female.** Body (Fig. 49A) stocky, similar in form to *Doropygus* species. Body length 3.29 mm. Second and third pedigerous somites each with well developed dorsal tergite. Brood pouch sub-globular and incorporating fifth pedigerous somite. Free urosome (Fig. 49B) 5-segmented: genital somite and 4 abdominal somites 200 $\times$ 406, 224 $\times$ 352, 230 $\times$ 321, 188 $\times$ 267, and 170 $\times$ 261  $\mu\text{m}$ , respectively. Anal somite gradually narrowing posteriorly. Caudal rami divergent and slender; each ramus (Fig. 49C) gradually narrowing distally, about 5.4 times longer than wide (295 $\times$ 55  $\mu\text{m}$ ); armed with 6 setae, all setae naked and much shorter than ramus; outer lateral seta (seta II) located at 28% of ramus length; subdistal seta (seta VII) located at 83% of ramus length.

Rostrum (Fig. 49D) evenly tapering, about 1.4 times longer than wide (164 $\times$ 115  $\mu\text{m}$ ), well defined basally, and with pointed apex. Antennule (Fig. 49E) distinctly narrowing distally and 10-segmented; proximal 2 segments much broader than distal segments; armature formula 3, 16, 6, 4+aesthetasc, 1, 3, 2+aesthetasc, 1, 2+aesthetasc, and 7+aesthetasc; 2 setae on first segment and 4 setae on second segment pinnate and much larger than other setae (as figured). Antenna (Fig. 49F) 3-segmented; coxa short and unarmed; allobasis with 2 equally long, weakly pinnate setae (both setae as long as free endopodal segment) representing exopod and 1 small seta on inner margin derived from incorporated first endopodal segment; free endopod 1-segmented, about 4.4 times as long as wide (61 $\times$ 14  $\mu\text{m}$ ); armed with terminal claw plus 11 small setae (arranged as 1, 1, 3, 1, 2, and 3), all setae attenuated at tip, terminal claw about twice as long as segment.

Labrum (Fig. 49G) with setulose posterior margin and broad posteromedian lobe ornamented with setules and spinules. Mandible (Fig. 49H) with 5 teeth and 2 small setae on coxal gnathobase, proximal tooth minutely bifurcate; basis with 1 seta on medial margin; exopod 2-segmented with 2 and 3 setae on first and second segments, respectively, all 5 setae about equal in length;



**FIGURE 49.** *Paranotodelphys molgulae* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath. Scale bars: A, 0.5 mm; B, 0.2 mm; C, E, H, 0.1 mm; D, G, I, 0.05 mm; F, 0.02 mm.



**FIGURE 50.** *Paranotodelphys molgulae* sp. nov., female. A, maxillule; B, distal seta of coxal epipodite of maxillule; C, maxilla; D, maxilliped; E, leg 1; F, leg 2; G, leg 4. Scale bars: A, C, D, 0.05 mm; B, 0.01 mm; E–G, 0.1 mm; H, 0.02 mm.

endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 49I) with dense setules on medial surface, lacking denticle or lobe. Maxillule (Fig. 50A) with 9 setae on arthrite; coxa indistinctly defined, with 1 seta on endite and 2 unequal setae on epipodite, smaller distal seta (Fig. 50B) characteristically constricted in middle; basis with 3 setae (2 small proximal and 1 long distal) on medial margin; exopod with 4 setae distally; endopod indistinctly 2-segmented with 2 setae medially on first segment and 4 setae on second segment. Maxilla (Fig. 50C) 5-segmented; syncoxa with 4 (including minute seta), 1, 2, and 3 setae on first to fourth endites, respectively; basis with claw bearing spinules along concave margin, plus 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 50D) incompletely 3-segmented with 9, 0, and 2 setae on first to third segments, respectively; 2 distal segments small; second segment ornamented with dense setules on all surfaces.

Legs 1–4 with 3-segmented rami (Fig. 50E–G). Inner seta on coxa of all swimming legs pinnate and distinct. Outer seta on basis of all legs small and naked. Inner distal spine on basis of leg 1 finely spinulose, 75 µm long, as long as first endopodal segment. Exopod of legs 2–4 bearing setiform elements (not spines) on outer margin. Inner seta on first exopodal segment of leg 4 small. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 2, 4	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 2, 4	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 49H) represented by 2 lobes (small outer and larger inner), each tipped with 1 naked seta.

**Male.** Unknown.

**Remarks.** Three species of *Paranotodelphys* are known to have an allobasis plus a 1-segmented free endopod in the antenna as in the new species (*P. furcifera*, *P. saccata*, and *P. polycarpae* sp. nov.). However, these three congeners can be readily differentiated from the new species because all have 3 setae on the third maxillipedal segment in contrast to only 2 in the new species. All described species of *Paranotodelphys* have 2 or 3, and 7 to 9 setae on the first and second endopodal segments of the mandible, respectively, except *P. longicaudata* in which the setation of the mandibular endopod is unknown. Therefore, the possession of 4 and 10 setae, respectively, on these segments in the new species is a unique armature configuration within *Paranotodelphys*. As an additional diagnostic feature, the new species has setiform elements rather than spines, on the outer margin of the exopod of legs 2–4.

## Genus *Notodelphyopsis* Schellenberg, 1922

**Diagnosis.** Female body with internal brood pouch extending from anterior margin of fourth pedigerous somite backwards and incorporating fused fifth pedigerous somite. Free urosome 4-segmented in female consisting of genital double-somite and 3 free abdominal somites. Urosome 6-segmented in male. Rostrum well-developed, variable in form. Female antennule typically elongate and comprising 7 or 8 expressed segments, but with maximum of 10 segments (Fig. 30); segmental fusion pattern for 7-segmented antennule: I-II, III-XI, XII-XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV-XXVIII. Male antennule typically 9- or 10-segmented; non-geniculate; segmental fusion pattern of 10-segmented antennule I-II, III-XI, XII, XIII, XIV, XV-XVI, XVII, XVIII-XX, XXI-XXIII, XXIV-XXVIII. Antenna typically consisting of coxa, basis, first endopodal segment with or without inner seta, and compound distal segment (representing fused second and third ancestral segments) bearing terminal claw; some species with allobasis (comprising basis plus first endopodal segment fused); exopod represented by 2 setae.

Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and 2-segmented endopod typically with 2 and 8 (rarely 10) setae on first and second segments, respectively. Maxillule with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 or 4 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented or unsegmented, armed with total of 5 or 6 setae. Maxilla 5-segmented with 9 setae on syncoxa (enditic formula 3, 1, 2, 3); basis with 3 setae (including 1 claw-like element); 3-segmented endopod with setal formula 1 1, 3. Maxilliped 3-segmented; first segment typically armed with 9 setae; second segment unarmed and typically with bulbous swelling distally; third segment with 2 or 3 setae. Legs 1–4 biramous with 3-segmented rami; armature formula typically:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-0/1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-0/1	1-0	I-0/1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-0/1	1-0	I-0/1; I-1; II/III, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 consisting of 2 papillae each bearing single setal element; inner, exopodal papilla rarely expressed as small free segment.

**Typespecies.** *Notodelphyopsis falcifera* Schellenberg, 1922, by original monotypy.

**Remarks.** The original diagnosis of *Notodelphyopsis* was remarkably brief: “antennule 8-segmented, long and slender, proximal segments not swollen. Limbs short. Other characters like *Paranotodelphys*.” Currently these two genera are distinguished from each other by the segmentation of the free urosome which is 5-segmented in female *Paranotodelphys* and 4-segmented

in *Notodelphyopsis*. The genus *Notodelphyopsis* currently comprises the type species, plus *N. perplexa* Illg, 1958 and two species originally described as species of *Paranotodelphys* and here transferred to *Notodelphyopsis* as *N. illgi* (Marchenkov & Boxshall, 2003) **comb. nov.** and *N. unguifer* (Kim & Moon, 2010) **comb. nov.** (see above).

***Notodelphyopsis falcifera* Schellenberg, 1922**

(Figs. 51, 52)

**Material examined.** 1 ♀ (dissected and figured) from *Ascidia depressiuscula* Heller, 1878, Gulf of Manaar India.

**Supplementary description of female.** Body (Fig. 51A, B) narrow, dorsoventrally depressed and arched ventrally. Body length 2.43 mm. Cephalosome with angular posterolateral corners and concave posterior margin; wider than first 3 pedigerous somites. First to third pedigerous somites broader posteriorly. Brood pouch elongated oval, 930×590 µm, longer than preceding part of prosome, and widest in middle; fifth pedigerous somite completely fused with brood pouch. Free urosome (Fig. 51C) consisting of genital double-somite and 3-segmented abdomen: genital double-somite 114×175 µm; free abdominal somites 80×134, 91×127, and 80×118 µm, respectively. Caudal ramus (Fig. 51C) elongate, about 12 times longer than wide (500×41 µm), gradually narrowing distally; armed with 6 small setae, all setae shorter than width of ramus; proximal outer lateral seta located at 30% of ramus length.

Rostrum (Fig. 51D) clearly defined from cephalosome, spatulate, broadened in distal third, 78×86 µm. Antennule long and slender, 7-segmented, reaching to posterior margin of third pedigerous somite when extended; seventh segment subdivided distally by indistinct suture line; armature formula 3, 17, 6, 4, 4, 2, and 11+aesthetasc; all setae small and naked. Antenna (Fig. 51F) 3-segmented: coxa short and unarmed; allobasis slightly inflated in middle with 2 unequal, pinnate setae representing exopod on outer margin; longer seta as long as free endopodal segment, shorter seta about half as long; free endopodal segment slightly shorter and narrower than basis, 82×19 µm, armed with 8 setae plus terminal claw more than half length of segment.

Labrum hirsute distally, with straight posterior margin and small posteromedian lobe. Mandible (Fig. 51G) with 5 teeth and 2 small setae on coxal gnathobase, 2 small spinules on distal margin near base of distalmost tooth; basis with 1 seta on medial margin and scattered setules on ventral surface; exopod unsegmented with 5 setae, distal 2 setae distinctly larger (about twice length of other 3); endopod with 2 and 8 setae on first and second segments, respectively. Paragnath (Fig. 52A) as small lobe bearing rounded protuberance at outer distal corner

and dense setules on medial surface. Maxillule (Fig. 51H) with 9 setae on arthrite, 1 on coxal endite, 2 on coxal epipodite, and 1 small proximal and 2 longer distal setae on medial margin of basis; exopod with 4 setae distally; endopod 2-segmented with 2 setae on first segment and 3 setae on second. Maxilla (Fig. 52B) 5-segmented; with 9 enditic setae on syncoxa (arranged as 3, 1, 2, 3), 3 on basis, and 1, 1, and 3 on first to third endopodal segments. Maxilliped (Fig. 51I) 3-segmented, armed with 9, 0, and 2 setae on first to third segments, respectively; articulation incomplete between second and third segments.

Legs 1–4 with 3-segmented rami. All legs lacking inner seta on first exopodal segment. Inner coxal seta large in leg 1 (Fig. 52C), absent in leg 2 (Fig. 52D), and small in legs 3 and 4 (Fig. 52E). Outer seta on basis large and pinnate in leg 1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 longer than first endopodal segment, 65 µm long. Exopod of leg 1 strongly curved, first segment broadened distally. Outer spines on first and second exopodal segments of legs 2–4 strong, curved outwards, claw-like. Inner setae on exopods and endopods of legs 2–4 short and naked. Third exopodal segment of leg 4 characteristically armed with 4 spines and 5 setae as in legs 2 and 3. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-0; I-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-0; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-0; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-0; I-1; III, I, 5	0-1; 0-2; 1, 2, 2

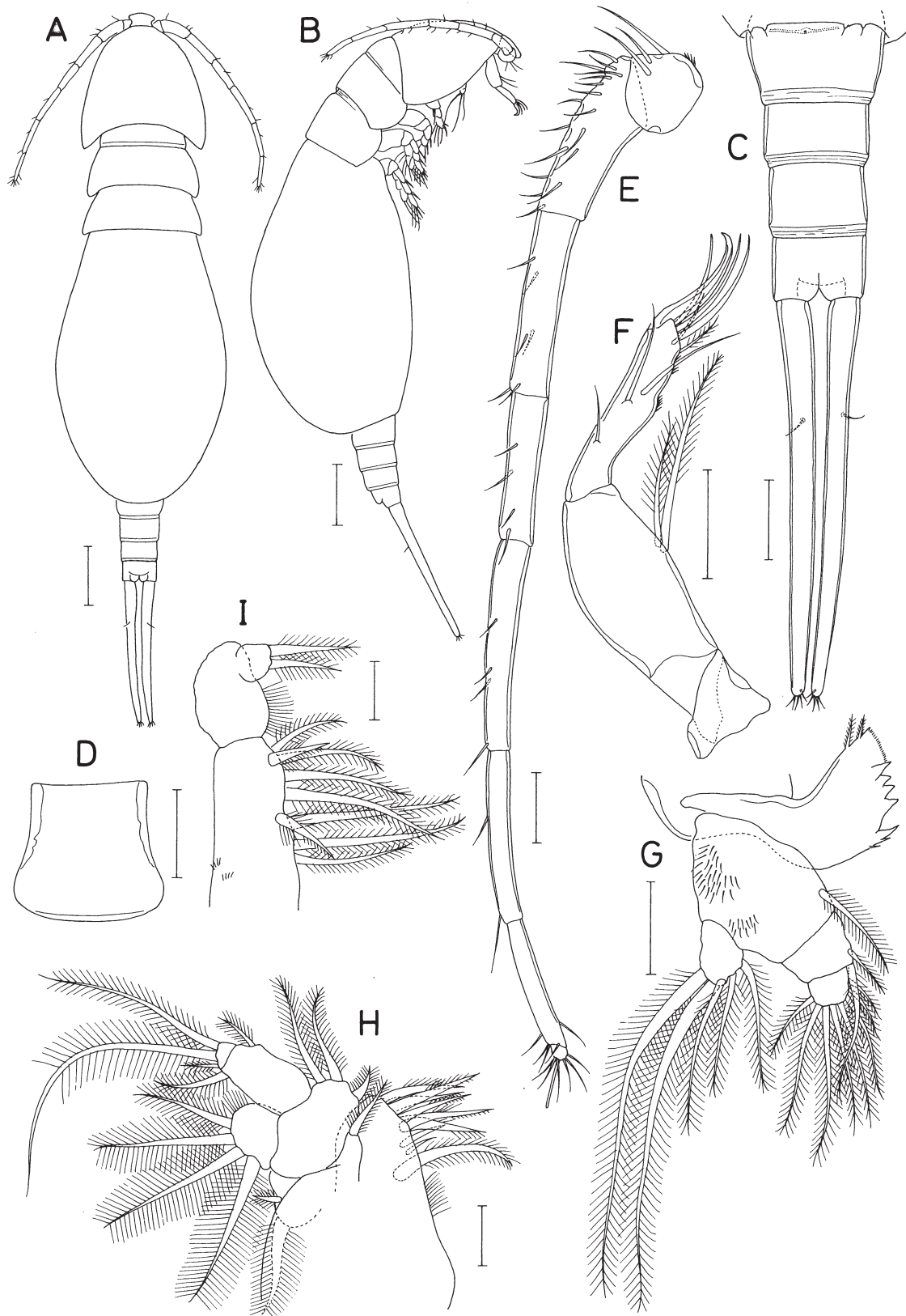
Leg 5 (Fig. 52F) represented by 2 small papillae, each tipped with 1 small seta.

**Male.** Not found.

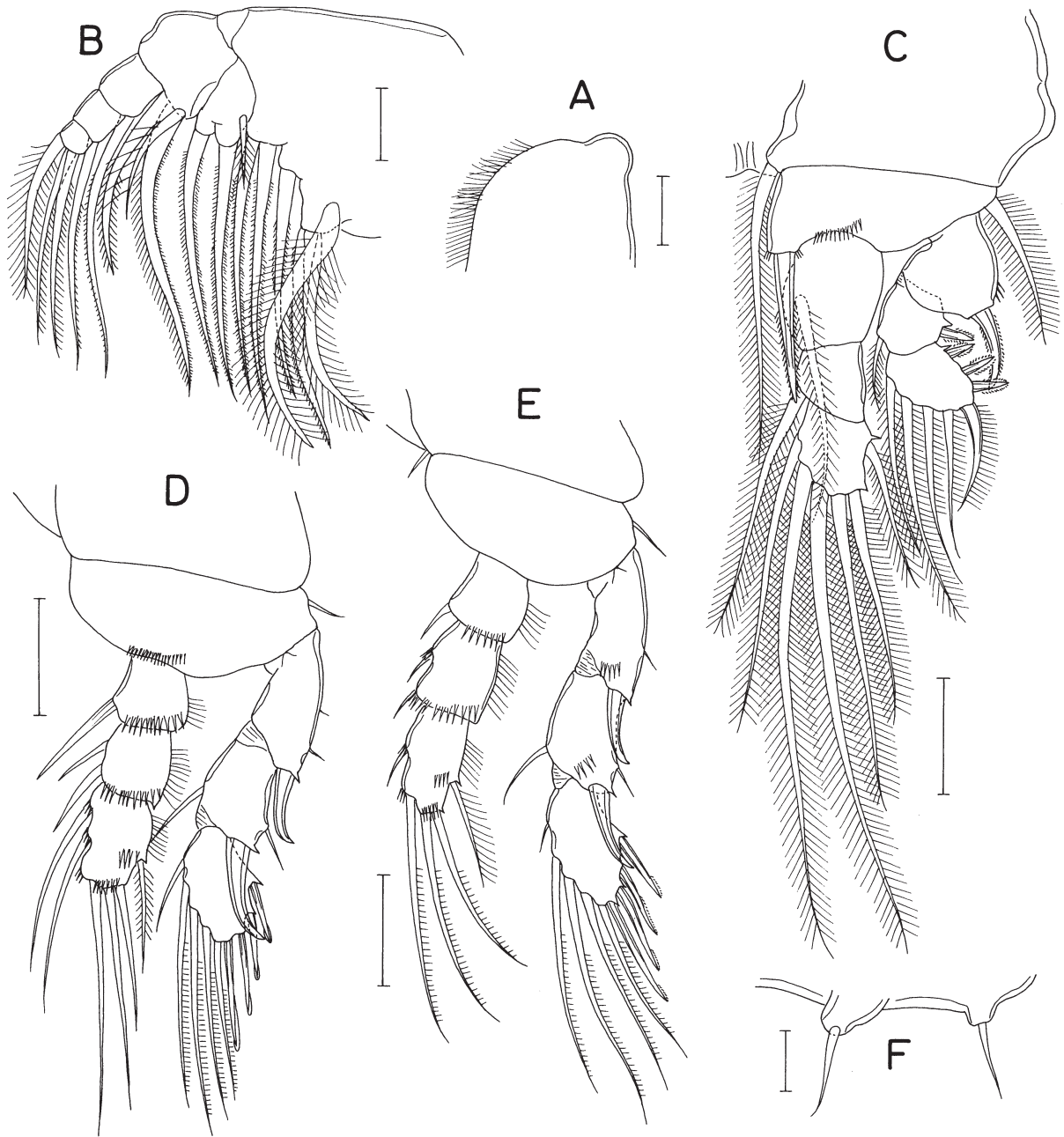
**Remarks.** The presence of nine setal elements (III, I, 5) on the third exopodal segment of leg 4 is very unusual for notodelphyids. Even the two new basal genera *Bathynotodelphys* **gen. nov.** and *Pronotodelphys* **gen. nov.** erected in the present account (above) possess a maximum of eight elements (II, I, 5) on this segment, and this maximum is shared with *Notodelphys* and *Paranotodelphys*. The absence of an inner coxal seta on leg 2 only is also extremely unusual in copepods. When setae are lost along a leg series, the loss tends to follow an anterior to posterior, or a posterior to anterior sequence. The absence of this seta in leg 2 while it is present in legs 1, 3 and 4 requires confirmation.

The known hosts of this Indo-Pacific species include the type host, *Ascidia gemmata* Sluiter, 1895 in Australia (Schellenberg, 1922), *A. zara* Oka, 1935 and *Ciona intestinalis* in Japan (Ooishi, 1962), and *Phallusia nigra* Savigny, 1816 in Korea (Kim, 2012). Here we add *Ascidia depressiuscula* from India as a new host record.





**FIGURE 51.** *Notodelphyopsis falcifera* Schellenberg, 1922, female. A, habitus, dorsal; B, habitus, right; C, urosome, ventral; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule; I maxilliped. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D–G, 0.05 mm; H, I, 0.02 mm.



**FIGURE 52.** *Notodelphyopsis falcifera* Schellenberg, 1922, female. A, paragnath; B, maxilla; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, 0.02 mm; C–E, 0.05 mm; F, 0.01 mm.

***Notodelphyopsis longicaudata* sp. nov.**

(Figs. 53, 54)

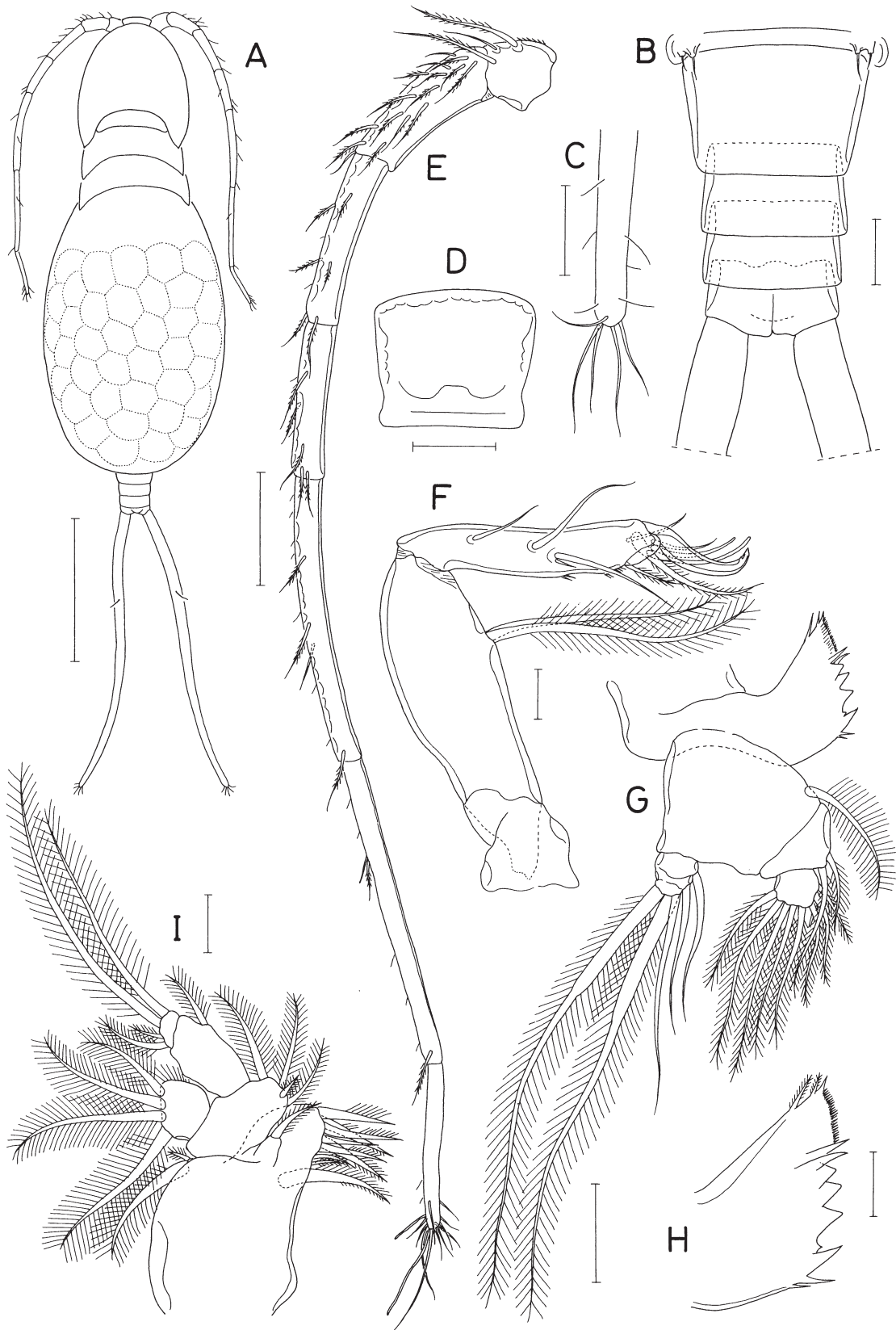
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21231) and dissected paratype (♀, figured) from *Ascidia archaia* Sluiter, 1890, Île Nou, New Caledonia, 1985.

**Additional material.** 1 ♀ (MNHN-IU-2018-1778) from *A. archaia*, Île Nou New Caledonia, Stn NC13.

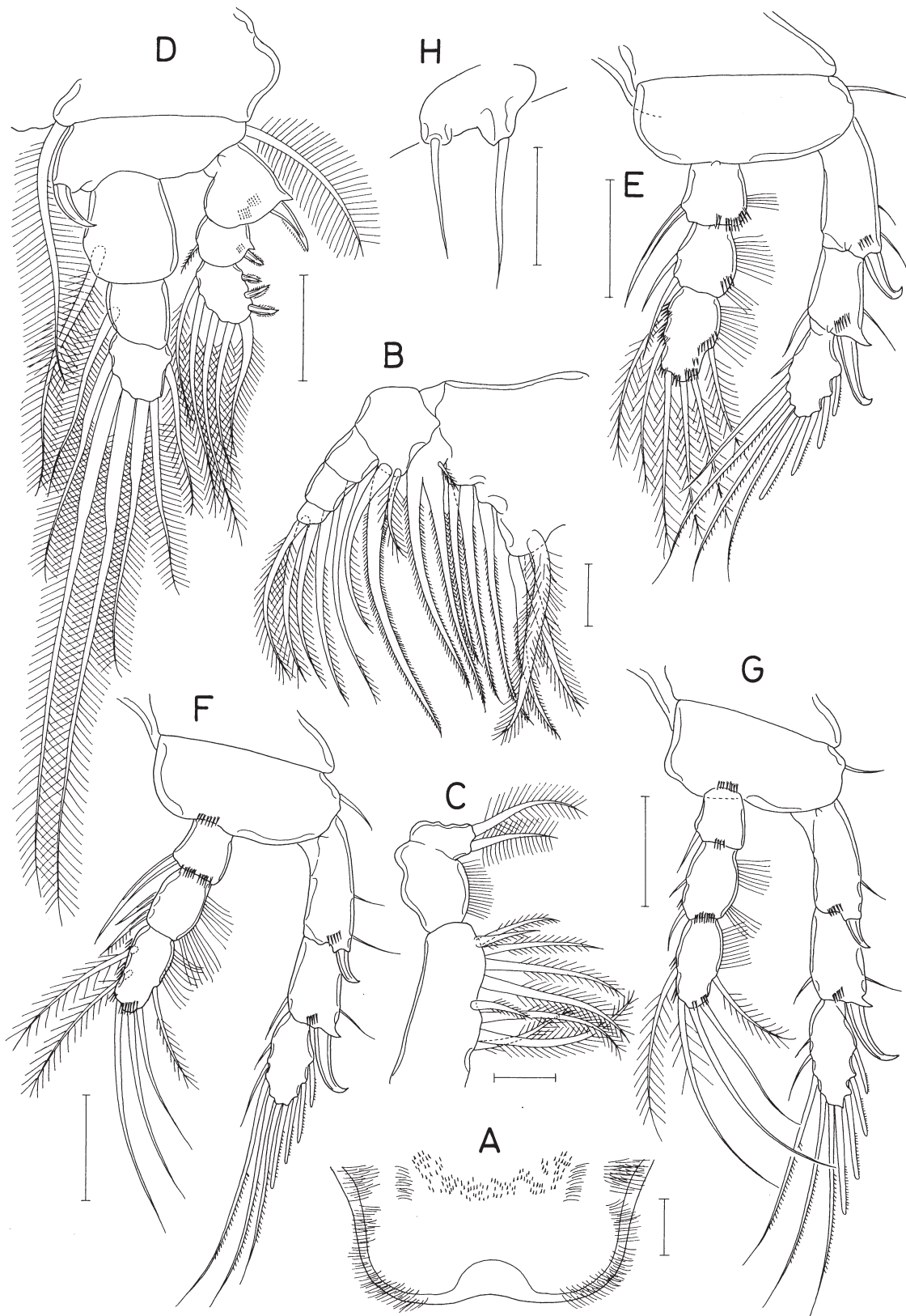
**Etymology.** The name refers to the extremely long caudal rami of the new species.

**Description of female.** Body (Fig. 53A) depressed,

similar to that of *Notodelphyopsis falcifera* in external appearance, but caudal rami and antennules much longer. Body length 2.77 mm, including elongate caudal rami. Posterolateral corners of cephalosome and of second and third pedigerous somites extended posteriorly, thus creating concave posterior margins. First pedigerous somite much narrower than other prosomites, lacking epimera. Brood pouch oval, 985×646 µm, longer than anterior part of prosome; incorporating fused fifth pedigerous somite. Free urosome (Fig. 53B) small, consisting of genital double-somite and 3-segmented abdomen; genital double-somite gradually narrowing posteriorly, 102×144 µm; first and



**FIGURE 53.** *Notodelphyopsis longicaudata* sp. nov., female. A, habitus, dorsal; B, urosome, ventral; C, distal part of caudal ramus; D, rostrum; E, antennule; F, antenna; G, mandible; H, coxal gnathobase of mandible; I, maxillule. Scale bars: A, 0.5 mm; B–D, G, 0.05 mm; E, 0.1 mm; F, H, I, 0.02 mm.



**FIGURE 54.** *Notodelphyopsis longicaudata* sp. nov., female. A, labrum; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4; H, leg 5. Scale bars: A–C, H, 0.02 mm; D–G, 0.05 mm.

second free abdominal somites equal in length, each wider than long. Anal somite shorter than preceding abdominal somites. Caudal ramus (Fig. 53A, C) extremely long, flexible, about 23 times longer than wide (1000×44 µm); armed with 6 small setae, 5 distally (Fig. 53C) and lateral seta positioned at 30% of ramus length; lateral margins parallel.

Rostrum (Fig. 53D) subrectangular, wider than long, 83×100 µm, slightly broadening distally, with weak constriction posteriorly. Antennule 7-segmented (Fig. 53E), extremely elongate and narrow, 1120 µm long, extending to middle of brood pouch; armature formula 3, 16, 6, 5, 4, 2+aesthetasc, and 11+2 aesthetascs; setae small, usually weakly pinnate; segments with minute setules on anterior margin. Antenna (Fig. 53F) consisting of coxa, allobasis and free 1-segmented endopod; short coxa unarmed; allobasis with 2 equally large, pinnate setae on outer margin representing exopod; free endopodal segment about 5 times as long as wide, armed with 10 setae plus terminal claw half as long as segment.

Labrum (Fig. 54A) broad with slightly concave posterior margin, ornamented with dense setules along lateral borders and minute spinules proximally on ventral surface. Mandible (Fig. 53G) consisting of coxa and biramous palp: coxal gnathobase (Fig. 53H) with 4 major teeth, 2 spiniform teeth on cutting margin, 2 small setae on distal proximal margin, 2 spinule-like processes on distal margin near distalmost tooth: palp consisting of basis, exopod and endopod; basis with 1 seta on medial margin; exopod indistinctly 3-segmented and armed with 1, 1, and 3 setae on first to third segments, respectively, proximal 3 setae naked 2 distal setae pinnate, expanded along proximal third, and more than twice as long as proximal 3 smaller setae: endopod 2-segmented, bearing 2 and 8 setae on first and second segments, respectively. Maxillule (Fig. 53I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 4 on medial margin of basis, second proximal seta much smaller than other 3; exopod with 4 setae distally; endopod 2-segmented with 1 seta on medial margin of first segment and 4 setae (2 large distal setae and 2 much smaller outer setae) on second segment. Maxilla (Fig. 54B) 5-segmented with 9 setae on syncoxa (3, 1, 2, and 3 on first to fourth endites, respectively), 3 on basis (1 large and 2 smaller), and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 54C) 3-segmented and armed with 9, 0, and 2 setae on first to third segments, respectively; articulation incomplete between second and third segments.

Legs 1–4 (Fig. 54D–G) with 3-segmented rami: all legs lacking inner seta on first exopodal segment. Inner seta on coxa large in leg 1, absent in legs 2–4. Outer seta on basis large and pinnate in leg 1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 curved, claw-like, about half as long as first endopodal segment. First exopodal segment of leg 1 expanded. Two inner subdistal setae on third endopodal segment of leg 1 enlarged and

broadened proximally. Inner seta on first endopodal segment of legs 2 and 3 strong, spiniform. Outer spine on first and second exopodal segments of leg 2–4 strong, curved, and claw-like. Outer margin of first and second exopodal segments of legs 2–4 ornamented with setules: 2 (1 in leg 4) on first and 1 on second segments. Spines on third exopodal segment of legs 2–4 setiform, blunt at tip. Third exopodal segment of leg 4 armed with 4 spines and 5 setae as in *N. falcifera*. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-0; I-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-0	1-0	I-0; I-1; III, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	I-0; I-1; III, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 54H) represented by 2 papillae fused to each other at base, each tipped with 1 naked seta.

**Male.** Unknown.

**Remarks.** *Notodelphyopsis longicaudata* **sp. nov.** is very similar to the type species, *N. falcifera*. They share many of the detailed morphological features of the mouthparts and legs 1–4, including the III, I, 5 setation formula for the third exopodal segment of leg 4. The significant differences between these two species are: (1) the antennule of *N. longicaudata* **sp. nov.** is longer than in *N. falcifera*, extending to the middle of the brood pouch (vs. extending only to the posterior margin of the third pedigerous somite in *N. falcifera*); (2) the caudal ramus of *N. longicaudata* **sp. nov.** is relatively longer than that of *N. falcifera*, 1000×44 µm, more than 20 times longer than wide (vs. 500×41 µm, about 12 times longer than wide in *N. falcifera*); (3) the exopodal setae of the antenna are subequal in *N. longicaudata* **sp. nov.** but markedly unequal in *N. falcifera*; and (4) the inner distal spine on the basis of leg 1 of *N. longicaudata* **sp. nov.** is short (about half as long as the first endopodal segment), but longer than the first endopodal segment in *N. falcifera*. The differences are sufficient to justify the establishment of this remarkable new species.

***Notodelphyopsis gemina* sp. nov.**

(Figs. 55–57)

**Type material.** Holotype (intact ♀, MNHN-IU-2009-5191), paratypes (19 intact ♀♀, MNHN-IU-2014-21232), and dissected paratypes (1 ♀, 1 ♂, figured), from *Corella antarctica* Sluiter, 1905, Antarctic Ocean (61°26'S, 41°55.4'W), depth 604 m, Eltanin cruise 12, 12 April 1964.

**Etymology.** The specific name is derived from the Latin *gemin* (=twin), alluding to the close similarity of the new species to *Notodelphyopsis illgi*.

**Description of female.** Body (Fig. 55A) slender, 1.87 mm long. Cephalosome well-defined, but

articulations between pedigerous somites indistinct: first to third pedigerous somites lacking epimera. Brood pouch variable in form; fifth pedigerous somite completely fused to brood pouch. Free urosome (Fig. 55B) slender, 4-segmented. Genital double-somite (Fig. 55C) 210×149 µm, subdivided dorsally and ventrally by faint, indistinct suture line at anterior third and ornamented with several transverse rows of minute spinules on ventral surface. Three free abdominal somites 152×131, 135×108, and 115×108 µm, respectively. Caudal ramus (Fig. 55D) elongate, about 9.3 times as long as wide (325×35 µm) and 2.8 times longer than anal somite, subdivided by constriction at 60% of length; ornamented with dense covering of setules on ventral surface; armed with 6 setae, 4 distal setae pinnate, other 2 naked, outer lateral seta located at 65% of ramus length.

Rostrum (Fig. 55E) 87×70 µm, spatulate, with nearly parallel lateral margins. Antennule (Fig. 55F) slender, elongate, 575 µm long and extending to posterior margin of second pedigerous somite; 9-segmented (Fig. 30), armature formula 3, 17, 6, 4+aesthetasc, 4, 2, 2, 2+aesthetasc, and 7+aesthetasc; several setae on proximal segments weakly pinnate, others naked (as figured). Antenna (Fig. 56A) 4-segmented, consisting of coxa, basis and 2-segmented endopod; coxa short and unarmed; basis with 2 equal, large pinnate setae representing exopod; first endopodal segment with 1 seta on inner margin; compound distal endopodal segment about 4.5 times longer than wide, armed with terminal claw and 11 setae and ornamented with 3 rows of spinules on distal half of outer side; 2 subdistal setae pinnate, others naked; 3 terminal setae blunt at tip; terminal claw small, about one-third as long as segment.

Labrum (Fig. 55G) with deeply concave, setulose posterior margin. Mandible (Fig. 55H) consisting coxa and biramous palp: coxa with 4 teeth and 1 small seta on gnathobase; distalmost tooth acutely pointed: palp consisting of basis, exopod and 2-segmented endopod; basis with 1 seta and setules on medial margin; exopod 3-segmented, armed with 1, 2, and 2 setae on first to third segments, respectively, 2 distal setae much longer than other 3; endopod incompletely articulated from basis, with 2 and 10 setae on first and second segments, respectively, one seta on second segment small and positioned on dorsal surface. Paragnath (Fig. 55I) as lobe bearing semicircular lobule at outer distal corner and setules on medial margin. Maxillule (Fig. 55J) with 9 setae (including 2 small) on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on medial margin of basis (proximal seta much smaller than distal 2); exopod with 4 setae distally; endopod incompletely 2-segmented with 2 setae medially on first segment and 4 long, proximally-pinnate setae on second segment. Maxilla (Fig. 56B) 5-segmented; syncoxa with 3+1 small, 1, 2, and 3 setae on first to fourth endites; basis with claw bearing spinules along concave margin, plus 2 setae; endopod with 1, 1, and 3 setae on first to third segments,

respectively. Maxilliped (Fig. 56C) 3-segmented and armed with 9 (2 spiniform), 0, and 3 setae on first to third segments, respectively; second segment ornamented with setules along medial margin and patch of spinules distally.

Legs 1–4 with 3-segmented rami. Outer seta on basis of all swimming legs naked (Fig. 56D–F). Inner distal spine on basis of leg 1 longer than first endopodal segment, 71 µm long. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

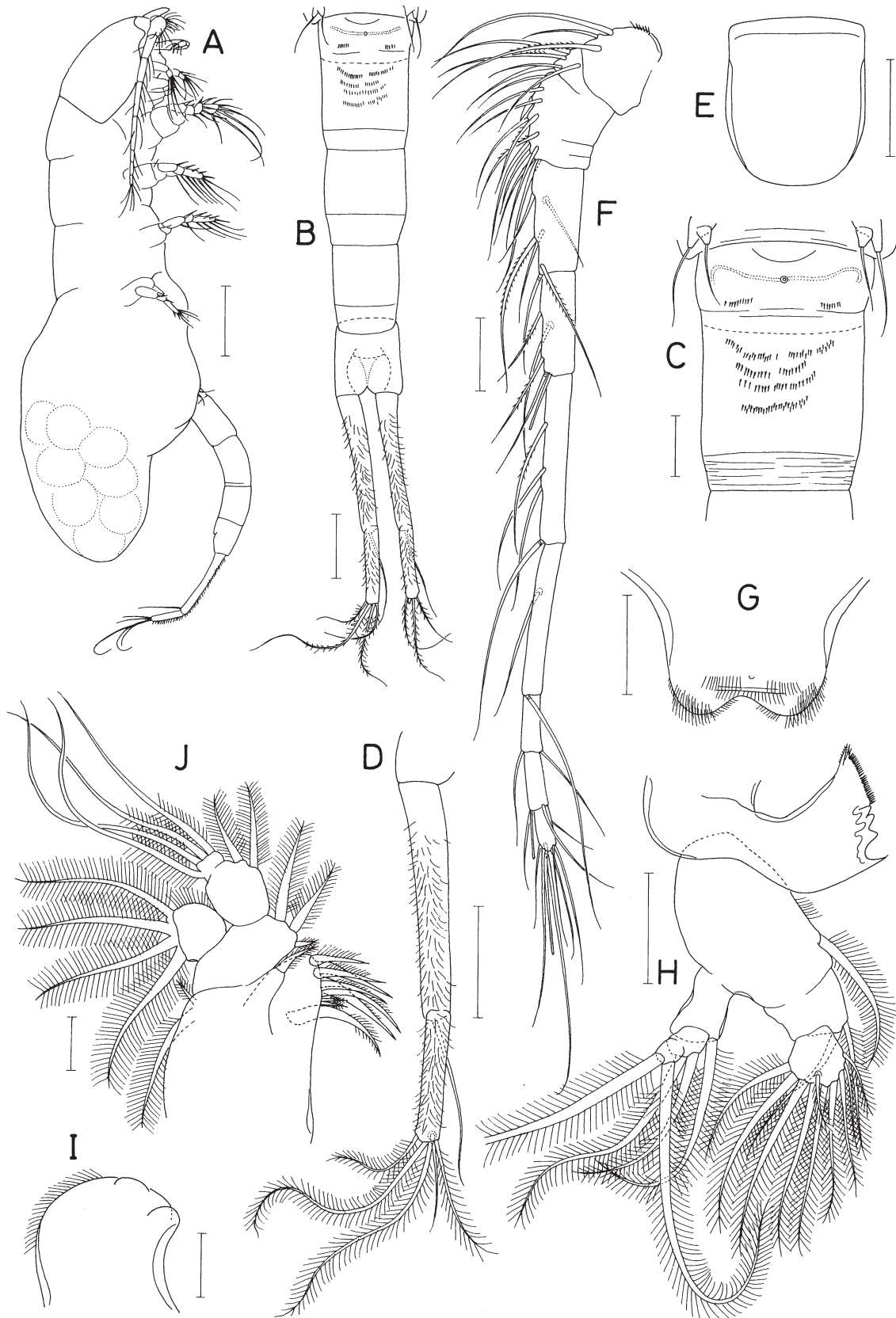
Leg 5 (Fig. 56G) reduced, represented by outer digitiform protopodal process tipped with naked seta and small free exopodal segment also tipped with naked seta.

**Description of male.** Body (Fig. 57A) tapering posteriorly and arched ventrally. Body length 785 µm. Cephalosome with well developed dorsal shield: second to fourth pedigerous somites each with well-developed dorsal tergite. Urosome (Fig. 57B) 6-segmented, with free fifth pedigerous somite, genital somite 62×86 µm, with row of fine spinules on ventral surface of each genital operculum, and 4 free abdominal somites 77×73, 77×73, 69×60, and 51×54 µm, respectively. First abdominal somite ornamented with 3 transverse rows of spinules on ventral surface (Fig. 57B). Caudal ramus about 4.8 times longer than wide (72×15 µm); armed with 6 setae, proximal outer lateral seta positioned at middle of ramus.

Rostrum as in female. Antennule (Fig. 57C) 10-segmented, non geniculate; segmental fusion pattern I-II, III-XI, XII, XIII, XIV, XV-XVI, XVII, XVIII-XX, XXI-XXIII, XXIV-XXVIII: armature formula 3, 17, 2, 2, 2, 4+aesthetasc, 1, 3, 2+aesthetasc, and 11+aesthetasc; second segment incompletely subdivided proximally with traces of 2 suture lines on posterior surface. Antenna as in female.

Labrum, paragnath, maxillule, and maxilla as in female. Mandible with 9 setae (rather than 10 as in female) on second endopodal segment. Maxilliped (Fig. 57D) armed with 7 setae (grouped as 3 and 4) on first segment; second segment with patch of spinules distally as in female. Legs 1–5 as in female.

**Remarks.** Marchenkov & Boxshall (2003) distinguished *Notodelphyopsis illgi* (Marchenkov & Boxshall, 2003) from related species by its slender body shape, elongate antennule, and the extremely elongate caudal rami of the female. *Notodelphyopsis gemina* **sp. nov.** shares these and other features with *N. illgi*. The latter species was recorded from the ascidian *Corynascidia herdmani* Ritter, 1913 living at a depth of 508 m in the North Pacific, whereas *N. gemina* **sp. nov.** was found in the Antarctic. Although the two species were found



**FIGURE 55.** *Notodelphyopsis gemina* sp. nov., female. A, habitus, right; B, urosome, ventral; C, genital double-somite, ventral; D, right caudal ramus, ventral; E, rostrum; F, antennule; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.2 mm; B, D, 0.1 mm; C, E–H, 0.05 mm; I, J, 0.02 mm.

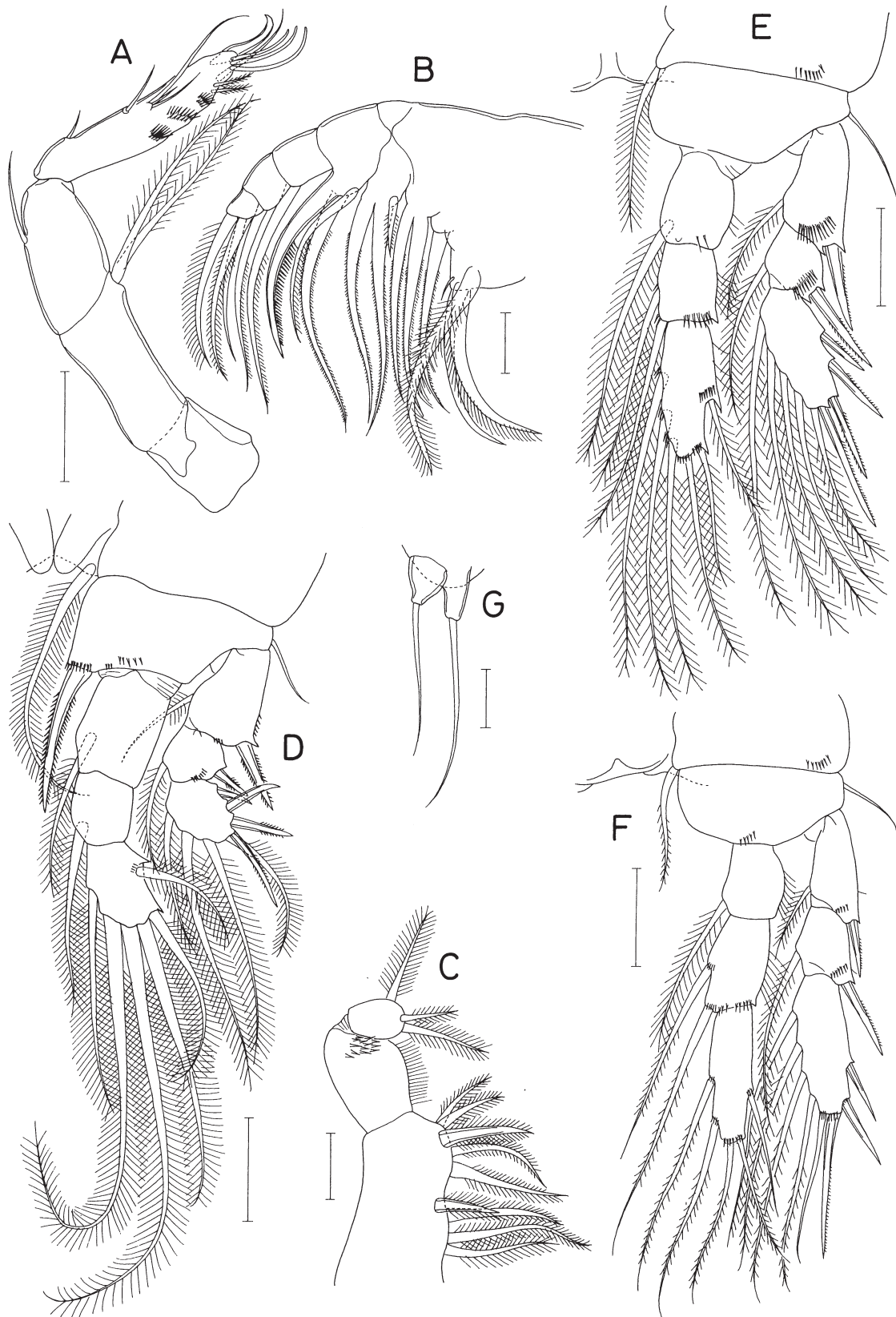
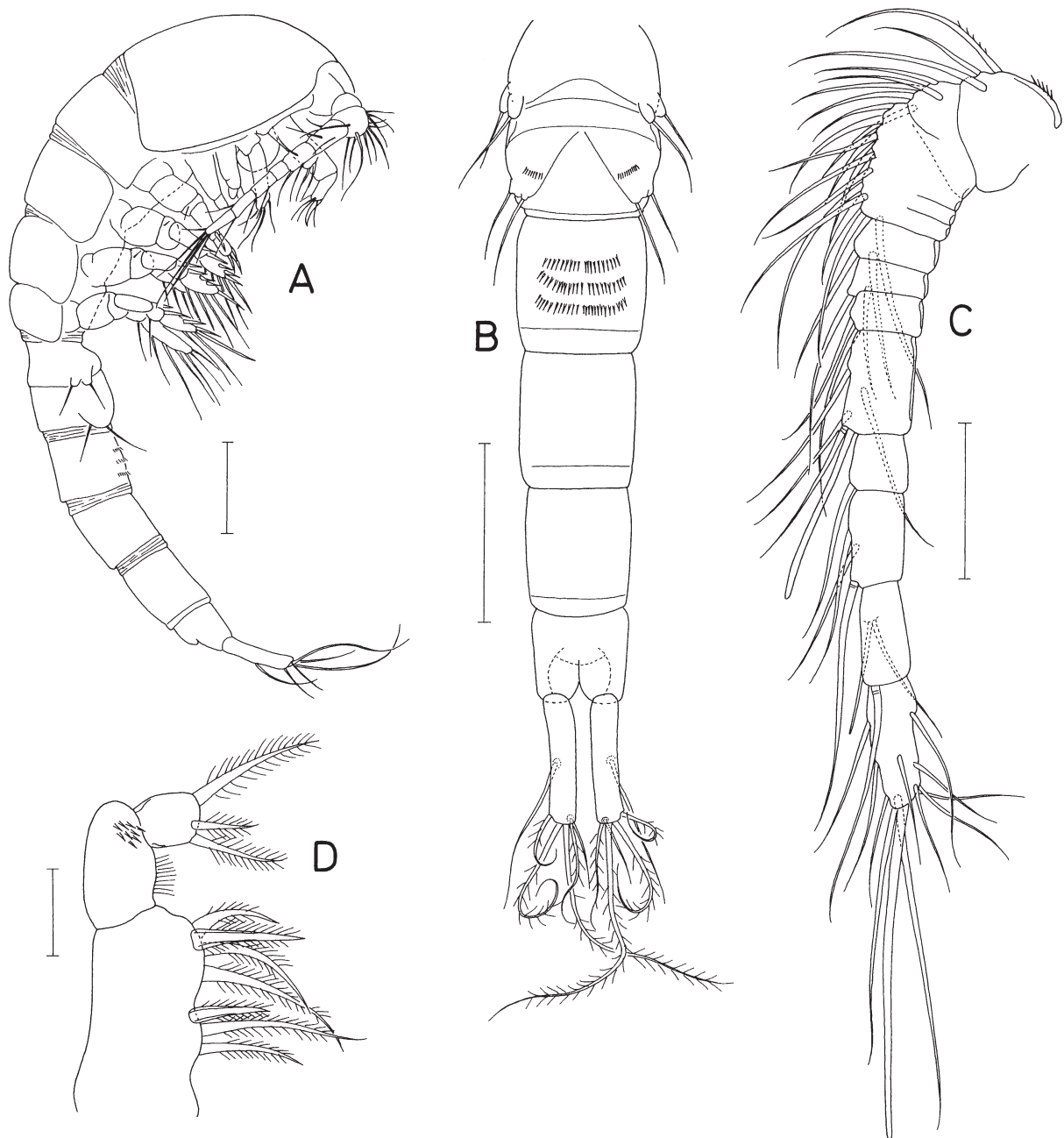


FIGURE 56. *Notodelphyopsis gemina* sp. nov., female. A, antenna; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A, D–F, 0.05 mm; B, C, G, 0.02 mm.





**FIGURE 57.** *Notodelphyopsis gemina* **sp. nov.**, male. A, habitus, right; B, urosome, ventral; C, antennule; D, maxilliped. Scale bars: A, B, 0.1 mm; C, 0.05 mm; D, 0.02 mm.

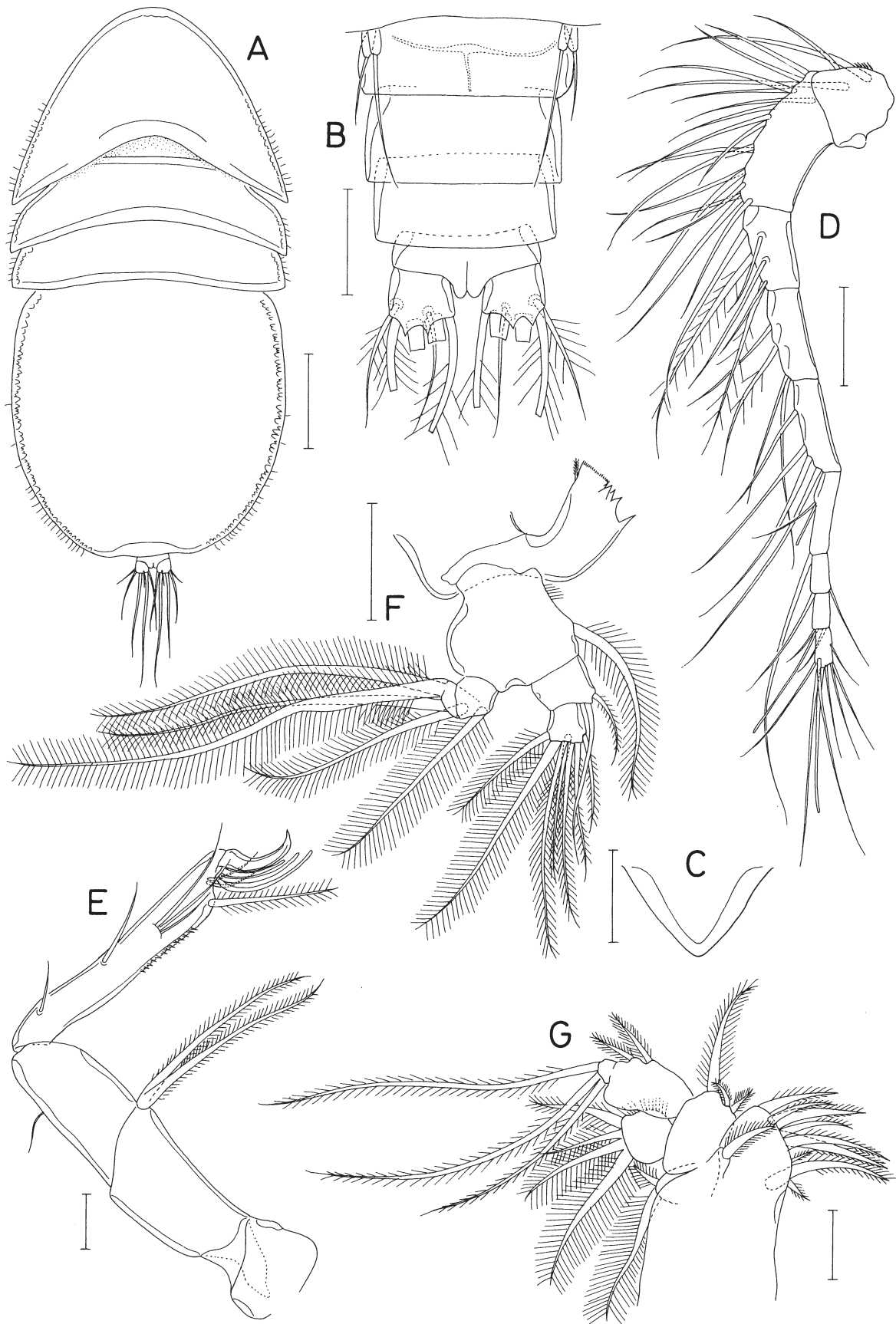
on different hosts and in very different zoogeographic regions, they display very few morphological differences. We note the following differences: (1) the body length of *N. illgi* is 2.37 mm in the female and 1.25 mm in the male, compared to 1.87 mm in the female and 0.79 mm in the male of *N. gemina* **sp. nov.**; (2) the caudal ramus of the female of *N. illgi* is 4.4 times longer than the anal somite, whereas it is only about 2.8 times longer in *N. gemina* **sp. nov.**; and (3) the antennule of the female is 10-segmented in *N. illgi*, but 9-segmented in *N. gemina* **sp. nov.** These

differences are sufficient to justify the establishment of a new species.

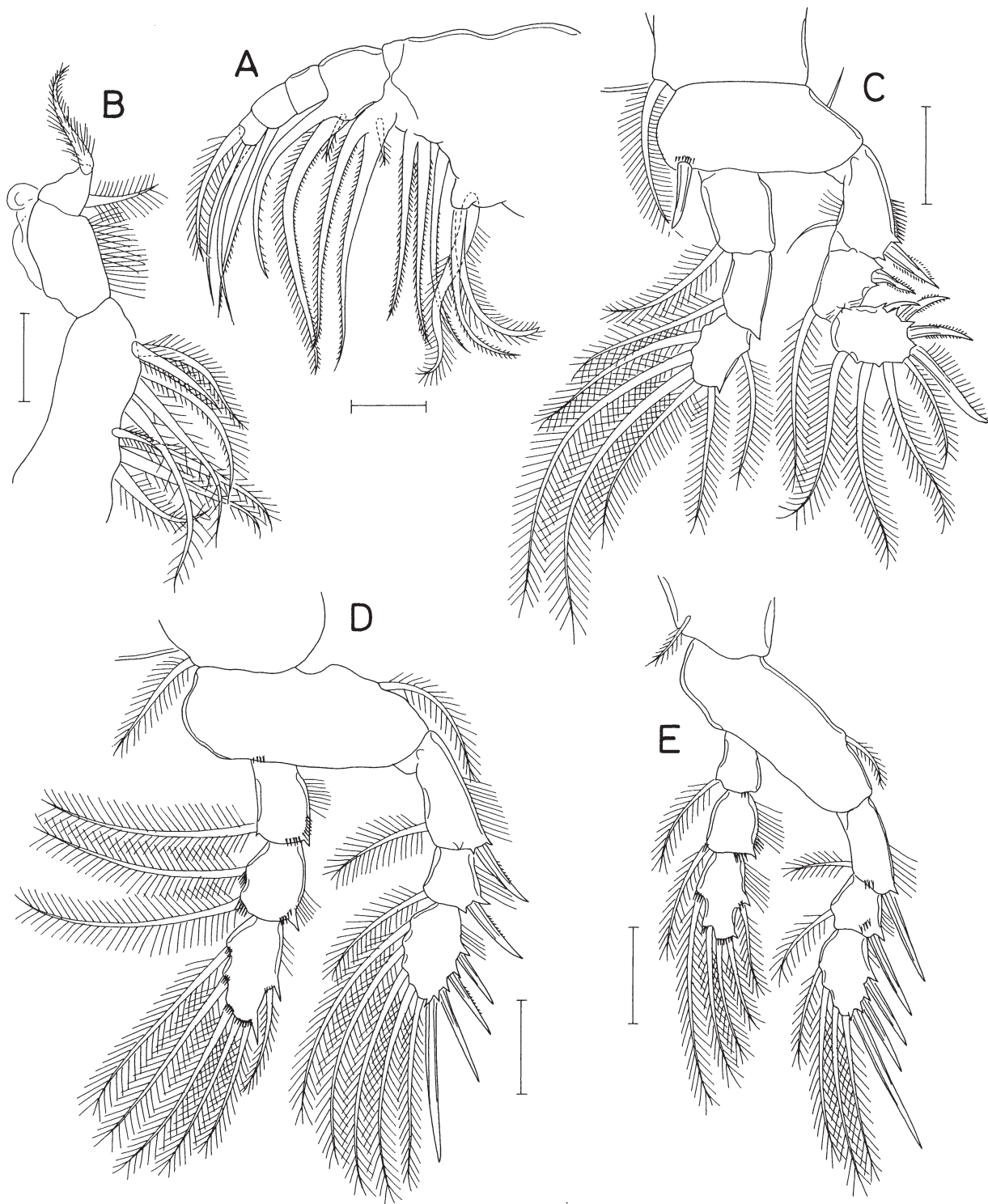
***Notodelphyopsis deplanata* sp. nov.**

(Figs. 58, 59)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21233), from *Ascidia ornata* Monniot F. & Monniot C., 2001 (MNHN-IT-2008-1160 =



**FIGURE 58.** *Notodelphyopsis deplanata* **sp. nov.**, female. A, habitus, dorsal; B, urosome, ventral; C, rostrum; D, antennule; E, antenna; F, mandible; G, maxillule. Scale bars: A, 0.2 mm; B-D, F, 0.05 mm; E, G, 0.02 mm.



**FIGURE 59.** *Notodelphyopsis deplanata* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4. Scale bars: A, B, 0.02 mm; C–E, 0.05 mm.

MNHN P5/ASC.A/299), CRRF CRCHO 148, Caminguin I., Bohol Sea, the Philippines (9°15.38'N, 124°39.12'E), west side of White Island, offshore sand cay, depth 18 m, 19 April 1997.

**Etymology.** The species name is from the Latin

*deplanat* (= flattened), alluding to its flattened body form.

**Description of female.** Body (Fig. 58A) broad, dorsoventrally depressed. Body length 1.21 mm; greatest width 0.59 mm across third pedigerous somite. Prosome

with parallel lateral margins; prosomites well-sclerotized, ornamented with minute setules on dorsal and lateral surfaces. Cephalosome extended posterolaterally, with strongly concave posterodorsal margin and pointed posterolateral corners. First pedigerous somite overlapped by cephalosome, not visible in dorsal view. Second and third pedigerous somites as wide as cephalosome, with well-developed epimera. Brood pouch incorporating fifth pedigerous somite, 580×580 µm, sub-circular, as long as wide and equal in width to second and third pedigerous somites. Free urosome (Fig. 58B) very small, 4-segmented, comprising genital double-somite and 3 free abdominal somites, narrowing distally; each somite much wider than long; anal somite much narrower than second free abdominal somite. Caudal ramus (Fig. 58B) short, as long as wide (31×31 µm); armed with 6 setae, 4 distal and 2 subdistal.

Rostrum (Fig. 58C) small, highly sclerotized, triangular, with angular apex. Antennule (Fig. 58D) slender and shorter than cephalosome; 9-segmented with armature formula 3, 16, 6, 4, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae generally long; 2 setae on third segment and 1 seta on fourth segment pinnate, all other setae naked; aesthetascs thin, each confluent at base with adjacent seta. Antenna (Fig. 58E) consisting of coxa, basis and 2-segmented endopod; coxa short and unarmed; basis with 2 large pinnate setae of equal length at outer distal corner representing exopod; first endopodal segment with 1 thin seta on inner margin; compound distal endopodal segment slender, about 6 times longer than wide, ornamented with row of spinules on outer margin; armed with terminal claw plus 11 setae (arranged as 1, 1, 3, 1, 2, and 3), one of subdistal setae pinnate and 3 distal setae blunt at tip; terminal claw about one-third as long as segment.

Labrum lost. Mandible (Fig. 58F) with 4 pointed teeth and 1 small seta on coxal gnathobase; basis with 1 relatively large seta and few setules on medial margin; exopod 2-segmented and armed with 1 and 4 setae on first and second segments, respectively; distal outer seta broadened proximally and longer than other 4 setae; endopod with 2 (short pinnate and long naked) and 7 pinnate setae on first and second segments, respectively. Maxillule (Fig. 58G) with 9 setae (2 small and 7 larger) on arthrite, 1 on coxal endite, 2 on epipodite, and 3 (2 small proximal and 1 larger distal) on medial margin of basis; exopod with 4 setae distally; endopod indistinctly 2-segmented with 2 small medial margin setae on first segment and 3 long setae on small second segment. Maxilla (Fig. 59A) 5-segmented; armed with 9 setae (arranged as 3, 1, 2, and 3) on syncoxa, 3 on basis, and 0, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 59B) 3-segmented with 9, 0, and 2 setae on first to third segments, respectively; second segment with long setules on medial margin and irregular, membranous fringe on outer margin.

Legs 1–4 with 3-segmented rami (Fig. 59C–E). Inner seta on coxa pinnate but small in legs 3 and 4. Outer seta on basis of leg 1 small and naked, but pinnate in legs 2–4. Inner distal spine on basis of leg 1 smooth, shorter than first endopodal segment. Outer margin of first exopodal segment spinulose in leg 1, but setulose in legs 2–4. Third exopodal segment of leg 1 directed outwards. Proximal spine on third exopodal segment of leg 1 smaller than other spines on same segment. Third exopodal segment of leg 4 with 3 spines and 4 setae (not 5 setae). Second endopodal segment of leg 4 with only 1 seta (not 2 setae). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 4	0-1; 0-1; 1, 2, 2

Leg 5 (Fig. 58B) represented by 2 digitiform processes, each tipped with 1 naked seta; seta on inner (exopodal) process much longer than outer basal seta.

**Male.** Unknown.

**Remarks.** *Notodelphyopsis deplanata* sp. nov. has a broad, dorsoventrally depressed body, and short caudal rami. In addition, it carries 7 setae on the second endopodal segment of the mandible and has reduced setation on the third exopodal and second endopodal segments of leg 4. Within the genus *Notodelphyopsis*, these features are unique to the new species and serve to differentiate it from all congeneric species.

### Genus *Pygodelphys* Illg, 1958

**Diagnosis.** Female body with internal brood pouch extending from anterior margin of fourth pedigerous somite backwards and incorporating fused fifth pedigerous somite. Free urosome 5-segmented in female consisting of genital somite and 4 free abdominal somites, and 6-segmented in male. Rostrum well-developed, variable in form. Female antennule typically 9- or 10-segmented: segmental fusion pattern for 9-segmented antennule I-II, III-XI, XII-XIV, XV-XVI, XVII, XVIII-XX, XXI-XXIII, XXIV, XXV-XXVIII (Fig. 30). Male antennule typically 9- or 10-segmented; non-geniculate; segmental fusion pattern usually as in female. Antenna typically consisting of coxa, basis, first endopodal segment with or without inner seta, and compound distal segment (representing fused second and third ancestral segments) bearing terminal claw; some species with allobasis (comprising basis plus first endopodal segment fused): exopod represented by 2 setae.

Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and typically with 4 and 10 setae on first and second segments, respectively, or reduced to 2 and 8/9.

Maxillule with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented or unsegmented, armed with total of 5 or 6 setae. Maxilla 5-segmented with 10 setae on syncoxa (enditic formula 3/4, 1, 2, 3); basis with claw plus 2 setae; 3-segmented endopod with setal formula 1 1, 3/4. Maxilliped 2-segmented; first segment typically armed with 9 setae; second segment with 2 setae. Legs 1–4 biramous with 3-segmented rami; armature formula typically:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 typically consisting of 2 papillae, each bearing single setal element; exopod expressed as free segment in some species; rarely leg absent.

**Type species:** *Pygodelphys aquilonaris* Illg, 1958 by original designation.

**Remarks.** The key features of the genus, as diagnosed by Illg (1958), are the combination of a 9- to 10-segmented antennule of the female, the 2-segmented maxilliped bearing 9 and 2 setae on proximal and distal segments, respectively, the presence of setiform elements (rather than spines) on outer margins of the posterior swimming legs, and the reduction of the fifth leg to two setiform papillae. Illg (1958) designated his new species *P. aquilonaris* as the type species of *Pygodelphys* and transferred three other species from *Doropygus*, as *P. antarctica* (Schellenberg, 1922), *P. novaeseelandiae* (Schellenberg, 1922) and *P. lamellipes* (Schellenberg, 1922). A fifth species, *P. patriciae* Stock, 1967, was added later by Stock (1967).

***Pygodelphys antarctica* (Schellenberg, 1922)**  
(Figs. 60, 61)

**Material examined.** 53 ♀♀, 40 ♂♂ (MNHN-IU-2018-1779) and dissected 1 ♀, 1 ♂ from *Paramolgula gregaria* (Lesson, 1830), Magellan Strait; 4 ♀♀ (MNHN-IU-2018-1780) and 1 dissected ♀ from *P. gregaria*, Tierra del Fuego, Argentina.

**Supplementary description of female.** Body (Fig. 60A) *Doropygus*-like in form, relatively slim. Body length 5.15 mm. First to third pedigerous somites each with well developed dorsal tergite. Brood pouch of fully grown adults shorter than anterior part of prosome; fifth pedigerous somite incorporated into brood pouch. Free urosome (Fig. 60B) slender, clearly 5-segmented; comprising short genital somite, 160×516 µm and 4 free abdominal somites gradually shorter and narrower towards posterior, 501×480, 436×400, 349×356, and 255×313 µm, respectively. First and second abdominal somites

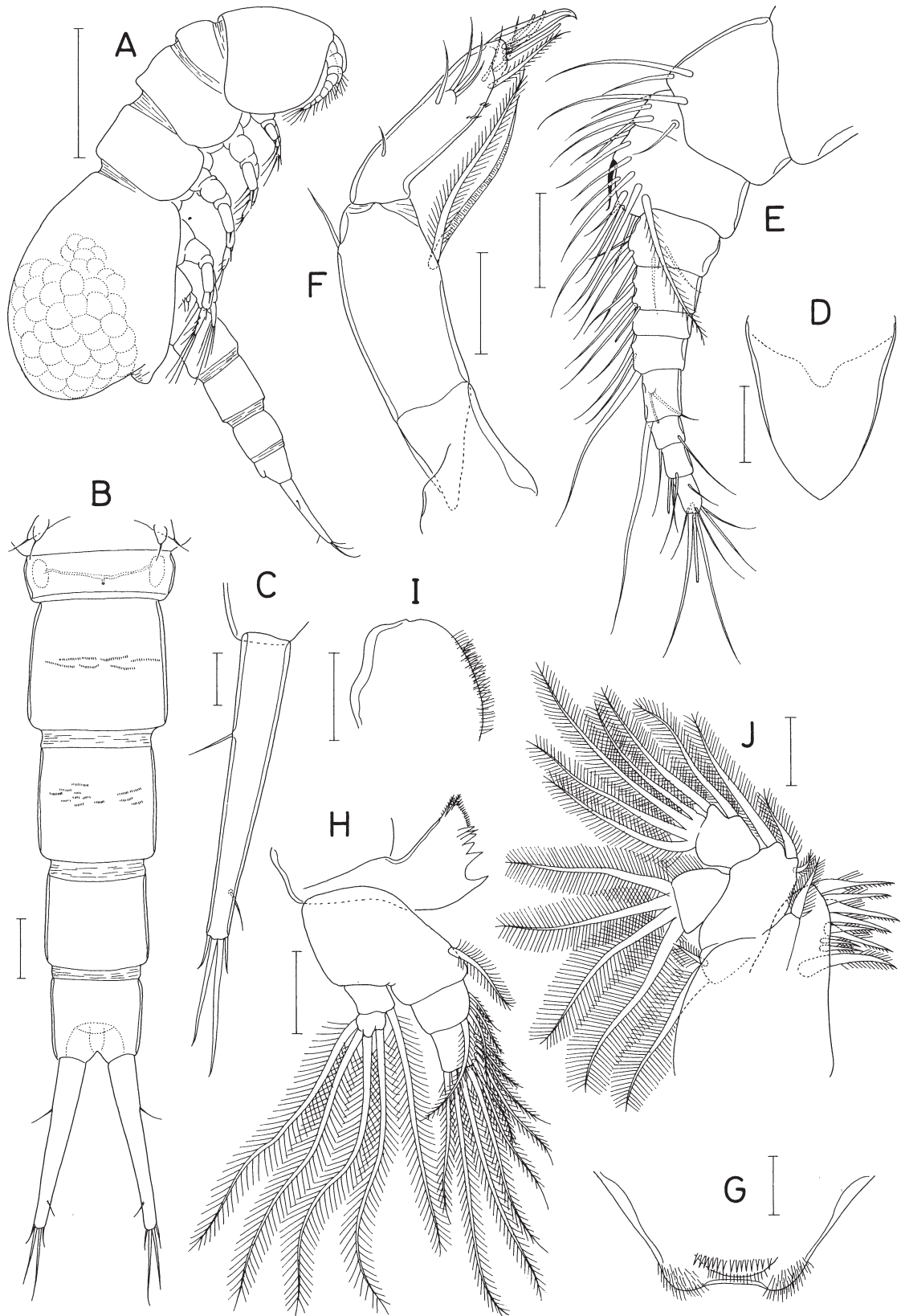
ornamented with scattered rows of minute spinules on ventral surface (Fig. 60B). Caudal ramus (Fig. 60C) slender, about 6.2 times as long as wide (590×95 µm) but variable in length (in other dissected specimen 4.6 times as long as wide, 391×85 µm); armed with 6 setae, distal setae stiff, not flexible, longest seta 263 µm long, 0.45 times as long as ramus; outer lateral seta invariably located at 35% of ramus length.

Rostrum (Fig. 60D) tapering, shield-shaped, longer than wide, with angular apex. Antennule 10-segmented (Fig. 30); first and second segments broadened; armature formula 3, 17, 6, 3+aesthetasc, 1, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; one of distal setae on second segment pinnate, all other setae naked. Antenna (Fig. 60F) 3-segmented, consisting of coxa, allobasis, and 1-segmented free endopod; basis with 2 large setae of subequal length (1 pinnate and 1 naked, wrinkled) subdistally on outer margin representing exopod, and 1 seta (derived from first endopodal segment) on inner margin; free compound endopodal segment about 3.6 times as long as wide, slightly shorter than basis, and armed with 11 setae plus terminal claw, half as long as segment.

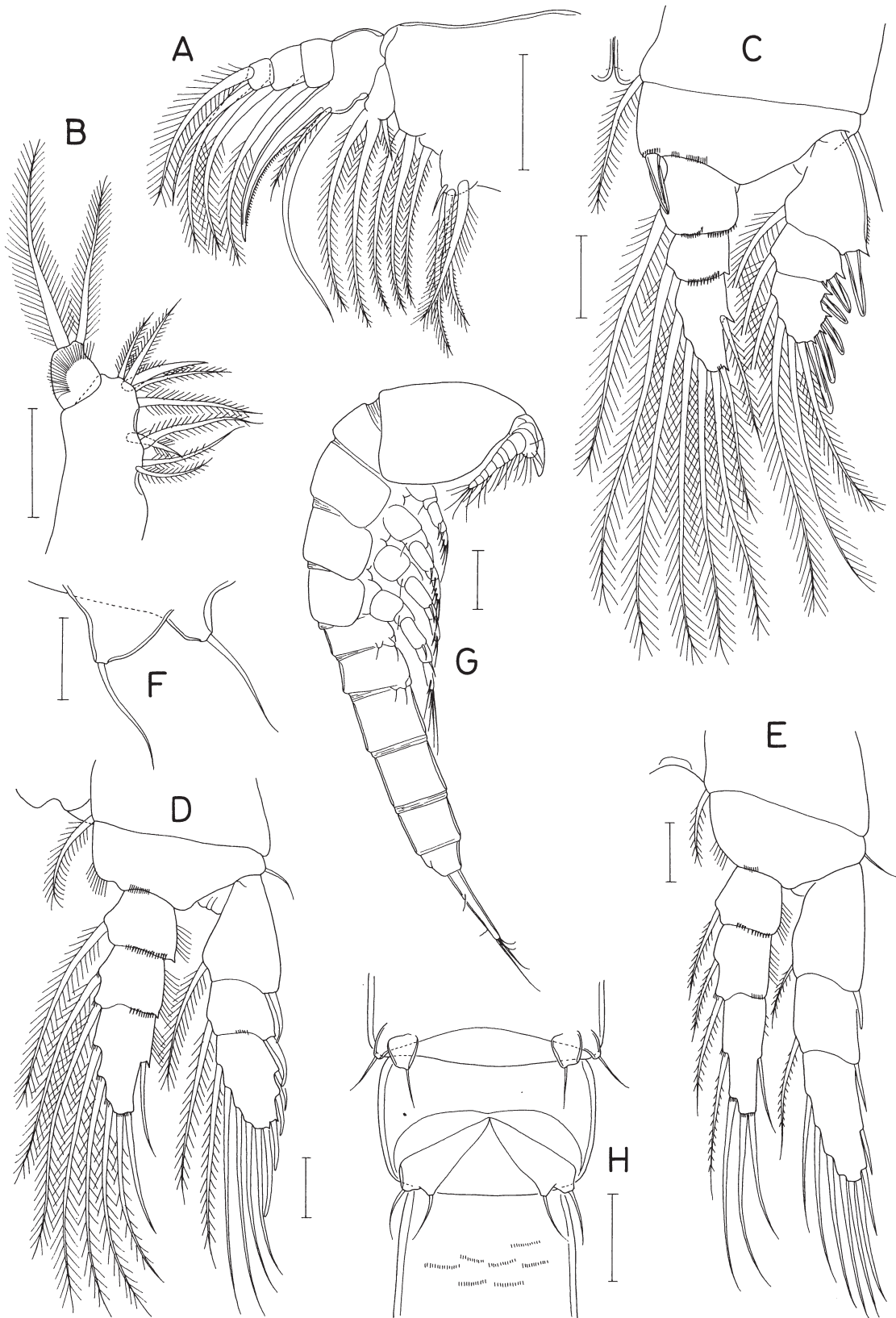
Labrum (Fig. 60G) strongly tapering, concave along posterior margin, ornamented with setules posterolaterally and with spinules and setules on weak median lobe. Mandible (Fig. 60H) with 6 teeth (2 proximal teeth spinule-like) and 2 small setae on coxal gnathobase; basis with 1 seta on medial margin; exopod 2-segmented, with 1 and 4 setae on first and second segments, respectively; endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 60I) as simple lobe bearing setules on medial margin. Maxillule (Fig. 60J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 unequal setae on medial margin of basis, and 4 on exopod; endopod 2-segmented with 2 setae on first segment and 4 on second. Maxilla (Fig. 61A) 5-segmented; armed with 10 setae on syncoxa (4, 1, 2, and 3), claw plus 2 setae on basis, and 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 61B) 2-segmented; first segment with 9 setae; second segment with 2 setae distally and ornamented with curved row of long setules.

Legs 1–4 with 3-segmented rami (Fig. 61C–E) but articulation between second and third endopodal segments indistinct in legs 2–4. Inner distal spine on basis of leg 1 shorter than first endopodal segment. Legs 2–4 armed with setiform outer margin elements on exopods. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 4	0-1; 0-2; 1, 2, 2



**FIGURE 60.** *Pygodelphys antarctica* (Schellenberg, 1922), female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 1 mm; B, 0.2 mm; C–F, H, 0.1 mm; G, I, J, 0.05 mm.



**FIGURE 61.** *Pygodelphys antarctica* (Schellenberg, 1922). Female: A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Male: G, habitus, right; H, anterior part of urosome showing legs 5 and 6, ventral. Scale bars: A–E, H, 0.1 mm; F, 0.05 mm; G, 0.2 mm.

Leg 5 (Fig. 61F) consisting of 2 small lobes, each tipped with 1 naked seta.

**Description of male.** Body (Fig. 61G) 2.27 mm long. Urosome 6-segmented, comprising fifth pedigerous somite, genital somite 159×255 µm, and 4 free abdominal somites 205×210, 218×193, 190×173, and 105×150 µm, respectively. Caudal ramus about 6.1 times as long as wide (273×45 µm); outer lateral seta positioned at 30% of ramus length; all caudal setae thin and flexible.

Rostrum as in female. Antennule with one seta (indicated by dark seta in Fig. 60E) on anterior margin of second segment enlarged and spiniform, otherwise antennule as in female. Antenna, mouthparts, and legs 1–4 as in female.

Leg 5 (Fig. 61H) represented by ventrolateral lobe tipped with 1 seta, and small trapezoidal exopodal segment tipped with 1 seta. Leg 6 (Fig. 61H) represented by 2 setae on genital operculum.

**Remarks.** The original description of this species was inadequate. Our material exhibits a very similar morphology to the type material, with the slender, tapering caudal rami bearing stiff distal setae (“saber-shaped” according to Schellenberg (1922)), and it occurs in association with the type host species in the same geographic region as the type. On this basis we attribute our material to *Pygodelphys antarctica* with confidence and provide a full modern description of this species.

Schellenberg (1922) recorded the ascidian *Paramolgula gregaria* collected at the Falkland Islands and at Ushuaia, Tierra del Fuego (Chile), as host to two different species of copepod associates, *P. antarctica* (as *Doropygus antarctica*) and *Campopera michaelsoni* Schellenberg, 1922.

### *Pygodelphys novaeseelandiae* (Schellenberg, 1922) (Figs. 62, 63)

**Material examined.** 1 ♀ (dissected and figured) from *Polycarpa* sp., Antipodes Island, New Zealand, Eltanin 27, Stn 1850 (49°40'S 178°53'E), depth 476–540 m, 1967.

**Supplementary description of female.** Body (Fig. 62A) strongly flexed ventrally with brood pouch greatly expanded lengthwise, extending beyond tips of caudal rami. Body length 3.45 mm measured from anterior margin of cephalosome to distal end of caudal rami. Prosome longer than body length, 3.94 mm long measured from anterior margin of cephalosome to posterior end of brood pouch. Free urosome (Fig. 62B) 5-segmented and gradually narrowing posteriorly; comprising short genital somite and 4 free abdominal somites. Genital and first abdominal somites each ornamented with rows of minute spinules on ventral surface. Caudal ramus (Fig. 62C) slightly curved, about 6.2 times longer than wide (409×66 µm) and twice as long as anal somite, slightly

narrowing distally; armed with 6 naked setae, outer lateral setae located at 39% of ramus length.

Rostrum (Fig. 62D) broad in proximal third, strongly tapering towards apex in distal two-thirds. Antennule (Fig. 62E) 9-segmented; armature formula 3, 16, 6, 4, 4, 2+aesthetasc, 1, 2+aesthetasc, and 7+aesthetasc; setae crowded, most large and naked; 2 pinnate setae on first and 1 on second segments. Antenna (Fig. 62F) 3-segmented; coxa short and unarmed; allobasis with 2 equally long, slender setae (1 unilaterally weakly pinnate and 1 naked) on outer margin representing exopod, and 1 seta derived from first endopodal segment; compound distal endopodal segment about twice as long wide (106×50 µm), shorter than allobasis, armed with 11 setae (all attenuated at tip) plus strong terminal claw.

Labrum (Fig. 62G) with setulose, roundly produced posterolateral corners and several spinules on mid-posterior border. Mandible (Fig. 62H) with 6 teeth and 2 small setae on coxal gnathobase and 1 small spinule between proximal second and third teeth; basis with 1 seta and setules on medial margin; exopod unsegmented with 5 equally long setae; first endopodal segment with 4 setae on medial margin and row of minute spinules on posterior border; second segment with 10 setae. Maxillule (Fig. 62I) armed as in *P. antarctica*. Maxilla (Fig. 63A) 5-segmented; syncoxa with 9 enditic setae, arranged as 3, 1, 2, and 3; basis with strong claw plus 2 setae; endopod small, armed with 1, 1, and 3 setae on first to third segments, respectively; one seta on third segment naked, other setae on endopod pinnate with long setules. Maxilliped (Fig. 63B) 2-segmented with 9 setae on first segment and 2 on second; second segment subdivided by trace of articulation distally.

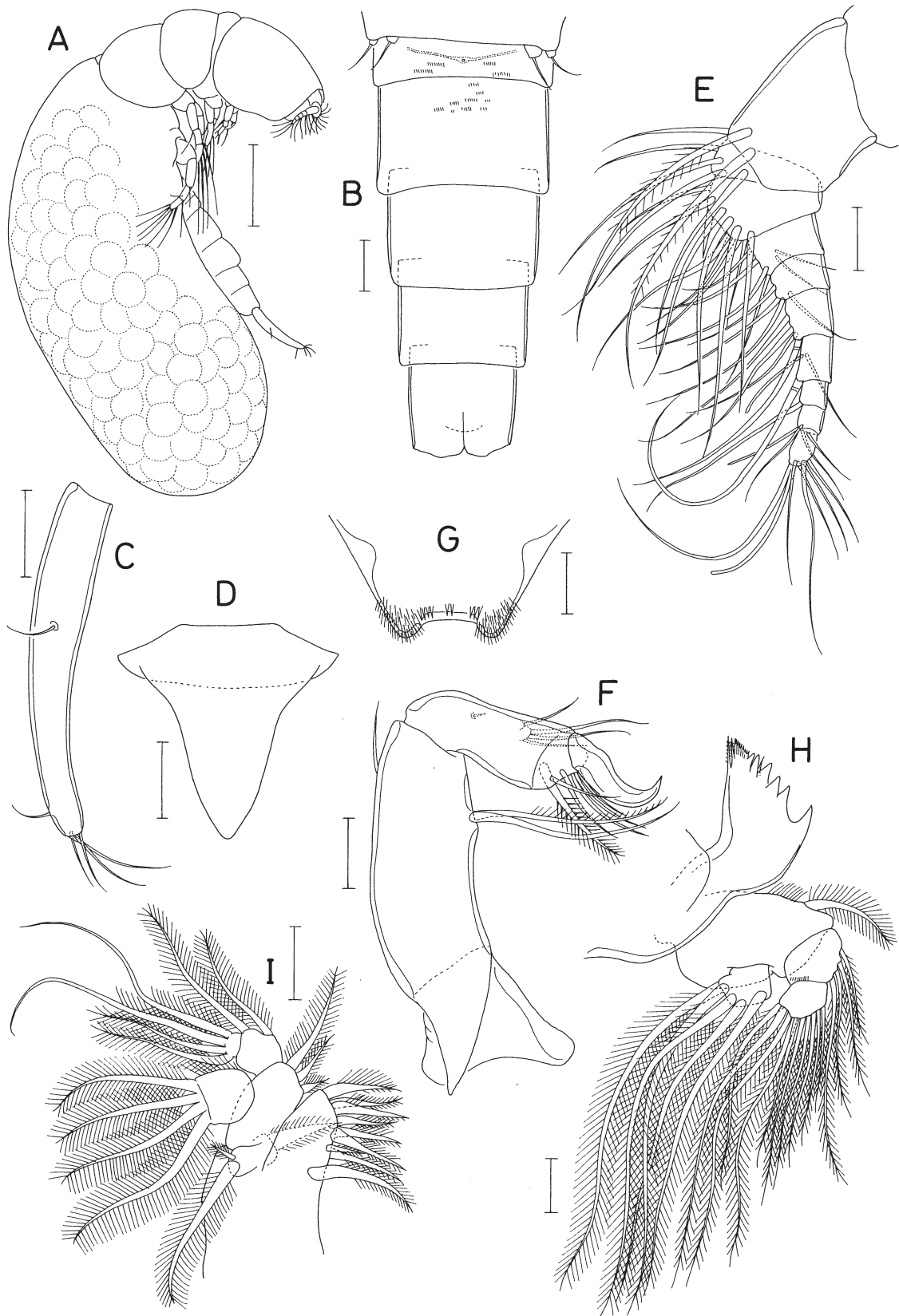
Legs 1–4 with 3-segmented rami (Figs. 63C–E). Inner distal spine on basis of leg 1 slightly longer than first endopodal segment. Exopods of legs 2–4 bearing only setae; outer setae on exopods elongate and usually naked. Armature formula for legs 1–4 as in *P. antarctica*.

Leg 5 (Fig. 63F) represented by 2 lobes each tipped with 1 naked seta; inner (exopodal) lobe bearing additional dentiform process on subdistal inner margin.

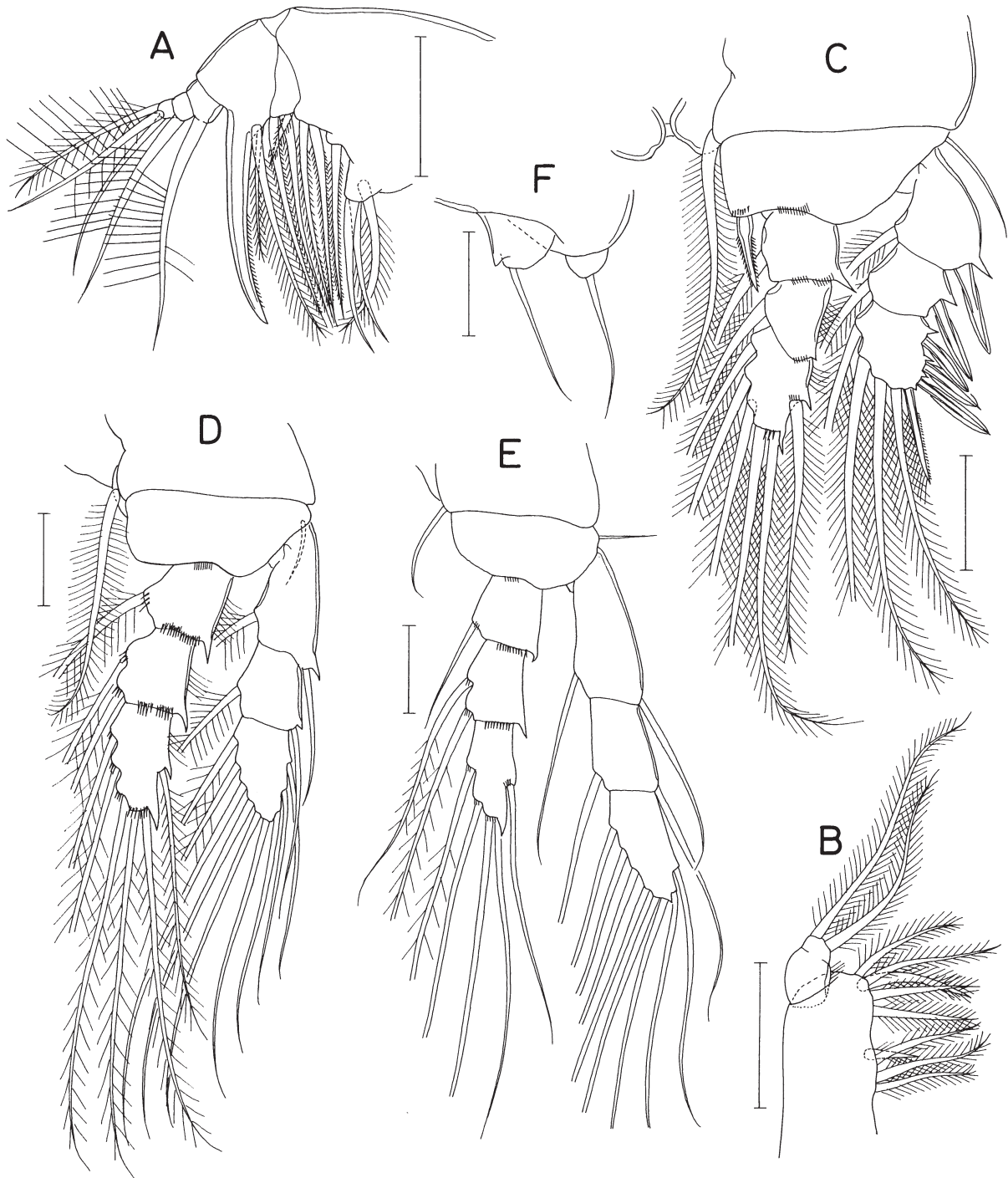
**Male.** Not found.

**Remarks.** Jones (1974) re-examined the type specimens of this species and provided a redescription based on newly collected material. Five species of solitary ascidians are known as hosts of *P. novaeseelandiae* in New Zealand waters and Jones (1974) collected more than 300 specimens, all females, and recorded their mean body length as 1.5 mm ± 0.4, contrasting markedly with the 3.45 mm length of our specimen. In contrast to our specimen, Jones (1974) illustrated an ovigerous female with a brood pouch that was not markedly expanded and was shorter than the urosome. However, in the original description, Schellenberg (1922) reported that the brood pouch was longer than the anterior part of the prosome. Thus, it seems likely that the specimens collected by Jones





**FIGURE 62.** *Pygodelphys novaeseelandiae* (Schellenberg, 1922), female. A, habitus, right; B, urosome, ventral; C, caudal ramus, medial; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.5 mm; B, C, 0.1 mm; D–I, 0.05 mm.

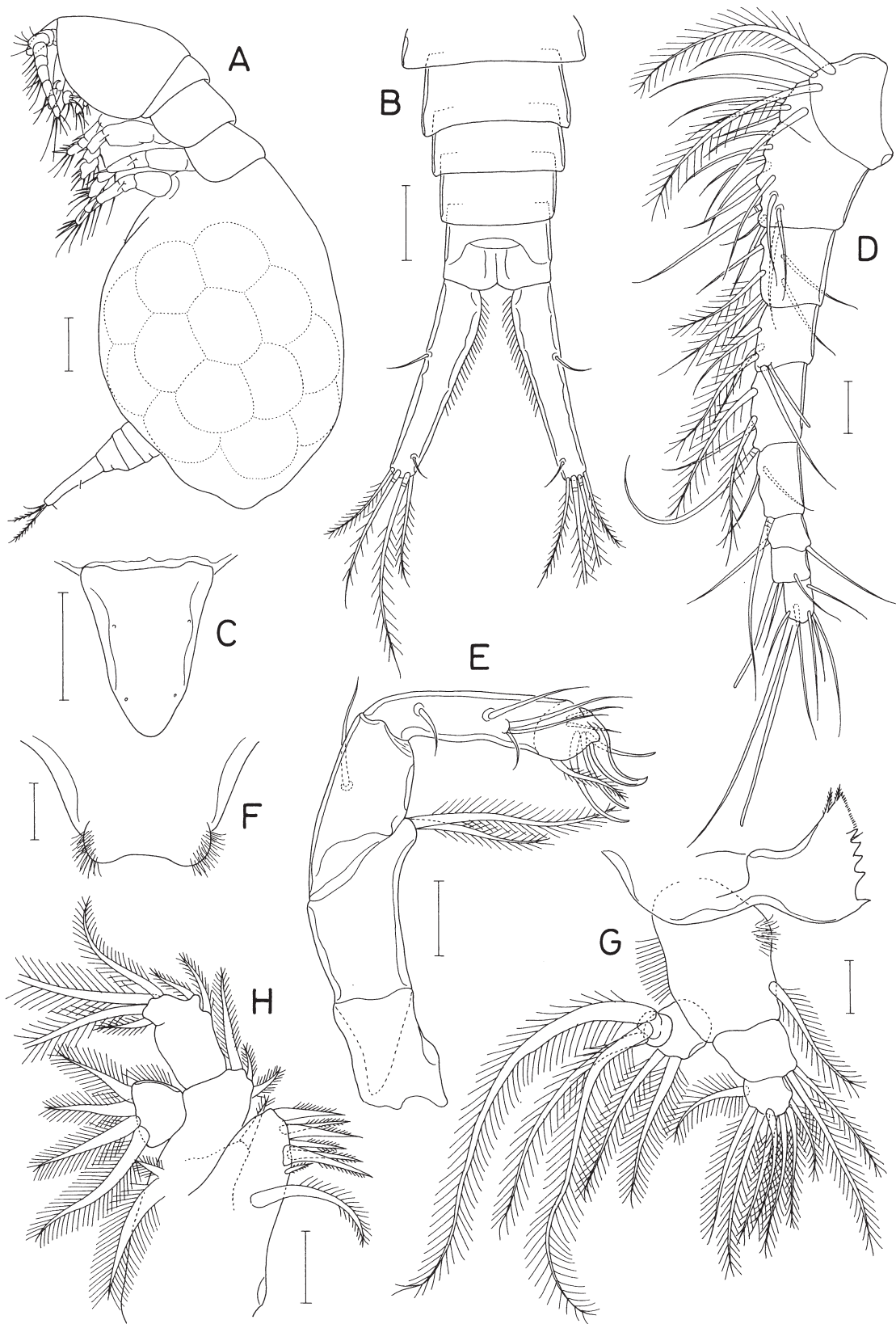


**FIGURE 63.** *Pygodelphys novaeseelandiae* (Schellenberg, 1922), female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A–E, 0.1 mm; F, 0.05 mm.

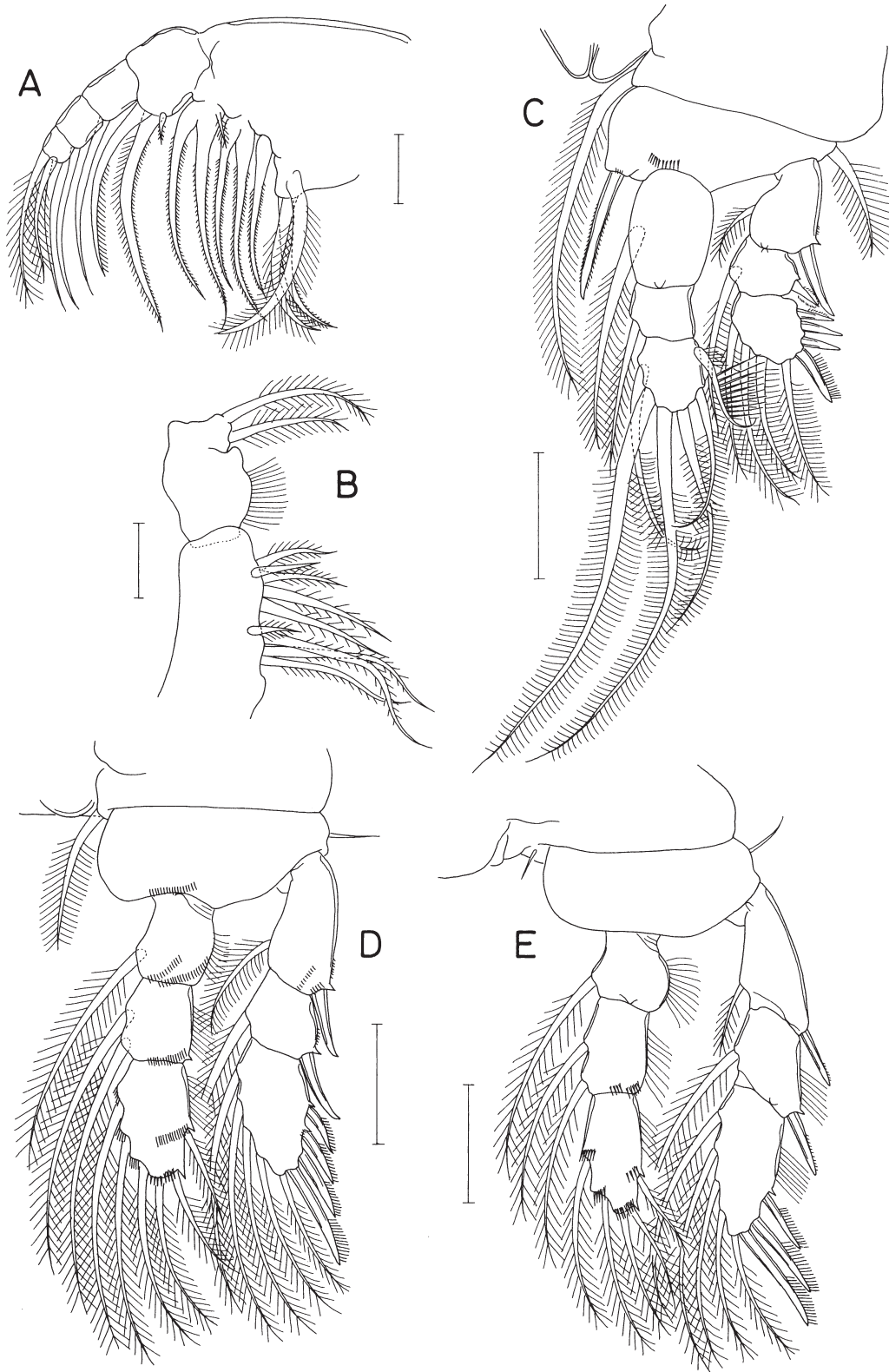
in New Zealand waters might not have been fully grown adults. The small dentiform process on the inner margin on the exopodal lobe of leg 5, which is characteristic of this species, was figured by Jones.

***Pygodelphys inflata* sp. nov.**  
(Figs. 64, 65)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21234), from *Perophora* sp., CRRF OCDN 8166-L, Palau (07°21.75'N, 134°30.31'E), depth 1 m, 09 November 2001.



**FIGURE 64.** *Pygodelphys inflata* sp. nov., female. A, habitus, left; B, urosome, dorsal; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule. Scale bars: A, 0.1 mm; B, C, 0.05 mm; D–H, 0.02 mm.



**FIGURE 65.** *Pygodelphys inflata* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4. Scale bars: A, B, 0.02 mm; C–E, 0.05 mm.

**Etymology.** The name of the new species alludes to its inflated brood pouch.

**Description of female.** Body (Fig. 64A) strongly flexed ventrally. Body length 1.19 mm. Cephalosome to third pedigerous somites dorsoventrally depressed. Brood pouch markedly inflated, globular, thin-walled, and longer than anterior part of prosome. Free urosome (Fig. 64B) 5-segmented; comprising genital somite, much broader but shorter than abdominal somites, plus 4 free abdominal somites, gradually narrowing posteriorly; each wider than long. Caudal rami (Fig. 64B) divergent, narrowing distally, about 4.6 times as long as wide (132×29 µm) and 2.3 times longer than anal somite, ornamented with setules along inner margin; armed with 6 setae, outer lateral seta naked and positioned at 37% of ramus length; four distal setae pinnate, longest seta as long as ramus, smallest subdistal seta naked.

Rostrum (Fig. 64C) longer than wide (80×62 µm), articulated at base, tapering distally towards rounded apex. Antennule (Fig. 64D) 9-segmented; armature formula 3, 17, 6, 4+aesthetasc, 4, 3, 2, 2+aesthetasc, and 7+aesthetasc; proximal segments only slightly broader than distal segments; several larger setae on first to fifth segments pinnate. Antenna (Fig. 64E) 4-segmented, including short coxa; basis with 2 unequal, pinnate setae at outer distal corner, longer seta 1.5 times length of shorter seta; first endopodal segment with 1 medial seta; compound distal endopodal segment about 3.7 times longer than wide (59×16 µm); armed with 11 setae (grouped as 1, 1, 3, 1, 2, and 3) plus terminal claw, about twice as long as segment.

Labrum (Fig. 64F) with patch of setules at each posterolateral corner; posterior margin concave. Mandible (Fig. 64G) with 5 teeth and 2 small setae on coxal gnathobase and 1 spinule between proximal 2 teeth; basis with 1 seta and tuft of setules on medial margin and setules along outer margin; exopod 3-segmented, with 2, 1, and 2 setae on first to third segments, respectively, 2 distal setae much larger than other 3; endopod with 2 and 8 setae on first and second segments, respectively. Maxillule (Fig. 64H) with 8 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 (2 small proximal and 1 larger distal) on medial margin of basis; exopod with 4 setae distally; endopod unsegmented with 6 setae (2 medial and 1 on outer subdistal setae smaller than distal 3). Maxilla (Fig. 65A) 5-segmented with 9 setae (3, 1, 2, and 3 on first to fourth endites, respectively) on syncoxa, 3 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 65B) 2-segmented with 9 setae on first segment and 2 setae on second; second segment with partial trace of articulation subdistally and ornamented with long setules on medial margin.

Legs 1–4 with 3-segmented rami. Inner coxal seta large in leg 1, smaller in legs 2 and 3, rudimentary in leg 4 (Fig. 65C–E). Outer seta on basis pinnate in leg 1, but smaller and naked in legs 2–4. Inner distal spine on basis

of leg 1 elongate, 53 µm long, longer than first endopodal segment. Outer seta on third endopodal segment of leg 1 with long, stiff setules perpendicular to setal axis; 2 inner subdistal setae on same segment enlarged. Spines on third exopodal segment of legs 2–4, and distal spine on third exopodal segment of leg 1 pectinate along outer margin. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2
Leg 5	absent.			

**Male.** Unknown.

**Remarks.** All described species of *Pygodelphys* are known to have an allobasis plus a single free compound endopodal segment in the antenna. The retention of a discrete basis plus a 2-segmented endopod is unique to the new species and distinguishes it from all congeneric species. The small body size, the absence of leg 5, and the possession of 2 and 8 setae on the first and second endopodal segments, respectively, of the mandible, are all features that are shared with *P. patriciae*. However, the latter species has 3 setae on the second segment of the maxilliped (vs. 2 setae in the new species), and has shorter caudal rami which are only about 2.7 times longer than wide, compared to about 4.6 times in the new species. These differences are sufficient to justify the establishment of the new species.

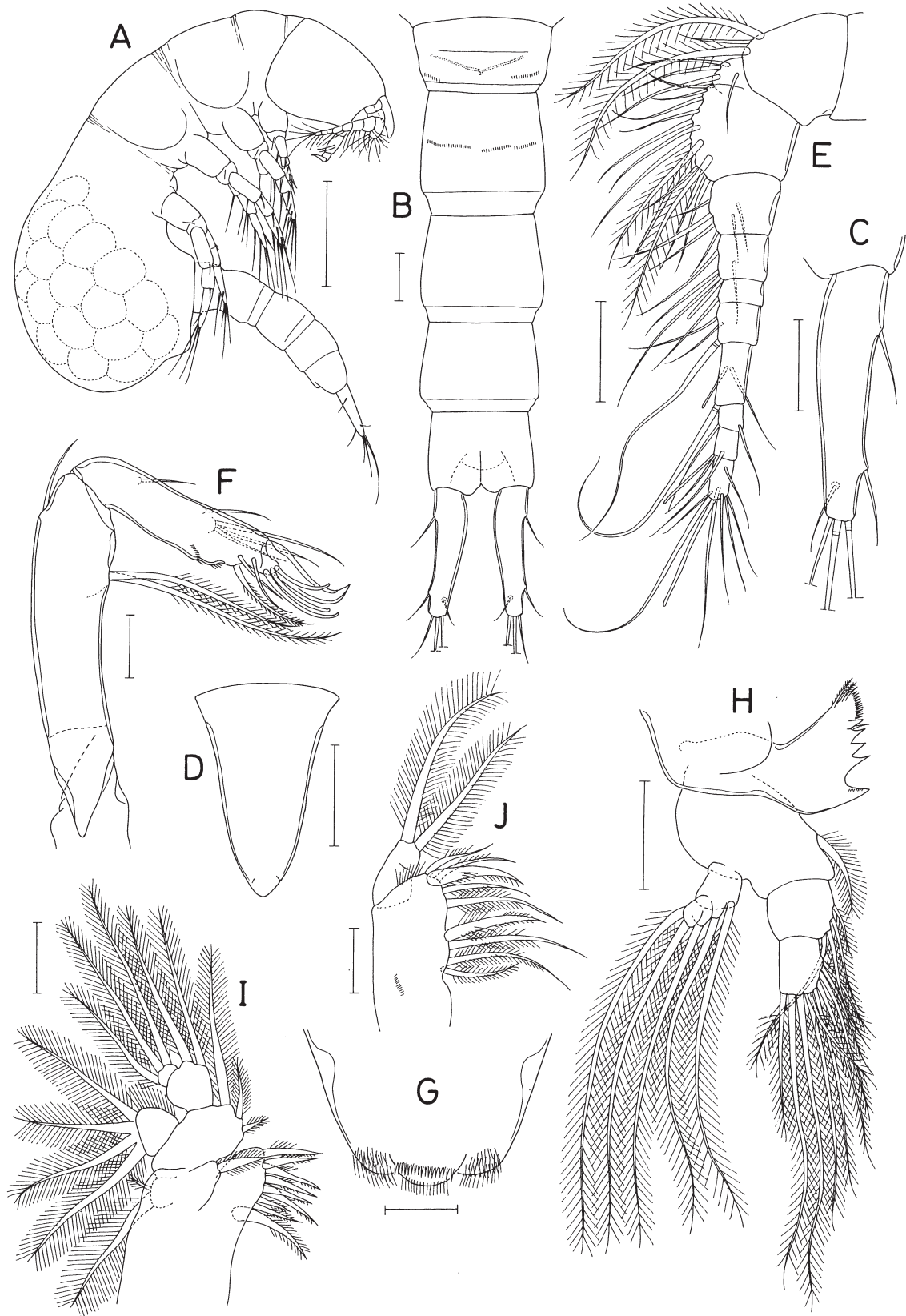
***Pygodelphys chilensis* sp. nov.**

(Figs. 66, 67)

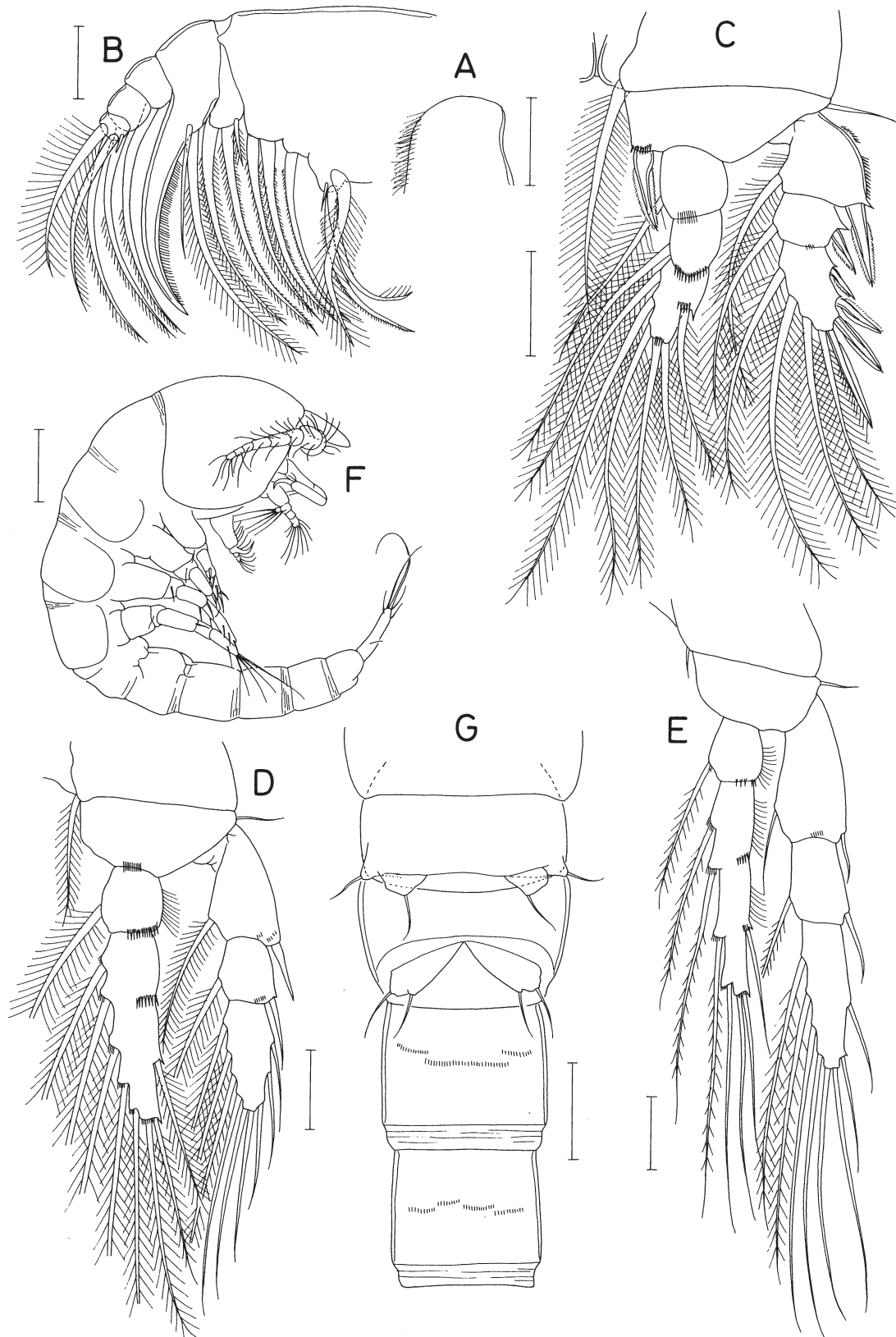
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21235), paratypes (intact, 6 ♀♀, 1 ♂, MNHN-IU-2014-21236), and dissected paratypes (1 ♀, 1 ♂, figured), from *Styela magalhaensis* Michaelsen, 1898, Coquimbo, Chile, depth 450 m, 09 November 2001.

**Etymology.** The name of the new species refers to its type locality.

**Description of female.** Body (Fig. 66A) moderately slender, strongly flexed ventrally. Body length 3.52 mm. Prosomites indistinctly articulated; second and third pedigerous somites with weakly developed epimera. Brood pouch incorporating fused fifth pedigerous somite rather small, subcircular in lateral view, shorter than anterior part of prosome. Free urosome (Fig. 66B) clearly 5-segmented, 141×295, 264×268, 228×264, 186×255, and 164×227 µm, respectively. Genital and first abdominal somites each ornamented with rows of minute spinules on ventral surface. Caudal ramus (Fig. 66C) about 3.9 times longer than wide (282×72 µm) and 1.7 times longer than anal somite, gradually narrowing distally; armed with 6 naked setae, outer lateral seta (seta II) positioned at 26%



**FIGURE 66.** *Pygodelphys chilensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilliped. Scale bars: A, 0.5 mm; B–E, H, 0.1 mm; F, G, I, J, 0.05 mm.



**FIGURE 67.** *Pygodelphys chilensis* sp. nov., female: A, paragnath; B, maxilla; C, leg 1; D, leg 2; E, leg 4. Male: F, habitus, right; G, anterior part of urosome showing legs 5 and 6, ventral. Scale bars: A, B, 0.05 mm; C–E, G, 0.1 mm; F, 0.2 mm.

of ramus length, seta III characteristically positioned on outer margin (not at outer distal corner) at 80% of ramus length.

Rostrum (Fig. 66D) large, 205×145 µm, elongate and tapering. Antennule (Fig. 66E) 10-segmented; armature formula 3, 17, 6, 4+aesthetasc, 1, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae naked, except 4 pinnate setae, 2 on first segment and another 2 on second segment. Antenna (Fig. 66F) slender, 3-segmented; short coxa unarmed; allobasis with 3 setae, 2 long, subequal pinnate setae on subdistal outer margin representing exopod and 1 smaller, naked seta derived from first endopodal segment on inner margin; compound distal endopodal segment about 3.4 times as long as wide, with terminal claw and 11 setae (arranged as 1, 1, 3, 1, 2, and 3), 3 distal setae blunt at tip.

Labrum (Fig. 66G) densely ornamented with setules posterolaterally, and with setules plus row of spinules on broad posteromedial lobe. Mandible (Fig. 66H) with 5 teeth and 2 small setae on coxal gnathobase, with 1 spinule between 2 proximal teeth; basis with 1 seta on medial margin; exopod indistinctly 3-segmented, with 2, 1, and 2 setae on first to third segments, respectively, all exopodal setae equally long; endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 67A) as simple lobe ornamented only with setules on medial margin; lacking spinules or denticles. Maxillule (Fig. 66I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite; basis with 3 setae on medial margin (2 small proximal and 1 larger distal); exopod with 4 setae distally; endopod 2-segmented, with 2 setae on first segment and 3 on small second segment. Maxilla (Fig. 67B) 5-segmented; syncoxa with 4 (including minute seta), 1, 2, and 3 setae on first to fourth endites, respectively; basis with strong claw bearing dense spinules along concave margin, plus 2 setae (smaller seta naked); endopod with 1, 1, and 4 setae on first to third segments, respectively, one of 4 setae on third segment minute, spinule-like. Maxilliped (Fig. 66J) 2-segmented with 9 setae on first segment and 2 on second; first segment with setules on distal border; second segment with trace of articulation on medial surface.

Leg 1 (Fig. 67C) with 3-segmented rami; inner distal spine on basis 80 µm long, longer than first endopodal segment, fringed with serrated membranes; first exopodal segment broad with fine spinules along outer margin. Legs 2–4 each with 3-segmented exopod and 2-segmented endopod (Fig. 67D, E). Inner seta on coxa of leg 4 rudimentary. Outer seta on basis of legs 1–4 small and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	1-1; III, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4
Leg 5	absent.			

**Description of male.** Body (Fig. 67F) strongly flexed ventrally. Body length 1.93 mm. Urosome 6-segmented: fifth pedigerous somite as wide as genital somite; genital and 4 free abdominal somites 130×222, 145×170, 145×156, 116×144, and 91×124 µm, respectively. First and second abdominal somites each ornamented with rows of minute spinules on ventral surface (Fig. 67G). Caudal ramus about 4.1 times longer than wide (149×36 µm).

Rostrum as in female. Antennule segmented as in female, but one seta on second segment broadened, spiniform. Antenna, labrum, mandible, paragnath, maxillule, and maxilla also as in female. Maxilliped 2-segmented, lacking trace of articulation on second segment.

Legs 1–4 with distinctly 3-segmented endopods, unlike female. Leg 5 (Fig. 67G) consisting of outer protopodal lobe tipped with seta and small free exopodal segment tipped with 1 seta. Leg 6 (Fig. 67G) represented by 2 setae on genital operculum.

**Remarks.** The new species shares the possession of only 5 (not 6) setae on the endopod of the maxillule with only two congeners, *P. aquilonaris* and *P. lamellipes* (Schellenberg, 1922). These two species can be distinguished from the new species by other characters. According to the description of Illg (1958), the female of *P. aquilonaris* retains a leg 5 consisting of a tiny outer papilla and inner lobe, each bearing an apical seta (vs. leg 5 absent in the new species); the caudal rami are about 5 times as long as wide in the female (vs. about 4 times in the new species), the proximal outer caudal seta is about three quarters of the length of the ramus and the subdistal outer seta is nearly as long as the ramus (vs. both setae much shorter than the ramus in the new species); and the second endopodal segment of the mandible bears 9 setae (vs. 10 setae in the new species). According to the description and illustrations of *P. lamellipes* by Schellenberg (1922), the length ratio of the anal somite and the caudal ramus is 3:4, i.e., the caudal ramus is 1.33 times longer than the anal somite (vs. 1.7 times longer in the new species); the proximal outer seta of the caudal ramus is pinnate (vs. naked in the new species), and leg 5 is present in the female (vs. absent in the new species).

The structure of the maxillule is uncertain in *P. patriciae*. In the original description this appendage was described as having an unsegmented endopod bearing only 2 setae, but in the illustration by Stock (1967), the second segment of the endopod was missing. *Pygodelphys patriciae* can be clearly differentiated from the new species by numerous other features including a 9-segmented antennule, distinctly shorter and tapering caudal rami, a 3-segmented endopod of leg 2 in the female, the presence of 3 setae on the second segment of the maxilliped, and the well-developed outer spines (rather than setae) on the exopods of legs 2–4.



## Genus *Pachypygus* Sars G. O., 1921

**Diagnosis.** Female body with large brood pouch, often extending from third pedigerous somite back, incorporating fourth pedigerous somite. Fifth pedigerous somite partly fused to brood pouch but well defined in some species. Free urosome 5- or 6-segmented in female, 6-segmented in male. Anal somite with processes in some species. Caudal rami curved; armed with 4 claws and 2 setae. Rostrum well-developed. Female antennule 8- or 9-segmented with first and second segments typically broader than distal segments: segmental fusion pattern I-II, III-XI, XII-XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV, XXV, XXVI-XXVIII; or with additional compound segment XII-XVI in 8-segmented species. Male antennule typically 8-segmented; non-geniculate. Antenna consisting of coxa, basis, and 2-segmented endopod with compound distal segment bearing terminal claw; or with allobasis incorporating first endopodal segment and 1-segmented free endopod; exopod reduced to seta or absent. Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and 4 and 9 or 10 setae on first and second endopodal segments, respectively. Maxillule with 9 or 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented, with variable setation. Maxilla indistinctly 5-segmented, syncoxal endite formula 4, 1, 2, 3, or reduced; basis with claw plus 2 setae; 3-segmented endopod with setal formula 1, 1, 3/4. Maxilliped 3-segmented and armed with 9 setae on first segment, 1 on second and 3 or 4 (rarely 2) on third. Legs 1–4 biramous and typically with 3-segmented rami (endopods of legs 2–4 only 2-segmented in one species); first exopodal segments of legs 2–4 elongate in many species; armature formula of female typically:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 0/4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-0; I-1; II, I, 0	0-1; 0-2; 1, 2, 2

Inner setae on exopodal segments of legs present or absent according to species, and usually sexually dimorphic. Basis and first two endopodal segments of leg 1 typically ornamented with scattered sensillae on anterior surface. Leg 5 consisting of large protopod fused to pedigerous somite and free exopodal segment armed with 2 elements.

**Type species.** *Pachypygus gibber* (Thorell, 1859), by original monotypy.

**Remarks.** Six nominal species have been described in the genus *Pachypygus*, of which *P. spinosus* Kim & Moon, 2011 was described on the basis of a juvenile, possibly of *P. gibber*. It has a small brood pouch, only 2 setae (not the usual 3) on the first antennular segment, 3 setae (not 4) on the first endopodal segment of the

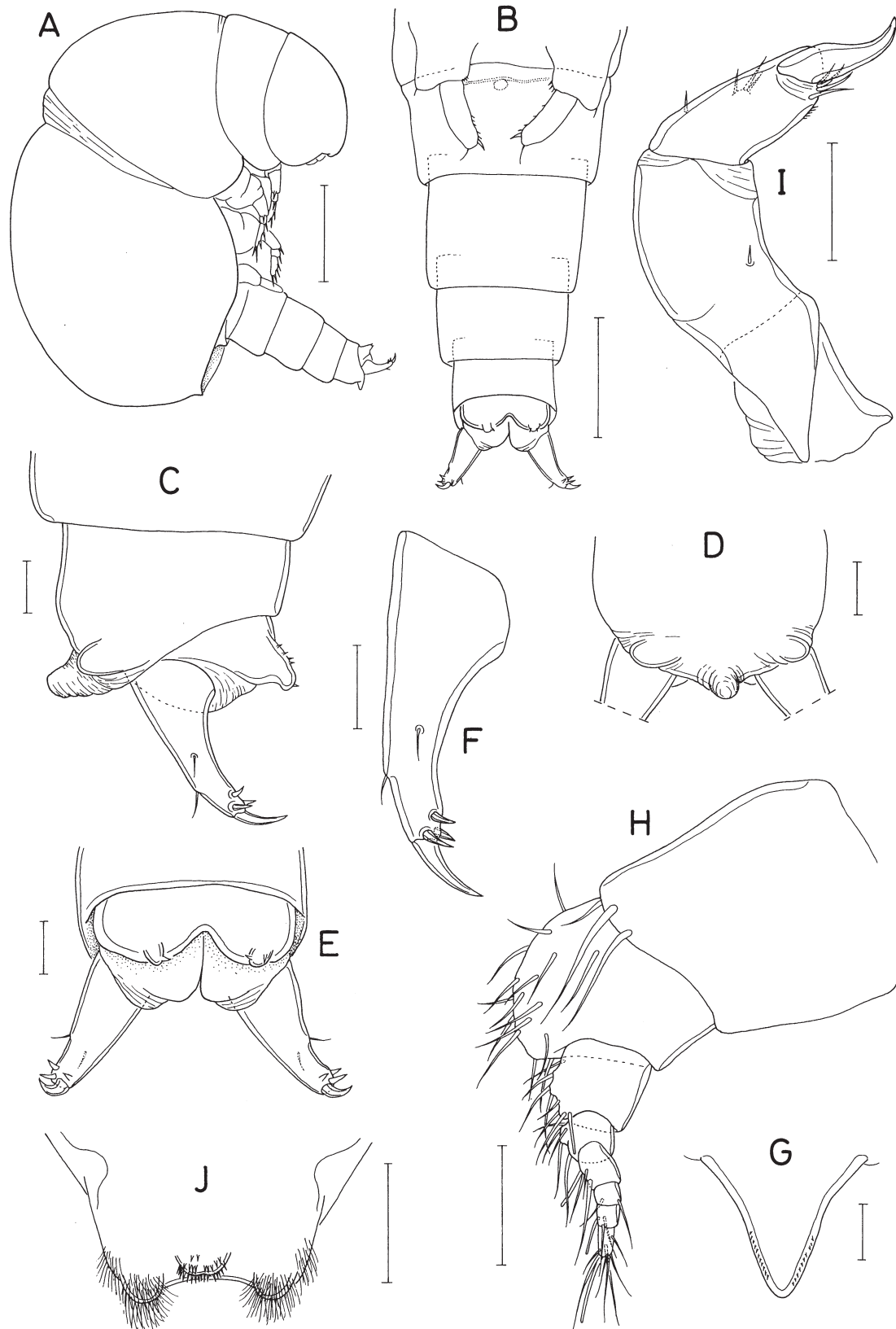
mandible, and 7 setae (not 9) on the first maxillipedal segment. *Pachypygus australis* Gotto, 1975 known from Australia has no distinguishing features that allow it to be differentiated from *P. curvatus* Ooishi, 1961, as discussed below in the remarks of the latter species. Thus, only four species are considered as valid: *P. gibber*, *P. macer* Illg, 1958, *P. curvatus*, and *P. globosus* Ooishi, 1963. The first three of these are redescribed below.

### *Pachypygus gibber* (Thorell, 1859)

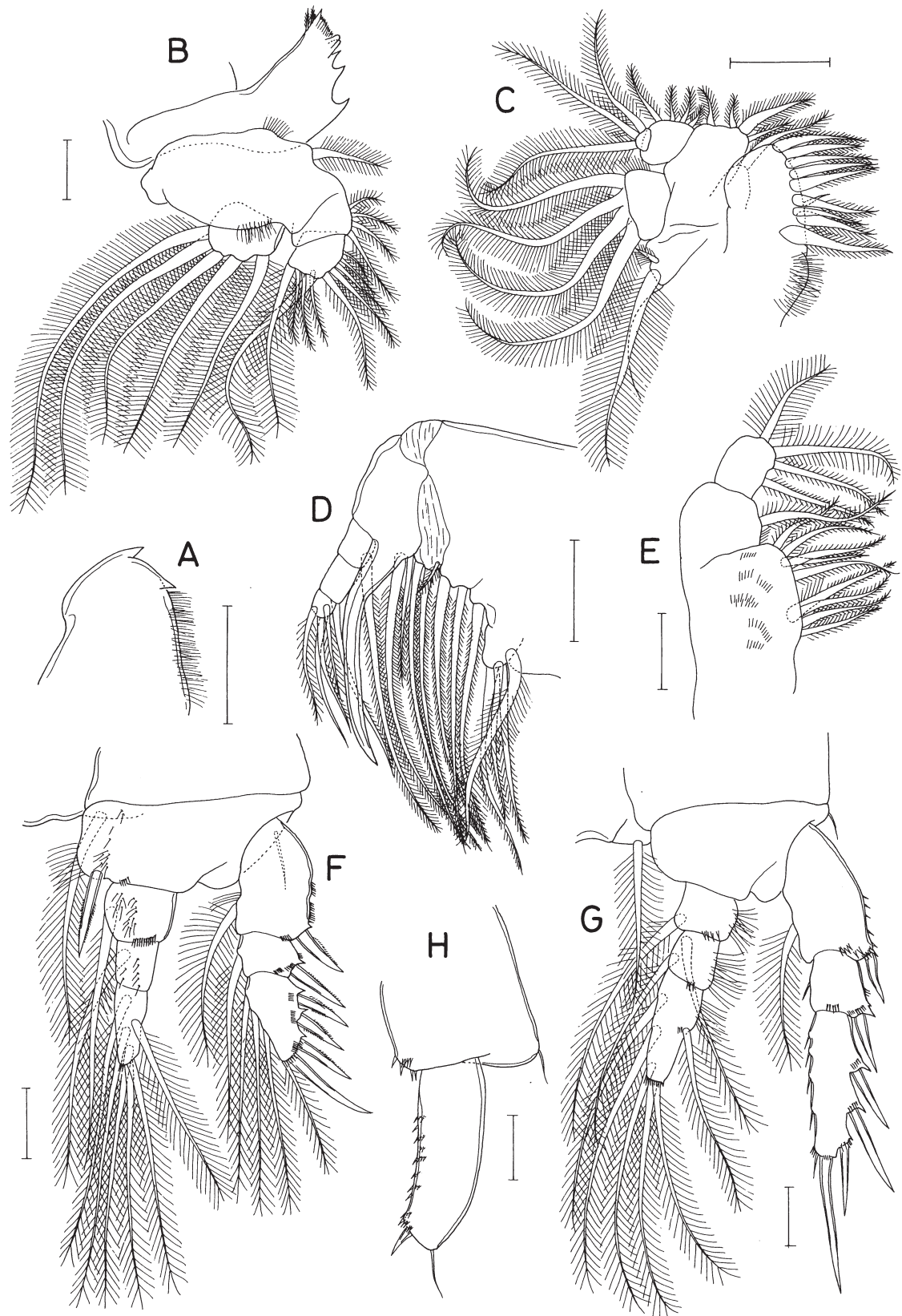
(Figs. 68–70)

**Material examined.** 14 ♀♀ (MNHN-IU-2018-1781) from *Molgula socialis* Alder, 1863, Wimereux, France; 1 ♀ from *Ascidia mentula* Müller, 1776, Kristineberg, 1962; 13 ♀♀ (MNHN-IU-2018-1782) and dissected 1 ♀, 1 ♂ (figured) from *Ciona intestinalis* (Linnaeus, 1758), Thau 1957; 1 ♀, 1 ♂ (MNHN-IU-2018-1783) from *Molgula* sp., collection data unknown; 1 ♀ (MNHN-IU-2018-1784) from *Ascidia tenue* Monniot C., 1983, St. David, Bermuda; 1 ♀ from *Phallusia nigra* Savigny, 1816, Bermuda; 3 ♀♀ (MNHN-IU-2018-1785) from *A. tenue*, St. David, Bermuda; 1 ♀ (MNHN-IU-2018-1786) from *Molgula azorensis* Monniot C., 1971, Azores, Biacores 216; 1 ♀ (dissected), 1 ♂ (MNHN-IU-2018-1787) from *M. azorensis*. Azores, Biacores cruise, 1971; 2 ♀♀ (MNHN-IU-2018-1788) and 1 dissected ♀ from *M. azorensis*, Biacores; 2 ♀♀ (MNHN-IU-2018-1789) from *Polycarpa tenera* Lacaze-Duthiers & Delage, 1892, Glenan; 3 ♀♀ (MNHN-IU-2018-1790) from *Ascidia conchilega* Müller, 1776, Kristineberg; 1 ♀ (dissected) from *Ecteinascidia turbinata* Herdman, 1880, Ibiza, Balearic Islands, Spain; 1 ♀ (MNHN-IU-2018-1791) and 1 dissected ♀ from *Ascidia curvata* (Traustedt, 1882), Bermuda; 2 ♀♀ (MNHN-IU-2018-1792) from *Ascidia virginea* Müller, 1776, Adriatic Sea; 9 ♀♀ (MNHN-IU-2018-1793) from *Ciona intestinalis*, Bonifacio 1983; 6 ♀♀ (MNHN-IU-2018-1794) from *C. intestinalis*, Bonifacio; 2 ♀♀ (MNHN-IU-2018-1795) from *Molgula manhattensis* (De Kay, 1843), Port de Lorient, August 1992; 1 ♀ (MNHN-IU-2017-1796) from *Molgula socialis*, Port de Treguier, August 1992; 1 ♀ (MNHN-IU-2018-1797) from *Ascidia archaia* Sluiter, 1890, CRCHO 239 Palau Malakai Harbor, depth 1 m; 2 ♀♀, 4 ♂♂ (MNHN-IU-2018-1798) and 1 dissected ♀ from *Molgula socialis*, Port du Harvre, 19 November 1997; 4 ♀♀, 4 ♂♂ (MNHN-IU-2018-1799) and dissected 1 ♀, 1 ♂ dissected from *Ascidia ceratodes* (Huntsman, 1912), California, Lambert coll.; 2 ♀♀, 5 ♂♂ (MNHN-IU-2017-2167) from *Molgula socialis*, ORHAGO 14, Stn 14, 10 (47°19'N 02°43'W), depth 34 m. 14 November 2014.

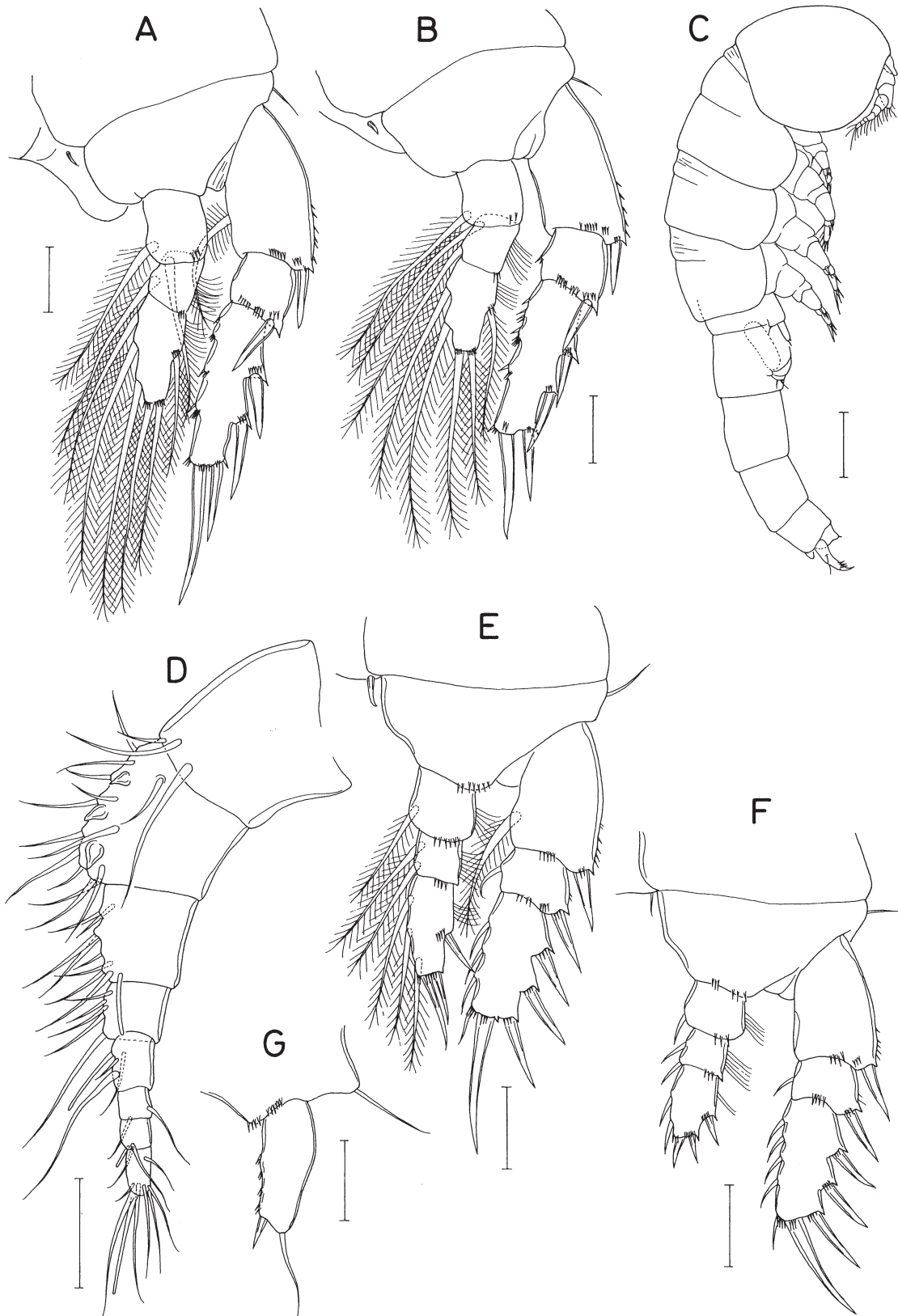
**Supplementary description of female.** Body (Fig. 68A) laterally compressed, comprising inflated prosome, flexed ventrally, and slender urosome. Body length of figured specimen 7.27 mm. Prosome 5-segmented, but



**FIGURE 68.** *Pachypygus gibber* (Thorell, 1859), female. A, habitus, right; B, urosome, ventral; C, distal part of abdomen, right; D, distal part of abdomen, dorsal; E, distal part of abdomen, ventral; F, caudal ramus, lateral; G, rostrum; H, antennule; I, antenna; J, labrum. Scale bars: A, 1 mm; B, 0.5 mm; C–F, H–J, 0.01 mm; G, 0.02 mm.



**FIGURE 69.** *Pachypygus gibber* (Thorell, 1859), female. A, paragnath; B, mandible; C, maxillule; D, maxilla; E, maxilliped; F, leg 1; G, leg 2; H, leg 5. Scale bars: 0.1 mm.



**FIGURE 70.** *Pachypygus gibber* (Thorell, 1859), female: A, leg 3; B, leg 4. Male: C, habitus, right; D, antennule; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, B, 0.1 mm; C, 0.2 mm; D–G, 0.05 mm.

in fully expanded adult first pedigerous somite concealed by cephalosome in lateral view. Third pedigerous somite markedly expanded. Brood pouch angular or slightly produced at postero-ventral corner. Urosome (Fig. 68B) 6-segmented, but fifth pedigerous somite not articulated from brood pouch. All urosomites wider than long, gradually shorter and narrower posteriorly. Third abdominal somite with soft posteromedian process dorsally and paired, sclerotized posterolateral processes (Fig. 68C, D); posterior margin oblique in lateral view, with longer dorsal margin and shorter ventral margin (Fig. 68C). Anal somite concealed by third abdominal somite in dorsal view (Fig. 68C, D), strongly sclerotized ventrally, with paired tubercles ornamented with spinules on ventral surface (Fig. 68C, E). Caudal ramus slightly curved ventrally, about 3.7 times as long as wide (545×148 µm), narrowing distally, and armed with 4 claws and 2 setae; terminal claw largest, 106 µm long, other 3 subdistal claws smaller, 42, 30, and 30 µm long; setae small, positioned at 58% and 79% of ramus length.

Rostrum (Fig. 68G) small, strongly tapering, with row of minute spinules along lateral margins. Antennule (Fig. 68H) 8-segmented; armature formula 3, 16, 7+aesthetasc, 5, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; first and second segments expanded, much wider than distal segments; all setae small and naked. Antenna (Fig. 68I) consisting of short coxa, allobasis and 1-segmented free endopod; allobasis with 1 small seta representing exopod on outer side and rudimentary suture on inner side; free endopodal segment distinctly shorter than basis, 2.1 times as long as wide (136×65 µm) and slightly narrowing distally; armed with 8 small setae (arranged as 1, 3, 1, and 3) plus terminal claw more than half length of segment.

Labrum (Fig. 68J) with setulose, semicircular posterolateral lobes, concave posterior margin, and small, spinulose posteromedial lobe. Mandible (Fig. 69B) with 5 teeth on coxal gnathobase; basis with 1 seta on subdistal medial margin, patches of setules on medial and posteroventral margins, and blunt protuberance proximally on outer margin; exopod short, unsegmented, with 5 setae (2 distal setae longer than other 3); endopod 2-segmented, incompletely articulated from basis, with 4 and 10 setae on first and second segments, respectively, second and third outer distal setae of second segment much smaller than outermost seta. Paragnath (Fig. 69A) with 1 apical and 1 medial subapical denticles, and setulose medial margin. Maxillule (Fig. 69C) with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 4 setae on medial margin of basis (second proximal seta larger than other 3); exopod distinctly shorter than wide, with 4 setae distally; endopod 2-segmented with 4 small setae on medial margin of first segment and 3 larger setae on small second segment. Maxilla (Fig. 69D) 5-segmented; syncoxa with 4 (all prominent), 1, 2, and 3 setae on first to fourth endites, respectively; basis with slender, smooth claw plus 2 setae; endopod slender with 1, 1, and 4 setae

on first to third segments, respectively. Maxilliped (Fig. 69E) 3-segmented, armed with 9, 1, and 4 setae on first to third segments, respectively; articulation incomplete between first 2 segments; first segment ornamented with several rows of minute spinules on both surfaces.

Legs 1–4 (Figs. 69F, G, 70A, B) with 3-segmented rami; outer spines on exopods strong, well-developed. Inner seta on coxa large in legs 1 and 2, but rudimentary in legs 3 and 4, that of leg 4 spiniform. Outer seta on basis of all swimming legs small and naked. Inner distal spine on basis of leg 1 straight, 120 µm long, longer than first endopodal segment. Basis and first 2 endopodal segments of leg 1 with sensillae on anterior (ventral) surface. Inner seta on first exopodal segment present in legs 1–3 but lacking in leg 4. Second and third exopodal segment of leg 2 with or without vestigial setae on inner margin but these setae lacking in legs 3 and 4, with several spinules instead. Third exopodal segment of legs 2–4 about 2.5 times longer than wide. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 5 (or III, I, 0)	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-0; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-0; I-0; III, I, 0	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 69H) consisting of protopod and exopod. Protopod fused with somite, armed with small outer distal seta and ornamented with several spinules on inner distal margin. Free exopodal segment 2.85 times longer than wide (285×100 µm), not reaching posterior margin of genital somite, armed with 1 small spine (45 µm long) and 1 small, thin seta (76 µm long); ornamented with several groups of minute spinules along medial surface.

**Supplementary description of male.** Body (Fig. 70C) narrow, 2.07 mm long. Prosome 5-segmented. Urosome 6-segmented. Third abdominal somite with posterodorsal process as in female, but lacking posterolateral processes. Anal somite with paired tubercles on ventral surface, ornamented with spinules; processes weaker than in female. Caudal ramus about 2.6 times longer than wide (129×50 µm).

Rostrum as in female. Antennule (Fig. 70D) 8-segmented; first and second segments only slightly expanded; non-geniculate; second segment with 3 setal elements modified as conical claws; armature formula 3, 13+3 claws, 8+aesthetasc, 5, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc. Antenna as in female. Labrum and mouthparts as in female.

Leg 1 as in female. Leg 2 with same armature formula as in female, but all medial setae on exopod prominent and 2 terminal setae on third endopodal segment spiniform. Third exopodal segment of leg 3 with 4 spines and 4 setae. Armature formula for legs 3 and 4 (Fig. 70E, F) different from that of female, as follows:

	Coxa	Basis	Exopod	Endopod
Leg 3	0-I	1-0	I-1; I-1; III, I, 4	0-1; 0-2; I, II, 3
Leg 4	0-1	1-0	I-0; I-1; III, I, 5	0-1; 0-2; I, II, II

Leg 5 exopod about 2.5 times longer than wide (83×33 µm). Leg 6 represented by 2 distal setae and 1 smaller, spiniform inner seta on genital operculum.

**Remarks.** This description of *Pachypygus gibber* is based on specimens taken from the type host *Ciona intestinalis* living on the French Mediterranean coast. Specimens from several other samples were dissected for comparison, including: three samples from the European Atlantic, three from the Mediterranean, and one each from California and Bermuda. The diagnostic combination of morphological traits of *P. gibber* can be summarised from this comparison as follows: (1) the terminal claw on the caudal ramus is distinctly larger (about 3 times longer) than the other 3 smaller claws, and the 2 caudal setae are positioned at about 60% and 80% of the ramus length; (2) the antennule is 8-segmented with 3 setae on the first segment; (3) the antenna has an allobasis armed with 1 small seta (naked or pinnate) on the outer side and the free endopod is 1-segmented (segment about twice as long as wide); (4) the mandibular endopod is armed with 4 and 10 setae on the first and second segments, respectively; (5) the maxillular endopod is armed with 4 and 3 setae on the first and second segments, respectively; (6) the third exopodal segment of legs 2–4 is about 2.5 times longer than wide, and reduced inner setae can be present or absent on leg 2, but are consistently absent on legs 3 and 4; (7) the free exopodal segment of female leg 5 is about 2.8 times longer than wide.

Illg (1958) listed the known hosts and the distributional range of this species. Subsequently Ooishi (1961) and Kim (2012) recorded its occurrence in Japan and Korea, respectively. Here we add California and the West Indies as additional distributional records. *Pachypygus gibber* seems to be a cosmopolitan species.

### *Pachypygus macer* Illg, 1958

(Figs. 71–73)

**Material examined.** 12 ♀♀, 10 ♂♂ (MNHN-IU-2018-1800) from *Microcosmus exasperatus* Heller, 1878, mangrove, Puerto Rico; 12 ♀♀, 4 ♂♂ (MNHN-IU-2018-1801) and dissected 2 ♀♀, 1 ♂ from *M. exasperatus*, marina of Bas du Fort, Guadeloupe; 2 ♀♀ (MNHN-IU-2018-1802) from *Styela canopus* (Savigny, 1816), marina of Bas du Fort, Guadeloupe; 1 ♀ (MNHN-IU-2018-1803) from *M. exasperatus*, marina of Riviere Sens, Guadeloupe; 3 ♀♀, 2 ♂♂ (MNHN-IU-2018-1804) and dissected 1 ♀, 1 ♂ (figured) from *Pyura styeliformis* Monniot F. & Monniot C., 2001, marine lake, Palau (07°16.80'N, 134°25.92'E), depth 0.5 m, 06 April 2004.

**Description of female.** Body (Fig. 71A) compressed,

2.65 mm long. Brood pouch tapering in distal third. Urosome (Fig. 71B) 6-segmented, including well-defined fifth pedigerous somite (137×315 µm); genital and 4 free abdominal somites 178×274, 241×259, 200×215, 96×156, and 63×130 µm, respectively. Anal somite (Fig. 71C) smaller than other abdominal somites; ventral surface well-sclerotized, but lacking process or ornamentation of spinules posteroventrally. Caudal ramus (Fig. 71D) slightly curved ventrally, about 3.1 times longer than wide (133×43 µm), and armed with 1 terminal and 3 subdistal claws plus 2 small setae; terminal claw about twice as long as 3 smaller claws; 2 setae positioned at 50% and 72% of ramus length.

Rostrum (Fig. 73A) triangular, slightly longer than wide. Antennule (Fig. 71E) 9-segmented; armature formula 3, 16, 5, 4, 5, 3, 2, 2+aesthetasc, and 7+aesthetasc; first two segments expanded; articulation indistinct between two terminal segments. Antenna (Fig. 71F) consisting of short coxa, basis, and 2-segmented endopod; basis with 1 or 2 minute setae distally representing exopod; first endopodal segment separate, unarmed; compound distal endopodal segment 2.7 times longer than wide (81×30 µm); armed with 8 or 9 small setae plus terminal claw, more than half length of segment.

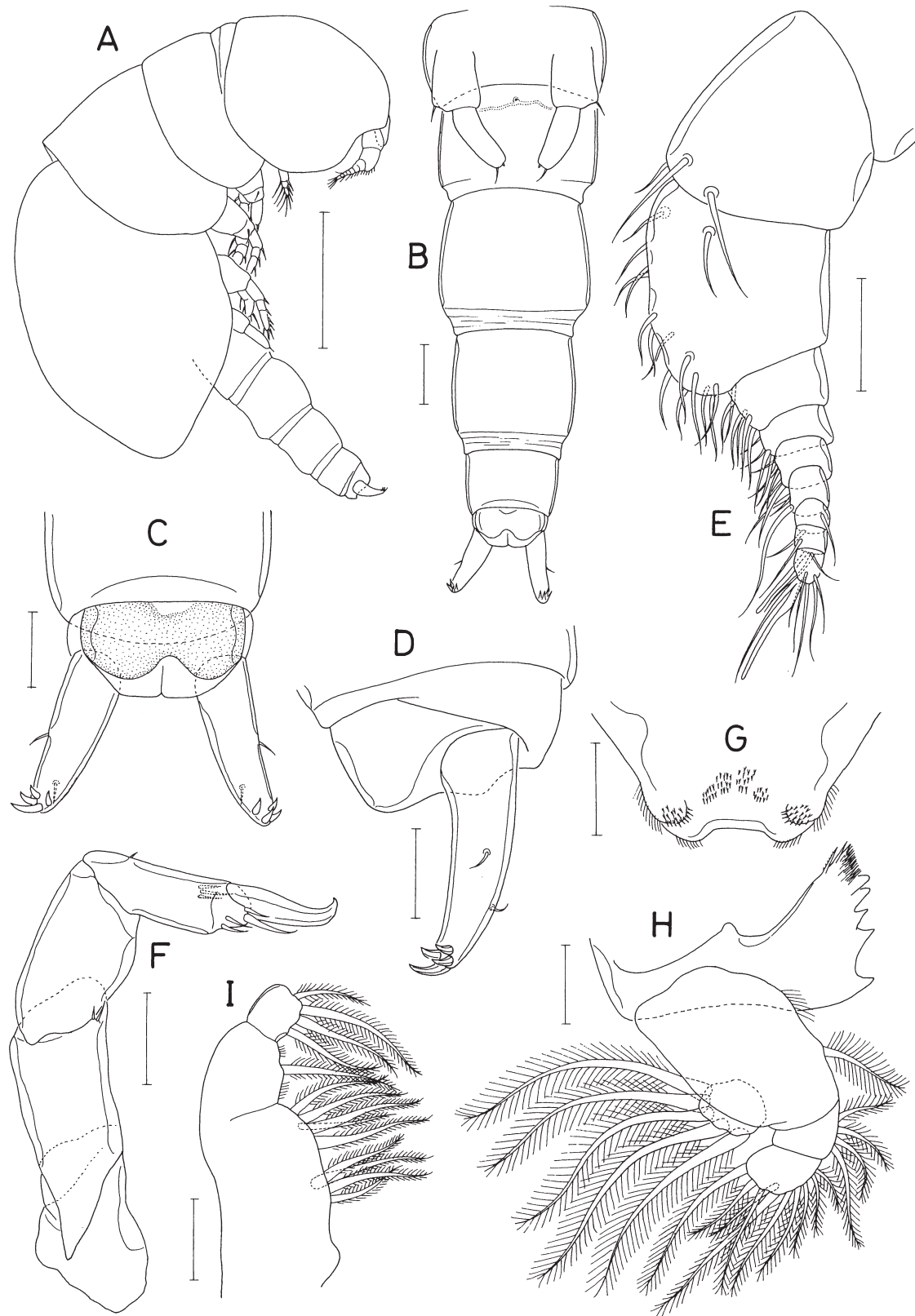
Labrum (Fig. 71G) with concave posterior margin, ornamented with setules posterolaterally and fine spinules on ventral surface. Mandible (Fig. 71H) with same setation pattern as in *P. gibber*, but 5 setae on exopod subequal in length; ornamented with setules only on inner margin of basis. Paragnath (Fig. 73B), maxillule (Fig. 72A) and maxilla (Fig. 72B) as in *P. gibber*. Maxilliped (Fig. 71I) 3-segmented with 9, 1, and 4 setae on first to third segments; articulation incomplete between first and second segments.

Legs 1–4 (Fig. 72C–F) with 3-segmented rami. Inner seta on coxa large and pinnate in legs 1 and 2, but vestigial in legs 3 and 4. Outer seta on basis well-developed in leg 1, but rudimentary in legs 2–4. Inner distal spine on basis of leg 1 distinctly longer than first endopodal segment. Third exopodal segment of legs 2–4 about 3 times longer than wide, with straight, smooth inner margin. Armature formula for legs 1–4 as follows:

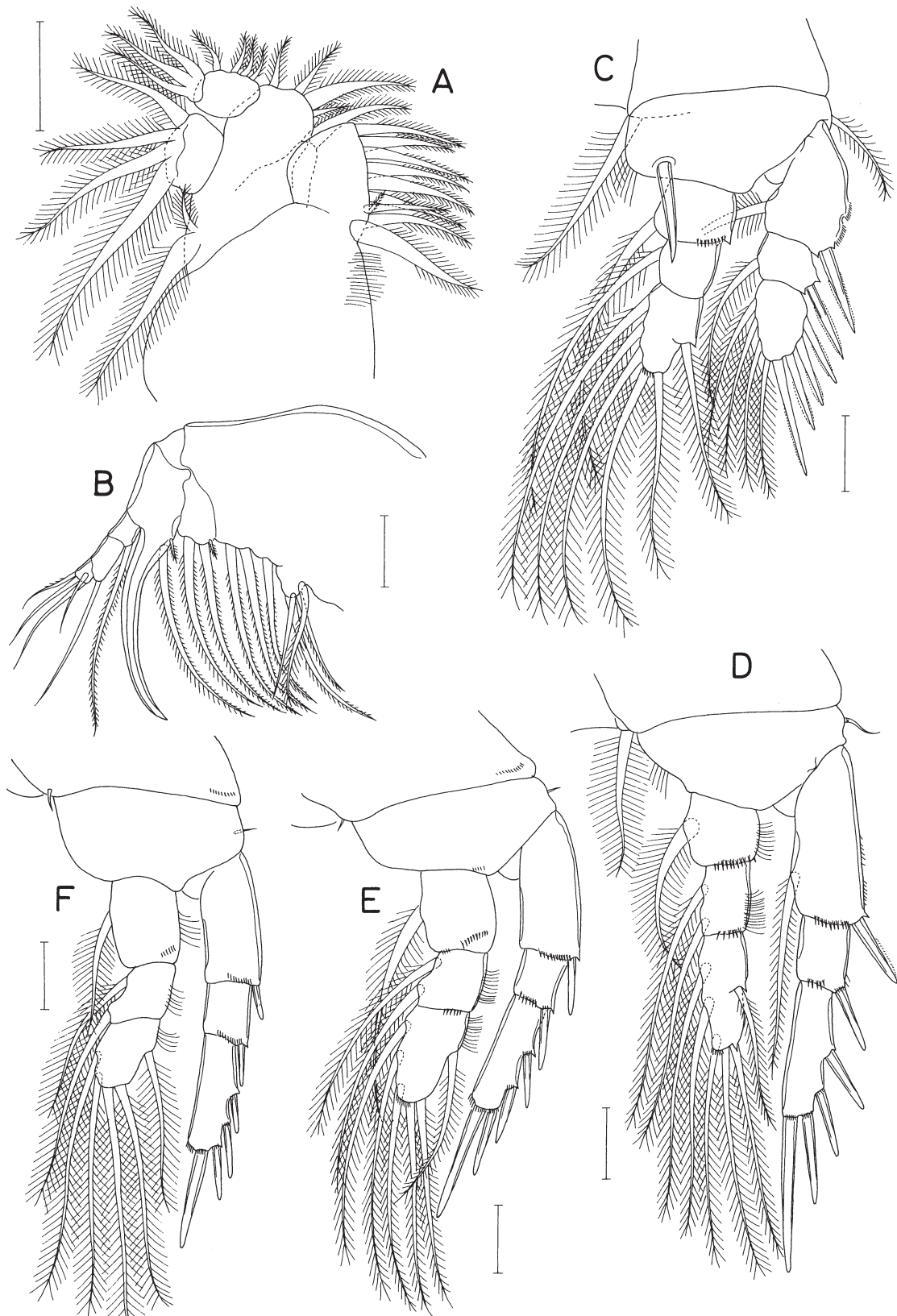
	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-0; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-0; I-0; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-0; I-0; III, I, 0	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 73C) protopod longer than wide, with naked outer distal seta; free exopodal segment about 2.9 times longer than wide (128×44 µm), armed with 1 small spine and 1 small seta distally; ornamented with 4 transverse rows of spinules on medial side.

**Description of male.** Body (Fig. 73D) 1.38 mm long. Urosome (Fig. 73E) 6-segmented. Fifth pedigerous

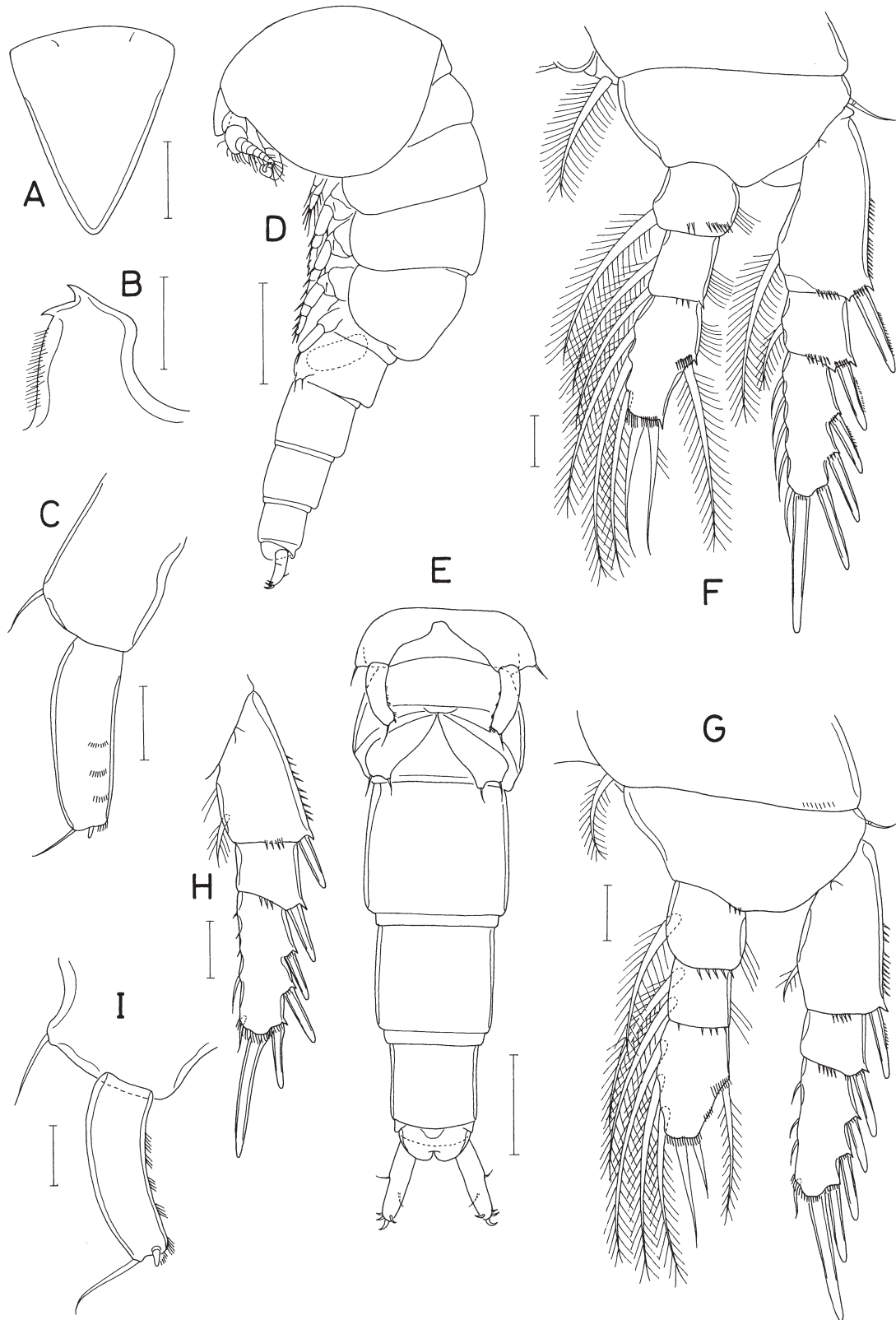


**FIGURE 71.** *Pachypygus macer* Illg, 1958, female. A, habitus, right; B, urosome, ventral; C, distal part of abdomen, ventral; D, distal part of abdomen, left; E, antennule; F, antenna; G, labrum; H, mandible; I, maxilliped. Scale bars: A, 0.5 mm; B, 0.1 mm; C–I, 0.05 mm.



**FIGURE 72.** *Pachypygus macer* Illg, 1958, female. A, maxillule; B, maxilla; C, leg 1; D, leg 2; E, leg 3; F, leg 4. Scale bars: 0.05 mm.





**FIGURE 73.** *Pachypygus macer* Illg, 1958, female: A, rostrum; B, paragnath; C, leg 5. Male: D, habitus, left; E, urosome, ventral; F, leg 2; G, leg 3; H, exopod of leg 4; I, leg 5. Scale bars: A–C, 0.05 mm; D, 0.2 mm; E, 0.1 mm; F–I, 0.02 mm.

somite short, obscurely defined from fourth pedigerous somite. Genital and 4 free abdominal somites 124×174, 146×146, 118×118, 83×79, and 31×70 µm, respectively. Caudal ramus about 3.7 times longer than wide (81×22 µm).

Rostrum as in female. Antennule with first and second segments less expanded than in female. Antenna and mouthparts as in female.

Leg 1 as in female. Two distal setae on third endopodal segment of legs 2–4 short and spiniform (Fig. 73F, G). Inner seta on coxa well-developed and pinnate in legs 1–3, but rudimentary in leg 4. Inner seta on first exopodal segment present in legs 1–4, although small in legs 3 and 4 (Fig. 73G, H). Inner seta absent on second exopodal segment of legs 3 and 4. Armature formula for legs 2–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 2	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-0; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-0; III, I, 2	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 73I) protopod wider than long; free exopodal segment 59×20 µm, ornamented with 5 rows of spinules on inner surface. Leg 6 (Fig. 73E) represented by 2 small setae on distal margin of genital operculum.

**Remarks.** This species was previously known only from the western Atlantic. The above description is based on specimens from *Pyura styeliformis* collected at Palau in the Pacific. The Palau specimens were compared with the specimens from *Microcosmus exasperatus* collected at Guadeloupe in the West Indies. The two populations exhibited no significant morphological differences, although Monnot (1986) recorded the existence of some variability in *P. macer*. *Pachypygus macer* has a characteristic form of brood pouch and the 2-segmented endopod of the antenna serves to distinguish it from the type species, *P. gibber*.

### *Pachypygus curvatus* Ooishi, 1961

(Figs. 74–75)

Syn: *Pachypygus australis* Gotto, 1975, **new synonym**.

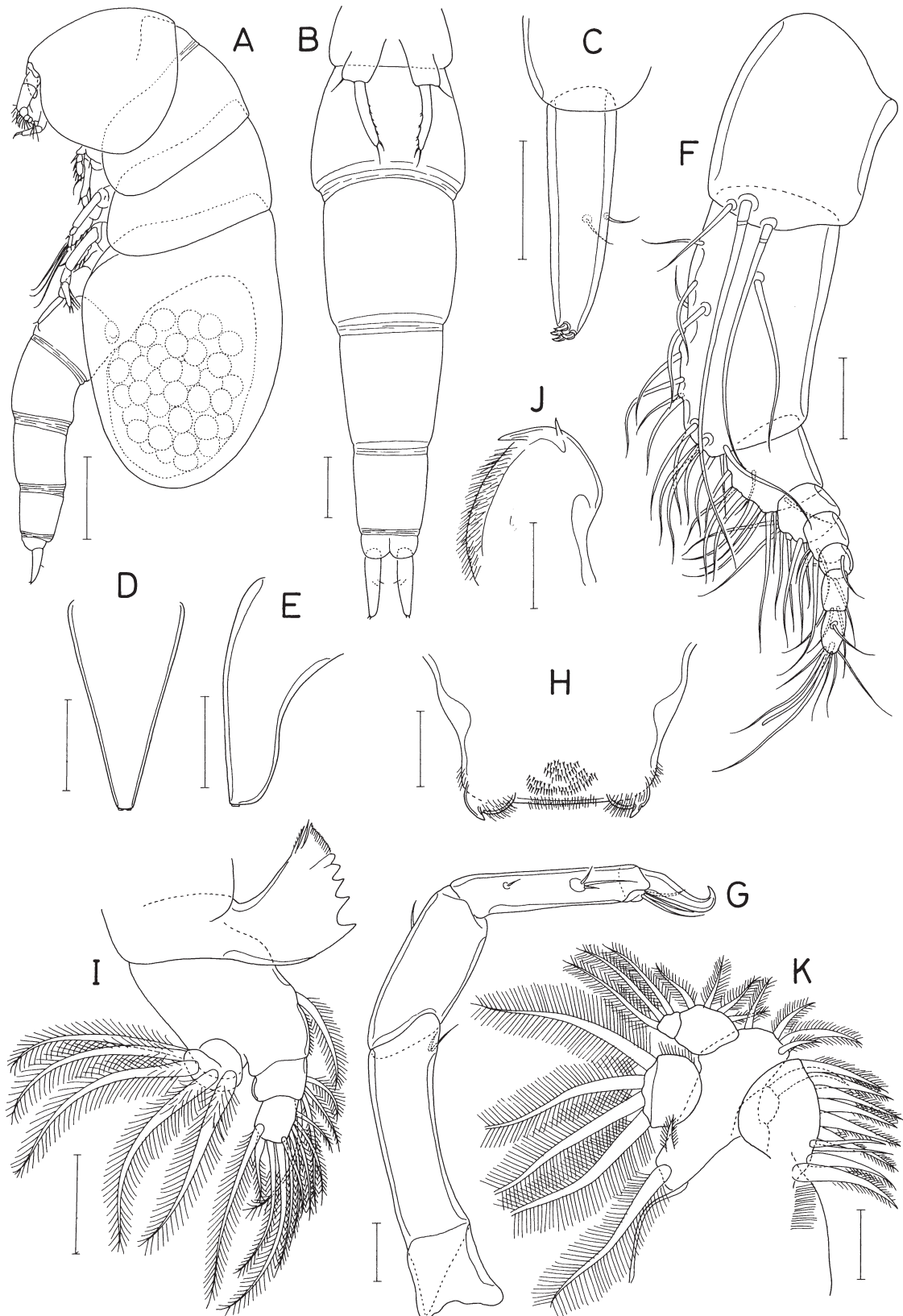
**Material examined.** 6 ♀♀ (MNHN-IU-2018-1805) from *Pyura sacciformis* (Drasche, 1884), Moorea M8; 27 ♀♀ (MNHN-IU-2018-1806) from *P. sacciformis*, Moorea M 17; 35 ♀♀ (MNHN-IU-2018-1807) from *Herdmania momus* (Savigny, 1816), Port de Papeete, Tahiti; 5 ♀♀ (MNHN-IU-2018-1808) and 2 dissected ♀♀ from *P. sacciformis*, New Caledonia, NC 47; 10 ♀♀ (MNHN-IU-2018-1809) and 2 dissected ♀♀ (figured) from *Herdmania pallida* (Heller, 1878), Port de Papeete, Tahiti, 1984; 12 ♀♀ (MNHN-IU-2018-1810) from *H. pallida*, Port de Noumea, New Caledonia, 1986; 1 ♀ (MNHN-IU-2018-1811) from from *H. pallida* Keehi

Lagoon, Honolulu, November 1998; 1 ♀ (MNHN-IU-2015-4) from *H. pallida*, New Caledonia, warf de Thio; 1 ♀ (MNHN-IU-2015-15) from *P. sacciformis*, Tahiti, Stn T48 (17°52.627'S 149°09.3305'W), depth 6 m.

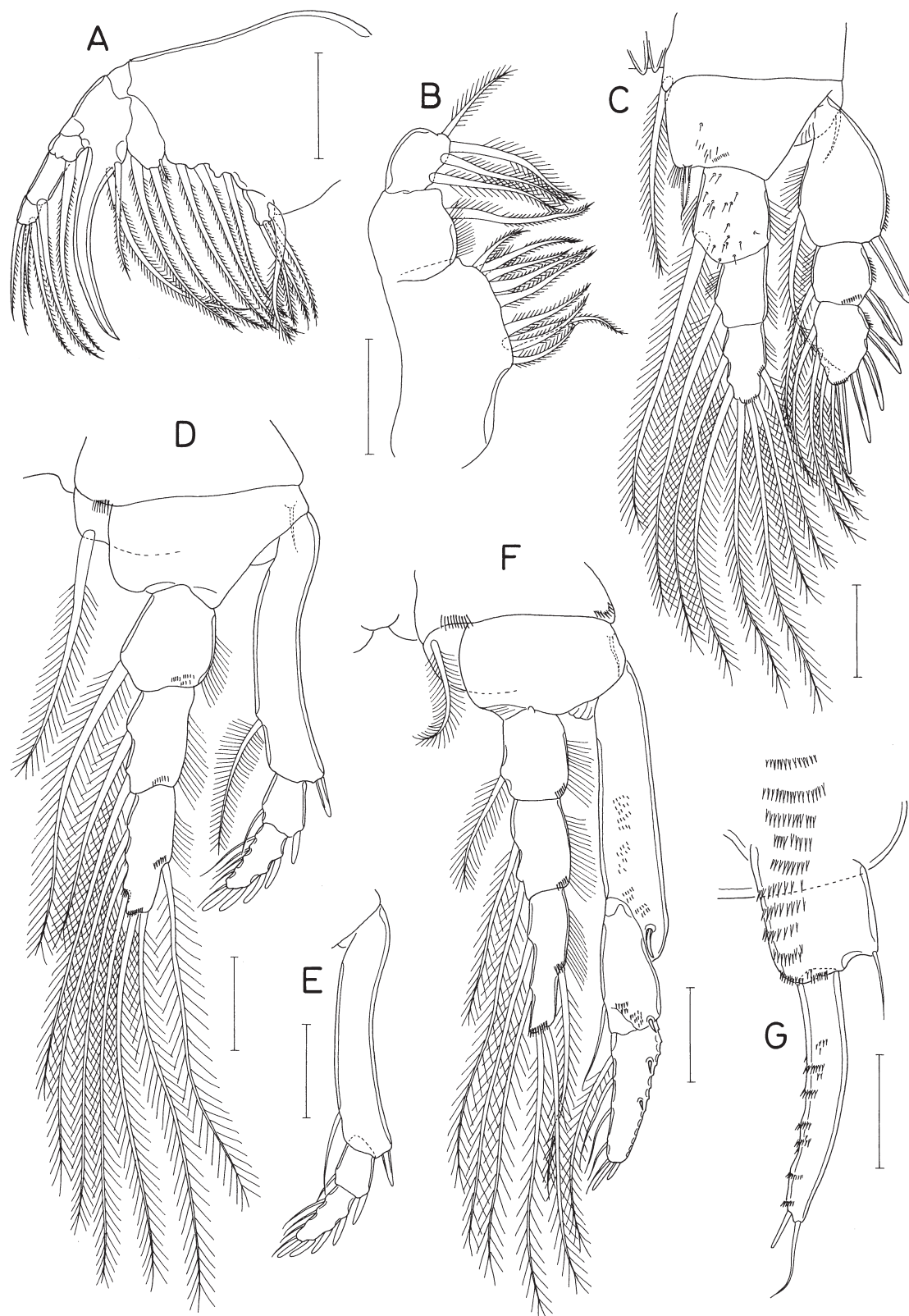
**Description of female.** Body (Fig. 74A) strongly bilaterally compressed, with highly sclerotized exoskeleton. Body length 4.39 mm. Brood pouch slightly longer than wide, with rounded posterior margin in lateral view. Urosome (Fig. 74B) narrow, 6-segmented, widest at posterior region of genital somite, narrower anteriorly and posteriorly. Fifth pedigerous somite about 200×400 µm; genital and 4 free abdominal somites 423×515, 469×438, 369×345, 285×250, and 85×192 µm, respectively. Anal somite short, without ventral prominence or sclerotization. Caudal rami directed posteriorly; each ramus (Fig. 74C) gradually narrowing distally, 3.6 times as long as wide (208×58 µm); armed distally with 4 small claws of equal length and 2 small setae both located at 42% of ramus length.

Rostrum elongate, 251×128 µm, evenly tapering, with truncate apex in ventral view (Fig. 74D) and dorsoventrally thick in lateral view (Fig. 74E). Antennule (Fig. 74F) 8-segmented; armature formula 3, 17, 11, 6, 4, 2, 3, and 7+aesthetasc; first 2 segments broadened; 2 of 3 setae on first segment enlarged, annulated at base; second segment characteristically more than 1.5 times longer than wide. Antenna (Fig. 74G) slender and elongate, consisting of coxa, basis and 2-segmented endopod; coxa short and unarmed; basis with 2 small setae at outer distal region, representing exopod; first endopodal segment with 1 small seta on inner margin; compound distal endopodal segment about 4.2 times longer than wide; armed with 7 setae (3 distal setae pointed at tip) plus terminal claw, about half as long as segment.

Labrum (Fig. 74H) bearing dentiform process on semicircular posterolateral lobes, ornamented with patch of spinules on mid-ventral surface, and with setules on posterior margin, posterolateral lobes, and distal part of lateral margins. Mandible (Fig. 74I) bearing 5 teeth on coxal gnathobase; basis with 1 seta on medial margin and ornamented with fine spinules along medial margin between seta and distal border; exopod armed with 5 setae of equal length, exopodal setae hirsute proximally and pinnate distally; endopod with 4 and 10 setae on first and second segments, respectively, second inner distal seta smaller than adjacent setae on either side. Paragnath (Fig. 74J) with 2 dentiform processes, 1 distal and 1 mediobasal, and with densely setulose medial surface. Maxillule (Fig. 74K) armed with 10 setae on arthrite, plus row of setules proximal to base of arthrite, 1 seta on coxal endite, 2 setae on epipodite; basis with 4 setae on medial margin; exopod with cuticular fold subdistally and 4 setae distally; endopod 2-segmented, with 4 setae on medial margin of first segment and 3 setae on small second segment. Maxilla (Fig. 75A) 5-segmented; syncoxa with 10 enditic setae arranged as 4, 1, 2 and 3 (including 1 very



**FIGURE 74.** *Pachypygus curvatus* Ooishi, 1961, female. A, habitus, left; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum ventral; E, rostrum, left; F, antennule; G, antenna; H, labrum; I, mandible; J, paragnath; K, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C–E, I, 0.1 mm; F–H, J, K, 0.05 mm.



**FIGURE 75.** *Pachypygus curvatus* Ooishi, 1961, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4; G, leg 5. Scale bars: 0.1 mm.

small seta); basis with 1 smooth claw plus 2 setae; endopod slender with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 75B) 3-segmented and armed with 9, 1, and 4 setae on first to third segments, respectively; articulation incomplete between first and second segments.

Legs 1–4 with 3-segmented rami. Inner seta on coxa of legs 1–4 well-developed and pinnate. Outer seta on basis of legs small and naked. Basis and first endopodal segment of leg 1 with sensillae on ventral surface (Fig. 75C). Inner distal spine on basis of leg 1 small, about half as long as first endopodal segment. First exopodal segment of legs 2–4 (Fig. 75D–F) elongate, about 5 times as long as wide in legs 2 and 3 and about 4 times as long as wide in leg 4. Second and third exopodal segments of legs 2 and 3 small, both combined much shorter than first exopodal segment. Exopod of leg 4 enlarged; first segment lacking inner seta, ornamented with minute spinules on ventral surface; outer spines on second and third segments vestigial; third segment tapering, linguiform; proximalmost inner seta much larger than other inner setae on second and third segments. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-0; I-1; II, II, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 75G) protopodal region with about 10 transverse rows of spinules on ventral surface and 1 naked seta at outer distal corner; exopodal segment elongate, about 6.0 times longer than wide (223×37 µm), ornamented with about 6 transverse rows of spinules along medial surface and armed with 2 unequal setae distally.

**Male.** Not found.

**Remarks.** Ooishi (1961) described this species as an associate of *Pyura sacciformis* (Drasche, 1884) (as *Pyura michaelsoni* (Oka)) from the Inland Sea in Japan. Subsequently, Seo & Lee (1996) and Kim (2012) recorded the occurrence of this species from *Ascidia* sp. and *Pyura sacciformis*, respectively, in Korean waters.

*Pachypygus australis* Gotto, 1975 was described as an associate of *Pyura pachydermatina* (Herdman, 1881) collected off Sydney, Australia. Gotto (1975) noted that it shared numerous features in common with *P. curvatus*, such as the elongate second antennular segment, the location of the two proximal setae at the same level on the caudal ramus, the elongated first exopodal segment of legs 2–4, the linguiform third exopodal segment of leg 4, and the presence of multiple rows of spinules on the ventral surface of the protopod of leg 5. Gotto (1975) seems to have distinguished *P. australis* from *P. curvatus* largely on the basis of geographical separation, noting “were material available from areas to the north of Australia, this copepod might well be regarded merely as

a geographical race of *P. curvatus*”. The differences used by Gotto (1975) to separate these two species in his key referred to a minor setation character on leg 2, the pattern of tubercular ornamentation on the third exopodal segment of leg 4, and the shape of the protopodal segment of leg 5. None of these appears to be a significant difference given our increased knowledge of the wide scale distribution of *P. curvatus* across the Pacific. *Pachypygus australis* is here treated as junior subjective synonym of *P. curvatus*.

### *Pachypygus tumidus* sp. nov.

(Figs. 76, 77)

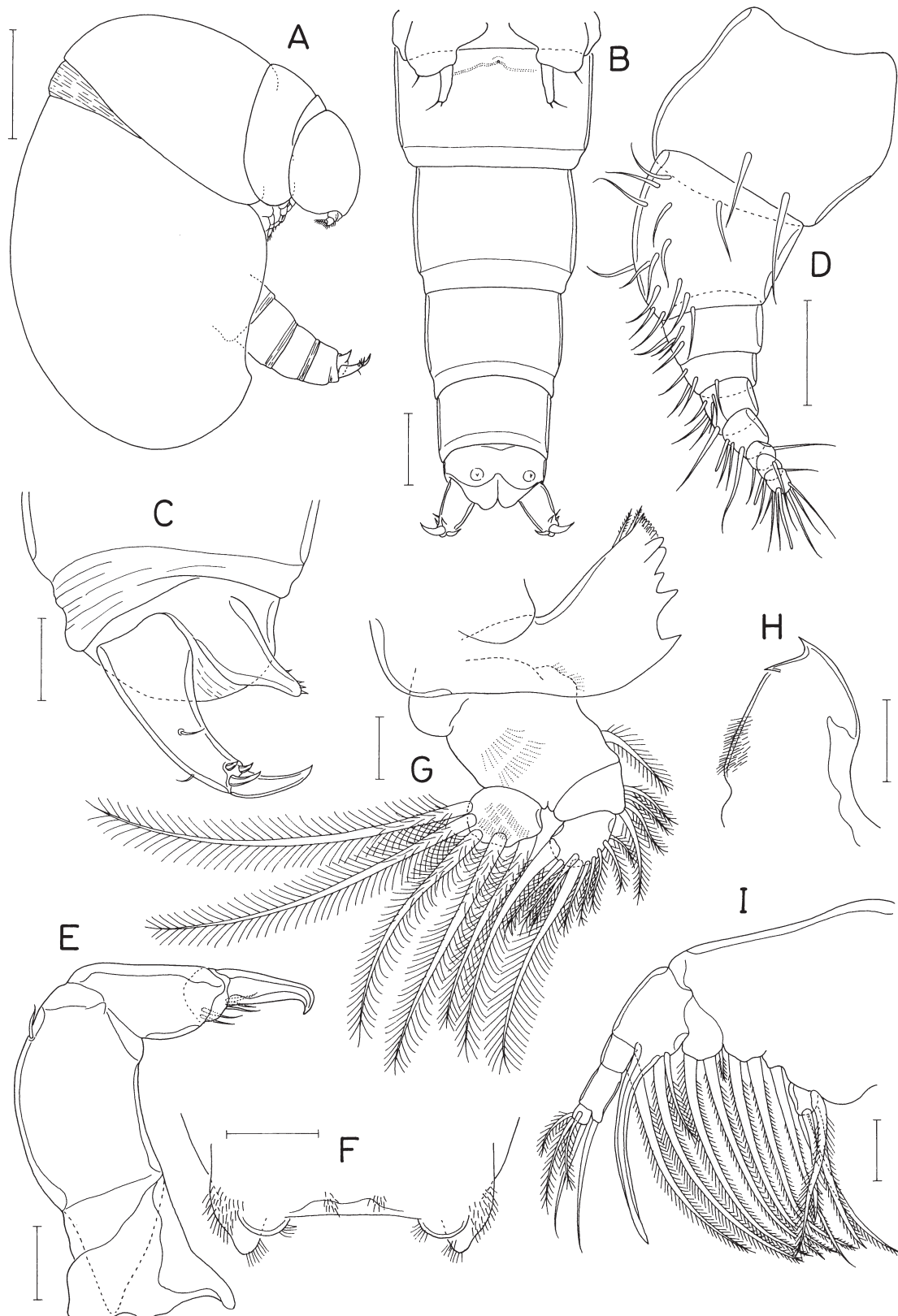
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21237) from *Herdmania pallida* (Heller, 1878) (MNHN-IT-2008-4630 = MNHN S2/HER/24), CRRF CRCHO 001, Turtle Island, Palau (07°18.56'N, 134°30.10'E), 17 February 1995.

**Etymology.** The specific name is derived from the Latin *tumid* (= swollen), referring to the swollen body.

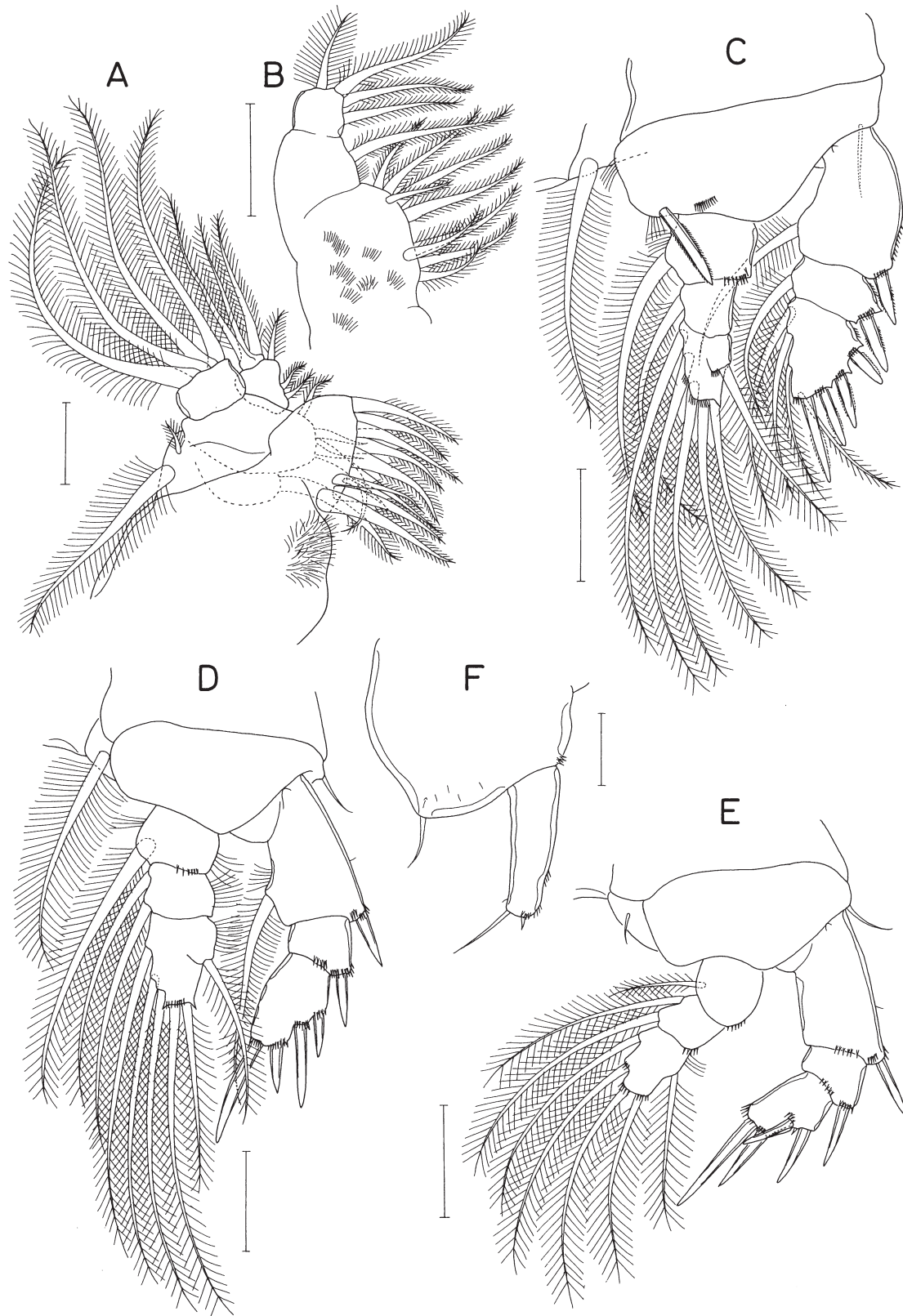
**Description of female.** Body (Fig. 76A) very similar in form to *P. gibber*, large, stout, moderately compressed, and firmly sclerotized. Body length 6.56 mm. Prosome 5-segmented. Third and fourth pedigerous somites expanded to form brood pouch; margin of brood pouch with distinct angle subdistally, visible in lateral view (Fig. 76A). Urosome (Fig. 76B) 6-segmented although fifth pedigerous somite obscure, largely fused with brood pouch. Genital and 4 free abdominal somites gradually narrowing distally, each much wider than long, 345×566, 351×468, 277×394, 191×326, and 147×295 µm, respectively. Anal somite (Fig. 76C) short, with pair of sclerotized, tapering ventral processes, each ornamented with spinules near tip. Caudal ramus (Fig. 76C) curved ventrally, tapering distally towards large terminal claw, 108 µm long, armed with 3 additional unequal claws 40, 18, and 16 µm long, plus 2 small setae positioned at 60% and 84% of ramus length.

Rostrum small. Antennule (Fig. 76D) small, tapering evenly towards tip; 9-segmented; armature formula 2, 14, 4, 4, 6, 4, 2, 2+aesthetasc, and 7+aesthetasc; all segments shorter than wide and all setae small and naked. Antenna (Fig. 76E) stout and 3-segmented; coxa short and unarmed; allobasis with 1 small seta on subdistal inner margin; free endopod 1-segmented, 1.7 times as long as wide (85×50 µm), armed with 5 small setae plus terminal claw, as long as segment.

Labrum (Fig. 76F) broad, with 2 pairs of setulose lobes (tapering outer lobe and weak, rounded inner lobe) posterolaterally; ornamented with small patches of minute spinules either side of mid-posterior border. Mandible (Fig. 76G) with 5 teeth, middle one smaller, and 2 small proximal setae on coxal gnathobase; basis with 1 seta on subdistal medial margin, patch of setules on proximal medial margin and 2 rows of setules on ventral surface;



**FIGURE 76.** *Pachypygus tumidus* sp. nov., female. A, habitus, right; B, urosome, ventral; C, distal part of abdomen, right; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxilla. Scale bars: A, 1 mm; B, 0.2 mm; C, 0.1 mm; D–I, 0.05 mm.



**FIGURE 77.** *Pachypygus tumidus* sp. nov., female. A, maxillule; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, F, 0.05 mm; B–E, 0.1 mm.

exopod unsegmented, armed with 5 setae (outer 2 longer than other 3); ornamented with about 3 rows of setules on ventral surface; endopod 2-segmented with 4 and 10 setae on first and second segments, respectively; first and fifth outer distal setae on second segment distinctly larger than other endopodal setae. Paragnath (Fig. 76H) as small lobe bearing 1 distal and 1 subdistal dentiform processes and setules on medial surface. Maxillule (Fig. 77A) with patch of setules on medial surface proximal to arthrite; armed with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 4 on medial margin of basis; exopod much wider than long, armed with 4 large setae distally; endopod with 6 setae, 3 each on first and second segments; second endopodal segment short, obscure. Maxilla (Fig. 76I) 5-segmented and armed as usual for genus; claw on basis slender and smooth; seta on second segment and one of 4 setae on third segment of endopod naked. Maxilliped (Fig. 77B) 3-segmented and armed with 9, 1, and 4 setae on first to third segments, respectively; articulations between segments incomplete; first segment ornamented with several short rows of minute spinules on both surfaces.

Legs 1–4 with 3-segmented rami (Fig. 77C–E). Inner seta on coxa large in legs 1 and 2, but small and naked in legs 3 and 4. Outer seta on basis of legs 1–4 small and naked. Inner distal spine on basis of leg 1 finely spinulose and longer than first endopodal segment. First exopodal segment of legs 2–4 less than twice as long as wide. Third exopodal segment of legs 1–4 about 1.5 times as long as wide. Inner setae absent on all exopodal segments of leg 4. First and third spines on third exopodal segment of legs 2 (Fig. 77D) and 3 longer than other 2 spines. Inner seta on first endopodal segment of leg 4 shorter than other setae on endopod. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2& 3	0-1	1-0	I-1; I-0; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-0; I-0; III, I, 0	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 77F) consisting of broad protopod and free exopod; protopod not demarcated from fifth pedigerous somite, bearing 1 naked seta at outer distal corner and scattered spinules at inner distal corner; exopodal segment gradually narrowing distally, armed with 1 small, spiniform seta and 1 naked seta, and ornamented with 2 groups of spinules on inner surface.

**Male.** Unknown.

**Remarks.** *Pachypygus tumidus* sp. nov. is very similar to *P. gibber* in body form. They also share the possession of 1 large and 3 smaller claws on the caudal ramus and an allobasis plus only 1 free endopodal segment on the antenna, plus they have similar setation on legs 1–4. The main differences between *P. tumidus* sp. nov. and *P. gibber* are as follows: (1) the anal somite lacks a posterodorsal process (vs. present in *P. gibber*); (2) the

antennule narrows gradually and has 2 setae on the first segment (vs. first and second segments markedly broader than distal segments, and with 3 setae on the first segment in *P. gibber*); (3) the basis of the antenna with 1 seta on inner margin (vs. with 1 seta on outer side in *P. gibber*); (4) the first endopodal segment of the maxillule bears 3 setae (vs. 4 setae in *P. gibber*); (5) the third exopodal segment of legs 2–4 is only 1.5 times longer than wide (vs. 2.5 times longer in *P. gibber*); and (6) the inner margins of the exopods of legs 2–4 are smooth (vs. spinulose in *P. gibber*). These differences are sufficient to justify the establishment of the new species.

***Pachypygus tenuirostris* sp. nov.**

(Figs. 78, 79)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21238) from *Polycarpa mytiligera* (Savigny, 1816), outer Récif Néokumbi, New Caledonia, NC 30, depth 20–30 m, Monniot coll., 09 March 1987.

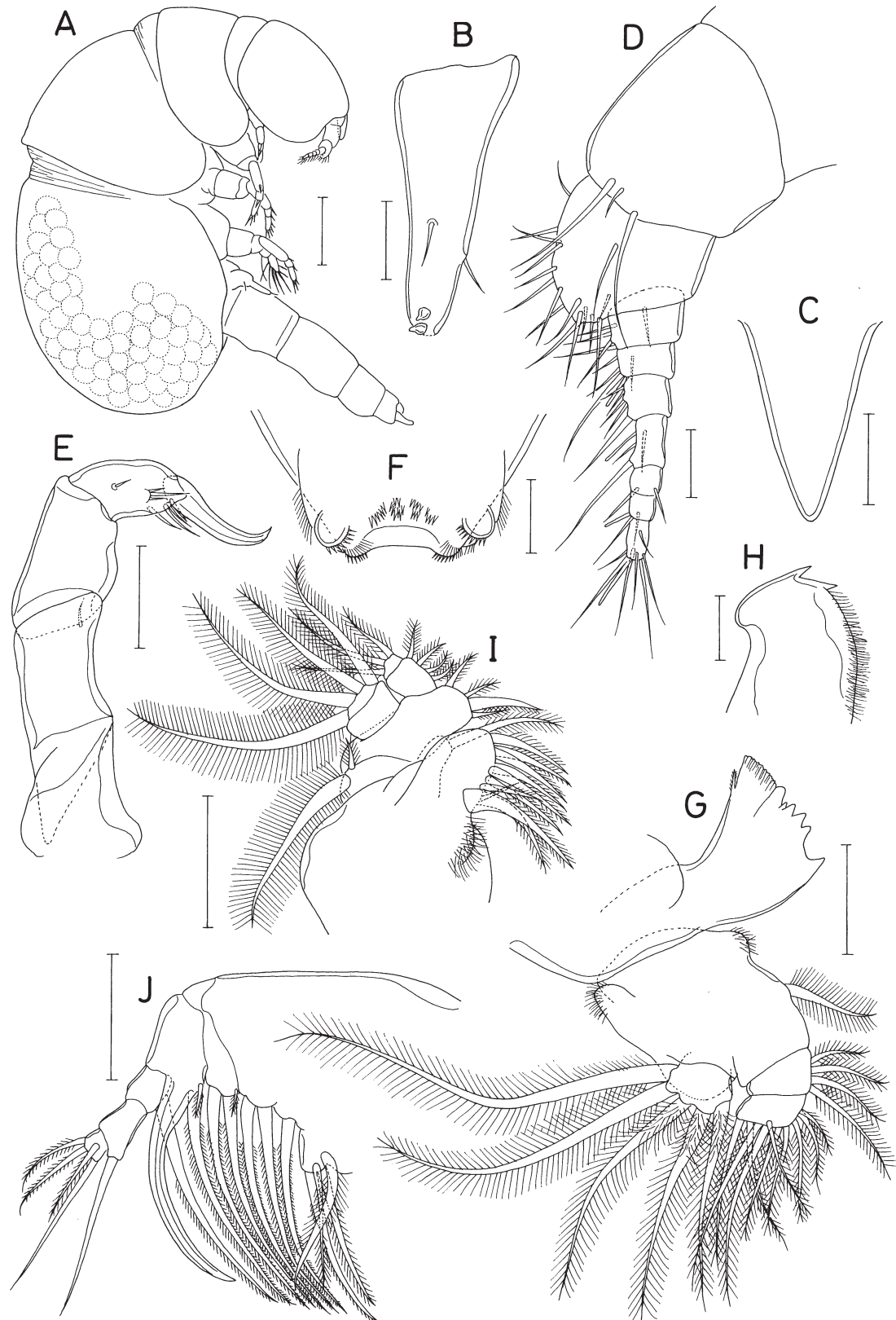
**Etymology.** The specific name *tenuirostris* is derived from the Latin *tenui* (=slender) and *rostr* (=a beak), alluding to the narrow rostrum of the new species.

**Description of female.** Body (Fig. 78A) compressed, with moderately sclerotized cuticle. Body length 5.56 mm. Cephalosome relatively small. Third pedigerous somite and brood pouch moderately expanded; brood pouch subcircular with rounded dorsal and posterior margins. Urosome 6-segmented, but fifth pedigerous somite obscure, largely incorporated into brood pouch. Genital somite shorter than first abdominal somite. Anal somite small, lacking process or spinules on ventral surface. Caudal ramus (Fig. 78B) about 2.4 times longer than wide (176×73 µm), tapering, armed with 2 setae and probably 4 claws (2 scars indicating positions of lost elements in holotype); 2 setae located at 60% and 72% of ramus length; 2 observed claws short and stout, only 11 µm long, slightly longer than wide.

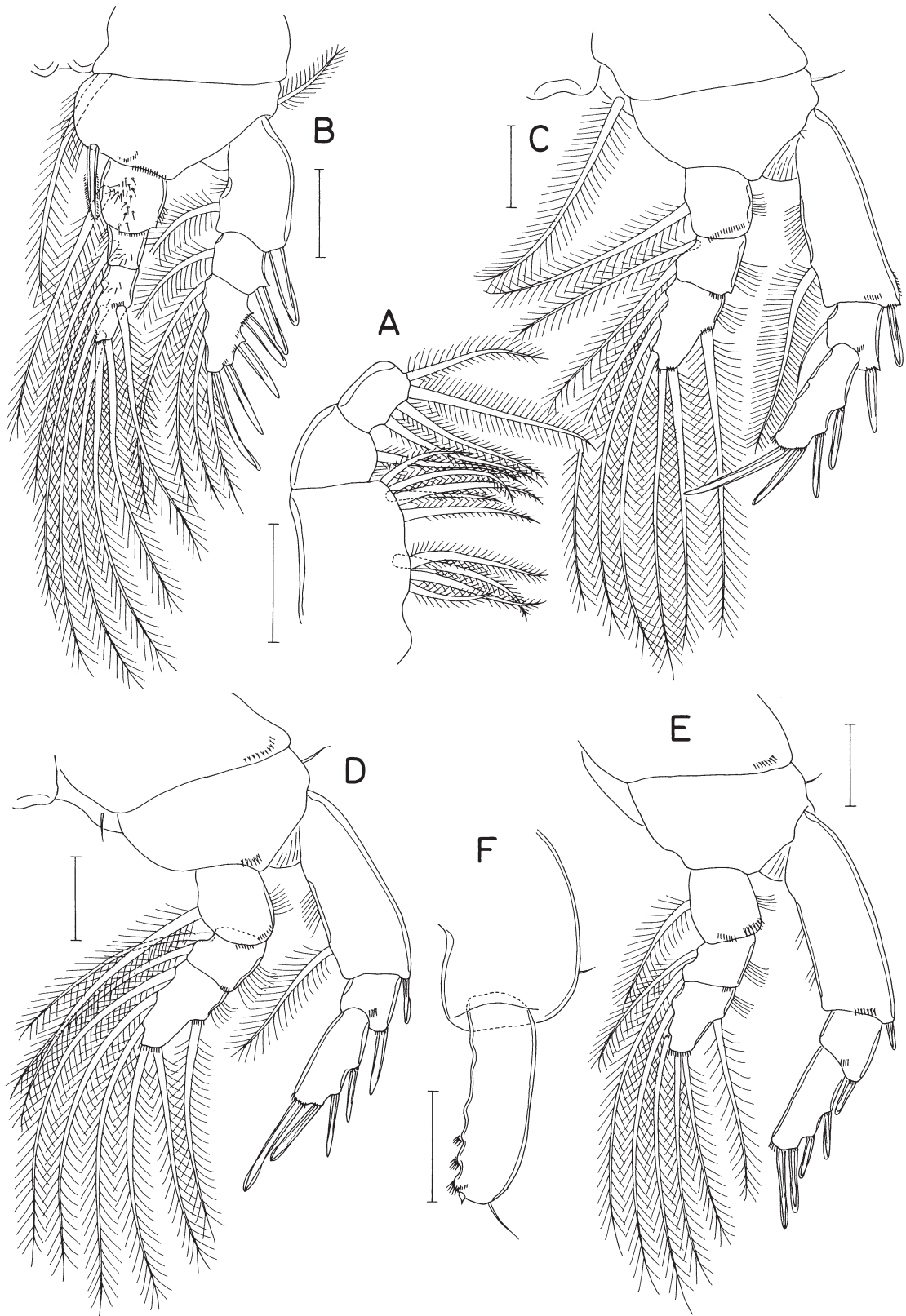
Rostrum (Fig. 78C) evenly tapering, beak-like, 109×75 µm. Antennule small, clearly 9-segmented (Fig. 78D); first and second segments expanded; armature formula 3, 16, 5, 4+aesthetasc, 5, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc. Antenna (Fig. 78E) 4-segmented; coxa unarmed; basis about twice as long as wide, with 1 small seta representing exopod near outer distal corner; first endopodal segment unarmed; compound distal endopodal segment shorter than first segment, 82×57 µm, about 1.45 times as long as wide, and armed with 8 small setae (grouped as 1, 3, 1, and 3) plus terminal claw, longer than segment.

Labrum (Fig. 78F) with semicircular posterolateral lobes, both spinulose, ornamented with 4 patches of spinules on mid-ventral surface, setules on lateral margins, and spinules and setules at posterolateral corners. Mandible (Fig. 78G) with 5 major teeth and 1 small proximal seta on coxal gnathobase, plus 1 subsidiary tooth between 2





**FIGURE 78.** *Pachypygus tenuirostris* sp. nov., female. A, habitus, right; B, left caudal ramus, outer; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scale bars: A, 0.5 mm; B–D, F, H, 0.05 mm; E, G, I, J, 0.1 mm.



**FIGURE 79.** *Pachypygus tenuirostris* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.1 mm.

proximal major teeth; basis armed with 1 subdistal seta, ornamented with patch of setules proximally on medial margin and setulose lobe proximally on outer margin; exopod unsegmented with 5 setae, outermost distinctly larger than other 4; endopod 2-segmented with 4 and 10 setae on first and second segments, respectively; 4 outer distal setae on second endopodal segment subequal in length. Paragnath (Fig. 78H) with 2 dentiform processes, located distally and subdistally, plus ornamentation of dense setules on medial margin. Maxillule (Fig. 78I) and maxilla (Fig. 78J) similar to those of *P. curvatus*. Maxilliped (Fig. 79A) distinctly 3-segmented, armed with 9, 1, and 4 setae on first to third segments, respectively.

Legs 1–4 with 3-segmented rami (Fig. 79B–E). Inner coxal seta large in legs 1 and 2, rudimentary in leg 3, and absent in leg 4. Outer seta on basis pinnate and moderately large in leg 1, but small and naked in legs 2–4. Inner distal spine on leg 1 basis 88 µm long, as long as first endopodal segment. First exopodal segment of legs 2–4 moderately elongate, about 2.5 times longer than wide. Third exopodal segment of legs 2–4 also about 2.5 times longer than wide, with smooth, linear inner margin. Endopodal segments of leg 1 with sensillae on anterior surface. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-0; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	I-0; I-0; III, I, 0	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 79F) protopod longer than wide, unornamented with rudimentary outer seta. Free exopodal segment about 3.2 times longer than wide (191×59 µm), armed distally with 1 small, strongly tapering seta (or spine) and 1 small, naked seta; ornamented with 3 rows of spinules on medial surface.

**Male.** Unknown.

**Remarks.** In the possession of a 2-segmented endopod in the antenna, *P. tenuirostris* **sp. nov.** can be readily differentiated from *P. gibber*, *P. globosus*, and *P. tumidus* **sp. nov.**, all three of which have an allobasis and only one free segment in the endopod. The two other congeners, *P. curvatus* and *P. macer*, which share a 2-segmented endopod can clearly be distinguished from the new species: in *P. curvatus* the second segment of the antennule is elongate, the first exopodal segment of legs 2–4 and the exopod of leg 5 are also elongate, whereas in the new species these segments are not elongate. In *P. macer* the brood pouch tapers in lateral view, the compound distal endopodal segment of the antenna is more than twice as long as wide (compared to only 1.45 times as long as wide in *P. tenuirostris* **sp. nov.**), and the second exopodal segment of leg 2 and the first exopodal segment of leg 3 both lack an inner seta (which is present in the new species).

***Pachypygus papillosus* sp. nov.**

(Figs. 80, 81)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21239), paratype (intact ♀, MNHN-IU-2014-21240), and dissected paratype (♀, figured) from the compound ascidian *Polycitor africanus* Monniot F. & Monniot C., 1997 (MNHN-IT-2008-6885 = MNHN A3/POL. A/21), CRRF OCDN 3667-U, Pemba Island, Tanzania (5°14.42'S–39°35.61'E), depth 30 m, 26 January 1996.

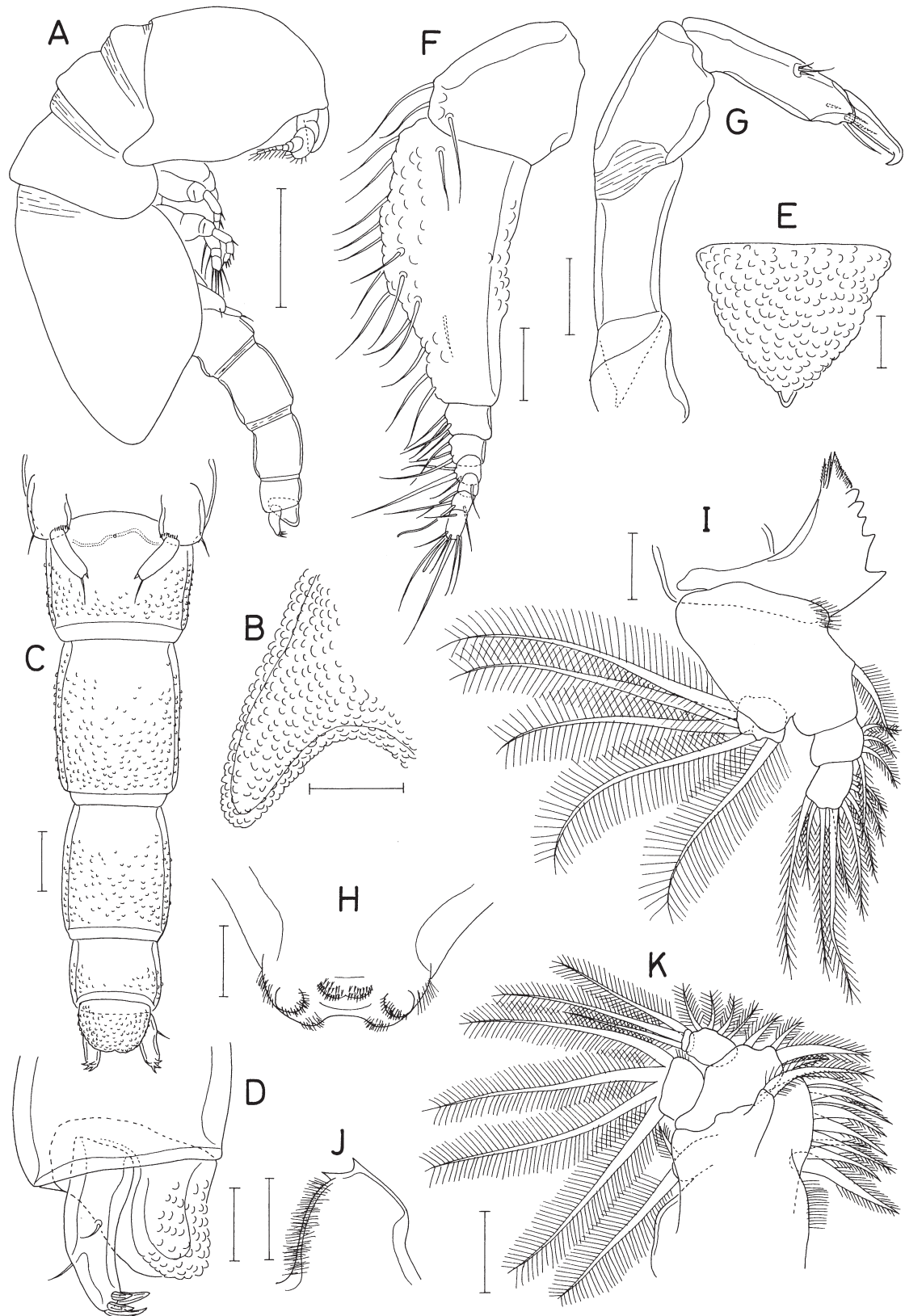
**Additional material.** 1 ♀ (MNHN-IU-2018-1812) from *P. africanus*, Pemba I., Tanzania, OCDN 3767-U; 1 ♀ (dissected) from *P. africanus*, Tanzania, OCDN 3667-U, 1996; 2 ♀♀ (MNHN-IU-2018-1813) from *P. africanus*, Ibo, Mozambique depth 0–20 m, November 1995.

**Etymology.** The specific name refers to the papillate ornamentation over body surface of the new species.

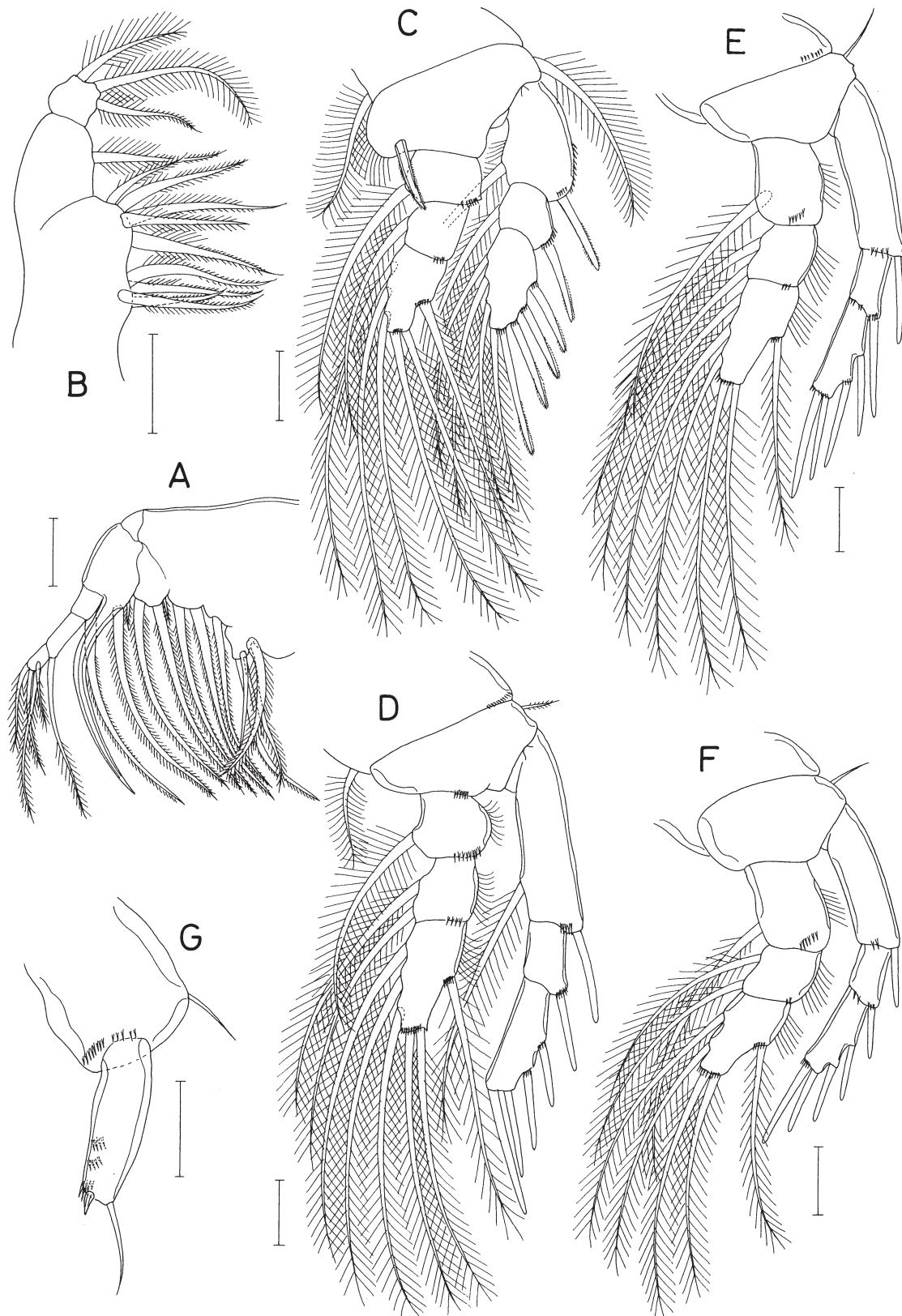
**Description of female.** Body (Fig. 80A) narrow in lateral view, ventrally flexed. Body with thick cuticle and surface densely ornamented with rounded papillae (Fig. 80B, C, D, E). Body length 2.65 mm. Dorsal shield of cephalosome with prominent, digitiform process at each posterolateral corner (Fig. 80A, B). Brood pouch with almost straight dorsal margin, tapering obliquely in posterior third. Fifth pedigerous somite short and largely fused with brood pouch. Free urosome (Fig. 80C) 5-segmented: genital somite rectangular, wider than long, 218×250 µm; 4 free abdominal somites 280×211, 225×185, 109×153, and 84×123 µm, respectively. Anal somite (Fig. 80D) with short dorsal margin and longer ventral margin in lateral view, and protruding posteroventrally, Caudal ramus (Fig. 80D) inserted proximally on dorsal surface of anal somite, about 2.75 times longer than wide (121×44 µm), slightly curved ventrally, narrowing distally; armed with 2 large and 2 small claws, plus 2 setae; lengths of claws 27, 21, 17, and 14 µm; 2 setae positioned at 48% and 71% of ramus length.

Rostrum (Fig. 80E) triangular, wider than long, 159×188 µm, densely papillate on ventral surface, and tipped with small conical process. Antennule (Fig. 80F) 8-segmented; second segment tapering, with papillate ornamentation, comprising about half length of entire antennule and about twice as long as wide; distal 6 segments small, combined length only half length of second segment; armature formula 3, 15?, 4, 3, 3, 2, 2+aesthetasc, and 7+aesthetasc; all setae small and naked. Antenna (Fig. 80G) narrow, 4-segmented; coxa and basis unarmed; first endopodal segment broad, unarmed; compound distal endopodal segment 1.2 times longer than first segment and 2.9 times as long as wide (94×32 µm); armed with 7 small setae (arranged as 3, 1, and 3) plus terminal claw, about half as long as segment.

Labrum (Fig. 80H) with paired semicircular lobes posterolaterally, both spinulose; posterior margin concave, mid-ventral lobe spinulose, and lateral margins setulose distally. Mandible (Fig. 80I) with 5 teeth and 2 small setae



**FIGURE 80.** *Pachypygus papillosus* sp. nov., female. A, habitus, right; B, posterolateral process of cephalosome; C, urosome, ventral; D, distal part of abdomen, right; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, paragnath; K, maxillule. Scale bars: A, 0.5 mm; B, C, 0.1 mm; D–K, 0.05 mm.



**FIGURE 81.** *Pachypygus papillosus* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: 0.05 mm.

on coxal gnathobase; basis with 1 seta and patch of setules proximally on medial margin; exopod unsegmented, armed with 5 subequal setae; endopod with 4 and 9 setae on first and second segments, respectively, second outer seta on distal margin of second endopodal segment small, about half as long as adjacent setae on either side. Paragnath (Fig. 80J) with 2 dentiform processes and setulose medial margin, as usual for genus. Maxillule (Fig. 80K) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 4 on medial margin of basis (second proximal seta much larger than other 3), 4 on exopod; endopod 2-segmented with 4 setae on medial margin of first segment and 3 setae on distal margin of small second segment. Maxilla (Fig. 81A) 5-segmented; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites, respectively; basis with slender, strongly curved claw plus 2 setae; slender endopod with 1, 1, and 4 pinnate setae on first to third segments, respectively. Maxilliped (Fig. 81B) 3-segmented, armed with 9, 1, and 3 setae on first to third segments, respectively; articulation between proximal 2 segments incomplete.

Legs 1–4 (Fig. 81C–F) with 3-segmented rami. Inner seta on coxa present in legs 1 and 2, lacking in legs 3 and 4. Outer seta on basis large in leg 1 but small in legs 2–4. Inner distal spine on basis of leg 1 longer than first endopodal segment, finely spinulose. Inner seta on first exopodal segment large in leg 2, absent in legs 3 and 4. Inner margin of second and third exopodal segments of legs 2–4 straight and smooth. First exopodal segment of legs 2–4 about 3 times longer than wide. Third exopodal segment about 3 times longer than wide in legs 2 and 3, about 2.5 times longer than wide in leg 4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-0; II, II, 0	0-1; 0-2; 1, 2, 3
Leg 3	0-0	1-0	I-0; I-0; II, II, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	I-0; I-0; II, II, 0	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 81G) protopod slightly longer than wide, armed with 1 seta at outer distal corner and ornamented with row of spinules distally near base of exopod; free exopodal segment about 3.1 times longer than wide (89×29 µm), armed with 1 small spine and 1 naked seta distally; ornamented with 3 rows of small spinules on medial surface.

**Male.** Unknown.

**Remarks.** As indicated by the specific name, the new species is characterised by the dense ornamentation of papillae on the dorsal surface of the prosome, all over the surface of the urosomites, and on certain appendages. The large processes on the cephalosome extend back from the posterolateral corners of the dorsal shield and are not known from any other species of *Pachypygus*. The presence of 9 setae on the second endopodal segment of the mandible, and the 3 setae on the third segment of the

maxilliped are also characteristic features; for comparison, all known congeners possess 10 and 4 setae, respectively, on these segments. Collectively these character states serve to clearly differentiate this distinctive new species from all of its congeners.

***Pachypygus exilis* sp. nov.**

(Figs. 82, 83)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21241) and paratype (♀, dissected) from the compound ascidian *Aplidium nadaense* (Nishikawa, 1980) (MNHN-IT-2008-576 = MNHN A1 /APL.B/407), CRRF OCDN 5743-A, Brooker Channel, Calvados Island Chain, Louisiade Archipelago, Papua New Guinea (11°03.09'S, 152°28.62'E), depth 7 m, 01 June 1998.

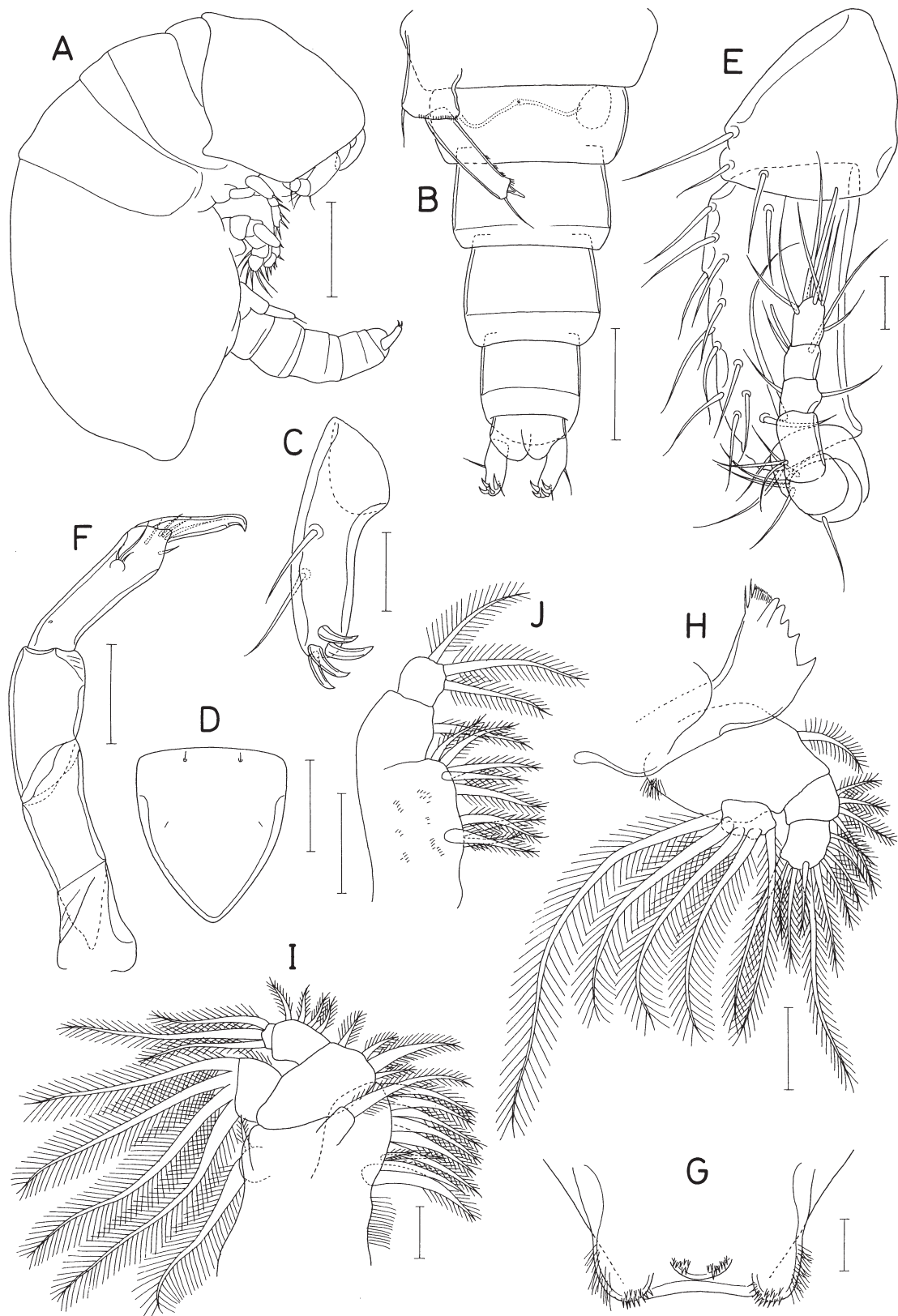
**Additional material.** 1 ♀ (dissected) from *Aplidium lineatum* Monniot F. & Monniot C., 1996, North Sulawesi, Indonesia, OCDN 1447-I.

**Etymology.** The specific name is from the Latin *exilis* (= small), referring to the relatively small body size of the new species.

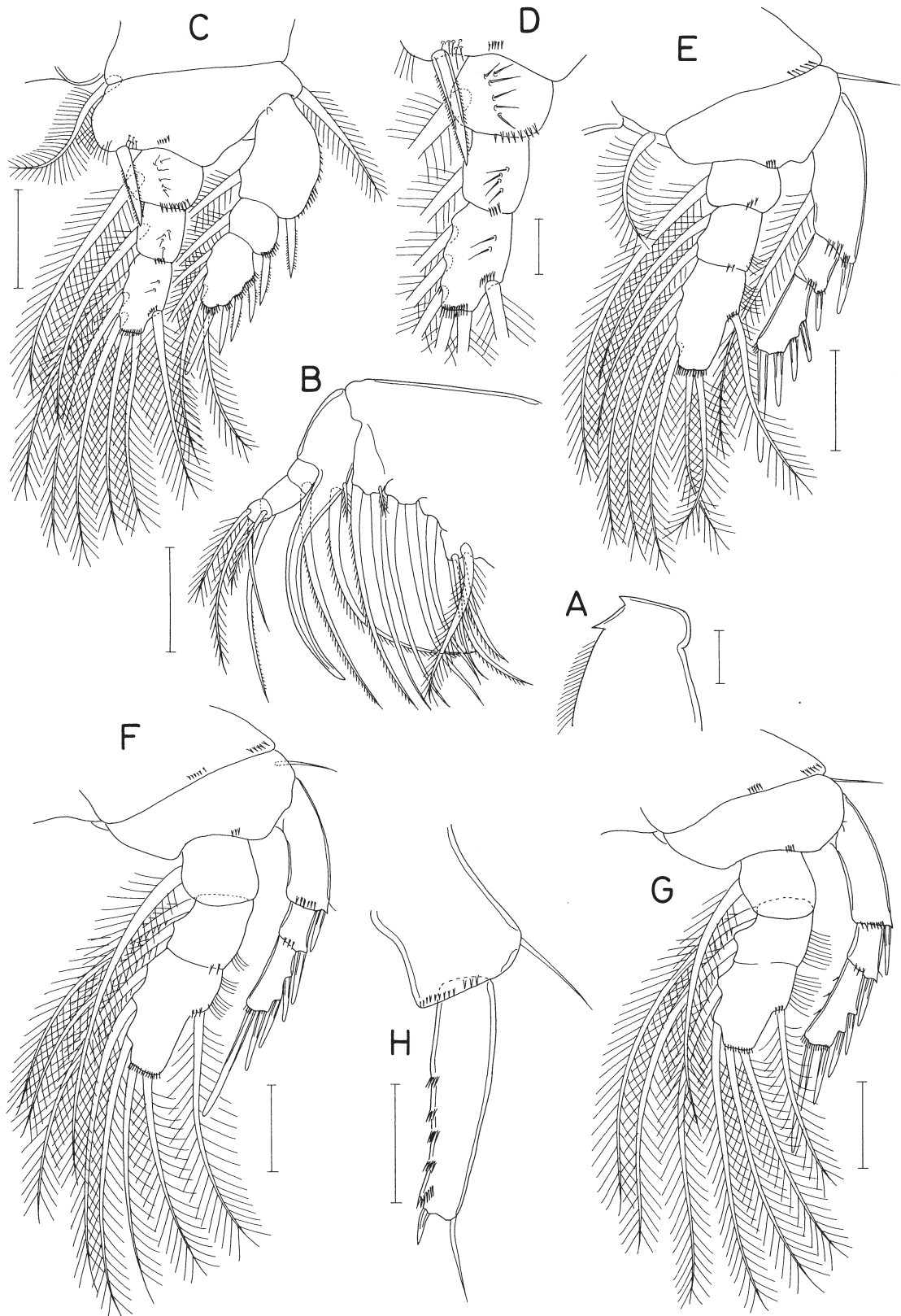
**Description of female.** Body (Fig. 82A) relatively small and stout, bilaterally compressed, and flexed ventrally. Body length 1.55 mm. Posterolateral corners of cephalosome produced into small nipple-like processes. Brood pouch tapering in posterior quarter towards blunt tip. Urosome (Fig. 82B) 6-segmented, distinctly narrowing posteriorly: fifth pedigerous somite 233 µm wide, distinct but not articulated from brood pouch. Genital somite much wider than long, 71×180 µm; 4 free abdominal somites 91×144, 98×122, 85×91, and 40×69 µm, respectively. Anal somite small, lacking posteroventral protuberance. Caudal ramus (Fig. 82C) about 2.8 times longer than wide (62×22 µm), armed with 4 distal claws and 2 setae; claws subequal in length and thickness, 13, 12, 11, and 11 µm long; 2 setae as long as greatest width of ramus, positioned at 49% and 67% of ramus length.

Rostrum (Fig. 82D) 94×82 µm, slightly longer than wide, tapering strongly in distal half, but with nearly parallel lateral margins proximally. Antennule (Fig. 82E) 9-segmented; first 2 segments broad; second segment elongate, about twice as long as wide; armature formula 3, 16 (2 setae omitted in Fig. 82E), 6, 4+aesthetasc, 5, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 82F) slender, 4-segmented; coxa, basis, and first endopodal segment unarmed; basis and first endopodal segment subequal in length; compound distal endopodal segment about 3.6 times longer than wide (87×24 µm) and about 1.3 times longer than first endopodal segment, armed with 8 setae (arranged as 3, 2, and 3) plus terminal claw, more than half as long as segment.

Labrum (Fig. 82G) with posterolateral prominences ornamented with setules laterally and spinules distally;



**FIGURE 82.** *Pachypygus exilis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, outer; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilliped. Scale bars: A, 0.2 mm; B, 0.1 mm; C, E, G, I, 0.02 mm; D, F, H, J, 0.05 mm.



**FIGURE 83.** *Pachypygus exilis* sp. nov., female. A, paragnath; B, maxilla; C, leg 1; D, endopod of leg 1; E, leg 2; F, leg 3; G, leg 4; H, leg 5. Scale bars: A, 0.02 mm; B–H, 0.05 mm.



small posteromedian lobe bearing spinules. Mandible (Fig. 82H) with 5 teeth and 2 small setae on coxal gnathobase; basis with 1 seta on medial margin and tuft of setules proximally on outer margin; exopod unsegmented, armed with 5 setae, outermost seta distinctly longer than other 4; endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 83A) as usual for genus. Maxillule (Fig. 82I) with 10 setae on arthrite, otherwise setation as in *P. papillosus* **sp. nov.** Maxilla (Fig. 83B) as usual for genus. Maxilliped (Fig. 82J) with 9, 1, and 3 setae on first to third segments, respectively; articulation incomplete between first and second segments.

Legs 1–4 (Fig. 83C–G) with 3-segmented rami. Inner coxal seta well-developed in legs 1 and 2, lacking in legs 3 and 4. Outer seta on basis large and pinnate in leg 1, small and naked in legs 2–4. Inner distal spine on basis of leg 1 longer than first endopodal segment, with spinulose margins. First to third endopodal segments of leg 1 (Fig. 83D) with 6, 3 or 4, and 2 or 3 sensillae, respectively, on anterior surface. First exopodal segment of legs 2–4 about 3 times longer than wide. Third exopodal segment of legs 2–4 about 2.5 times longer than wide. Armature formula for legs 1–4 as in *P. papillosus* **sp. nov.**

Leg 5 (Fig. 83H) protopod longer than wide, armed with 1 seta at outer distal corner and ornamented with row of spinules distally near base of exopod; free exopodal segment about 3.9 times longer than wide (101×26 µm), armed with 1 small spine and 1 naked seta distally, ornamented with 4 or 5 rows of small spinules on medial surface.

**Male.** Unknown.

**Remarks.** *Pachypygus exilis* **sp. nov.** most closely resembles *P. papillosus* **sp. nov.** as both have paired posterolateral processes on the corners of the dorsal shield of the cephalosome. Both also have 3 setae on the third segment of the maxilliped and share the identical armature formula for legs 1–4. They differ in: (1) the size of the posterolateral processes on the cephalosome, which are small in the new species but large in *P. papillosus* **sp. nov.**; (2) the unusually elongate second segment of the antennule is rectangular in the new species, compared to tapering in *P. papillosus* **sp. nov.**; and (3) the second endopodal segment of the mandible is armed with 10 setae in the new species, compared to only 9 setae in *P. papillosus* **sp. nov.** The most conspicuous difference, however, is that the new species lacks any papillate ornamentation on the body surface, in contrast to the highly ornate *P. papillosus* **sp. nov.**

### *Pachypygus stomozae* **sp. nov.**

(Figs. 84, 85)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21242) from the compound ascidian *Stomoza roseola* (Millar, 1955) (MNHN-

IT-2008-8049 = MNHN A3/STO/4), CRRF OCDN 1218-J, Manado Is., Sulawesi, Indonesia (01°23.74'N–124°32.41'E), depth 20 m, 06 May 1993.

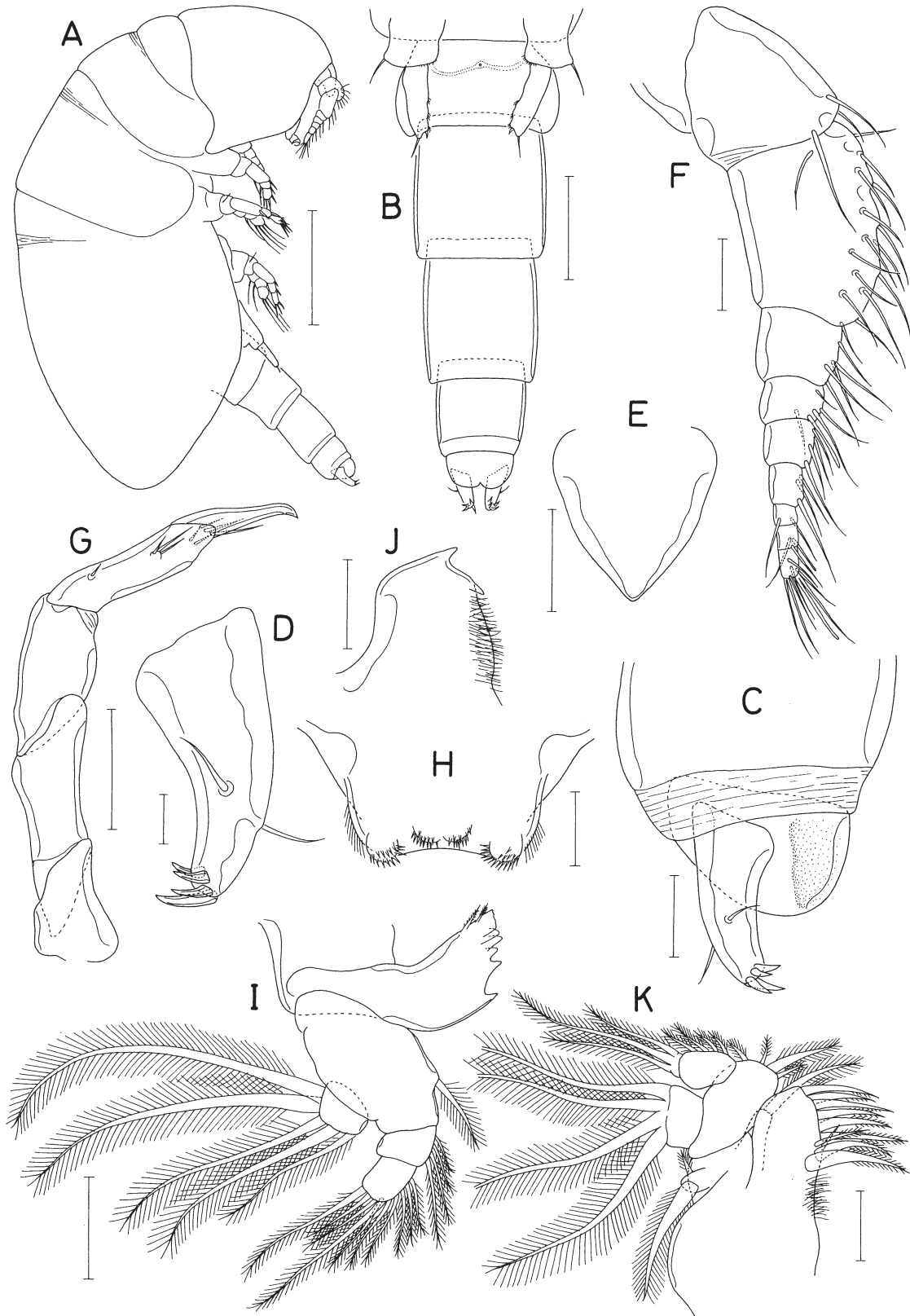
**Etymology.** The species name is derived from the generic name of the ascidian host.

**Description of female.** Body (Fig. 84A) bilaterally compressed, flexed ventrally. Body length 3.06 mm. Dorsal shield of cephalosome with prominent, nipple-like posterolateral processes. Brood pouch in lateral view slightly longer than wide, tapering in posterior third, with rounded posterior margin; fifth pedigerous somite largely incorporated into brood pouch. Free urosome (Fig. 84B) 5-segmented: genital somite much wider than long, 173×318 µm, with convex lateral margins; 4 free abdominal somites 286×259, 273×223, 182×173, and 68×132 µm, respectively. First to third abdominal somites each distinctly longer than wide. Anal somite (Fig. 84C) with rounded expansion ventrally, with sclerotized ventral surface. Caudal ramus (Fig. 84D) inserted dorsolaterally on anal somite, curved ventrally, tapering, about twice as long as wide (114×56 µm), and armed with 4 claws and 2 setae; claws 26, 17, 15, and 15 µm long; 2 setae shorter than width of ramus at base, positioned at 60% and 75% of ramus length.

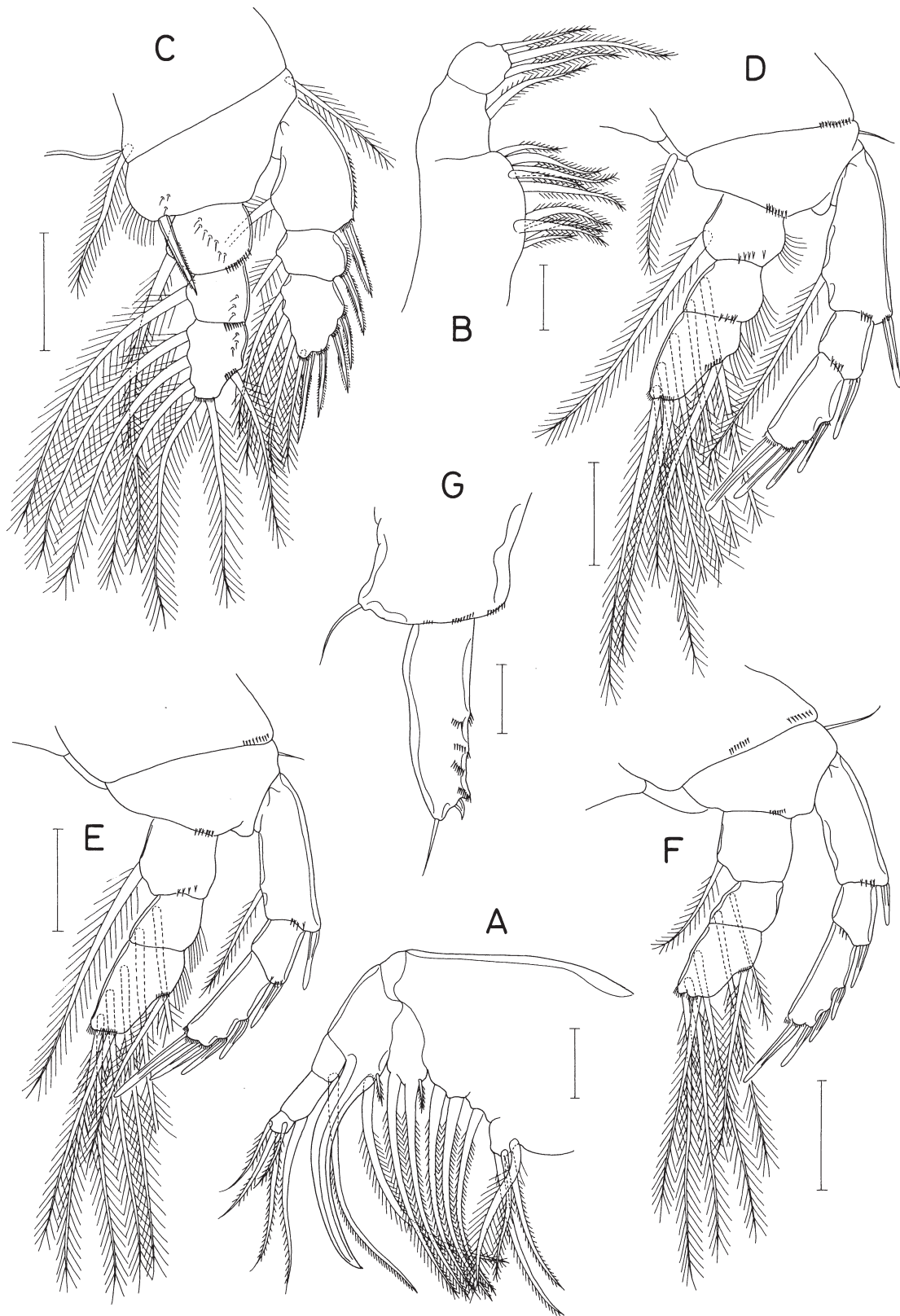
Rostrum (Fig. 84E) conical, slightly longer than wide (170×159 µm), with slightly angular apex. Antennule (Fig. 84F) 9-segmented, gradually narrowing from second to apical segments; armature formula 3, 16, 5, 4+aesthetasc, 4, 3, 2, 2+aesthetasc, and 7+aesthetasc; second segment broadest and longest, about 1.5 times longer than wide; all setae thin and naked. Antenna (Fig. 84G) slender, 4-segmented; coxa, basis and first endopodal segment unarmed; basis only slightly longer than first endopodal segment; compound distal endopodal segment about 3.5 times longer than wide (131×38 µm) and about 1.2 times longer than first; armed with 9 setae (arranged as 1, 3, 2, and 3) plus terminal claw, nearly as long as segment.

Labrum (Fig. 84H) setulose along lateral margins; with paired spinulose, semicircular posterolateral lobes and weak mid-posterior lobes. Mandible (Fig. 84I) with 5 teeth and 2 setae on coxal gnathobase; basis with 1 seta on medial margin; exopod unsegmented, armed with 5 setae, innermost shorter than others, outer 2 setae distinctly longer than other 3; endopod with 4 and 10 setae on first and second segments, respectively; second and third inner distal setae on second segment about half as long as first and fourth inner distal setae. Paragnath (Fig. 84J) with distal and subdistal dentiform processes and ornamented with setules on medial margin. Maxillule (Fig. 84K) and maxilla (Fig. 85A) armed as in *P. exilis* **sp. nov.** Maxilliped (Fig. 85B) 3-segmented and armed with 9, 1, and 3 setae on first to third segments, respectively; articulation between first and second segments incomplete.

Legs 1–4 (Fig. 85C–F) with 3-segmented rami. Inner seta on coxa well-developed in legs 1 and 2, but absent in legs 3 and 4. Outer seta on basis large and pinnate in leg



**FIGURE 84.** *Pachypygus stomozoe* sp. nov., female. A, habitus, right; B, urosome, ventral; C, distal part of abdomen, right; D, left caudal ramus, outer; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, paragnath; K, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, F, H, J, K, 0.05 mm; D, 0.02 mm; F, G, I, 0.1 mm.



**FIGURE 85.** *Pachypygus stomozoae* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, B, G, 0.05 mm; C–F, 0.1 mm.

1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 longer than first endopodal segment, 73  $\mu\text{m}$  long, ornamented with minute spinules along margins. Basis and first to third endopodal segments of leg 1 with 3, 7, 3, and 3 hair-like sensillae, respectively on anterior surface. First exopodal segments of legs 2–4 each about 2.5 times longer than wide. Third exopodal segment of legs 2–4 about 2.0, 2.6, and 2.6 times longer than wide, respectively. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-0; II, II, 0	0-1; 0-2; 1, 2, 3
Leg 3	0-0	1-0	I-1; I-0; II, II, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	I-0; I-0; II, II, 0	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 85G) 2-segmented: protopod about as long as wide, not articulated basally, with 1 outer distal seta and minute spinules on posteroventral border; free exopodal segment about 2.9 times longer than wide (144 $\times$ 49  $\mu\text{m}$ ), armed with small, claw-like spine and naked seta on oblique distal margin, and ornamented with 4 rows of minute spinules on medial surface.

**Male.** Unknown.

**Remarks.** In possessing paired posterolateral processes on the dorsal shield of the cephalosome and 3 setae on the third segment of the maxilliped, *Pachypygus stomozoe* **sp. nov.** is similar to *P. papillosus* **sp. nov.** and *P. exilis* **sp. nov.** It can be differentiated from *P. papillosus* **sp. nov.** by its smooth body surface, lacking the numerous papillae so characteristic of *P. papillosus* **sp. nov.**, and by the smaller posterolateral processes on the cephalosome and the possession of 10 setae on the second endopodal segment of the mandible (vs. 9 in *P. papillosus* **sp. nov.**). *Pachypygus stomozoe* **sp. nov.** is more similar to *P. exilis* **sp. nov.** The differences between the new species and *P. exilis* **sp. nov.** are as follows: (1) the body is almost twice as long, 3.06 mm long (vs. 1.55 mm in *P. exilis* **sp. nov.**); (2) the first and second abdominal somites are distinctly longer than wide (vs. wider than long in *P. exilis* **sp. nov.**); (3) the second antennular segment is about 1.5 times longer than wide (vs. about twice as long as wide in *P. exilis* **sp. nov.**); (4) the 2 outer setae on the mandibular exopod are longer than the other 3 setae (vs. the outermost seta is longer than the other 4 in *P. exilis* **sp. nov.**); and (5) the first exopodal segment of leg 3 bears an inner seta (vs. this seta lacking in *P. exilis* **sp. nov.**). This comprehensive set of differences justifies the establishment of the new species.

***Pachypygus bisetiger* sp. nov.**

(Figs. 86, 87)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21243), paratype (intact ♀, MNHN-IU-2014-21244),

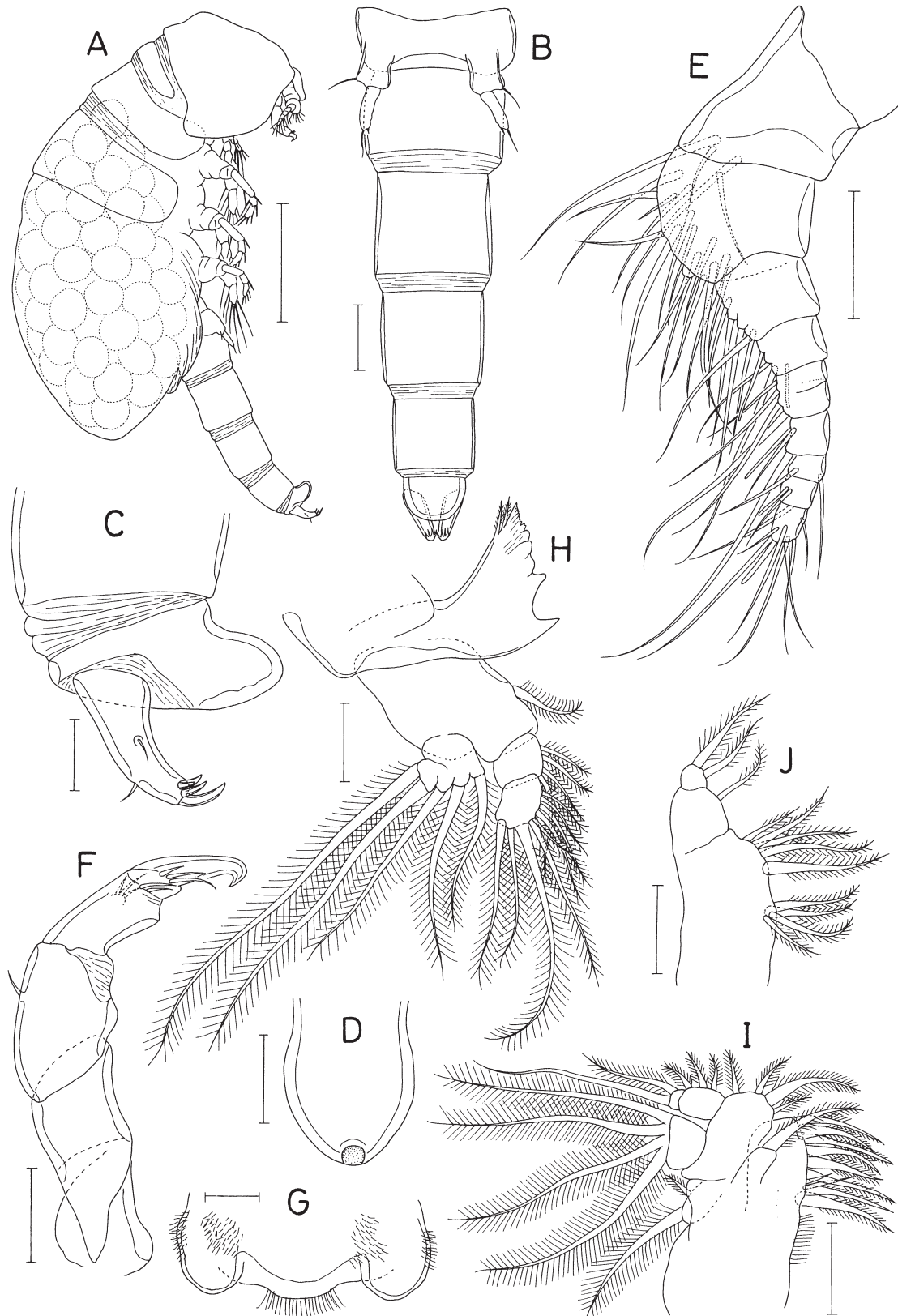
and dissected paratype (♀, figured), from the compound ascidian *Clavelina detorta* (Sluiter, 1904), lagoon, New Caledonia, B. Richer de Forges - ORSTOM coll.

**Etymology.** The specific name refers to the presence of the two setae on the third segment of the maxilliped.

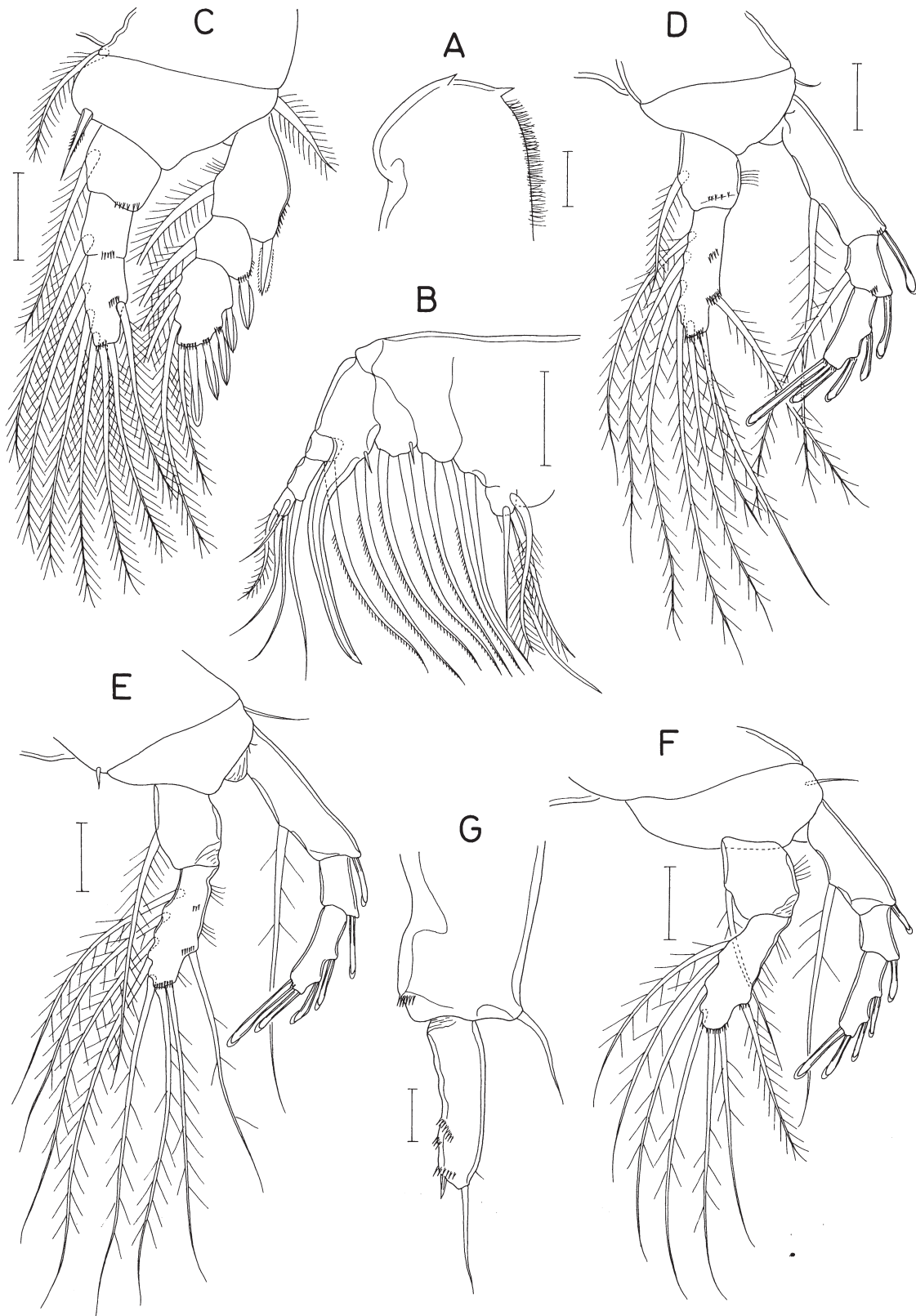
**Description of female.** Body (Fig. 86A) bilaterally compressed. Dorsal shield of cephalosome with short, broad posterolateral processes and convex dorsal protrusion. Dorsal tergites of first to third prosomites incompletely developed, with unsclerotized gaps between them. Third and fourth pedigerous somites forming brood pouch; fourth pedigerous somite suboval. Urosome (Fig. 86B) 6-segmented, gradually narrowing distally. Fifth pedigerous somite short, 90 $\times$ 242  $\mu\text{m}$ , but well-defined from fourth pedigerous somite. Genital and 4 free abdominal somites 155 $\times$ 215, 181 $\times$ 176, 167 $\times$ 158, and 121 $\times$ 124, and 67 $\times$ 94  $\mu\text{m}$ , respectively. Anal somite (Fig. 86C) with highly sclerotized posteroventral protrusion and short dorsal margin. Caudal ramus (Fig. 86C) inserted dorsolaterally on anal somite, about 2.5 times longer than wide (114 $\times$ 45  $\mu\text{m}$ ), narrowing distally, and armed with 4 distal claws (1 large and 3 small) and 2 setae; lengths of claws 35, 20, 17, and 14  $\mu\text{m}$ ; setae as long as distal width of ramus, positioned at 56% and 75% of ramus length.

Rostrum (Fig. 86D) bulbous, narrowing proximally, widest in middle, rounded distally and with large pore at apex. Antennule (Fig. 86E) 9-segmented, second segment widest, more distal segments narrowing gradually; fifth segment subdivided by incomplete suture line on posterior side; armature formula 3, 16, 5, 2+ 2 aesthetascs, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked and most setae long. Antenna (Fig. 86F) stout, 4-segmented; coxa and basis unarmed; first endopodal segment slightly shorter than basis, with 1 seta on inner margin; compound distal endopodal segment slightly shorter than first, twice as long as wide (61 $\times$ 32  $\mu\text{m}$ ); armed with 8 setae (grouped as 3, 2, and 3) plus terminal claw longer than segment.

Labrum (Fig. 86G) with large semicircular posterolateral lobes ornamented with setules on outer margin and inner side; convex posterior margin setulose. Mandible (Fig. 86H) with 6 teeth, including 4 blunt, indistinct proximal ones, and 2 small setae on coxal gnathobase; basis with 1 seta on medial margin; exopod with 5 setae, outer 2 distinctly larger than 3 inner setae; endopod with 4 and 9 setae on first and second segments, respectively; 2 outer distal setae on second endopodal segment subequal in length, third much larger than other 8. Paragnath (Fig. 87A) as usual for genus. Maxillule (Fig. 86I) with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite; basis with 4 setae on medial margin, second proximal seta larger than other 3; exopod with 4 setae distally; endopod 2-segmented, with 3 small setae on first, and 2 (1 long, naked and 1 short pinnate) setae on second segment. Maxilla (Fig. 87B) 6-segmented; precoxa with 4 and 1 setae on first and second endites, respectively;



**FIGURE 86.** *Pachypygus bisetiger* sp. nov., female. A, habitus, right; B, urosome, ventral; C, distal part of abdomen, right; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilliped. A, 0.5 mm; B, 0.1 mm; C–F, H–J, 0.05 mm; G, 0.02 mm.



**FIGURE 87.** *Pachypygus bisetiger* sp. nov., female. A, paragnath; B, maxilla; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, G, 0.02 mm; B–F, 0.05 mm.

coxa incompletely articulated from precoxa, with 2 and 3 setae on first and second endites, respectively; basis with slender, smooth claw plus 2 setae; endopod slender with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 86J) 3-segmented, armed with 9, 1, and 2 setae on first to third segments, respectively; third segment small; articulation incomplete between first 2 segments.

Leg 1 (Fig. 87C) with 3-segmented rami. Legs 2–4 (Fig. 87D–F) each with 3-segmented exopod and 2-segmented endopod. Inner seta on coxa well-developed in leg 1, rudimentary in leg 3, but apparently absent in legs 2 and 4. Outer seta on basis broad and pinnate in leg 1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 acutely pointed at tip, 39 µm long, slightly longer than first endopodal segment. Outer spines on exopods of legs 2–4 slender, but swollen distally. First exopodal segment of legs 2–4 elongated, about 3.3 times longer than wide in legs 2 and 3 and 2.5 times in leg 4. Setae on legs 2–4 sparsely pinnate. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; II, II, 0	0-1; 1, 2, 5
Leg 3	0-1	1-0	I-1; I-0; II, II, 0	0-1; 1, 2, 5
Leg 4	0-0	1-0	I-1; I-0; II, II, 0	0-1; 1, 2, 4

Leg 5 (Fig. 87G) 2-segmented. Protopod longer than wide, fused with somite, armed with 1 naked seta at outer distal corner and ornamented with row of several minute spinules near inner distal corner; free exopodal segment about 3.4 times longer than wide (65×19 µm), armed distally with 1 small spine and 1 naked seta; ornamented with 3 rows of minute spinules on medial surface.

**Male.** Unknown.

**Remarks.** *Pachypygus bisetiger* **sp. nov.** is unique in the genus in having only 2 setae on the third segment of the maxilliped; all other species have either 3 or 4 setae. In addition, there are only 2 setae on the second endopodal segment of the maxillule in the new species, whereas there are 3 setae on this segment in all other described species. The 2-segmented endopod of legs 2–4 in the new species is also unique: all other species have 3-segmented endopods on these legs. The distal segments of the 2-segmented endopods are compound, representing the second and third ancestral segments.

### Genus *Notopterophorus* Leuckart, 1859

**Diagnosis.** Female body with large brood pouch, often extending from third pedigerous somite backwards, incorporating fourth pedigerous somite and most of fifth. First to third or fourth pedigerous somites each typically with paired dorsal wing-like extensions; extensions often terminating in slender tapering process(es). Free

urosome 5-segmented in female consisting of genital somite and 4 abdominal somites. Urosome 6-segmented in male. Anal somite often with processes. Caudal rami curved; armed with 4 claws and 2 setae. Rostrum well-developed. Female antennule 8- or 9-segmented, with first and second segments typically broader than distal segments: segmental fusion pattern I-II, III-XI, XII-XIV, XV-XVI, XVII-XX, XXI-XXIII, XXIV, XXV, XXVI-XXVIII; or with additional compound segment XII-XVI in 8-segmented species. Male antennule typically 9-segmented; non-geniculate. Antenna consisting of coxa, basis, and 2-segmented endopod or with allobasis incorporating first endopodal segment and 1-segmented free endopod; exopod reduced to seta or absent. Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and 4 and 10 setae on first and second endopodal segments, respectively (3 and 8 in *N. glabrus* **sp. nov.**). Maxillule with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on medial margin of basis; exopod unsegmented with 4 setae distally; endopod 2-segmented with variable setation on first and second segments; unsegmented in some species. Maxilla indistinctly 5-segmented, syncoxa enditic formula 4, 1, 2, 3, or reduced; basis with claw plus 2 setae, 3-segmented endopod with setal formula 1, 1, 3 or 4. Maxilliped 3-segmented and armed with 9 setae on first segment, 1 on second and 4 on third (rarely 3). Legs 1–4 biramous with 3-segmented exopods and 2-segmented endopods; first exopodal segment of legs 2–4 typically elongate; armature formula of female typically:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 1, 2, 4
Legs 2 & 3	0-1	1-0	I-1; I-1; III, I, 0	0-1; 1, 2, 5
Leg 4	0-1	1-0	I-0; I-1; II, I, 0	0-1; 1, 2, 4

Leg 5 consisting of large protopod fused to somite and free exopodal segment armed with 2 elements.

**Type species.** *Notopterophorus elongatus* Buchholz, 1869.

**Remarks.** *Notopterophorus* is a problem genus; indeed, it lies at the focal point of a cluster of nomenclatural and taxonomic problems. Firstly, as noted by many previous authors, *Notopterophorus* of Costa, 1840 is a *nomen nudum*. Sars (1921) attributed this genus to Costa (1852) as this publication included a plate of figures some of which clearly represented a *Notopterophorus*. Illg & Dudley (1965) considered this issue at some length and finally attributed the genus *Notopterophorus* to Leuckart (1859). This treatment was followed by Gotto (1993), for example, but has not been universally adopted. Secondly, species delimitation is an historic problem within the genus *Notopterophorus*. Illg & Dudley (1965) devoted considerable effort into the careful analysis of the nominal species and their diagnostic features in their study of the notodelphyids from the vicinity of Naples. They

recognized five species as valid, providing redescrptions of three of them: *N. elongatus* Buchholz, 1869, *N. papilio* Hesse, 1864, and *N. elatus* Giesbrecht, 1882, and treating two others as valid, *N. auritus* (Thorell, 1859) and *N. micropterus* Sars G.O., 1921. The painstaking study of Illg & Dudley (1965) also established numerous synonymies between early species records that were incompletely or inadequately described by Costa (1852), Hesse (1864, 1869), Buchholz (1869), Leuckart (1859), Aurivillius (1882), Kerschner (1879) and others. In his synopsis of the British fauna Gotto (1993) included four species, *N. auritus*, *N. elatus*, *N. elongatus*, and *N. papilio*. Currently five species are listed as valid in the World of Copepoda (Walter & Boxshall, 2020): *N. micropterus*, *N. auritus*, *N. elongatus*, *N. papilio* and *N. elatus*—all widely recorded in European waters.

Various characters, including the positions of the 2 caudal setae, the setation of particular appendages, and even the relative lengths of setae and spines on these appendages, have been highlighted as useful in species discrimination. However, after careful comparison between the appendages of the described species, we have failed to find reliable differences between species. Our comparisons excluded *N. cristatus* Hesse, 1871 which is a *species inquirendum*. Some characters have been recognized as variable: for example, the endopod of the maxillule has been described as having either 6 or 7 setae. Sars (1921) figured the 7 (4+3) setae condition of the endopod in *N. auritus*, but only 6 setae were present in one of our examined specimens. Illg & Dudley (1965) reported that the setation could be either 6 or 7 in *N. papilio* and *N. elongatus*. In an individual of *N. papilio* we observed the 6 and 5 setae conditions on different sides of the body. Given our current inadequate state of knowledge concerning variability exhibited within this genus, we here treat this variability as infraspecific.

### *Notopterophorus micropterus* Sars G. O., 1921 (Figs. 88–91)

**Material examined.** 8 ♀♀, 2 ♂♂ (MNHN-IU-2018-1814) from *Ascidia mentula* Müller, 1776, Bergen, Norway; 63 ♀♀, 1 ♂ (MNHN-IU-2018-1815) and dissected 2 ♀♀, 1 ♂ from *A. mentula*, Bergen, Norway.

**Supplementary description of female.** Body (Fig. 88A) dark brown in colour after alcohol preservation. Body length 5.40 mm. Prosome (Fig. 88B) with somites defined from each other by weak constrictions. First to third pedigerous somites each with paired dorsal extensions; small on first pedigerous somite, short, broad and with pointed apex on second, and tapering and with slender apical process on third. Brood pouch oval in dorsal view, with conical process on posteromedial margin (process variable in size, pointed or blunt, sometimes absent). Urosome 6-segmented, but fifth pedigerous somite largely

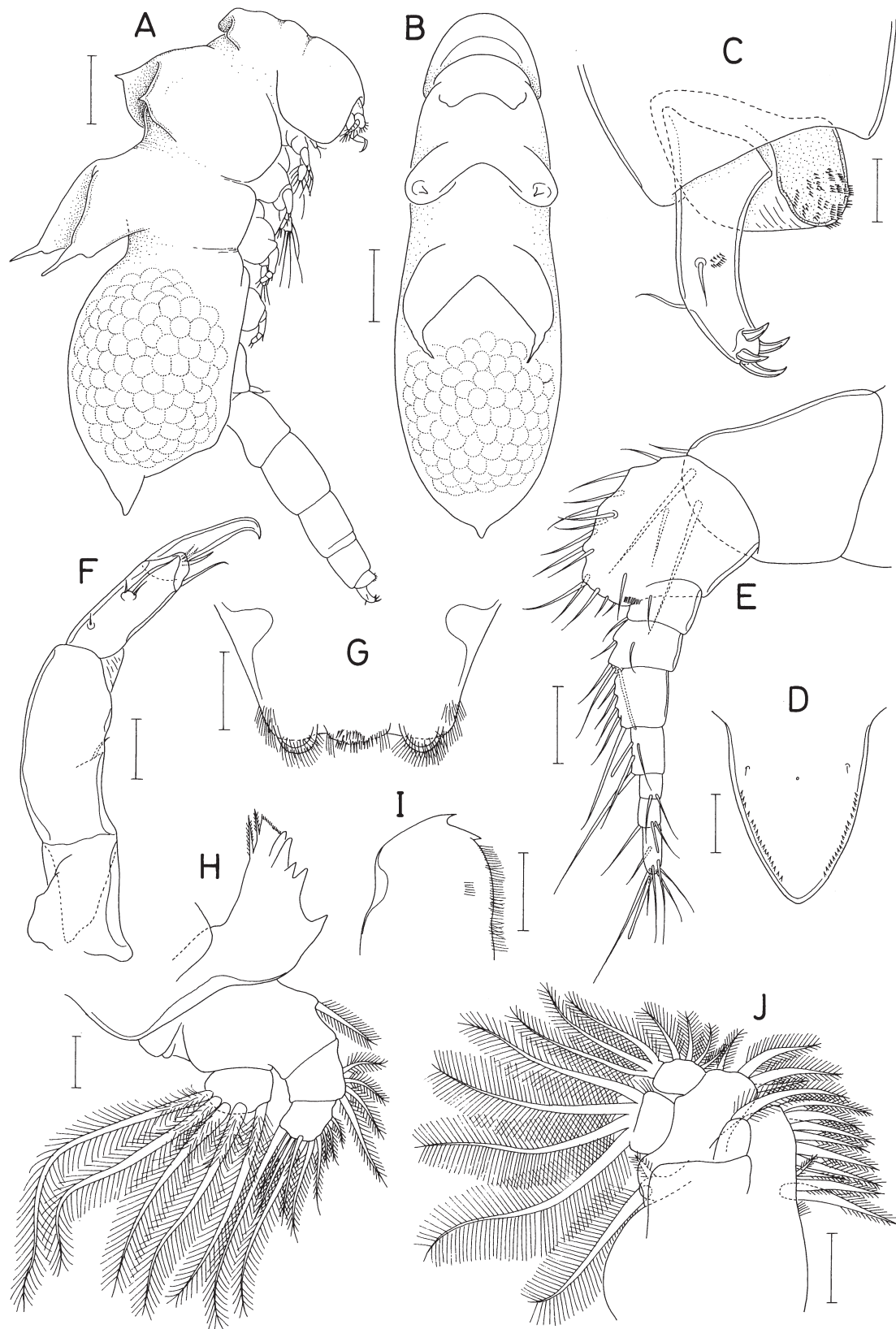
incorporated into brood pouch. Genital somite 408×476 µm; 4 free abdominal somites 497×415, 401×340, 258×252, and 17×190 µm, respectively. Anal somite (Fig. 88C) highly sclerotized ventrally and ornamented with rows of minute spinules. Caudal ramus (Fig. 88C) about 2.4 times longer than wide, gradually narrowing distally, armed with 4 claws and 2 setae; claws 36, 29, 25, and 22 µm long; 2 setae located at 60% and 74% of ramus length; ornamented with patch of minute spinules near proximal seta.

Rostrum (Fig. 88D) small, conical, 67×47 µm, with slightly convex lateral margins each with row of minute spinules. Antennule (Fig. 88E) 9-segmented; first and second segments expanded; armature formula 3, 16, 2, 4+aesthetasc, 5, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; second segment with minutely wrinkled surface near articulation with third segment. Antenna (Fig. 88F) consisting of coxa, allobasis and free 1-segmented endopod; coxa unarmed; allobasis with 1 small seta and short trace of suture at region slightly proximal to midlength; free compound endopodal segment 2.25 times longer than wide (90×40 µm), shorter than basis, and armed with 8 small setae plus terminal claw, as long as segment.

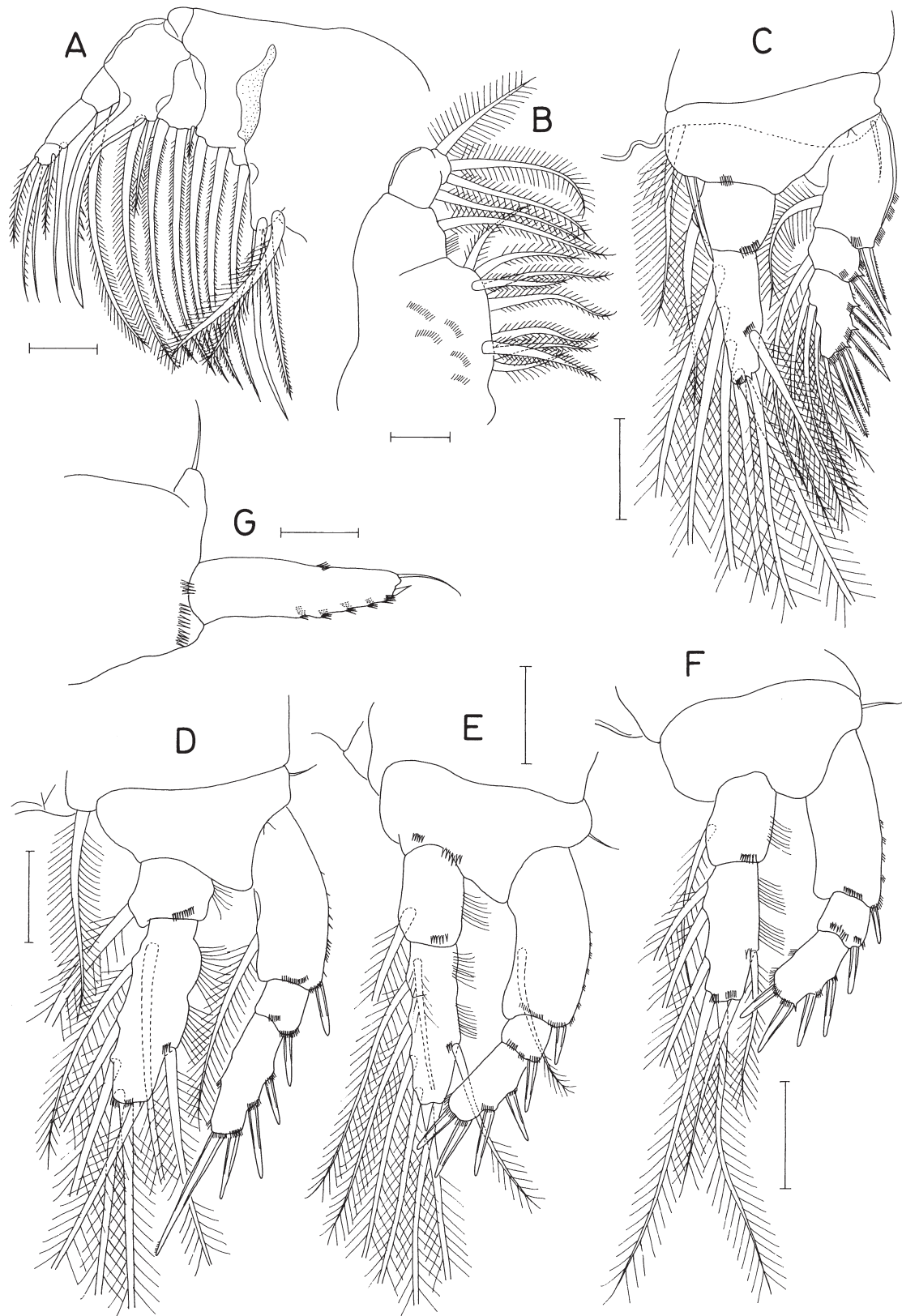
Labrum (Fig. 88G) with 3 setulose lobes along distal margin. Mandible (Fig. 88H) with 5 teeth along medial margin of coxal gnathobase, middle tooth smaller than other 4; basis with 1 medial seta; exopod with 5 setae, outermost seta longer than others; endopod with 4 and 10 setae on first and second segments, respectively; outermost and fifth outer seta on distal margin of second segment distinctly longer than others on segment. Paragnath (Fig. 88I) with 2 pointed processes (1 apical and 1 subapical) and setulose medial margin. Maxillule (Fig. 88J) armed with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite; basis with 4 setae on medial margin, 2 middle setae larger than other 2; exopod with 4 setae distally; endopod 2 segmented with 4 and 3 setae on first and second segments, respectively. Maxilla (Fig. 89A) 5-segmented; syncoxa subdivided by incomplete unsclerotized region, with 4, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 2 setae and 1 slender claw bearing 2 or 3 pairs of spinules on concave margin; endopod slender, armed with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 89B) 3-segmented, but first and second segments separated by incomplete articulation; armed with 9, 1, and 4 setae on first to third segments, respectively; first segment ornamented with rows of minute spinules on anterior and posterior surfaces; third segment with faint, incomplete suture line.

Legs 1–4 (Fig. 89C–F) each with 3-segmented exopod and 2-segmented endopod; exopods slightly longer than endopods. Inner seta on coxa well-developed in legs 1 and 2, but lacking in legs 3 and 4. Outer seta on basis small in all legs. Inner distal seta on basis of leg 1 slender, smooth, and longer than first endopodal segment.

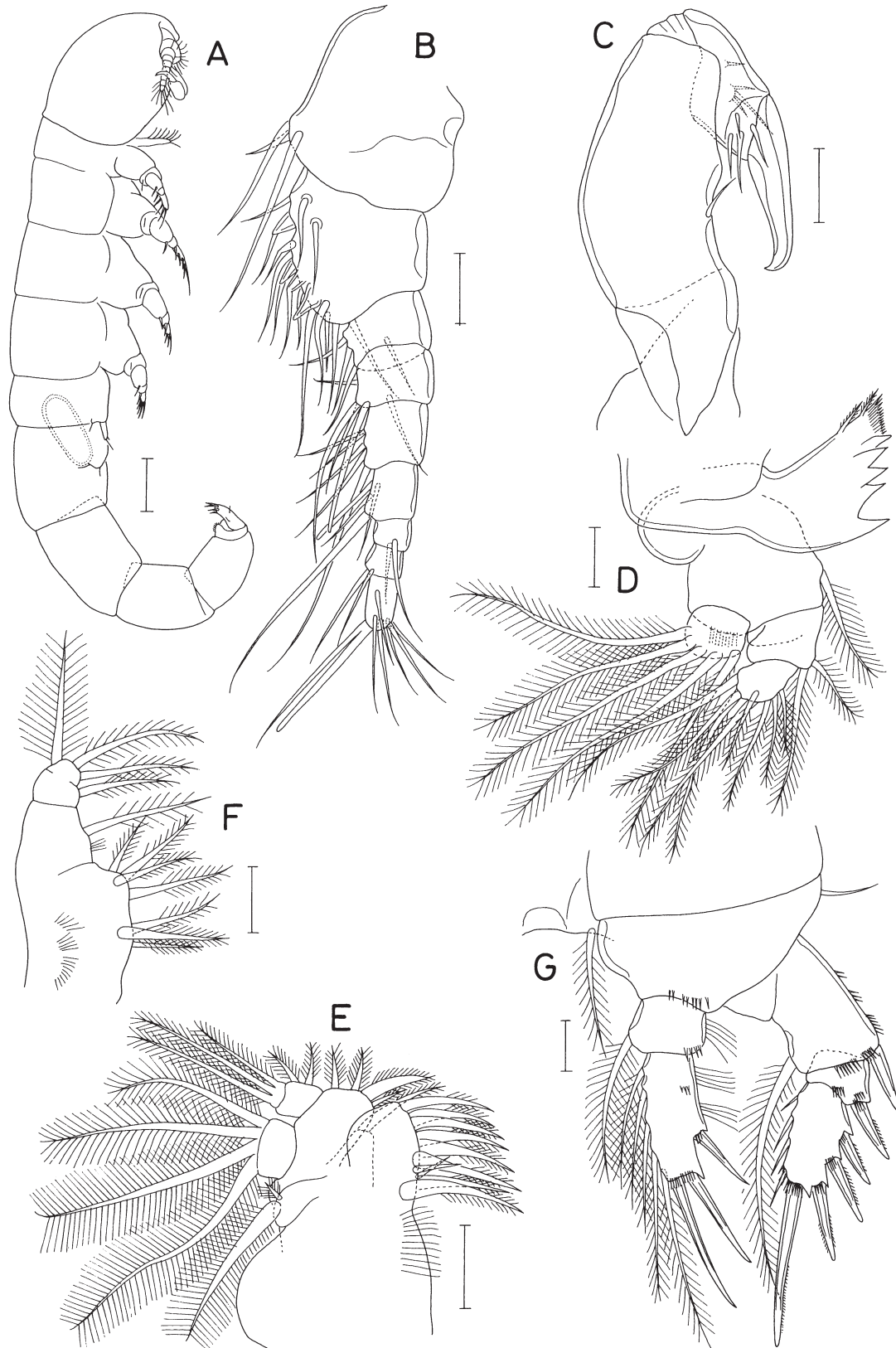




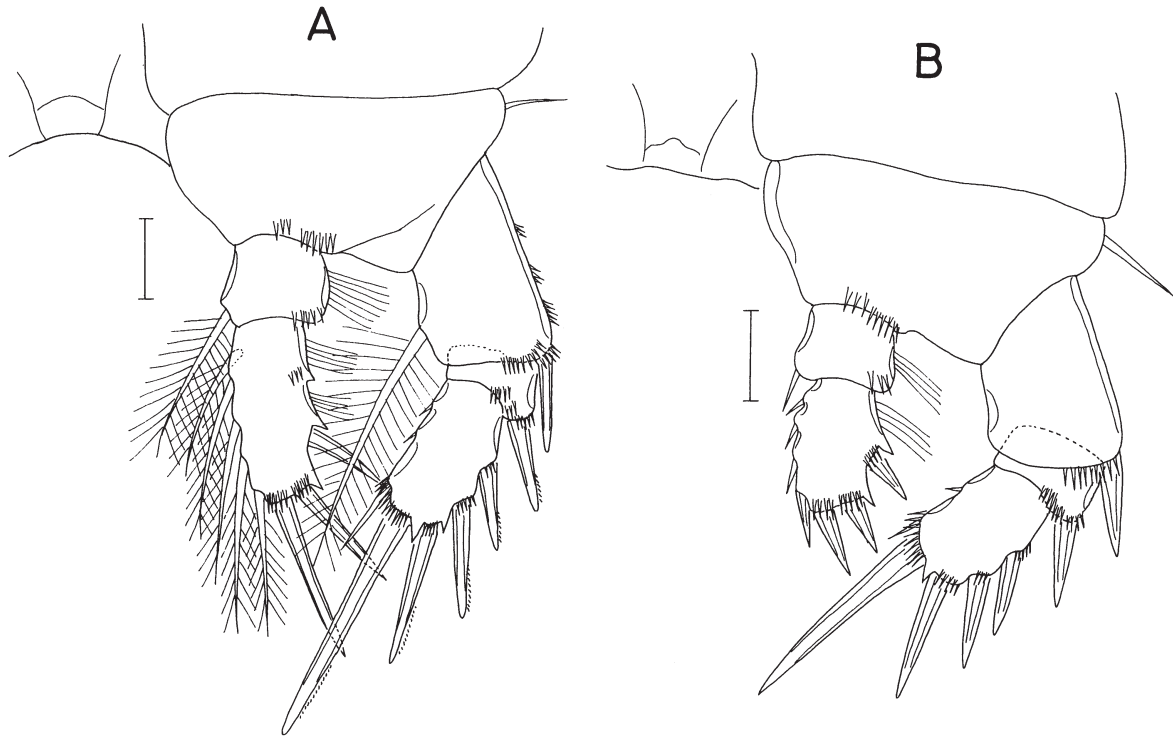
**FIGURE 88.** *Notopterophorus micropterus* Sars G. O., 1921, female. A, habitus, right; B, habitus, dorsal; C, distal part of abdomen, right; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, B, 0.5 mm; C, E–J, 0.05 mm; D, 0.02 mm.



**FIGURE 89.** *Notopterophorus micropterus* Sars G. O., 1921, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, B, G, 0.05 mm; C–F, 0.1 mm.



**FIGURE 90.** *Notopterophorus micropterus* Sars G. O., 1921, male. A, habitus, right; B, antennule; C, antenna; D, mandible; E, maxillule; F, maxilliped; G, leg 2. Scale bars: A, 0.1 mm; B–G, 0.02 mm.



**FIGURE 91.** *Notopterophorus micropterus* Sars G. O., 1921, male. A, leg 3; B, leg 4. Scale bars: 0.02 mm.

Distalmost spine on third exopodal segment of leg 2 distinctly longer than other spines on same segment, but same element on legs 3 and 4 shorter than other spines on segment. Second endopodal segment of leg 3 with trace of articulation at proximal third (Fig. 89E). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 1, 2, 4
Leg 2	0-1	1-0	I-1; I-0; III, I, 0	0-1; 1, 2, 5
Leg 3	0-0	1-0	I-1; I-0; III, I, 0	0-1; 1, 2, 5
Leg 4	0-0	1-0	I-0; I-0; III, I, 0	0-1; 1, 2, 4

Leg 5 (Fig. 89G) consisting of protopod and exopod. Protopod not articulated from somite, with 1 naked seta on outer distal process and row of spinules at ventrodistal region near base of exopod. Free exopodal segment 3.6 times longer than wide (138×38 μm), slightly narrowing distally, armed with 1 small spine and 1 slender seta; ornamented with 5 rows of minute spinules on medial surface and 1 or 2 rows of minute spinules on outer surface.

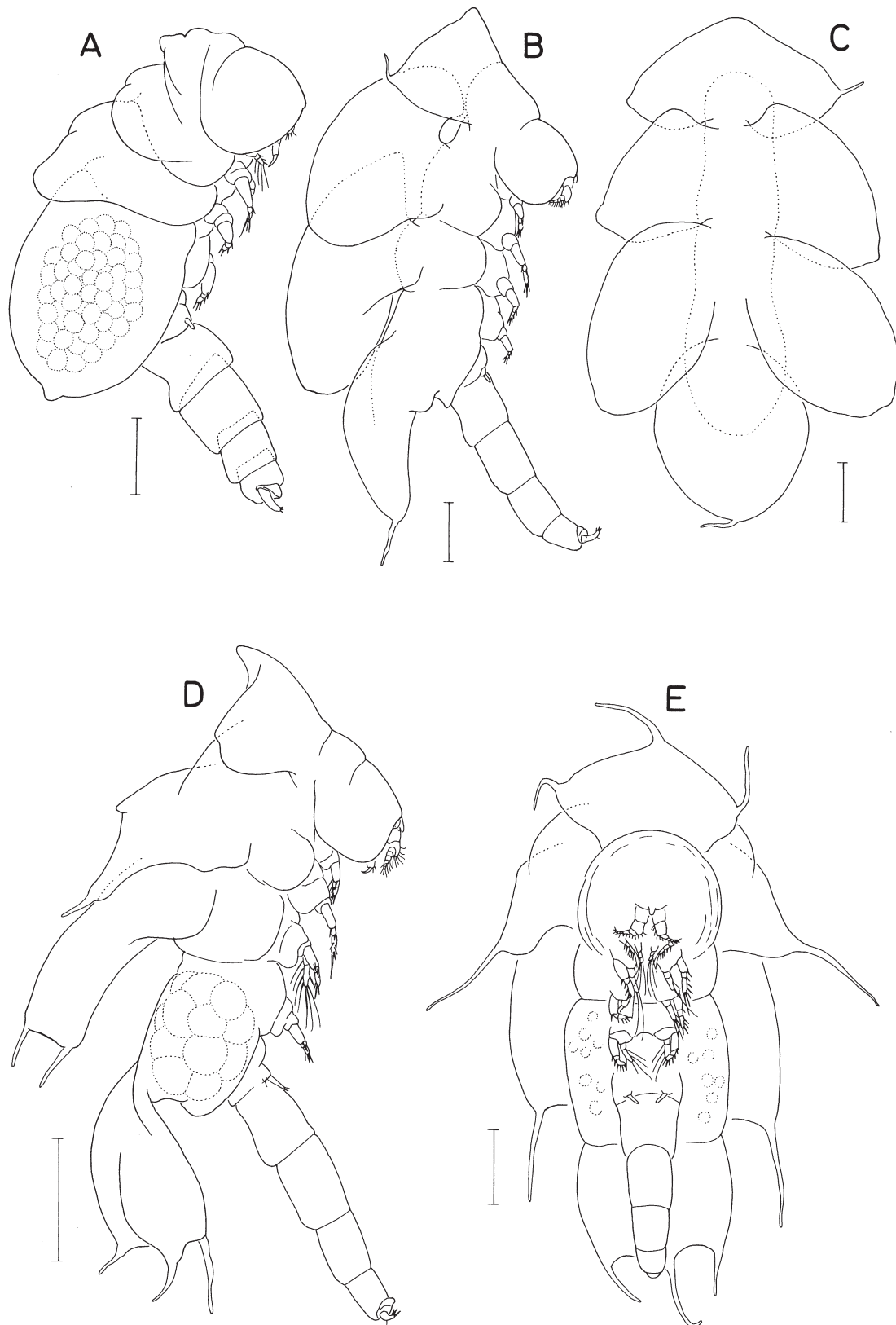
**Supplementary description of male.** Body (Fig. 90A) distinctly segmented. Body length 1.58 mm. Prosome-urosome division indistinct. Prosome slightly dorsoventrally depressed. Urosome 6-segmented, cylindrical, curved ventrally. Anal somite with fewer

spinules on ventral surface than in female. Caudal rami as in female.

Rostrum as in female. Antennule (Fig. 90B) 9-segmented but articulation indistinct between penultimate and terminal segments; non-geniculate; armature formula 3, 12+III, 4, 4+aesthetasc. 5. 3+aesthetasc, 2, 2, and 7+aesthetasc; second segment armed with 12 setae and 3 conical, thick spines. Antenna (Fig. 90C) much stouter than that of female; free endopodal segment as long as wide, armed with 8 setae plus terminal claw, longer than segment.

Labrum as in female. Mandible (Fig. 90D) with 5 equal teeth on coxal gnathobase; basis with large, globular outer proximal swelling; 5 setae on exopod equal in length; endopod with 2 and 8 setae on first and second segments, respectively. Maxillule (Fig. 90E) different from that of female in having 2 setae on first endopodal segment; second proximal seta on basis larger than other 3 setae. Maxilla as in female. Maxilliped (Fig. 90F) with 7 (3+4) setae on first segment.

Leg 1 as in female. Legs 2–4 (Figs. 90G, 91A, B) with rami broader and shorter than in female; terminal spine on third exopodal segment of each leg much longer than other spines. Distal endopodal segment of legs 2 and 3 armed with 3 spines and 5 setae. Distal endopodal segment leg 4 armed with 4 spines and 3 setae. Armature formula for legs 2–4 as follows:



**FIGURE 92.** Habitus of three species of *Notopterophorus*. A, female *N. auritus* (Thorell, 1859), right; B, C, female *N. elongatus* Buchholz, 1869, right and dorsal; D, E, female *N. papilio* Hesse, 1864, right and ventral. Scale bars: 0.5 mm.

Leg 2	0-1	1-0	I-1; I-0; III, I, 4	0-1; I, II, 5
Leg 3	0-0	1-0	I-1; I-0; III, I, 3	0-1; I, II, 5
Leg 4	0-0	1-0	I-0; I-0; III, I, 2	0-1; I, III, 3

Leg 5 with 2 rows of minute spinules on medial surface, otherwise similar to that of female. Leg 6 represented by 2 naked setae on genital operculum.

**Remarks.** It is uncertain whether *N. micropterus* is a distinct species or merely a form of *N. auritus*. Our female specimens possess short wing-like extensions on the first to third pedigerous somites, as figured by Sars (1921), and on this evidence we tentatively identify them as *N. micropterus*. However, as stated above, this whole cluster of species is in urgent need of revision to determine the validity of the nominal species.

### *Notopterophorus auritus* (Thorell, 1859)

(Fig. 92A)

**Material examined.** 6 ♀♀ (MNHN-IU-2018-1816) and 1 dissected ♀ from *Ascidia mentula* Müller, 1776, Kristineberg, Sweden.

**Remarks.** This species is distinguished by short dorsal humps on the first to third pedigerous somites (Fig. 92A).

### *Notopterophorus elongatus* Buchholz, 1869

(Fig. 92B, C)

**Material examined.** 4 ♀♀, 1 ♂ (MNHN-IU-2018-1917) and 1 dissected ♀ (figured) from *Phallusia mammillata* (Cuvier, 1815), Banyuls-sur-Mer, France.

**Remarks.** The female of *N. elongatus* has short filiform processes on the dorsal wings of the pedigerous somites. There are 3 filiform processes on the dorsal wing of first pedigerous somite, two processes on each wing of the second and third pedigerous somites, and a single process on the wing of the fourth pedigerous somite (Giesbrecht, 1882; Illg & Dudley, 1965). However, other studies have indicated that these processes are sometimes absent (e.g. Buchholz, 1869), or present only on some of the wings (Fig. 92B, C).

### *Notopterophorus papilio* Hesse, 1864

(Fig. 92D, E)

**Material examined.** 4 ♀♀ (MNHN-IU-2018-1817) from *Ascidia mentula* Müller, 1776, Glenan; 3 ♀♀, 5 ♂♂ (MNHN-IU-2018-1818) and 1 dissected ♀ from *Ascidia aximensis* Müller, 1953, Sierra Leone, 03 October 1990; 12 ♀♀ (MNHN-IU-2009-2466) from *A. mentula*, Port Antifer, Le Havre, France, Breton coll., November 2008.

**Remarks.** In some of the females examined here the

dorsal wing-like extension of the first pedigerous somite lacks filiform processes (Fig. 92D), and the wings of the second pedigerous somite have only posterior filiform processes with the anterior processes either rudimentary (Fig. 92D) or lacking (Fig. 92E).

### *Notopterophorus glabrus* sp. nov.

(Figs. 93, 94)

**Type material.** Holotype (intact ♀, MNHN-IU-2017-2145), paratypes (2 intact ♀♀, MNHN-IU-2014-21245) from *Ascidia interrupta* Heller, 1878 (MNHN-IT-2008-XXX = MNHN P5/ASC.A/436), Pointe Burgos, Les Anses-d'Arlet, Martinique, MADIBENTHOS exped., (14°29.6'N, 61°05.5'W), depth 5–25 m, MNHN coll., 07 September 2016.

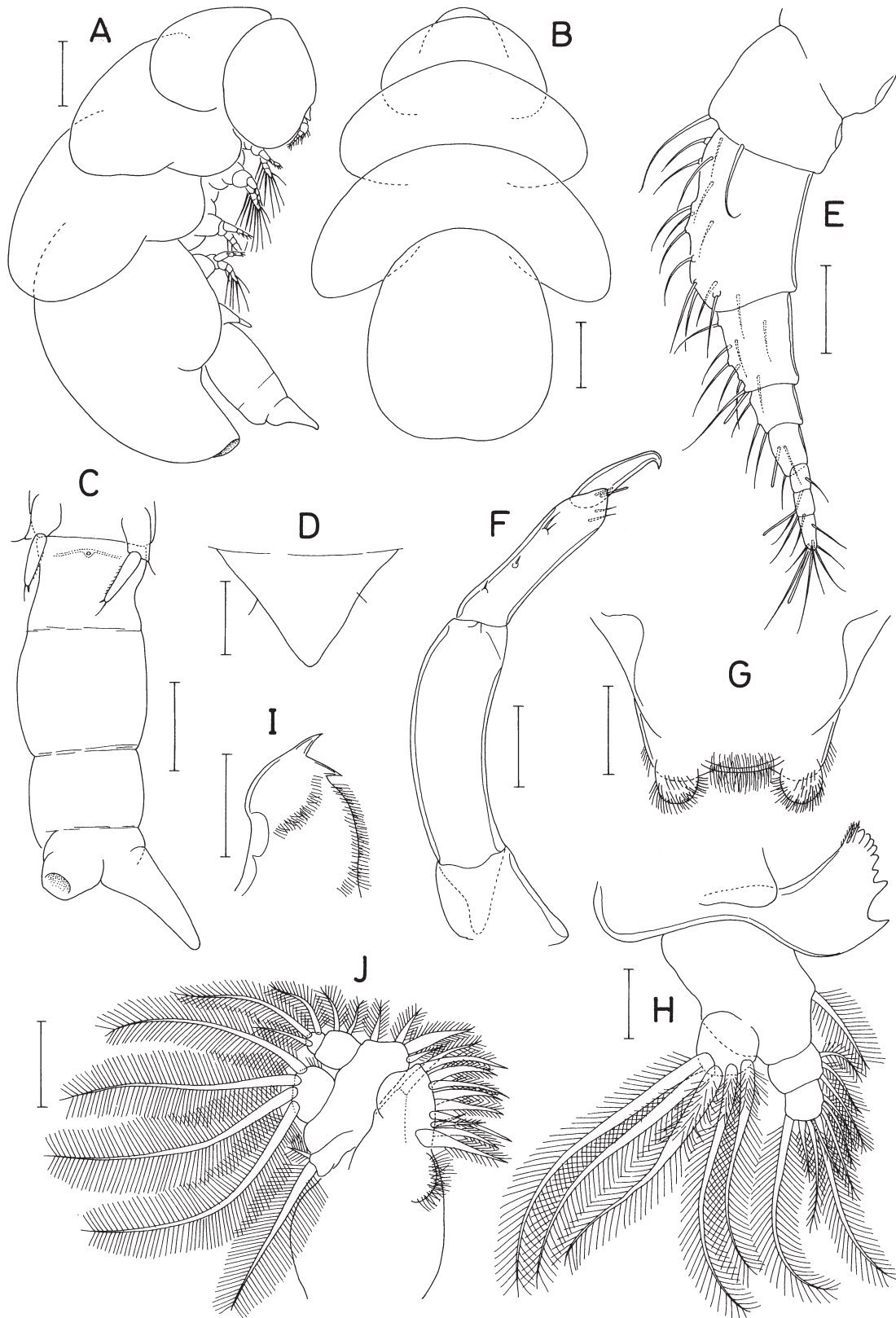
**Additional material.** 1 ♀ (MNHN-IU-2017-2146) and 1 dissected ♀ (figured) from *A. interrupta*, MADIBENTHOS AR051, Martinique, (14°26.9'N, 60°54'W), depth 3–20 m, 11 September 2016; 1 ♀ (MNHN-IU-2017-2155) from *Microcosmus anchylodeirus* Traustedt, 1883, Martinique, (14°31.7'N, 61°05.3'W), depth 6 m, 06 September 2016; 1 ♀ (MNHN-IU-2017-2157) from *Phallusia* sp., MADIBENTHOS Stn AR 415, Martinique (14°50.5'N, 61°13.7'W), depth 22–31 m, 01 October 2016.

**Etymology.** The specific name is derived from the Latin *glab* (= smooth), referring to the smooth wings on the pedigerous somites.

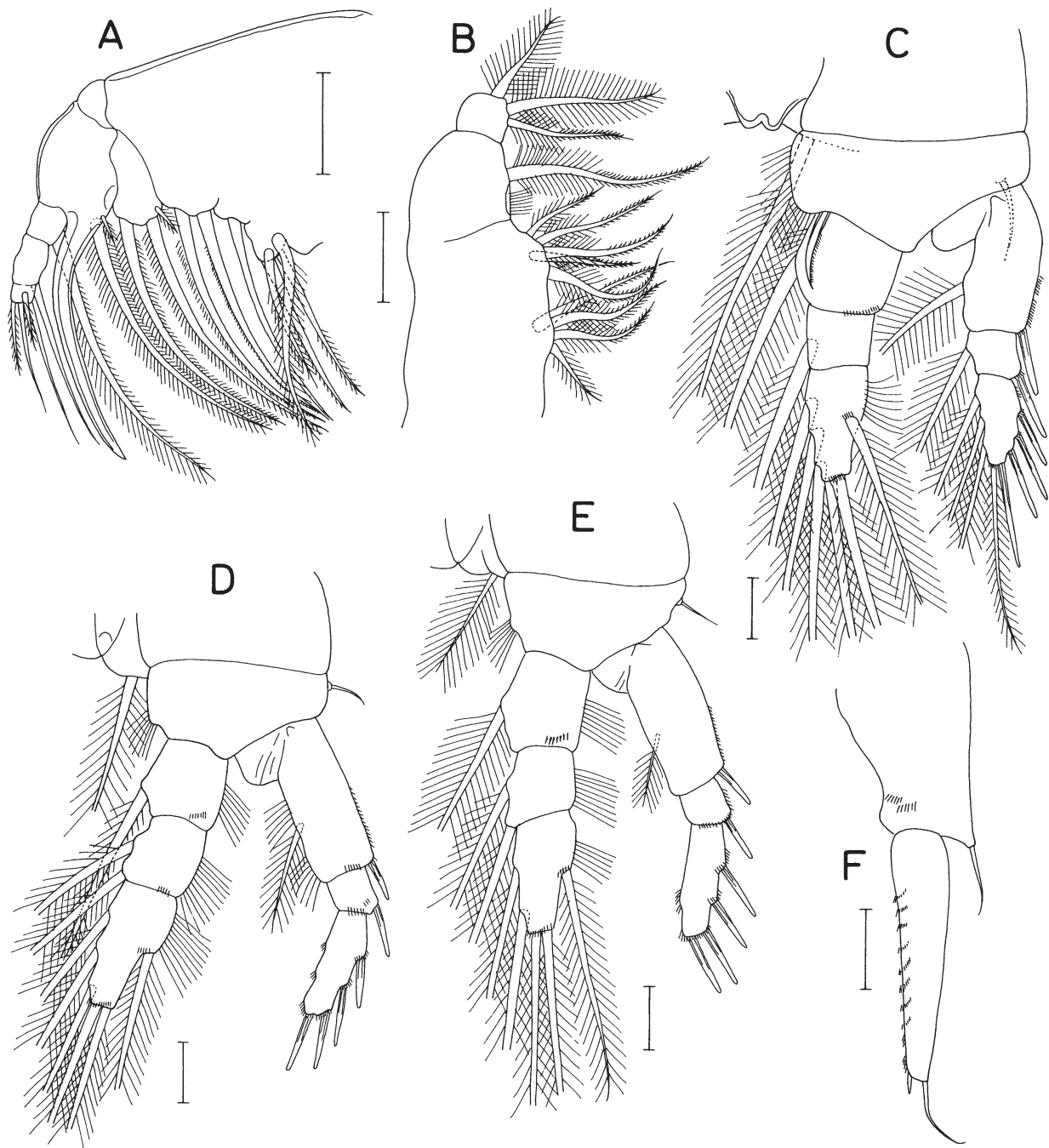
**Description of female.** Body (Fig. 93A, B) large, 9.30 mm long. First to fourth pedigerous somites each bearing large dorsolateral extensions with smooth margins, lacking any filiform processes: extensions subcircular on first and fourth pedigerous somites, broad and wing-like on second and third pedigerous somites. Fourth pedigerous somite forming brood pouch, fused to short fifth pedigerous somite. Free urosome (Fig. 93C) small, obscurely segmented: genital somite articulated from fifth pedigerous somite; abdominal somites indistinctly defined. Three abdominal regions recognizable by lateral constrictions and areas of wrinkled integument. Caudal rami conical, obscurely defined from anal somite, about twice as long as wide (629×320 µm), smooth, lacking caudal setation elements.

Rostrum (Fig. 93D) small, triangular, ornamented with 1 sensilla on each lateral margin. Antennule (Fig. 93E) small, slender, gradually narrowing distally; 8-segmented; armature formula 2, 15, 9+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae thin and short. Antenna (Fig. 93F) slender, 3-segmented; coxa and allobasis unarmed; free endopodal segment about 3.6 times longer than wide (205×57 µm), slightly shorter than basis; armed with about 8 small setae plus terminal claw, about half as long as segment.

Labrum (Fig. 93G) covered with ornamentation



**FIGURE 93.** *Notopterophorus glabrus* sp. nov., female. A, habitus, right; B, habitus, dorsal; C, urosome, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, B, 1 mm; C, 0.5 mm; D, 0.05 mm; E–J, 0.1 mm.



**FIGURE 94.** *Notopterothorus glabrus* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.1 mm.

of setules along posterior margin, with prominent posterolateral lobes. Mandible (Fig. 93H) with 8 teeth and 2 small setae on coxal gnathobase; basis with 1 medial seta; exopod unsegmented with 5 subequal setae; endopod with 3 and 8 setae on first and second segments, respectively. Paragnath (Fig. 93I) with 1 apical and 1 subapical dentiform processes and row of setules on medial margin and anterior surface. Maxillule (Fig. 93J) with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite,

and 4 on basis, second proximal seta larger than other 3; exopod with 4 setae distally; endopod with 2 setae on medial margin of first segment and 3 on second. Maxilla (Fig. 94A) 5-segmented; syncoxa with 10 setae arranged as 4, 1, 2, and 3; basis with 1 slender, smooth claw plus 2 setae; endopod slender with 1, 1, and 4 setae on first to third segments, respectively; articulation indistinct between second and third segments. Maxilliped (Fig. 94B) 3-segmented; armed with 9, 1, and 3 setae on first



to third segments, respectively; articulation incomplete between proximal 2 segments.

Legs 1–4 with 3-segmented rami (Fig. 94C–E); exopods and endopods almost equal in length. All legs with inner coxal seta, small outer seta on basis, and inner seta on first exopodal segment. Inner distal spine on basis slender and shorter than first endopodal segment. Spines on third exopodal segment of legs 2–4 equal in length. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	I-1; I-0; III, I, 0	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-0; III, I, 0	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 94F) consisting of protopod and exopod. Protopod longer than wide, not articulated from somite, bearing 1 naked seta on slightly projecting outer distal corner and several fine spinules near mediiodistal corner. Exopodal segment elongate, gradually narrowing distally, about 4.5 times longer than wide (313×69 µm), armed distally with 1 small setiform spine and 1 naked seta, and ornamented with about 10 rows of fine spinules on medial surface.

**Male.** Unknown.

**Remarks.** The structure and armature of the appendages in previously described species of *Notopterophorus* are relatively uniform, as mentioned above. *Notopterophorus glabrus* **sp. nov.** deviates from this uniformity and is clearly defined from its congeners. It has 3 and 8 setae (rather than 4 and 10 setae as usual for the genus) on the first and second segments of the mandibular endopod, 5 (2+3) setae (rather than 6 or 7 setae as usual) on the maxillular endopod, and 3 setae (rather than 4) on the third segment of the maxilliped. The presence of an inner seta on the first exopodal segment of leg 4 of the new species is also an unusual feature in *Notopterophorus*. These differences are sufficient to justify the establishment of the new species.

### Genus *Gunenotophorus* Buchholz, 1869

**Diagnosis.** Female body comprising cephalosome, metasome (representing first to fourth pedigerous somites) forming large, globular brood pouch, and urosome. Fifth pedigerous somite largely or completely incorporated into brood pouch. Free urosome 5-segmented in female consisting of genital somite and 4 abdominal somites. Anal somite with or without processes. Caudal rami with reduced setation. Female antennule indistinctly segmented, with up to 7 segments partially expressed. Antenna consisting of coxa, basis, and 2-segmented endopod; exopodal seta absent. Mandible with well developed coxal gnathobase and biramous palp armed with 1 seta on basis, 5 setae on exopod, and 1 and 4 or 5 setae on first and second

endopodal segments, respectively. Maxillule with 8 or 9 setae on arthrite, 1 on coxal endite, 2 on epipodite; basis and endopod fused to form baseoendopod bearing 4 setae; exopod unsegmented with 4 setae distally. Maxilla indistinctly 3-segmented, syncoxa enditic formula 3, 2, 3; basis with claw plus 2 setae; endopod reduced with 3 to 5 small setae. Maxilliped unsegmented and armed with total of 7 setae. Leg 1 biramous with 3-segmented rami; leg 2 biramous with elongate 3-segmented exopod and short 2- or 3-segmented endopod according to species; legs 3 and 4 biramous with elongate 3-segmented exopods and reduced 2-segmented endopods; endopods of legs 2–4 typically ornamented with rings of minute setules; armature formula of female typically:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 1	0-1; 1, 3, 1
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 1	0-0; 0, 2, 1
Leg 4	0-0	0-0	I-1; I-0; 2, 1, 1	0-0; 0, 2, 0

Leg 5 represented by small lobe tipped with 1 small seta, or absent.

**Type species.** *Gunenotophorus globularis* Buchholz, 1869, by original monotypy.

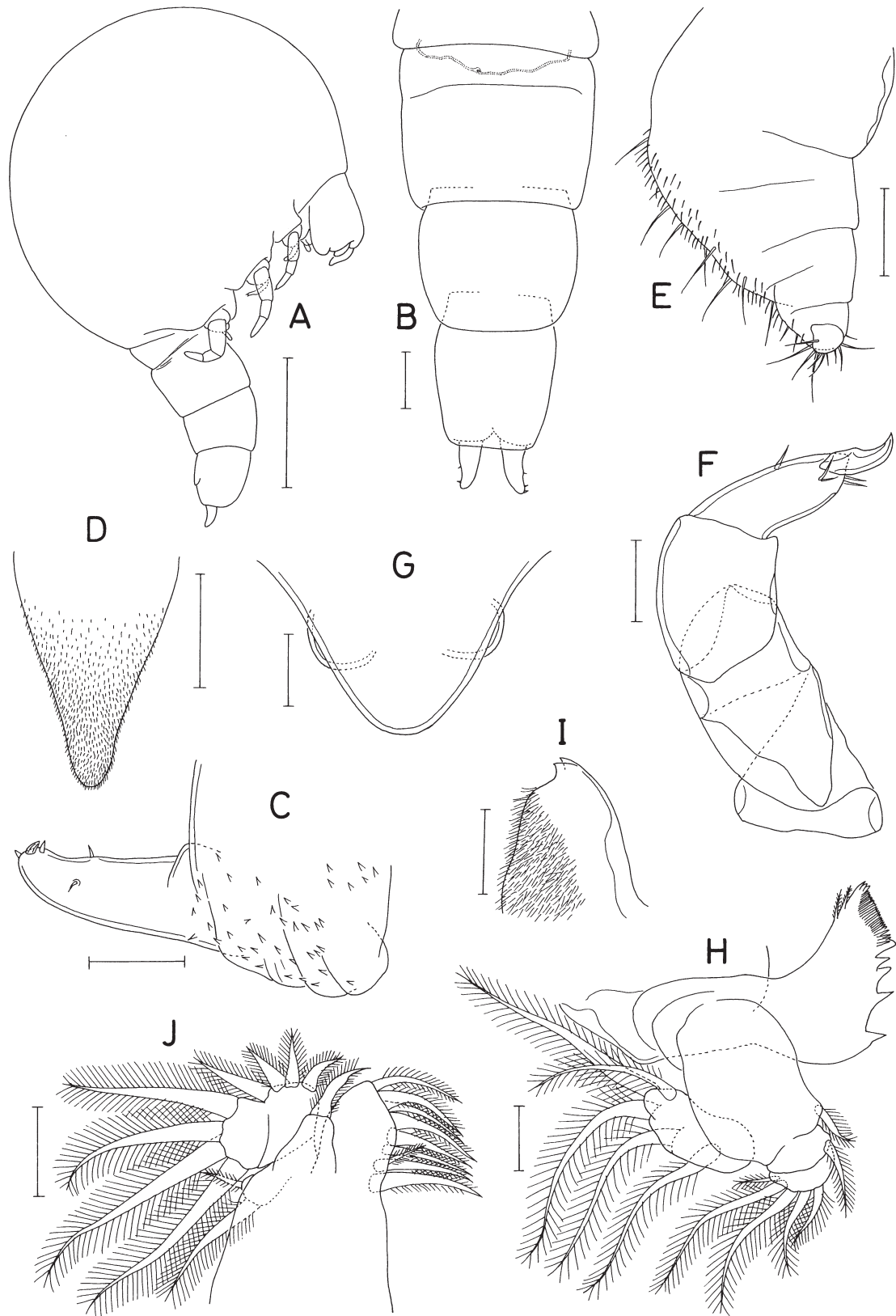
**Remarks.** Illg (1958), Illg & Dudley (1965) and Gotto (1993) all attributed this genus to Buchholz (1869). The original use of the name by Costa (1840) was a *nomen nudum*, as pointed out by numerous authors. Illg & Dudley (1965) examined the convoluted nomenclatural history of this genus and its type species, and we follow them in an attempt to maintain stability of usage.

### *Gunenotophorus globularis* Buchholz, 1869

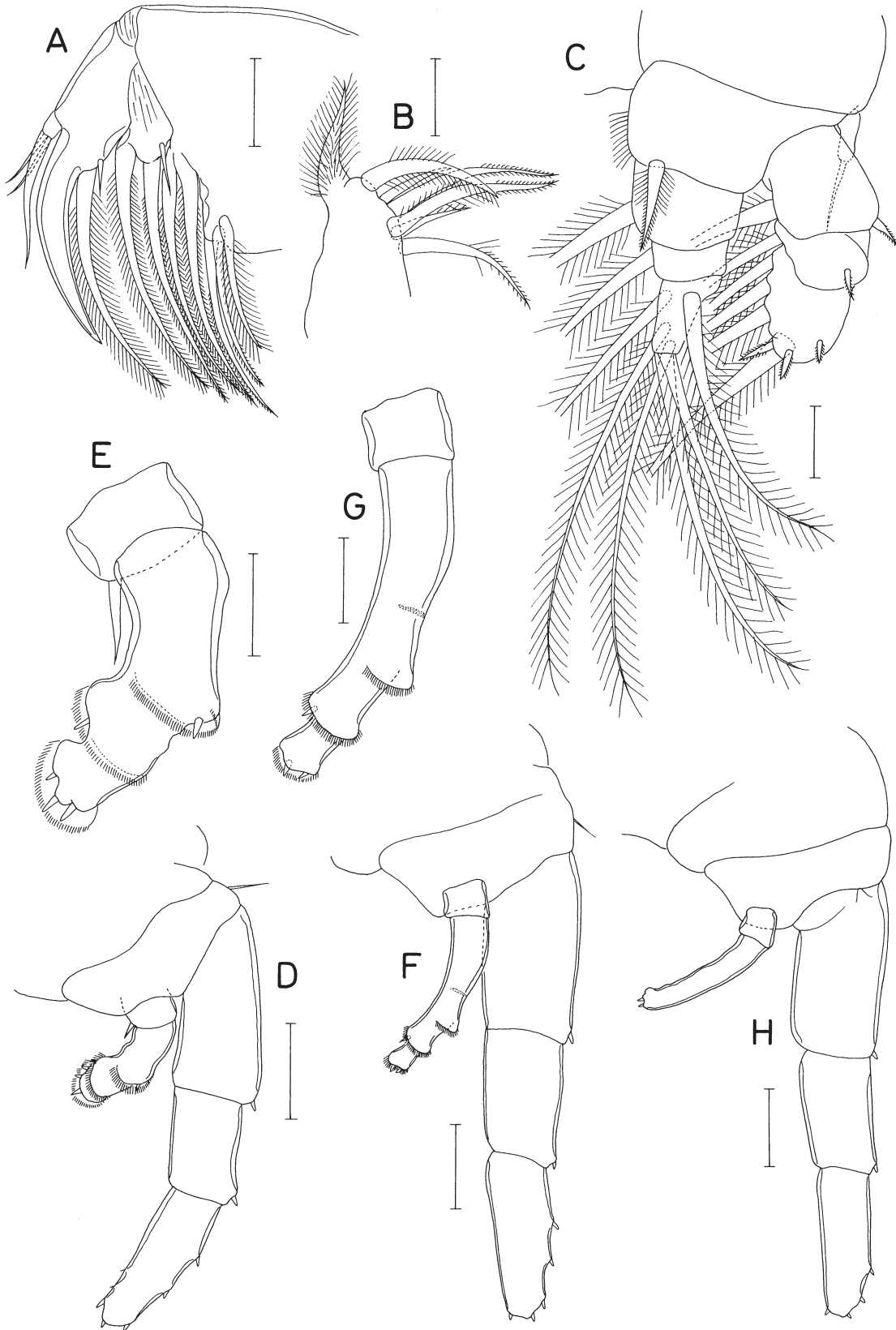
(Figs. 95, 96)

**Material examined.** 14 ♀♀ (MNHN-IU-2018-1819) and 2 dissected ♀♀ from *Polycarpa pomaria* (Savigny, 1816), Kristineberg; 1 ♀ (MNHN-IU-2018-1820) from *P. pomaria*, Noirmoutier, France; 1 ♀ (MNHN-IU-2018-1821) and 1 dissected ♀ from *P. kornogi* Glémarec & Monniot C., 1966, Norwegian Sea Norbi CP 11; 3 ♀♀ (MNHN-IU-2018-1822) and 1 dissected ♀ from *P. mamillaris* (Pallas, 1774), Bioice Stn 2307; 1 juvenile (MNHN-IU-2009-2467) and 2 dissected juveniles from *Styela canopus* (Savigny, 1816), Port Gare Maritime, Vannes, France, L. Roux coll., 23 April 2009.

**Supplementary description of female.** Body (Fig. 95A) comprising cephalosome, swollen metasome, and indistinctly segmented urosome. Body length 5.44 mm in dissected specimen. Metasome modified as unsegmented, spherical brood pouch, formed by fusion of first to fourth pedigerous somites: first pedigerous somite defined from posterior part of metasome by weak suture line in some specimens. Fifth pedigerous somite short, not defined



**FIGURE 95.** *Gunenotophorus globularis* Buchholz, 1869, female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 1 mm; B, 0.2 mm; C, D, 0.1 mm; E–J, 0.05 mm.



**FIGURE 96.** *Gunenotophorus globularis* Buchholz, 1869, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, endopod of leg 2; F, leg 3; G, endopod of leg 3; H, leg 4. Scale bars: A–C, E, G, 0.05 mm; D, F, H, 0.1 mm.

from metasome. Free urosome (Fig. 95B) 3-segmented, consisting of genital double-somite, and 2-segmented abdomen. Genital double-somite with incomplete dorsal and ventral suture lines marked by wrinkled integument, near anterior third. Anal somite with wrinkled dorsal suture line near midlength in some specimens. Distal part of anal somite flexible and eversible, ornamented with numerous spinules on dorsal and ventral surfaces. Caudal ramus (Fig. 95C) twice as long as wide, indistinctly defined from anal somite; rami directed posteriorly, but directed more laterally when anal somite expanded; rami armed with 3 or 4 small spines distally and 2 small setae near distal third.

Rostrum (Fig. 95D) linguiform, longer than wide, tapering, covered by numerous minute setules; lateral margins slightly concave (Fig. 95D) or convex. Antennule (Fig. 95E) strongly tapering; obscurely segmented, with 4 incomplete suture lines and several surface wrinkles; armed with thin setae and ornamented with minute setules on anterior surface; setae hardly distinguishable from setules. Antenna (Fig. 95F) stout, 4-segmented; coxa short and unarmed; basis only slightly longer than wide; first endopodal segment as long as basis, unarmed; compound distal endopodal segment about 1.8 times longer than wide (79×44 µm), armed with 5 small setae plus terminal claw, about half as long as segment.

Labrum (Fig. 95G) strongly tapering, with rounded distal margin and large semicircular lobe on each side. Mandible (Fig. 95H) with 5 teeth and 1 or 2 small proximal setae on coxal gnathobase; basis with 1 seta on distal medial margin; exopod with 5 setae, second outer seta largest, outermost seta small, less than half length of second outer seta; endopod with 1 and 5 setae on first and second segments, respectively, outermost seta on second segment small, less than one-third length of adjacent seta. Maxillule (Fig. 95J) with 9 setae on arthrite, 1 on coxal endite and 2 on epipodite; exopod incompletely defined at base with 4 large setae distally; baseoendopod with 4 setae. Maxilla (Fig. 96A) 3-segmented; syncoxa (first segment) with 3, 2, and 3 setae on first to third endites; basis with robust claw plus 2 setae; endopod small, unsegmented with 3 (occasionally 4 or 5) small setae. Maxilliped (Fig. 96B) unsegmented and armed with 6 (occasionally 5) setae on medial margin and 1 broad seta apically.

Leg 1 (Fig. 96C) with 3-segmented rami. Legs 2–4 (Fig. 96D–H) each with 3-segmented exopod and 2-segmented endopod. Inner coxal seta lacking in legs 1–4. Outer seta on basis digitiform proximally and thin distally in leg 1, very small in legs 2 and 3, and absent in leg 4. Inner distal spine on basis of leg 1 setiform, pinnate along proximal half and spinulose distally. Exopod of leg 1 broadened, slightly longer than endopod. Endopods of legs 2–4 much smaller, less than half as long as exopods, with shorter proximal segment and much longer distal segment. Distal endopodal segment of legs 2 and 3 ornamented with 3 rings of minute setules in distal

region. Setae on leg 1 large and pinnate, setae on legs 2–4 rudimentary. Distal endopodal segment of leg 3 with trace of articulation near middle. Setation of legs 2–4 variable. Armature formula for legs 1–4 of dissected specimen as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 1	0-1; 1, 3, 1
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 1	0-0; 0, 2, 1
Leg 4	0-0	0-0	I-1; I-0; 2, 1, 1	0-0; 0, 2, 0

Leg 5 rudimentary, represented by small, slightly curved lobe tipped with 1 small seta.

**Male.** Not found in this study.

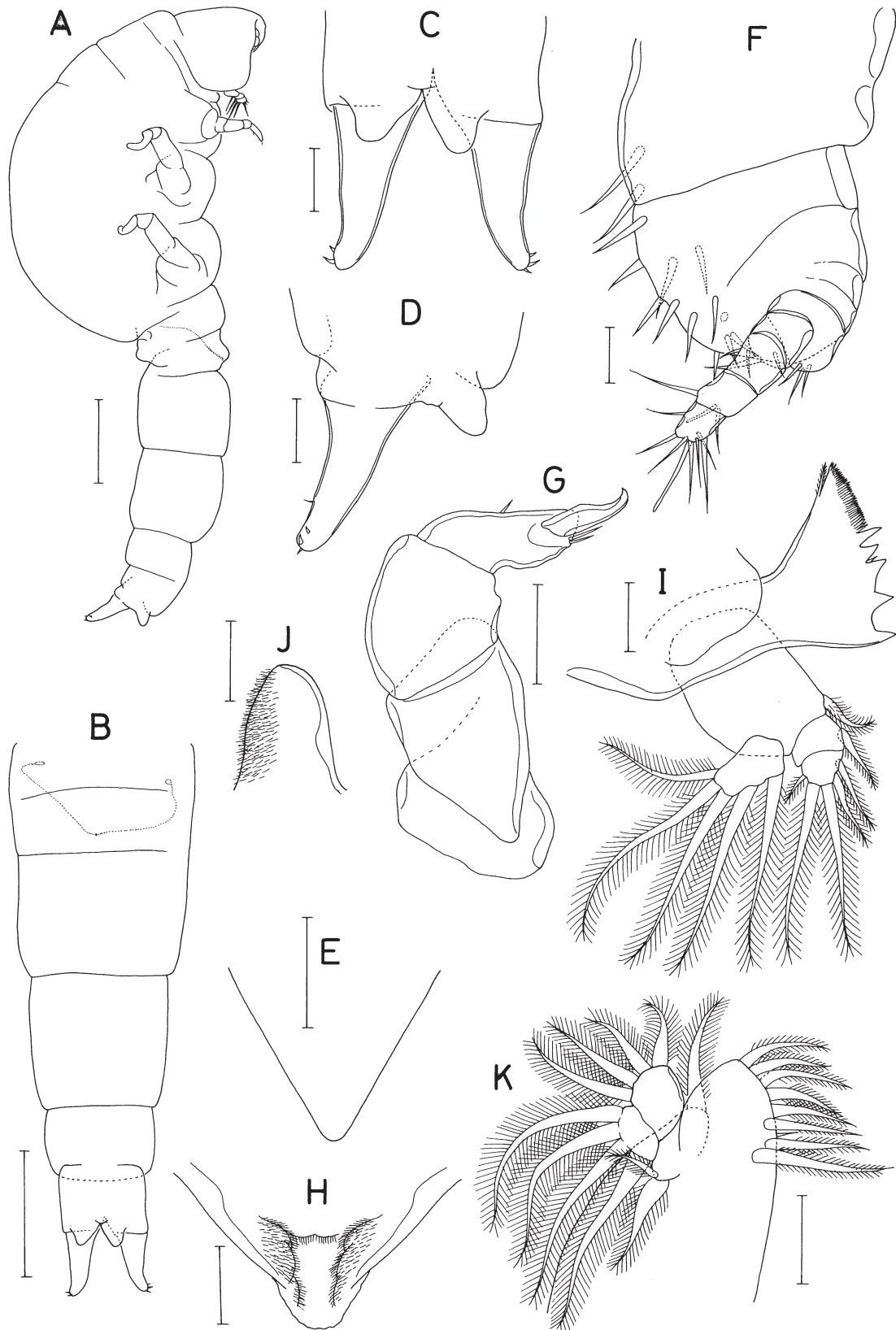
**Remarks.** The juvenile specimens, probable copepodid V, were found to have 3-segmented endopods in legs 2–4, so the 2-segmented adult condition probably results from secondary fusion during the final moult to adult. The second endopodal segment of the mandible possessed only 4 setae and lacked the small outer seta of the adult. This species has been reported from over 20 species of ascidian hosts (Illg, 1958; Gotto, 1993) and both *Polycarpa kornogi* and *Styela partita*, reported here, are new host records. This species has a wide geographical distribution with records extending from the Atlantic coast of North America across to Europe and the Mediterranean, south to South Africa and into the Indian Ocean (Gotto, 1993).

### *Gunenotophorus spinipes* Schellenberg, 1922 (Figs. 97, 98)

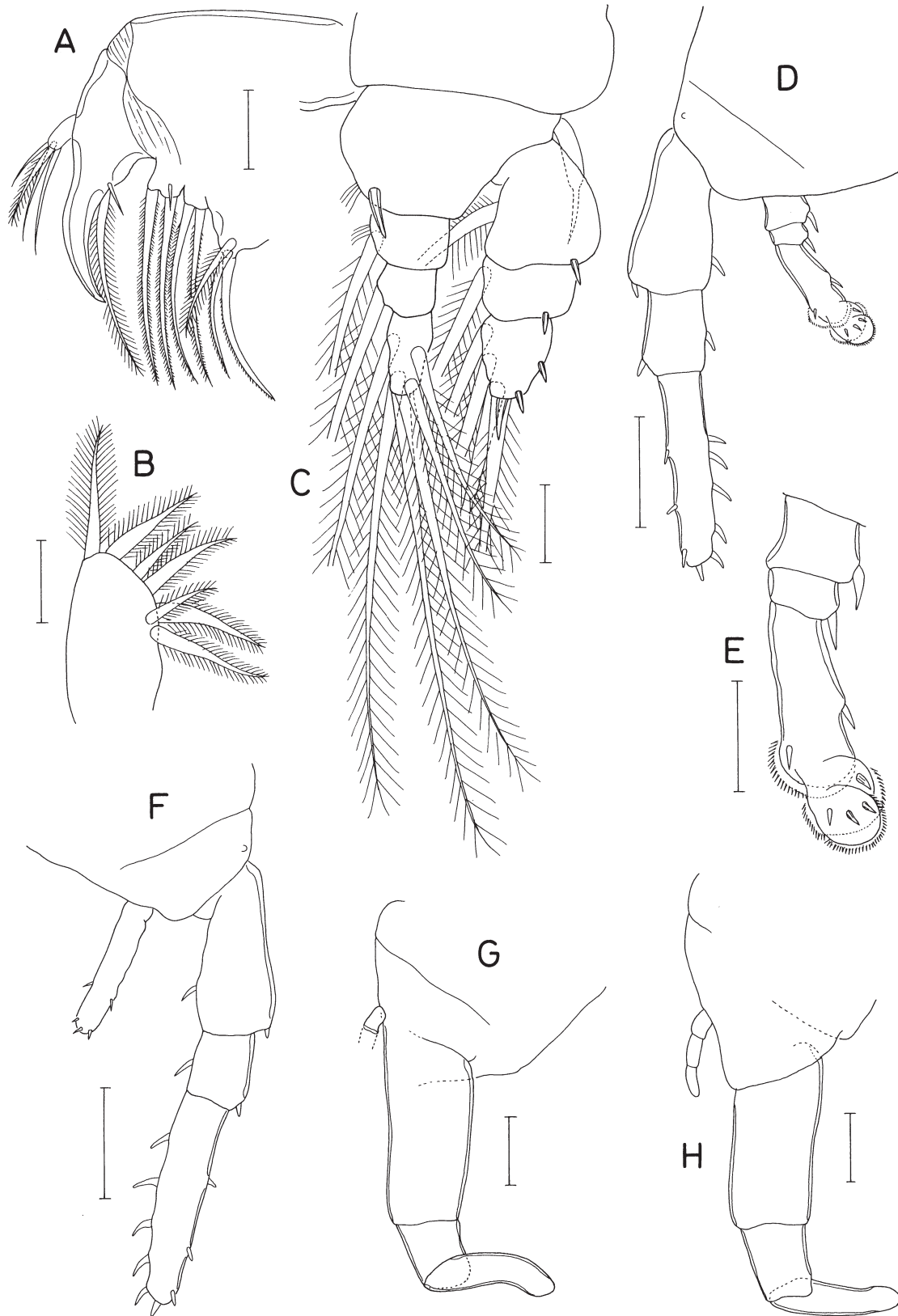
**Material examined.** 1 ♀ (dissected) from *Cnemidocarpa nordenskjoldi* (Michaelsen, 1898), Tierra del Fuego, Argentina.

**Supplementary description of female.** Body (Fig. 97A) not strongly expanded, comprising cephalosome, metasome, and urosome. Body length 4.67 mm. Dorsal shield of cephalosome extended ventrally. Metasome unsegmented with convex dorsal margin and traces of 2 suture lines anteriorly on dorsal surface. Urosome (Fig. 97B) 6-segmented, but proximal articulations indistinct between fifth pedigerous and genital somites, and between genital and first abdominal somites. Articulation between third abdominal and anal somites also incomplete. Anal somite expanded posteroventrally into pair of bulbous processes (Fig. 97B–D). Caudal rami tapering, slightly curved outwards in distal part; 1.8 times longer than wide (250×140 µm), slightly shorter than anal somite (255×345 µm); armed with 3 small spines and 1 seta.

Rostrum (Fig. 97E) triangular with blunt apex. Antennule (Fig. 97F) indistinctly 7-segmented; armature formula 2, 13?, 3, 1, 2, 2+aesthetasc, and 7+aesthetasc; first and second segments greatly expanded; second



**FIGURE 97.** *Gunenotophorus spinipes* Schellenberg, 1922, female. A, habitus, right; B, urosome, ventral; C, distal part of abdomen, ventral; D, distal part of abdomen, right; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, paragnath; K, maxillule. Scale bars: A, B, 0.5 mm; C–E, 0.1 mm; F, 0.02 mm; G–K, 0.05 mm.



**FIGURE 98.** *Gunenotophorus spinipes* Schellenberg, 1922, female. A, maxilla; B, maxilliped; C, leg 1; D, left leg 2; E, endopod of left leg 2; F, right leg 2; G, leg 3; H, leg 4. Scale bars: A–C, E, 0.05 mm; D, F–H, 0.1 mm.

segment with traces of 3 possible partial articulations along posterior side; all setae short and naked. Antenna (Fig. 97G) stout, 4-segmented; proximal 3 segments (coxa, basis, and first endopodal segment) unarmed; compound distal endopodal segment 1.44 times longer than wide (62×43 µm), armed with 1 medial and 2 distal setae plus terminal claw 46 µm long.

Labrum (Fig. 97H) tapering strongly towards weak, blunt distal lobe; ornamented with numerous setules on ventral surface. Mandible (Fig. 97I) with 5 teeth and 1 small proximal seta on gnathobase of coxa plus 1 small spinule located between proximal second and third teeth; basis with 1 seta on distal medial margin; exopod unsegmented, armed with 4 equal setae and 1 smaller outer seta; endopod with 1 and 5 setae on first and second segments, respectively, outermost seta on second segment much smaller than other 4. Paragnath (Fig. 97J) as simple lobe densely covered with setules on medial surface. Maxillule (Fig. 97K) with 9 setae on arthrite (but third proximal seta rudimentary), 1 on coxal endite, 2 on epipodite, 4 on exopod, and 4 on baseoendopod. Maxilla (Fig. 98A) 3-segmented; syncoxa with 8 setae arranged as 3, 2, and 3; basis with short, robust claw plus 2 unequal setae; endopod unsegmented, small, armed distally with 4 small setae. Maxilliped (Fig. 98B) unsegmented, armed with 7 setae (5 medial and 2 apical).

Legs 1–4 (Fig. 98C–H) without inner seta on coxa. Outer seta on basis of leg 1 thickened in proximal half and thin distally. Outer seta absent on basis of legs 2–4. Exopod of leg 1 broader and slightly longer than endopod. Inner distal spine on basis of leg 1 small, smooth, shorter than first endopodal segment. Leg 2 pair asymmetrical: left leg 2 endopod 3-segmented (Fig. 98D) but right leg 2 endopod unsegmented and armed with 1, 3, 1 setae (Fig. 98F); exopod more than twice as long as endopod; endopod (Fig. 98E) of left leg 2 ornamented with 3 rings of setules distally on third segment. Legs 3 and 4 displaced laterally (Fig. 97A), each with 3-segmented exopod and endopod (leg 3 endopod damaged); third exopodal segment directed laterally, slightly curved in leg 3 and straight in leg 4; endopods of legs 3 and 4 rudimentary. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	0-0	1-1; 1-1; 3, 1, 5	0-1; 0-1; 1, 3, 2 (left endopod)
Leg 3	0-0	0-0	0-0; 0-0; 0	0-0; ?
Leg 4	0-0	0-0	0-0; 0-0; 0	0-0; 0-0, 0
Leg 5	absent.			

**Male.** Unknown.

**Remarks.** Schellenberg (1922) described this species as an associate of *Alloeocarpa incrustans* (Herdman, 1886) (as *A. emilionis* Michaelsen) and *Polyzoa opuntia* Lesson, 1830 (as *P. coccinea* (Cunningham)) from the

Strait of Magellan. Schellenberg (1922) highlighted the diagnostic features of *G. spinipes* which serve to differentiate it from *G. globularis*, as follows: endopod of maxilla with 4 setae; third exopodal segment of leg 2 with 5 inner setae and these setae are short (about equal to only half the width of the segment); endopod of leg 2 about half as long as exopod, with first and second segments each bearing an inner distal seta. These features are exhibited by our single specimen found in association with *Cnemidocarpa nordenskjoldi* collected off Tierra del Fuego, which appears to constitute a new host record. Comparison with Schellenberg's original description indicates that the unsegmented endopod of leg 2 on the right side of our female is an abnormal condition.

### *Gunenotophorus antennularis* sp. nov.

(Figs. 99, 100)

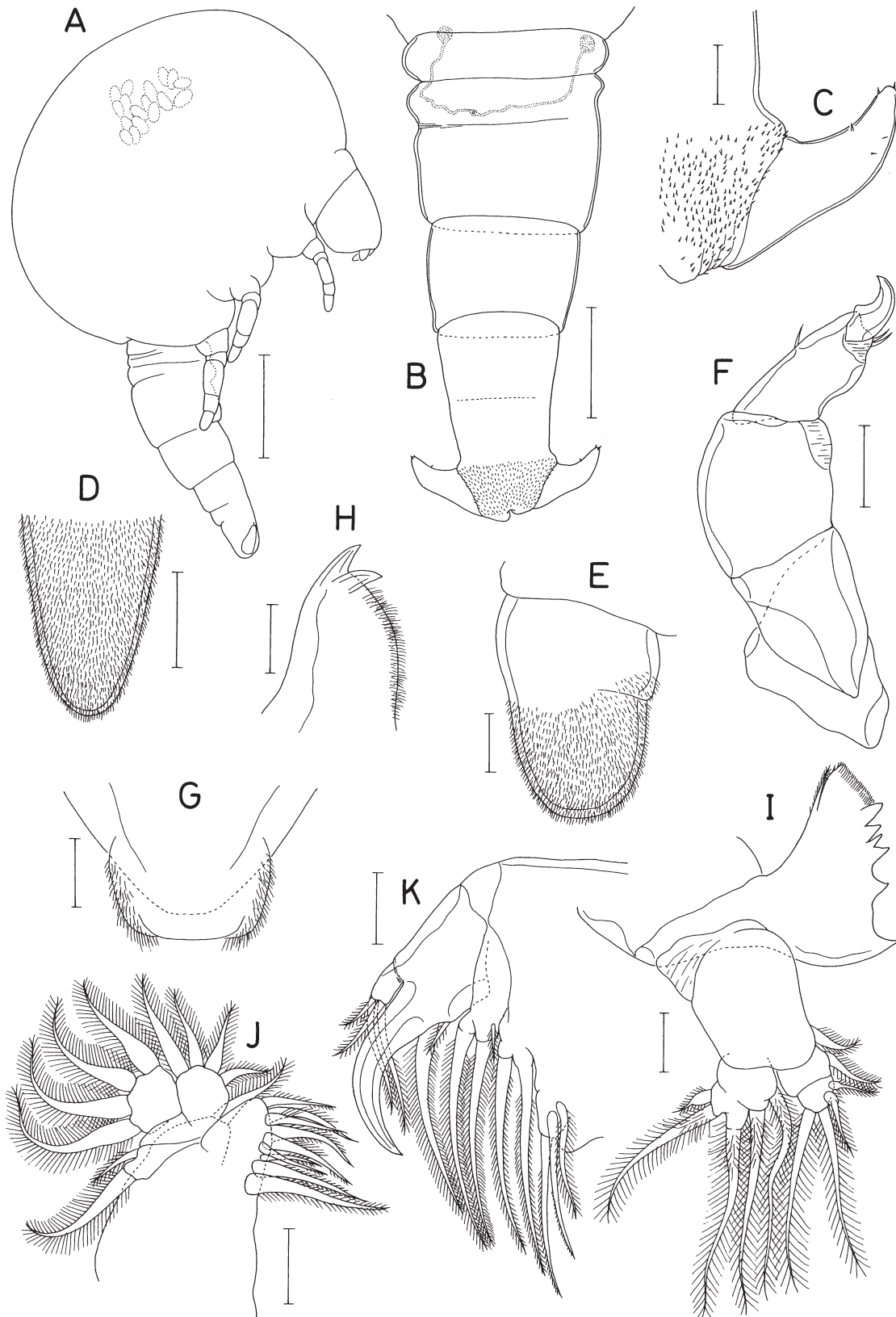
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21246) from *Molgula amesophleba* (Codreanu & Mack-Fira, 1956), Etang de Leucate, Mediterranean coast of France, Clanzig coll., 1985.

**Etymology:** The name of the new species alludes to the unique lobate form of the paired antennules of the female.

**Description of female.** Body (Fig. 99A) form very similar to that of *G. globularis*, but larger; body length 7.05 mm. Urosome (Fig. 99B) 5-segmented, but articulations indistinct between fifth pedigerous and first abdominal somites. Fifth pedigerous and genital somites short, about equal in length. Anal somite longer than wide, with trace of suture line near middle of dorsal surface; ornamented with covering of minute spinules on ventral and dorsal surfaces. Caudal rami directed laterally (Fig. 99B), obscurely defined from anal somite; each ramus (Fig. 99C) tapering, slightly curved, about 1.3 times longer than wide (313×247 µm); caudal setae minute, hardly visible.

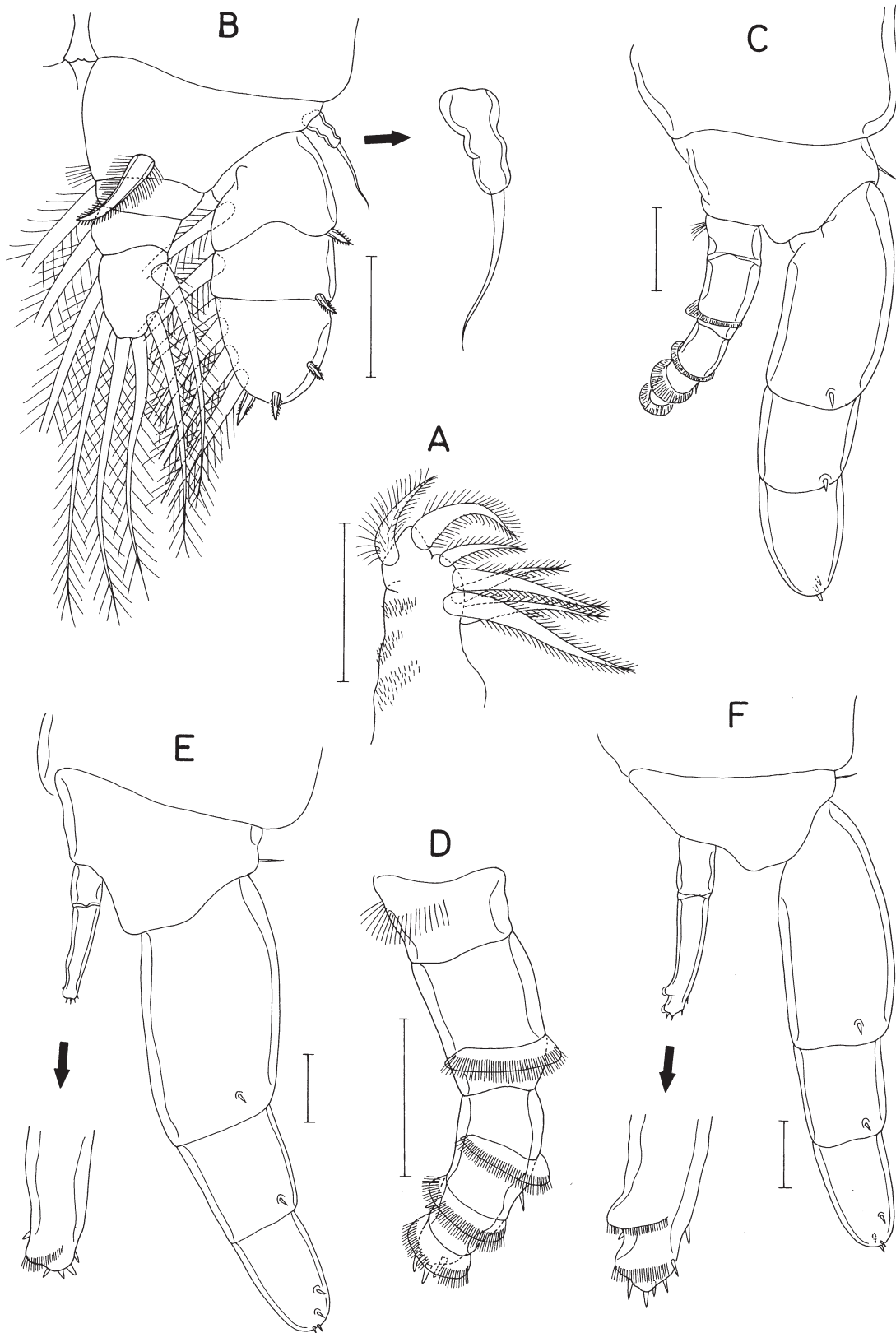
Rostrum (Fig. 99D) linguiform, tapering, rounded distally, and ornamented with dense converging of setules on all surfaces. Antennule (Fig. 99E) simple, lobate, unsegmented and unarmed, rounded distally, only narrowing slightly towards tip, 193×143 µm, traces of articulations visible in proximal third; distal two-thirds ornamented with dense covering of setules. Antenna (Fig. 99F) stout, 4-segmented, as in female *G. globularis*.

Labrum (Fig. 99G) tapering strongly; posterior part forming large, setulose lobe. Mandible (Fig. 99I) with broad medial margin on coxal gnathobase bearing 6 teeth and 1 small seta; basis with 1 seta on distal medial margin; exopod indistinctly 2-segmented and armed with 2 and 3 setae on first and second segments, respectively, outer seta on second segment short and broad; endopod 2-segmented with 1 and 4 setae on first and second segments, respectively, 2 medial setae on second segment



**FIGURE 99.** *Gunenotophorus antennularis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, paragnath; I, mandible; J, maxillule; K, maxilla. Scale bars: A, 1 mm; B, 0.5 mm; C, D, 0.1 mm; E–K, 0.05 mm.





**FIGURE 100.** *Gunenotophorus antennularis* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, endopod of leg 2; E, leg 3; F, leg 4. Scale bars: 0.1 mm.

shorter than distal setae, with swollen basal region. Paragnath (Fig. 99H) with 2 large dentiform processes apically and dense covering of setules on medial surface. Maxillule (Fig. 99J) as in *G. globularis*, but all 9 setae on arthrite prominent. Maxilla (Fig. 99K) similar to that of *G. globularis*, except endopod bearing 4 setae (2 shorter and 2 longer). Maxilliped (Fig. 100A) unsegmented, armed with 7 setae and ornamented with 3 patches of minute spinules on outer surface.

Legs 1 and 2 (Fig. 100B, C) with 3-segmented rami. Legs 3 and 4 (Fig. 100E, F) with 3-segmented exopods and 2-segmented endopods. Inner coxal seta absent in legs 1–4. Leg 1 outer seta on basis with thickened, sinuous proximal part; inner distal spine of basis broad and pinnate; exopod broad and distinctly longer than endopod. Exopod twice as long as endopod in leg 2, 3.3 times longer in leg 3, and 2.6 times longer in leg 4. Endopod (Fig. 100D) of leg 2 ornamented with 4 rings of setules, 1 on second and 3 on third segments. Similar but less prominent setular rings present on distal endopodal segment of legs 3 and 4, 1 on leg 3 and 2 on leg 4. All setae on legs 2–4 rudimentary. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, 4	0-1; 0-1; 2, 2, 2
Leg 2	0-0	1-0	1-0; 1-0; 3(or 4)	0-0; 0-0; 1, 3, 1
Leg 3	0-0	1-0	1-0; 1-0; 3(or 4)	0-0; 1, 3, 1
Leg 4	0-0	1-0	0-0; 0-0; 4	0-0; 1, 5, 1
Leg 5	absent.			

**Male.** Unknown.

**Remarks.** In all previously described species of *Gunentophorus* the antennule is segmented and strongly tapering. In contrast, the female of this distinctive new species has lobate, unsegmented antennules that are densely ornamented with setules and apparently lack any typical setation elements. The new species is very similar to *G. globularis* in external body form. In addition to the antennule, the new species differs in having 4 setae (vs. 5 in *G. globularis*) on the second endopodal segment of the mandible.

### Genus *Botachus* Thorell, 1859

**Diagnosis:** Body consisting of cephalosome and first to fourth pedigerous somites, with fourth somite completely fused to fifth and forming elongate brood pouch, as long as anterior part of prosome, plus 5-segmented free urosome. Anal somite with paired posteroventral protuberances densely ornamented with minute spinules. Caudal rami armed with 2 claws and 4 setae. Antennule 7- or 8-segmented. Antenna 4-segmented; basis with large pinnate seta and small seta (representing exopod); compound distal endopodal segment armed with 9 setae plus terminal claw. Mandible with 4 teeth and 1 proximal

seta on coxal gnathobase; basis with 1 seta; exopod 2-segmented and armed with 3 and 2 setae on first and second segments, respectively; endopod unsegmented, armed with 12 setae. Maxillule with 8 setae on arthrite, 1 seta on coxal endite, 2 setae on epipodite, 3 unequal setae on medial margin of basis; exopod with 4 distal setae; endopod smaller than exopod, with 3 distal setae. Maxilla 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 3 setae; first to third endopodal segments with 1, 1, and 4 setae, respectively. Maxilliped lobate with 10 setae (8 medial and 2 apical). Legs 1–4 with 3-segmented exopods and 2- or 3-segmented endopods. Inner coxal seta lacking in legs 1–4. Inner distal spine present on basis of leg 1. Armature formula variable:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0/I	I-1; I-1; VI, 1	0-0; 1, 2, 2 or 0-0; 0-1; 1, 2, 1
Leg 2	0-0	1-0	I-1; I-1; VI, 2	0-1; 0-0; 1, I, 3 or 1, II, 2 or I, 2
Leg 3	0-0	1-0	I-0; I-1; V, 2	0-1; 0-0; 1, I, 3 or 1, II, 2 or I, 2
Leg 4	0-0	0/1-0	I-0; I-1; V, 2	0-0; 0-0; 1, I, 2 or 1, II, 1 or I, 2

Leg 5 consisting of digitiform protopod and free exopodal segment bearing 2 setae.

**Type Species:** *Botachus cylindratus* Thorell, 1859, by original monotypy.

**Remarks.** This genus is treated as effectively monotypic. Two species described and named by Hesse (1869), *B. fulvus* Hesse, 1869 and *B. macroone* Hesse, 1869, were regarded as indeterminable by Illg (1958) and are not considered here. Stock (1967) proposed to recognize *Goniodelphys* Buchholz, 1869 as a junior synonym of *Botachus* and transferred its type species, *Goniodelphys trigona* Buchholz, 1869, and he also included *Notopterophoroides malacodermatus* Schellenberg, 1922 in *Botachus*. However, this proposal was rejected by Ooishi & Illg (1973) because it would result in an expanded generic concept for *Botachus* that would be “meaningless taxonomically”. Ooishi & Illg (1973) continued to recognize *Goniodelphys* as valid and to consider *N. malacodermatus* as a species of *Notopterophoroides*.

The most important differences between *Botachus* and related genera such as *Goniodelphys* seem to be the possession of 4 setae on the exopod and 3 setae on the endopod of the maxillule. The absence of the inner spine on the basis of leg 1 in *B. cylindratus* was regarded as a significant difference between *Botachus* and *Goniodelphys*, but this spine is present in the male and in the new species described below. The genera related to *Botachus* can be distinguished using the following key.

## Key to genera of “*Botachus* group”

1. Maxillule with 4 setae on exopod and 3 setae on endopod.  
..... *Botachus*  
Maxillule with 3 setae on exopod and 4 setae on endopod  
..... 2
2. First outer element of third exopodal segment of leg 1 is a  
seta..... 3  
First outer element of third exopodal segment of leg 1 is a  
spine..... 4
3. Caudal ramus with 3 spines and 3 setae; mandibular exopod  
with 4 setae..... *Notopterophoroides*  
Caudal ramus with 6 setae; mandibular exopod with 4  
setae..... *Ooishillgia* **gen. nov.**
4. Maxillule as simple lobe..... *Microrra*  
Maxillule segmented and biramous..... 5
5. First endopodal segment of mandible armed with 2 setae;  
legs 1–4 usually with 2-segmented endopod.... *Periproctia*  
First endopodal segment of mandible armed with 4 or 5  
setae; legs 1–4 with 3-segmented endopod.....  
..... *Goniodelphys*

### *Botachus cylindratus* Thorell, 1859

(Figs. 101, 102)

**Material examined.** 9 ♀♀, 4 ♂♂ (MNHN-IU-2018-1823) from *Ascidia mentula* Müller, 1776, Brest, France; 5 ♀♀ *A. mentula* (MNHN-IU-2018-1824), Brest; 20 ♀♀, 1 ♂ (MNHN-IU-2018-1825) from *A. mentula*, Porto Vecchio, Corsica; 2 ♀♀, 3 ♂♂ (MNHN-IU-2018-1826) from *A. mentula*, Glénan, France; 1 ♀, 2 ♂♂ (MNHN-IU-2018-1827) from *A. mentula*, Adriatic; 4 ♀♀ (MNHN-IU-2018-1828) from *A. mentula*, Kristineberg, Sweden; 1 ♀ (MNHN-IU-2018-1829) from *A. mentula*, Bergen; 2 ♀♀, 1 ♂ (MNHN-IU-2018-1830) from *A. mentula*, Canaries; 8 ♀♀ (MNHN-IU-2018-1918) from *A. mentula*, Le Havre, Port Antifer, Breton coll., November 2008; 9 ♀♀, 2 ♂♂ (MNHN-IU-2017-2161) and dissected 1 ♀, 1 ♂ from *A. mentula*, Corsica, MEDITS 2016 Stn M16-3 (41°50.74'N 09° 27.53'E), depth 72 m; 11 ♀♀, 2 ♂♂ (MNHN-IU-2017-2164) from *A. mentula*, Corsica (42°10.70'N 09°36.22'E), MEDITS 2016 Stn M16-1.

1 ♀ (MNHN-IU-2018-1831) and 1 dissected ♀ from *A. muricata* Heller, 1874, Porto Vecchio, Corsica, depth 3 m.

3 ♀♀ (MNHN-IU-2018-1832) from *Phallusia fumigata* (Grube, 1864), Porto Vecchio, Corsica.

#### Supplementary description of female associated with *Ascidia mentula* from Corsica:

Body (Fig. 101A) slender, depressed, 1.51 mm long. Prosome gradually broadening distally. Fourth pedigerous somite forming brood pouch, longer than anterior part of prosome; fifth pedigerous somite completely fused with fourth. Free urosome cylindrical, 5-segmented, directed ventrally. Anal somite with spinulose, highly sclerotized ventrodistal protuberance. Caudal ramus (Fig. 101B)

about 2.4 times longer than wide (59×25 µm), extended posteroventrally, armed with 2 claws and 4 naked setae and ornamented with several rows of minute spinules; 2 claws subequal in length and thickness, thicker claw 46 µm long and thin claw 43 µm long; posteroventral naked seta wrinkled, smallest seta inserted into basal part of thick claw.

Rostrum longer than wide, narrowing distally towards rounded apical margin. Antennule, antenna, and mouthparts as described and illustrated by Illg & Dudley (1965).

Leg 1 (Fig. 101C) with 3-segmented exopod and 2-segmented endopod; compound distal endopodal segment subdivided by indistinct suture line. Inner coxal seta absent in legs 1–4. Legs 2–4 (Fig. 101D–F) with 3-segmented rami; first and second exopodal segments lacking inner seta; first and second endopodal segments also lacking inner setae; setae stiff, with short setules distally. Leg 4 lacking outer seta on basis. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-1; I-0; VI, 1	0-0; 1, 2, 2
Leg 2	0-0	1-0	I-0; I-0; VI, 2	0-0; 0-0; I, 2
Leg 3	0-0	1-0	I-0; I-0; V, 2	0-0; 0-0; I, 2
Leg 4	0-0	0-0	I-0; I-0; V, 2	0-0; 0-0; I, 2

Leg 5 (Fig. 101G) small, consisting of digitiform protopod and rectangular free exopod; protopod tipped with long, naked seta; exopodal segment about 2.2 times longer than wide, also tipped with 1 naked seta (shorter than protopodal seta) and ornamented with spinules on inner margin.

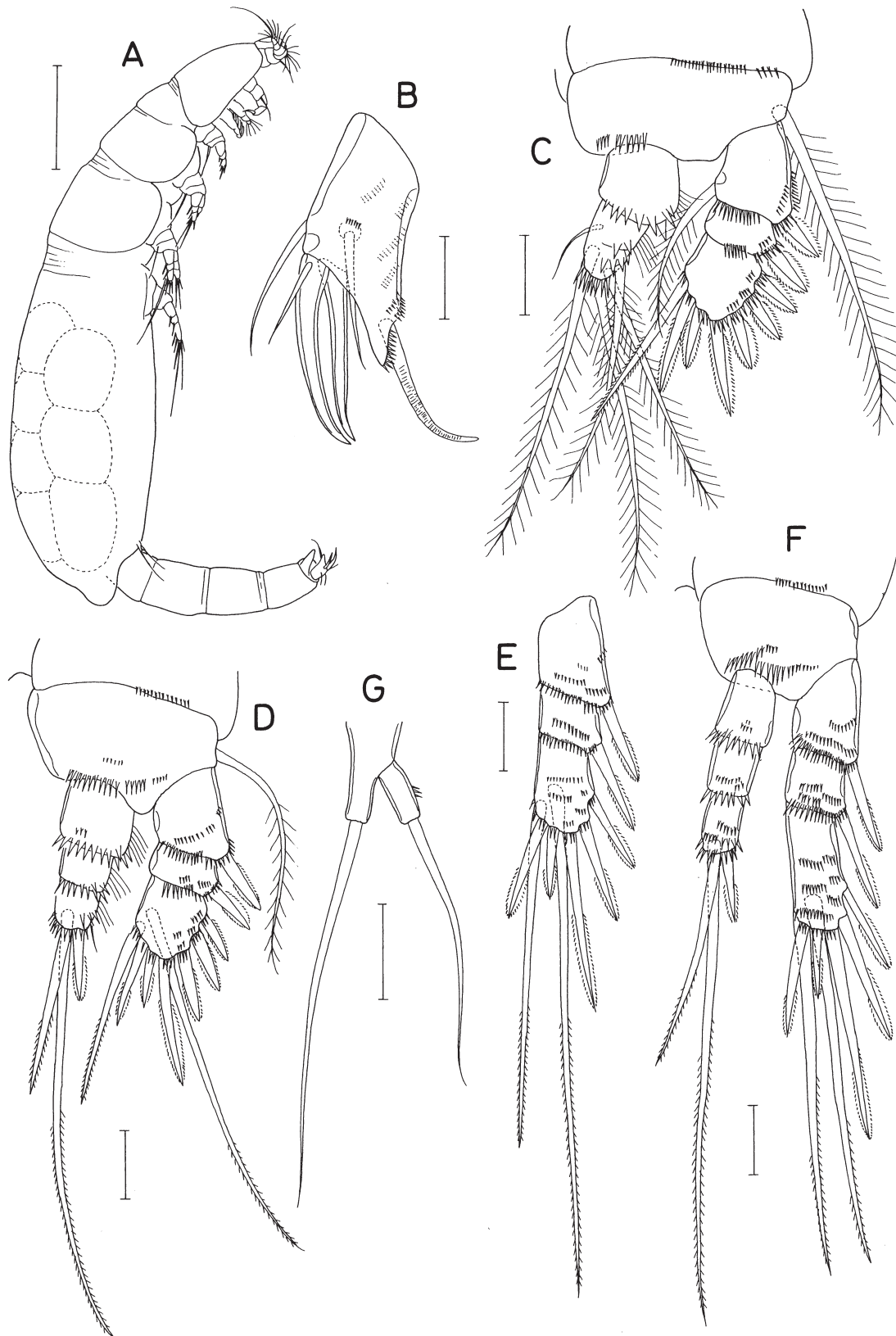
#### Supplementary description of female associated with *A. mentula* from Le Havre (Atlantic).

Morphological features as in above female from Corsica in the Mediterranean, except for leg armature and segmentation of leg 1 endopod, as follows:

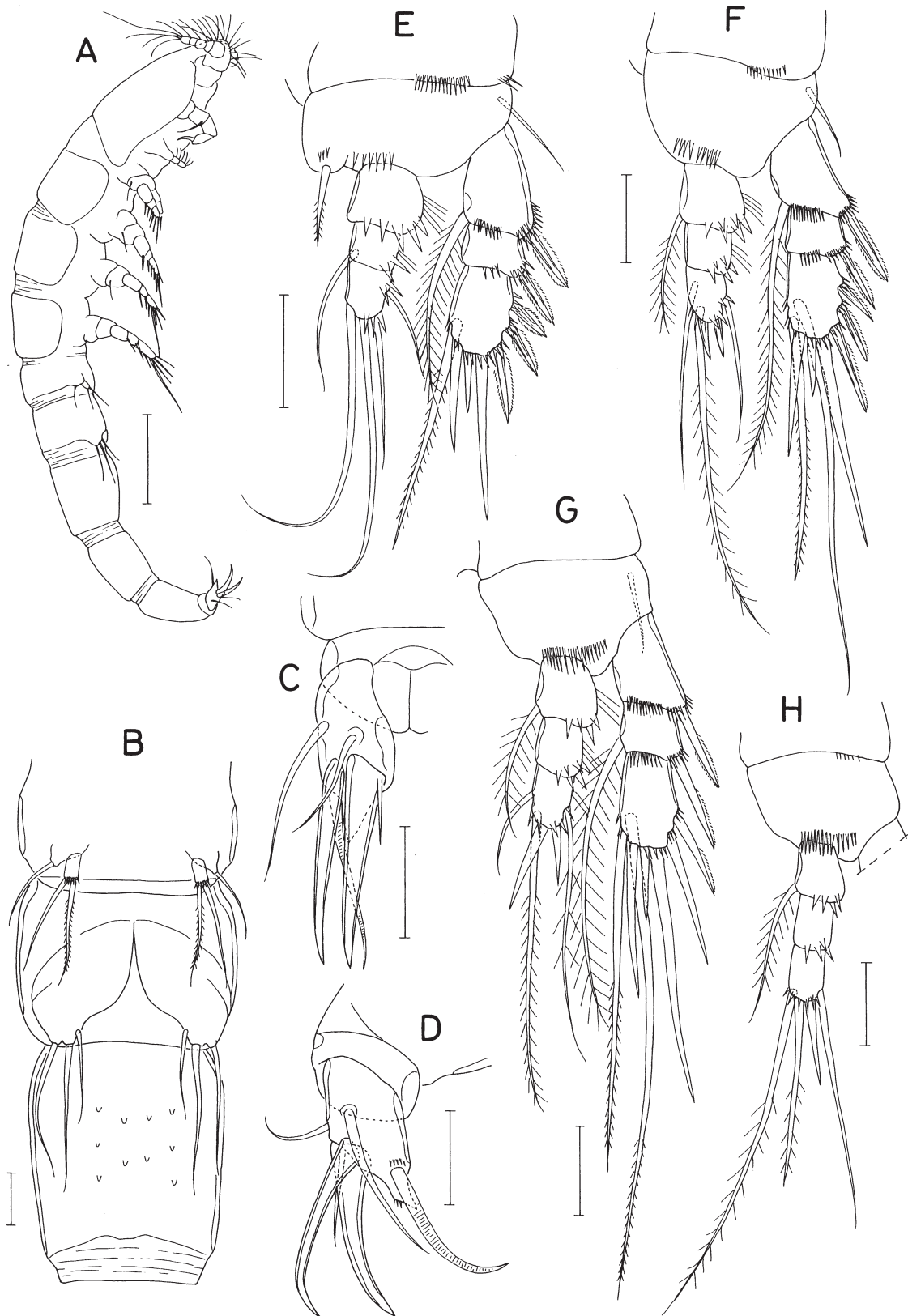
	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-1; I-0; VI, 1	0-0; 0-1; 1, 2, 1
Leg 2	0-0	1-0	I-1; I-0; VII, 1	0-0; 0-0; 1, II, 2
Leg 3	0-0	1-0	I-0; I-0; V, 2	0-0; 0-0; 1, II, 2
Leg 4	0-0	1-0	I-0; I-0; V, 2	0-0; 0-0; 1, II, 1

#### Supplementary description of female associated with *Ascidia muricata* from Corsica.

Morphological features as in female associated with *A. mentula* from Corsica, except for leg armature and segmentation, as follows:



**FIGURE 101.** *Botachus cylindratus* Thorell, 1859 female. A, habitus, right; B, caudal ramus, medial; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4; G, leg 5. Scale bars: A, 0.2 mm; B-G, 0.02 mm.



**FIGURE 102.** *Botachus cylindratus* Thorell, 1859 male. A, habitus, right; B, proximal part of urosome showing legs 5 and 6, ventral; C, caudal ramus, dorsal; D, caudal ramus, right; E, leg 1; F, leg 2; G, leg 3; H, protopod and endopod of leg 4. Scale bars: A, 0.1 mm; B-H, 0.02 mm.

**TABLE 1.** Variation in leg segmentation and armature in female *Botachus cylindratus*.

Locality	Atlantic samples		Mediterranean samples			
	Brest	Le Havre	Naples	Corsica	Corsica	Corsica
leg 1 enp segs	3	3	2	2	2	2
legs 2-4 enp segs	3	3	3	3	2	2
Leg 2 & 3 setal elements on enp	5	5	3	3	5	5
leg 4 setal elements on enp	3	4	3	3	4	4
Host	<i>Ascidia mentula</i>	<i>Ascidia mentula</i>	<i>Ascidia mentula</i>	<i>Ascidia mentula</i>	<i>Ascidia muricata</i>	<i>Phallusia fumigata</i>
Sources	Illg & Dudley, 1965	present study	Illg & Dudley, 1965	present study	present study	present study

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-1; I-0; VI, 1	0-0; 1, 2, 2
Leg 2	0-0	1-0	I-1; I-0; VII, 1	0-0; 1, II, 2
Leg 3	0-0	1-0	I-0; I-0; V, 2	0-0; 1, II, 2
Leg 4	0-0	1-0	I-0; I-0; V, 2	0-0; 1, II, 1

### Supplementary description of male associated with *A. mentula* from Corsica.

Body (Fig. 102A) slender, 0.85 mm long. Prosome strongly depressed. Urosome 6-segmented; fifth pedigerous somite free. First abdominal somite ornamented with 10 small tubercles on ventral surface (Fig. 102B). Anal somite (Fig. 102C, D) short, without ventral protuberance. Caudal ramus (Fig. 102C, D) about 2.1 times longer than wide (34×16 µm), bearing tapering posteroventral process; armed with 2 claws and 4 setae; 2 claws almost equal in length, 40 and 39 µm, but unequal in thickness; setae naked, smallest seta inserted into basal part of thicker claw.

Rostrum, antennule, antenna, and mouthparts as in female.

Leg 1 (Fig. 102E) basis bearing inner distal seta and small, naked outer seta; endopod 3-segmented, but articulation indistinct between second and third segments. Leg 2 (Fig. 102F) exopod and endopod each bearing inner seta on first segment; third endopodal segment with 2 spines and 3 setae. Leg 3 (Fig. 102G) exopod with inner seta on second segment; endopod armed as in leg 2. Leg 4 (Fig. 102H) lacking outer seta on basis, as in female; exopod as in leg 3; endopod with inner seta on first segment and 1 spine and 3 setae on third segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	I-1; I-0; VI, 1	0-0; 0-1; 1, 2, 1
Leg 2	0-0	1-0	I-1; I-0; VI, 2	0-1; 0-0; 1, II, 2
Leg 3	0-0	1-0	I-0; I-1; V, 2	0-1; 0-0; 1, II, 2
Leg 4	0-0	0-0	I-0; I-1; V, 2	0-1; 0-0; 1, I, 2

Leg 5 (Fig. 102B) protopod short, not articulated from ventral surface of somite, with naked seta on tip of

short outer distal process; exopod rectangular, 10×6 µm, with rows of fine spinules distally; armed with 2 setae of equal length, inner seta feebly pinnate, outer seta naked. Leg 6 (Fig. 102B) represented by 3 naked distal setae on genital operculum, middle seta longest, inner shortest.

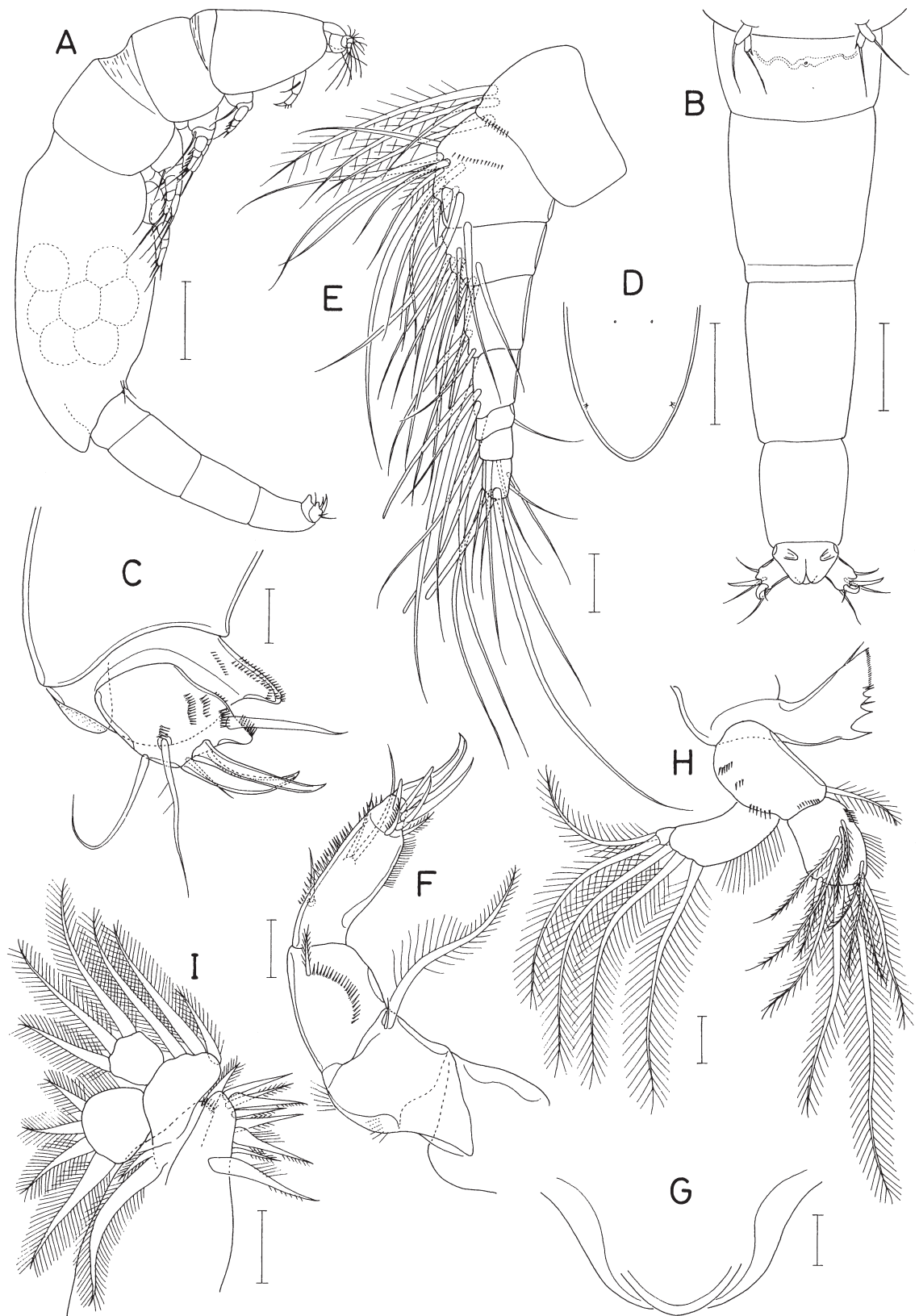
**Remarks.** As described above and by Illg & Dudley (1965), *B. cylindratus* exhibits extreme variability in the segmentation and setation of the biramous swimming legs (see Table 1). The nature of this variability requires further morphological study and analysis of a sufficient number of samples from different hosts and localities in order to determine whether there is any discernible pattern related to either host usage or geographical distribution.

### *Botachus major* sp. nov. (Figs. 103–105)

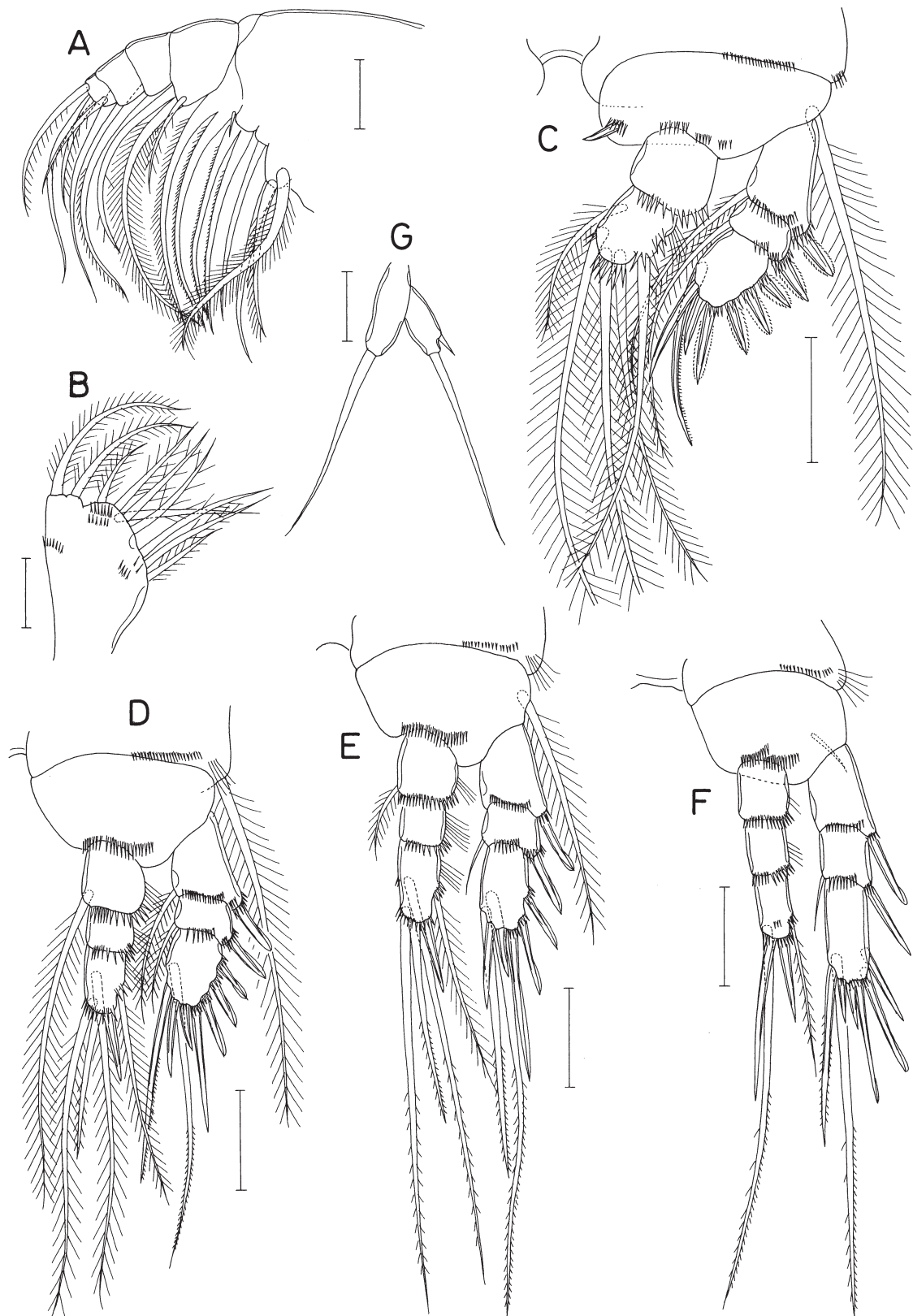
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21247), paratypes (intact, 2 ♀♀ and 1 ♂, MNHN-IU-2014-21248), and dissected paratype (♀, figured), from *Ascidia involuta* Heller, 1875 (MNHN-IT-2008-1058 = MNHN P5/ASC.A/255), Sierra Leone, Iles Banana, R/V “Sea Diver”, depth 28 m, 04 October 1990; 1 ♂ (dissected and figured) from *A. involuta*, Sierra Leone 04 October 1990, depth 28 m.

**Etymology.** The specific name is from the Latin *major*, meaning “larger”, and refers to the body size of the new species.

**Description of female.** Body (Fig. 103A) slender, curved ventrally, and distinctly segmented. Body length 2.07 mm. Prosome depressed; fourth pedigerous somite forming brood pouch, about 700×370 µm in lateral view, as long as anterior part of prosome; fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 103B) cylindrical, 5-segmented, narrowing posteriorly. Genital somite 102×193 µm, with copulatory pore on ventral surface; 4 abdominal somites 193×168, 182×125, 116×102, and 45×75 µm, respectively. Anal somite (Fig. 103C) with paired tapering posteroventral protuberances densely ornamented with minute spinules on ventral surface; anal operculum large. Caudal ramus (Fig. 103C)

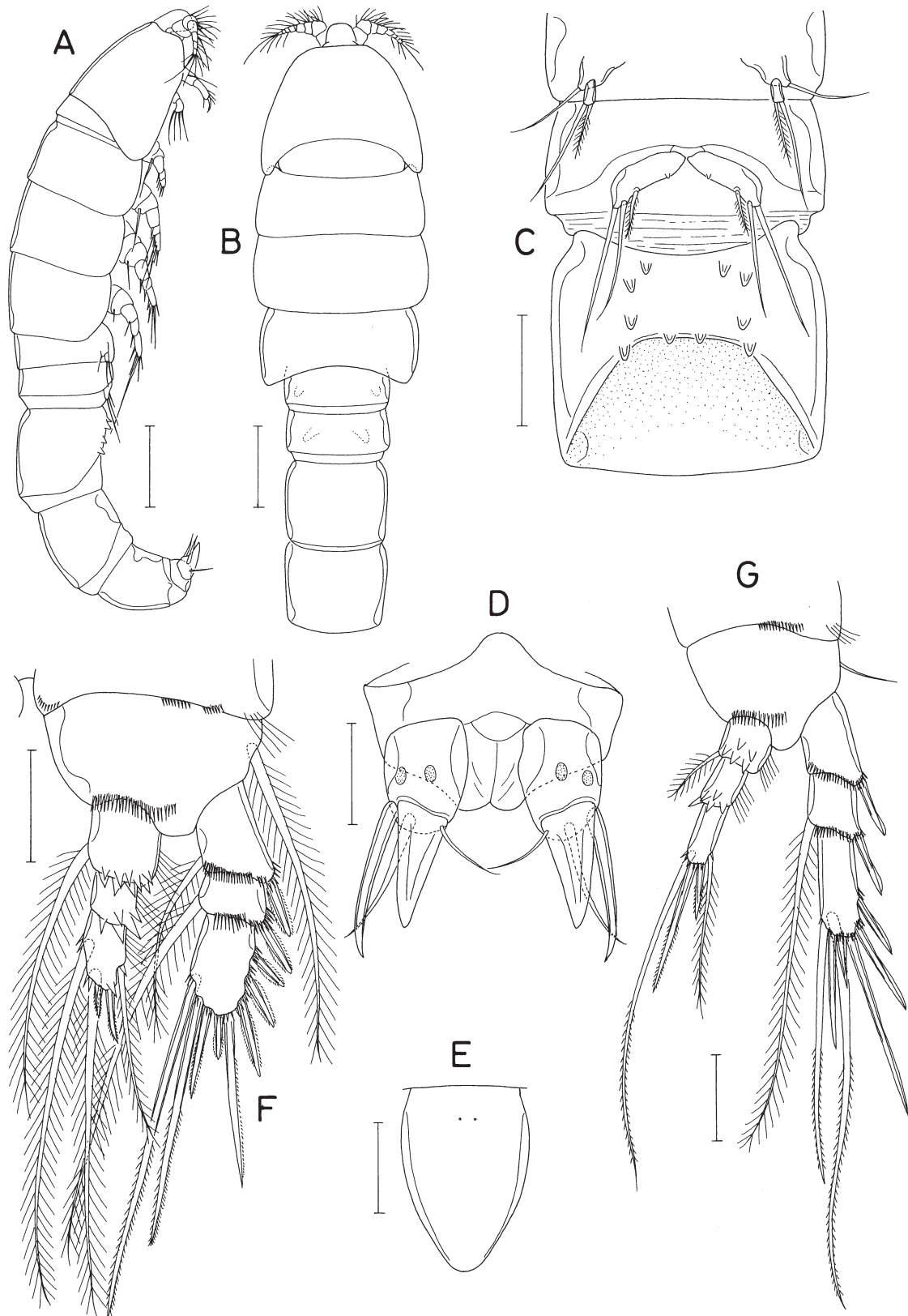


**FIGURE 103.** *Botachus major* sp. nov., female. A, habitus, right; B, urosome, ventral; C, anal somite and caudal ramus, right; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C, E-I, 0.02 mm; D, 0.05 mm.



**FIGURE 104.** *Botachus major* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, B, G, 0.02 mm; C-F, 0.05 mm.





**FIGURE 105.** *Botachus major* sp. nov., male. A, habitus, right; B, habitus, without last 2 abdominal somites, dorsal; C, proximal part of urosome showing legs 5 and 6, ventral; D, anal somite and caudal rami, dorsal (stippled circles indicating insertion positions of setae); E, rostrum; F, leg 2; G, leg 4. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D-G, 0.05 mm.

short, divergent, with ventrodistal extension; armed with 2 claws and 4 setae, ornamented with scattered rows of minute spinules; 2 claws unequal in thickness, thick claw 42 µm long, thin claw 50 µm.

Rostrum (Fig. 103D) longer than wide (79×68 µm), narrowing towards rounded distal margin. Antennule (Fig. 103E) 158 µm long, 8-segmented; armature formula 4, 14, 9+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae crowded and generally long, several setae on proximal segments pinnate; first and second segments each with 1 transverse row of minute spinules. Antenna (Fig. 103F) stout, 4-segmented; coxa short and unarmed; basis nearly as long as wide, exopod represented by 1 large pinnate seta and 1 small setule at outer distal corner; ornamented with 2 rows of setules on inner surface; first endopodal segment as long as basis, with 1 small seta subdistally and curved row of small spinules; compound distal endopodal segment about 2.8 times longer than wide (53×19 µm), with spinulose inner surface and setulose distal outer margin; armed with 9 setae plus terminal claw 38 µm long, more than half length of segment.

Labrum (Fig. 103G) simple, smooth, with broad posteromedian lobe. Mandible (Fig. 103H) with 4 teeth and 1 thin proximal seta on coxal gnathobase, proximalmost tooth bifid; 1 needle-like spinule present between distal second and third teeth; basis with 1 seta at mediobasal corner and scattered rows of minute spinules; exopod 2-segmented and armed with 3 and 2 setae on first and second segments, respectively, outer distal seta on second segment shorter than other exopodal setae; endopod unsegmented, armed with 12 setae (4 on anterior surface and 8 on distal and subdistal margins); medial margin of endopod ornamented with row of minute spinules proximally and row of setules distally. Maxillule (Fig. 103I) with 8 setae on arthrite, 1 seta and patch of minute spinules on coxal endite, 2 unequal setae on epipodite, and 3 unequal setae on medial margin of basis; exopod with 4 distal setae increasing in length from inner to outer; endopod smaller than exopod, with 3 distal setae increasing from outer to inner. Maxilla (Fig. 104A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively, proximal seta on distal endite minute; basis with 3 setae; first to third endopodal segments with 1, 1, and 4 setae, respectively. Maxilliped (Fig. 104B) lobate, broadened distally, armed with 10 setae (8 medial and 2 apical); ornamented with scattered rows of fine spinules.

Leg 1 (Fig. 104C) with 3-segmented exopod and 2-segmented endopod. Legs 2–4 (Fig. 104D–F) with 3-segmented rami. Coxa of legs 1–4 unarmed. Outer seta on basis large and pinnate in legs 1–3, but small and naked in leg 4. Inner distal spine present on basis of leg 1, 15 µm long, shorter than first endopodal segment. Inner seta on second exopodal segment of legs 3 and 4 small and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; VI, 1	0-0; 1, 2, 2
Leg 2	0-0	1-0	I-1; I-1; VI, 2	0-1; 0-0; 1, I, 3
Leg 3	0-0	1-0	I-0; I-1; V, 2	0-1; 0-0; 1, I, 3
Leg 4	0-0	1-0	I-0; I-1; V, 2	0-0; 0-0; 1, I, 2

Leg 5 (Fig. 104G) small, consisting of digitiform protopod and exopod; protopod tipped with naked seta (58 µm long); exopodal segment articulated from protopod, 20×9 µm, armed with 1 naked seta (58 µm long) at tip and 1 small subdistal seta (7 µm long).

**Description of male.** Body (Fig. 105A) 1.64 mm long. Prosome 800 µm long. Fourth pedigerous somite with concave posterodorsal margin (Fig. 105B). Fourth pedigerous and urosomites well-sclerotized. Urosome 6-segmented; fifth pedigerous somite 113×264 µm; genital somite (Fig. 105C) 123×259 µm, as short as fifth pedigerous somite, with small genital operculum ventrally. Abdomen strongly curved ventrally. First abdominal somite (Fig. 105C) 216×255 µm, ornamented with 10 tubercles on ventral surface. Anal somite (Fig. 105D) lacking posteroventral protuberance. Caudal ramus (Fig. 105D) slightly narrowing distally, 45×42 µm, armed with 2 claws plus 4 setae; claws very unequal, one robust, conical, 60 µm long and 27 µm wide, outer distal claw 77 µm long and 8 µm wide; 1 seta inserted into basal part of robust claw (2 dorsal setae missing in Fig. 105D).

Rostrum (Fig. 105E) longer than that of female. Antennule 8-segmented and similar to that of female; armature formula 4, 12+2 spines, 8+aesthetasc, 4, 3+aesthetasc, 2, 2, and 7+aesthetasc. Antenna, labrum, mandible, maxillule, maxilla, and maxilliped as in female.

Leg 1 also as in female. Legs 2–4 ornamented with large spinules along distal border of first and second endopodal segments (Fig. 105F, G). Third endopodal segment of leg 2 armed with 2 spines and 3 setae. Legs 3 and 4 each with large inner seta on second exopodal segment (Fig. 105G). First endopodal segment of leg 4 with inner seta.

Leg 5 (Fig. 105C) small and consisting of short protopod and exopod; protopod with 1 naked seta on outer distal corner; free exopod rectangular, armed with 2 setae distally (short pinnate inner seta and long naked outer seta). Leg 6 (Fig. 105C) represented by 3 setae on genital operculum, small inner seta pinnate, other 2 longer setae naked.

**Remarks.** The new species *B. major* sp. nov. differs from the type species, *B. cylindratus*, in numerous characters. The major differences are summarised in Table 2, and collectively these are sufficient to justify the establishment of the new species.

**TABLE 2.** Morphological differences between *Botachus cylindratus* and *B. major* **sp. nov.**

Characters	<i>Botachus cylindratus</i>	<i>Botachus major</i> <b>sp. nov.</b>
Female body length	1.51 mm	2.07 mm
Male body length	0.85 mm	1.64 mm
Claws on female caudal ramus	Subequal in length & width	Unequal in length & width
Claws on male caudal ramus	Equal length, unequal in width	Very unequal in length & width
Leg 1 inner element on basis	Absent in female; seta in male	Spine in both sexes
Inner seta exp2 of legs 1–4	absent	present
Outer seta on basis legs 1–3	small	large

### Genus *Goniodelphys* Buchholz, 1869

**Diagnosis:** Body consisting of cephalosome, first to fifth pedigerous somites and free urosome. Fourth pedigerous somite fused to fifth and forming brood pouch as long as anterior part of prosome. Free urosome 5-segmented, comprising genital somite and 4 free abdominal somites. Anal somite with paired tapering posteroventral protuberances densely ornamented with minute spinules. Caudal rami armed with 2 claws and 4 setae. Antennule 8-segmented. Antenna 4-segmented; basis with large pinnate seta and small seta (representing exopod); compound distal endopodal segment armed with 10 setae plus terminal claw. Mandible with 5 teeth and 1 or 2 proximal setae on coxal gnathobase, basis with 1 seta; exopod 2-segmented and armed with 3 and 2 setae on first and second segments, respectively, or unsegmented and armed with only 4 setae; endopod 2-segmented, armed with 4 or 5 and 9 setae on first and second segments, respectively. Maxillule with 9 setae on arthrite, 1 seta on coxal endite, 2 setae on epipodite, 3 setae on medial margin of basis; exopod with 3 distal setae; endopod with 4 distal setae. Maxilla 5-segmented; syncoxa with 3, 1, 2, and 2/3 setae on first to fourth endites, respectively; basis with 3 setae; first to third endopodal segments with 1, 1, and 3/4 setae, respectively. Maxilliped lobate with 10 setae (4 + 4 medial plus 2 apical). Legs 1–4 with 3-segmented exopods and 2- or 3-segmented endopods. Inner coxal seta lacking in legs 1–4. Inner distal spine present on basis of leg 1. Armature formula:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	I-1; I-1; II, I, 4	0-0; 0-1; 1, 2, 2
Legs 2 & 3	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2, 1, 2, 3
Leg 4	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 consisting of protopod with 1 seta and exopodal segment bearing 2 setae.

**Type Species:** *Goniodelphys trigona* Buchholz, 1869, by original monotypy.

**Remarks.** The original description of the type species *G. trigona* by Buchholz (1869) lacked detail by modern standards but it was redescribed by Illg & Dudley (1965). However, their material was an immature female (Copepodid V) so, although their specimen came from Italian waters (Pozzuoli) close to the type locality (Naples Bay), their redescription provided insufficient morphological information for a robust species comparison. Subsequently Ooishi & Illg (1973) obtained adults of both sexes from *Asciidiella aspersa* in the Gulf of Trieste. They commented that in the adult female leg 1 was functionally 2-segmented due to the suppression of the articulation between ancestral segments 2 and 3. Legs 2–4 exhibit the same segmentation as in the Copepodid V stage but the segments were more elongate and the setae were better developed. In addition, the 2 claws on the caudal ramus were much more robust than in the Copepodid V.

The genus *Goniodelphys* remained monotypic for more than a century until Ooishi & Illg (1973) described a second species, *G. tokiokai* Ooishi & Illg, 1973, collected from *Pterygascidia longa* (Van Name, 1918) in the Philippines at a depth of 72 to 80 m. Here we recognize *G. tokiokai* as the type species of a new genus, *Ooishillgia* **gen. nov.** (see below). In their wider discussion, Ooishi & Illg (1973) highlighted the similarities between *Goniodelphys*, *Notopterophoroides* Schellenberg, 1922 and the monotypic genus *Ustina* Illg, 1951. They re-examined the type material of *Ustina clarki* Illg, 1951 and concluded that it should be placed in *Goniodelphys*, as *G. clarki* (Illg, 1951) which they formally recognized as a new combination.

### *Goniodelphys indica* **sp. nov.**

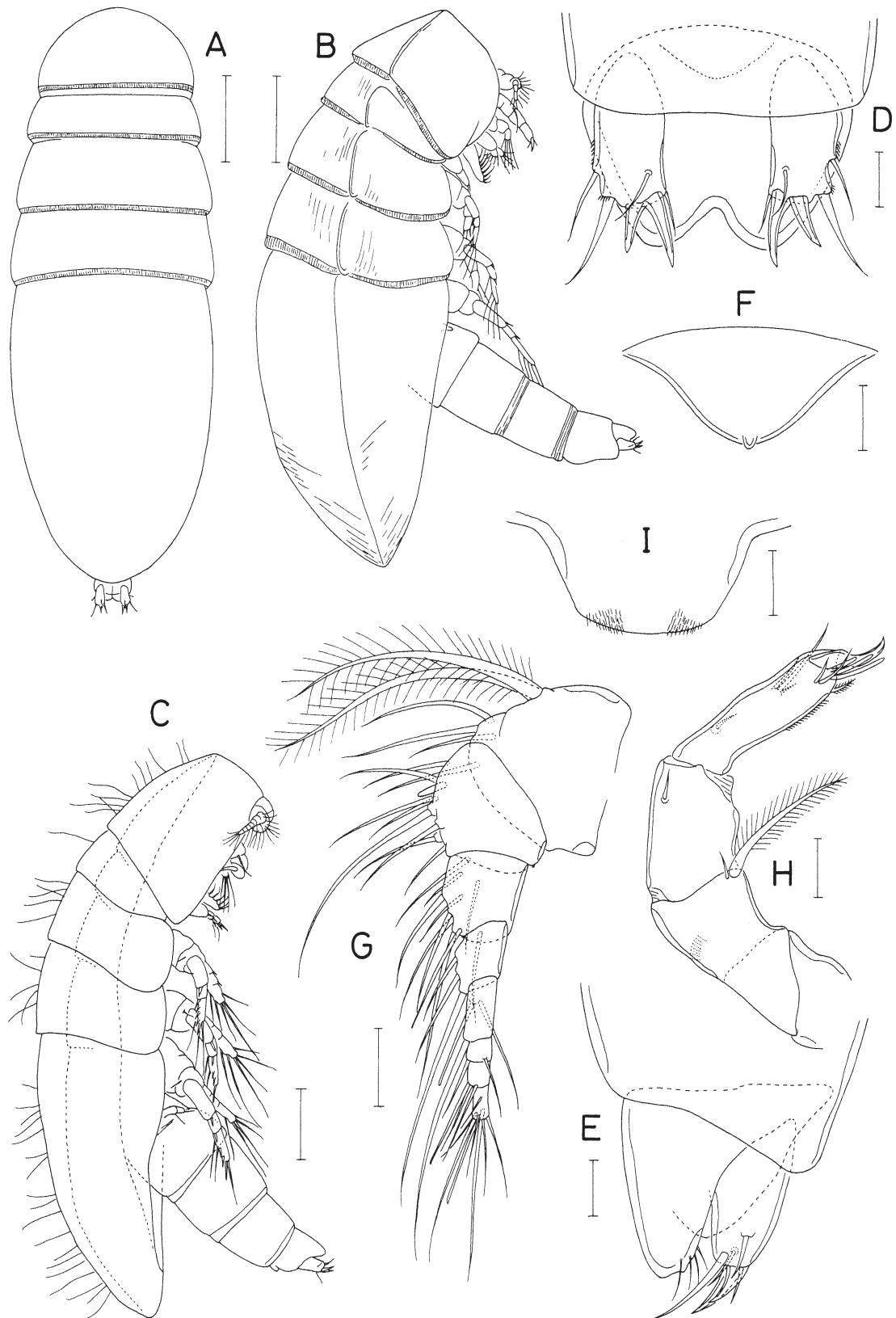
(Figs. 106–108)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21249), paratype (intact ♀, MNHN-IU-2014-21250)), and dissected paratype (♀, figured) from *Ascidia fictile* Monniot C., 1997 (MNHN-IT-2008-1016 = MNHN P5/ASC.A/292), MUA20, Nosy Be, Madagascar, depth 27 m, P. Laboute coll., 08 October 1991.

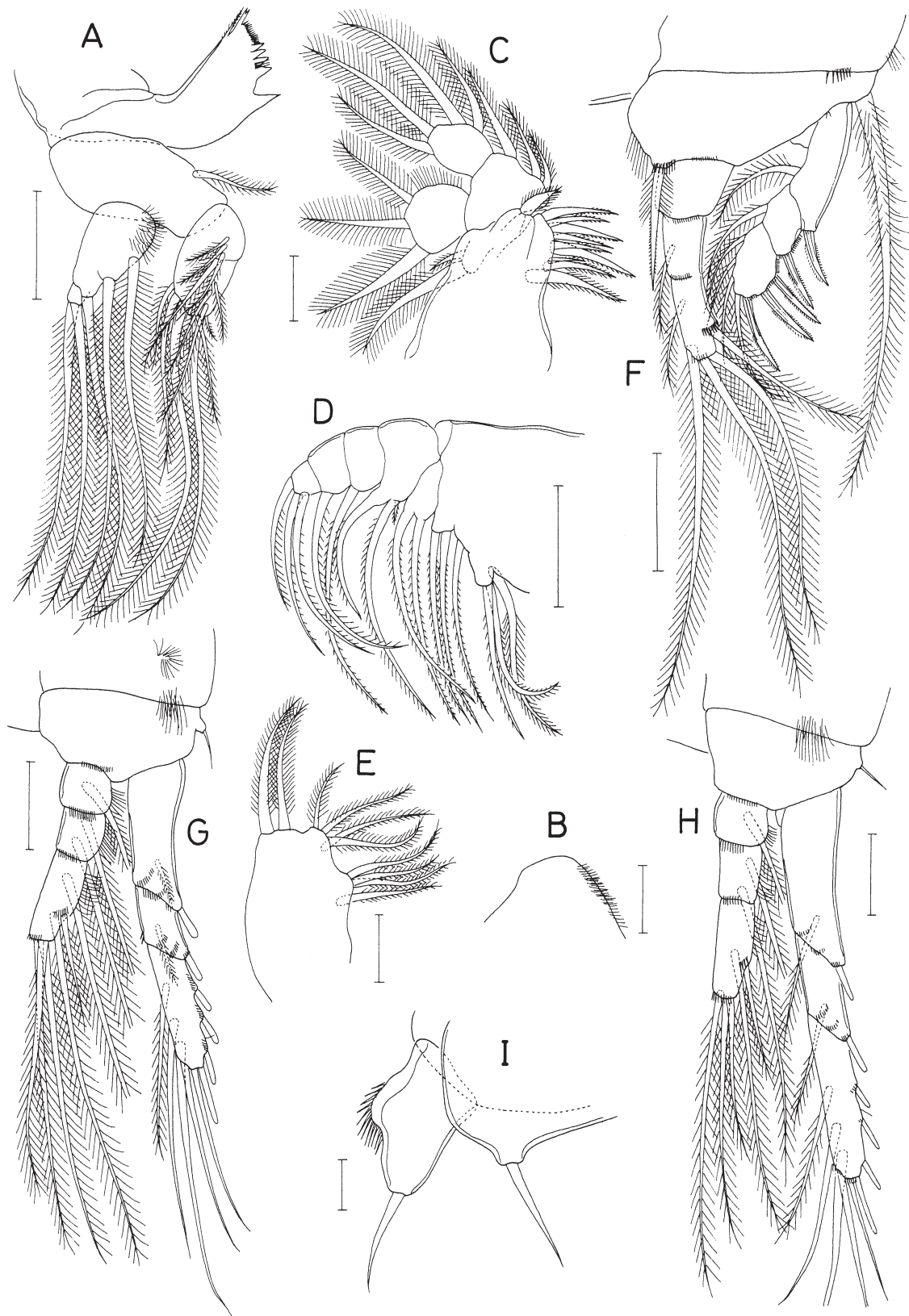
**Additional material.** 8 ♂♂ (MNHN-IU-2018-1833) and 2 dissected specimens (1 copepodid V ♀, 1 ♂) from *A. fictile*, Nosy Be, Madagascar, collected by Laboute.

**Etymology.** The new species is named for its geographic origin, the Indian Ocean.

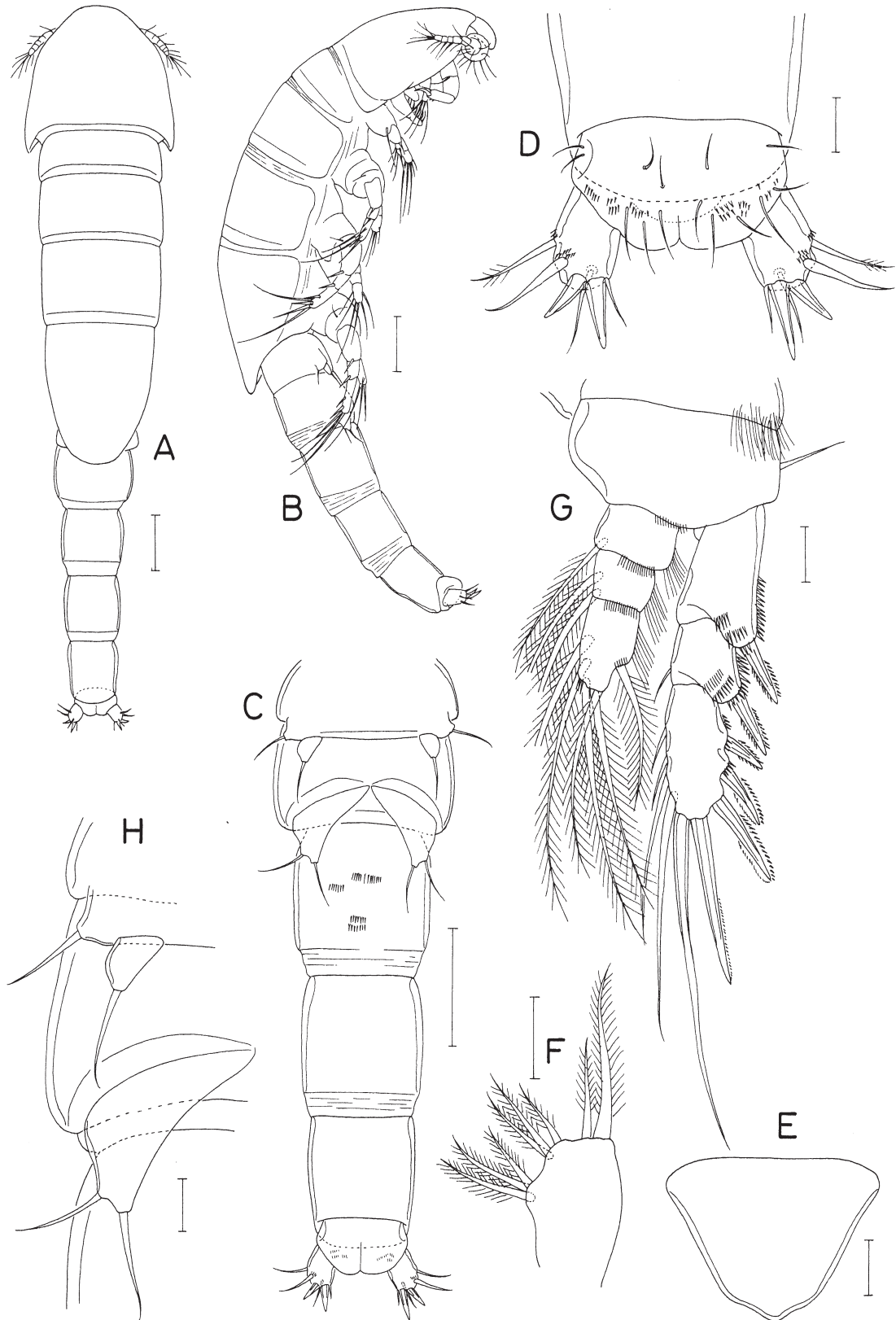
**Description of female.** Body (Fig. 106A, B) 3.70 mm long, with spindle-shaped prosome with flattened dorsal and ventrolateral surfaces 3.30 mm long, clearly segmented. Cephalosome 0.52×0.91 µm, much wider than



**FIGURE 106.** *Goniodelphys indica* sp. nov., female. A, habitus, dorsal; B, habitus, right; C, habitus of copepodid V female, right; D, anal somite and caudal rami, dorsal; E, anal somite and caudal ramus, left; F, rostrum; G, antennule; H, antenna; I, labrum. Scale bars: A, B, 0.5 mm; C, 0.2 mm; D-I, 0.05 mm.



**FIGURE 107.** *Goniodelphys indica* sp. nov., female. A, mandible; B, paragnath; C, maxillule; D, maxilla; E, maxilliped; F, leg 1; G, leg 2; H, leg 4; I, leg 5. Scale bars: A, D, F-H, 0.1 mm; C, C, 0.05 mm; E, I, 0.02 mm.



**FIGURE 108.** *Goniodelphys indica* sp. nov., male. A, habitus, dorsal; B, habitus, right; C, urosome, ventral; D, anal somite and caudal rami, ventral; E, rostrum; F, maxilliped; G, leg 2; H, legs 5 and 6. Scale bars: A-C, 0.1 mm; D-H, 0.02 mm.

long, semicircular in dorsal view, fringed with narrow membrane along posterior margin both dorsally and laterally. First to fourth pedigerous somites 0.26×1.01, 0.39×1.14, 0.38×1.17, and 1.76×1.17 µm, respectively; first to third each fringed with narrow membrane along posterior margin. Fourth pedigerous somite forming brood pouch, longer than anterior prosomal somites combined, tapering in lateral view but with rounded posterior margin in dorsal view. Fifth pedigerous somite fused with fourth. Free urosome cylindrical, 5-segmented, narrowing posteriorly. Anal somite (Fig. 106D) with highly sclerotized posteroventral protuberances bearing few long setules apically. Caudal ramus (Fig. 106D) positioned dorsally, about 2.3 times longer than wide (145×64 µm); armed with 2 claws and 4 naked setae; lengths of claws 68 and 45 µm.

Rostrum (Fig. 106F) much wider than long, with small, nipple-shaped tubercle on rounded apex. Antennule (Fig. 106G) attenuated distally, 8-segmented; armature formula 6, 10, 8+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; suture line between sixth and seventh segments indistinct; 2 proximal setae on first segment pinnate and much larger than other setae. Antenna (Fig. 106H) 4-segmented; coxa short and unarmed; basis with exopod represented by 1 large pinnate seta and 1 vestigial seta at outer distal corner, ornamented with row of minute setules on inner surface; first endopodal segment with 1 small seta on inner side; compound distal endopodal segment about 3.6 times as long as wide; armed with 10 setae (distal 3 setae blunt at tip) plus small terminal claw, less than half as long as segment.

Labrum (Fig. 106I) simple, with convex distal margin and 2 patches of minute spinules distally. Mandible (Fig. 107A) with 5 teeth, 1 proximal seta, distally bifurcate proximal extension, and 3 needle-like spinules between second and third distal teeth on coxal gnathobase; basis with 1 medial seta; exopod 2-segmented, armed with 3 and 2 setae on first and second segments, respectively, all setae subequal in length; endopod incompletely segmented and armed with 4 and 9 setae on first and second segments, respectively; mediobasal seta on second segment very small. Paragnath (Fig. 107B) as simple lobe with setulose medial surface. Maxillule (Fig. 107C) with 9 setae on arthrite, 1 broad seta on coxal endite, 2 setae on epipodite; basis with 3 setae on medial margin; exopod and endopod with 3 and 4 setae, respectively. Maxilla (Fig. 107D) 5-segmented; syncoxa with 3, 1, 2, and 2 setae on first to fourth endites, respectively; 3 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 107E) armed with 10 setae (8 medial and 2 apical).

Legs 1–4 with 3-segmented rami (Fig. 107F–H) but with articulation incomplete between second and third endopodal segments of leg 1. Exopods of legs 2–4 distinctly longer than endopods. Coxa unarmed. Outer seta on basis very large in leg 1 (longer than rami), but small in legs 2–4. Inner distal spine on basis of leg 1 long

and setiform, setulose proximally but spinulose distally. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 0-1; 1, 2, 2
Legs 2 & 3	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2, 1, 2, 3
Leg 4	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 107I) consisting of short, lobate protopod and free exopod; protopod tipped with seta; exopod 59×34 µm, distally with 1 seta and 1 vestigial seta; mid-inner margin of exopod convex and spinulose.

**Description of male.** Body (Fig. 108A, B) slender, slightly depressed. Body length 1.29 mm. Dorsal shield of cephalosome with slightly extended, pointed posterolateral corners. Posterodorsal part of fourth pedigerous somite only slightly extended. Urosome (Fig. 108C) 6-segmented: fifth pedigerous somite free. First abdominal somite ornamented with rows of minute spinules on ventral surface. Anal somite (Fig. 108D) with smaller posterior process than in female, ornamented with scattered setules and minute spinules on ventral surface. Caudal ramus 34×25 µm, armed as in female.

Rostrum (Fig. 108E) 58×77 µm, only slightly wider than long, strongly tapering, with convex distal margin. Antennule armed as in female, but aesthetascs larger. Antenna as in female. Labrum and mandible as in female. Maxillule with 3 setae on endopod. Maxilla with 2 large setae on basis, lacking additional small seta. Maxilliped (Fig. 108F) armed with 8 setae (6 medial and 2 apical).

Leg 1 with same armature formula as in female; endopod distinctly 3-segmented; inner distal spine on basis strong, spinulose, and extending to middle of second segment. Exopods of legs 2–4 with well-developed outer and distal spines (Fig. 108G); longer than endopods, as in female. Inner seta on second exopodal segment and proximal 2 inner setae on third exopodal segment of legs 2–4 rudimentary. Distal-most seta on third exopodal segment of legs 2–4 enlarged (longer than ramus). Armature formula for legs 2–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 2	0-0	1-0	I-0; I-1; III, I, 5	0-1; 0-2, 1, 2, 3
Leg 3	0-0	1-0	I-0; I-1; II, I, 5	0-1; 0-2, 1, 2, 3
Leg 4	0-0	1-0	I-0; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 108H) protopod short, with outer distal seta; exopod 23×16 µm, unornamented, tapering with slightly convex outer margin, bearing single seta apically. Leg 6 (Fig. 108H) represented by 2 naked setae distally on genital operculum.

**Copepodid V female.** Body (Fig. 106C) 1.78 mm long. Prosome 1.59 mm long, with concave dorsal surface ornamented with numerous long setules but lacking membranous fringe along posterior margins of anterior somites. Other morphological aspects as in adult.

**Remarks.** The original description of *G. trigona* by Buchholz (1869) mentioned some specific character states which allow us to distinguish it from the new species. According to Buchholz (1869), *G. trigona* is characterised by the following: (1) the body length is 2 mm in the female and 0.7 to 0.8 mm in the male (vs. 3.70 mm in the female and 1.29 mm in the male of *G. indica* **sp. nov.**); (2) the cephalosome is triangular in dorsal view and slightly longer than wide (vs. rounded anteriorly and much wider than long in *G. indica* **sp. nov.**); (3) the terminal segment of the antenna widens towards the tip (vs. this segment is narrow along its whole length in *G. indica* **sp. nov.**); and (4) the endopod of leg 1 lacks an inner seta on the second and third segments (vs. these setae are present in *G. indica* **sp. nov.**). These marked differences support the recognition of the new species.

*Goniodelphys indica* **sp. nov.** was collected on the coast of Madagascar, in a different biogeographical region from *G. trigona*, which is known only from the Mediterranean (Illg & Dudley, 1965).

Although the original description (Illg, 1951) of *G. clarki* lacked detail, it can be distinguished from the new species by the markedly smaller female body of the former (2.2 mm) compared to the new species (3.70 mm), and by the possession of 2-segmented endopods in legs 1–4, rather than 3-segmented endopods as in the new species. The host of *G. clarki* was confirmed by Ooishi & Illg (1973) as *Herdmania momus* (Savigny, 1816) collected in Japanese waters.

***Goniodelphys nosybensis* sp. nov.**  
(Figs. 109, 110)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21251) from *Polycarpa pigmentata* (Herdman, 1906) (MNHN-IT-2008-6638 = MNHN S1/POL.B/350), MUA 68, Nosy Be, Madagascar, Laboute coll., 1995.

**Etymology.** This species is named after the type locality, Nosy Be, Madagascar.

**Description of female.** Body (Fig. 109A) compressed, 3.70 mm long. Prosome 2.85 mm long, clearly segmented. Fourth pedigerous somite forming brood pouch, tapering in posterior half (in lateral view), longer than anterior part of prosome. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 109B) slender, 5-segmented; genital somite 285×406 µm, slightly narrowing posteriorly, with copulatory pore on ventral surface. Four abdominal somites 460×370, 400×327, 285×267, and 152×194 µm, respectively; first to third somites longer than wide; setulose on all surfaces. Anal somite (Fig. 109C) roundly protruded posteroventrally, highly sclerotized. Caudal ramus (Fig. 109C) about 1.6 times longer than wide (116×73 µm), narrowing distally, armed with 2 claws and 4 setae; lengths of claws very

unequal, 110 and 45 µm; setae naked, ventrodorsal seta distinctly longer than other 3.

Rostrum (Fig. 109D) triangular, 175×170 µm, with blunt apex. Antennule (Fig. 109E) attenuated distally, 375 µm long, 8-segmented; first and second segments with 6 and 10 setae, respectively; setation of other segments uncertain due to numerous missing setae; several setae pinnate. Antenna (Fig. 109F) 4-segmented, including short coxa; basis with exopod represented by 1 large and 1 small seta at outer distal corner, ornamented with small patch of setules on inner margin; first endopodal segment slightly longer than wide, with 1 seta on inner margin; compound distal endopodal segment about 2.5 times longer than wide (118×48 µm), armed with 10 setae (distal 3 blunt tipped) plus terminal claw more than half as long as segment.

Labrum (Fig. 109G) with semicircular, setulose posteromedian lobe. Mandible (Fig. 109H) with 5 teeth, 2 proximal setae, and 3 needle-like spinules between distal second and third teeth; basis with 1 seta on medial margin; exopod 2-segmented with 3 and 2 equal setae on first and second segments, respectively; endopod 2-segmented and armed with 5 setae (distalmost seta longest and naked) on first segment and 9 setae on second. Maxillule (Fig. 109I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 110A) 5-segmented; syncoxa with 9 setae (3, 1, 2, and 3 on first to fourth endites, respectively), basis with 3 setae, distal seta stiff, claw-like; endopod with 1, 1, and 4 setae on first to third segments, respectively, (1 seta on third endopodal segment small, liable to be overlooked). Maxilliped (Fig. 110B) lobate, armed with 10 setae (8 medial and 2 apical).

Legs 1–4 with 3-segmented rami but articulation between second and third endopodal segments of leg 1 incomplete (Fig. 110C). Exopods distinctly longer than endopods in legs 2 (Fig. 110D), 3 and 4 (Fig. 110E). Inner coxal seta absent in legs 1–4. Outer seta on basis large and pinnate in leg 1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 straight, smooth, extending to middle of second endopodal segment. Armature formula for legs 1–4 as follows:

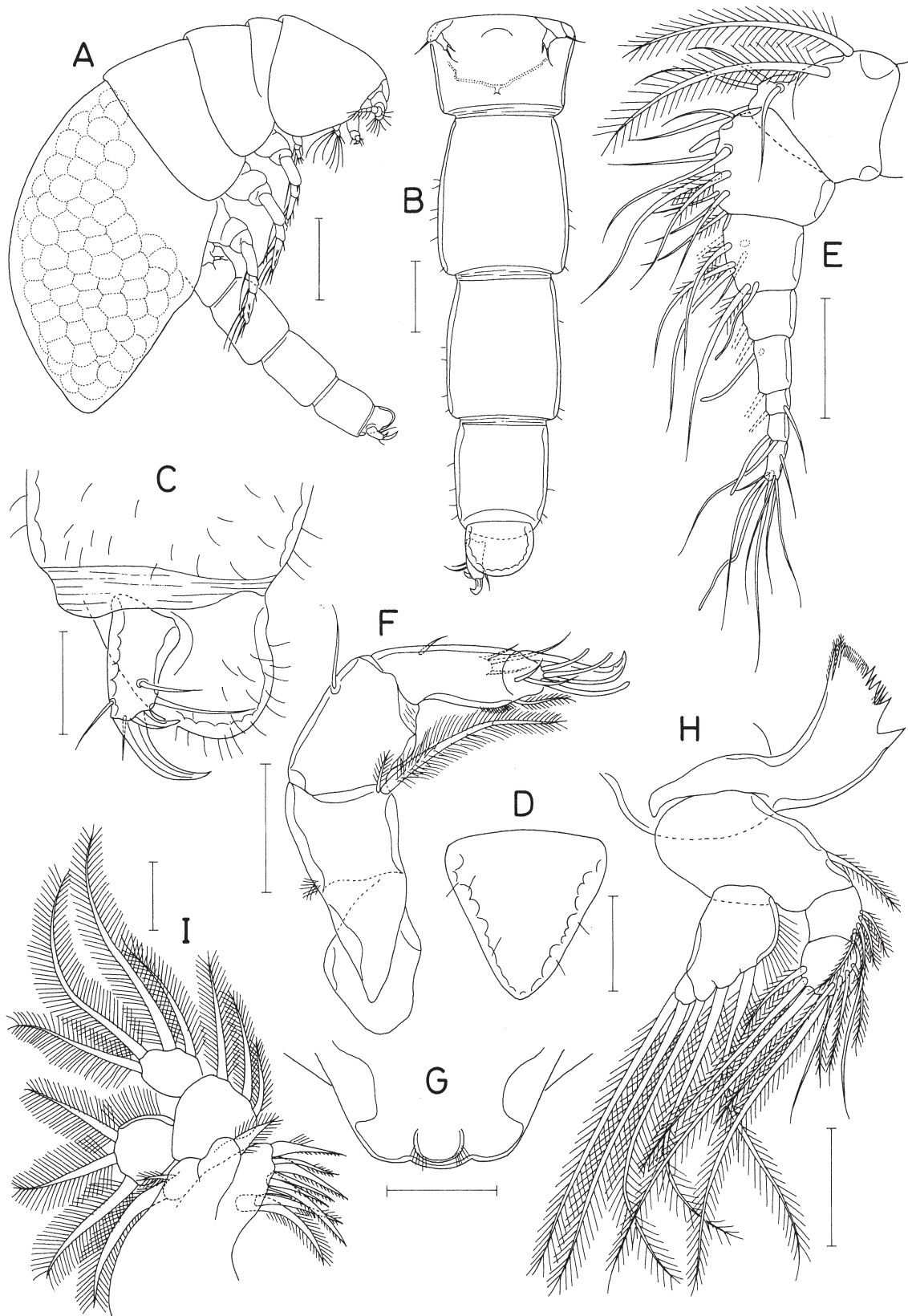
	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 0-1; 1, 2, 2
Legs 2 & 3	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2, 1, 2, 3
Leg 4	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 110F) consisting of free protopod and exopod; protopod with naked seta on outer margin; exopodal segment subrectangular, about 1.9 times longer than wide (55×29 µm), armed with 2 naked setae, distal seta 68 µm long and subdistal seta 21 µm and blunt at tip. Leg 6 (Fig. 110G) represented by 3 equal setae on genital operculum.

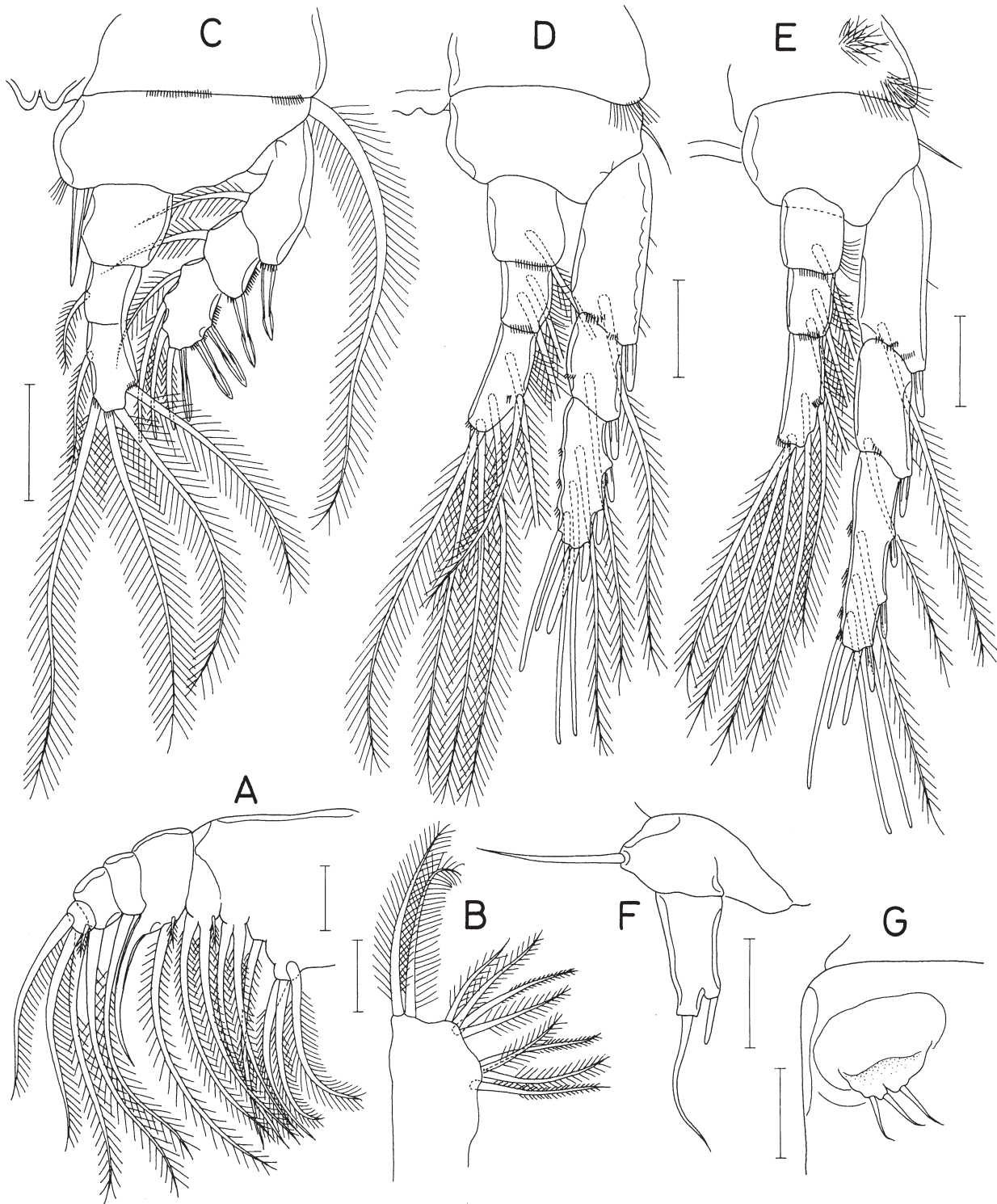
**Male.** Unknown.

**Remarks.** Although *Goniodelphys nosybensis* **sp.**





**FIGURE 109.** *Goniodelphys nosybensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, anal somite and caudal ramus, right; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C-H, 0.1 mm; I, 0.05 mm.



**FIGURE 110.** *Goniodelphys nosybensis* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5; G, left genital aperture bearing leg 6. Scale bars: A, B, F, G, 0.05 mm; C-E, 0.1 mm.

**nov.** does not have the typical body form of the genus, its fourth pedigerous somite is fused to the fifth and forms the brood pouch which is tapering and extended posteriorly, and the free urosome is inserted somewhat anteriorly into the ventral side of the brood pouch. Legs 2–4 have 3-segmented rami and each leg has 2 inner setae on the second endopodal segment. On the basis of these character states, the new species is placed in *Goniodelphys*.

The possession of 5 setae on the first endopodal segment of the mandible of *G. nosybensis* **sp. nov.** is an extraordinary feature, unique within the Notodelphyidae: the maximum setation for this segment reported elsewhere in the family is 4 setae. The presence of armature on the female leg 6 (represented by 3 setae on the genital operculum) is also an unusual feature. These characteristics serve to distinguish the new species from its congeners.

### Genus *Notopterophoroides* Schellenberg, 1922

**Diagnosis:** Prosome typically consisting of cephalothorax incorporating first pedigerous somite plus 3 defined pedigerous somites. Fourth pedigerous somite forming brood pouch and fused with fifth pedigerous somite. Sclerotized sternal spikes present on cephalothorax and second and third pedigerous somites in some species. Free urosome 5-segmented, comprising genital somite and 4 abdominal somites. Anal somite produced ventrally. Caudal rami armed with 3 claws and 3 setae. Antennule 7-segmented. Antenna 4-segmented; basis with large pinnate exopodal seta; compound distal endopodal segment armed with 9 setae plus terminal claw. Mandible with 5 teeth and 1 or 2 proximal setae on coxal gnathobase, basis with 1 seta; exopod 2-segmented and armed with 3 and 2 setae on first and second segments, respectively; endopod 2-segmented, armed with 4 and 9 setae on first and second segments, respectively. Maxillule with 9 setae on arthrite, 1 seta on coxal endite, 2 setae on epipodite, 3 setae on medial margin of basis; exopod with 3 distal setae; endopod with 4 distal setae. Maxilla 5-segmented; syncoxa with 3, 1, 2, and 2/3 setae on first to fourth endites, respectively; basis with 3 setae; first to third endopodal segments with 1, 1, and 3 setae, respectively. Maxilliped lobate with 11 setae (9 medial and 2 apical). Leg 1 with 3-segmented exopod and 2-segmented endopod. Legs 2–4 with 3-segmented rami. Inner coxal seta lacking in legs 1–4. Inner distal spine present on basis of leg 1. Armature formula:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 1, II, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	I-0; I-0; III, I, 4	0-1; 0-2, 1, 2, 3
Leg 3	0-0	1-0	I-0; I-0; II, I, 4	0-1; 0-2, 1, 2, 3
Leg 4	0-0	1-0	I-0; I-0; II, I, 4	0-1; 0-2; 1, 2, 2

Leg 5 consisting of protopod armed with outer seta

and exopodal segment bearing 2 setae; protopods of leg pair fused to form transverse protopodal plate in some species.

**Type Species:** *Notopterophoroides armadillo* Schellenberg, 1922 by subsequent designation (Lang, 1948).

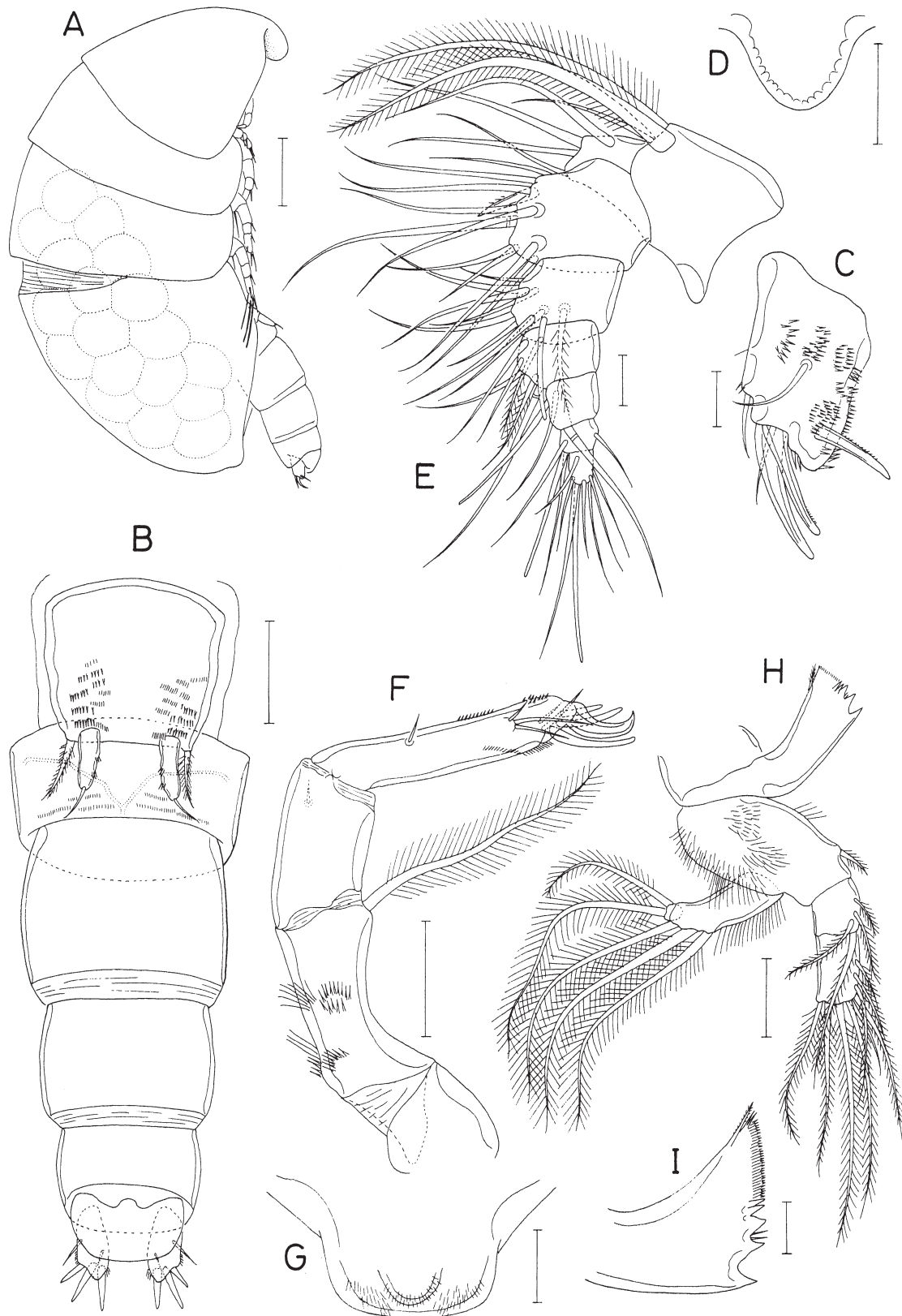
**Remarks.** The morphological boundaries delimiting this genus from *Ustina* and *Goniodelphys* are subtle. Stock (1967), in his key to the genera of the *Bonnierilla*-group, highlighted the linear exopodal segment of leg 5 armed with 2 setal elements, the 3-segmented state of the endopods of legs 2–4, and the brood pouch chiefly involving the fourth pedigerous somite, as key characters. Stock (1967) also proposed to transfer *N. malacodermatus* to the genus *Botachus*. However, this latter proposal was essentially reversed by Ooishi & Illg (1973). They concluded that *N. malacodermatus* should be retained in its original genus. Here we follow Ooishi & Illg (1973).

### *Notopterophoroides armadillo* Schellenberg, 1922

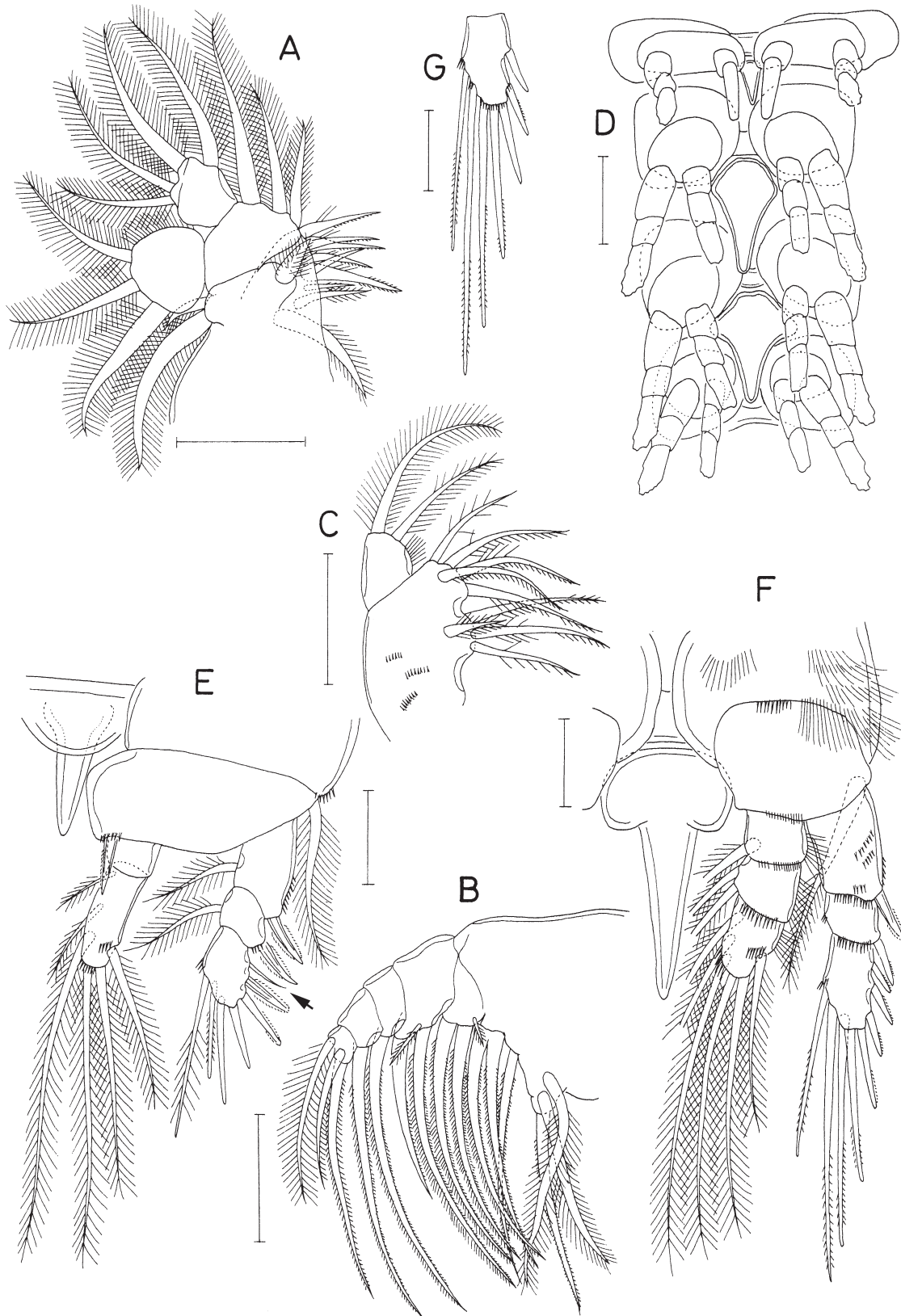
(Figs. 111–113)

**Material examined.** 5 ♀♀, 2 ♂♂ (MNHN-IU-2018-1834) and dissected 1 ♀, 1 ♂ (figured) from *Phallusia philippinensis* Millar, 1975, Caminguin Is., Philippines, CRCHO 171; 1 ♀ (dissected) from *Ascidia archaia* Sluiter, 1890, Île Nou, New Caledonia, 27 August 1985.

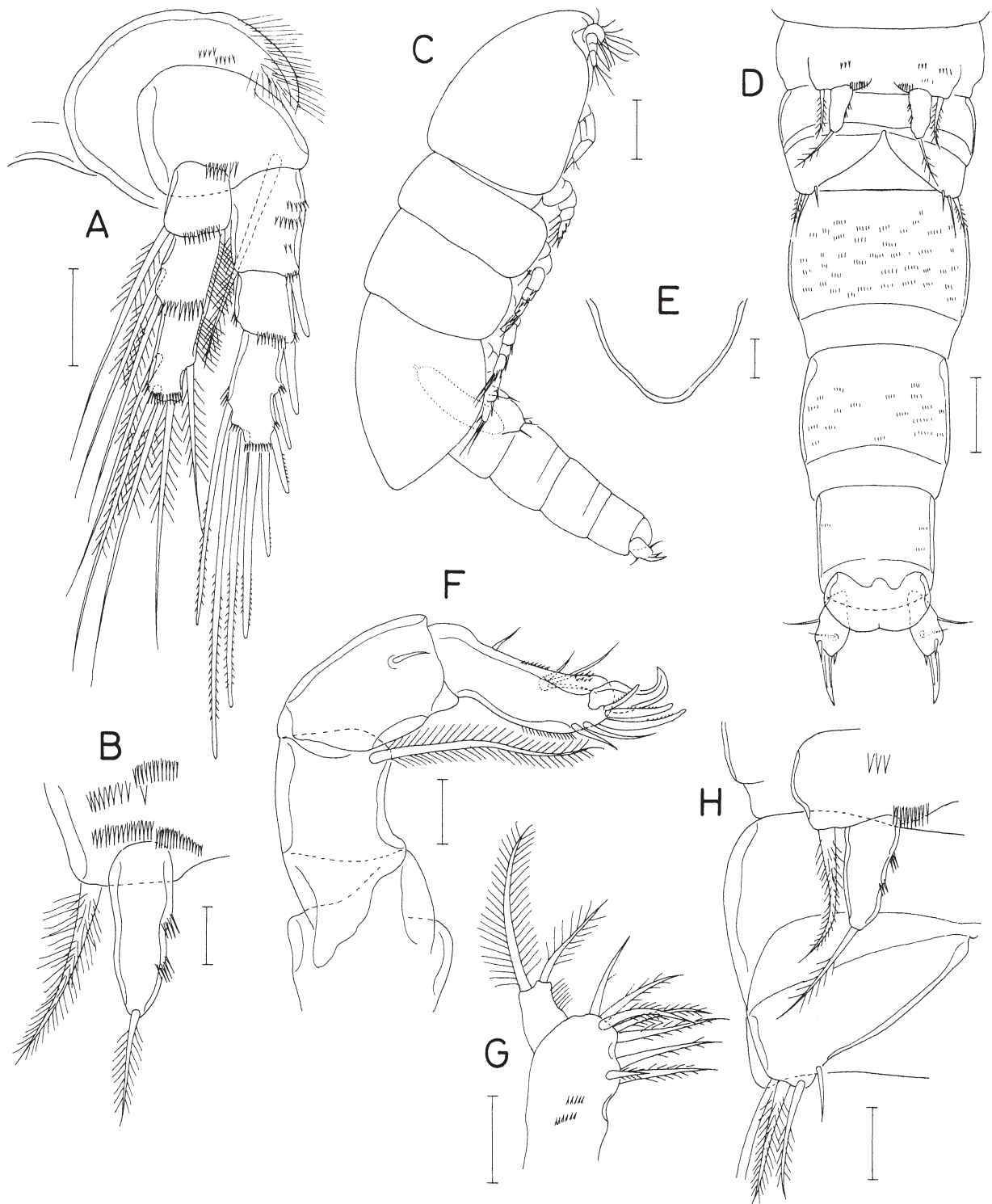
**Supplementary description of female.** Body (Fig. 111A) stout, semilunar in lateral view, with smooth, moderately flexible exoskeleton. Body length 1.86 mm; prosome 1.37 mm long, strongly compressed, consisting of cephalothorax and 3 pedigerous somites (second to fourth). Greatest dorsoventral depth of prosome 655 µm across third pedigerous somite. Highly sclerotized “sternal spikes” present posteriorly on ventral surface of cephalothorax, and ventrally on second and third pedigerous somites (Fig. 112D), each spike lying posterior to intercoxal sclerite, smaller in first pedigerous somite (Fig. 112E), distinctly larger in second and third (Fig. 112F); all sternal spikes with broad base (or pedestal). Fourth pedigerous somite forming brood pouch tapering posteriorly to obtusely angled apex; both third and fourth pedigerous somites containing eggs. Fifth pedigerous somite completely fused to fourth. Free urosome (Fig. 111B) cylindrical, 5-segmented, gradually narrowing posteriorly; all urosomites wider than long. Genital somite 95×236 µm, ornamented with 2 transverse rows of minute spinules on distal border of ventral surface. Four abdominal somites 179×202, 123×170, 90×140, and 57×110 µm, respectively. Anal somite produced ventrally and sclerotized, without ornamentation. Caudal ramus (Fig. 111C) 73×45 µm, bluntly produced posteroventrally, ornamented with several patches of small spinules; armed with 3 spiniform claws and 3 naked setae; lengths of 3 claws 52, 44, and 32 µm, ventral subdistal claw shortest.



**FIGURE 111.** *Notopterophoroides armadillo* Schellenberg, 1922, female. A, habitus, right; B, urosome, ventral; C, caudal ramus, outer; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, coxal gnathobase of mandible. Scale bars: A, 0.2 mm; B, D, 0.1 mm; C, E, I, 0.02 mm; F-H, 0.05 mm.



**FIGURE 112.** *Notopterophoroides armadillo* Schellenberg, 1922, female. A, maxillule; B, maxilla; C, maxilliped; D, legs 1-4 and sternal spikes; E, leg 1 and sternal spike of cephalothorax; F, leg 2 and sternal spike of second pedigerous somite. Scale bars: A-C, E, F, 0.05 mm; D, 0.1 mm.



**FIGURE 113.** *Notopterophoroides armadillo* Schellenberg, 1922, female: A, leg 4; B, leg 5. Male: C, habitus, right; D, urosome, ventral; E, rostrum; F, antenna; G, maxilliped; H, legs 5 and 6. Scale bars: A, D, 0.05 mm; B, E-H, 0.02 mm; C, 0.1 mm.

Rostrum (Fig. 111D) as semicircular ventral process at frontal margin of dorsal cephalothoracic shield. Antennule (Fig. 111E) about 190  $\mu$ m long, 7-segmented;

armature formula 7, 11, 10+aesthetasc, 5, 2+aesthetasc, 3+aesthetasc, and 7+aesthetasc; first 2 setae on first segment large and pinnate; 2 pinnate setae on third segment

and 1 on fourth; 1 seta on second segment spiniform. Antenna (Fig. 111F) slender, 4-segmented; coxa short and unarmed; basis narrowed in middle, about twice as long as wide, armed with 1 large pinnate (exopodal) seta at outer distal corner; ornamented with 2 patches of spinules and 2 patches of slender setules; first endopodal segment about 1.5 times longer than wide, with 1 small seta subdistally; compound distal endopodal segment slender, about 5 times longer than wide (105×21 µm), and ornamented with fine spinules distally on both margins; armed with 9 setae (3 distal setae blunt) plus small terminal claw, about one-third as long as segment.

Labrum (Fig. 111G) with semicircular posteromedian lobe and minute setules on posteroventral region and lobe. Mandible (Fig. 111H) with 5 teeth and 1 small proximal seta on coxal gnathobase (Fig. 111I) with 2 needle-like spinules present between distal second and third teeth: basis hirsute on dorsal and outer surfaces and armed with small seta on medial margin; exopod 2-segmented, armed with 3 and 2 setae on first and second segments, respectively, outer distal seta on second segment about half as long as other 4 setae; first exopodal segment with dense setules on medial margin: endopod indistinctly 2-segmented and armed with 4 and 9 setae on first and second segments, respectively. Maxillule (Fig. 112A) with 9 setae on arthrite, 1 broad seta on coxal endite, 2 unequal setae on epipodite, 3 setae on medial margin of basis, 3 setae on exopod, and 4 on endopod; endopod distally subdivided by indistinct suture line into proximal and short distal regions bearing 1 and 3 setae, respectively. Maxilla (Fig. 112B) 5-segmented; syncoxa with 9 setae (3, 1, 2, and 3 on first to fourth endites); basis with 3 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 112C) clearly 2-segmented; first segment with 9 setae (4 proximal and 5 distal) on medial margin and several rows of minute spinules; small second segment with 2 setae apically and row of setules on medial margin.

Leg 1 (Fig. 112E) with 3-segmented exopod and 2-segmented endopod. Legs 2–4 with 3-segmented rami (Figs. 112F, 113A). Left and right members of legs 1–4 close to each other, with very narrow intercoxal plate (Fig. 112D). Coxa of legs 1–4 unarmed. Coxa of legs 2–4 setulose on ventral surface. Basis broad in leg 1, narrower in legs 2–4. Outer seta on basis of legs 1–4 large, extending to middle of third exopodal segment. Inner distal spine on basis of leg 1 longer than first endopodal segment, 32 µm long. First outer element of third exopodal segment of leg 1 represented by seta (arrow in Fig. 112E). Spines and setae on exopods not clearly differentiated in legs 2–4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 1, II, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	I-0; I-0; III, I, 4	0-1; 0-2, 1, 2, 3
Leg 3	0-0	1-0	I-0; I-0; II, I, 4	0-1; 0-2, 1, 2, 3
Leg 4	0-0	1-0	I-0; I-0; II, I, 4	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 113B) consisting of protopodal plate and free exopod; protopodal plate quadrate and formed by fusion of left and right potopods (Fig. 111B), bearing 1 plumose seta at each outer distal corner and several transverse rows of fine spinules on both sides of ventral surface; exopodal segment small, 61×23 µm, tapering, slightly constricted in middle; apically tipped with 1 seta and ornamented with 2 rows of spinules on inner surface.

**Supplementary description of male.** Body (Fig. 113C) narrow, 1.13 mm long. Prosome consisting of cephalothorax and 3 pedigerous somites with almost parallel dorsal and ventral margins. Fourth pedigerous somite tapering in distal half. Cephalothorax and metasomites lacking sternal spike. Urosome (Fig. 113D) 6-segmented, with free fifth pedigerous somite measuring 45×138 µm. Genital somite 65×132 µm, slightly narrowing distally. Four abdominal somites 102×120, 93×100, 64×78, and 29×70 µm, respectively: first & second abdominal somites ornamented with numerous minute spinules on ventral surface. Caudal ramus 40×28 µm. Spermatophore (Fig. 113C) sausage-shaped, 160×42 µm.

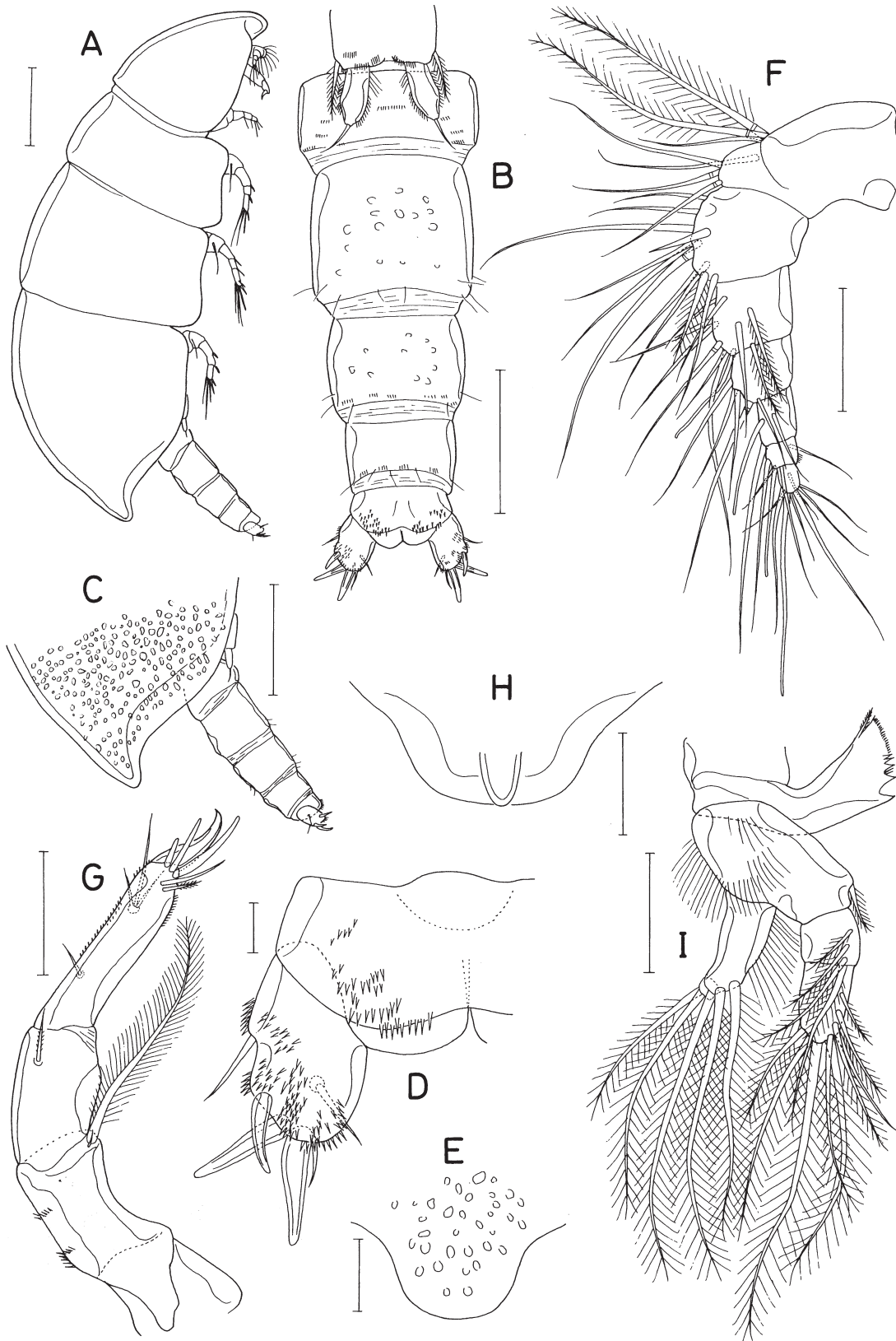
Rostrum (Fig. 113E) similar to that of female. Antennule as in female. Antenna (Fig. 113F) stout; basis unornamented; second endopodal segment about 2.9 times longer than wide (55×19 µm), much shorter than that of female.

Labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 113G) with 7 or 8 setae (3 proximal and 4 or 5 distal) on first segment and 2 setae on distal segment.

Legs 1–4 armed as in female; including setiform proximal outer element on third exopodal segment of leg 1.

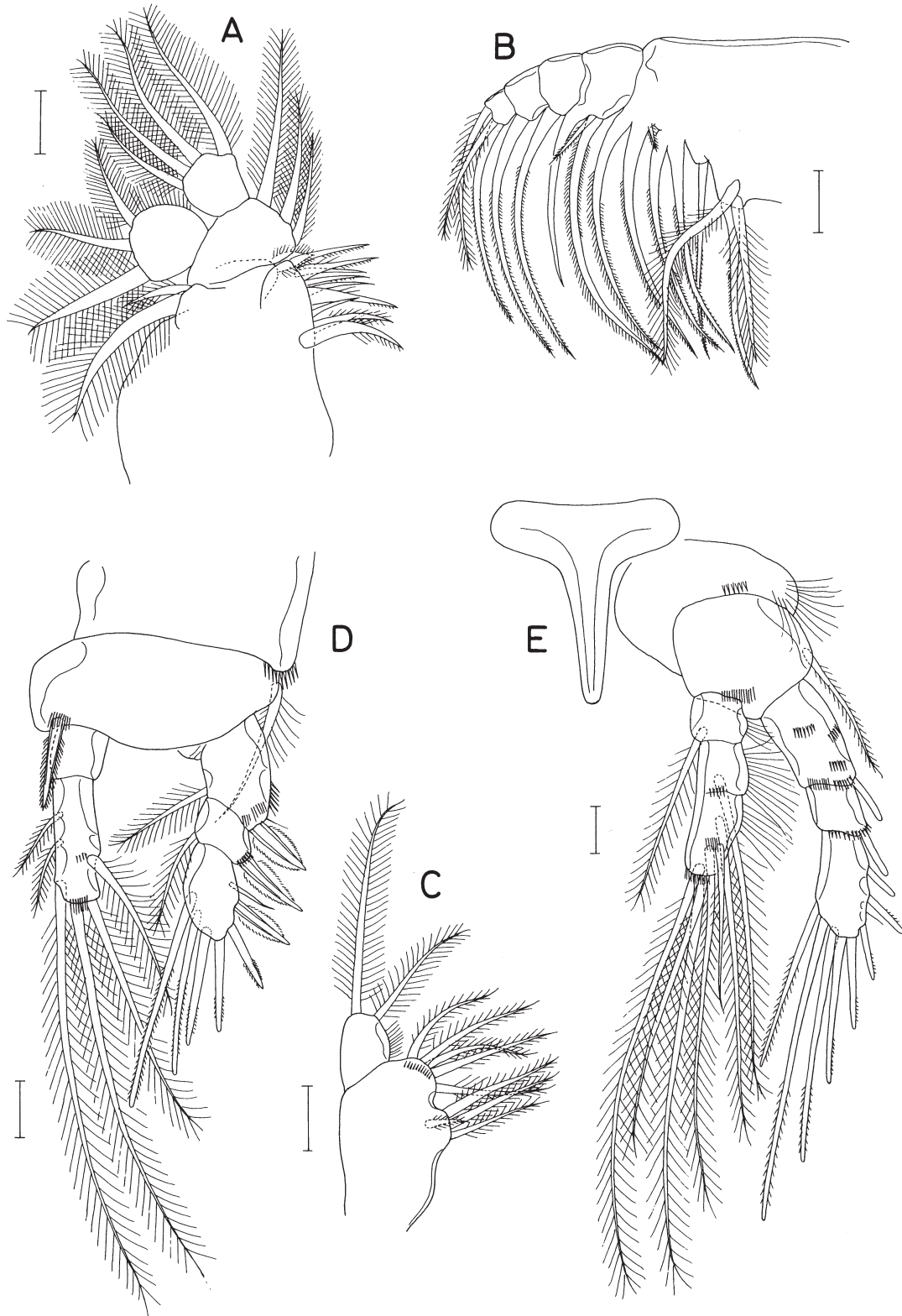
Left and right protopods of fifth legs separated (Fig. 113D), short and armed with 1 outer distal seta; free exopod similar to that of female (Fig. 113H), 33×15 µm. Leg 6 (Fig. 113H) represented by 3 setae on genital operculum, 2 outer ones subequal and pinnate, and inner one small and naked.

**Remarks.** Only two species are currently included in *Notopterophoroides*: *N. armadillo* and *N. malacodermatus*. In the original report of *N. armadillo*, Schellenberg (1922) illustrated only the female body form, the exopod of leg 3, and leg 5 of this species, all of which agree well with those of our specimens. The body length, the sizes of the sternal spikes (referred to as “Sternaldorn” by Schellenberg) and other important features are also the same. However, *N. armadillo* is described as having thick, armored body cuticle ornamented with numerous pore-like pits and we were unable to confirm this distinctive feature in our material. Interestingly, we found the same kind of cuticle present in *N. baliense* **sp. nov.** (described below). Nevertheless, the specimens are identified as *N. armadillo*, on the assumption that the thickness and sculpture of the cuticle of this species may change with age.

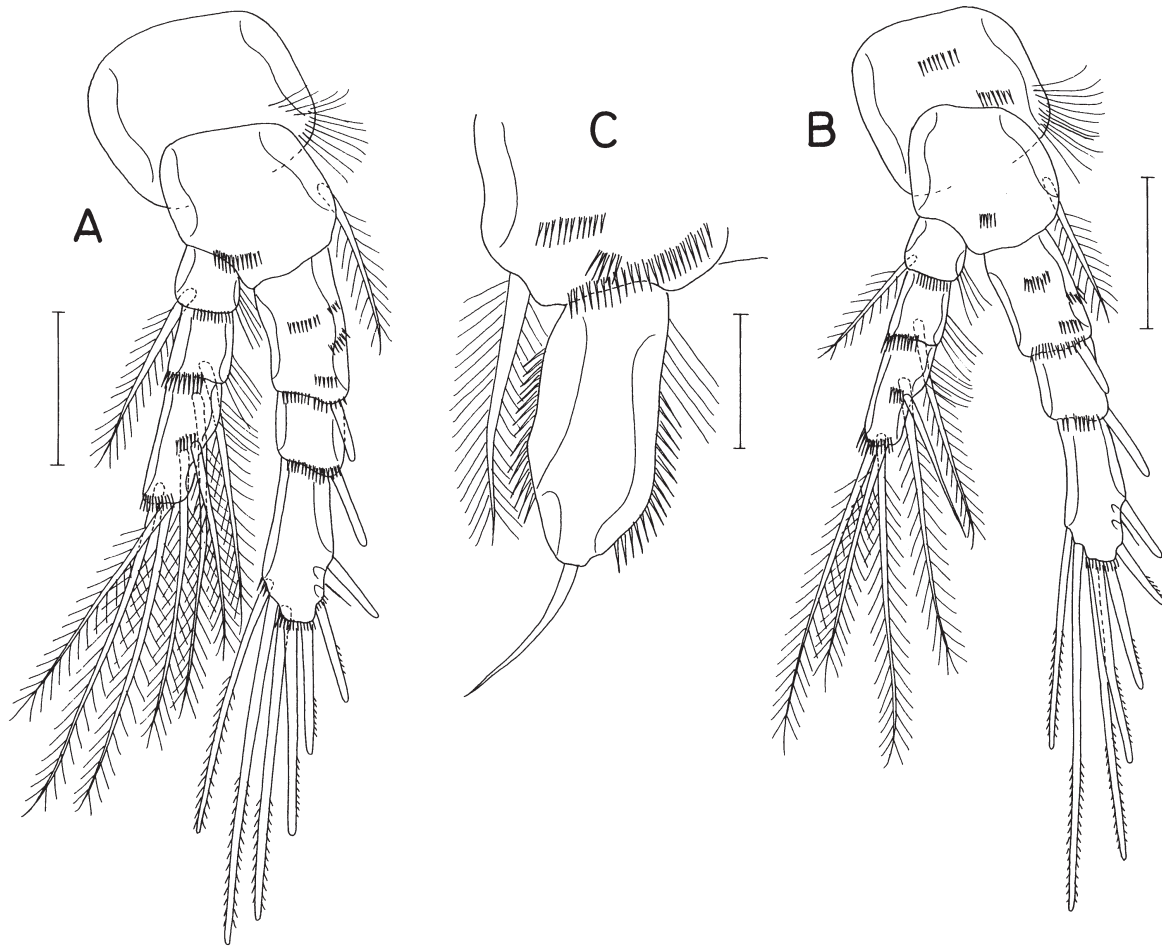


**FIGURE 114.** *Notopterophoroides baliense* sp. nov., female. A, habitus, right; B, urosome, ventral; C, posterior part of body, right; D, anal somite and caudal ramus, ventral; E, rostrum; F, antennule; G, antenna; H, labrum, I, mandible. Scale bars: A, C, 0.2 mm; B, 0.1 mm; D, 0.01 mm; E-I, 0.05 mm.





**FIGURE 115.** *Notopterophoroides baliense* sp. nov., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2 and sternal spike of cephalothorax. Scale bars: 0.02 mm.



**FIGURE 116.** *Notopterophoroides baliense* sp. nov., female. A, leg 3; B, leg 4; C, leg 5. Scale bars: A, B, 0.05 mm; C, 0.02 mm.

***Notopterophoroides baliense* sp. nov.**

(Figs. 114–116)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21252), paratypes (2 intact ♀♀, MNHN-IU-2014-21253), and dissected paratypes (2 ♀♀) from *Ascidia gemmata* Sluiter, 1895 (MNHN-IT-2008-XXX = MNHN P5/ASC.A/XXXX), CRRF CRCHO 434, Bali, Indonesia, Tulamben, depth 20 m, Colin coll., 30 October 2000.

**Etymology.** The name of the new species is based on the type locality, Bali.

**Description of female.** Body (Fig. 114A) narrow, bilaterally compressed, with thick, rigid exoskeleton ornamented with numerous, irregularly shaped, pore-like pits mainly on prosomal surfaces (Fig. 114C, E). Body length 1.55 mm. Prosome 1.36 mm long, consisting of cephalothorax and 3 pedigerous somites (second to fourth). Cephalothorax triangular, 0.35×0.30 mm in lateral view, narrower than pedigerous somites, with sternal spike on ventral surface just posterior to intercoxal sclerite of leg 1 and overlapping protopod of leg 2 (Fig. 115E). Free pedigerous somites lacking sternal spikes,

0.22×0.43, 0.27×0.48, and 0.52×0.45 mm, respectively, in lateral view. Fourth pedigerous somite forming brood pouch tapering posteriorly, characteristically terminating in conical process: fifth pedigerous somite incorporated into brood pouch. Free urosome (Fig. 114B) 5-segmented: genital somite 60×128 µm, with rows of fine spinules on ventral surface. Four abdominal somites 106×114, 76×97, 45×77, and 40×71 µm, respectively; first to third abdominal somites ornamented with scattered long setules along posterior border. Anal somite (Fig. 114D) slightly protruded posteroventrally and ornamented with spinules on ventral surface. Caudal ramus (Fig. 114D) small, 36×24 µm, covered with dense spinules distally: armed with 3 claws and 3 setae; claws spiniform, blunt at tip, 23, 21, and 16 µm long; setae naked, shorter than width of ramus, distal seta inserted proximally on distal claw.

Rostrum (Fig. 114E) as semicircular anterior protuberance on cephalothorax, not articulated at base. Antennule (Fig. 114F) 7-segmented; armature formula 7, 11, 10+aesthetasc, 5, 2+aesthetasc, 4+aesthetasc, and 7+aesthetasc; setae mostly naked, except 5 pinnate setae

(2 on first segment, 1 on second, and 2 on third); one seta on second segment spiniform. Antenna (Fig. 114G) 4-segmented; coxa short; basis about 1.6 times longer than wide, with large pinnate (exopodal) seta at outer distal corner and 2 rows of minute spinules on inner surface; first endopodal segment about 1.4 times longer than wide, with 1 small subdistal seta on inner side; compound distal endopodal segment slender, about 3.4 times longer than wide (75×22 µm), ornamented with spinules along inner margin and setules distally on outer margin; armed with 9 setae (including 3 bluntly tipped distal setae) plus terminal claw about half as long as segment.

Labrum (Fig. 114H), mandible (Fig. 114I), and maxilla (Fig. 115B) similar to those of *N. armadillo*. Maxillule lacking subdivision on endopod, otherwise as in *N. armadillo*. Maxilliped (Fig. 115C) distinctly 2-segmented with 9 setae (4 proximal and 5 distal) on medial margin of first segment and 2 apical setae on second segment; row of fine spinules present on first segment near base of mediolateral setae.

Leg 1 (Fig. 115D) with 3-segmented exopod and 2-segmented endopod. Legs 2–4 (Figs. 115D, E, 116A, B) with 3-segmented rami but articulations incomplete between second and third endopodal segments in legs 2–4. Coxa of legs 1–4 lacking inner seta. Outer seta on basis of leg 1 not enlarged, only slightly longer than first exopodal segment, as in legs 2–4. Inner distal spine on basis of leg 1 straight, 30 µm long, longer than first endopodal segment. Third exopodal segment of leg 1 bearing seta (not spine) as proximalmost outer element. Third exopodal segment of legs 2–4 thin, with setule between second and third outer setae in leg 2 and between first and second outer setae in legs 3 and 4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 1, I, 5	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 4	0-1; 0-1, 1, 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 2, 1, 4	0-1; 0-1, 1, 2, 3
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 4	0-1; 0-1; 1, 2, 2

Leg 5 (Fig. 116C) consisting of rectangular protopodal plate and free exopod; protopodal plate with seta at each outer distal corner; ornamented with rows of spinules ventrally near base of exopod; exopod about 2.2 times longer than wide (43×19 µm), with lateral margins parallel proximally but tapering in distal quarter, tipped with apical seta (pinnate or naked), and ornamented with setules proximally on inner margin and dense spinules on remaining part of margins.

**Male.** Unknown.

**Remarks.** *Notopterophoroides baliense* sp. nov. is instantly recognizable by the conical process at the posterior end of the brood pouch. In addition, it has a single large sternal spike on the ventral surface of the cephalothorax just posterior to the intercoxal sclerite of leg

1, unlike *N. armadillo* which bears 3 sternal spikes and *N. malacodermatus* which either has none or has only small sternal spikes (Schellenberg, 1922). The possession of only a single inner seta on the second endopodal segment of legs 2–4 also seems to be a diagnostic feature.

***Notopterophoroides quadridentatum* sp. nov.**

(Figs. 117, 118)

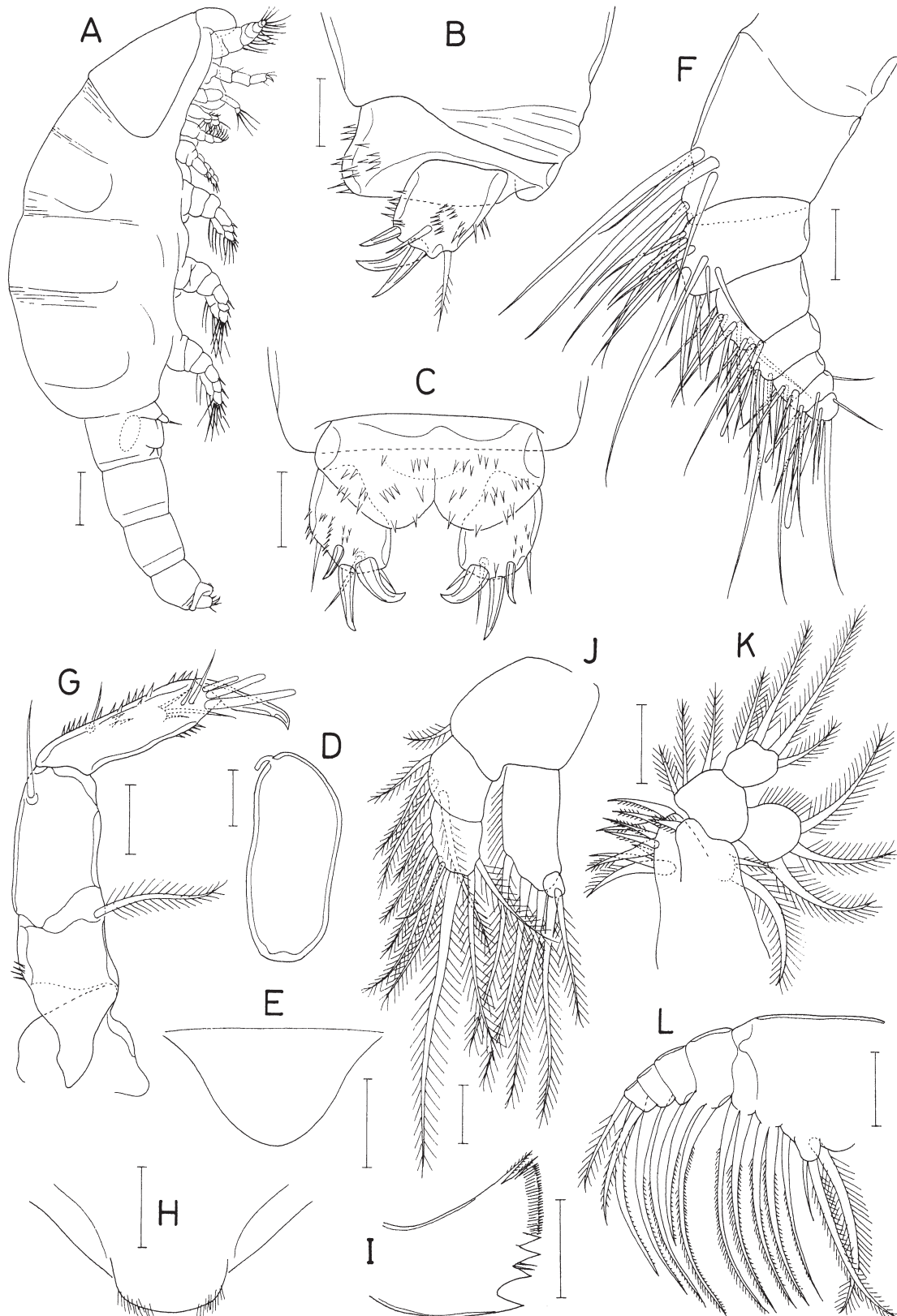
**Type material.** Holotype (intact ♂, MNHN-IU-2014-21254) and paratype (♂, dissected and figured) from *Phallusia arabica* Savigny, 1816 (MNHN-IT-2008-6109 = MNHN P5/PHA/75), MUA 3, Nosy Be, Madagascar, P. Laboute coll.

**Etymology.** The specific name *quadridentatum* refers to the presence of four teeth on the mandibular gnathobase.

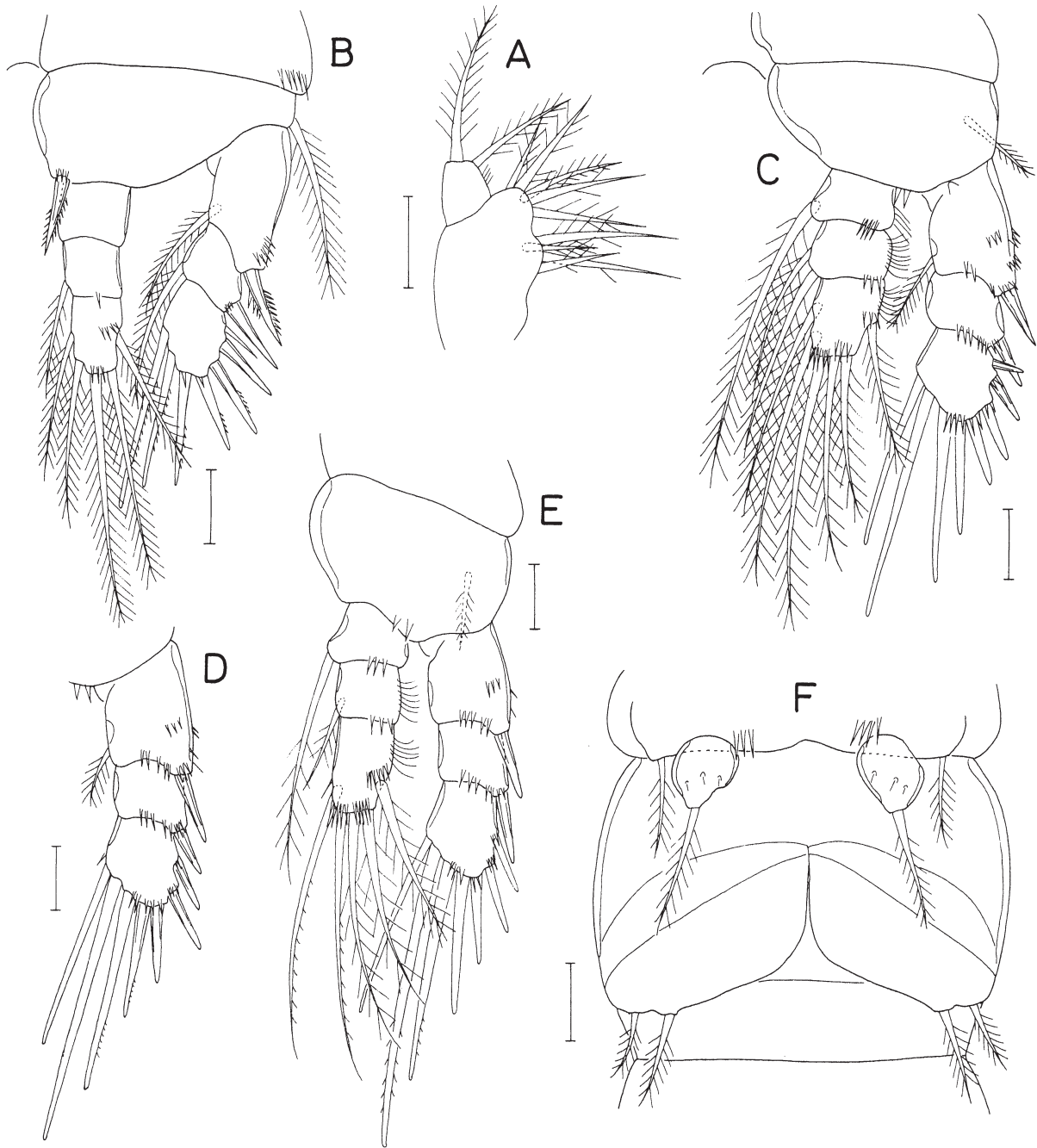
**Description of male.** Body (Fig. 117A) moderately narrow, slightly compressed. Body length 1.34 mm: prosome 854 µm long, tapering anteriorly in lateral view, obscurely segmented by weak constrictions and wrinkles between somites. Dorsoventral depth of prosome 340 µm. Dorsal cephalothoracic shield distinct. Fifth pedigerous somite fused with fourth. Free urosome distinctly 5-segmented. Anal somite (Fig. 117B, C) short, half as long as wide, protruding posteroventrally, ornamented with scattered spinules on ventral surface; anal operculum discernible. Caudal ramus (Fig. 117B) small, about 1.3 times longer than wide (32×25 µm), armed with 3 claws and 3 setae (Fig. 117C) and ornamented with spinules scattered over all surfaces; lengths of claws 22, 20, and 12 µm; all shorter than ramus. Spermatophore (Fig. 117D) 75×32 µm, with thick wall and short tube.

Rostrum (Fig. 117E) wider than long, 65×125 µm, nearly semicircular. Antennule (Fig. 117F) short, 117 µm long, and 7-segmented; armature formula 7, 13, 12+aesthetasc, 6, 6, 4+aesthetasc, and 5+aesthetasc; setae extremely crowded, all naked. Antenna (Fig. 117G) 4-segmented; coxa short; basis slightly longer than wide, with pinnate exopodal seta and several small spinules on inner margin; first endopodal segment longer than basis, with 1 naked seta subdistally on outer margin; compound distal endopodal segment about 3.1 times longer than wide (47×15 µm), ornamented with spinules on outer and inner margins; armed with 9 setae (including 3 bluntly tipped) plus terminal claw about half as long as segment.

Labrum (Fig. 117H) with large posteromedian lobe bearing setules on posterolateral surfaces. Mandibular coxal gnathobase (Fig. 117I) with 4 teeth, 2 small proximal setae, and 2 needle-like spinules between second and third teeth: basis of mandible with small mediolateral seta (Fig. 117J): exopod 2-segmented with 3 and 2 setae on first and second segments, respectively; terminal seta on second segment about 0.7 times as long as other 4 setae: endopod with 4 and 9 setae on first and second segments,



**FIGURE 117.** *Notopterophoroides quadridentatum* sp. nov., female. A, habitus, right; B, anal somite and caudal ramus, left; C, anal somite and caudal rami, ventral; D, spermatophore; E, rostrum; F, antennule; G, antenna; H, labrum; I, coxal gnathobase of mandible; J, mandibular palp; K, maxillule; L, maxilla. Scale bars: A, 0.1 mm; B-D, F-L, 0.02 mm; E, 0.05 mm.



**FIGURE 118.** *Notopterophoroides quadridentatum* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, exopod of leg 3; E, leg 4; F, legs 5 and 6. Scale bars: 0.02 mm.

respectively; apical seta on second endopodal segment enlarged. Maxillule (Fig. 117K) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 117L) 5-segmented; syncoxa with 3 (including small naked seta), 1, 2, and 2 setae on first to fourth endites, respectively; basis with 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 118A) distinctly

2-segmented with 9 (4+5) medial setae on first segment and 2 apical setae on second.

Legs 1–4 (Fig. 118B–E) with 3-segmented rami. Inner coxal seta absent on legs 1–4. Inner distal spine on basis of leg 1 slightly longer than first endopodal segment, straight and spinulose. Third exopodal segment of leg 1 bearing small seta as proximalmost outer element. Second endopodal segment bearing 1 inner seta in legs 1 and 4,

but with 2 inner setae in legs 2 and 3. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 1, II, 4	0-0; 0-1; 1, 2, 2
Leg 2	0-0	1-0	I-1; I-0; 3, 1, 4	0-1; 0-2; 1, 3, 2
Leg 3	0-0	1-0	I-1; I-0; 2, 1, 4	0-1; 0-2; 1, 3, 2
Leg 4	0-0	1-0	I-0; I-0; 2, 1, 4	0-1; 0-1; 1, 3, 1

Leg 5 (Fig. 118F) consisting of short protopod and small free exopod; left and right protopods fused to form protopodal plate bearing pinnate seta at each outer corner ornamented with few inner spinules: exopodal segment suboval, slightly longer than wide (18×16 µm) with 1 pinnate seta on apex and 3 small sensillae on ventral surface. Leg 6 (Fig. 118F) represented by 2 pinnate setae on distal margin of genital operculum.

**Female.** Unknown,

**Remarks.** Species of the genus *Notopterophoroides* seem to exhibit very little sexual dimorphism, as indicated by *N. armadillo* redescribed above. This weak sexual dimorphism allows us to describe *N. quadridentatum* **sp. nov.** on the basis of the male, since robust comparisons can still be made with its other congeners.

The most remarkable feature of the new species is the 3-segmented endopod of leg 1. Within the genus this feature is shared only with *N. malacodermatus*, which Schellenberg (1922) described very imperfectly, illustrating only the exopod of leg 3 and leg 5. His figured leg 5 is somewhat similar to that of *N. quadridentatum* **sp. nov.**, but the protopodal seta is longer than the apical seta on the exopod, the exopod of leg 3 lacks an inner seta on the first segment, and the outer spines on the exopod are very short. These differences are sufficient to distinguish *N. quadridentatum* **sp. nov.** from other congeneric species.

### *Notopterophoroides tripartitum* **sp. nov.**

(Figs. 119, 120)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21255) collected along with *N. deplanatum* **sp. nov.** from *Ascidia ornata* Monniot F. & Monniot C., 2001 (MNHN-IT-2008-1160 = MNHN P5/ASC.A/299), CRRF CRCHO 148, Camiguin Island, Bohol Sea, the Philippines (09°15.38'N, 124°39.12'E), depth 18 m, 19 April 1997.

**Etymology.** The specific name *tripartitum* is derived from the Latin *tri* (=three) and *parti* (=a part), referring to the three-segmented prosome.

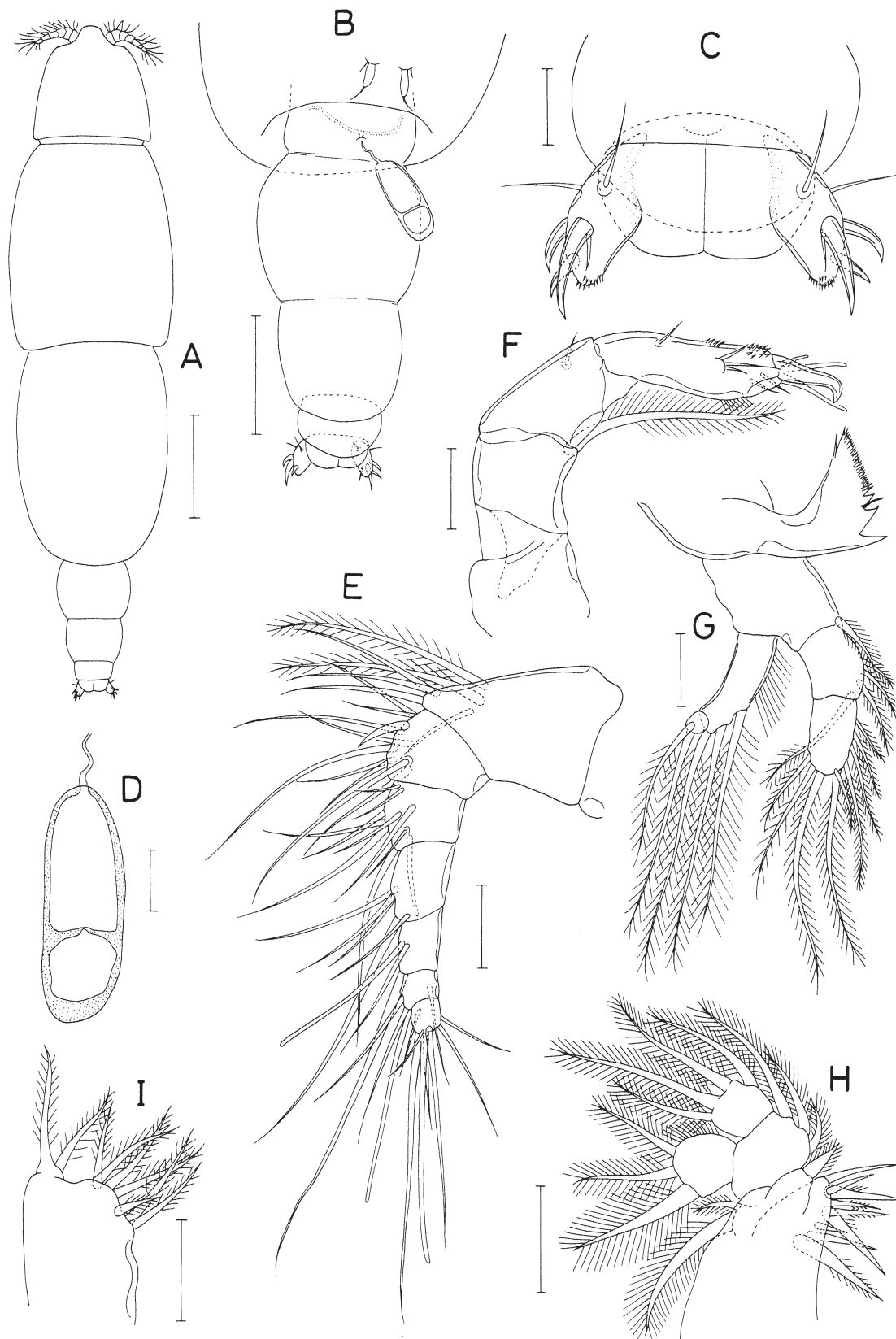
**Description of female.** Body (Fig. 119A) narrow and cylindrical. Body length 1.32 mm: prosome 1.06 mm long, occupying 80% of total body length. Prosome 3-segmented, consisting of cephalothorax (227×227 µm) incorporating first pedigerous somite, shorter and

narrower than following 2 compound metasomites. First metasomite formed by fusion of second and third pedigerous somites, 410×318 µm. Second metasomite (= fourth and fifth pedigerous somites) 423×290 µm, slightly longer but narrower than first metasomite, with rounded posterodorsal margin. Free urosome (Fig. 119B) small, 5-segmented; genital somite not articulated from metasome, 113 µm wide, narrower than first and second abdominal somites; small copulatory pore present on ventral surface; single spermatophore (Fig. 119B, D) attached to copulatory pore, 79×29 µm, containing 2 internal chambers of unequal sizes. First abdominal somite 125×139 µm, with convex lateral margins; second and third abdominal somites 103×107 and 58×73 µm, respectively. Anal somite small, 36×55 µm, unornamented, with weak posteroventral protuberance. Caudal rami (Fig. 119C) fused with anal somite, divergent, positioned dorsolaterally on somite and widely separated from each other at base, approximately 40×18 µm, with roundly protruded, spinulose apex; armed with 3 naked setae and 3 claws, 25, 16, and 12 µm long.

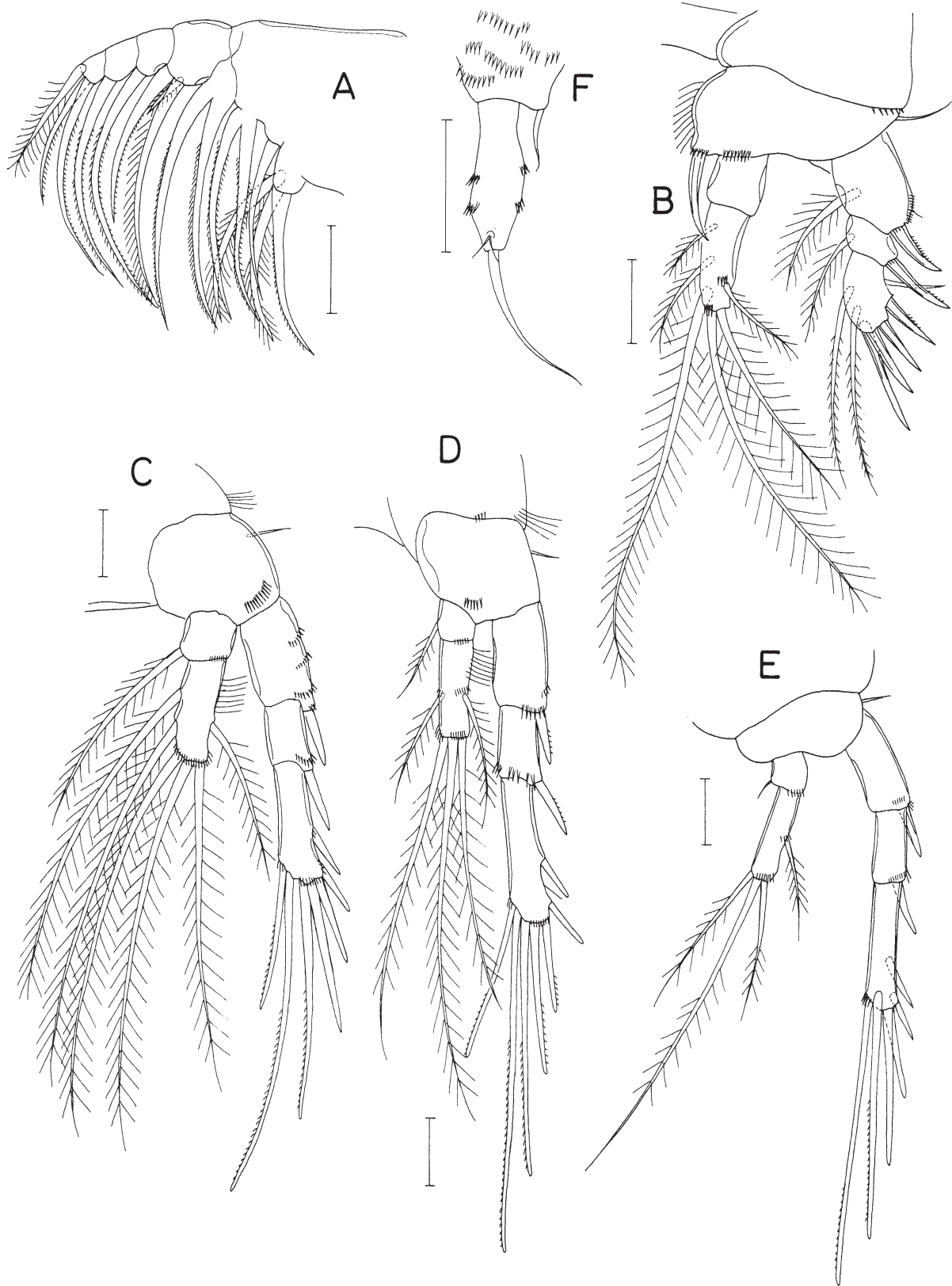
Rostrum as semicircular anterior protuberance on cephalothorax (Fig. 119A). Antennule (Fig. 119E) small, 112 µm long, and 7-segmented; armature formula 6, 10, 9+aesthetasc, 5, 2+aesthetasc, 3+aesthetasc, and 7+aesthetasc; one seta on second segment spiniform; 2 large setae on first segment pinnate, all other setae naked. Antenna (Fig. 119F) 4-segmented, including short, unarmed coxa; basis slightly longer than wide, with 1 large, pinnate outer distal seta representing exopod; first endopodal segment nearly as long as basis, with small seta subdistally on inner side; compound distal endopodal segment about 3.1 times as long as wide (46×15 µm), ornamented with 2 patches of spinules and 1 patch of setules; armed with 9 setae (arranged as 1, 3, 2, and 3) plus strongly curved terminal claw about half as long as segment.

Labrum not observed (fragile, easily destroyed). Mandible (Fig. 119G) with 5 teeth, 1 small seta, and 1 needle-like spinule between second and third distal teeth on coxal gnathobase; basis with 1 seta mediolaterally; exopod slender, 2-segmented, armed with 3 and 2 setae on first and second segments, respectively; outer seta on second segment shorter than other 4 setae: endopod with 4 and 9 setae on first and second segments, respectively. Maxillule (Fig. 119H) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite; 3 on medial margin of basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 120A) 5-segmented; syncoxa with 8 setae (3, 1, 2, and 2), 3 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 119I) unsegmented with 7 setae mediolaterally and 2 setae apically.

Legs 1–4 (Fig. 120B–E) with 3-segmented exopods and 2-segmented endopods; inner seta absent on coxa of all legs; outer seta on basis small and naked. Inner distal spine on basis of leg 1 naked, curved, 22 µm long, about 1.5 times longer than first endopodal segment; inner margin of basis setulose. Protopod broad in leg 1, but narrow in



**FIGURE 119.** *Notopterophoroides tripartitum* sp. nov., female. A, habitus, dorsal; B, urosome, ventral; C, anal somite and caudal rami, dorsal; D, spermatophore; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilliped. Scale bars: A, 0.2 mm; B, 0.1 mm; C-I, 0.02 mm.



**FIGURE 120.** *Notopterophoroides tripartitum* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.02 mm.



legs 2–4. Third exopodal segment of leg 1 armed with seta as first outer element. Endopods of legs 2–4 distinctly shorter than exopods, not extending beyond distal border of second exopodal segment. Inner seta on first endopodal segment of leg 4 vestigial. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	1-1; 1-1; 1, IV, 2	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 2, 1, 4	0-1; 1, 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 2, 1, 4	0-1; 1, 2, 2
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 3	0-1; 1, 2, 1

Leg 5 (Fig. 120F) small, consisting of short protopod and free exopod; protopod with small, naked outer distal seta and several rows of spinules on ventral surface; exopodal segment spindle-shaped, narrow proximally and distally, about 3.1 times longer than wide (23×8 µm) with 2 transverse rows of spinules on both margins plus 1 bifurcate sensilla subdistally, and tipped with 1 naked seta.

**Male.** Unknown.

**Remarks.** This species is included in *Notopterophoroides*, but with some reservations. It shares with other species of *Notopterophoroides* the presence of 3 claws on the caudal ramus, 5 setae on the mandibular exopod, plus 4 and 9 setae, respectively, on the first and second endopodal segments of the mandible, and a seta as the proximal outer element on the third exopodal segment of leg 1. However, unlike other species of the genus, it has an unsegmented maxilliped and only 2-segmented endopods in legs 2–4. The 3-segmented prosome, with the first metasomite formed by fusion of the second and third pedigerous somites is, however, particularly distinctive and is a unique characteristic within this group of related genera.

### *Notopterophoroides deplanatum* sp. nov.

(Figs. 121, 122)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21256) from *Ascidia ornata* Monniot F. & Monniot C., 2001 (MNHN-IT-2008-1160 = MNHN P5/ASC.A/299), CRRF CRCHO 148, offshore sand cay, Camiguin Island, the Philippines (09°15.38'N, 124°39.12'E), depth 18 m, 19 April 1997.

**Etymology.** The specific name is derived from the Latin *deplanat*, meaning “flattened”, and refers to the extremely flattened body of the new species.

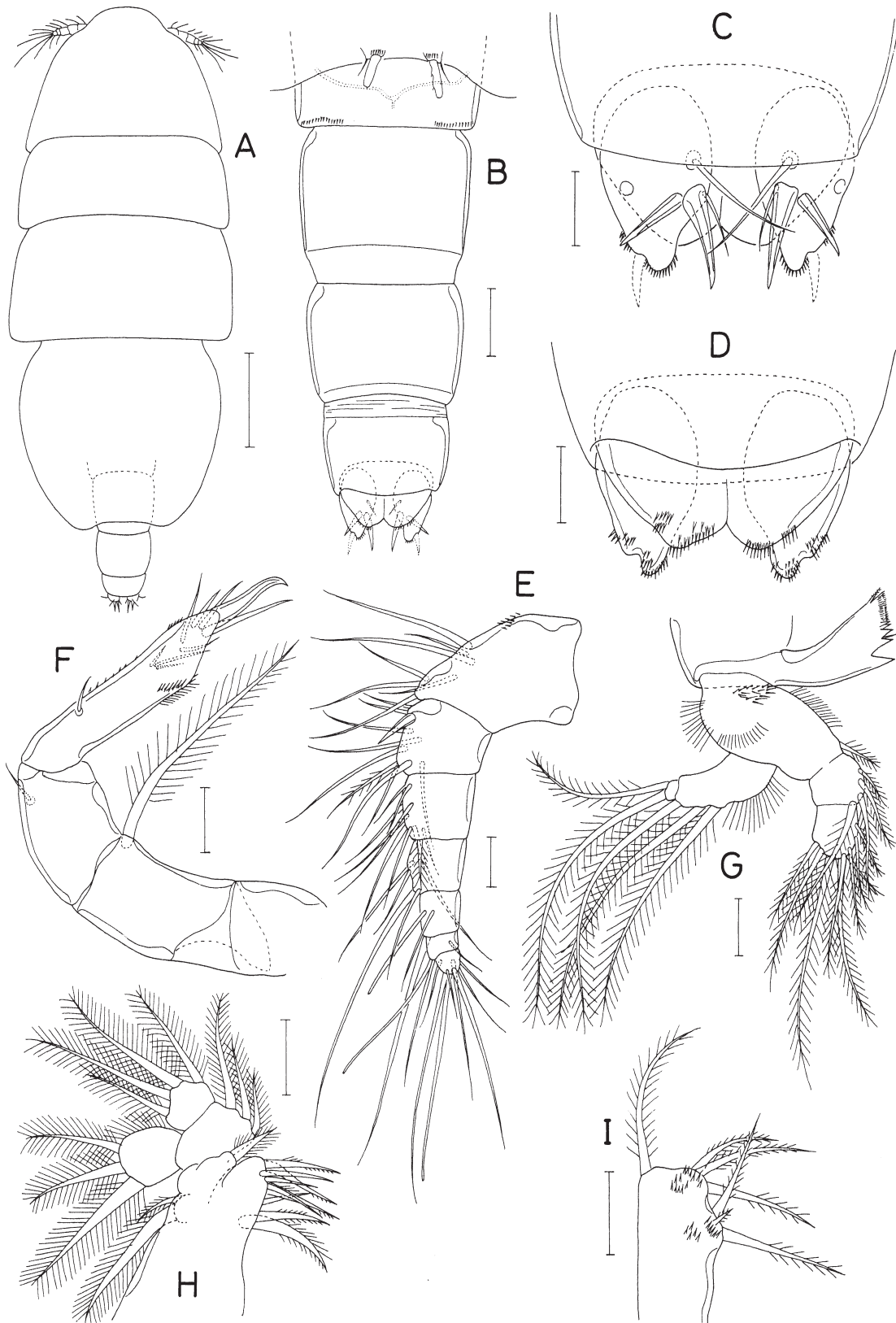
**Description of female.** Body (Fig. 121A) extremely flattened dorsoventrally, 1.27 mm long. Prosome 110 µm long, occupying 87% of total body length, consisting of cephalothorax, 280×420 µm with broad, weak anterior protrusion, second and third pedigerous somites, 165×451, 260×455, respectively, and fourth pedigerous somite, 405×435 µm, incorporating fused fifth pedigerous somite.

Free urosome (Fig. 121B) small, 5-segmented, gradually narrowing posteriorly: genital somite 145 µm wide, not articulated from metasome, ornamented with row of minute spinules on both sides of posteroventral margin. Four free abdominal somites 118×127, 100×116, 56×95, and 47×71 µm, respectively. Anal somite (Fig. 121C, D) with paired sclerotized posteroventral protuberances ornamented with patches of spinules. Caudal ramus about 1.8 times longer than wide (51×29 µm) positioned dorsally on anal somite, tapering and with spinulose ornamentation distally, possibly armed with 3 claws and 3 setae; 2 claws positioned dorsally at 60% length of ramus, other claw missing but scar visible.

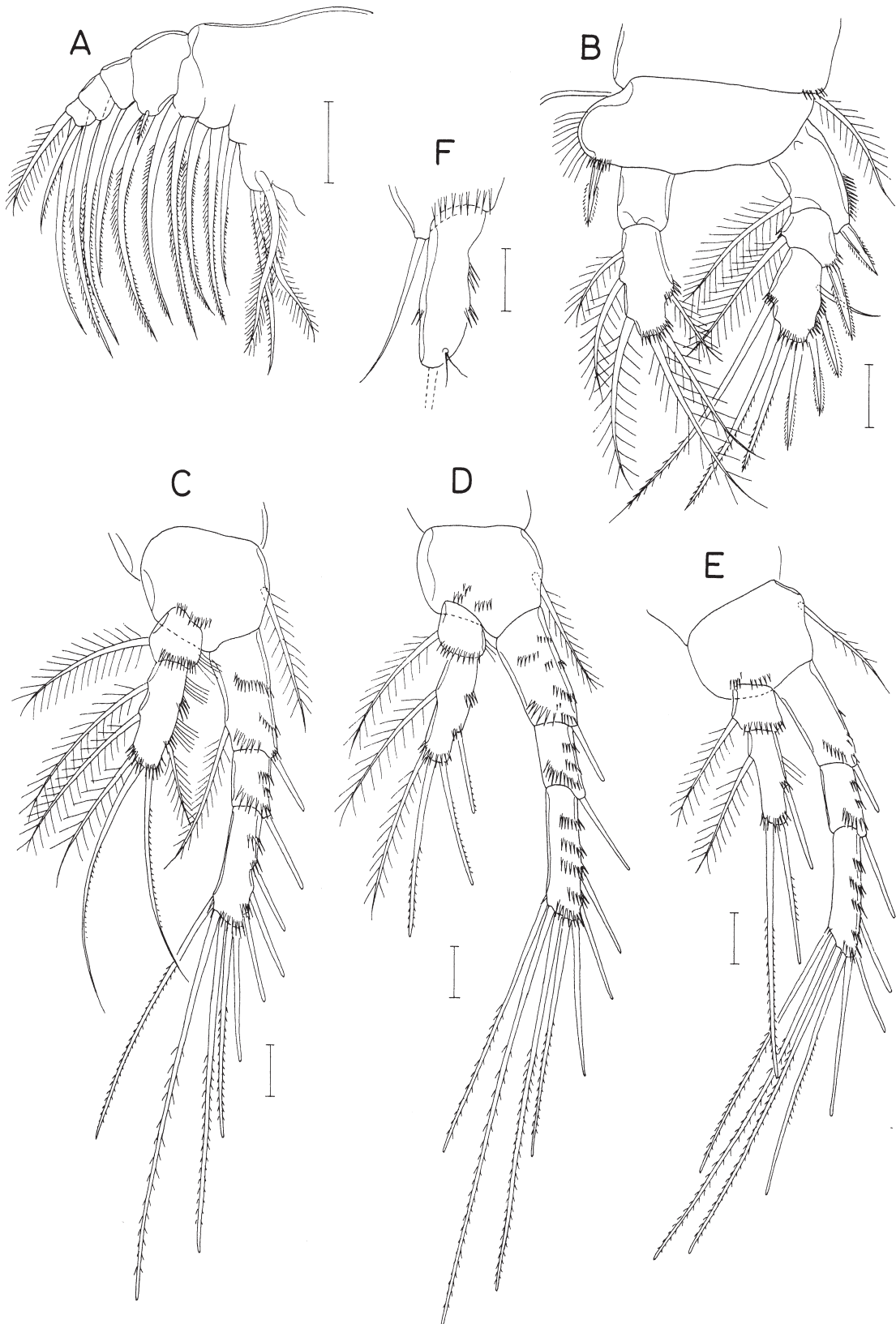
Rostrum as weak anterior protrusion on frontal margin of dorsal cephalothoracic shield. Antennule (Fig. 121E) small, 150 µm long and 7-segmented; armature formula 7, 9+spine, 10, 4, 2+aesthetasc, 2+aesthetasc, and 7+aesthetasc; first segment with patch of minute spinules on proximal anterior surface; setae thin and aesthetascs hard to distinguish from setae. Antenna (Fig. 121F) 4-segmented; coxa short and unarmed; basis about 1.7 times longer than wide, armed with large pinnate exopodal seta at outer distal corner; first endopodal segment about 1.3 times longer than wide and 0.8 times longer than basis, with 1 small seta subdistal on inner surface; compound distal endopodal segment about 4.3 times longer than wide (73×17 µm), ornamented with minute spinules on inner margin, and spinules plus setules subdistally on outer margin; armed with 9 setae (all attenuated) plus slender terminal claw, less than half length of segment.

Labrum weak, destroyed. Mandible (Fig. 121G) with narrow coxal gnathobase bearing 5 teeth, 1 spinule between distal second and third teeth, and 1 small seta on proximal margin; basis with setules on outer and medial margins, armed with 1 small mediobasal seta; exopod 2-segmented, armed with 3 and 2 setae on first and second segments, respectively; outer distal seta on second segment half as long as other exopodal setae: endopod with 4 and 9 setae on first and second segments, respectively. Maxillule (Fig. 121H) and maxilla (Fig. 122A) armed as in *N. tripartitum* sp. nov. Maxilliped (Fig. 121I) unsegmented, armed with 6 (3+3) setae medially plus apical seta; with patches of fine spinules near base of medial setae; one proximal seta on medial margin much smaller than others.

Legs 1–4 (Fig. 122B–E) with 3-segmented exopods and 2-segmented endopods. Protopod broad in leg 1, but narrow in legs 2–4. Rami of leg 1 widely separated. Coxa of legs 1–4 unarmed. Outer seta on basis of leg 1 not enlarged, similar in length to those of legs 2–4. Inner distal spine on basis of leg 1 serrate, 22 µm long, slightly longer than first endopodal segment. Rami of legs 2–4 slender. Third exopodal segment of leg 1 bearing seta as first outer element. Endopods of legs 2–4 much shorter than exopod, not extending beyond distal border of second exopodal segment. Armature formula for legs 1–4 as follows:



**FIGURE 121.** *Notopterophoroides deplanatum* sp. nov., female. A, habitus, dorsal; B, urosome, ventral; C, anal somite and caudal rami, dorsal; D, anal somite and caudal rami, ventral; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilliped. Scale bars: A, 0.2 mm; B, 0.05 mm; C-I, 0.02 mm.



**FIGURE 122.** *Notopterophoroides deplanatum* **sp. nov.**, female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: A-E, 0.02 mm; F, 0.1 mm.

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	1-1; 1-1; 1, III, 3	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-0; 3, 1, 4	0-1; 1, 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 2, 1, 4	0-1; 1, 2, 2
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 4	0-1; 1, 2, 1

Leg 5 (Fig. 122F) small, consisting of short protopod and free exopod; protopod with small, naked outer distal seta, and row of spinules along ventrodorsal border; exopodal segment about 3.4 times longer than wide ( $27 \times 8 \mu\text{m}$ ), slightly constricted proximally, ornamented with 2 and 1 rows of spinules on inner and outer margins, respectively and 1 bifurcate sensilla subdistally; probably armed with single apical seta (seta missing, but scar visible).

**Male.** Unknown.

**Remarks.** This species is similar to *N. tripartitum* **sp. nov.** in having the unsegmented maxilliped and 2-segmented endopods in legs 2–4. Both species were collected from the same host at a same time. However *N. deplanatum* **sp. nov.** differs from *N. tripartitum* **sp. nov.** in having a 4-segmented, strongly depressed prosome (vs. 3-segmented and cylindrical in *N. tripartitum* **sp. nov.**), 7 setae on the maxilliped (vs. 9 setae in *N. tripartitum* **sp. nov.**), an inner seta on the first exopodal segment of leg 2 (vs. this seta missing in *N. tripartitum* **sp. nov.**), 8 setae on the third exopodal segment of leg 2, and 7 setae on the third exopodal segment of leg 4 (vs. 7 and 6 setae, respectively in *N. tripartitum* **sp. nov.**). These major differences cannot be considered as intraspecific variation and justify the establishment of the separate species.

### *Ooishillgia* **gen. nov.**

**Diagnosis.** Body of female elongate and bilaterally compressed. Prosome consisting of cephalosome, 3 pedigerous somites plus fourth and fused fifth pedigerous somites. Brood pouch extending through third and fourth pedigerous somites, rounded posteriorly. Free urosome 5-segmented in female, 6-segmented in male. Anal somite with weak posteroventral protuberance. Caudal ramus small, located dorsally on anal somite, armed with 6 setae. Rostrum well-developed. Antennule 8-segmented. Antenna 4-segmented; basis with 1 large exopodal seta. Mandible with 4 setae on exopod; endopod with 4 and 9 setae on first and second segments, respectively. Maxillule with 3 setae each on basis and exopod, and 4 setae on endopod. Maxilla with claw plus 2 setae on basis and 4 setae on third endopodal segment. Maxilliped unsegmented with 8 medial and 2 apical setae in female, and 6 medial and 2 apical setae in male. Leg 1 with 3-segmented rami; third exopodal segment with seta as first outer element. Legs 2–4 each with 3-segmented exopod and 2-segmented endopod. Inner coxa seta lacking in legs 1–4. Leg 1 basis with inner distal spine; outer seta not

enlarged. Leg 5 small with free exopodal segment bearing single apical seta.

**Type and only species.** *Goniodelphys tokiokai* Ooishi & Illg, 1973, by original designation.

**Etymology.** The new genus named for the late Shigeo Ooishi and Paul L. Illg, who originally described the type species and have contributed enormously to our understanding of the Notodelphyidae. Gender feminine.

**Remarks.** The characters of type species suggest that the new genus is closely related to *Notopterophoroides*, with which it shares numerous derived character states. In particular, the possession of a seta as the proximal outer element on the third exopodal segment of leg 1 is an important synapomorphic trait. However, *Ooishillgia* **gen. nov.** differs from *Notopterophoroides* and from other similar genera in having 4 setae on the mandibular exopod, and 6 setae but no claws on the caudal ramus. We here remove *G. tokiokai* from *Goniodelphys* and establish *Ooishillgia* **gen. nov.** to accommodate it.

### *Ooishillgia tokiokai* (Ooishi and Illg, 1973) **comb. nov.**

(Figs. 123, 124)

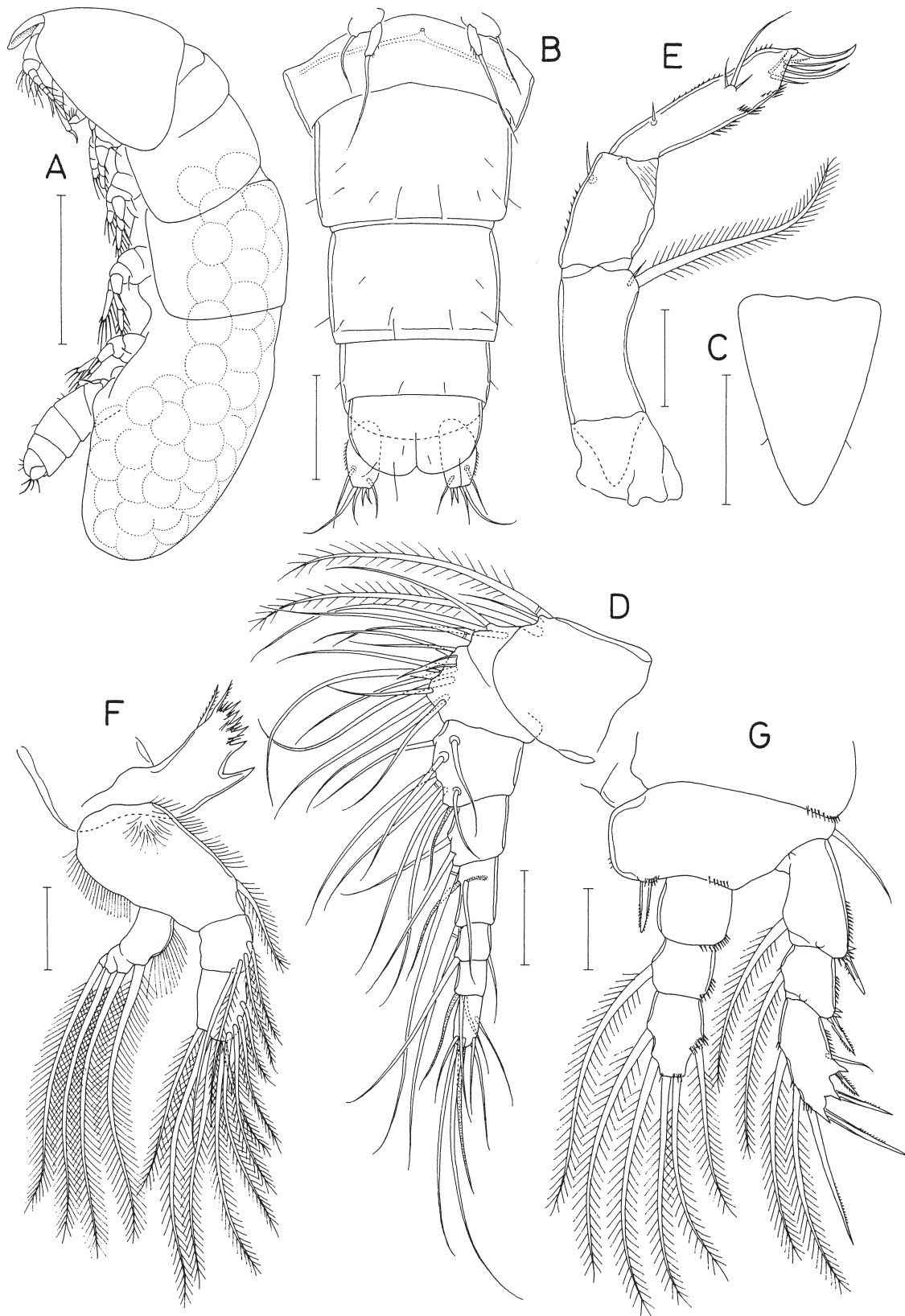
Syn.: *Goniodelphys tokiokai* Ooishi & Illg, 1973: 217, figs. 1-4.

**Material examined.** 1 ♀, 1 ♂ (both dissected) from *Pterygascidia longa* (Van Name, 1918), West of Panay Island, the Philippines ( $11^{\circ}27'N$ ,  $121^{\circ}43'E$ ), MUSORSTOM Stn 131, depth 120 m, 05 June 1985.

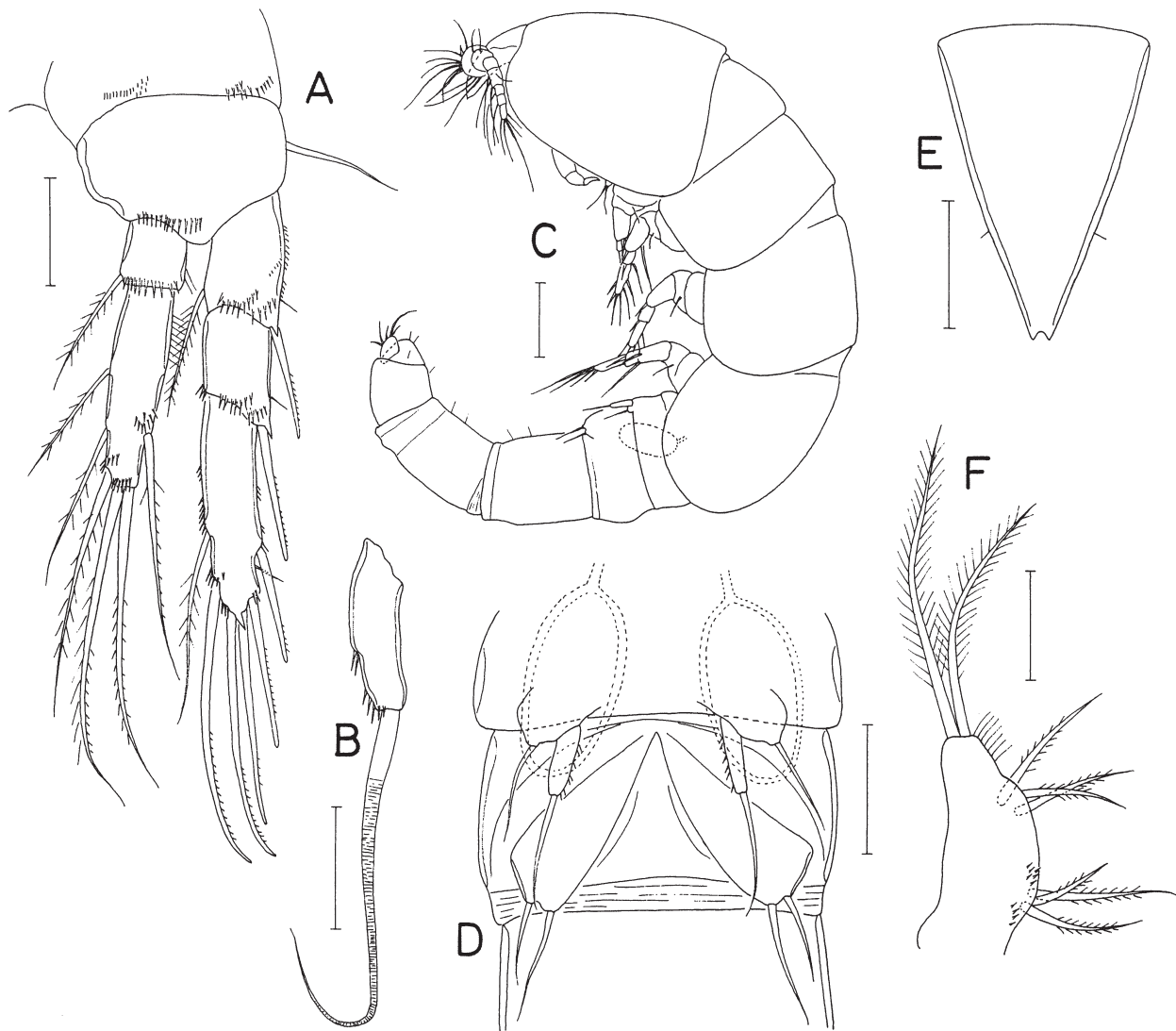
**Supplementary description of female.** Female body (Fig. 123A) elongate, 2.23 mm long measured from frontal margin of cephalosome to posterior end of brood pouch. Fourth pedigerous somite extending beyond caudal rami; fifth pedigerous somite incorporated into brood pouch. Free urosome (Fig. 123B) stout, 5-segmented; anal somite with weak posteroventral protuberance. Caudal ramus  $65 \times 35 \mu\text{m}$ , located dorsally on anal somite; armed with 6 setae.

Rostrum (Fig. 123C) longer than wide ( $162 \times 112 \mu\text{m}$ ), triangular. Antennule (Fig. 123D) 8-segmented; fifth segment with trace of subdivision; armature formula 3, 15 (or 7, 11), 8+aesthetasc, 3, 3+aesthetasc, 2, 2+aesthetasc, and 6+aesthetasc; aesthetascs thin and hard to distinguish from setae. Antenna (Fig. 123E) 4-segmented; basis bearing large, pinnate seta plus vestigial seta, representing exopod.

Labrum simple, unornamented, with straight posterior margin lacking posteromedian lobe. Mandible (Fig. 123F) with 6 acute teeth and several needle-like spinules on cutting margin and 2 small setae on proximal margin of coxal gnathobase; exopod with 4 large setae; endopod with 4 and 9 setae on first and second segments, respectively. Maxillule bearing 9 setae on arthrite, 1 each on coxal endite and epipodite, 3 on basis and on exopod, and 4 on endopod. Maxilla 5-segmented with 9, 2+claw,



**FIGURE 123.** *Ooishillgia tokiokai* (Ooishi & Illg, 1973) **n. comb.**, female. A, habitus, left; B, urosome, ventral; C, rostrum; D, antennule; E, antenna; F, mandible; G, leg 1. Scale bars: A, 0.5 mm; B, C, 0.1 mm; D-G, 0.05 mm.



**FIGURE 124.** *Ooishillgia tokiokai* (Ooishi & Illg, 1973) **n. comb.**, female: A, leg 4; B, exopod of leg 5. Male: C, habitus, left; D, first two urosomal somites, ventral; E, rostrum; F, maxilliped. Scale bars: A, D, E, 0.05 mm; B, F, 0.02 mm; C, 0.1 mm.

1, 1, and 4 as armature formula. Maxilliped unsegmented, with 8 medial and 2 apical setae.

Leg 1 (Fig. 123G) with 3-segmented rami. Third exopodal segment armed with 1 seta (proximalmost element) and 2 slender spines on outer margin, 1 slender spine distally, and 3 setae on inner margin; first outer spine (second element) much shorter than 2 distal spines. Legs 2–4 each with 3-segmented exopod and 2-segmented endopod, lacking inner seta on second exopodal segment (Fig. 124A). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 1, III, 3	0-0; 0-1; 1, 2, 2
Leg 2	0-0	1-0	I-1; I-0; 3, 1, 4	0-1; 1, 2, 6
Leg 3	0-0	1-0	I-1; I-0; 2, 1, 4	0-1; 1, 2, 5

Leg 4 0-0 1-0 1-1; 1-0; 2, 1, 3 0-1; 1, 2, 3

Leg 5 small; free exopodal segment (Fig. 123B) slender,  $37 \times 11 \mu\text{m}$ , with large naked apical seta.

**Description of male.** Body (Fig. 124C) strongly curved ventrally. Body length 1.30 mm. Urosome 6-segmented with clearly defined fifth pedigerous somite. Caudal ramus as in female.

Rostrum (Fig. 124E) minutely bifurcate at apex. Antennule, antenna, labrum, mandible, maxillule, maxilla as in female. Maxilliped (Fig. 124F) with 6 (3+3) medial and 2 apical setae.

Legs 1–4 as in female. Leg 5 (Fig. 124D) also similar to that of female. Leg 6 (Fig. 124D) represented by 2 naked setae on genital operculum.

**Remarks.** The male of this species is reported here

for the first time. The single female studied exhibits some differences from the original description. The setation of the antennule and the relative lengths of the outer spines on the third exopodal segment of leg 1 differ between the type specimens and our specimen. Ooishi & Illg (1973) described a stout exopodal segment on leg 5 and illustrated the presence of an inner seta on the second exopodal segment of leg 4. These discrepancies may be considered to be artefacts, or may represent infraspecific variation, since both the type and our specimens were derived from the same host species collected in the same geographical region.

### Genus *Microra* Monniot C., 1983

**Diagnosis:** Body dorsoventrally depressed. Prosome consisting of cephalosome, 3 free pedigerous somites and brood pouch. Fourth pedigerous somite longer than 3 anterior pedigerous somites combined. Fifth pedigerous somite completely fused with fourth. Free urosome 5-segmented, comprising genital somite and 4 abdominal somites. Anal somite posteroventrally protuberant, well-sclerotized. Caudal ramus armed with 2 claws and 4 setae. Antennule 7-segmented. Antenna 4-segmented; basis with exopodal seta distally; compound distal endopodal segment armed with 7 setae plus terminal claw. Mandible with weakly bilobed coxal gnathobase, both lobes spinulose, without teeth; basis with 1 seta; exopod and endopod unsegmented, both armed with 4 setae. Maxillule forming tapering lobe bearing 4 setae. Maxilla 5-segmented; syncoxa unarmed; basis with 3 setae; third and fourth segments each with 1 seta; fifth segment with 3 setae. Maxilliped lobate with 2 setae distally. Legs 1–4 with 3-segmented exopods and 2-segmented endopods. Inner coxal seta absent and outer seta on basis small in all legs 1–4. Basis of leg 1 lacking inner distal element. Endopods much smaller than exopods. First endopodal segment unarmed in all legs. Armature formula as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-0; I-0; III, 3	0-0; 1, 2, 0
Leg 2	0-0	1-0	1-0; 1-0; 8	0-0; 2, 2, 0
Leg 3	0-0	1-0	1-0; 1-0; 7	0-0; 2, 2, 0
Leg 4	0-0	1-0	1-0; 1-0; 7	0-0; 1, 2, 1

Leg 5 represented by 2 small digitiform processes, each bearing apical seta.

**Type species:** *Microra angulata* Monniot C., 1983, by original designation.

**Remarks.** This genus has remained monotypic since its discovery. In his original diagnosis of the genus Monniot (1983) highlighted the reduced size of leg 1, the presence of a single exopodal seta on the 3-segmented antenna, the 1-segmented endopods of legs 1 to 4, and the presence

of 2 claws on the caudal rami. Here we confirm that the endopods are actually 2-segmented, each comprising a small unarmed proximal segment and a setiferous second segment.

### *Microra angulata* Monniot C., 1983

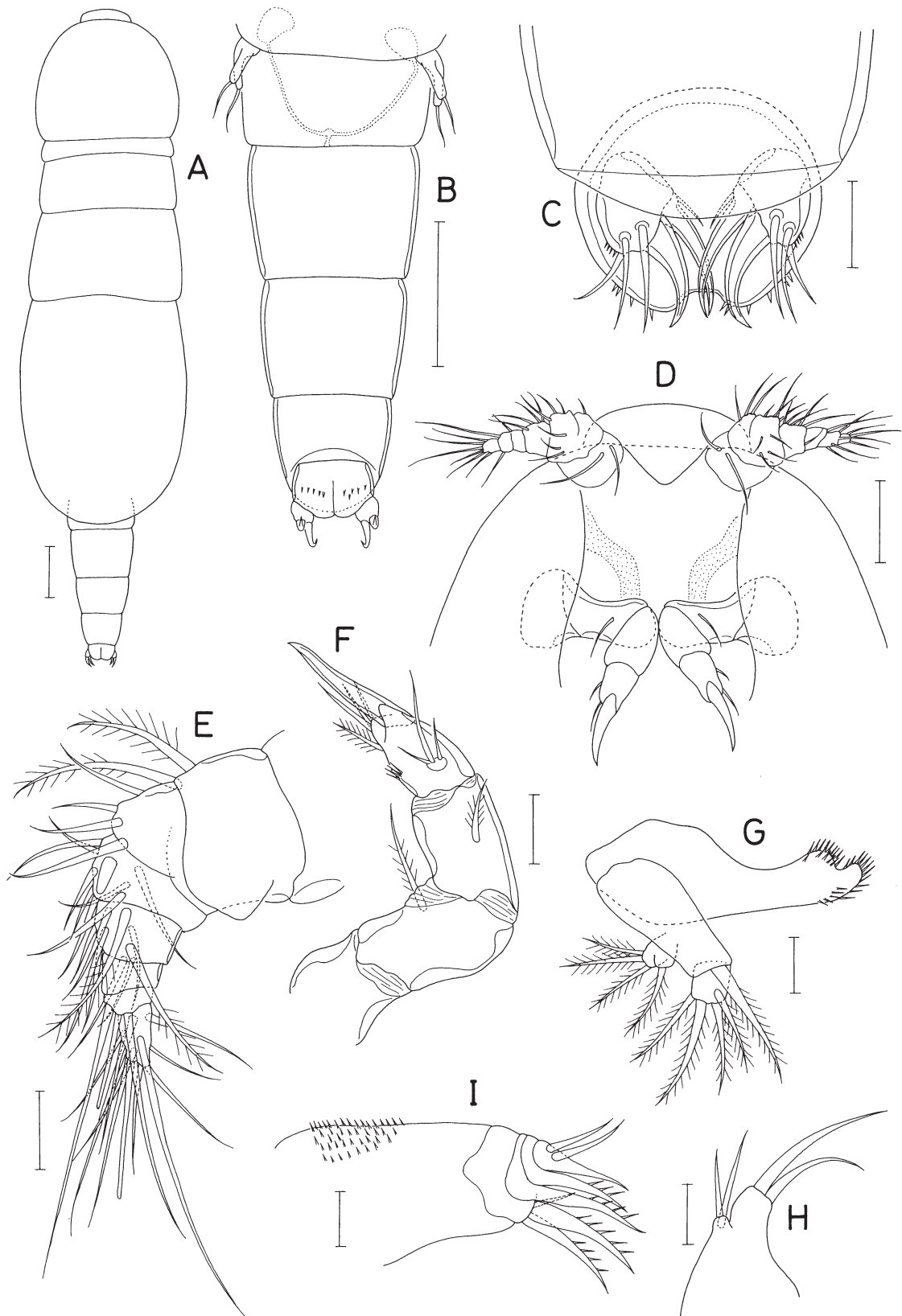
(Figs. 125, 126)

**Material examined.** 3 ♀♀ (MNHN-IU-2018-1835) from *Ascidia interrupta* Heller, 1878, Riviere Sens, Guadeloupe; 2 ♀♀ (MNHN-IU-2018-1836) from *A. interrupta*, Grande Anse, Guadeloupe; 2 ♀♀ (both dissected and figured) from *A. interrupta*, Pointe de Salines, Martinique; 2 ♀♀ (MNHN-IU-2018-1920) from *A. interrupta*, Martinique MADIBENTHOS Stn. AR051, (14°29.6'N, 61°05.5'W), depth 5-25 m, 07 September 2016.

**Redescription of female.** Body (Fig. 125A) elongate and dorsoventrally depressed. Body length 1.30 mm; prosome 1.02 mm, occupying 78% of body length, consisting of cephalosome and 4 pedigerous somites. Dorsal shield of cephalosome 240×290 µm, rounded anteriorly and laterally. First pedigerous somite very short, about one-third as long as second: second to fourth 105×295, 178×309, and 436×338 µm, respectively. Fourth pedigerous somite forming brood pouch with rounded posterodorsal margin, longer than 3 anterior pedigerous somites combined. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 125B) 5-segmented, gradually narrowing posteriorly; genital somite 64×130 µm; 4 abdominal somites 90×118, 80×100, 73×82, and 36×56 µm, respectively. Anal somite posteroventrally protuberant, well-sclerotized, ornamented with few spinules on ventral surface. Caudal ramus (Fig. 125C) small, located dorsally on anal somite, 19×19 µm, armed with 2 claws and 4 setae; 2 claws subequal, longer than ramus; one small seta inserted into basal part of dorsal claw.

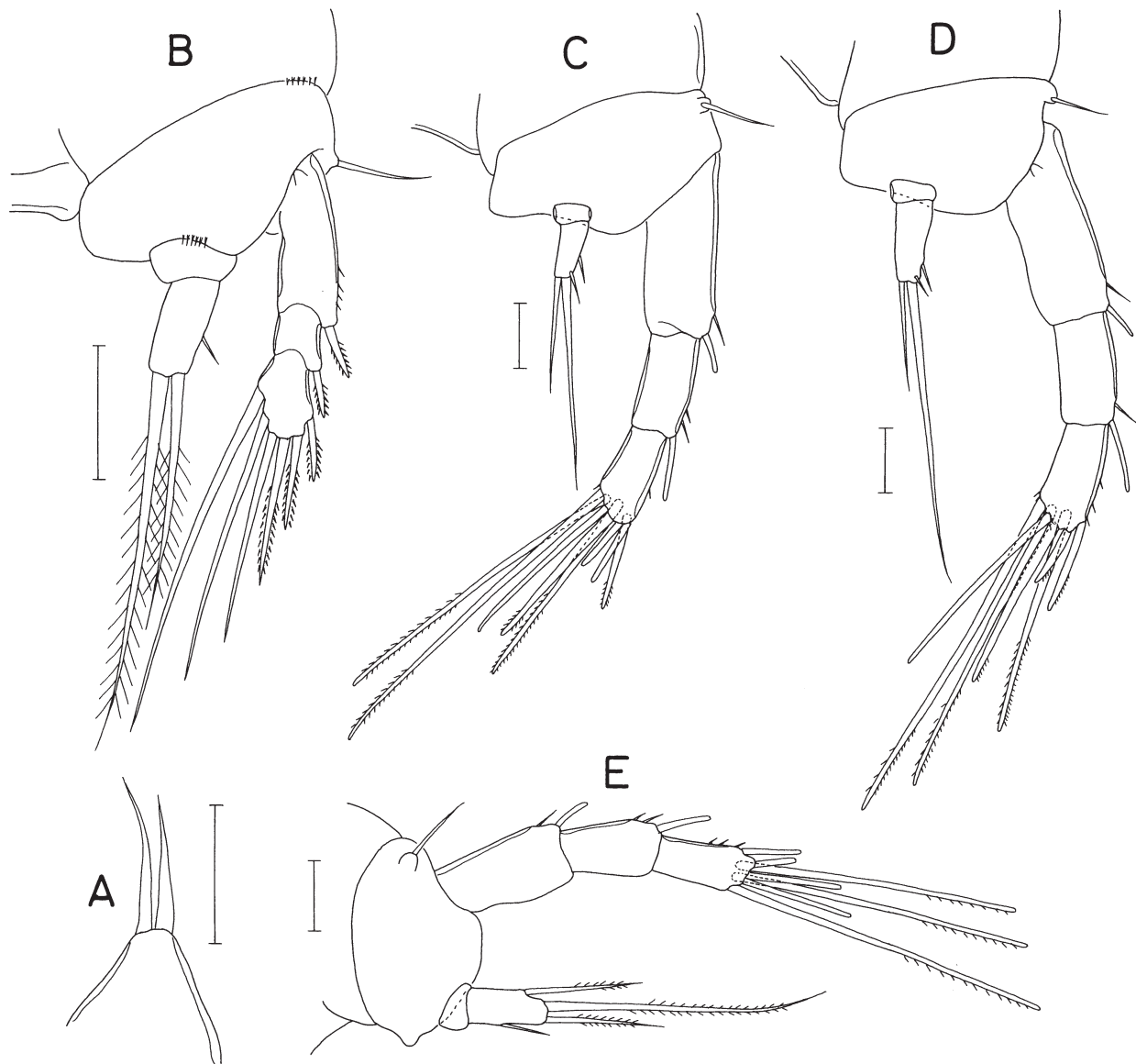
Rostrum (Fig. 125D) triangular, directed posteriorly, not free from cephalosome. Antennule (Fig. 125E) small, distinctly narrowing distally, 7-segmented; armature formula 2, 4, 9, 9, 0, 2+aesthetasc, and 10+aesthetasc; first segment inflated posteriorly; several setae pinnate; one seta on third segment spiniform, blunt, short, but broad. Antenna (Fig. 125F) stout, 4-segmented; coxa unarmed; basis 1.3 times longer than wide, with exopodal seta distally; first endopodal segment as long as basis, with 1 seta on inner surface; compound distal endopodal segment not elongate, slightly shorter than first, tapering, and ornamented with row of spinules; armed with 7 setae plus terminal claw longer than segment.

Labrum missing. Mandible (Fig. 125G) with weakly bilobed coxal gnathobase, both lobes spinulose and without teeth; basis with 1 seta distally; exopod and endopod unsegmented, both armed with 4 setae. Maxillule (Fig. 125H) as tapering lobe bearing 2 subdistal and 2 larger distal setae, all setae naked. Maxilla (Fig. 125I)



**FIGURE 125.** *Microrora angulata* Monniot C., 1983, female. A, habitus, dorsal; B, urosome, ventral; C, anal somite and caudal rami; D, anterior part of cephalosome, ventral; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilla. Scale bars: A, B, 0.1 mm; C, E, F, 0.02 mm; D, 0.05 mm; G-I, 0.01 mm.





**FIGURE 126.** *Microrora angulata* Monniot C., 1983, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: 0.02 mm.

obscurely 5-segmented; first segment (syncoxa) unarmed, but with numerous spinules on outer proximal surface; second segment (basis) with 3 setae (1 minute, other 2 broad, spinulose distally); third and fourth segments each with 1 spinulose seta; fifth segment with 3 naked setae (1 not articulated at base). Maxilliped (Fig. 126A) as small triangular lobe bearing 2 naked setae distally.

Legs 1–4 (Fig. 126B–E) each with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent and outer seta on basis naked and small in all legs 1–4. Basis of leg 1 lacking inner distal element. Endopods much smaller than exopods, half as long as exopod in leg 1, 0.2 to 0.25 times as long in legs 2–4. First endopodal segment unarmed in all 4 legs, short, at most 0.3 times as

long as second endopodal segment. Outer setae on second endopodal segment of legs 1–3 rudimentary. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-0; I-0; III, 3	0-0; 1, 2, 0
Leg 2	0-0	1-0	1-0; 1-0; 8	0-0; 2, 2, 0
Leg 3	0-0	1-0	1-0; 1-0; 7	0-0; 2, 2, 0
Leg 4	0-0	1-0	1-0; 1-0; 7	0-0; 1, 2, 1

Leg 5 (Fig. 125B) represented by 2 small digitiform processes, fused at base, each bearing 1 small apical seta.

**Male.** Described by Monniot (1983); not found in present study.

**Remarks.** Some morphological aspects overlooked in the original description are emended in the above redescription. The most important emendation is the 2-segmented state of the endopods of legs 1–4. The material examined here comes from the type host *A. interrupta* collected in the same general locality, Guadeloupe, as the type material.

### Genus *Periproctia* Stock, 1967

**Diagnosis:** Prosome comprising cephalosome defined by cephalic shield and fused first to fourth pedigerous somites, together forming brood pouch. Pedigerous somites defined only by dorsal tergite; fifth pedigerous somite fused to fourth. Free urosome comprising genital and 4 abdominal somites. Anal somite with pair of highly sclerotized, ventral protuberances referred to as “periproctal ring” by Stock (1967) or “perianal ring” by Illg & Dudley (1961). Caudal rami armed with 2 to 4 claws and 2 to 4 setae (total of 6). Antennule 6- to 8-segmented. Antenna 4-segmented; basis with plumose seta representing exopod (rarely absent); compound distal endopodal segment armed with 9 setae plus terminal claw. Mandible with 5 teeth and 0/1 seta on coxal gnathobase; basis with 1 seta on medial margin; exopod 2-segmented and armed with 5 setae (3 on first and 2 on second segment); endopod armed with 2 and 5 or 6 setae on first and second segments, respectively. Maxillule armed with 5 to 9 setae on arthrite, 1 on coxal endite (rarely absent), 1 or 2 on epipodite, 2 or 3 on medial margin of basis, 3 on exopod, and 4 on endopod. Maxilla 5-segmented; syncoxa with 3, 1, 2, and 4 setae on first to fourth endites, respectively, 2 setae on basis, and 1, 1, and 2/3 setae on first to third endopodal segments, respectively. Maxilliped unsegmented with 6 to 8 medial plus 1 or 2 apical setae. Legs 1–4 with 3-segmented exopods and 2- or 3-segmented endopods. All legs lacking inner coxal seta. Outer seta on basis very large in leg 1, but small in legs 2–4. Three distal setae on endopod of leg 1 enlarged. First and second exopodal segments of legs 2–4 typically with bifurcate or trifurcate outer distal corners. Third exopodal segments of legs 3 and 4 elongate. Armature formula typically as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-0/1; I-0/1; II, I, 3/4	0-0; 1, 2, 2/3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-0/1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-0/1; 2, 1, 5	0-0/1; 1, 2, 5
Leg 4	0-0	1-0	1-0/1; 1-0/1; 2, 1, 5	0-0/1; 1, 2, 3/4

Leg 5 consisting of protopod with outer seta and free exopodal segment with apical seta.

**Type species:** *Periproctia biuncata* Stock, 1967, by original designation.

**Remarks.** Stock (1967) considered that the material of *Bonnierilla arcuata* Brément, 1909 described by Illg

& Dudley (1961) was not conspecific with Brément’s species. He designated this material as a new species, *P. falsiarcuata* Stock, 1967 and placed it in a new genus, *Periproctia*. This genus takes its name from the modification of the anal somite into the periproctal ring. We agree with this generic placement but we treat *P. falsiarcuata* as a *species inquirendum* because was inadequately described and cannot be recognized.

### *Periproctia stocki* sp. nov.

(Figs. 127, 128)

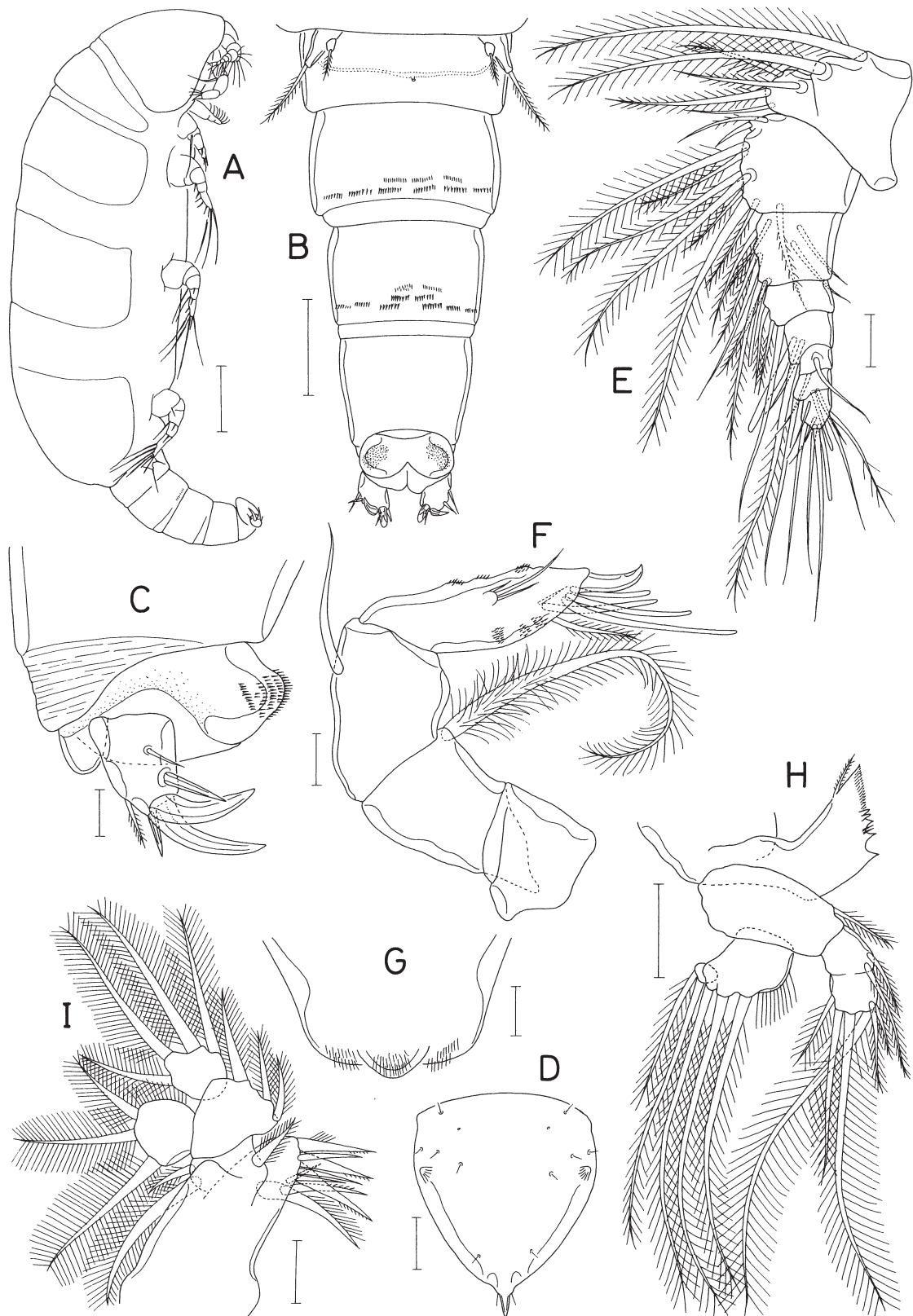
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21257), paratypes (2 intact ♀♀, MNHN-IU-2014-21258), and dissected paratype (♀, figured) from *Ritterella tokioka* Kott, 1992 (MNHN-IT-2008-7934 = MNHN A1/RIT/22), AURACEA 1995, Ibo, Mozambique, depth 0-20 m, Monniot coll., 11 November 1995.

**Additional material.** 1 ♀ (dissected) from *R. tokioka*, Madagascar, (25°25’S, 44°15’E), depth 20-27 m, 22 May 2010; 3 ♀♀ (MNHN-IU-2018-1837) and 2 dissected ♀♀ from *Eudistoma* sp., Bahrain, 20 October 1994.

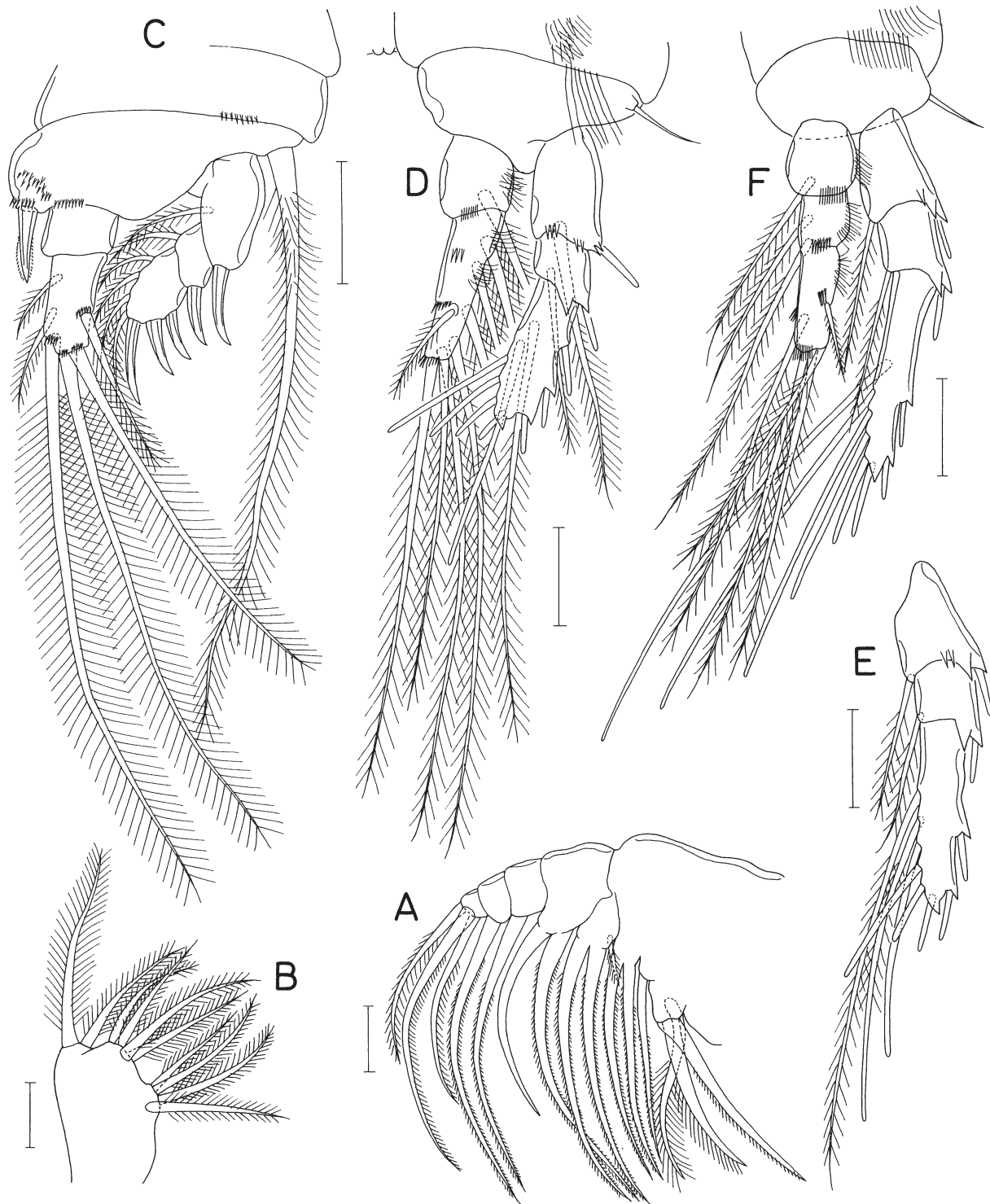
**Etymology.** The new species is named in honor of Jan H. Stock who established the genus *Periproctia*.

**Description of female.** Body (Fig. 127A) relatively large, 2.10 mm long, with clearly defined prosome-urosome division. Prosome stout, cylindrical, 0.53 mm in dorso-ventral depth. Cephalosome defined by cephalic shield. First to fourth pedigerous somites fused forming brood pouch, but each defined by their dorsal tergite. Fifth pedigerous somite completely fused to fourth. Free urosome (Fig. 127B) gradually narrowing posteriorly, about one-third as long as prosome, consisting of distinctly segmented genital and 4 abdominal somites. Genital somite much wider than long (91×220 µm), bearing single copulatory pore on ventral surface. Four abdominal somites wider than long, 125×200, 116×166, 114×139, and 90×103 µm, respectively. First and second abdominal somites ornamented with rows of minute spinules on posteroventral surface. Anal somite (Fig. 127C) with highly sclerotized ventral protuberance on each side each ornamented with minute spinules around apex. Anal operculum well-developed (Fig. 127C). Caudal ramus (Fig. 127C) about 1.3 times longer than wide (46×35 µm), narrowing distally, and armed with 4 claws and 2 setae; lengths of claws 54, 47, 31, and 22 µm, 2 larger claws slightly curved, smaller claws straight, spiniform.

Rostrum (Fig. 127D) 94×76 µm, parallel in proximal third and tapering in distal two-thirds, terminating in small, beak-like apical process; ornamented with about 6 pairs of fine setules on ventral surface and small papilla proximally on each side. Antennule (Fig. 127E) 148 µm long, and 8-segmented; all segments wider than long; armature formula 6, 10, 8+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae crowded, mostly



**FIGURE 127.** *Periproctia stocki* sp. nov., female. A, habitus, right; B, urosome, ventral; C, anal somite and caudal ramus, right; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C-G, I, 0.02 mm; H, 0.05 mm.



**FIGURE 128.** *Periproctia stocki* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4. Scale bars: A, B, 0.02 mm; C-F, 0.05 mm.

large and pinnate. Antenna (Fig. 127F) stout, 4-segmented; coxa short and unarmed; basis gradually broadening distally, with large, plumose seta representing exopod at outer distal corner; first endopodal segment slightly longer than wide, with 1 inner subdistal seta; compound distal endopodal segment about 2.8 times longer than

wide ( $77 \times 28 \mu\text{m}$ ), ornamented with 3 patches of minute spinules on both outer and inner sides; armed with 9 setae (4 distal setae blunt at tip) plus small terminal claw, about one-third as long as segment.

Labrum (Fig. 127G) with setulose posteromedian lobe and setules on posterior margin. Mandible (Fig.

127H) with 5 teeth and 1 seta on coxal gnathobase and 1 or 2 needle-like spinules between distal second and third teeth; basis with 1 seta on subdistal medial margin; exopod 2-segmented and armed with 3 setae on first segment and 2 on small second segment), distalmost seta small (about half as long as other setae), ornamented with setules on medial margin of first segment: endopod 2-segmented but articulation between segments indistinct: armed with 2 and 6 setae on first and second segments, respectively, 2 mid-terminal setae (third and fourth setae) on second segment much larger than other 4 setae. Maxillule (Fig. 127I) armed with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 3 on exopod, and 4 on endopod. Maxilla (Fig. 128A) 5-segmented; syncoxa with 3, 1, 2, and 4 setae on first to fourth endites, respectively, basis with 2 setae, and with 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 128B) unsegmented with 10 setae (8 medial and 2 apical).

Legs 1–4 (Fig. 128C–F) each with 3-segmented exopod and 2-segmented endopod; second segment of leg 3 endopod subdivided by incomplete suture line on outer side. All legs lacking inner coxal seta. Outer seta on basis very large, about 3 times as long as exopod in leg 1 but small and naked in legs 2–4. Three distal setae on endopod of leg 1 enlarged. Ventral surface of coxa of legs 2–4 with long setules on outer side. First and second exopodal segments of legs 2–4 with bifurcate or trifurcate outer distal corner. Third exopodal segment of legs 3 and 4 elongate. Outer and distal setae on exopods of legs 2–4 naked and blunt tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 127B) small, consisting of protopod and free exopod. Protopod extended posterolaterally, bearing apical seta; exopodal segment very small with small apical seta.

**Male.** Unknown.

**Remarks.** The genus *Periproctia* is currently regarded as containing three valid species, *P. biuncata*, *P. falsiarcuata*, and *P. triuncata* Stock, 1967, all described when the genus was established (Stock, 1967). The new species differs from these three species in having: (1) 4 claws and 2 setae on the caudal ramus (in contrast to 2 claws and 4 setae in *P. biuncata*, and 3 claws and 3 setae in the other two species), (2) 6 setae on the second endopodal segment of the mandible (vs. 5 setae in all 3 congeneric species), (3) an inner seta on the second exopodal segment of leg 4 (vs. seta absent in congeners), and (4) 8 setae on the endopod of leg 4 (compared to 4 setae in *P. biuncata* and 6 setae in the other two species).

The additional specimens extracted from *Eudistoma* sp. collected from Bahrain have a body length of 1.16–1.25 mm, which is significantly smaller than the type specimens. Nevertheless, there were no other morphological differences between the samples, so we tentatively identify them as *Periproctia stocki* sp. nov.

***Periproctia acutirostris* sp. nov.**

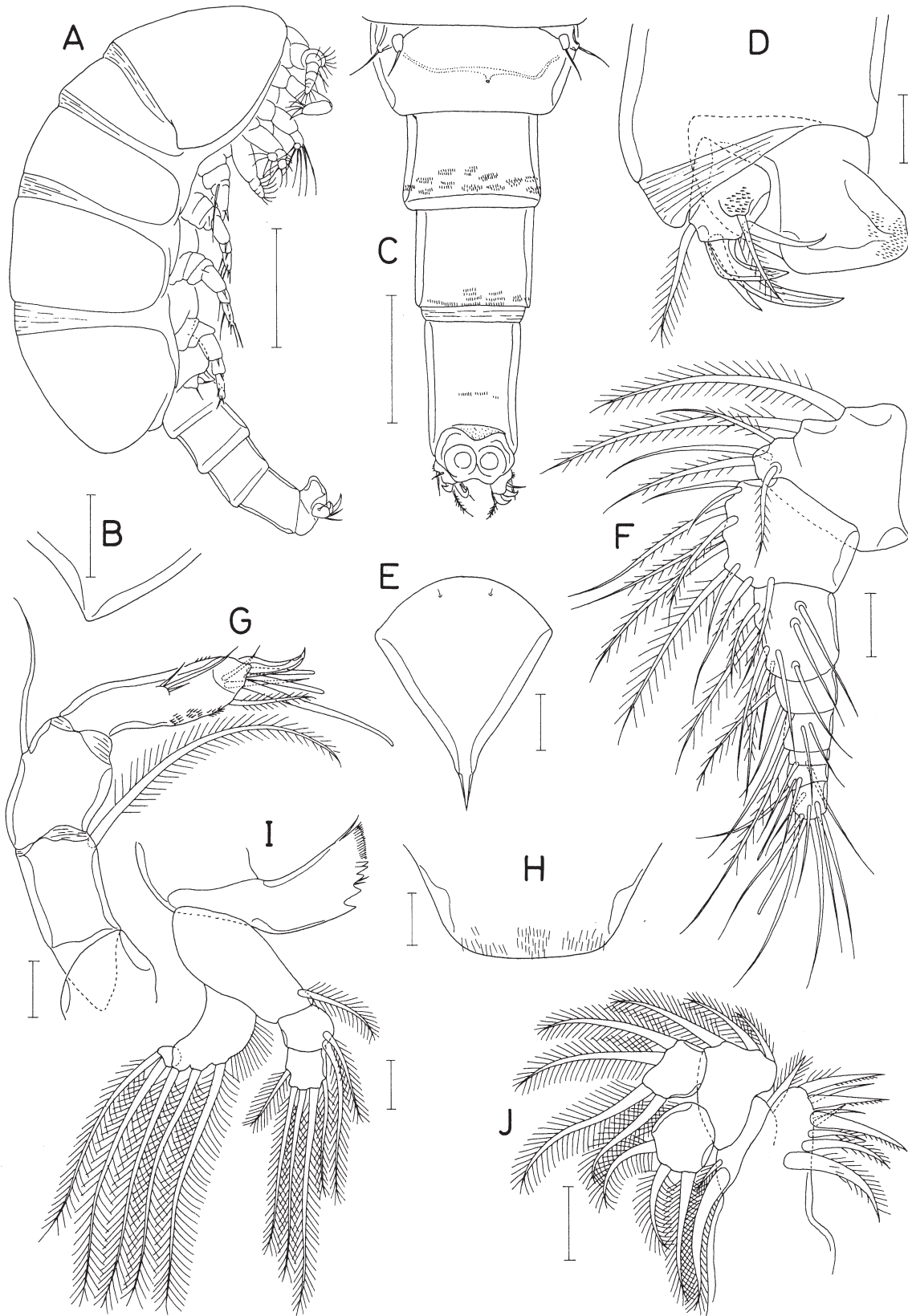
(Figs. 129, 130)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21259), paratype (intact ♀, MNHN-IU-2014-21260), and dissected paratypes (♀, figured) from *Diplosoma multitestis* Monniot F. & Monniot C., 1996 (Holotype MNHN-IT-2008-3581 = MNHN A2/DIP.A/109), CRRF OCDN 1813-G, eastern Filed Atoll, 140 km southwest of Port Moresby, Papua New Guinea (10°00.66'S, 145°39.90'E), depth 20 m, 22 October 1993.

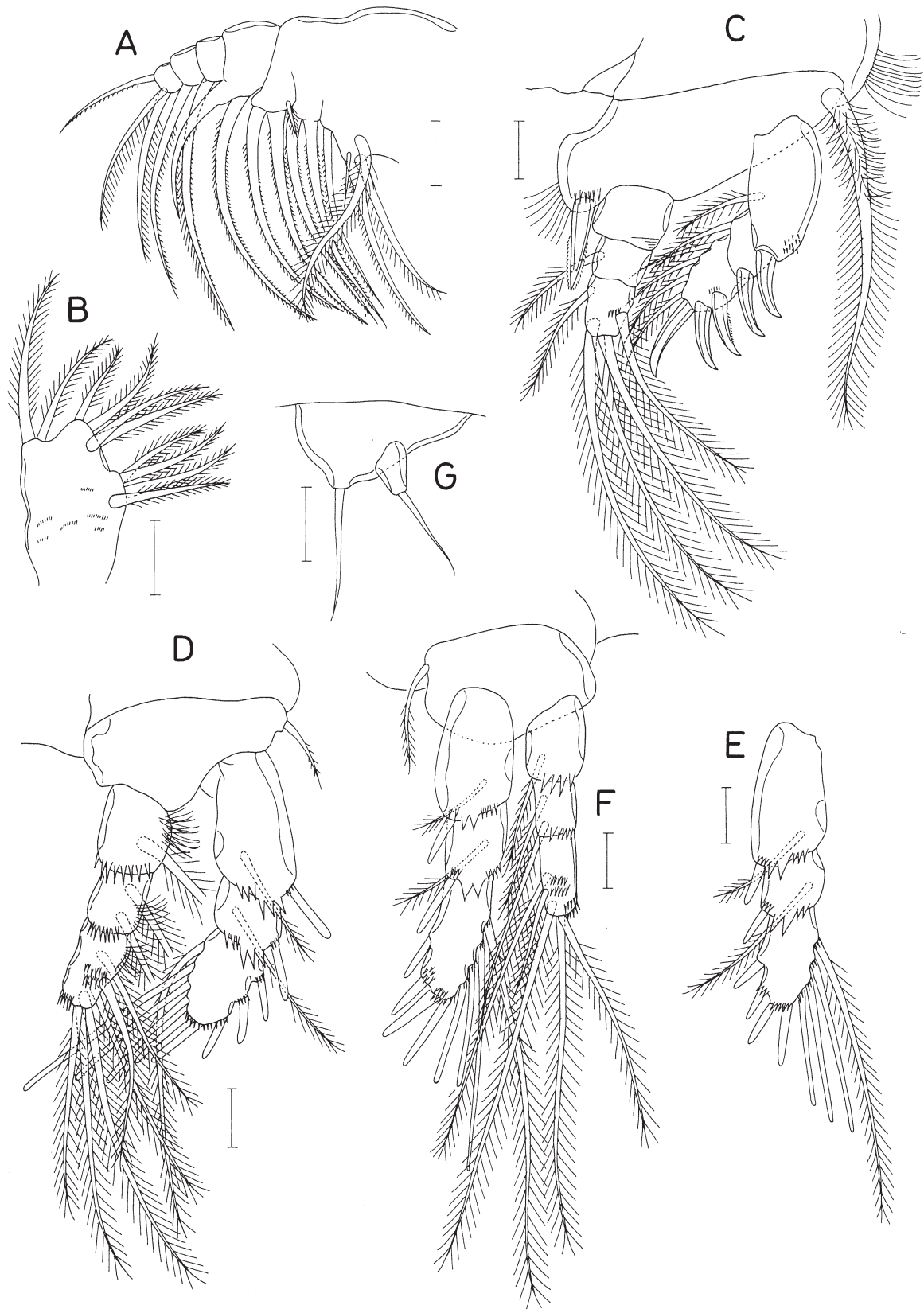
**Etymology.** The specific name is derived from the Latin words *acut* (=sharp) and *rostrum* (=snout) and refers to the acutely pointed apical process on the rostrum.

**Description of female.** Body (Fig. 129A) consisting of stout, unsegmented prosome and narrow urosome. Dorsal shield of cephalosome with slightly produced, angular posterolateral corners (Fig. 129B). Pedigerous somites fused but recognizable by retained dorsal tergites. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 129C) 5-segmented: genital somite 73×162 µm, much wider than long; copulatory pore present on ventral surface. First to third abdominal somites 75×107, 87×91, and 105×75 µm, respectively. Third abdominal somite distinctly longer than wide. First and second abdominal somites ornamented with multiple rows of minute spinules on posteroventral surface. Anal somite (Fig. 129D) short, with pair of highly sclerotized ventral protuberances ornamented with minute spinules around apex. Caudal ramus (Fig. 129D) slightly narrowing distally, about 1.2 times longer than wide (27×23 µm), armed with 3 claws and 3 setae, and ornamented with patch of minute spinules near base of proximal seta; 3 claws unequal in length and thickness, 44, 25, and 25 µm long; dorsal and outer lateral setae pinnate, ventral seta naked, all setae longer than ramus.

Rostrum (Fig. 129E) 85×65 µm, tapering to acute, beak-like apical process. Antennule (Fig. 129F) 136 µm long and 8-segmented; armature formula 6, 10, 8+aesthetasc, 3, 3, 2, 2+aesthetasc, and 7+aesthetasc; about half of setae large and pinnate, smaller setae naked. Antenna (Fig. 129G) with short, unarmed coxa; basis with 1 large seta representing exopod at outer distal corner; first endopodal segment with 1 naked seta on inner margin; compound distal endopodal segment about 3.3 times longer than wide (65×20 µm), ornamented with several patches of minute spinules; armed with 9 setae plus small terminal claw, less than half length of segment.



**FIGURE 129.** *Periproctia acutirostris* sp. nov., female. A, habitus, right; B, right posterolateral corner of cephalosome; C, urosome, ventral; D, anal somite and caudal ramus, right; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, 0.2 mm; B, 0.05 mm; C, 0.1 mm; D-J, 0.02 mm.



**FIGURE 130.** *Periproctia acutirostris* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4; G, leg 5. Scale bars: 0.02 mm.

Labrum (Fig. 129H) simple with slightly convex posterior margin; ornamented with setules on posteroventral surface. Mandible (Fig. 129I) with 5 teeth on coxal gnathobase and 2 needle-like spinules between distal second and third teeth; basis with 1 seta subdistally on medial margin; exopod 2-segmented, armed with 3 and 2 setae on first and second segments, respectively, distalmost seta slightly shorter than other 4 setae; endopod 2-segmented and armed with 2 and 5 setae (1 medial, 3 distal, and 1 outer) on first and second segments, respectively. Maxillule (Fig. 129J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 130A) 5-segmented; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites respectively; basis with 2 setae, shorter distal seta naked; endopod with 1, 1, and 3 setae on first to third segments, respectively; 1 seta on first endite of syncoxa small, needle-like. Maxilliped (Fig. 130B) unsegmented and armed with 10 setae (arranged as 4, 4, and 2); mediobasal corner protruded.

Legs 1–4 (Fig. 130C–F) with 3-segmented rami. Inner coxal seta absent in all legs. Inner distal spine on basis of leg 1 extending beyond distal margin of second endopodal segment, 32 µm long. Outer seta on basis large (longer than exopod) in leg 1 but small in legs 2–4. Exopods slightly longer than endopods in legs 1 and 2, but distinctly longer than endopods in legs 3 and 4. In legs 2–4, inner setae on first and second segments and

proximal inner seta on third segment pinnate; all other setae on exopods rod-shaped with blunt tip. Outer distal corner of first and second exopodal segments trifurcate in leg 2 but bifurcate in legs 3 and 4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-0	1-0	1-1; 1-1; 3, 1, 4	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	1-1; 1-1; 3, 1, 4	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 130G) consisting of broad protopod and small, tapering exopodal segment (13×10 µm), each tipped with 1 naked seta.

**Male.** Unknown.

**Remarks.** *Periproctia acutirostris* sp. nov. can be differentiated from all congeners by the possession of 3-segmented endopods in legs 1–4. In all previously described species of *Periproctia* the endopods of these legs are 2-segmented (Table 3)

***Periproctia latirostris* sp. nov.**

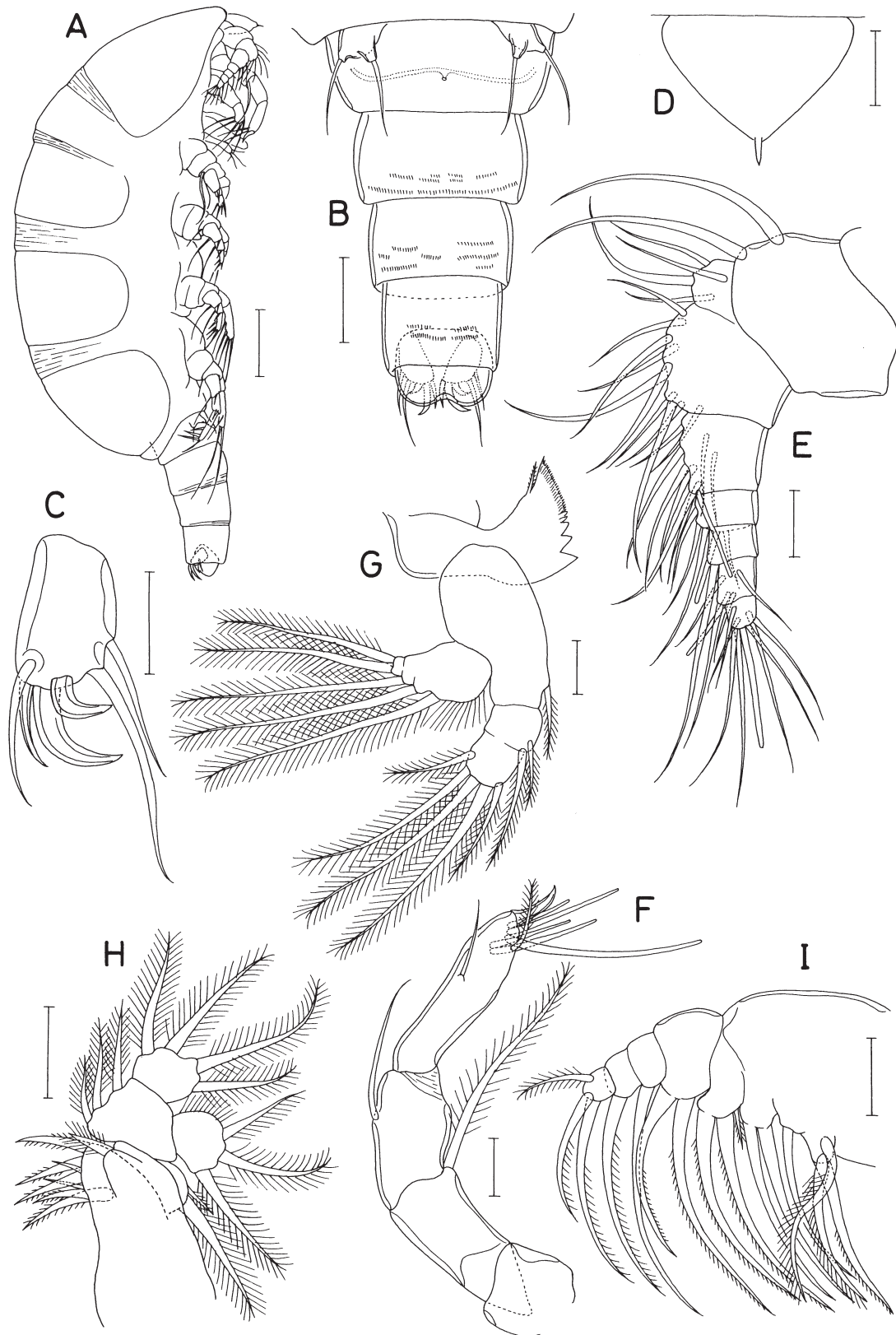
(Figs. 131, 132)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21261), paratype (intact ♀, MNHN-IU-2014-21262),

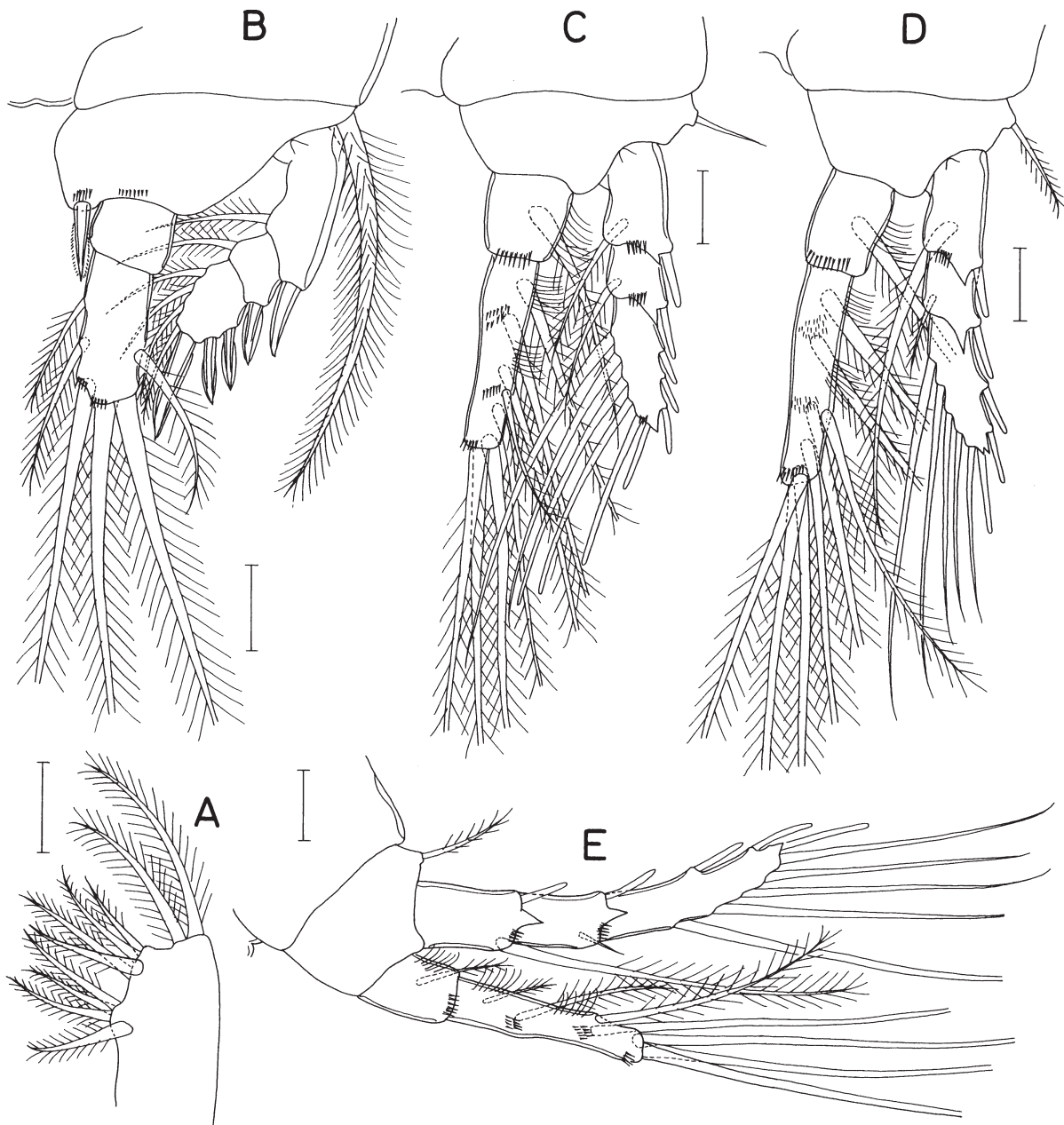
**TABLE 3.** Appendage setation patterns in species of *Periproctia*. Abbreviations: CR, caudal ramus; cl, claw; Mnd, mandible; Mxp, maxilliped; P1-4, legs 1-4; set, setae; enp endopod; exp exopod.

Species	CR cl,set	Mnd enp	Mxp	P1 exp	P1 enp	P2 enp	P3 exp	P3 enp	P4 exp	P4 enp
<i>P. arcuata</i>	-	-	-	2-2-7	0-6	-	-	-	2-2-8 2-2-6	1-6 1-5
<i>P. biuncata</i>	II,4	2-5	6+1	2-1-7	0-5	1-6	2-2-8	1-6	1-1-8	0-4
<i>P. falsiarcuata</i>	III,3	2-5	8+2	2-1-7	0-6	1-8	2-1-8	1-8	2-1-8	0-6
<i>P. triuncata</i>	III,3	2-5	7+1	2-2-7	0-5	1-8	2-1-8	1-8	2-1-8	0-6
<i>P. stocki</i> sp. nov.	IV,2	2-6	8+2	2-2-7	0-6	1-8	2-2-8	1-8	2-2-8	1-7
<i>P. acutirostris</i> sp. nov.	III,3	2-5	8+2	2-2-7	0-1-5	1-2-5	2-2-8	1-2-6	2-2-8	1-2-5
<i>P. latirostris</i> sp. nov.	III,3	2-5	8+2	2-2-7	0-6	1-8	2-2-8	1-8	2-2-8	1-7
<i>P. bisetigera</i> sp. nov.	II,4	2-5	8+2	1-2-7	0-5	0-8	2-2-8	1-8	2-2-8	1-7
<i>P. spissa</i> sp. nov.	III,3	2-6	8+1	2-2-7	0-6	1-8	2-2-8	1-8	2-2-8	1-7
<i>P. angusta</i> sp. nov.	III,3	2-6	8+2	2-2-6	0-6	1-8	2-2-8	1-8	2-2-8	1-7
<i>P. obtusa</i> sp. nov.	III,3	2-5	8+1	2-2-7	0-1-5	1-8	2-2-8	1-8	2-2-8	1-7
<i>P. longirostris</i> sp. nov.	III,3	2-6	8+2	2-2-7	0-6	1-8	2-1-8	1-8	1-1-8	0-6
<i>P. biunguifera</i> sp. nov.	II,4	2-6	6+2	1-2-7	0-6	1-8	2-2-8	1-8	2-2-8	1-6
<i>P. spinata</i> sp. nov.	III,3	2-5	8+1	2-1-7	0-6	1-8	2-2-8	1-8	1-2-8	0-5
<i>P. horrida</i> sp. nov.	II,4	2-5	8+1	2-2-7	0-6	1-8	2-2-8	1-8	2-1-8	0-6
<i>P. onchopodata</i> sp. nov.	III,3	2-5	8+2	1-2-7	0-6	1-8	1-1-8	0-7	1-1-8	0-5
<i>P. hexachaeta</i> sp. nov.	III,3	2-5	5+1	2-2-7	0-6	1-8	2-1-8	1-8	2-1-8	0-7
<i>P. laticaudata</i> sp. nov.	III,3	2-5	7+1	1-2-7	0-6	1-8	2-1-8	1-8	2-1-8	0-6
<i>P. spinifera</i> sp. nov.	III,3	2-5	4+1	2-2-7	0-6	1-8	2-2-8	1-8	2-2-8	0-4
<i>P. robusta</i> sp. nov.	II,4	2-5	8+1	1-2-6	0-5	0-4	1-1-4	0-4	1-1-5	0-3





**FIGURE 131.** *Periproctia latirostris* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilla. Scale bars: A, 0.1 mm; B, 0.05 mm; C-I, 0.02 mm.



**FIGURE 132.** *Periproctia latirostris* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: 0.02 mm.

and dissected paratype (♀, figured) from *Polysyncraton lacazei* (Giard, 1872) (MNHN-IT-2008-7096 = MNHN A2/POL/8), Portugal, Saldania coll.

**Etymology.** The specific name is a combination of the Latin *lati* (=broad) and *rostrum* (=snout), alluding to the broad rostrum of the new species.

**Description of female.** Body (Fig. 131A) stout, 836 µm long. Dorsoventral depth 282 µm at middle of prosome. Pedigerous somites fused, but with weakly expressed dorsal tergites on second to fourth somites. Free urosome (Fig. 131B) about 0.35 times as long as prosome, 5-segmented, narrowing posteriorly: genital

and 4 abdominal somites 54×135, 52×101, 46×86, and 43×56 µm, respectively. First to third abdominal somites ornamented with rows of minute spinules on ventral surface. Anal somite highly sclerotized, surface smooth, without spinules. Caudal ramus (Fig. 131C) about 1.6 times longer than wide (30×19 µm), armed with 3 claws (2 robust and 1 slender) and 3 naked setae; lengths of claws 24, 17, and 15 µm; lengths of setae 44, 29, and 29 µm.

Rostrum (Fig. 131D) wider than long, 40×51 µm, tapering steeply towards small, beak-like apical process. Antennule (Fig. 131E) 120 µm long and 7-segmented;

armature formula 2, 14 (or 6, 10), 8+aesthetasc, 4+aesthetasc, 1, 4+aesthetasc, and 7+aesthetasc; articulation indistinct between terminal 2 segments; all setae naked. Antenna (Fig. 131F) moderately slender, 4-segmented; coxa short and unarmed; basis with 1 large, pinnate seta (representing exopod) at outer distal corner; first endopodal segment with 1 naked seta on inner margin; compound distal endopodal segment about 3.6 times longer than wide (65×18 µm), bearing 7 setae (including 1 pinnate seta and 5 blunt tipped setae) plus small terminal claw, one-third as long as segment.

Labrum missing. Mandible (Fig. 131G) with 5 teeth and 1 seta on coxal gnathobase; basis with 1 seta on medial margin; exopod with 5 subequal setae; endopod indistinctly 2-segmented with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 131H) with 7 setae on arthrite of precoxa, 1 on coxal endite, 2 on epipodite, 3 on basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 131I) 5-segmented; syncoxa with 9 setae (arranged 3, 1, 2, and 3), 2 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 132A) unsegmented, armed with 8 medial and 2 apical setae.

Legs 1–4 (Fig. 132B–E) each with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent in legs 1–4. Outer seta on basis large, longer than exopod in leg 1, but small in legs 2–4. Exopod longer than endopod in legs 1 and 4, but rami similar in length in legs 2 and 3. Outer setae on exopods of legs 2–4 rod-shaped with blunt tip. Inner seta on second exopodal segment of legs 3 and 4 small. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 132B) small, consisting of protopod tipped with 1 seta and conical exopod tipped with apical seta; exopodal segment not articulated from protopod.

**Male.** Unknown.

**Remarks.** In having an inner seta present on the second exopodal segment of leg 4 *P. latirostris* **sp. nov.** is similar to *P. stocki* **sp. nov.** and *P. acutirostris* **sp. nov.**, among the described species. However, these two species are easy to distinguish from *P. latirostris* **sp. nov.**: *P. stocki* **sp. nov.** has 4 claws and 2 setae on the caudal ramus, compared to 3 + 3 in *P. latirostris* **sp. nov.** (Table 3), and *P. acutirostris* **sp. nov.** has 3-segmented endopods in legs 1–4 (vs. 2-segmented endopods). The broad rostrum of *P. latirostris* **sp. nov.** is also a characteristic feature serving to differentiate it from its congeners.

### *Periproctia bisetigera* **sp. nov.**

(Figs. 133, 134)

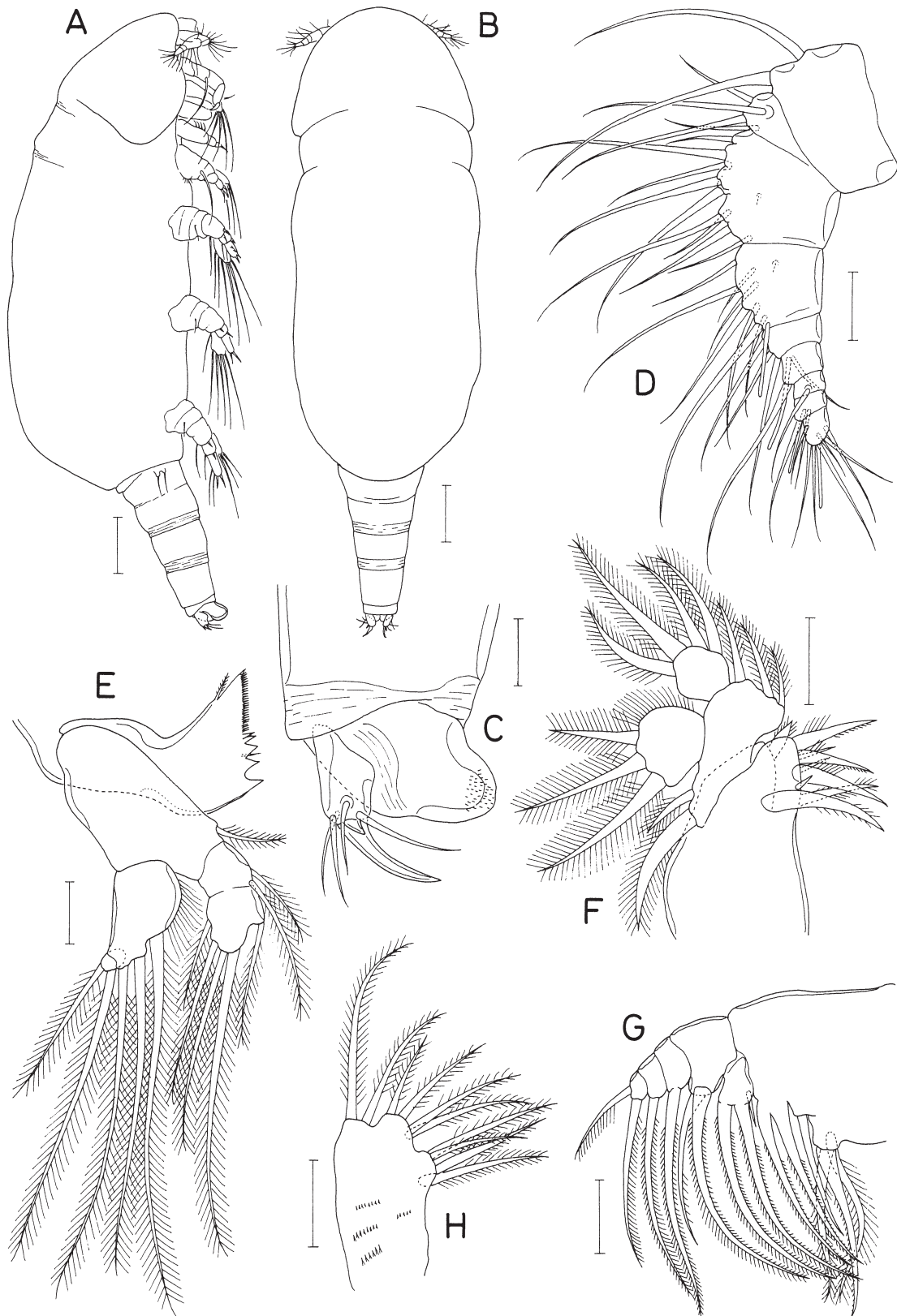
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2009-5059) from *Cystodytes* sp. (MNHN-IT-2008-2635 = MNHN A3/CYS/135), CRRF DNG 083, marine lake, Raja Ampat, West Papua, Indonesia (00°26.929'N, 130°21.149'E), depth 0.5 m, L.J. Bell and L.E. Martin coll., 04 November 2007.

**Etymology.** The specific name combines the Latin words *bi* (=two), *seta* (=bristle), and *gero* (=carry) and alludes to the presence of 2 setae on the third endopodal segment of the maxilla.

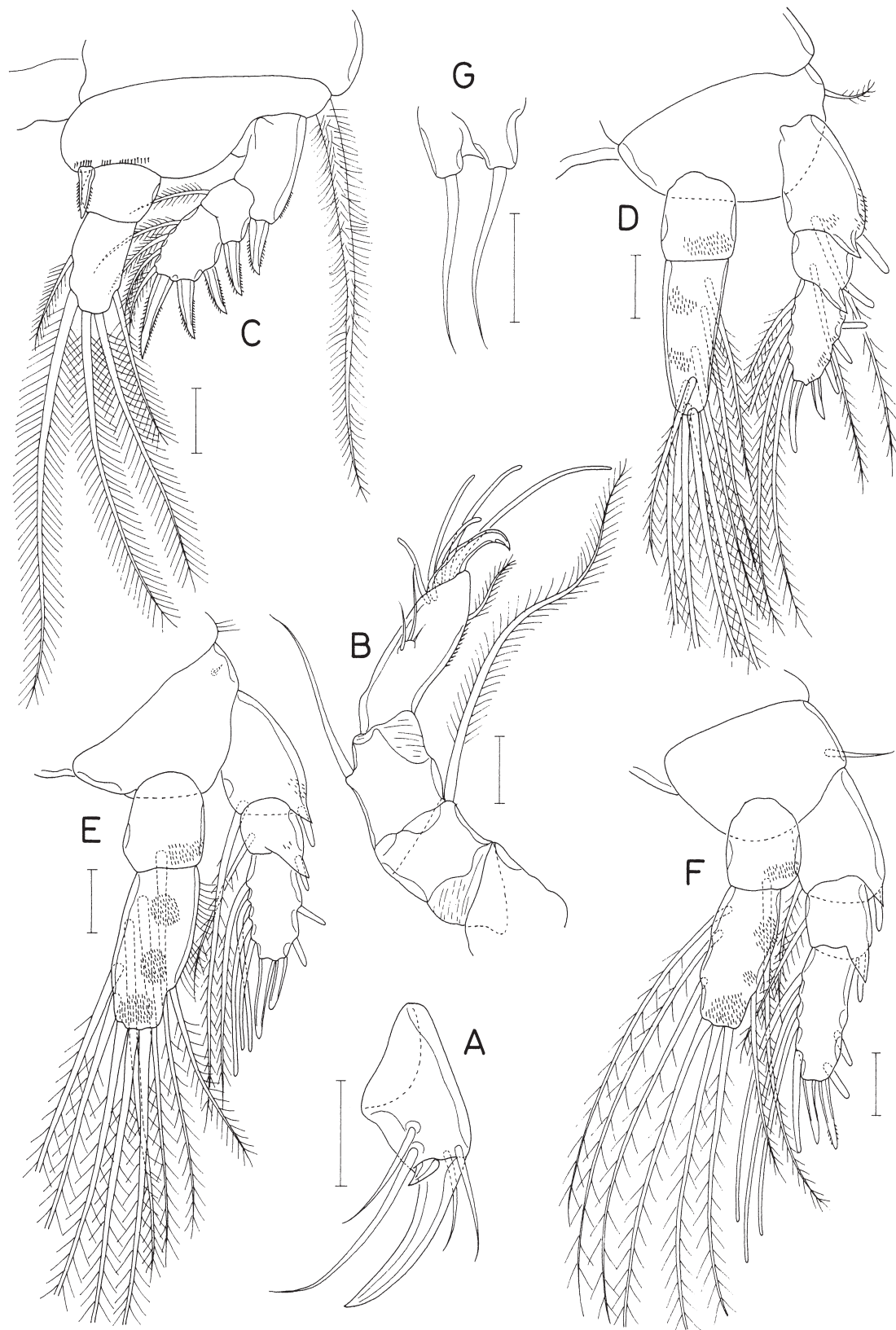
**Description of female.** Body (Fig. 133A, B) stout, 1.10 mm long. Prosome cylindrical, 808 µm long. Cephalosome defined from first pedigerous somite only by dorsal and lateral constrictions: pedigerous somites fused but first pedigerous somite discernible by dorsal and lateral constrictions. No dorsal tergites present on pedigerous somites. Fifth pedigerous somite not defined, fused to fourth. Free urosome narrowing posteriorly, 5-segmented: genital somite 45×143 µm, much wider than long; 4 abdominal somites 60×110, 65×92, 80×74, and 29×58 µm, respectively. Anal somite (Fig. 133C) with pair of highly sclerotized ventral protuberances ornamented with minute spinules around apex. Caudal ramus (Fig. 133C, 134A) about 1.6 times longer than wide (31×19 µm), slightly narrowing distally; armed with 1 large and 1 small, stout claws and 4 naked setae; larger claw 33 µm long, longer than ramus and small claw 7 µm long, unnoticeable.

Rostrum small with angular apex, lacking beak-like process at tip. Antennule (Fig. 133D) 118 µm long and 8-segmented; armature formula 2, 13 (or 6, 9), 8+aesthetasc, 3, 2+aesthetasc, 1, 2+aesthetasc, and 7+aesthetasc; setae naked; setae on proximal segments generally long. Antenna (Fig. 134B) 4-segmented; coxa short and unarmed; basis also short, wider than long, bearing 1 extremely long pinnate seta representing exopod at outer distal corner; first endopodal segment slightly longer than wide, with 1 naked seta on inner margin; compound distal endopodal segment about 2.8 times longer than wide (50×18 µm), ornamented with spinules on mid outer margin; armed with 9 setae (including 1 pinnate and 5 blunt setae) plus terminal claw about half as long as segment.

Labrum missing. Mandible (Fig. 133E) with 5 teeth, 1 spinule between distal second and third teeth, and 1 proximal seta on coxal gnathobase; basis with 1 seta on subdistal medial margin; exopod 2-segmented, with 3 setae on first segment and 2 setae on small second segment; distal seta of second segment about half as long as other 4 setae; endopod incompletely 2-segmented with 2 and 5 setae on first and second segments, respectively; setae on second segment unequal in length. Maxillule (Fig. 133F) with 8 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 3 on exopod, and 4 on endopod.



**FIGURE 133.** *Periproctia bisetigera* sp. nov., female. A, habitus, right; B, habitus, dorsal; C, anal somite and caudal ramus, right; D, antennule; E, mandible; F, maxillule; G, maxilla; H, maxilliped. Scale bars: A, B, 0.1 mm; C-H, 0.02 mm.



**FIGURE 134.** *Periproctia bisetigera* sp. nov., female. A, caudal ramus; B, antenna; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: 0.02 mm.

Maxilla (Fig. 133G) 5-segmented; syncoxa with 9 setae (arranged 3, 1, 2, and 3), 2 on basis, and 1, 1, and 2 on first to third endopodal segments, respectively. Maxilliped (Fig. 133H) unsegmented, armed with 10 setae (8 medial and 2 apical), ornamented with rows of small spinules proximally.

Legs 1–4 (Fig. 134C–F) each with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent in all legs. Outer seta of basis large in leg 1, but small in legs 2 and 4, and minute in leg 3. Inner distal spine on basis of leg 1 as long as first endopodal segment. First and second exopodal segments of legs 2–4 bearing well-developed, dentiform outer distal process. Inner seta absent on first exopodal segment of leg 1 and first endopodal segment of leg 2. Third exopodal segment of legs 2–4 bearing 2 spines distally. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-0; I-1; II, I, 4	0-0; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, II, 4	0-0; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, II, 4	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-1; 2, II, 4	0-1; 1, 2, 4

Leg 5 (Fig. 134G) represented by 2 lobes, each lobe tipped with 1 naked seta, both setae equal in length.

**Male.** Unknown.

**Remarks.** Two outstanding features characterise the new species: (1) the first exopodal segment of leg 1 lacks an inner seta; and (2) the first endopodal segment of leg 2 also lacks an inner seta. These two features are not known in any of the five described species of *Periproctia*. The possession of two claws on the caudal ramus which are very unequal in length, may be an additional diagnostic feature allowing for easy recognition of the new species.

### *Periproctia spissa* sp. nov.

(Figs. 135, 136)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21263) and paratype ♀ (dissected and figured) from *Pseudodistoma aureum* (Brewin, 1957) (MNHN-IT-2008-7326 = MNHN A1/PSE/67), CRRF OCDN 8852-H, Baluan, Papua New Guinea (02°32.27'S, 147°17.97'E), depth 7 m, 22 June 2003.

**Additional material.** 1 ♀ (dissected) from *Pseudodistoma* sp., Papua New Guinea (02°40.68'S, 150°28.23'E), depth 18 m, 03 July 2003, coll. CRRF, OCDN 9100-2.

**Etymology.** The specific name is derived from the Latin *spiss* (=compact), alluding to the stout body form of the new species.

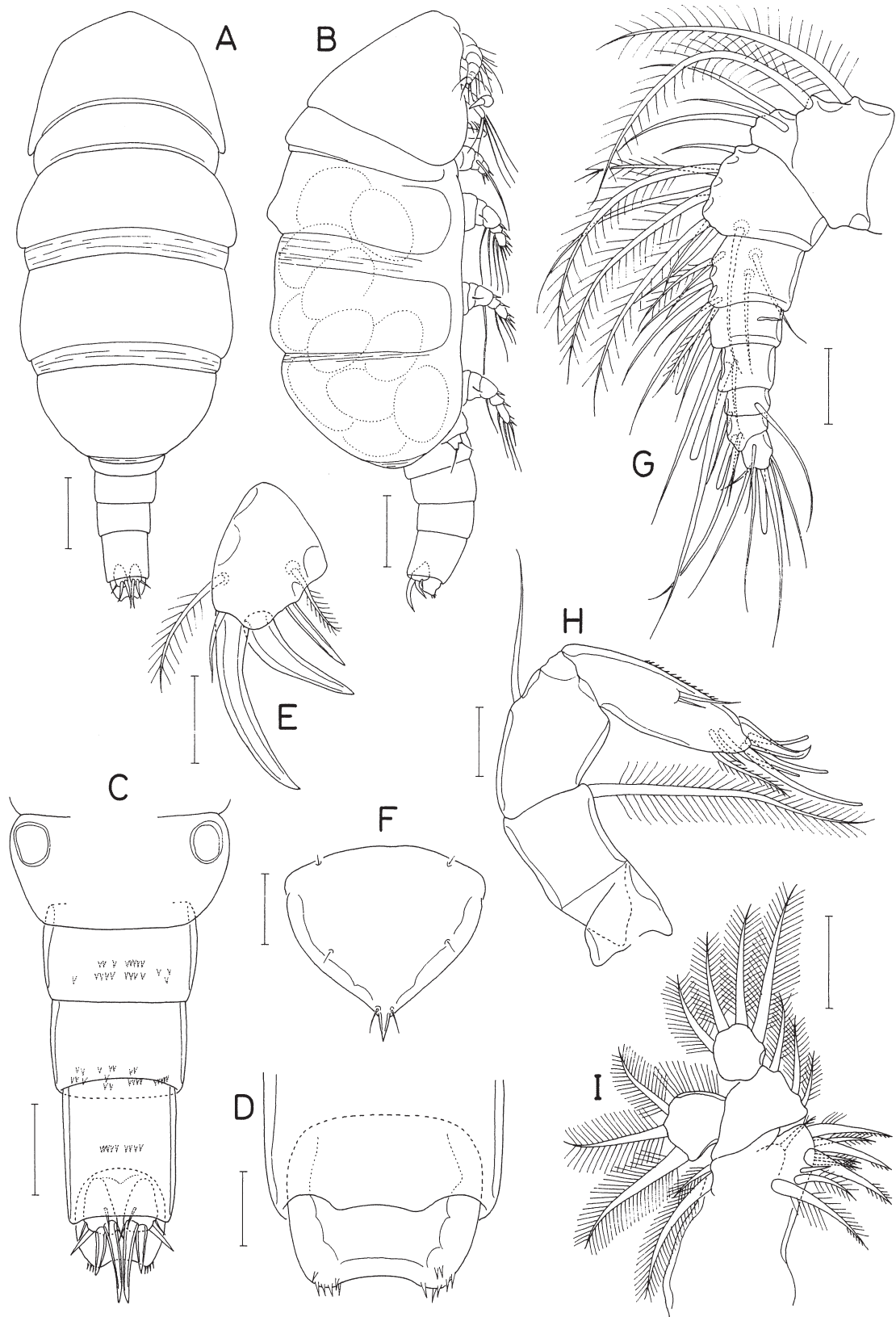
**Description of female.** Body (Fig. 135A, B) consisting of stout prosome and small urosome. Body length 850 µm. Prosome cylindrical, slightly depressed,

646 µm long, consisting of cephalosome and 4 pedigerous somites; somites only recognizable by retained dorsal tergites separated by constricted, wrinkled regions. Cephalosome roughly pentagonal in dorsal view. Greatest width of prosome 317 µm at level corresponding to second pedigerous somite. Second to fourth pedigerous somites forming brood pouch; fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 135C) 5-segmented: genital somite 63×122 µm; genital apertures distinct, located dorsally. Four abdominal somites 51×85, 51×76, 74×63, and 51×51 µm, respectively. First to third abdominal somites ornamented with transverse rows of small spinules on ventral surface. Third abdominal somite distinctly longer than wide. Anal somite (Fig. 135D) highly sclerotized, subrectangular, with concave posterior margin in ventral view; ornamented with spinules near posterolateral corners. Caudal ramus (Fig. 135E) small, 1.2 times longer than wide (30×25 µm), narrowing distally; armed with 3 claws (2 strong distal and 1 slender ventral) and 3 setae (2 pinnate and 1 naked); lengths of claws 44, 31, and 20 µm.

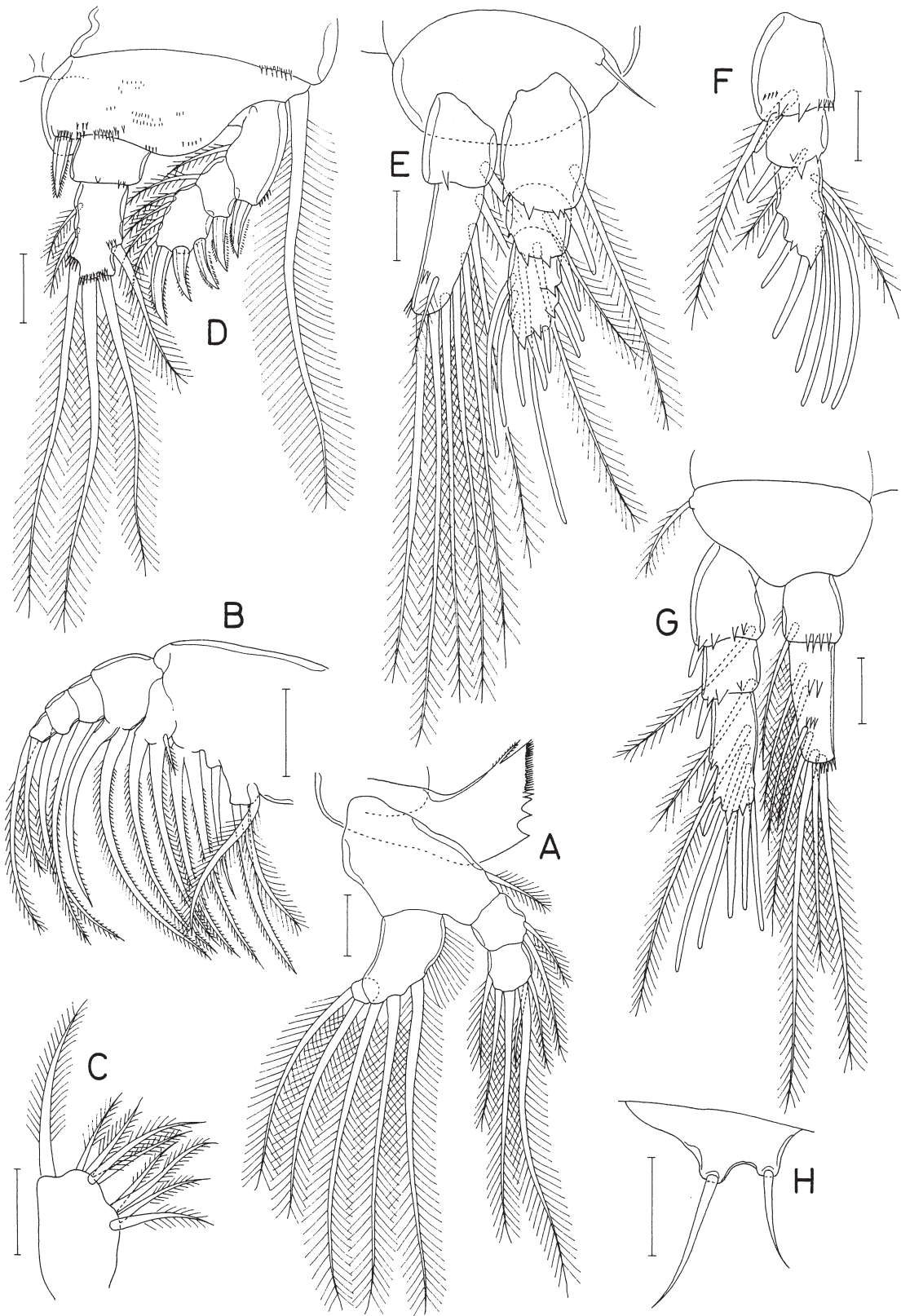
Rostrum (Fig. 135F) slightly wider than long, 55×57 µm, tapering steeply towards beak-like apical process; ornamented with 3 pairs (proximal, middle, and distal) of small setules (or sensillae). Antennule (Fig. 135G) 110 µm long and 8-segmented; armature formula 2, 12 (or 5, 9), 8+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; some of larger setae pinnate (2 on first, 4 on second, and 2 on third segments); fourth segment with trace of subdivision on posterior side. Antenna (Fig. 135H) 4-segmented; coxa short and unarmed; basis slightly longer than wide, bearing large, pinnate seta representing exopod at outer distal corner; first endopodal segment also slightly longer than wide, with 1 naked seta on inner margin; compound distal segment about 2.9 times longer than wide (52×18 µm), ornamented with spinules on inner margin; armed with 8 setae (including 1 pinnate and 4 blunt setae) plus small terminal claw, less than half length of segment.

Labrum with setulose posterior margin and shallow posteromedian lobe. Mandible (Fig. 136A) with 4 teeth, 1 spinule between distal second and third teeth, and 1 small seta on coxal gnathobase; basis with 1 seta on subdistal medial margin; exopod 2-segmented with 3 setae on first segment and 2 setae on small second segment; setae on second segment shorter than setae on first; endopod 2-segmented with 2 and 6 setae on first and second segments, respectively. Maxillule (Fig. 135I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 136B) 5-segmented; syncoxa with 9 setae (arranged as 3, 1, 2, and 3), 2 on basis, and 1, 1, and 2 on first to third endopodal segments, respectively. Maxilliped (Fig. 136C) unsegmented, armed with 9 setae (8 medial and 1 apical).

Legs 1–4 (Fig. 136D–G) each with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent



**FIGURE 135.** *Periproctia spissa* **sp. nov.**, female. A, habitus, dorsal; B, habitus, right; C, urosome, dorsal; D, anal somite, ventral; E, caudal ramus, lateral; F, rostrum; G, antennule; H, antenna; I, maxillule. Scale bars: A, B, 0.1 mm; C, 0.05 mm; D-I, 0.02 mm.



**FIGURE 136.** *Periproctia spissa* sp. nov., female. A, mandible; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, exopod of leg 3; G, leg 4; H, leg 5. Scale bars: 0.02 mm.



in all legs. Outer seta of basis large in leg 1, small in legs 2–4. Inner distal spine on basis of leg 1 slightly longer than first endopodal segment. Outer and distal setae on exopods of legs 2–4 rod-shaped, with blunt tip. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 136H) represented by small, broad plate bearing 2 small lobes distally; each lobe tipped with 1 naked seta; seta on inner lobe (exopod) shorter than that on outer lobe.

**Male.** Unknown.

**Remarks.** The numbers of setae on the maxilliped in all seven known species of *Periproctia* are as follows: 7 (6 medial and 1 apical) in *P. biuncata*, 8 (7 medial and 1 apical) in *P. triuncata*, and 10 (8 medial and 2 apical) in the other species (Table 3). The possession of 9 setae (8 medial and 1 apical) on the maxilliped differentiates *P. spissa* **sp. nov.** from all congeneric species. The second endopodal segment of the mandibular palp is armed with 6 setae in *P. spissa* **sp. nov.** It shares this setation with *P. stocki* **sp. nov.** but all other species described above have only 5 setae. It differs from *P. stocki* **sp. nov.** in caudal armature: having 3 claws plus 3 setae compared to 4 claws and 2 setae in *P. stocki* **sp. nov.**

### *Periproctia angusta* **sp. nov.**

(Figs. 137, 138)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21264) from *Hypodistoma deerratum* (Sluiter, 1895) CRRF. Coll., Papua New Guinea.

**Etymology.** The specific name is derived from the Latin *angust* meaning “narrow” and refers to the narrow body of the new species.

**Description of female.** Body (Fig. 137A) narrow, 927 µm long. Prosome 710 µm long, cylindrical, slightly dorsoventrally depressed; consisting of cephalosome and fused pedigerous somites, without dorsal tergites. Cephalosome with weakly rounded posterolateral lobes. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 137B) 5-segmented: genital somite much wider than long, 99 µm wide; first to third abdominal somites 61×73, 67×61, and 58×48, respectively. Second abdominal somite ornamented with row of minute spinules on ventral surface. Anal somite (Fig. 137C) short, with pair of large, tubercle-like ventral protuberances covered with dense ornamentation of fine spinules. Caudal ramus (Fig. 137C) about 1.2 times longer than wide (17×14 µm); armed

with 3 claws and 3 naked setae; lengths of claws 22, 15, and 14 µm; 1 seta (second proximal seta) with blunt tip.

Rostrum absent. Antennule (Fig. 137D) 85 µm long and 8-segmented; armature formula 5, 10, 7+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 3 of 5 setae on first segment pinnate. Antenna (Fig. 137E) stout, 4-segmented; coxa, basis, and first endopodal segment subequal in length; basis with large plumose seta representing exopod; first endopodal segment with 1 naked seta on inner margin; compound distal endopodal segment about 2.5 times longer than wide (38×15 µm), ornamented with several patches of minute spinules; armed with 8 setae (including 1 pinnate and 4 bluntly tipped setae) plus terminal claw about half as long as segment.

Labrum (Fig. 137F) simple, unornamented, with convex posterior margin. Mandible (Fig. 137G) with 5 teeth, 2 spinules between distal second and third teeth, and 1 small proximal seta on coxal gnathobase; basis with small medial seta; exopod 2-segmented and armed with 3 setae on first segment and 2 setae on small second segment, outer distal seta on second segment about half as long as other 4 setae; endopod armed with 2 and 6 setae on first and second segments, respectively. Maxillule (Fig. 137H) with 7 setae on arthrite, 1 on coxal endite, 2 on epipodite, only 2 on medial margin of basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 138A) 5-segmented; syncoxa with 8 setae (3, 1, 2, and 2), 2 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 137I) lobate, armed with 8 medial and 2 apical setae.

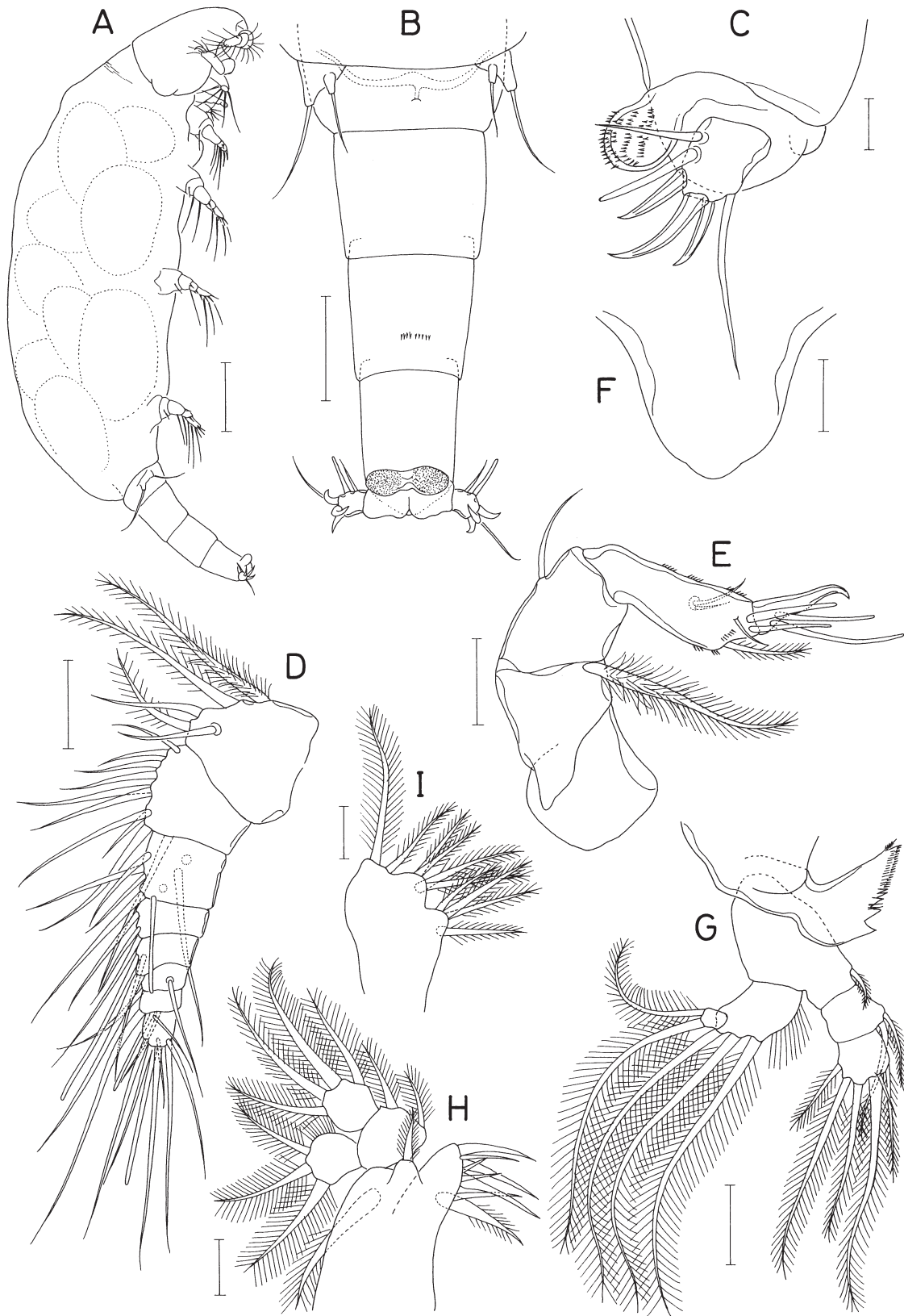
Legs 1–4 (Fig. 138B–E) with 3-segmented exopods and 2-segmented endopods. Inner coxal seta absent in all legs. Outer seta on basis large, slightly longer than exopod in leg 1, but much smaller in legs 2–4. Third exopodal segment of leg 1 armed with 3 spines and 3 inner setae. Third exopodal segment of legs 2–4 terminating in acute, spiniform process. Outer and distal setae of exopods of legs 2–4 rod-shaped, bluntly tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 3	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

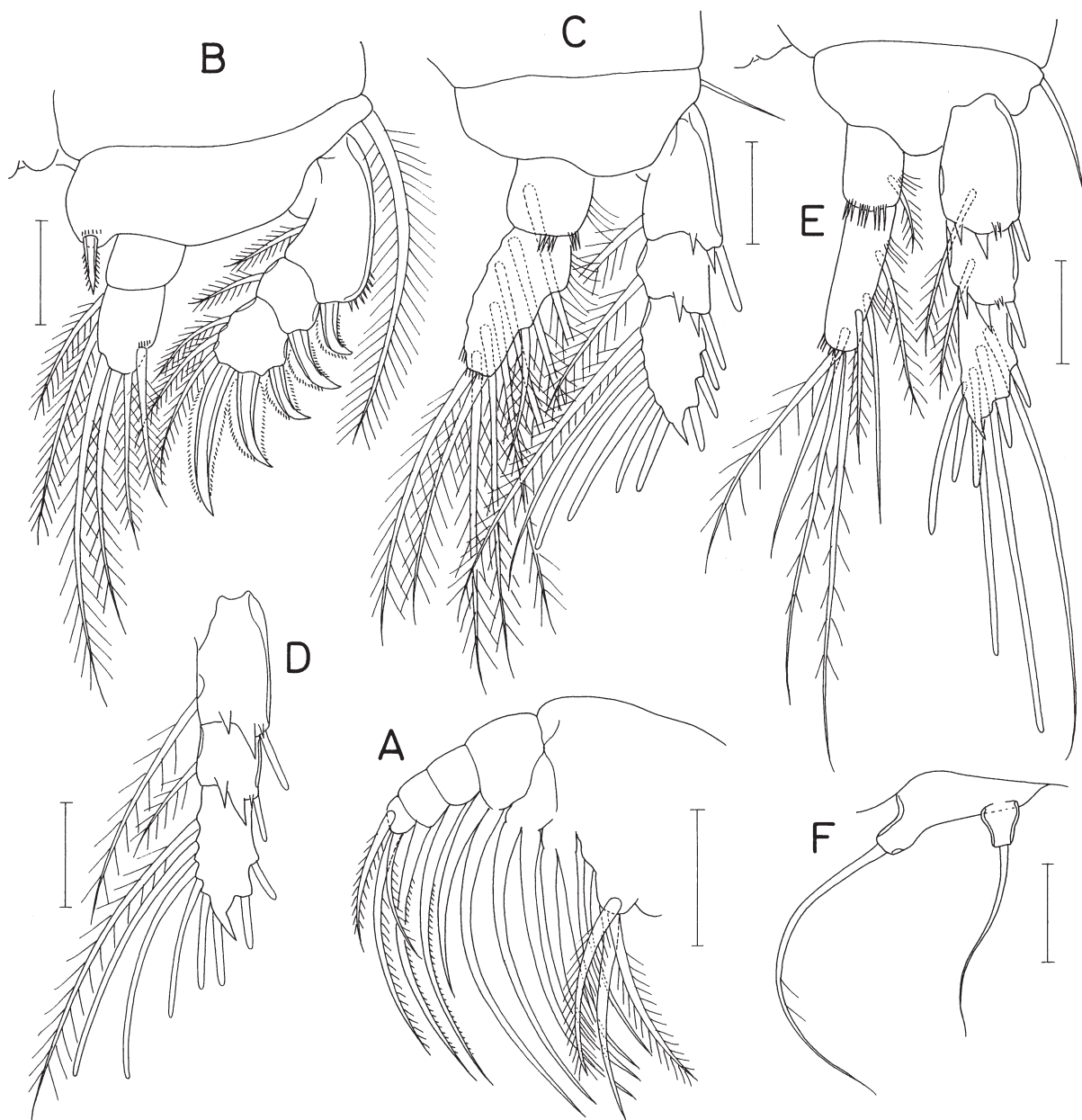
Leg 5 (Fig. 138F) small, consisting of broad protopod and exopod; protopod with digitiform outer extension tipped with weakly pinnate seta; small exopodal segment incompletely articulated at base, tapering, with naked apical seta.

**Male.** Unknown.

**Remarks.** One outstanding setation feature, the possession of only 3 inner setae (armature formula II, I, 3) on the third exopodal segment of leg 1 (Table 3), serves



**FIGURE 137.** *Periproctia angusta* **sp. nov.**, female. A, habitus, right; B, urosome, ventral; C, anal somite and caudal ramus, left; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilliped; I, maxilliped. Scale bars: A, 0.1 mm; B, 0.05 mm; C, H, I, 0.01 mm; D-G, 0.02 mm.



**FIGURE 138.** *Periproctia angusta* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, exopod of leg 3; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

to characterise the new species. In all other known species of *Periproctia*, this segment of leg 1 carries 4 inner setae (armature formula II, I, 4). The presence of only 2 medial setae on the basis of the maxillule (rather than the more typical 3 setae) is also an unusual feature, shared only with *P. biuncata*.

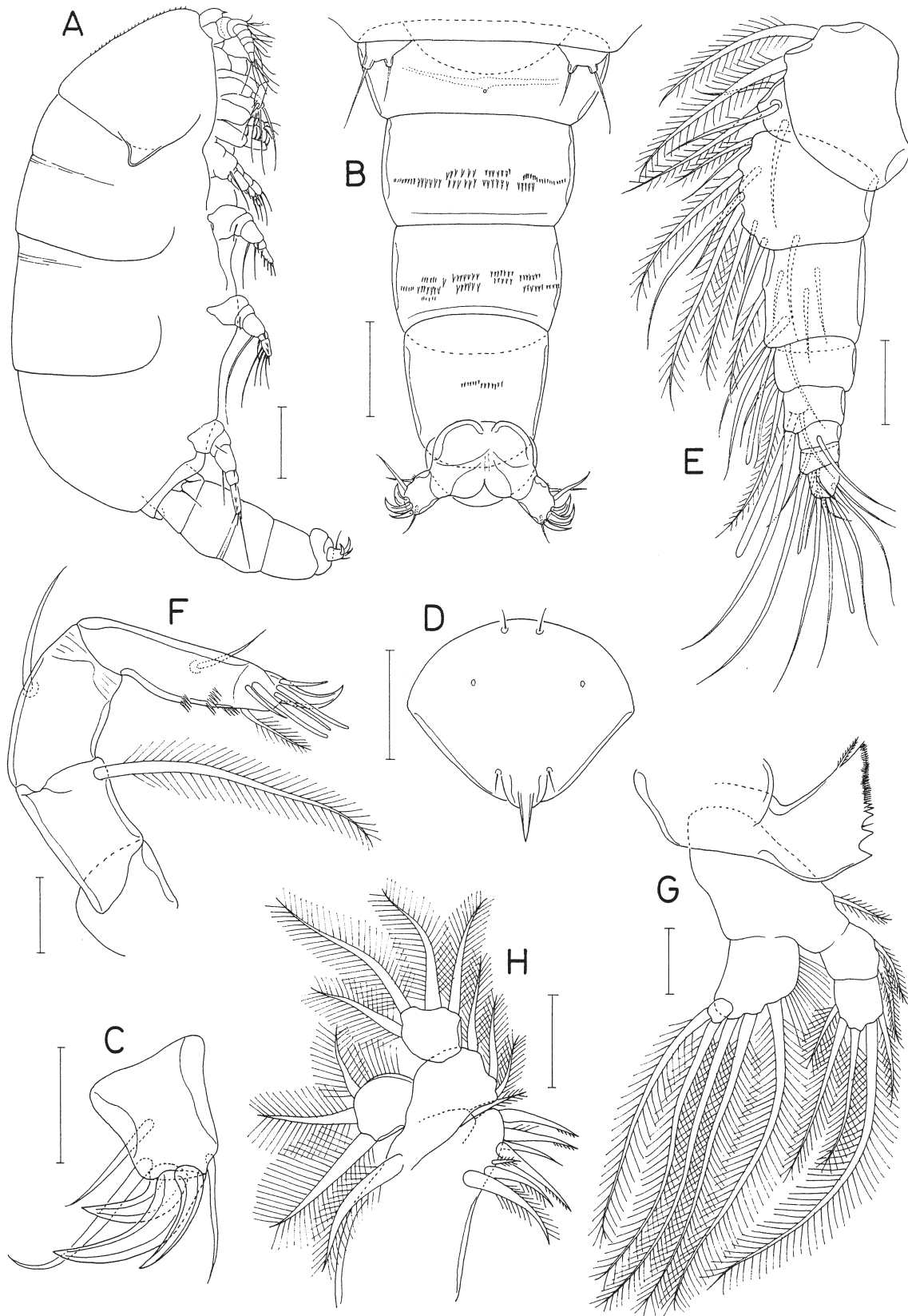
***Periproctia obtusa* sp. nov.**

(Figs. 139, 140)

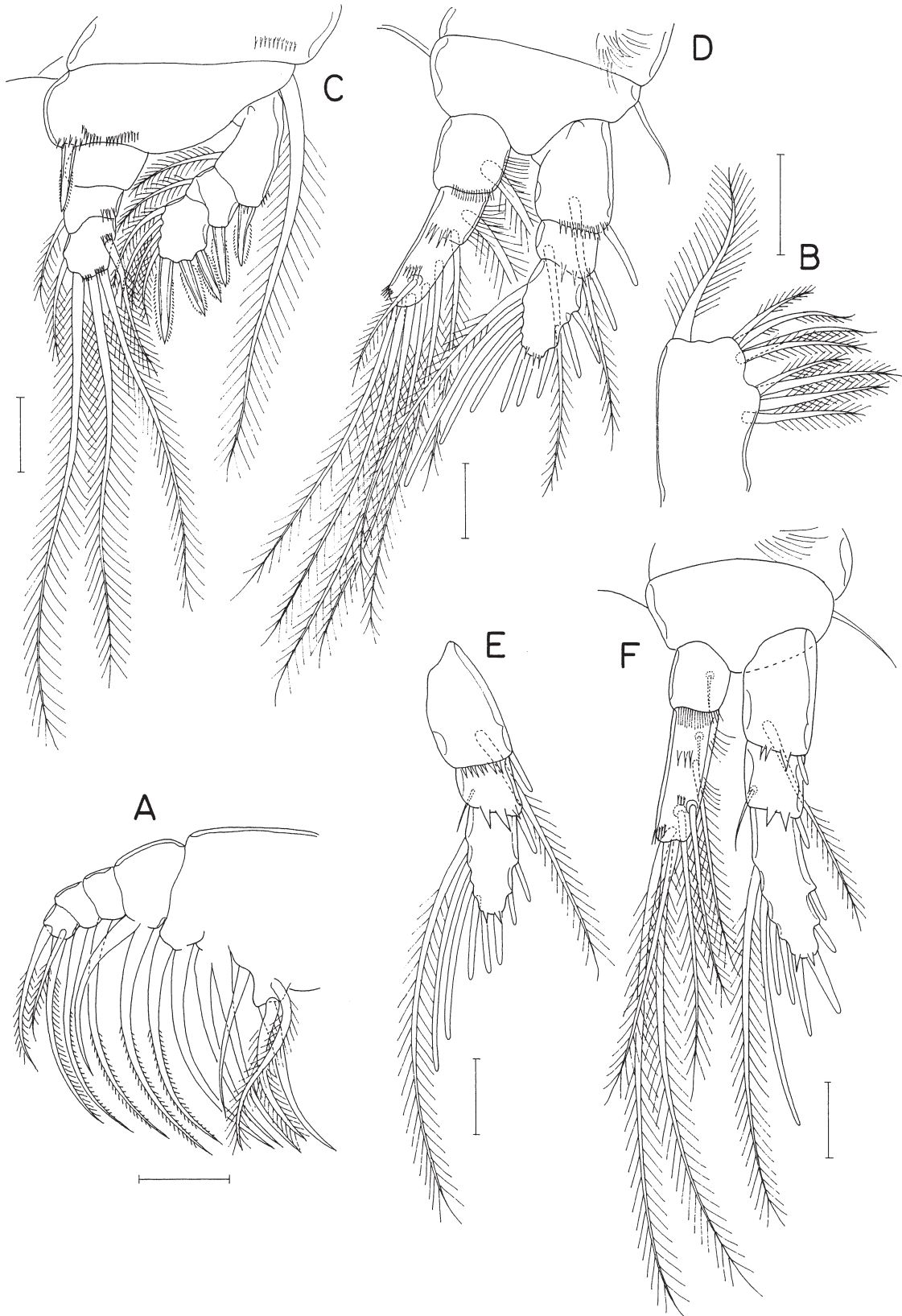
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21265) from *Trididemnum discrepans* (Sluiter, 1909) (MNHN-IT-2008-8737 = MNHN A2/TRI/172), CRRF OPHG 1445-P, Mabul, Malaysia (04°14.05'N, 118°53.61'E), depth 8 m, Pilcher coll., 18 July 2004.

**Etymology.** The specific name is derived from the Latin *obtus* (=blunt) referring to the stout body of the new species.

**Description of female.** Body (Fig. 139A) stout, 954 µm long. Prosome unsegmented, 720 µm long; greatest



**FIGURE 139.** *Periproctia obtusa* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule. Scale bars: A, 0.1 mm; B, 0.05 mm; C-H, 0.02 mm.



**FIGURE 140.** *Periproctia obtusa* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4. Scale bars: 0.02 mm.

dorsoventral depth 320 µm. Cephalosome with longitudinal row of about 25 small denticles along dorsal midline and with blunt, nipple-shaped, sclerotized posterolateral process at each side. Pedigerous somites fused but with 2 weak dorsal tergites present, corresponding to second and third pedigerous somites. Fourth pedigerous somite forming broad, rounded dorsal extension overlapping anterior part of genital somite (stippled area in Fig. 139B). Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 139B) 5-segmented: genital somite much wider than long, 51×135 µm, bearing small copulatory pore on ventral surface; 4 abdominal somites 58×104, 57×92, 64×78, and 32×60 µm, respectively. First to third abdominal somites ornamented with transverse rows of minute spinules ventrally. Anal somite with blunt, sclerotized ventral protuberances. Caudal ramus (Fig. 139C) narrowing distally, as long as wide (22×22 µm), and armed with 3 strong claws and 3 naked setae; lengths of 3 claws 28, 21, and 20 µm; setae at least as long as ramus.

Rostrum (Fig. 139D) as long as wide (40×41 µm), roughly rhomboidal, tapering towards pointed, beak-like apical process; ornamented with 3 pairs of minute sensillae. Antennule (Fig. 139E) broad, 117 µm long, and 8-segmented; armature formula 2, 14 (or 6, 10), 7+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; distal segments very short; larger setae on proximal segments pinnate. Antenna (Fig. 139F) 4-segmented; coxa short and unarmed; basis with large, pinnate exopodal seta at outer distal corner; first endopodal segment with 1 naked seta on inner margin; compound distal endopodal segment about 3.1 times longer than wide (50×16 µm), ornamented with 3 patches of spinules on outer side; armed with 7 setae (including 1 pinnate and 3 bluntly tipped setae) plus small terminal claw, less than half length of segment.

Labrum missing. Mandible (Fig. 139G) comprising coxa bearing 5 teeth (2 proximal ones small) and 1 seta on gnathobase, and palp consisting of basis, exopod and endopod; basis with 1 seta on medial margin; exopod 2-segmented and armed with 3 and 2 setae on first and second segments, respectively; outer distal seta on second exopodal segment slightly shorter than other 4 exopodal setae; endopod armed with 2 and 5 setae on first and second segments, respectively; second medial seta of second endopodal segment markedly larger than other 4 setae on segment. Maxillule (Fig. 139H) bearing 7 setae on arthrite, 1 on each coxal endite and epipodite, 3 on medial margin of basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 140A) 5-segmented, syncoxa with 8 setae (arranged 3, 1, 2, and 2), 2 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 140B) lobate, bearing 8 medial setae and 1 apical seta.

Leg 1 (Fig. 140C) with 3-segmented rami. Legs 2–4 (Fig. 140D–F) each with 3-segmented exopod and 2-

segmented endopod. Inner coxal seta absent in legs 1–4. Outer seta on basis large and pinnate in leg 1, small and naked in legs 2–4. Three distal setae on third endopodal segment of leg 1 enlarged. Inner seta on second exopodal segment of legs 3 and 4 rudimentary (Fig. 140E, F). Inner seta on first endopodal segment and proximal inner seta on second endopodal segment of leg 4 also rudimentary (Fig. 140F). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 139B) represented by small plate bearing 2 distal processes; each process tipped with 1 pinnate seta.

**Male.** Unknown.

**Remarks.** *Periproctia obtusa* sp. nov. can be differentiated from other species in the genus by the combination of three characteristic features: (1) the endopod of leg 1 is 3-segmented; (2) the cephalosome bears a longitudinal row of about 25 minute surface denticles along the dorsal midline; and (3) the coxal epipodite of the maxillule bears only a single seta (it lacks the typically small second seta). The first of these features is shared only with *P. acutirostris* sp. nov., but the other two features have not been recorded in any *Periproctia* species.

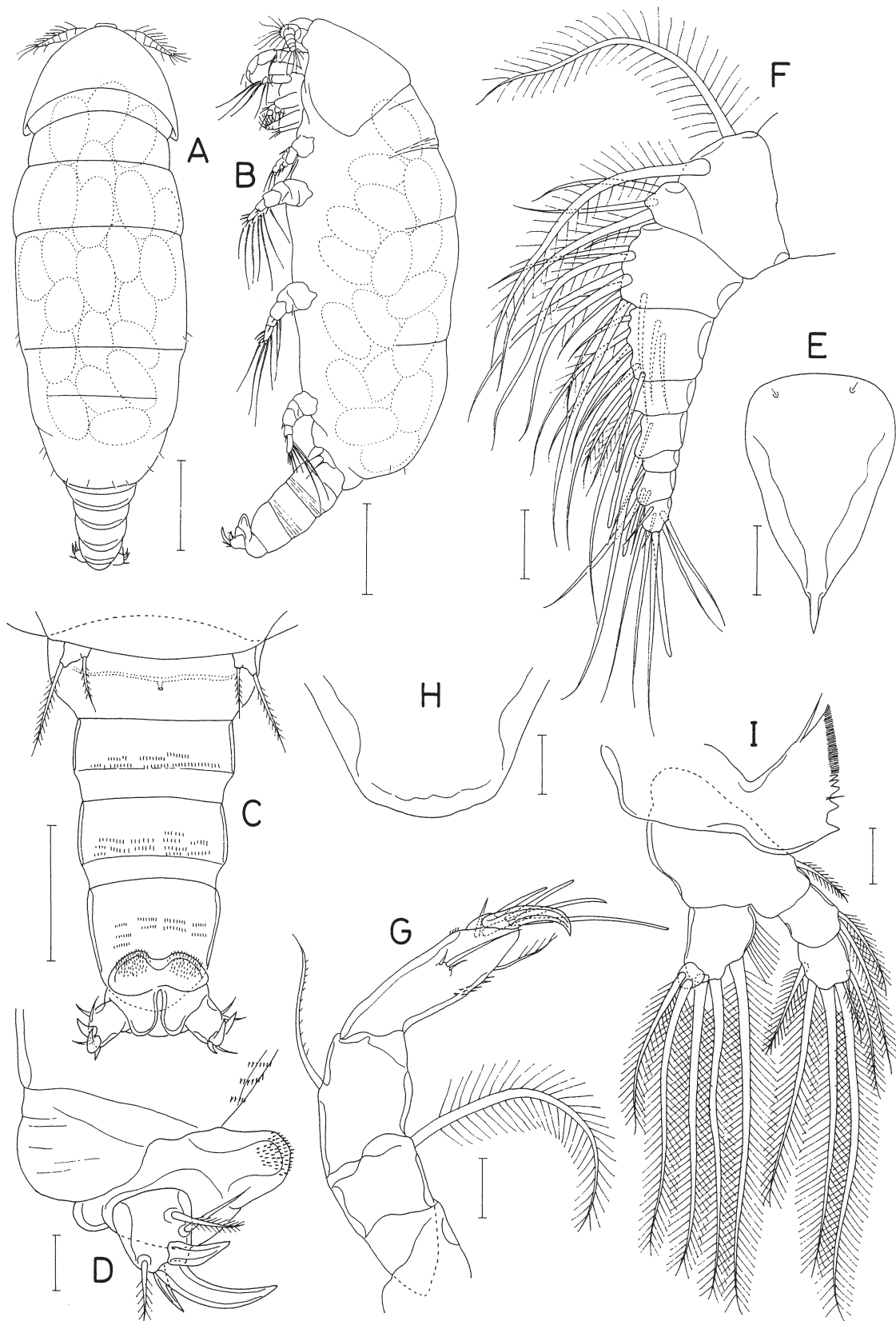
#### *Periproctia longirostris* sp. nov.

(Figs. 141, 142)

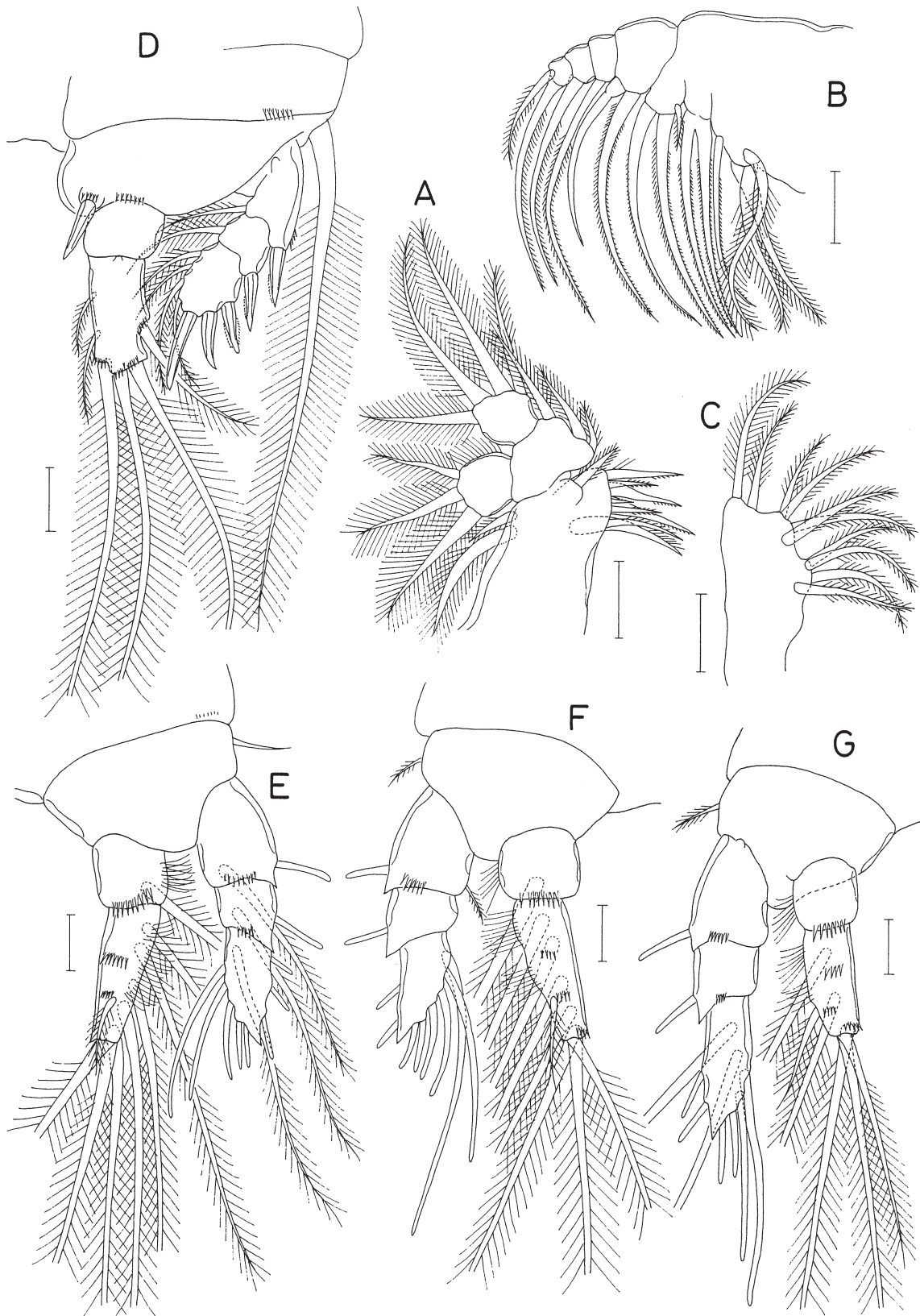
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21266), paratype (intact ♀, MNHN-IU-2014-21267), and dissected paratype (♀, figured) from *Aplidium* sp., lobster wall, Mabul Malaysia (04°14.53'N, 118°37.57'E), depth 17 m, 22 July 2004.

**Etymology.** The specific name refers to the elongate rostrum of the new species.

**Description of female.** Body (Fig. 141A, B) rather narrow. Body length 1.31 mm in dissected largest specimen. Prosome cylindrical, 1.04 µm long, 0.39 mm wide, ornamented with scattered setules dorsally and laterally in posterior half. Cephalosome clearly defined; 4 pedigerous somites fused and recognizable only by weak dorsal suture lines. Brood pouch extending through all pedigerous somites (Fig. 141A, B). Free urosome (Fig. 141C) 5-segmented: genital somite and first to third abdominal somites 63×157, 61×121, 65×111, and 72×100 µm, respectively. First to third abdominal somites ornamented with rows of minute spinules ventrally. Anal somite (Fig. 141D) short, with pair of highly sclerotized and strongly projecting ventral protuberances ornamented



**FIGURE 141.** *Periproctia longirostris* **sp. nov.**, female. A, habitus, dorsal; B, habitus, left; C, urosome, ventral; D, anal somite and caudal ramus, right; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D-H, 0.02 mm.



**FIGURE 142.** *Periproctia longirostris* sp. nov., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4. Scale bars: 0.02 mm.



with spinules. Caudal rami divergent (Fig. 141D), ramus slightly narrowing distally, as long as wide (29×29 µm), armed with 3 unequal claws and 3 setae (2 pinnate and 1 naked); lengths of claws 44, 22, and 18 µm.

Rostrum (Fig. 141E) elongate, 77×44 µm, highly sclerotized, tapering towards distal beak-like process; pair of small sensillae present proximally. Antennule (Fig. 141F) gradually narrowing distally, 123 µm long, and 8-segmented; armature formula 5, 9, 8+aesthetasc, 3, 2+aesthetasc, 1, 2+aesthetasc, and 7+aesthetasc; setae crowded, proximal 2 setae markedly enlarged; most setae naked but several larger ones pinnate. Antenna (Fig. 141G) 4-segmented; basis and first endopodal segment each 1.3 times longer than wide and armed as usual for genus; compound distal endopodal segment 3.2 times longer than wide (64×20 µm), ornamented with scattered spinules; armed with 8 setae (including 1 pinnate and 4 bluntly tipped distal setae) plus slender terminal claw, about half as long as segment.

Labrum (Fig. 141H) simple, smooth, with slightly convex posterior margin. Mandible (Fig. 141I) with 5 teeth, 1 needle-like spinule between distal second and third teeth, and 1 proximal seta on coxal gnathobase; basis with 1 medial seta; exopod 2-segmented, with 3 and 2 setae on first and second segments, respectively, outer seta on second segment about half as long as adjacent seta; endopod with 2 and 6 setae on first and second segments, respectively. Maxillule (Fig. 142A) with 8 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 142B) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 2 setae, distal seta short and naked; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 142C) lobate, armed with 8 medial and 2 apical setae.

Legs 1–4 (Fig. 142D–G) each with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent in legs 1–4. Outer seta on basis large, more than twice as long as exopod in leg 1, but small in legs 2–4. Inner distal spine on basis of leg 1 smooth, as long as first endopodal segment. Third exopodal segment of legs 2–4 terminating in acutely pointed process. Leg 3 lacking inner seta on second exopodal segment. Leg 4 lacking inner seta on proximal 2 exopodal and first endopodal segments. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-0; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 1, 2, 3

Leg 5 (Fig. 141C) represented by small lobe on posteroventral margin of somite, armed with 2 pinnate setae distally.

**Male.** Unknown.

**Remarks.** *Periproctia longirostris* sp. nov. is characterised by multiple setal losses on legs 3 and 4. The setae lost are as follows: the inner setae on (1) the second exopodal segment of leg 3; (2) the first and (3) second exopodal segments of leg 4; (4) the first endopodal segment of leg 4; and (5) the inner seta derived from the ancestral second endopodal segment of leg 4 (now incorporated into a compound distal segment). Some reduction in leg setation was also recorded in the three species of *Periproctia* named by Stock (1967), *P. biuncata*, *P. falsiarcuata*, and *P. triuncata*. The setal losses (3), (4), and (5), as listed above, are shared with all three species, but setal loss (1) is shared only with *P. falsiarcuata* and *P. triuncata*, and setal loss (2) is shared only with *P. biuncata*. These different setation patterns on the second exopodal segment of leg 3 and on the first exopodal segment of leg 4 serve to differentiate *P. longirostris* sp. nov. from these three congeners. There are additional significant differences including: *P. longirostris* sp. nov. has 3 spines and 3 setae on the caudal ramus (vs. 2 spines and 4 setae in *P. biuncata*), 6 setae on the second endopodal segment of the mandible (vs. 5 setae in all the three species described by Stock, 1967), 10 setae on the maxilliped (less than 10 setae in *P. biuncata* and *P. triuncata*), and an inner seta on the second exopodal segment of leg 1 (this seta absent in *P. biuncata* and *P. falsiarcuata*).

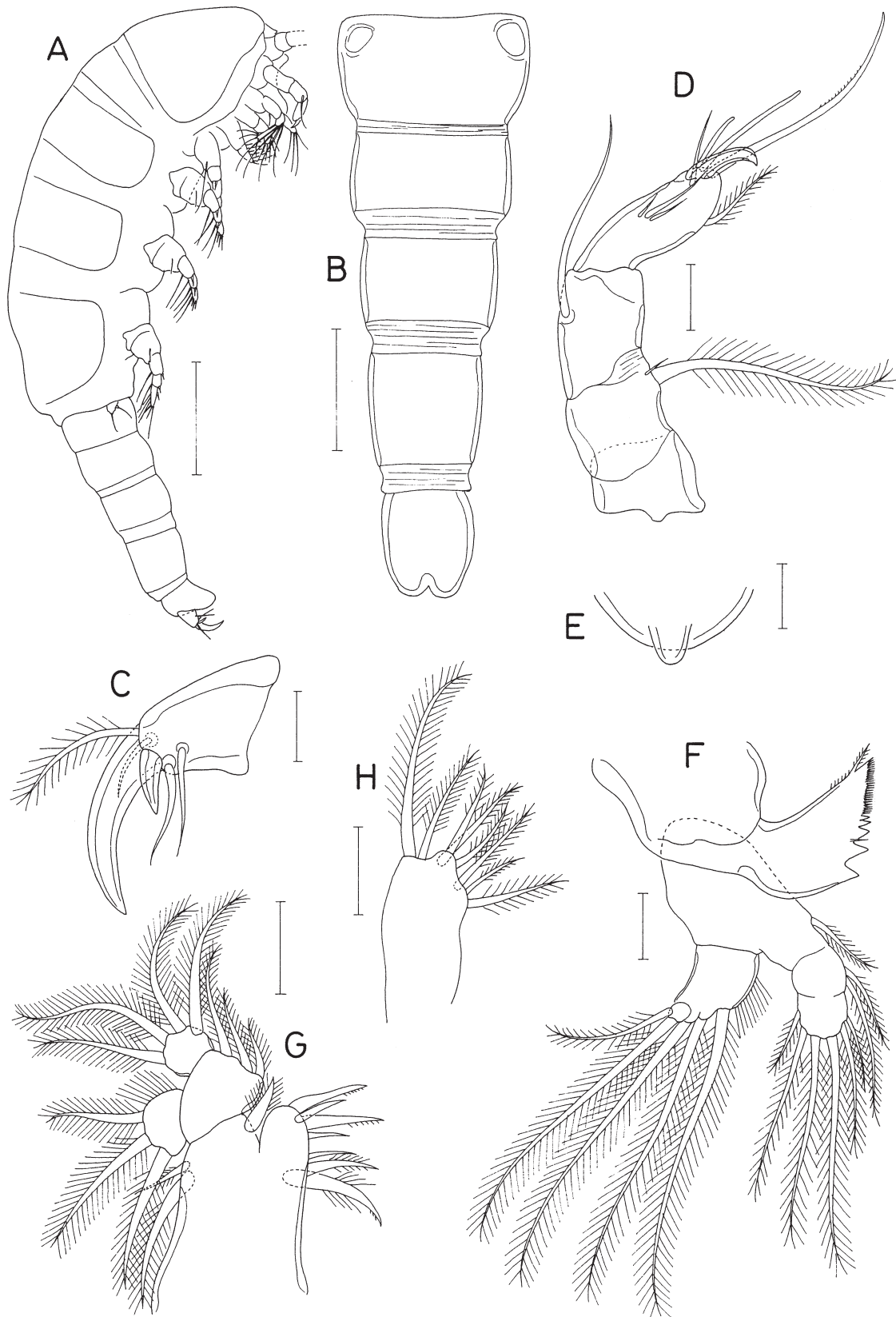
***Periproctia biunguifera* sp. nov.**  
(Figs. 143, 144)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21268) from *Eucoelium coronaria* (Monniot F., 1988) (MNHN-IT-2008-6921 = MNHN A3/POL.B/12), Noumea, New Caledonia, Laboute coll., 1986.

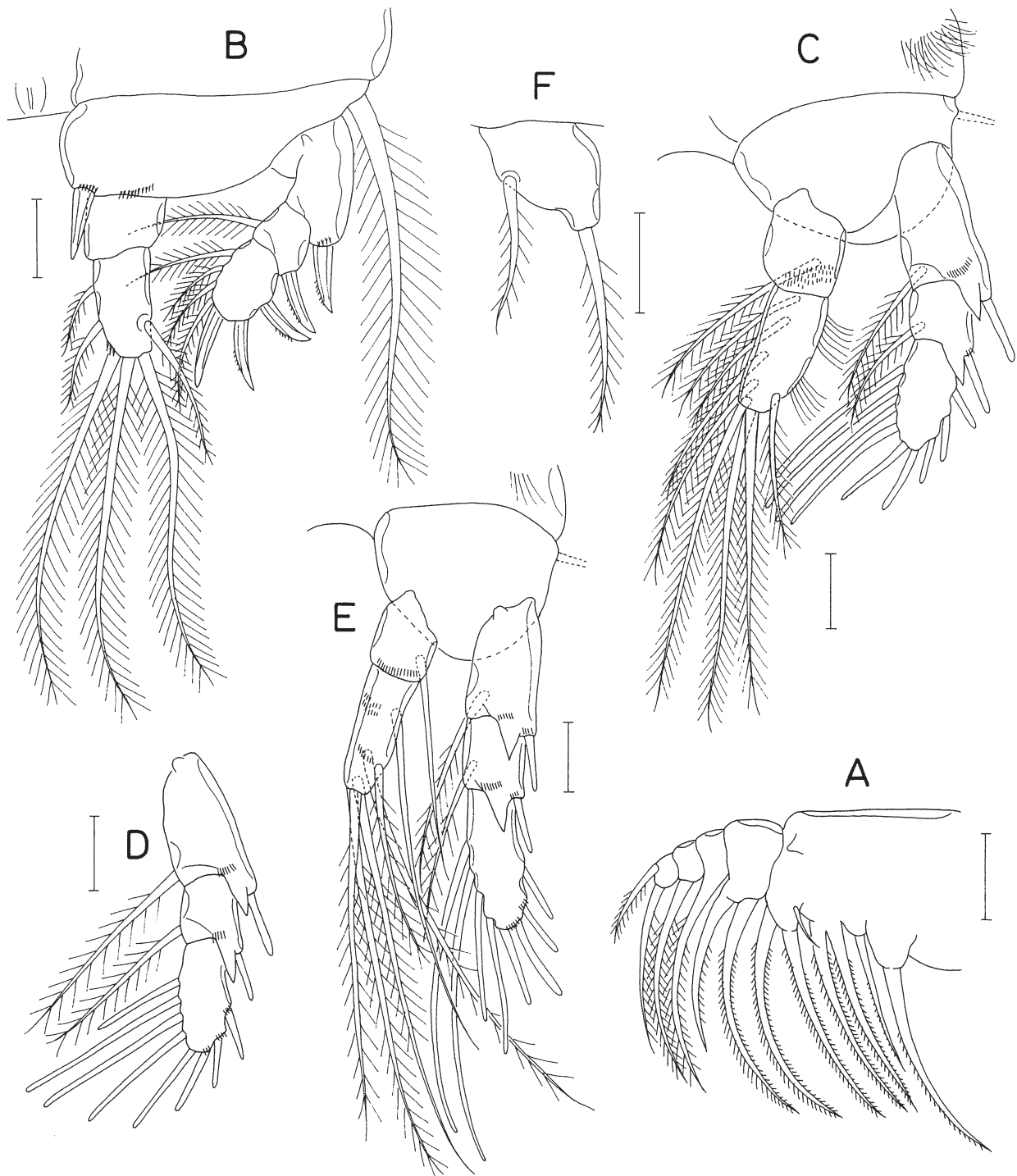
**Etymology.** The name of the new species refers to the presence of 2 claws on the caudal ramus.

**Description of female.** Body (Fig. 143A) narrow, 1.25 mm long; prosome about 0.82 mm long. Cephalosome well-defined. First to fourth pedigerous somites fused, discernible by retained dorsal tergites. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 143B) 5-segmented, 100×160, 88×135, 96×113, 155×94, and 92×75 µm, respectively. Urosomites well-sclerotized and smooth, lacking spinular ornamentation on ventral surface. Anal somite with pair of strong ventral protuberances. Caudal ramus (Fig. 143C) narrowing distally, about 1.2 times longer than wide (42×35 µm): armed with 2 unequal claws and 4 setae (1 pinnate and 3 naked); larger claw 54 µm, longer than ramus, and smaller claw 18 µm.

Rostrum (Fig. 143E) short, semicircular, with large apical tubercle. Antennule missing. Antenna (Fig. 143D) 4-segmented; short coxa unarmed; basis also short, wider than



**FIGURE 143.** *Periproctia biunguifera* **sp. nov.**, female. A, habitus, right; B, urosome, dorsal; C, caudal ramus; D, antenna; E, rostrum; F, mandible; G, maxillule; H, maxilliped. Scale bars: A, 0.2 mm; B, 0.1 mm; C-H, 0.02 mm.



**FIGURE 144.** *Periproctia biunguifera* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, exopod of leg 3; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

long, armed with 1 large pinnate seta and 1 rudimentary seta at outer distal corner (representing exopod); first endopodal segment with large, naked seta on inner margin; compound distal endopodal segment about 2.4 times longer than wide ( $45 \times 19 \mu\text{m}$ ); armed with 8 setae (including 1 pinnate and 3 blunt tipped setae; 1 of blunt-tipped setae very long, much

longer than distal segment) plus small terminal claw, about half as long as segment.

Labrum missing. Mandible (Fig. 143F) with 5 teeth and 1 small seta on coxal gnathobase; basis with 1 medial seta; exopod 2-segmented with 3 and 2 setae on first and second segments, respectively, outer distal seta on second

segment small, less than half as long as other 4 setae; endopod indistinctly 2-segmented with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 143G) with 7 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 3 on exopod, and 4 on endopod. Maxilla (Fig. 144A) 5-segmented; syncoxa with 3? (setal number on first endite uncertain due to damage), 1, 2, and 3 setae on first to fourth endites, respectively; basis with 2 setae; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 143H) lobate, armed with 6 medial and 2 apical setae.

Legs 1–4 (Fig. 144B–E) with 3-segmented exopods and 2-segmented endopods. Inner coxal seta absent in legs 1–4. Outer seta on basis of leg 1 large. Inner distal spine on basis of leg 1 18 µm long, as long as first endopodal segment. First and second exopodal segments of legs 2–4 with large, dentiform outer distal process. Outer setae on first and second exopodal segments and all setae on third exopodal segment of legs 2–4 naked and bluntly tipped. First exopodal segment of leg 1 lacking inner seta. Armature formula for legs 1–4 as follows (outer seta on basis of legs 2 and 4 missing, but presence confirmed by insertion scars):

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-0; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-0; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-1; 1, 2, 3

Leg 5 (Fig. 144F) as small, tapering lobe bearing 2 pinnate setae, longer seta on outer distal apex and shorter on inner margin.

**Male.** Unknown.

**Remarks.** The maxilliped of *P. biunguifera* **sp. nov.** is armed with only 8 setae and this number has been recorded previously only in *P. triuncata*. The arrangement of the setae is, however, different in these two species: 6 medial and 2 apical setae in *P. biunguifera* **sp. nov.**, compared with 7 medial and 1 apical in *P. triuncata*. Another diagnostic feature of the new species is the setation of the endopod of leg 4 which carries 1 and 6 setae on the first and second segments, respectively, which is a unique character state combination within *Periproctia* (Table 3). In combination, the possession of 2 claws and 4 setae on the caudal ramus, the presence of 2 setae on the third endopodal segment of the maxilla, and the loss of the inner seta from the first exopodal segment of leg 1 also serve to diagnose the new species.

***Periproctia spinata* sp. nov.**

(Figs. 145, 146)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21269), paratypes (8 intact ♀♀, MNHN-IU-2014-

21670), dissected paratypes (2 ♀♀, figured), from *Polysyncraton* sp., CRRF OCDN 8467-N, reef, west side of Ceblat Normanby Is., Papua New Guinea (10°00.21'S, 150°50.04'E), 18 January 2002.

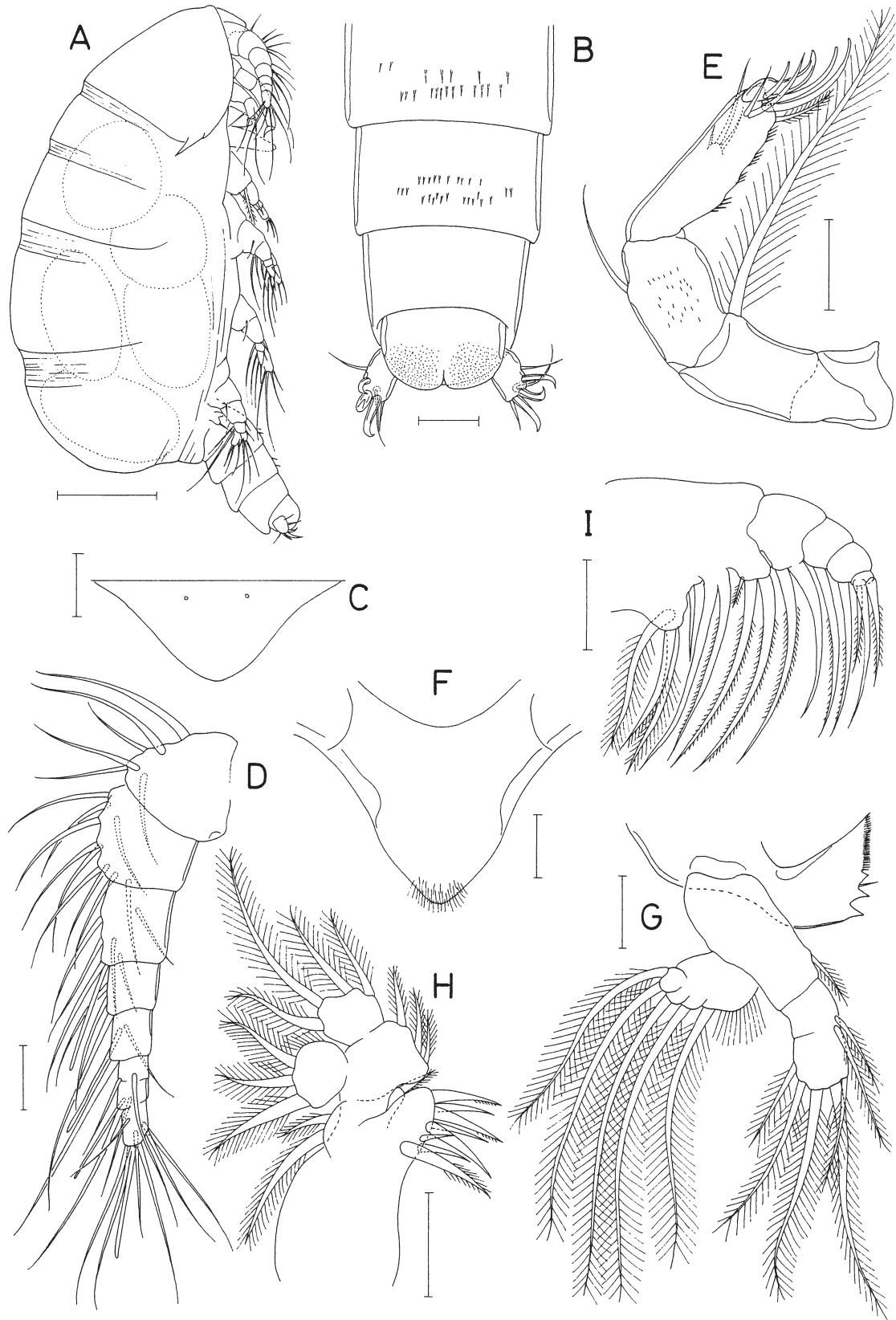
**Etymology.** The specific name is derived from the Latin *spina* (=thorn) and refers to the spiniform posterolateral cephalosomal processes.

**Description of female.** Body (Fig. 145A) small, inflated, with soft thin exoskeleton. Body length 0.59 mm. Prosome 0.49 mm long. Cephalosome with acutely pointed process at each posterolateral corner. Four pedigerous somites fused, discernible only by faint dorsal wrinkles. Fifth pedigerous somite completely fused with fourth. Free urosome 5-segmented: all urosomites much wider than long. First and second abdominal somites ornamented with small spinules scattered on ventral surface (Fig. 145B). Anal somite slightly protruded posteroventrally, surface of protrusion covered with numerous minute granules. Caudal ramus (Fig. 145B) small, about 1.5 times longer than wide (16×11 µm); armed with 3 subequal claws and 3 naked setae.

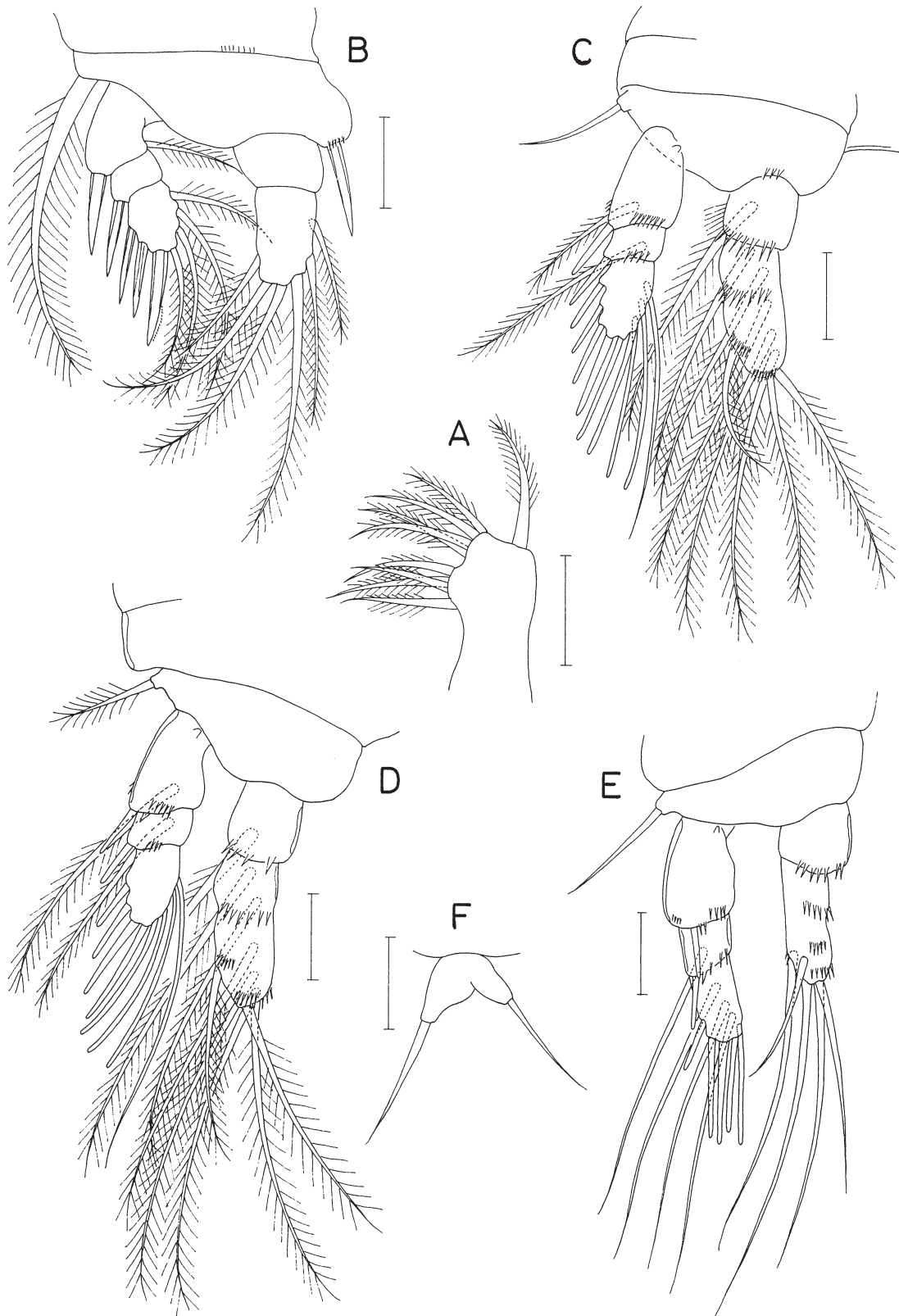
Rostrum (Fig. 145C) much wider than long, rounded distally, lacking apical process. Antennule (Fig. 145D) 134 µm long and 8-segmented; articulations between 3 terminal segments indistinct; armature formula 6, 10, 6+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked; proximal 2 setae on first segment not enlarged. Antenna (Fig. 145E) 4-segmented; coxa short and unarmed; basis with large outer exopodal seta; first endopodal segment about 1.3 times longer than wide, with 1 seta on inner margin and minute spinules scattered over surface; compound distal endopodal segment about 3.3 times longer than wide (43×13 µm), ornamented with 4 groups of spinules along outer margin; armed with 9 setae (3 distal setae blunt tipped) plus small terminal claw, about half as long as segment.

Labrum (Fig. 145F) tapering strongly towards narrow, setulose apex. Mandible (Fig. 145G) with 3 teeth and 1 needle-like spinule between proximal 2 teeth, lacking seta on proximal margin; basis with 1 seta on medial margin; exopod obscurely segmented, armed with 5 setae, outer distal seta slightly shorter than others; endopod incompletely 2-segmented with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 145H) with 8 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 3 on exopod, and 4 on endopod. Maxilla (Fig. 145I) 5-segmented; syncoxa with 9 setae (3, 1, 2, and 3); basis with 2 setae, endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 146A) with 8 medial setae and 1 apical seta.

Legs 1–4 (Fig. 146B–E) with 3-segmented exopods and 2-segmented endopods. Inner coxal seta absent in legs 1–4. Outer seta on basis of leg 1 large. Inner distal spine on basis of leg 1 much longer than first endopodal segment, extending to middle of second segment. Outer setae on first and second exopodal segments and all setae



**FIGURE 145.** *Periproctia spinata* sp. nov., female. A, habitus, right; B, abdomen, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla. Scale bars: A, 0.1 mm; B-I, 0.02 mm.



**FIGURE 146.** *Periproctia spinata* **sp. nov.**, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

on third exopodal segment of legs 2 and 3 naked. Leg 1 lacking inner seta on second exopodal segment. Leg 4 lacking inner seta on first exopodal and first endopodal segments. All setae on leg 4 naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-0; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-0; 1, 2, 2

Leg 5 (Fig. 146F) small, bilobed; each lobe tipped with naked seta.

**Male.** Unknown.

**Remarks.** Two rare character states of *Periproctia spinata* sp. nov. are useful in distinguishing this new species from its congeners. Firstly, the second exopodal segment of leg 1 lacks an inner seta. Secondly, the second endopodal segment of leg 4 is armed with only 5 setae. The first character state is shared only with *P. biuncata* and *P. falsiarcuata*, but the second character state has not yet been recorded within the genus. Additional diagnostic character states include: the maxilliped bears 9 setae (8 medial and 1 apical) and the first exopodal segment of leg 4 lacks an inner seta. The combination of these four character states allows the new species to be differentiated unequivocally from all of its congeners (Table 3).

### *Periproctia horrida* sp. nov.

(Figs. 147, 148)

**Type material.** Holotype (intact ♀, MNHN-IU2014-21271), paratypes (25 intact ♀♀, MNHN-IU-2014-21272), and dissected paratypes (2 ♀♀, figured) from *Aplidium rubripunctum* (Monniot C. & Monniot F., 1997) (Type MNHN-IT-2008-699 = MNHN A1/APL.B/346), Bahrain (26°12.47'N-50°58.14'E), CRRF OCDN B18, sea grass bed, depth 5 m, 24 September 1994.

**Etymology.** The specific name is from the Latin *horrid* (=prickly), alluding to the denticulate cephalosome of the new species.

**Description of female.** Body (Fig. 147A) consisting of cylindrical prosome and small urosome. Body length 1.27 mm; prosome 1.02 mm long, and 373 µm in dorsoventral depth. Cephalosome ornamented with longitudinal row of 12 pointed denticles anteriorly along dorsal midline (Fig. 147A, K). First to fourth pedigerous somites fused, retaining 3 weakly expressed dorsal tergites corresponding to first to third somites. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 147B) 5-segmented: all urosomites wider than long; genital somite 53×185 µm, with small copulatory pore visible on ventral surface. Four abdominal somites 50×125, 51×107, 73×98, and 39×81 µm, respectively:

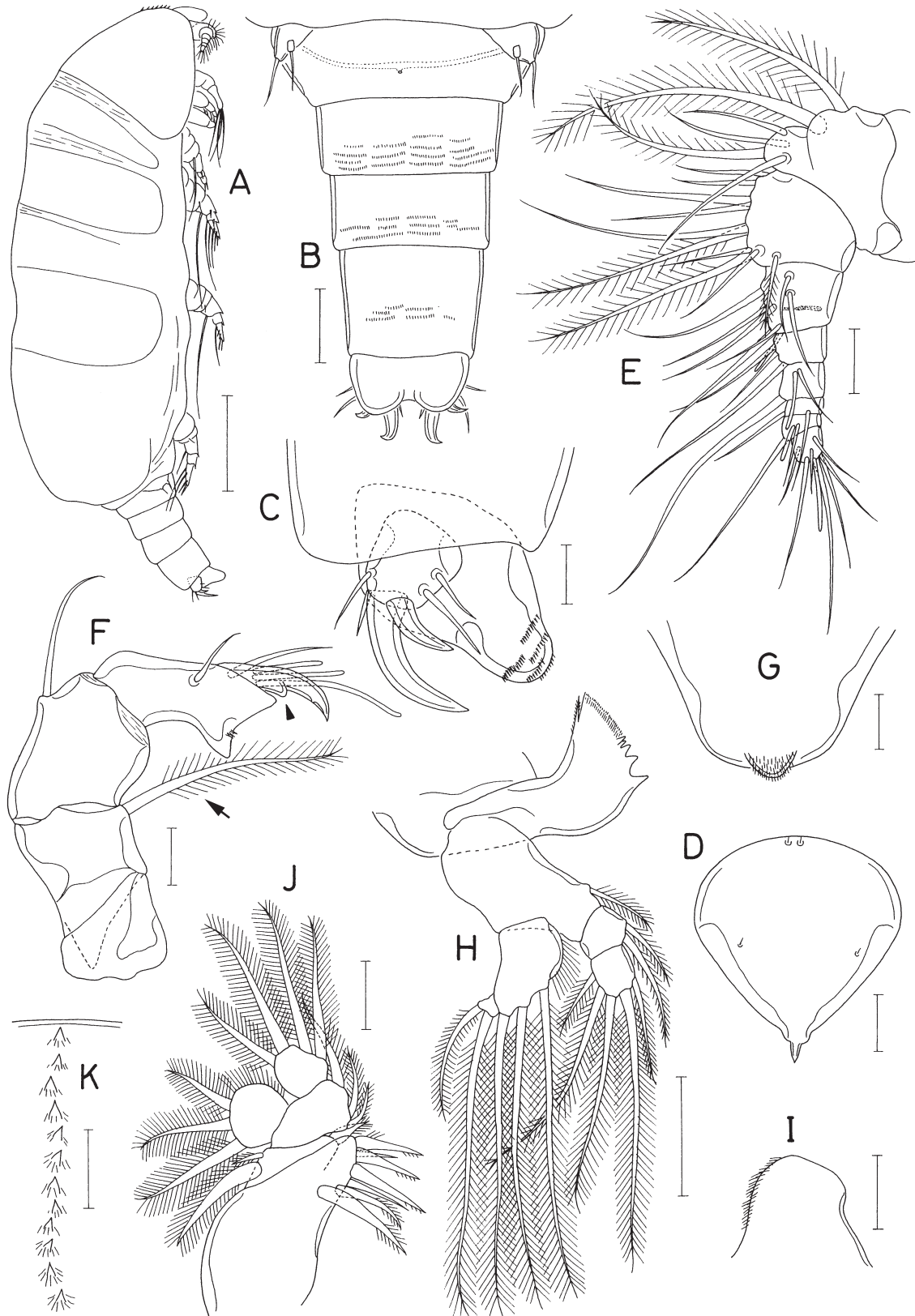
first to third abdominal somites ornamented with rows of minute spinules on ventral surface. Anal somite (Fig. 147C) with pair of strong ventral protuberances, each ornamented with rows of fine spinules around apex. Caudal ramus (Fig. 147C) slightly longer than wide (33×31 µm), positioned dorsolaterally on somite, armed with 2 claws and 4 naked setae; lengths of claws 53 and 27 µm.

Rostrum (Fig. 147D) subcircular, 80×74 µm, well-sclerotized laterally, with small beak-like apical process. Antennule (Fig. 147E) small, 113 µm long, 8-segmented; armature formula 6, 10, 7+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; third segment subdivided by partial suture line; 3 pinnate setae on first and second segments, other setae naked. Antenna (Fig. 147F) stout, 4-segmented; short coxa unarmed; basis as long as wide, armed large pinnate exopodal seta (arrow in Fig. 147F) at outer distal corner; first endopodal segment as long as wide, with naked seta on inner margin; compound second endopodal segment bearing large, conical process on outer margin, ornamented with 3 minute spinules at base of outer process; armed with 5 setae (including 3 blunt distal setae) plus terminal claw bearing blunt tubercle proximally (arrowhead in Fig. 147F).

Labrum (Fig. 147G) simple, with convex posterior margin and finely setulose posteromedian lobe. Mandible (Fig. 147H) with 5 teeth and 1 proximal seta on coxal gnathobase; basis with 1 seta on medial margin; exopod 2-segmented, armed with 3 and 2 setae on first and second segments, respectively; outer distal seta on second exopodal segment small, less than half as long as other 4 setae; endopod with 2 and 5 setae on first and second segments, respectively. Paragnath (Fig. 147I) as small, simple lobe, bearing setules on medial margin. Maxillule (Fig. 147J) with 7 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 3 on exopod, and 4 on endopod. Maxilla (Fig. 148A) with 9 setae (3, 1, 2, and 3) on syncoxa, 2 on basis, and 1, 1, and 2 on first to third endopodal segments, respectively. Maxilliped (Fig. 148B) lobate with 8 medial and 1 apical setae.

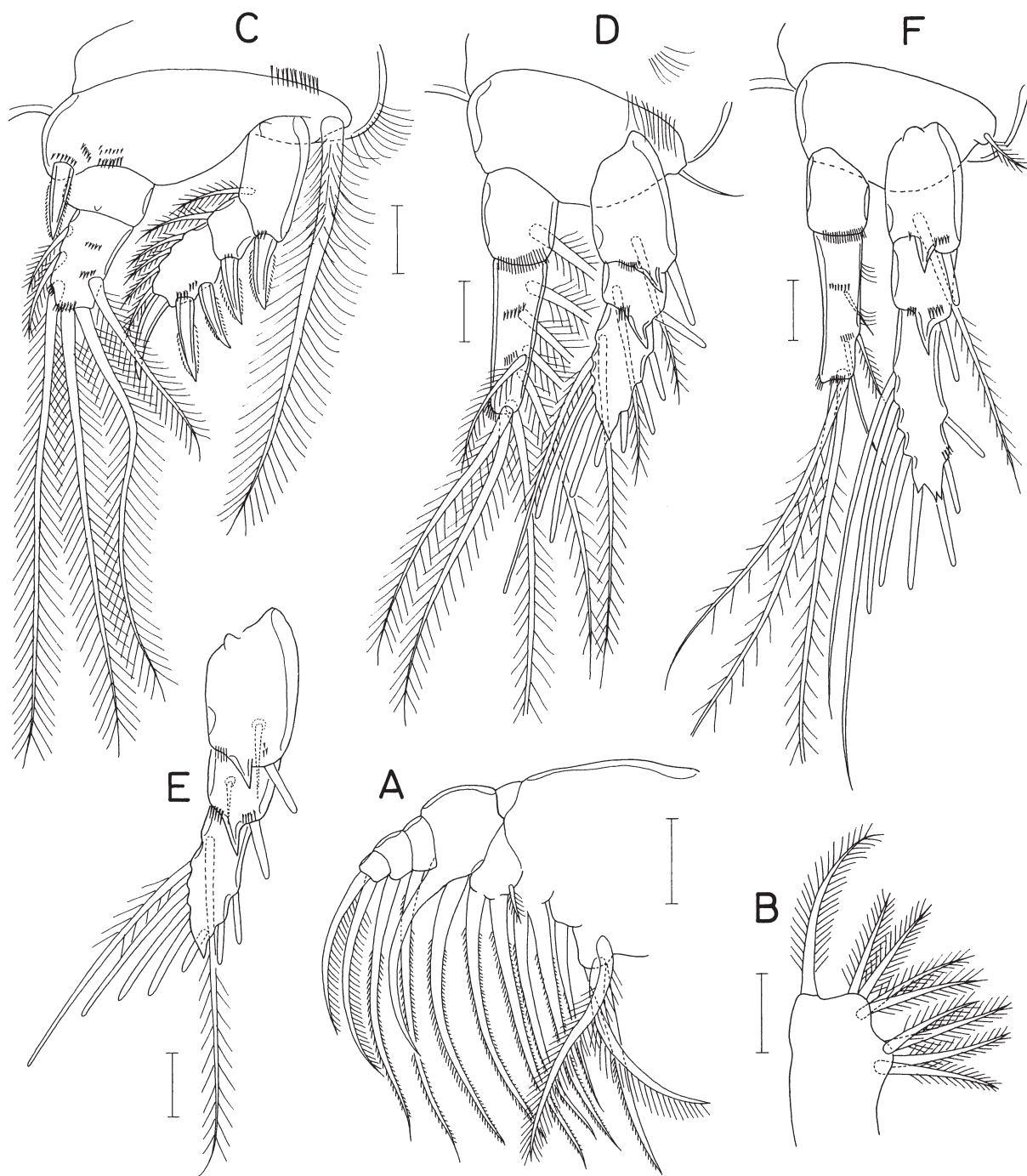
Legs 1–4 (Fig. 148C–F) with 3-segmented exopods and 2-segmented endopods. Leg 1 with large outer seta on basis; inner distal spine on basis longer than first endopodal segment, 24 µm long. First and second exopodal segments of legs 2–4 with well-developed, dentiform outer distal process. Inner seta on first and second endopodal segments of leg 3 variable in size, from small (Fig. 148E) to large. Leg 4 lacking inner seta on second exopodal segment and first endopodal segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-0; 2, 1, 5	0-0; 1, 2, 3



**FIGURE 147.** *Periproctia horrida* sp. nov., female. A, habitus, right; B, urosome, ventral; C, anal somite and caudal ramus, right; D, rostrum; E, antennule; F, antenna showing blunt tubercle on claw (arrowhead); G, labrum; H, mandible; I, paragnath; J, maxillule; K, dorsomedian denticles on cephalosome. Scale bars: A, 0.2 mm; B, H, 0.05 mm; C-G, I-K, 0.02 mm.





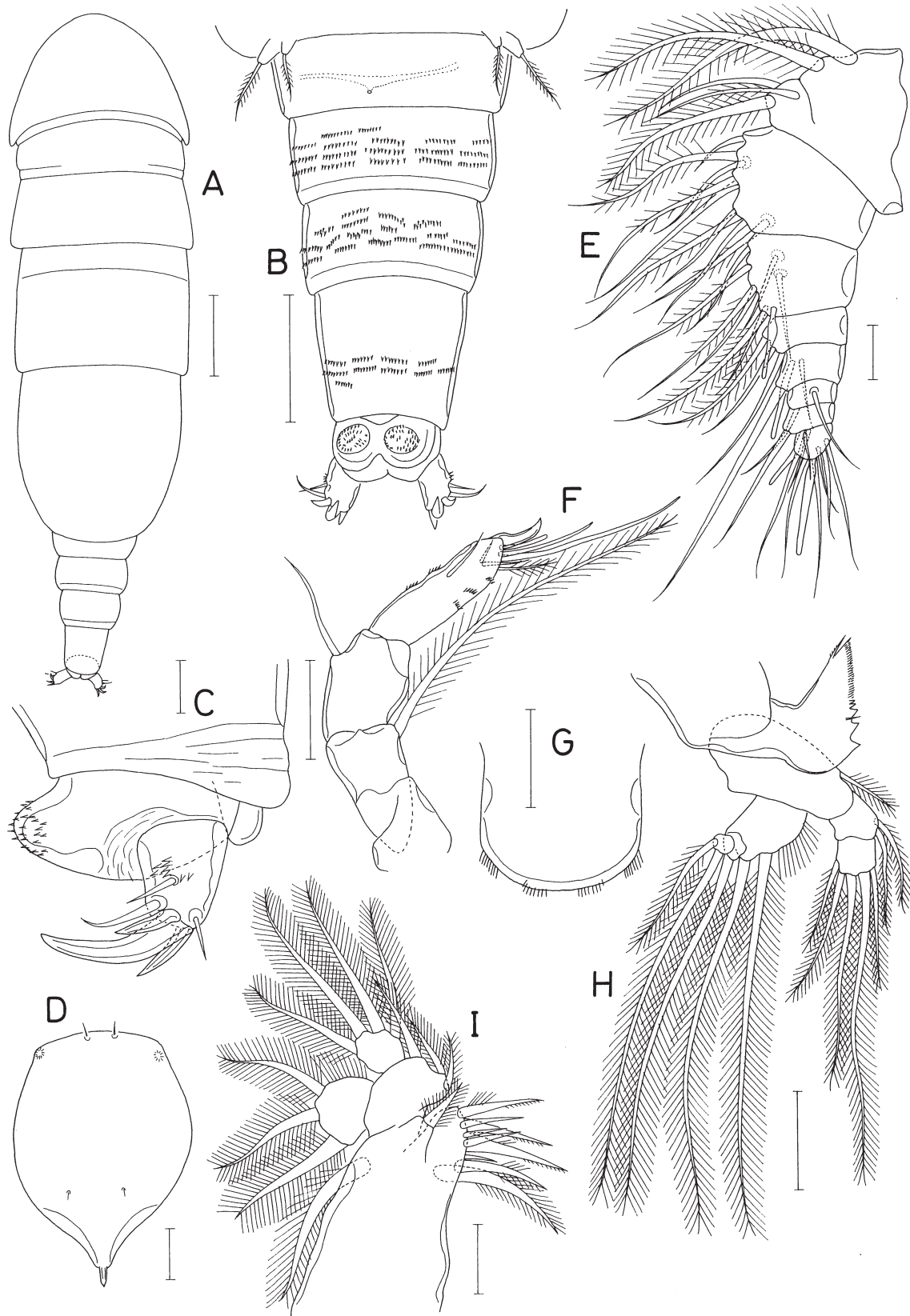
**FIGURE 148.** *Periproctia horrida* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4. Scale bars: 0.02 mm.

Leg 5 (Fig. 147B) represented by conical protopod tipped with 1 seta and small, articulating exopodal segment tipped with 1 seta.

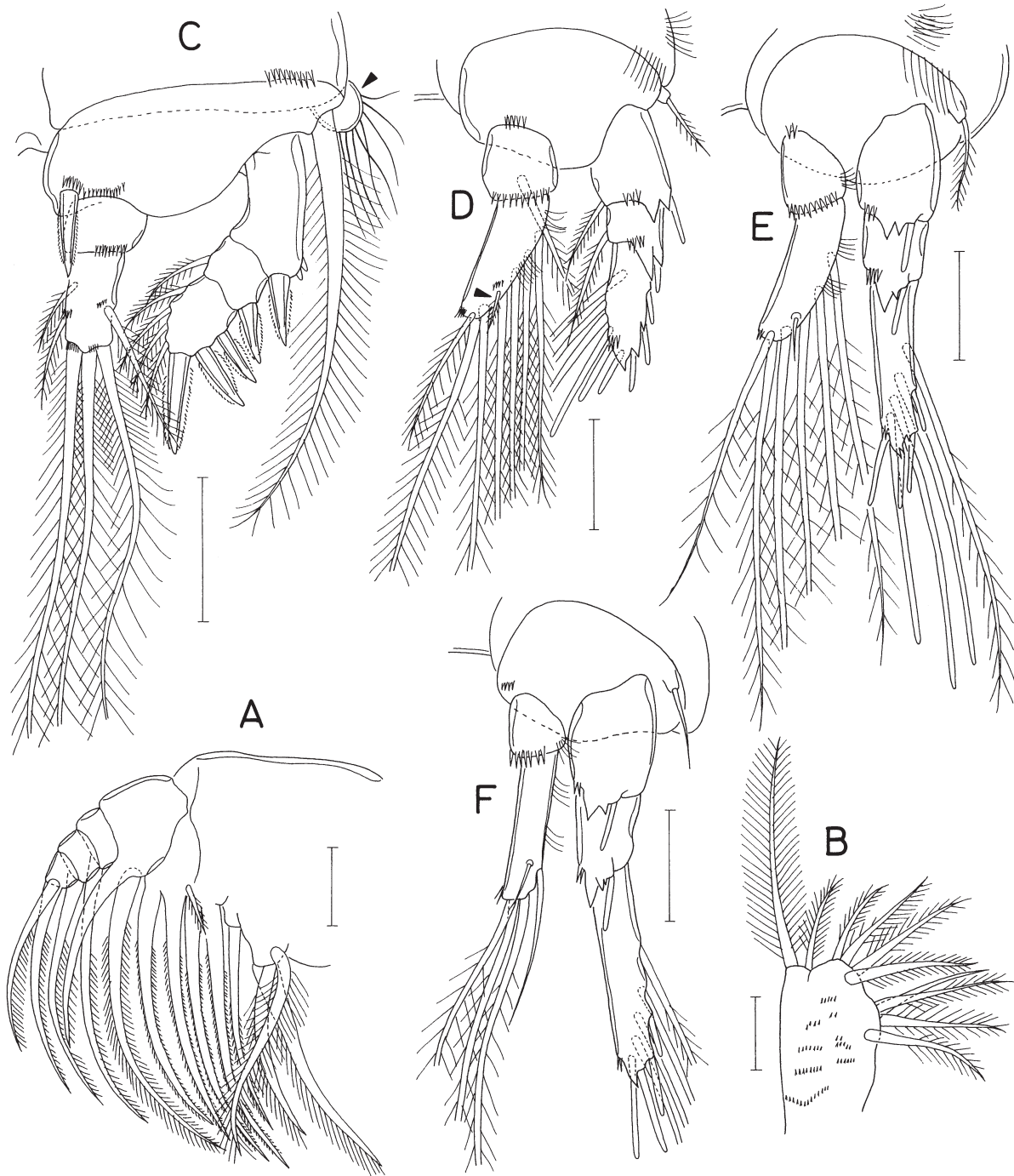
**Male.** Unknown.

**Remarks.** This new species is readily recognizable by a combination of two unusual features: the presence

of a row of denticles along the dorsal midline of the cephalosome, and the large conical process on the second endopodal segment of the antenna. Surface denticles are also present on the cephalosome of *P. obtusa* sp. nov., but the large process on the second endopodal segment of the antenna is an autapomorphic feature of *P. horrida* sp.



**FIGURE 149.** *Periproctia onchopodata* sp. nov., female. A, habitus, dorsal; B, urosome, ventral; C, anal somite and caudal ramus, left; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C-E, I, 0.02 mm; F-H, 0.05 mm.



**FIGURE 150.** *Periproctia onchopodata* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4. Scale bars: A, B, 0.02 mm; C-F, 0.05 mm.

nov. and allows us to differentiate between these two new species.

***Periproctia onchopodata* sp. nov.**  
(Figs. 149, 150)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21273) and dissected paratype (♀, figured) from

*Eudistoma amplum* (Sluiter, 1909) (MNHN-IT-2008-3954 = MNHN A3/EUD/151), CRRF OCDN 2841-W, Palau (07°15.08'N, 134°24.62'E), east of Ngeruktabel, Long Lake, depth 1 m, 20 June 1995.

**Etymology.** The specific name is a combination of Greek words *onch* (=tubercle) and *pod* (=a foot). It alludes to the large tubercle at the outer distal corner of the coxa of leg 1.

**Description of female.** Body (Fig. 149A) narrow,

arched ventrally, 1.54 mm long. Prosomes slightly depressed, distinctly segmented, 1.20 mm long, with parallel lateral margins. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 149B) gradually narrowing posteriorly, 5-segmented: genital somite 58×187 µm, with small copulatory pore on ventral surface. Four abdominal somites 65×162, 67×142, 102×120, and 45×85 µm, respectively. First to third abdominal somites each ornamented with rows of minute spinules ventrally. Anal somite (Fig. 149C) short, with pair of spinulose ventral protuberances; anal operculum well-developed. Caudal ramus (Fig. 149C) about 1.2 times longer than wide (42×34 µm), slightly narrowing distally: armed with 1 large and 2 smaller claws and 3 naked setae; patch of spinules present near base of proximal seta; lengths of claws 59, 29, and 25 µm; setae shorter than ramus.

Rostrum (Fig. 149D) longer than wide (106×75 µm), widest in middle and narrowing both proximally and distally, with papilla at each proximal corner and small beak-like apical process. Antennule (Fig. 149E) stout, 155 µm long, and 8-segmented; armature formula 5, 9, 8+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; pinnate setae 4 on first segment, 4 on each second and third, and 1 on fourth; aesthetasc on third segment swollen proximally. Antenna (Fig. 149F) 4-segmented; coxa short and unarmed; basis with large exopodal seta at outer distal corner; first endopodal segment with 1 seta on inner margin; compound distal endopodal segment 3.0 times as long as wide, ornamented with rows of spinules on both margins; armed with 8 setae plus small terminal claw, less than half length of segment.

Labrum (Fig. 149G) characteristically with parallel lateral margins and convex posterior margin ornamented with 4 groups of setules. Mandible (Fig. 149H) comprising coxa and palp; coxa bearing 5 teeth, including 2 small proximal ones, 1 small seta on proximal margin, and 1 needle-like spinules between second and third distal teeth; basis with 1 seta on medial margin; exopod 3-segmented and armed with 2, 1, and 2 setae on first to third segments, respectively; outer distal seta on third exopodal segment small, less than half length of other 4 setae; endopod armed with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 149I) with 9 setae on arthrite, 1 seta on coxal endite and on epipodite; basis, exopod and endopod with 3, 3, and 4 setae, respectively. Maxilla (Fig. 150A) 5-segmented; syncoxa and basis with 9 and 2 setae, respectively, as usual; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped lobate (Fig. 150B) armed with 8 medial and 2 apical setae; ornamented with several rows of minute spinules on surface.

Legs 1–4 (Fig. 150C–F) each with 3-segmented exopod and 2-segmented endopod. Leg 1 bearing large globular tubercle ornamented with long setules at outer distal corner of coxa (arrowhead in Fig. 150C); outer seta

on basis large; inner distal spine on basis longer than first endopodal segment, 31 µm long; first exopodal segment bearing 2 blunt denticles at outer distal corner. First and second exopodal segments of legs 2–4 each with bifid outer distal corner. Inner seta absent on first and second exopodal segments and first endopodal segment of legs 3 and 4. Outer seta (indicated by arrowhead in Fig. 150D) on second endopodal segment of leg 2 small and pinnate. Same seta in legs 3 and 4 also small but naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-0; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 1, 2, 4
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 1, 2, 2

Leg 5 (Fig. 149B) represented by 2 digitiform lobes on posteroventral margin of compound fourth/fifth pedigerous somite; each lobe tipped with pinnate seta.

**Male.** Unknown.

**Remarks.** The presence of the large globular tubercle at the outer distal corner of the coxa of leg 1 is a feature unique to *P. onchopodata* **sp. nov.** The armature pattern of the legs of the new species is also characteristic since it lacks an inner seta on the first exopodal segment of leg 1 (this feature is shared with *P. bisetigera* **sp. nov.** and *P. biunguifera* **sp. nov.**), lacks an inner seta on the first and second exopodal segments of leg 3 (a unique setation pattern within *Periproctia*), and lacks an inner seta on the first and second exopodal segments of leg 4 (a feature shared with *P. biuncata* and *P. longirostris* **sp. nov.**). The possession of only 5 setae on the second endopodal segment of leg 4 also is an unusual feature which is shared only by *P. spinata* **sp. nov.** and *P. onchopodata* **sp. nov.** (Table 3).

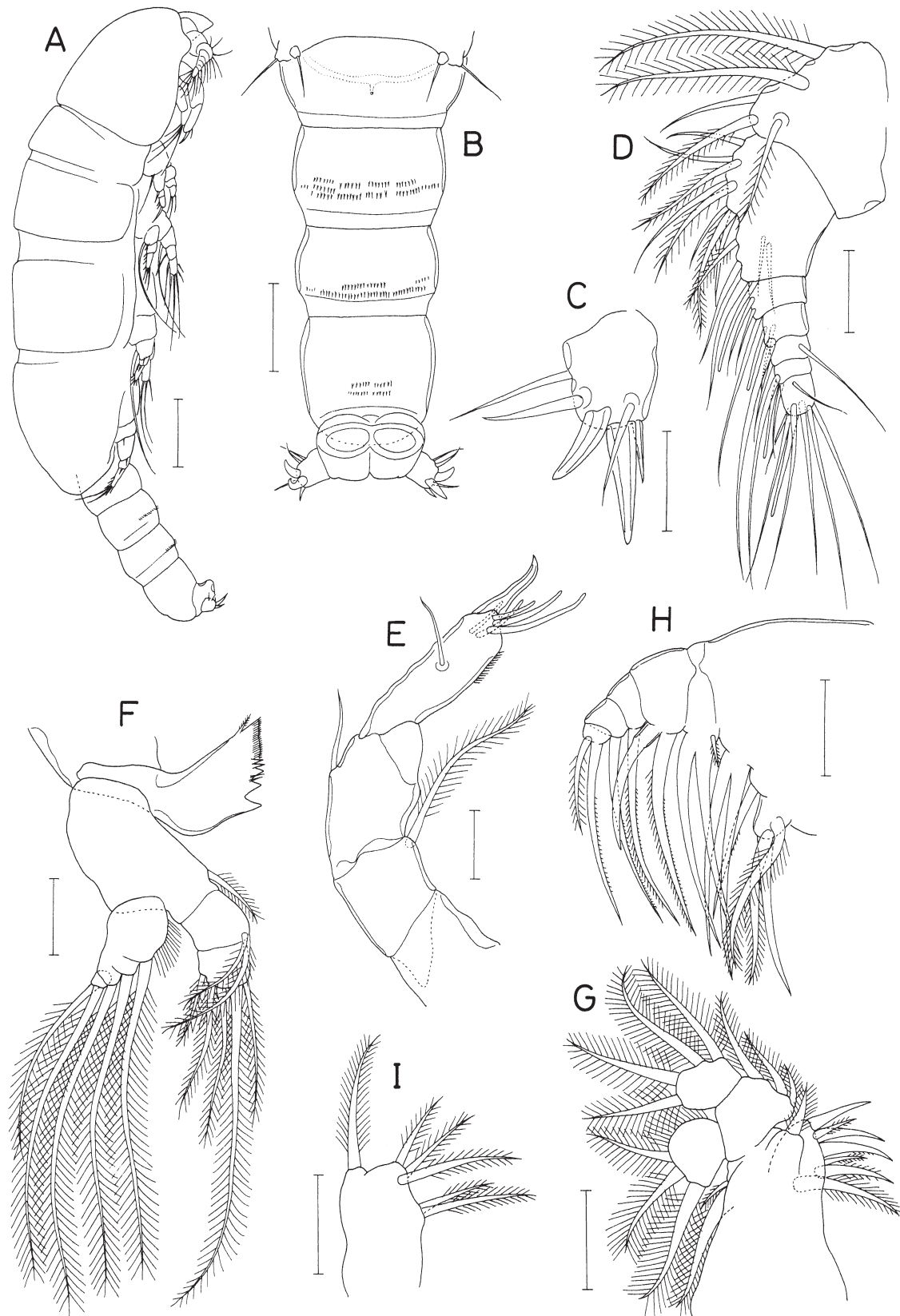
### *Periproctia hexachaetata* **sp. nov.**

(Figs. 151, 152)

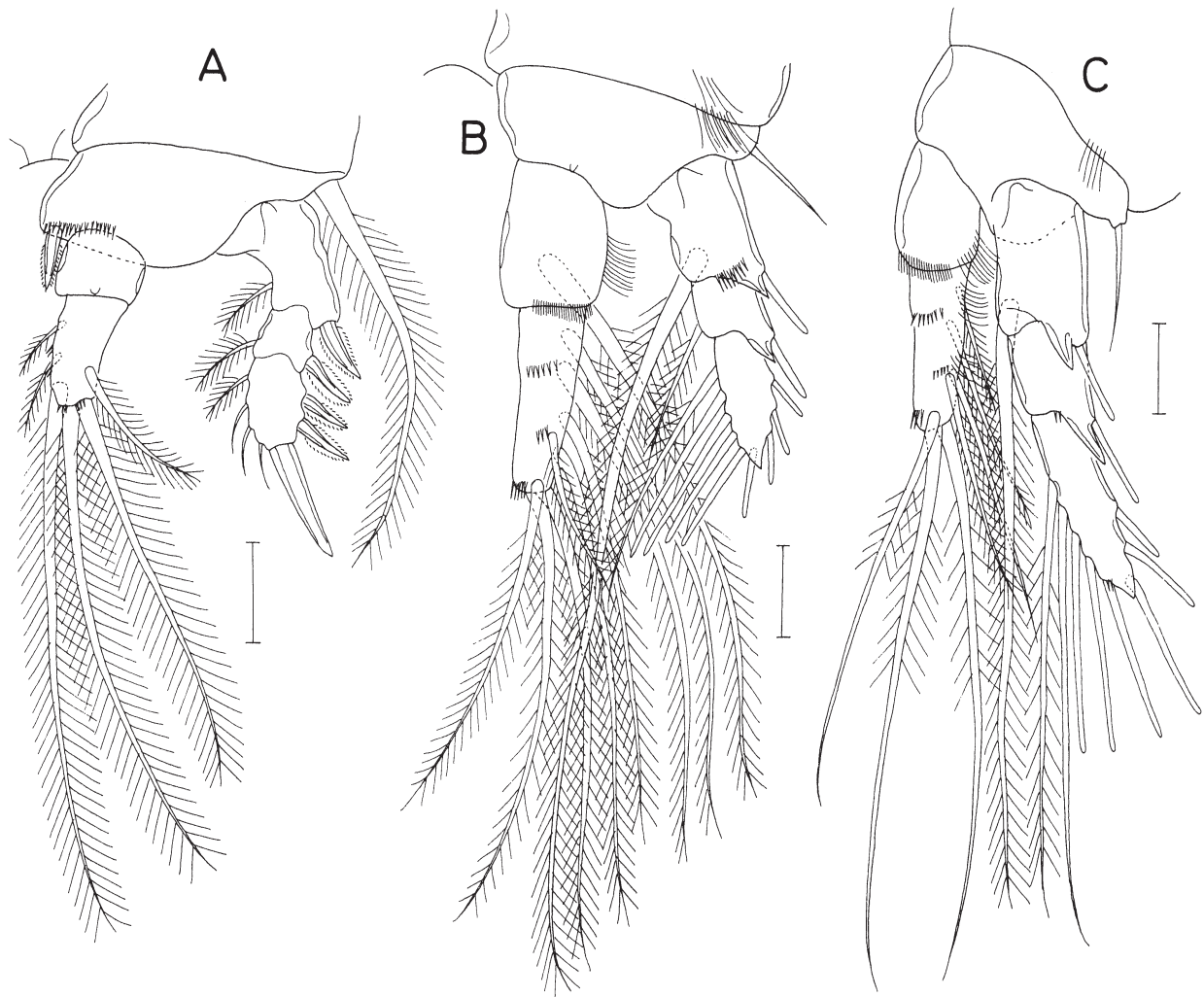
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21274) and dissected paratype (♀, figured) from *Lissoclinum patella* (Gottschaldt, 1898) (MNHN-IT-2008-5014 = MNHN A2/LIS/157), CRRF OCDN 5762-W, Boia Boia Waga Island, Papua New Guinea (10°12.26'S, 150°44.75'E), depth 10 m, 27 May 1998.

**Etymology.** The specific name is from the Greek *hexa* (=six) and *chaet* (=a bristle), alluding to the presence of 6 setae on the maxilliped.

**Description of female.** Body (Fig. 151A) slender, cylindrical, 925 µm long; prosome 727 µm long and 200 µm in dorsoventral depth. Four pedigerous somites fused but discernible by retained dorsal tergites and constrictions between them: fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 151B) 5-segmented, with



**FIGURE 151.** *Periproctia hexachaetata* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; I, maxilliped. Scale bars: A, 0.1 mm; B, 0.05 mm; C-I, 0.02 mm.



**FIGURE 152.** *Periproctia hexachaetata* sp. nov., female. A, leg 1; B, leg 2; C, leg 4. Scale bars: 0.02 mm.

nearly parallel lateral margins; genital somite 108  $\mu$ m wide, only slightly wider than first abdominal somite. Four abdominal somites 59 $\times$ 88, 53 $\times$ 82, 64 $\times$ 77, and 30 $\times$ 62  $\mu$ m, respectively; first to third abdominal somites ornamented with 2 rows of minute spinules ventrally. Anal somite with pair of smooth ventral protuberances. Caudal rami widely separated from each other at base and directed posterolaterally; each ramus (Fig. 151C) subrectangular, about 1.3 times longer than wide (24 $\times$ 19  $\mu$ m); armed with 3 claws and 3 naked setae; lengths of claws 24, 17, and 12  $\mu$ m; smallest dorsal claw thin.

Rostrum similar to that of *P. obtusa* sp. nov., as long as wide (54 $\times$ 54  $\mu$ m), with small beak-like process at apex. Antennule (Fig. 151D) 94  $\mu$ m long and 7-segmented; armature formula 5, 13+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 4 setae on each of first and second segments pinnate. Antenna (Fig. 151E) 4-segmented; coxa short and unarmed; basis short, wider than long, with large outer distal seta representing

exopod; first endopodal segment with 1 seta on inner margin; compound distal endopodal segment about 2.9 times longer than wide (47 $\times$ 16  $\mu$ m), ornamented with spinules on outer margin; armed with 6 setae (grouped as 1, 2, and 3) plus slender terminal claw, about half as long as segment,

Labrum missing. Mandible (Fig. 151F) with 5 teeth, 2 needle-like spinules between second and third teeth, and 1 small seta on coxal gnathobase; basis with 1 medial seta; exopod with 5 setae, distal outer seta shorter than other 4; endopod with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 151G) with 7 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on each basis and exopod, and 4 on endopod. Maxilla (Fig. 151H) with 9 setae on syncoxa (grouped as 3, 1, 2, and 3), 2 on basis, and 1, 1, and 2 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 151I) armed with 5 (2+3) medial setae and 1 apical seta.

Legs 1–4 each with 3-segmented exopod and 2-

segmented endopod (Fig. 152A-C). Outer seta on basis of leg 1 large, as typical for genus. Inner setae on exopod and second endopodal segment of leg 1 small. Inner seta absent on second exopodal segment of legs 3 and 4. First and second exopodal segments of legs 2–4 with strong dentiform outer distal process. Inner seta on first exopodal segment of legs 2 and 3 very large, more than twice as long as exopod. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-0; 2, 1, 5	0-0; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-0; 2, 1, 5	0-0; 1, 2, 4

Leg 5 (Fig. 151B) small, consisting of small outer distal extension on posteroventral margin of somite, tipped with naked seta, and tiny free exopod with naked apical seta.

**Male.** Unknown.

**Remarks.** The most characteristic feature of *P. hexachaetata* **sp. nov.** is the possession of only 6 setae (5 medial and 1 apical) on the maxilliped. This armature pattern of the maxilliped has not previously been recorded in any species of *Periproctia*. The armature of the endopod of leg 4 is also characteristic because the endopod has an unarmed first segment and carries 7 setae on the second segment: this combination has not been found in any congeners (Table 3).

### *Periproctia laticaudata* **sp. nov.**

(Figs. 153, 154)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21275), paratypes (2 intact ♀♀, MNHN-IU-2014-21276), and dissected paratypes (2 ♀♀, figured) from *Didemnum psammatoedes* (Sluiter, 1895), Îles Mesha Maree, Djibouti, Monniot coll., 13 October 1996.

**Etymology.** The specific name is derived from the Latin *lati* (=broad) and *cauda* (tail), referring to the broad abdomen of the new species.

**Description of female.** Body (Fig. 153A) small, 670 µm long. Prosome 500 µm long and dorsoventral depth 210 µm. First to fourth pedigerous somites fused forming brood pouch. Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 153B) stout, 5-segmented; all urosomites much wider than long: genital somite 27×108 µm, with copulatory pore on ventral surface. Four abdominal somites 20×81, 23×70, 36×60, and 27×51 µm, respectively; first to third abdominal somites ornamented with rows of minute spinules on ventral surface. Anal somite (Fig. 153C) bearing pair of ventral protuberances densely covered with minute spinules; anal operculum distinct. Caudal ramus 17×17 µm, narrowing distally,

armed with 3 claws and 3 naked setae, and ornamented with spinules near base of proximal seta; lengths of claws 21, 15, and 15 µm.

Rostrum (Fig. 153D) triangular, 55×45 µm, evenly tapering towards small beak-like process at apex. Antennule (Fig. 153E) 87 µm long and 7-segmented; armature formula 6, 17+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 153F) rather slender, 4-segmented; coxa short and unarmed; basis longer than wide, with 1 large outer distal seta representing exopod; first endopodal segment longer than wide, with 1 naked seta on inner margin; compound distal endopodal segment about 3.7 times longer than wide (48×13 µm), 1.5 times longer than first endopodal segment, armed with 6 naked setae (grouped as 1, 2, and 3) plus small terminal claw, less than half as long as segment.

Labrum missing. Mandible (Fig. 153G) similar to that of *P. hexachaetata* **sp. nov.**, with 2 and 5 setae on first and second endopodal segments, respectively. Maxillule (Fig. 153H) with 6 setae on arthrite, 1 on coxal endite, 2 on epipodite, 2 on medial margin of basis, 3 on exopod and 4 on endopod. Maxilla (Fig. 154A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 2 setae; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 153I) armed with 7 (4+3) medial and 1 apical setae.

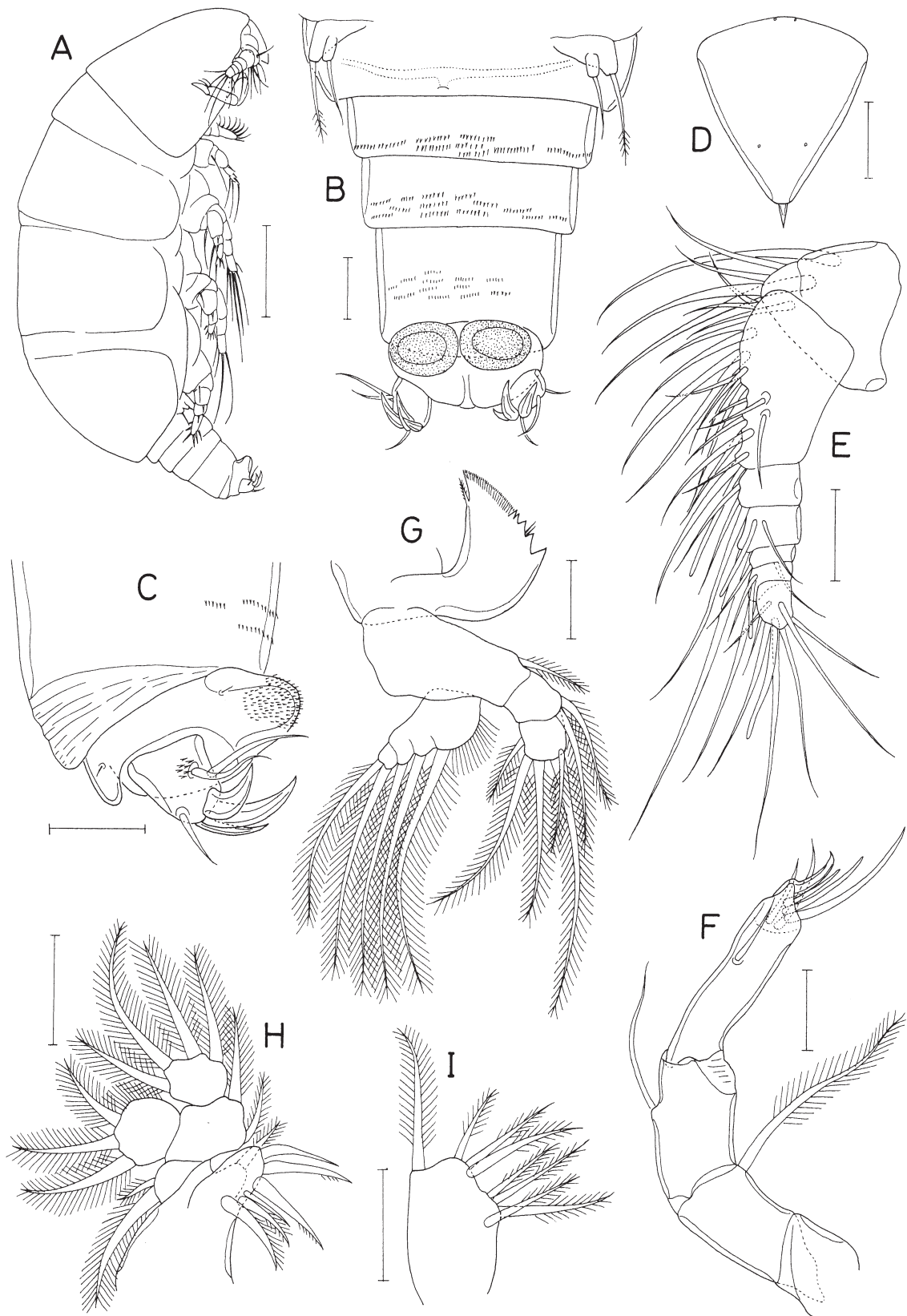
Legs 1–4 (Fig. 154B-E) with 3-segmented exopods and 2-segmented endopods. Outer seta on basis of leg 1 longer than exopod. Inner distal spine on basis of leg 1 slightly longer than first endopodal segment. In leg 2, inner seta on first endopodal segment and proximalmost inner seta on second endopodal segment elongate. Second exopodal segments of legs 3 and 4 lacking inner seta. Inner seta on first exopodal segment present in right leg 4, but absent in left leg 4. Outer distal process of first and second exopodal segments of legs 2–4 variable, simple, bifurcate, or trifurcate. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-0; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-0; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1 (or 1-0);	0-0; 1, 2, 3
			1-0; 2, 1, 5	

Leg 5 (Fig. 153B) consisting of broad, tapering protopod tipped with 1 feebly pinnate seta and small, free exopod with naked apical seta.

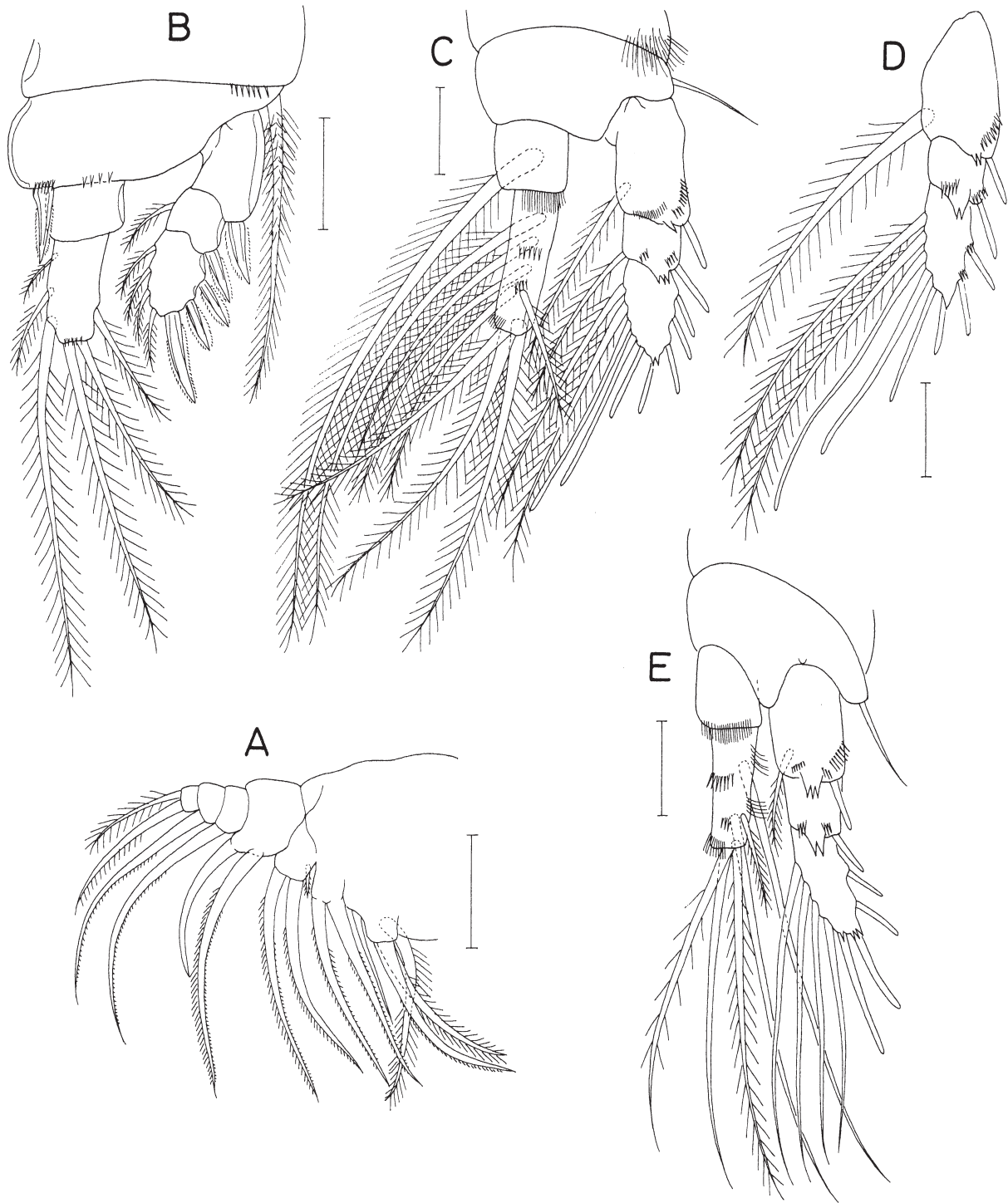
**Male.** Unknown.

**Remarks.** In having only 2 medial setae on the basis of the maxillule, *P. laticaudata* **sp. nov.** resembles *P. biuncata* and *P. angusta* **sp. nov.**, but it is easily distinguishable from these two species, because there are 7 setae on the maxilliped of *P. biuncata* and 10 setae in *P.*



**FIGURE 153.** *Periproctia laticaudata* sp. nov., female. A, habitus, right; B, urosome, ventral; C, anal somite and caudal ramus, right; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilliped. Scale bars: A, 0.1 mm; B-I, 0.02 mm.

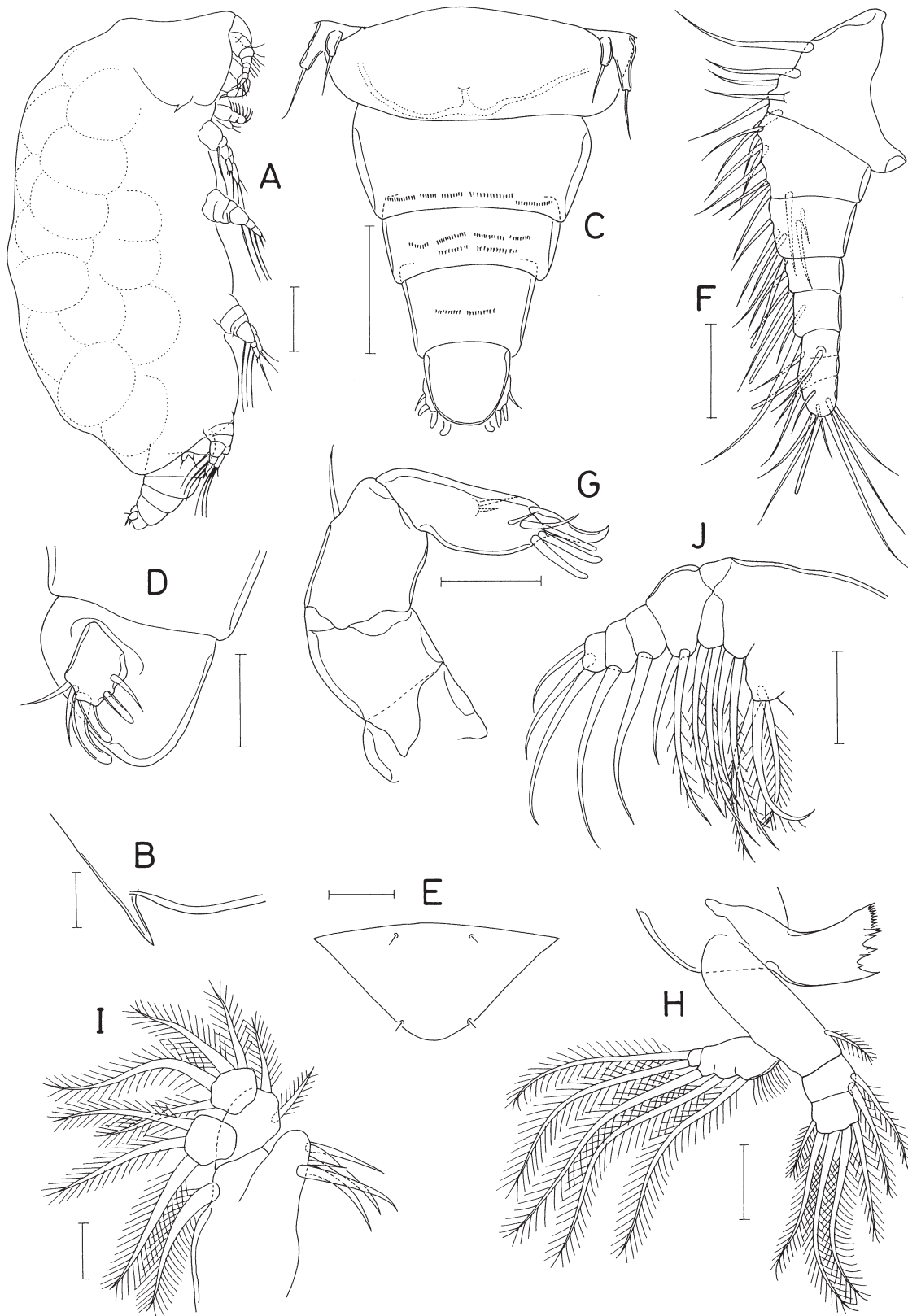




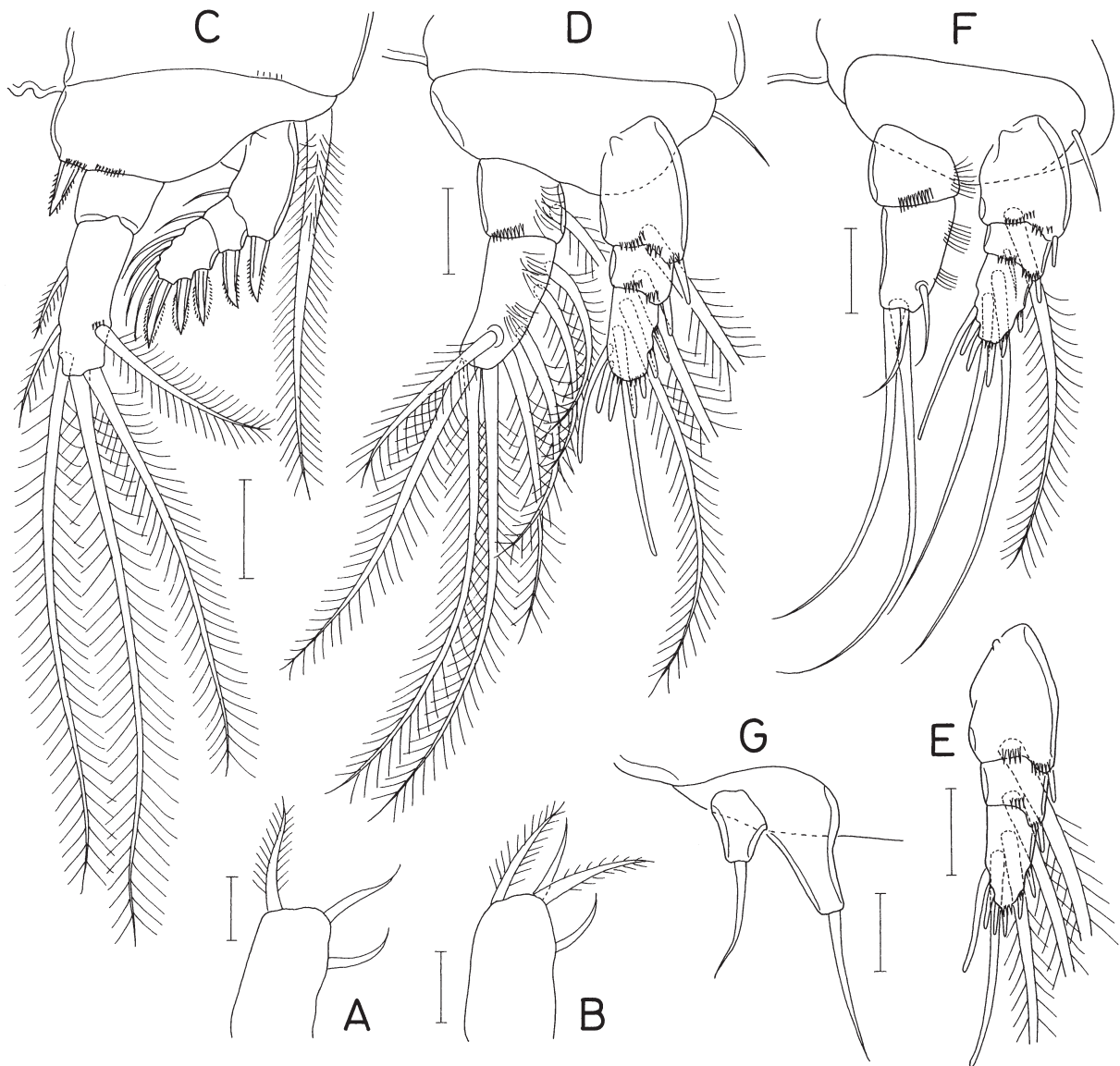
**FIGURE 154.** *Periproctia laticaudata* **sp. nov.**, female. A, maxilla; B, leg 1; C, leg 2; D, exopod of leg 3; E, leg 4. Scale bars: 0.02 mm.

*angusta* **sp. nov.**, whereas the maxilliped of *P. laticaudata* **sp. nov.** is armed with 8 setae (vs. 7 medial and 1 apical). This armature of the maxilliped was previously known only in *P. triuncata*, but this species differs from *P. laticaudata* **sp. nov.** in various other character states, for example, the first exopodal segment of leg 1 bears an inner

seta (vs. this seta is absent in *P. laticaudata* **sp. nov.**), the second endopodal segment of leg 1 bears 5 setae (vs. 6 setae in *P. laticaudata* **sp. nov.**), and the second exopodal segment of leg 3 lacks an inner seta (vs. this seta is present in *P. laticaudata* **sp. nov.**).



**FIGURE 155.** *Periproctia obtusispinata* sp. nov., female. A, habitus, right; B, posterolateral process of cephalosome; C, urosome, ventral; D, anal somite and caudal ramus, right; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.1 mm; B, I, 0.01 mm; C, 0.05 mm; D-H, J, 0.02 mm.



**FIGURE 156.** *Periproctia obtusispinata* sp. nov., female. A, B, maxillipeds; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4; G, leg 5. Scale bars: A, B, G, 0.01 mm; C-F, 0.02 mm.

***Periproctia obtusispinata* sp. nov.**  
(Figs. 155, 156)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21277), paratypes (3 intact ♀♀, MNHN-IU-2014-21278), and dissected paratypes (3 ♀♀, figured) from *Lissoclinum timorensis* (Sluiter, 1909). Each copepod was removed from a membranous cyst, Mont Dore, New Caledonia, Monniot coll.

**Additional material.** 8 ♀♀ (MNHN-IU-2018-1838) from *L. timorensis*, Mont Dore, New Caledonia.

**Etymology.** The specific name combines the Latin words *obtus* (=blunt) and *spina* (=spine), alluding to the blunt claws on the caudal ramus.

**Description of female.** Body (Fig. 155A) stout, 830

µm long. Prosome 700 µm long, occupying 84% of body length, with thin, soft exoskeleton. Dorsoventral depth of prosome 335 µm. Cephalosome fused with first pedigerous somite, but defined by lateral expansions of cephalic shield with small spiniform process at each posterolateral corner (Fig. 155B). First to fourth pedigerous somites fused, forming entire brood pouch: fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 155C) steeply tapering, 5-segmented: genital somite 36×120 µm; 4 abdominal somites 45×93, 33×73, 36×53, and 27×34 µm, respectively. First to third abdominal somites each ornamented with 1 or 2 transverse rows of minute spinules ventrally. Anal somite (Fig. 155C, D) bluntly protruded posteroventrally to form convex posteroventral margin, unornamented. Caudal ramus small, about 1.25

times longer than wide (15×12 µm): armed with 3 blunt claws and 3 setae; lengths of claws 16, 11, and 9 µm; setae naked, not longer than ramus.

Rostrum (Fig. 155E) weak, much wider than long, 36×76 µm, with rounded distal margin lacking any processes. Antennule (Fig. 155F) 88 µm long and 6-segmented; armature formula 6, 9, 6+aesthetasc, 3, 2+aesthetasc, and 11+2 aesthetascs; terminal segment subdivided into 3 parts by 2 partial suture lines on one surface; all setae naked and relatively short. Antenna (Fig. 155G) stout, 4-segmented; coxa short and unarmed; basis wider than long and unarmed (lacking exopodal seta); first endopodal segment slightly longer than wide, with 1 seta on inner margin; compound distal endopodal segment about 2.3 times longer than wide (30×13 µm); armed with 7 setae (3 distal setae blunt at tip) plus terminal claw about half as long as segment.

Labrum very weak, missing. Mandible (Fig. 155H) bearing several denticles of irregular sizes on coxal gnathobase; basis elongate with 1 seta on medial margin; exopod 2-segmented, armed with 3 and 2 setae on first and second segments, respectively; outer distal seta on second exopodal segment slightly shorter than other 4 setae; endopod with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 155I) with 5 setae on arthrite; coxa with only 1 seta on epipodite, lacking endite; basis with 2 setae on medial margin; exopod and endopod with 3 and 4 setae, respectively. Maxilla (Fig. 155J) 5-segmented and armed with 3, 2, and 2 setae respectively on first to third endites of syncoxa, 2 setae on basis, and 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 156A, B) armed with 2-4 medial setae and 1 outer distal seta; number of medial setae variable, 4, 4, 4, 3, 2, and 2 setae respectively on observed maxillipeds of 3 dissected specimens (4 setae is considered to be normal condition).

Legs 1-4 (Fig. 156C-F) with 3-segmented exopods and 2-segmented endopods. Outer seta on basis large in leg 1, but small in legs 2-4. Inner distal spine on basis of leg 1 as long as first endopodal segment, 12 µm long. Outer setae on exopods of legs 2-4 small. Inner seta on second exopodal segment of leg 4 small. Second endopodal segment of leg 4 armed only with 4 setae. Armature formula for legs 1-4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-0; 1, 2, 1

Leg 5 (Fig. 156G) small, consisting of free protopod and exopod; protopodal segment extended distally, forming digitiform process bearing naked seta at tip; exopod clearly articulated at base, tapering, armed with naked apical seta.

**Male.** Unknown.

**Remarks.** *Periproctia obtusispinata* sp. nov. and *P. biuncata* are the only two species lacking the outer distal seta representing the exopod on the basis of the antenna. Moreover, they also have in common a 6-segmented antennule, and the presence of only 2 setae on the basis of the maxillule and only 4 setae on the endopod of leg 4. Nevertheless, they differ in numerous other character states (Table 3) including: *P. obtusispinata* sp. nov. has 3 setae (vs. 2 setae in *P. biuncata*) on the third endopodal segment of the maxillule, at most 5 setae (vs. 7 setae in *P. biuncata*) on the maxilliped, an inner seta on the second exopodal segment of leg 1 (vs. absent in *P. biuncata*), 6 setae on the second endopodal segment of leg 1 (vs. 5 setae in *P. biuncata*), and an inner seta on the first and second exopodal segments of leg 4 (vs. absent in *P. biuncata*). These differences are sufficient to justify the establishment of the new species.

***Periproctia robusta* sp. nov.**

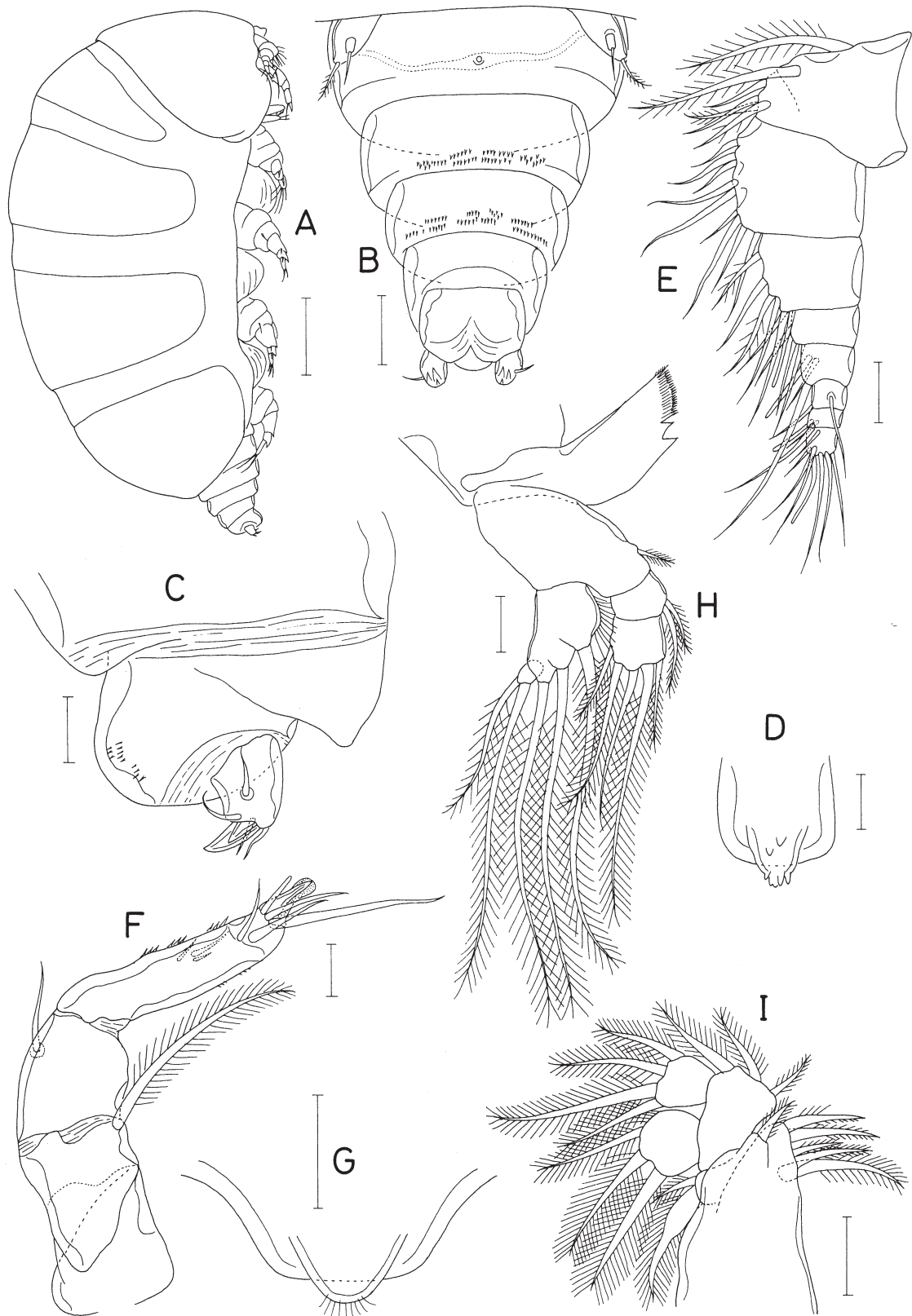
(Figs. 157, 158)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21279), paratype (intact ♀, MNHN-IU-2014-21280), and dissected paratype (♀, figured) from *Trididemnum discrepans* (Sluiter, 1909) (MNHN-IT-2008-8737 = MNHN A2/TRI/119), CRRF OCDN 3256-X, Honda Bay, Palawan, the Philippines (09°55.87'N, 118°55.02'E), depth 20 m, 24 November 1997.

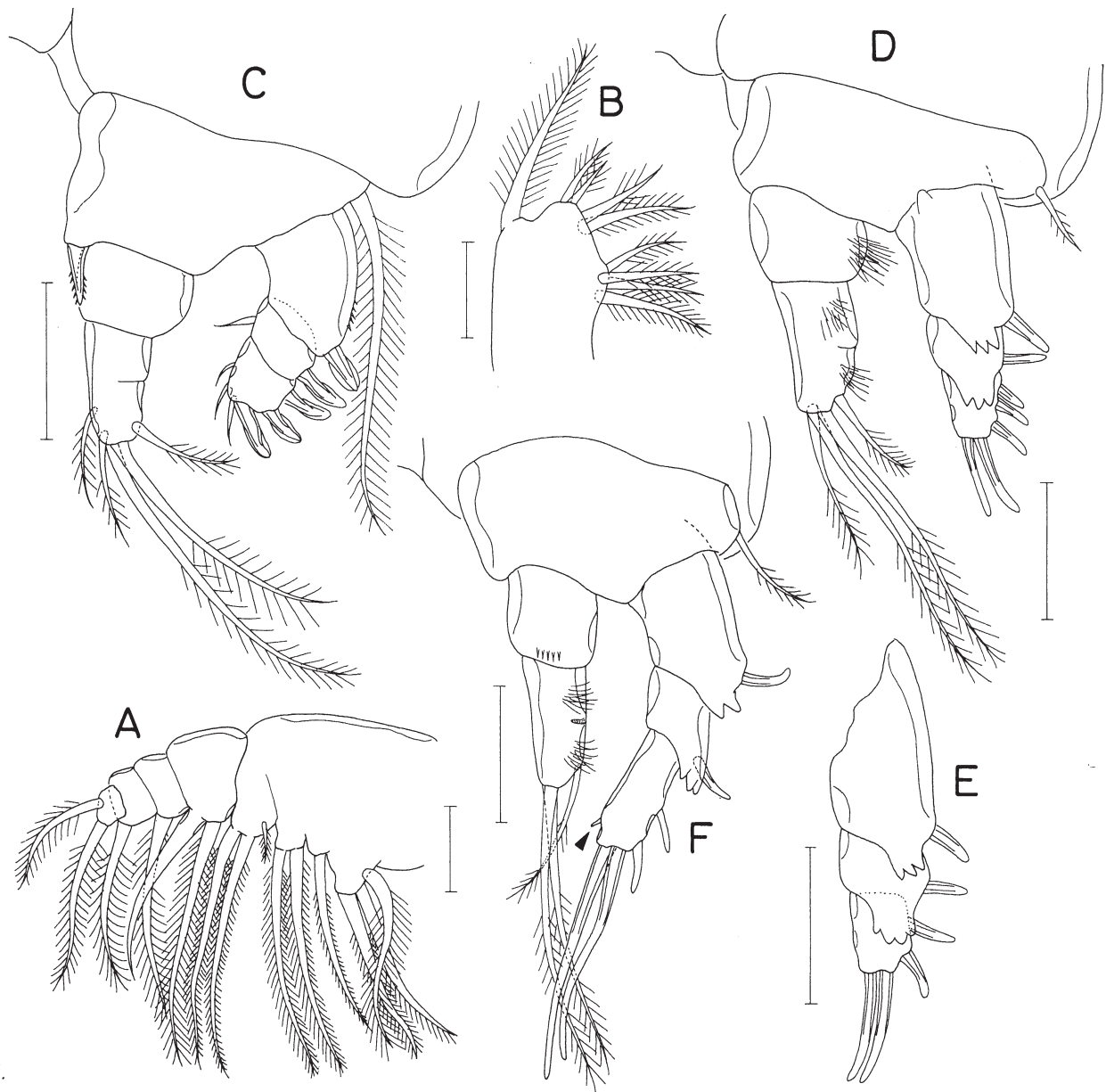
**Etymology.** This new species is named for its robust body.

**Description of female.** Body (Fig. 157A) robust, 1.55 mm long. Prosome unsegmented, 1.40 mm long, occupying 90% of body length; dorsoventral depth 0.58 mm. Cephalic shield and dorsal tergites of 4 pedigerous somites distinct: ventral body surface between legs strongly inflated, protruding ventrally (Fig. 157A). Fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 157B) robust, steeply tapering: genital somite 85×218 µm, bearing copulatory pore on ventral surface. Four abdominal somites 55×167, 44×135, 45×105, and 55×75 µm, respectively; first and second abdominal somites ornamented with rows of small spinules ventrally. Anal somite with highly sclerotized, blunt ventral protuberance on each side, ornamented with scattered spinules; anal operculum large (Fig. 157C). Caudal ramus (Fig. 157C) slightly longer than wide (29×24 µm), armed with 2 stout claws and 4 naked setae; lengths of claws 18 and 10 µm.

Rostrum (Fig. 157D) small, rectangular, with stout apical tubercle bearing small irregular papillae. Antennule (Fig. 157E) 150 µm long and 8-segmented; suture line between 2 terminal segments indistinct; armature formula 6, 9, 6+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 3 pinnate setae on first segment and 2 setae on third, all other setae naked. Antenna (Fig. 157F) 4-



**FIGURE 157.** *Periproctia robusta* sp. nov., female. A, habitus, right; B, urosome, ventral; C, anal somite and caudal ramus, left; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, G, 0.05 mm; C-F, H, I, 0.02 mm.



**FIGURE 158.** *Periproctia robusta* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4. Scale bars: A, B, 0.02 mm; C-F, 0.05 mm.

segmented; first 3 segments each nearly as long as wide; coxa unarmed; basis with large pinnate (exopodal) seta at outer distal corner; first endopodal segment with 1 naked seta on inner margin; compound distal endopodal segment distinctly narrower than proximal segments, 3.5 times longer than wide ( $77 \times 22 \mu\text{m}$ ), ornamented with 3 groups of small spinules on inner surface; armed with 8 setae (arranged as 3, 2, and 3) plus small terminal claw, 25% as long as segment, typically capped with mucus-like material.

Labrum (Fig. 157G) with linear posterior margin and large, setulose posteromedian lobe. Mandible (Fig. 157H) with narrow coxal gnathobase bearing only 2 teeth; basis

with small medial seta; exopod 2-segmented with 3 and 2 setae on first and second segments, respectively, outer distal seta on second segment about half as long as other 4 setae; endopod with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 157I) with 5 setae on arthrite, 1 on coxal endite, 2 on epipodite (larger proximal seta swollen proximally), 3 on medial margin of basis, 3 on exopod, and 4 on endopod. Maxilla (Fig. 158A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 2 setae; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 158B) with 8 medial and 1 outer distal setae.

Legs 1–4 (Fig. 158C–F) with 3-segmented exopods and 2-segmented endopods, with reduced setation. Outer seta on basis elongate in leg 1, short in legs 2–4. Inner distal spine on basis of leg 1 shorter than first endopodal segment. Second endopodal segment of legs 1–4 subdivided by trace of articulation on outer side. Inner setae absent on exopods of legs 2 and 3. Third exopodal segment of leg 1 bearing 3 inner setae. Third exopodal segment of leg 4 with or without 1 minute inner seta (arrowhead in Fig. 158F). Outer distal process of first and second exopodal segments usually trifurcate. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-0; I-1; II, I, 3	0-0; 1, 2, 2
Leg 2	0-0	1-0	I-0; I-0; III, II, 0	0-0; 1, 2, 1
Leg 3	0-0	1-0	I-0; I-0; II, II, 0	0-0; 1, 2, 1
Leg 4	0-0	1-0	I-0; I-0; II, II, 0 or 1	0-0; 1, 2, 0

Leg 5 (Fig. 157B) small, consisting of protopod and free exopod; protopod with 1 pinnate seta on apex of outer process; exopod very small with naked apical seta.

**Male.** Unknown.

**Remarks.** The small terminal claw of the antenna, which is capped with mucus-like material, may be a diagnostic feature of the new species. The new species can also be differentiated from its congeneric species by the extreme reduction of setation elements in the swimming legs. For example, the third exopodal segment of leg 4 is armed only with 4 well developed elements, the smallest number recorded for any species within the genus (Table 3), although a setal vestige is found in one specimen.

### Genus *Bonnierilla* Canu, 1891

**Diagnosis:** Body form generally swollen, compressed. Prosome consisting of cephalosome and unsegmented metasome (comprising fused first to fourth pedigerous somites) forming brood pouch: fifth pedigerous somite fused with metasome. Free urosome 5-segmented, consisting of genital somite and 4-segmented abdomen. Caudal ramus typically with 6 setae, sometimes with 1 claw and 5 setae. Antennule most commonly 8-segmented, ranging from 6- to 9-segmented. Antenna 4-segmented; basis typically with setal vestige(s) representing exopod; compound distal endopodal segment usually elongate. Mandible with 5 setae on exopod; endopod 2-segmented usually with 4 setae on first segment and 9 setae on second. Maxillule with 9 or 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, and usually 4 (rarely 3) on exopod and endopod. Maxilla 5-segmented; first endite of syncoxa with 3 (rarely 4) setae; endopod 3-segmented with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped 2-segmented, armed with 10 medial setae

on first segment and 2 setae on second. Legs 1–4 with 3-segmented rami. Inner coxal seta absent in legs 1 and 2. Leg 1 with 5 or 6 setae on third endopodal segment. Leg 5 consisting of protopod bearing outer seta and free exopodal segment bearing 1 or 2 setae.

**Type species:** *Bonnierilla longipes* (Kerschner, 1879) by original monotypy.

**Remarks.** The genus *Bonnierilla* was established by Canu (1891) to accommodate *Paryphes longipes* Kerschner, 1879, since Kerschner's *Paryphes* was preoccupied by *Paryphes* Burmeister, 1835 (Hemiptera). It currently comprises 12 valid species, two of which are removed here and transferred to a new genus. Four of the remaining ten species are redescribed here based on the study of new material and an additional nine new species are described.

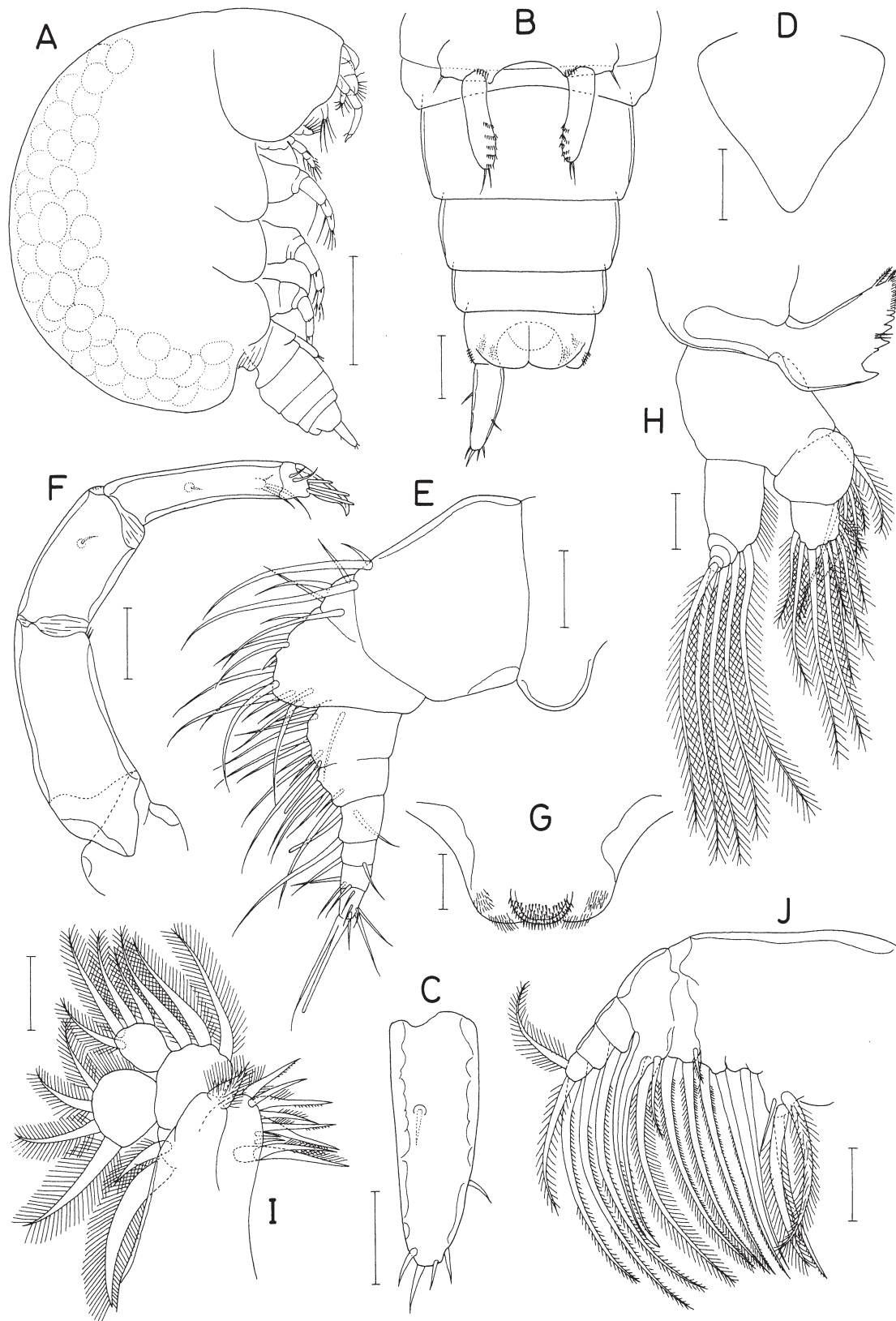
### *Bonnierilla acollaris* Schellenberg, 1922

(Figs. 159, 160)

**Material examined.** 1 ♀ from *Halocynthia spinosa* Sluiter, 1905, Ibo, Mozambique, 11 November 1995.

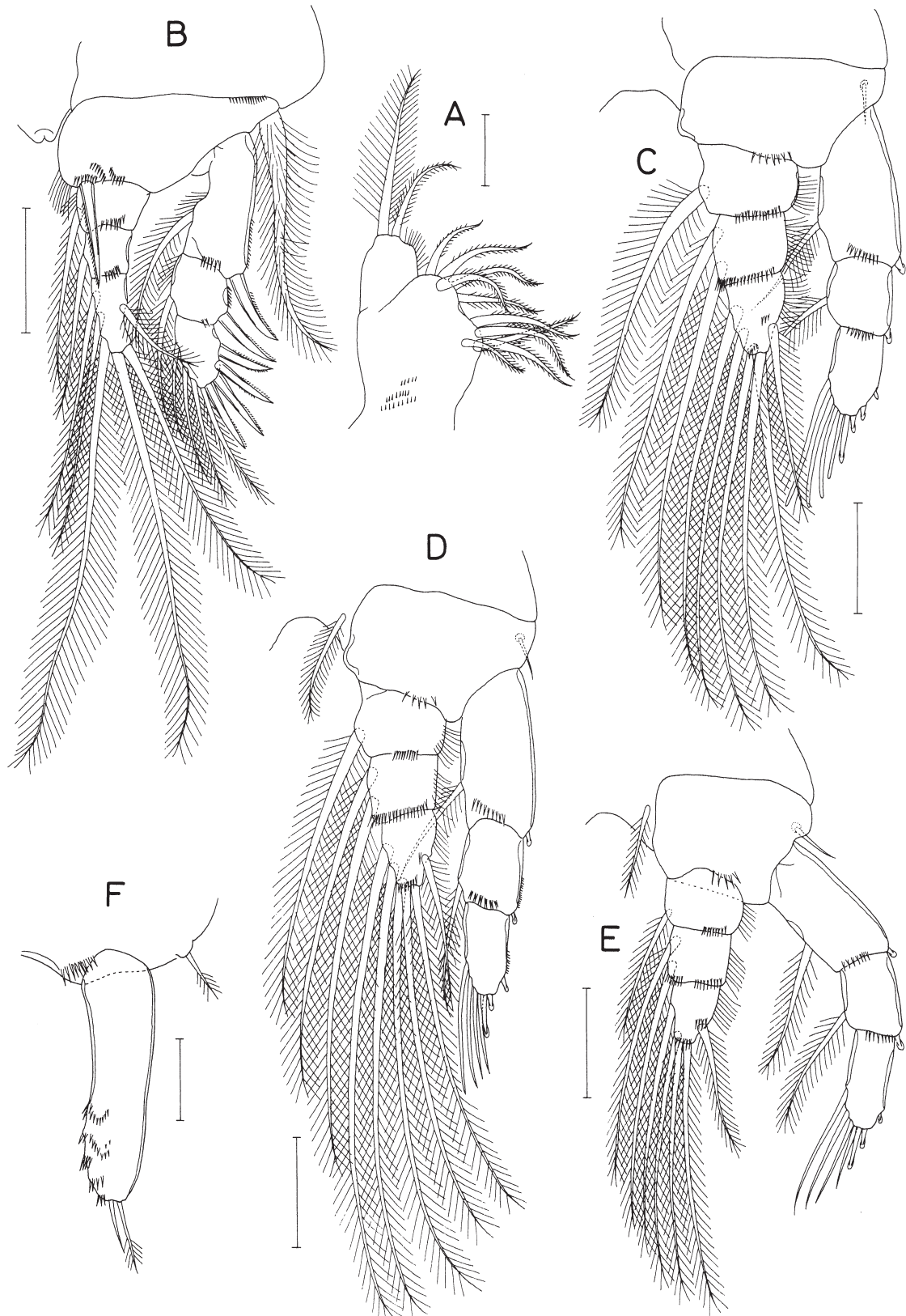
**Description of female.** Body (Fig. 159A) swollen, compressed, 3.00 mm long; prosome 2.50 mm long, consisting of incompletely defined cephalosome and metasome forming brood pouch. Metasome unsegmented, expanded dorsally with dorsoventral depth of 1.20 mm; bearing 3 lobate expansions ventrally, one at base of each of legs 2 to 4. Fifth pedigerous somite fused to metasome. Free urosome (Fig. 159B) broad, 5-segmented; all urosomites much wider than long; genital somite very short. Anal somite ornamented with patch of small spinules posteriorly on outer surface and 2 patches of fine granules dorsally on each side: anal operculum large. Caudal rami widely separated from each other, about 1.5 times longer than anal somite; each ramus tapering, with rounded distal margin (Fig. 159C); armed with 6 small setae; largest seta about half as long as maximum width of ramus; outer lateral and dorsal setae positioned at 40 and 70% of ramus length, respectively.

Rostrum (Fig. 159D) as long as wide (130×130 µm), almost triangular, narrowing abruptly in distal third. Antennule (Fig. 159E) small, 295 µm long and 8-segmented; armature formula 3, 16, 10+aesthetasc, 5, 2+aesthetasc, 2, 3, and 7+aesthetasc; first and second segments much broader than distal segments; articulations between distal 6 segments indistinct; all setae naked. Antenna (Fig. 159F) rather slender, 4-segmented; coxa short and unarmed; basis more than twice as long as wide, armed with 2 minute setal vestiges at outer distal corner; first endopodal segment about 1.8 times longer than wide (98×56 µm), armed with 1 small seta; compound distal endopodal segment about 3.5 times longer than wide (127×36 µm), distinctly narrower than first, armed with 9 small setae (distal 3 setae blunt at tip, not longer than



**FIGURE 159.** *Bonnierilla acollaris* Schellenberg, 1922, female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C-H, J, 0.05 mm; I, 0.02 mm.





**FIGURE 160.** *Bonnierilla acollaris* Schellenberg, 1922, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: A, F, 0.05 mm; B-E, 0.1 mm.

terminal claw) plus small terminal claw less than half as long as segment.

Labrum (Fig. 159G) ornamented with setules on posterior margin and posterolateral surfaces, and with densely spinulose posteromedian lobe. Mandible (Fig. 159H) with coxa bearing 5 major teeth and 2 small proximal setae, 1 small subsidiary tooth between first and second teeth, and 2 thin spinules between second and third teeth; basis with 1 seta mediodistally; exopod 4-segmented with 5 subequal setae; endopod 2-segmented with 4 and 9 setae on first and second segments, respectively; first endopodal segment broad. Maxillule (Fig. 159I) with 10 setae on arthrite, 1 broad, strongly tapering seta on coxal endite, 2 unequal setae on epipodite, 3 setae on medial margin of basis, and 4 setae each on exopod and endopod. Maxilla (Fig. 159J) 5-segmented; syncoxa with 4 (including small, needle-like distal seta), 1, 2, and 3 setae on first to fourth endites, respectively; basis with 1 slender claw plus 2 unequal setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 160A) incompletely 2-segmented; first segment with 10 setae (5 medial and 5 mediodistal) and ornamented with rows of minute spinules proximally; second segment narrow and ornamented with setules on medial margin, bearing 2 unequal apical setae.

Leg 1 (Fig. 160B) with 3-segmented rami: lacking inner coxal seta; basis with large outer seta almost as long as exopod, ornamented with setules on distal inner margin; inner distal spine 86 µm long, spinulose along medial margin and extending to distal border of second endopodal segment. Exopod about 1.4 times longer than endopod; first exopodal segment about twice as long as wide. Endopod narrow, tapering; 3 distal setae on third segment enlarged.

Legs 2–4 (Fig. 160C–E) with 3-segmented rami. Inner seta on coxa absent in leg 2, but present in legs 3 and 4. Outer seta on basis small and naked. Exopod about 1.4 times longer than endopod in leg 2, about 1.6 times longer in leg 3, and 1.7 times longer in leg 4. Outer and distal setae on exopods very small, blunt at tip; inner setae on third exopodal segment also small and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; II, I, 4	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 4	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 160F) consisting of short protopod and free exopodal segment; protopod bearing small outer distal seta and mediodistal row of spinules near base of exopod. Exopod about 3.5 times longer than wide (152×44 µm), slightly narrowing in middle, ornamented with 5 rows of spinules on medial surface and 2 small apical setae, inner

seta naked, outer seta 45 µm long, slightly longer than inner seta, pinnate distally.

**Male.** Not available.

**Remarks.** In the original description of *B. acollaris* by Schellenberg (1922) several diagnostic features of this species were recorded: (1) the last third of the lateral margin of the anal somite is spinulose; (2) the longest seta on the caudal ramus is half as long as the ramus is wide; (3) the proximal endite of the maxilla bears 4 elements; (4) all setation elements on the third exopodal segment of legs 1–4 are naked; (5) the third exopodal segments of legs 3 and 4 bear 2 outer spines and 1 apical spine plus 4 setae; and (6) the outer spines on the exopodal segments of the female leg 3 are very small (as figured by Schellenberg).

These morphological characteristics are all shared by our single specimen from Mozambique, supporting its identification as *B. acollaris*. This species was originally found in *Ascidia malaca* (Traustedt, 1883), *A. glabra* Hartmeyer, 1922 and *Ascidella aspersa* from the southwestern coast of Australia (Schellenberg, 1922).

### *Bonnierilla altera* Stock, 1967

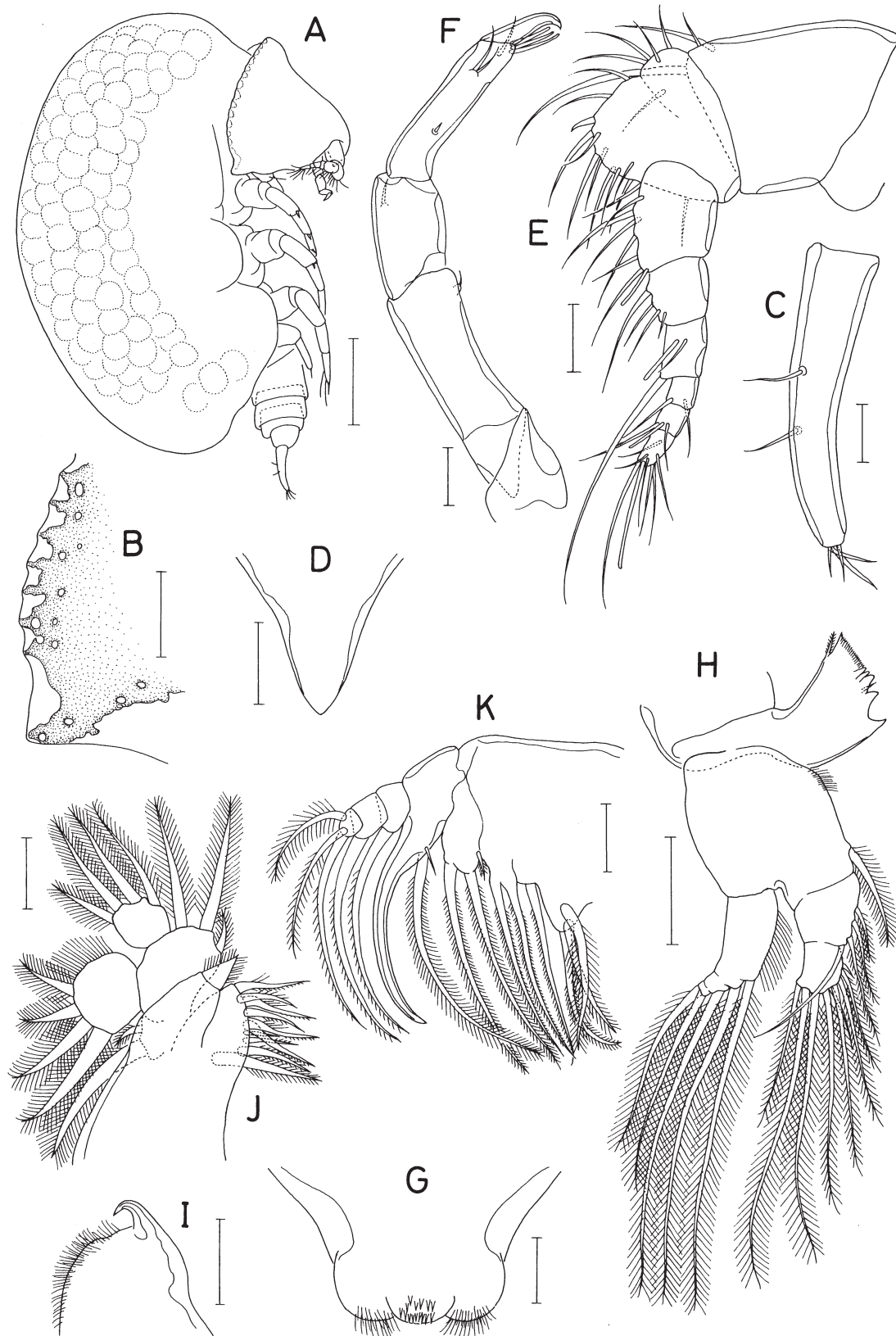
(Figs. 161, 162)

Syn: *Bonnierilla longipes*: Canu, 1892: 197, pl. 9, fig. 4-13, pl. 10, fig. 1.

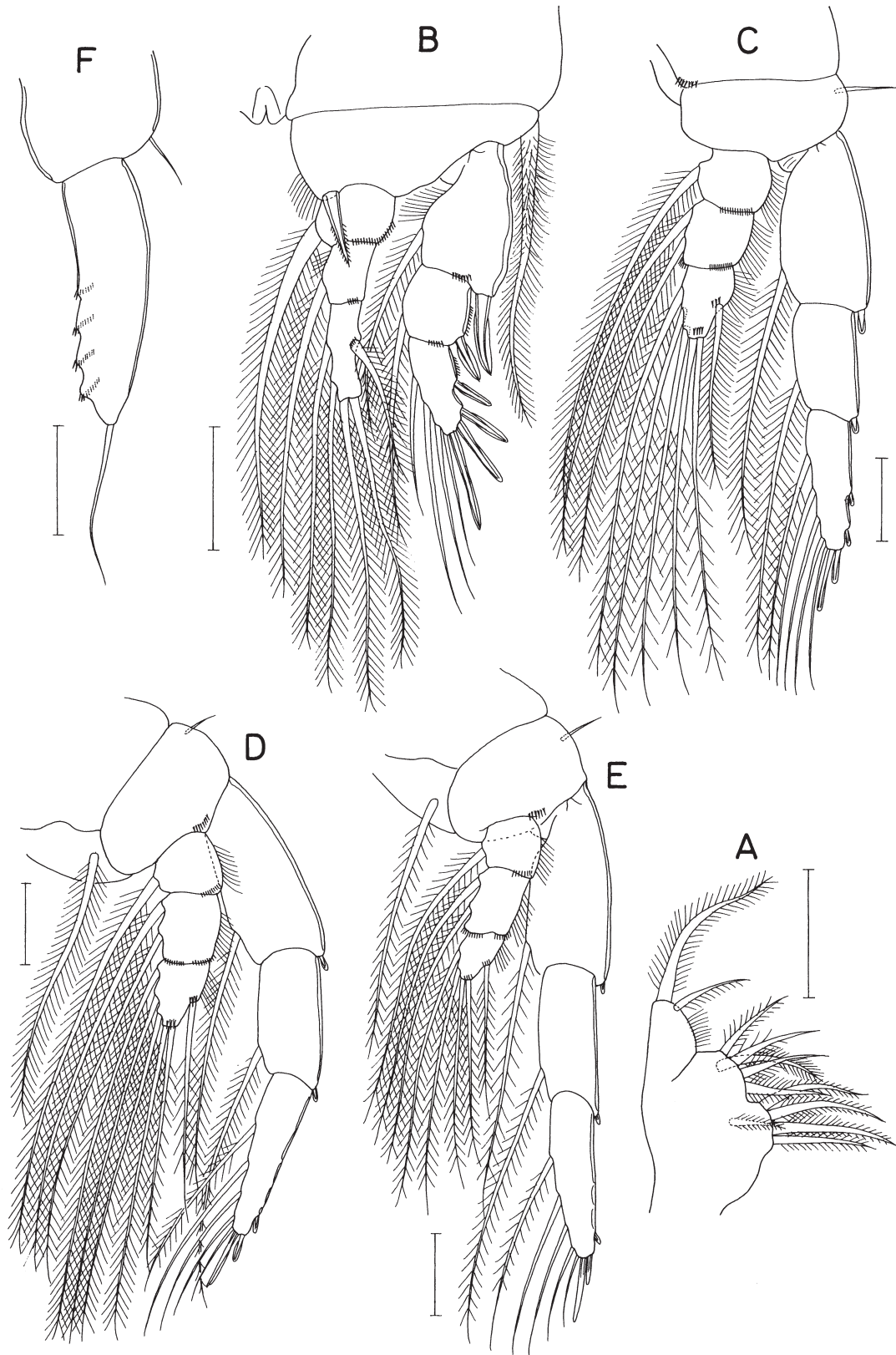
**Material examined.** 1 ♀ (MNHN-IU-2018-1839) and 1 dissected ♀ (figured) from *Polycarpa pomaria* (Savigny, 1816), Portugal.

**Description of female.** Body (Fig. 161A) compressed, 3.90 mm long. Prosome 3.32 mm long, consisting of well-defined cephalosome and inflated, unsegmented metasome. Posterior border of cephalosome extended to form sculptured flared “collar” overlapping anterior part of metasome; posterolateral corners of dorsal shield produced into blunt processes (Fig. 161A, B). Free urosome small and 5-segmented. Caudal ramus (Fig. 161C) curved ventrally and gradually narrowing distally, about 4.1 times longer than wide (261×63 µm); armed with 6 small, naked setae; outer lateral and dorsal setae positioned at 43 and 62% of ramus length, respectively; all setae shorter than width of ramus at base.

Rostrum (Fig. 161D) as long as wide, tapering steeply. Antennule (Fig. 161E) 380 µm long, 8-segmented; first and second segments expanded; armature formula 3, 16, 8+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked and thin. Antenna (Fig. 161F) slender, 4-segmented; short coxa unarmed; basis about 2.7 times longer than wide, with small tubercle at outer distal corner tipped with vestigial exopodal seta; first endopodal segment about 1.4 times longer than wide, with 1 small seta subdistally; compound distal endopodal segment 3.8 times longer than wide (141×37 µm), armed with 7 small setae (distal 3 blunt tipped) plus terminal claw about half as long as segment.



**FIGURE 161.** *Bonnierilla altera* Stock, 1967, female. A, habitus; B, right posterolateral corner of cephalosome; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule; K, maxilla. Scale bars: A, 0.5 mm; B, D, H, 0.1 mm; C, E-G, I-K, 0.05 mm.



**FIGURE 162.** *Bonnierilla altera* Stock, 1967, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.1 mm.

Labrum (Fig. 161G) with setules on posterior margin and spinules on posteromedial lobe. Mandible (Fig. 161H) with 5 teeth on coxal gnathobase; basis with 1 distal seta plus proximal tuft of setules on medial margin; exopod with 5 setae, distal 2 distinctly shorter than other 3; endopod incompletely articulated at base and between segments, armed with 4 and 8 setae on first and second segments, respectively; distalmost seta on first endopodal segment naked and proximalmost seta on second endopodal segment minute, spinule-like. Paragnath (Fig. 161I) with strongly curved, claw-like apical process. Maxillule (Fig. 161J) armed with 10 setae on arthrite, 1 broad seta on coxal endite, 2 unequal setae on epipodite, 3 on basis (proximal seta much smaller than distal 2), 4 each on exopod and endopod. Maxilla (Fig. 161K) 5-segmented; syncoxa with 9 setae (3, 1, 2, and 3); basis with smooth claw plus 1 large and 1 minute seta; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 162A) incompletely 2-segmented with 10 and 2 setae on first and second segments, respectively; setae on second segment unequal, smaller seta less than half as long as large seta.

Legs 1–4 (Fig. 162B–E) with 3-segmented rami. Inner coxal seta absent in legs 1 and 2, but large seta present in legs 3 and 4. Outer seta on basis large, slightly longer than exopod in leg 1, but small and naked in legs 2–4. Exopod about 1.4 times longer than endopod in leg 1 and more than twice as long in legs 2–4. Spines on exopods of legs 2–4 small and blunt at tip. Third exopodal segment of legs 2–4 tapering, slightly longer than second. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 162F) protopod bearing small, naked outer distal seta, lacking spinules on posterior border; exopodal segment digitiform and about 3.4 times longer than wide (235×69 µm), armed with 1 naked seta distally and ornamented with 5 rows of fine spinules on inner surface.

**Male.** Unknown

**Remarks.** The two females available in this study can be identified as *B. longipes* sensu Canu (1892), which was renamed by Stock (1967) as *B. altera*. Our specimens generally agree with Canu's illustrations in having similar body size, the flared "collar" of the dorsal shield covering the cephalosome, two very unequal setae on the second segment of the maxilliped, 5 setae on the third endopodal segment of leg 1, and the same shape of exopodal segment of leg 5. Canu mentioned that this copepod was very common in "*Cynthia lurida*" (the current valid name of this ascidian is not confirmable in WoRMS) at Boulogne

on the coast of France and co-occurred together with *Gunenotophorus globularis*, *Doropygus pulex* Thorell, 1859 and *Lichomolgus albens* Thorell, 1859. Interestingly, *B. altera*, *G. globularis*, and *D. pulex* all co-occurred in the ascidian *Polycarpa pomaria* in this study.

#### ***Bonnierilla mollia* Ho, 1984**

(Figs. 163, 164)

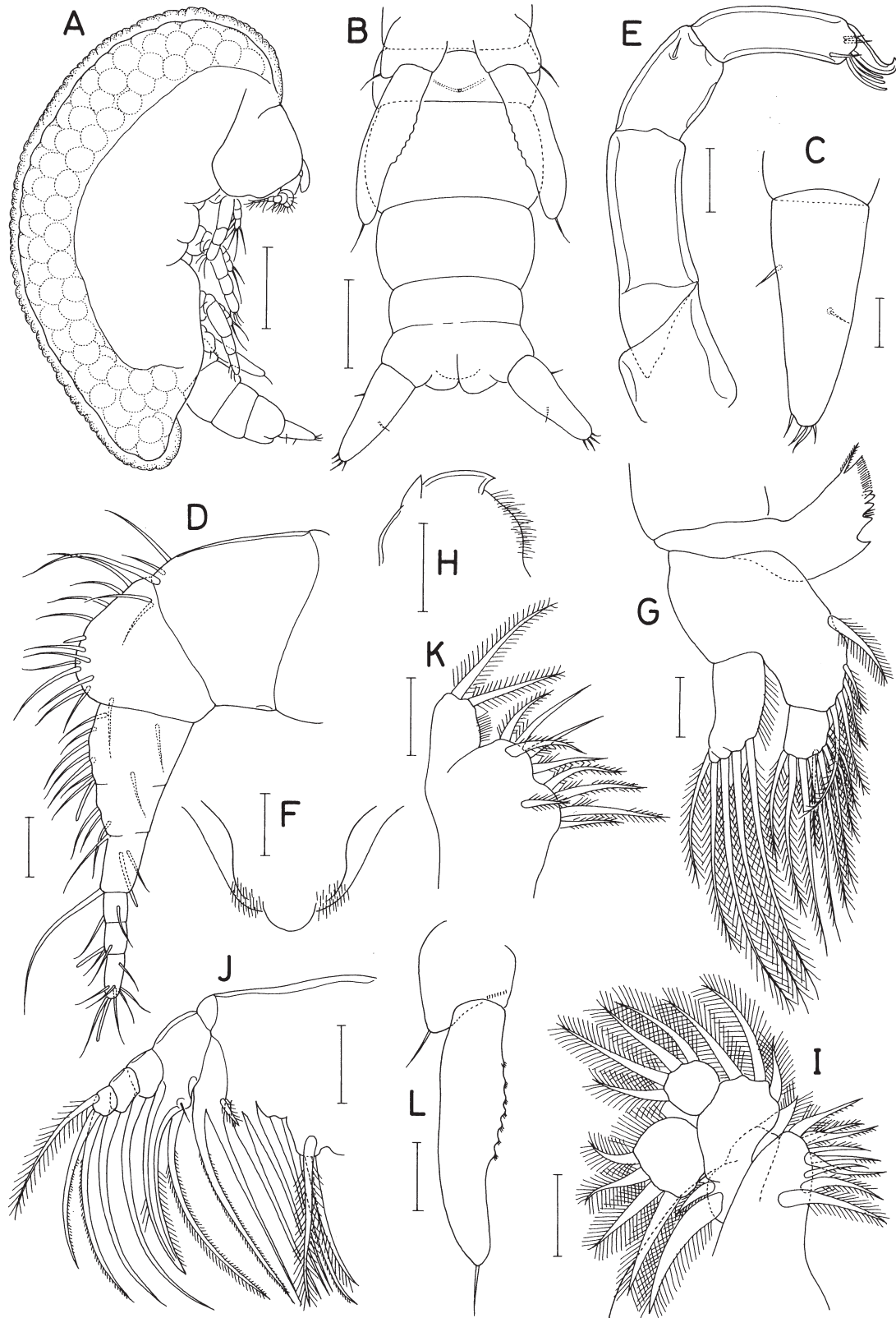
**Material examined.** 1 ♀ (dissected and figured) from *Polycarpa mytiligera* (Savigny, 1816), Chesterfield Corail II cruise, Stn DW164, (19°41.5'S 158°18.8'E), 2 August 1988.

**Description of female.** Body (Fig. 163A) compressed. Body length about 4.1 mm. Prosoma inflated lengthwise, consisting small cephalosome and unsegmented metasome. Metasome gradually narrowing in posterior half (in lateral view): cuticle soft, covered with mucus-like material. Free urosome (Fig. 163B) 5-segmented; articulation between last 2 abdominal somites obscure. Caudal rami divergent and widely separated from each other; each ramus (Fig. 163C) tapering, about 2.3 times longer than wide (233×100 µm), armed with 6 small naked setae; outer lateral and dorsal setae located at 31 and 49% of ramus length, respectively.

Rostrum weakly defined, destroyed during dissection. Antennule (Fig. 163D) 6-segmented, third segment bearing traces of 2 segmental articulations; armature formula 3, 15, 15+2 aesthetascs, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna 4-segmented (Fig. 163E); coxa and basis unarmed; first endopodal segment with 1 small seta subdistally; compound distal endopodal segment about 3 times longer than wide, armed with 6 small setae plus small terminal claw less than half length of segment.

Labrum (Fig. 163F) with prominent, naked posteromedial lobe; posterolateral surfaces setulose. Mandible (Fig. 163G) with 5 teeth and 1 proximal seta on coxal gnathobase; basis and first endopodal segment fused, armed with 5 setae (arranged 1 + 4); second endopodal segment with 9 setae; exopod with 5 setae, 2 distal setae unequal in length, both shorter than other 3. Paragnath (Fig. 163H) bearing 2 dentiform processes apically. Maxillule (Fig. 163I) as usual for genus: 9 setae on arthrite, 3 on basis, and 4 each on exopod and endopod. Maxilla (Fig. 163J) 5-segmented; syncoxa with 9 setae (3, 1, 2, and 3), basis with spinulose claw plus 2 setae (1 minute); endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 163K) incompletely 2-segmented with 10 setae on first segment and 2 on second.

Legs 1–4 with 3 segmented rami (Fig. 164A–C). Leg 1 as usual for genus. Inner coxal seta present only in legs 3 and 4. Exopods of legs 2–4 swollen, more than twice as long as endopods, and characteristically armed only with inner setae, lacking outer and distal spines.



**FIGURE 163.** *Bonnierilla mollia* Ho, 1984, female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule; J, maxilla; K, maxilliped; L, leg 5. Scale bars: A, 0.5 mm; B, 0.2 mm; C-K, 0.05 mm; L, 0.1 mm.

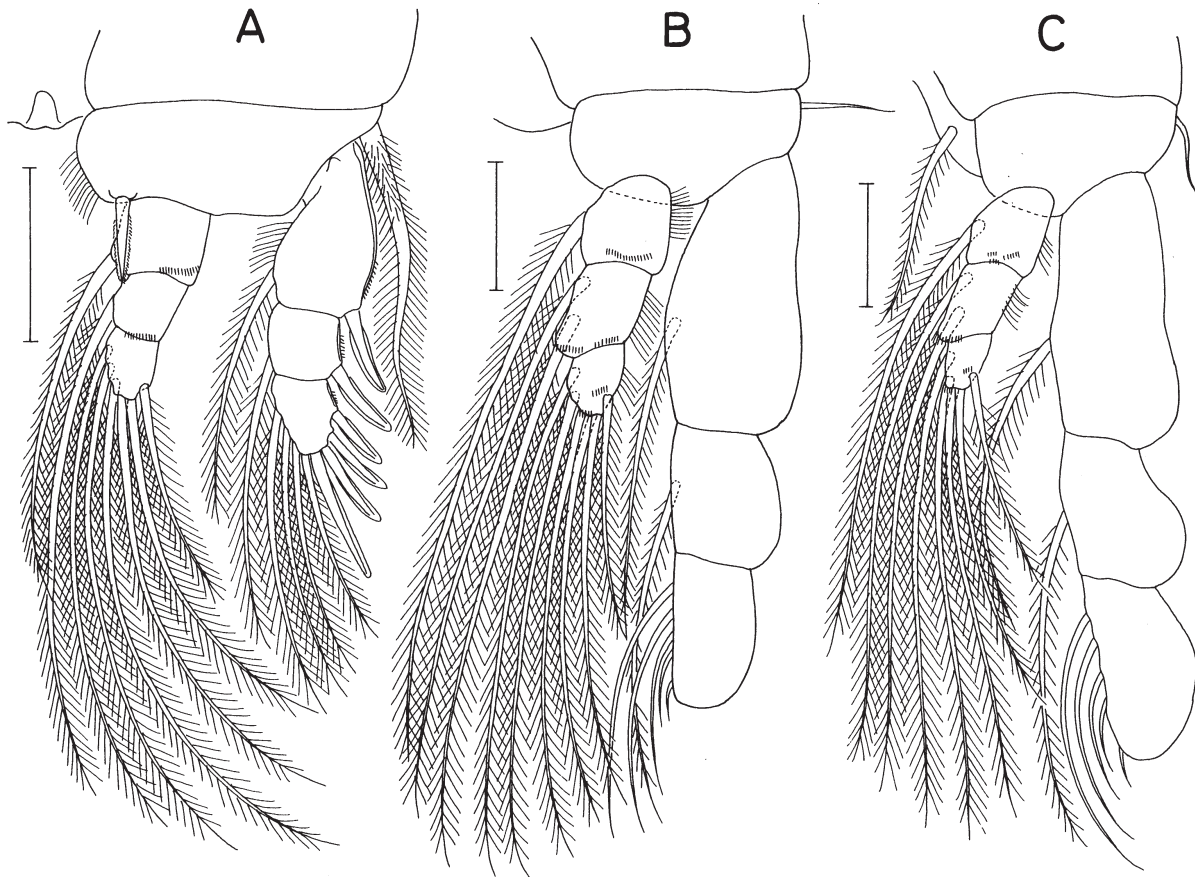


FIGURE 164. *Bonnierilla mollia* Ho, 1984, female. A, leg 1; B, leg 2; C, leg 4. Scale bars: 0.1 mm.

Third exopodal segment of legs 2–4 with rounded outer and distal margins. Endopods of legs 2–4 not extending beyond distal border of first exopodal segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-0; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	0-1; 0-1; 0, 0, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	0-1; 0-1; 0, 0, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	0-1; 0-1; 0, 0, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 163L) 2-segmented; protopod short with small, thin outer distal seta and inner distal row of minute spinules; exopodal segment about 4 times longer than wide (389×98 μm), widest at proximal third; armed with 1 small, thin apical seta, and ornamented with 7 groups of minute spinules along inner margin.

**Male.** Unknown.

**Remarks.** This species is characterised by the lack of outer spines on the exopods of legs 2–4. No significant differences were found between the original description of this species by Ho (1984) and our single female from New Caledonia. The type locality of this species is Sado Island in Japan.

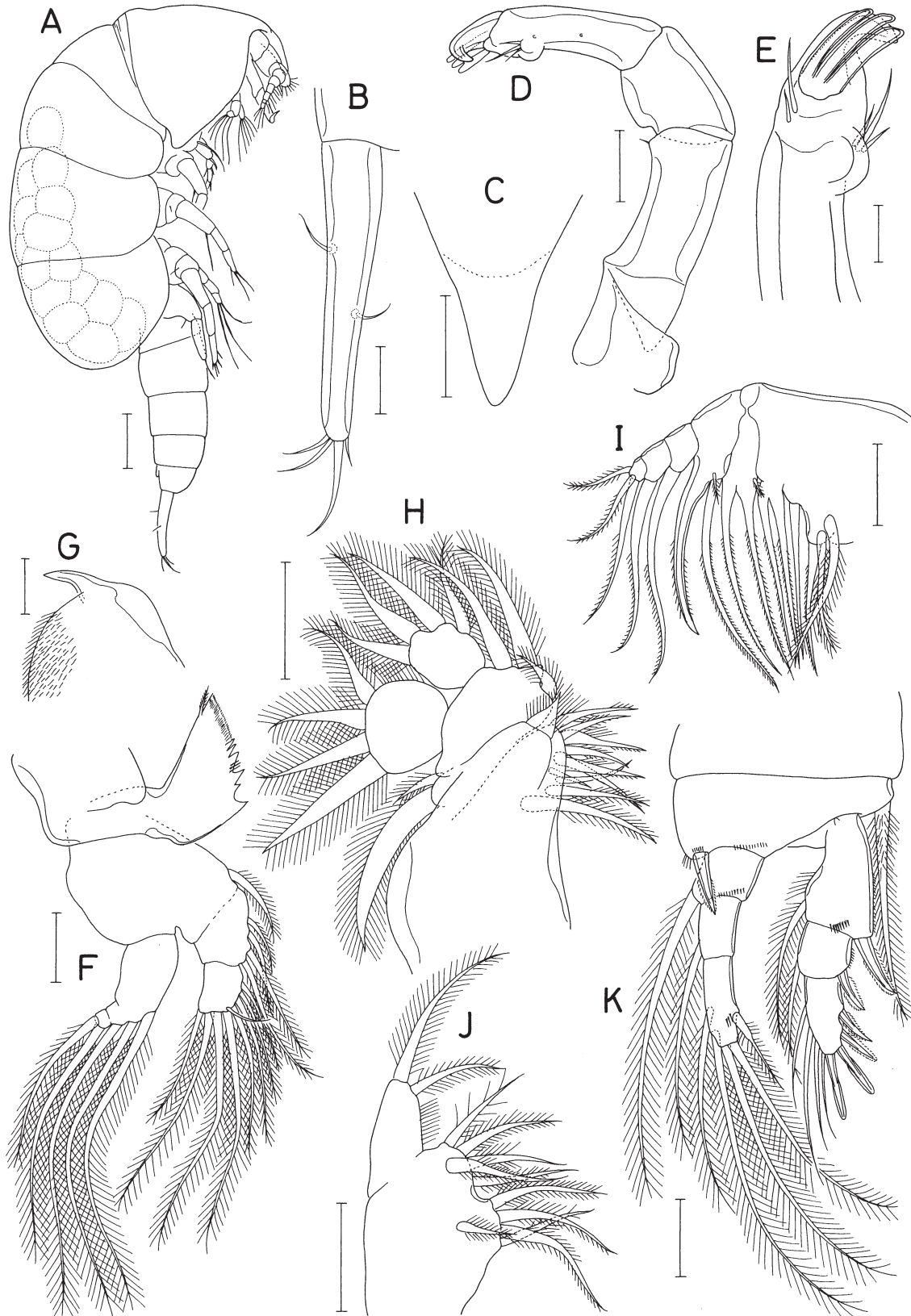
***Bonnierilla similis* Illg & Dudley, 1961**

(Figs. 165, 166)

**Material examined.** 6 ♀♀ (MNHN-IU-2018-1840) and 1 dissected ♀ (figured) from *Pyura microcosmus* (Savigny, 1816), Taureau, Roscoff, France.

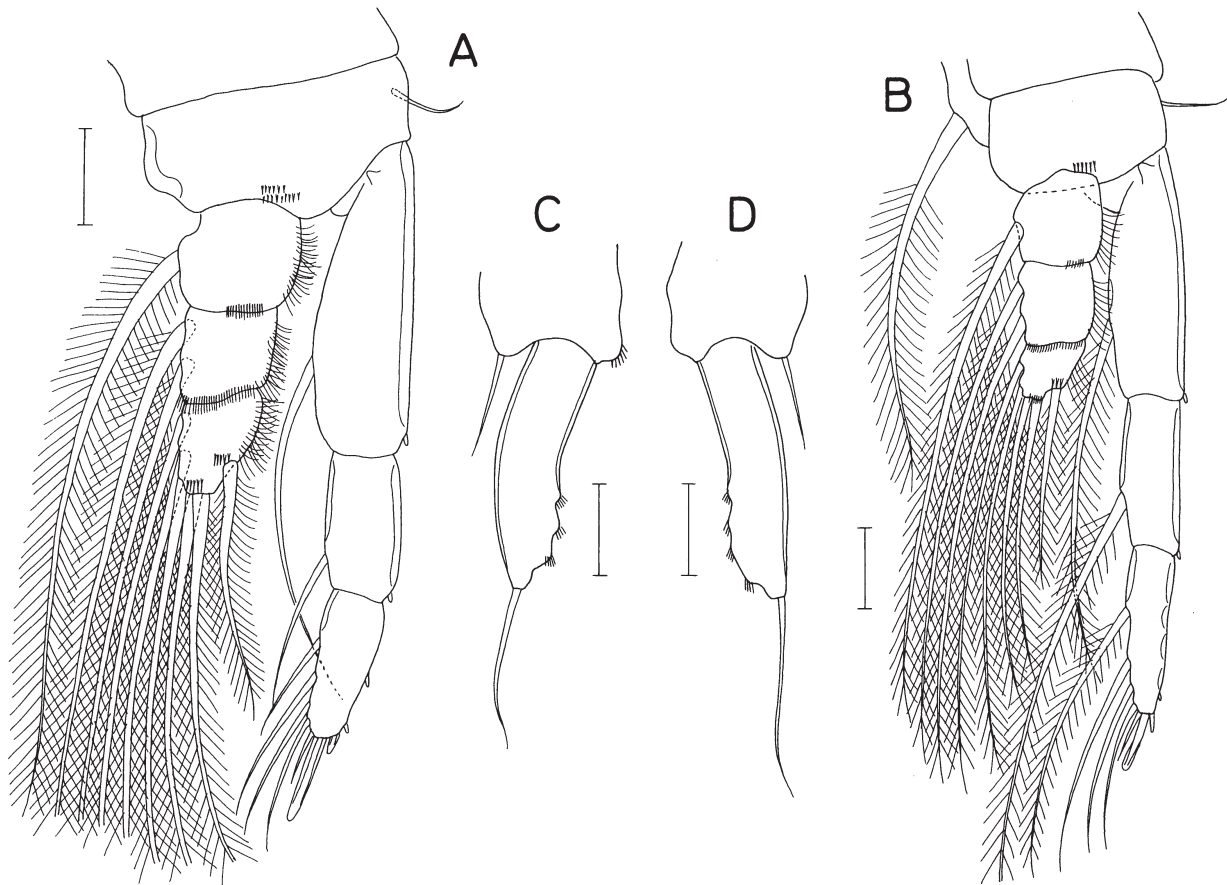
**Description of female.** Body (Fig. 165A) compressed, 2.58 mm long. Cephalosome produced into blunt projections at posterolateral corners of dorsal shield. Metasome consisting of well-defined first to fourth pedigerous somites in unexpanded specimen; greatest dorsoventral depth of metasome 0.55 mm. Free urosome 5-segmented: 4 abdominal somites becoming gradually shorter and narrower posteriorly. Caudal ramus (Fig. 165B) elongate, slightly curved ventrally, gradually narrowing distally and 4.8 times longer than wide (226×47 μm); armed with 6 naked setae, outer lateral and dorsal setae located at 37 and 58% of ramus length, respectively; longest distal seta about 0.35 times as long as ramus.

Rostrum (Fig. 165C) longer than wide, tapering. Antennule 8-segmented; first and second segments much broader than distal 6 segments; setation not elucidated due to damage to specimens. Antenna (Fig. 165D) 4-segmented; last segment (compound distal endopodal



**FIGURE 165.** *Bonnierilla similis* Illg & Dudley, 1961, female. A, habitus, right; B, caudal ramus; C, rostrum; D, antenna; E, distal part of antenna; F, mandible; G, parnath; H, maxillule; I, maxilla; J, maxilliped; K, leg 1. Scale bars: A, 0.2 mm; B, D, F, H-K, 0.05 mm; C, 0.1 mm; E, G, 0.02 mm.





**FIGURE 166.** *Bonnierilla similis* Illg & Dudley, 1961, female. A, leg 2; B, leg 4; C, right leg 5; D, left leg 5. Scale bars: 0.05 mm.

segment) forming broad, rounded subdistal tubercle armed with 3 setae, distal margin with 5 setae, 3 equal in length, broad, rod-shaped, and fused at base (Fig. 165E); terminal claw short and stout.

Labrum not examined. Mandible (Fig. 165F) 5 teeth, 1 subsidiary tooth between distal first and second teeth; basis with 1 medial seta; exopod with 3 long proximal setae and 2 unequal, shorter setae distally; endopod obscurely articulated with basis, armed with 4 and 9 setae on first and second segments, respectively. Paragnath (Fig. 165G) with large, claw-like apical process. Maxillule (Fig. 165H) as usual for genus, but arthrite bearing 10 setae; seta on coxal endite broad; proximal seta on basis much shorter than distal 2. Maxilla (Fig. 165I) also as usual for genus; 9 setae on syncoxa arranged as 3, 1, 2, and 3; claw on basis finely spinulose along both margins; 3 endopodal segments with 1, 1, and 3 setae, respectively. Maxilliped (Fig. 165J) incompletely 2-segmented with 10 setae on first segment and 2 unequal setae on second.

Legs 1–4 with 3-segmented rami (Fig. 165K, 166A, B). Inner coxal seta absent in legs 1 and 2, but large seta present in legs 3 and 4. Outer seta on basis slightly shorter than exopod in leg 1 and very small in legs 2–4. Inner

distal spine on basis of leg 1 slightly longer than first endopodal segment. Exopod twice as long as endopod in legs 2 and 3, and about 2.4 times longer than endopod in leg 4. Outer spines on exopods of legs 2–4 very small, mostly rudimentary. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 166C, D) comprising short protopod and free exopod; protopod with naked outer distal seta; exopod with naked seta on apex plus 3 or 4 groups of spinules on inner margin; in dissected specimen left exopod more slender than right, 4.24 times longer than wide (144×34 μm); right exopod 3.68 times longer than wide (140×38 μm); apical seta slightly shorter than exopodal segment.

**Male.** Unknown.

**Remarks.** This species has a characteristic feature that serves to differentiate it from all of its congeners, the

3 strong rod-shaped distal setae on the distal margin of the antenna. Originally this species was reported from *Pyura squamulosa* Alder, 1863 collected on the Mediterranean coast of France (Illg & Dudley, 1961). Holmes & Gotto (1987) subsequently reported it from Irish waters.

***Bonnierilla iboensis* sp. nov.**

(Figs. 167–169)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21281), paratypes (intact, 2 ♀♀, 2 ♂♂, MNHN-IU-2014-21282), and dissected paratypes (1 ♀, 1 ♂, figured), from *Styela canopus* (Savigny, 1816) (MNHN-IT-2008-8134 = MNHN S1/STY/273), AURACEA 1995, Matemo cliff, Ibo Island, Mozambique, depth 10–20 m, C. Monniot coll., 18 November 1995.

**Etymology.** The specific name refers to the type locality, Ibo.

**Description of female.** Body (Fig. 167A) stout, compressed; length 2.16 mm. Prosome 1.47 mm long, consisting of cephalosome and unsegmented metasome with rounded posterior margin. Free urosome (Fig. 167B) 5-segmented, narrowing only slightly posteriorly; lengths of somites from genital to anal somite 106, 182, 120, 90, and 90 µm. Caudal ramus (Fig. 167C) elongate, curved ventrally, tapering, about 4.6 times longer than wide (206×45 µm) and more than twice as long as anal somite; armed with 6 naked setae, all setae shorter than width of ramus at base; outer lateral and dorsal setae located at 35 and 54% of ramus length, respectively.

Rostrum (Fig. 167D) longer than wide (130×109 µm) with rounded apex. Antennule (Fig. 167E) 320 µm long, 8-segmented; first and second segments much broader than distal segments; armature formula 3, 16, 8+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 167F) slender, 4-segmented; coxa short and unarmed; basis with 1 tiny vestigial seta distally; first endopodal segment with convex outer margin and 1 subdistal seta; compound distal endopodal segment about 3.3 times longer than wide (95×29 µm) and 1.7 times longer than first; armed with 8 setae (all shorter than terminal claw and distal 3 setae with blunt tip) plus terminal claw, half as long as segment.

Labrum (Fig. 167G) with setulose posteromedial lobe and posterior margin. Mandible (Fig. 167H) with 5 teeth on cutting margin of coxa; basis with 1 medial seta; exopod 2-segmented, armed with 2 and 3 setae on first and second segments, respectively; endopod with 4 and 9 setae on first and second segments, respectively. Paragnath (Fig. 168A) with acute apical process. Maxillule (Fig. 167I) with 9 setae on arthrite, 1 broad seta on coxal endite, 2 on epipodite, 3 on basis, and 4 each on exopod and endopod. Maxilla (Fig. 167J) 5-segmented, with 9 setae (3, 1, 2, and 3) on syncoxa, claw plus 2 setae on basis, and 1, 1, and 3 setae on first to third endopodal segments, respectively.

Maxilliped (Fig. 168B) unsegmented with broad proximal and narrow distal parts, armed with 10 medial and 2 apical setae.

Legs 1–4 with 3-segmented rami (Fig. 168C–E); exopod about 1.3 times longer than endopod in leg 1, about 1.7 times longer in legs 2 and 3, and twice as long in leg 4. Inner coxal seta absent in legs 1 and 2 but present in legs 3 and 4. Outer seta on basis large, pinnate in leg 1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 extending to distal border of second endopodal segment, 73 µm long. Outer spines on exopods of legs 2–4 rudimentary or absent on some segments. All setae on third exopodal segments of legs 2–4 naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-I; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; I, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 168F) 2-segmented; short protopod with outer distal seta and inner distal row of small spinules; exopodal segment tapering markedly, about 2.5 times longer than wide (136×55 µm), with apical seta plus rudimentary seta distally, and ornamented with 3 rows of minute spinules on inner margin.

**Description of male.** Body (Fig. 169A) narrow, 1.25 mm long. Prosome consisting of dorsoventrally depressed cephalosome and 4-segmented cylindrical metasome. Urosome (Fig. 169B) 6-segmented: fifth pedigerous somite well-defined, wider than genital somite; genital somite 93×166 µm, with well-developed genital opercula; 4 abdominal somites gradually narrower and shorter, 107×114, 90×108, 52×95, and 45×84 µm, respectively. Caudal ramus (Fig. 169C) about 6 times longer than wide (145×24 µm) and about 3.2 times longer than anal somite; outer lateral and dorsal setae positioned as in female.

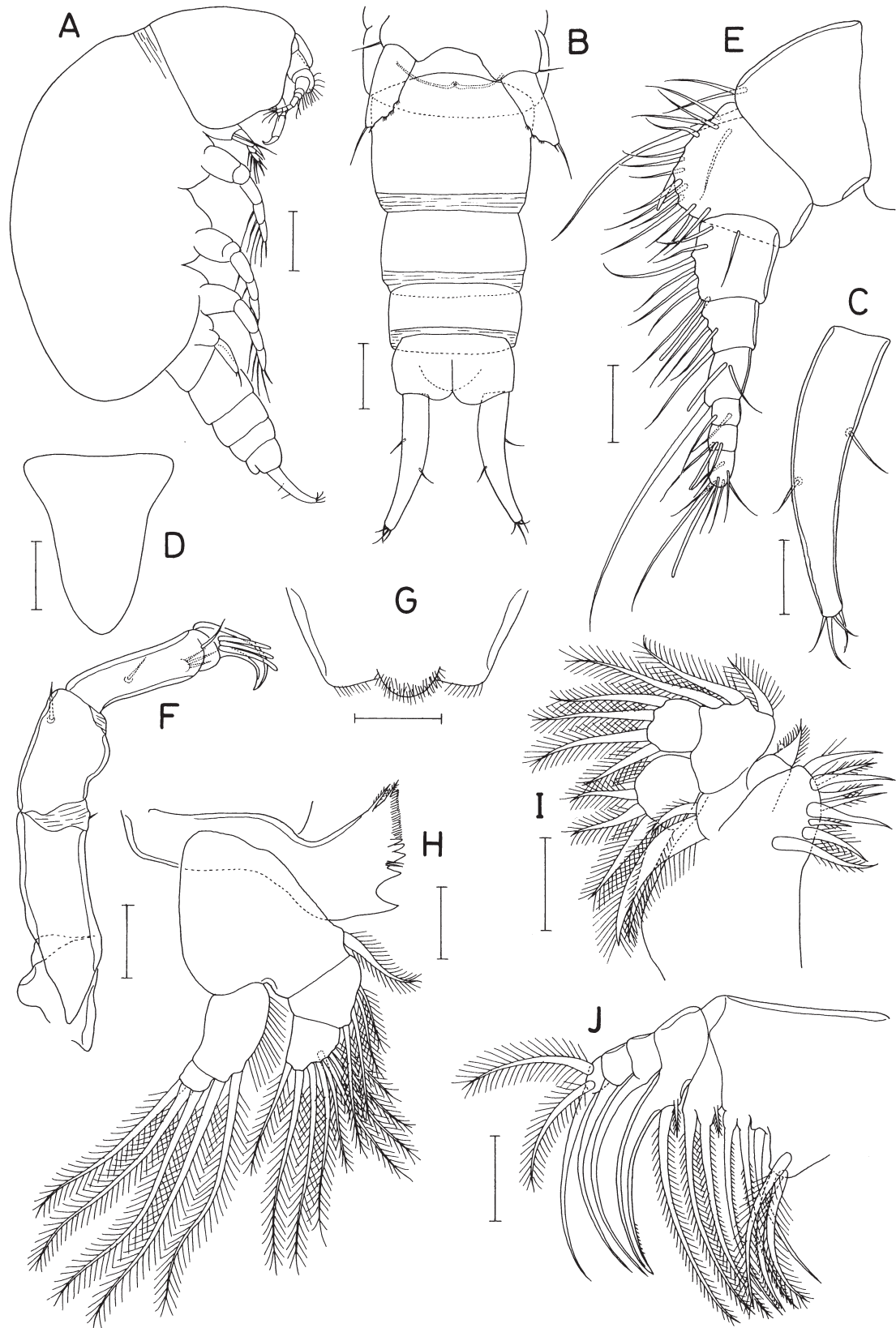
Rostrum, antennule, antenna, labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 169D) unsegmented as in female, but armed with 8 medial and 2 apical setae.

Leg 1 as in female. Legs 2–4 (Fig. 169E–G) with well-developed outer spines on exopods. Exopod 1.6 times longer than endopod in legs 2 and 3, and 1.9 times longer in leg 4. Armature formula for legs 2–4 as follows:

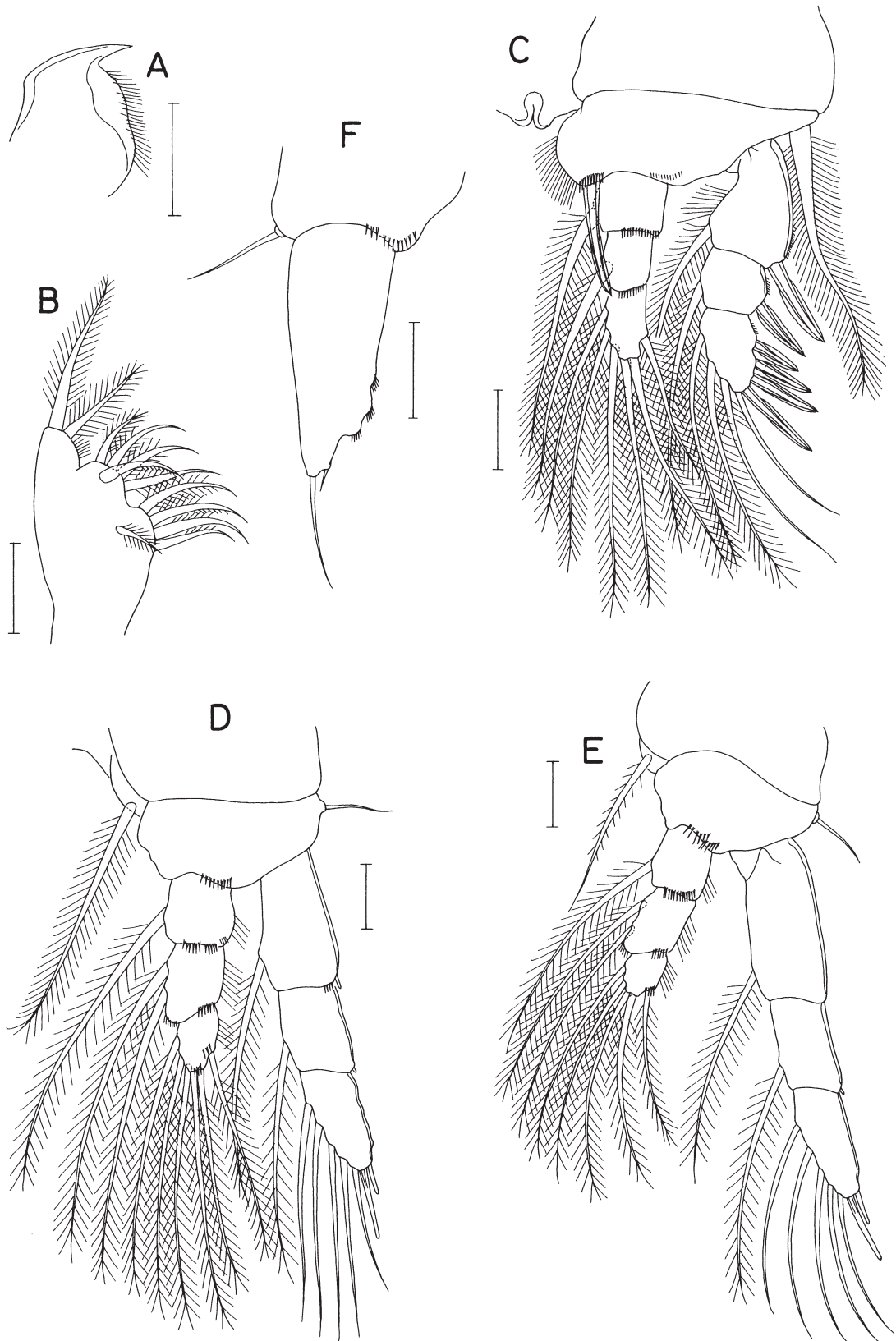
	Coxa	Basis	Exopod	Endopod
Leg 2	0-0	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 169B) as in female. Leg 6 (Fig. 169B) represented by 2 naked setae on genital operculum.

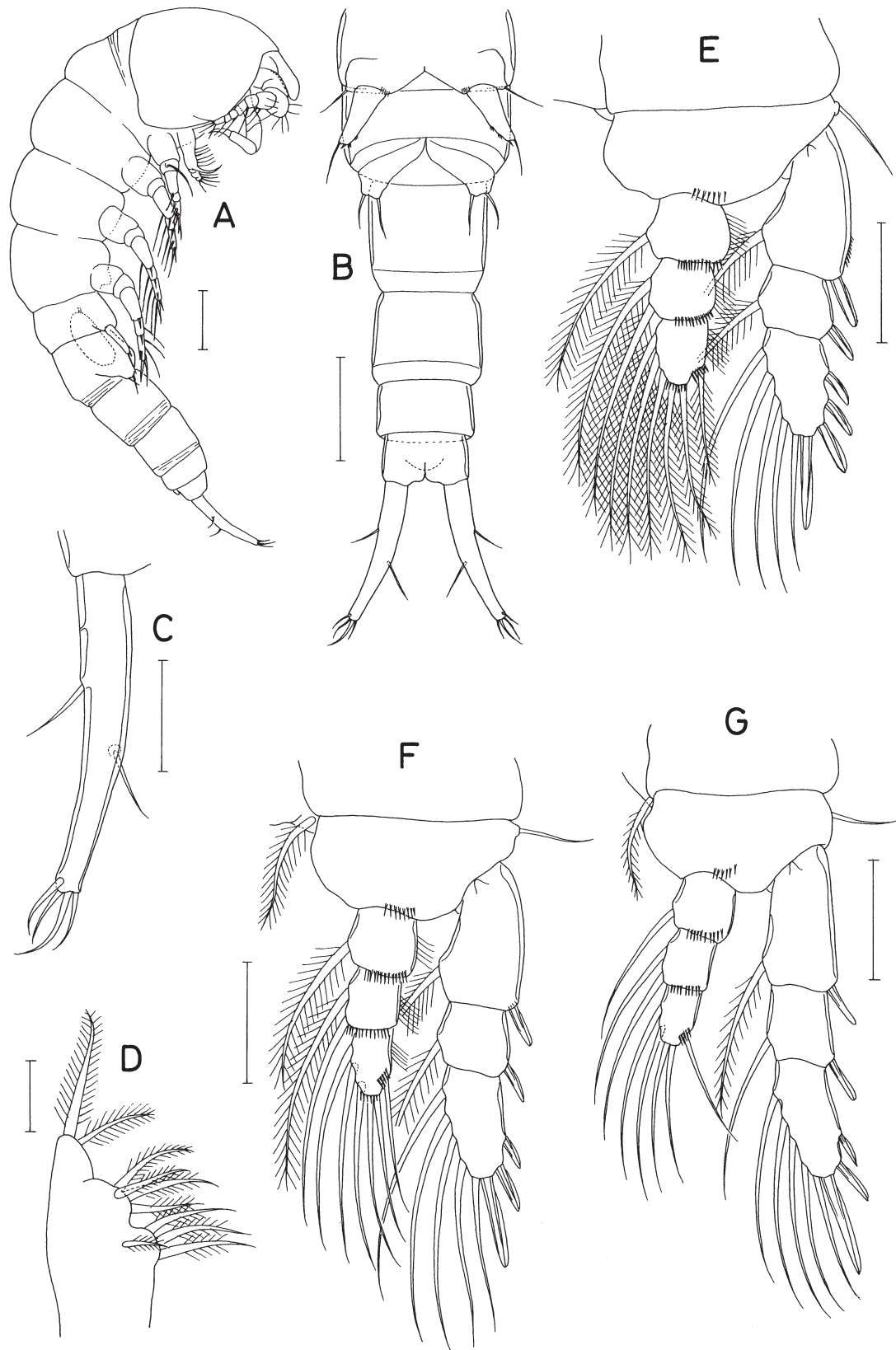
**Remarks.** *Bonnierilla iboensis* sp. nov. has the typical morphological features of *Bonnierilla*, i.e., the



**FIGURE 167.** *Bonnierilla iboensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.2 mm; B, 0.1 mm; C-J, 0.05 mm.



**FIGURE 168.** *Bonnierilla iboensis* **sp. nov.**, female. A, paragnath; B, maxilliped; C, leg 1; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.05 mm.



**FIGURE 169.** *Bonnierilla iboensis* sp. nov., male. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, maxilliped; E, leg 2; F, leg 3; G, leg 4. Scale bars: A, B, 0.1 mm; C, E-G, 0.05 mm; D, 0.2 mm.

mandible has 4 setae on the first endopodal segment and 9 setae on the second; the maxillule bears 4 setae each on the exopod and endopod; the maxilliped of the female has 10 medial and 2 apical setae; the inner coxal seta is absent in legs 1 and 2 but present in legs 3 and 4; the third endopodal segment of leg 1 bears 6 setae; and the endopod of leg 4 is armed with 1, 2, and 5 elements respectively on the first to third segments.

Eleven previously described species are valid within the genus *Bonnierilla*, of which only three species (*B. acollaris*, *B. mollia* and *B. similis*) have the endopod of the mandible armed with 4 and 9 setae on the first and second segments, respectively, plus the maxillule bearing 4 setae on both the exopod and endopod, as in *B. iboensis* **sp. nov.** (see Table 4). *Bonnierilla similis* can be distinguished from *B. iboensis* **sp. nov.** by its characteristic antennal setation and by the possession of 5 setae on the third endopodal segment of leg 1 (rather than 6 as in the new species). The two remaining species can also be readily differentiated from the new species: *B. acollaris* has more than two spines on the third exopodal segments of legs 2–4 (whereas the new species has only 2 spines), and a digitiform exopodal segment of leg 5 rather than a tapering segment as in *B. iboensis* **sp. nov.** *Bonnierilla mollia* has inflated exopods of legs 2–4 which are devoid of any spines, whereas the exopods of the new species are not inflated and all segments are armed with outer spines. These differences are sufficient to justify the establishment of the new species.

***Bonnierilla reniformis* sp. nov.**  
(Figs. 170, 171)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21283) from *Styela canopus* (Savigny, 1816) (MNHN-IT-2008-XXXX = MNHN S1/STY/316), ATIMO VATAE TR16, Madagascar (24°59'S, 47°05'E), depth 15–17 m, MNHN coll., 09 May 2010.

**Etymology.** The specific name is derived from the Latin *ren*, meaning kidney, and refers to kidney-shaped body of the new species, as is typical in the genus *Bonnierilla*.

**Description of female.** Body (Fig. 170A) stout, compressed; length 3.46 mm. Prosome inflated, 2.84 mm long, consisting of well-defined cephalosome and unsegmented metasome. Free urosome (Fig. 170B) 5-segmented, narrowing posteriorly: genital somite short, obscurely defined from metasome; 4 abdominal somites 254×335, 154×285, 96×238, and 104×223 µm, respectively. Caudal rami widely separated from each other; each ramus (Fig. 170C) about 3.4 times longer than wide (211×63 µm) and twice as long as anal somite, widest at proximal quarter, with straight outer margin and proximally convex inner margin: armed with 6 naked setae, all shorter than width of ramus; outer lateral and

dorsal setae located at 37 and 62% of ramus length, respectively.

Rostrum (Fig. 170D) wider than long, 144×152 µm, tapering slightly proximally and strongly distally. Antennule (Fig. 170E) 403 µm long, 6-segmented; terminal segment with traces of 2 articulations; first and second segments broad; armature formula 3, 16, 9+aesthetasc, 4, 2+aesthetasc, and 11+aesthetasc; setae mostly small, all naked. Antenna (Fig. 170F) slender, 4-segmented; coxa short and unarmed; basis about 2.6 times longer than wide and armed with 2 minute vestigial setae distally; first endopodal segment slightly longer than wide, with convex outer margin, armed with 1 small seta subdistally; compound distal endopodal segment about 3.6 times longer than wide (115×32 µm); armed with 9 small setae plus strongly curved terminal claw, about half as long ent.

Labrum (Fig. 171A) setulose posteriorly and with weakly pronounced, spinulose posteromedian lobe. Mandible (Fig. 170G) bearing 3 teeth and 1 small seta on coxal gnathobase; basis with 1 medial seta; exopod with 5 setae, outer distal seta about half as long as other 4; endopod with 4 and 9 setae on first and second segments, respectively. Maxillule (Fig. 170H) with 9 setae on arthrite, 1 broad seta on coxal endite, 2 on epipodite, 3 on basis (proximal seta about one-third as long as distal 2), and 3 each on exopod and endopod. Maxilla (Fig. 170I) armed with 3, 1, 2, and 3 setae on first to fourth endites of syncoxa, basis with claw plus 1 seta; and 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 171B) unsegmented, but divisible into broad proximal and narrow distal parts bearing 10 and 2 setae, respectively.

Legs 1–4 (Figs. 171C–F) with 3-segmented rami. Inner seta on coxa absent in legs 1 and 2, but present in legs 3 and 4. Outer seta on basis well-developed (shorter than exopod) in leg 1, but small in legs 2–4. Inner distal spine on basis of leg 1 naked, 77 µm long, extending beyond middle of second endopodal segment. Exopod about 1.7 times longer than endopod in leg 2, about 1.8 times longer in leg 3, and twice as long in leg 4. Outer spines on exopodal segments of legs 2–4 vestigial or absent. All inner setae on third exopodal segment of legs 2–4 naked. Armature formula for legs 1–4 as follows:

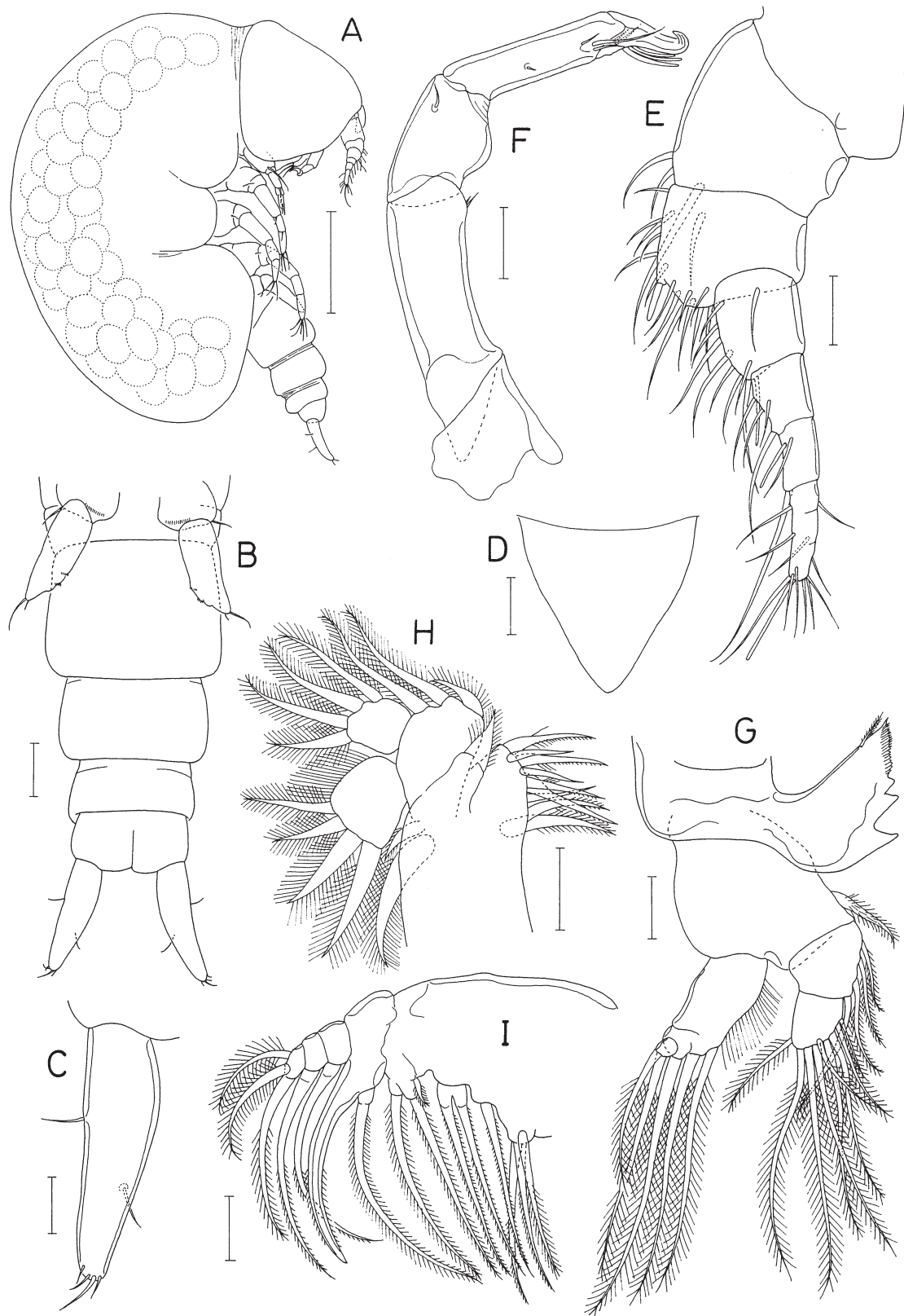
	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-I; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	0-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 171G) very similar to that of *B. iboensis* **sp. nov.**; exopodal segment about 2.7 times longer than wide (203×74 µm), armed with 2 unequal setae distally; segment with 4 rows of minute spinules on inner margin.

**Male.** Unknown.

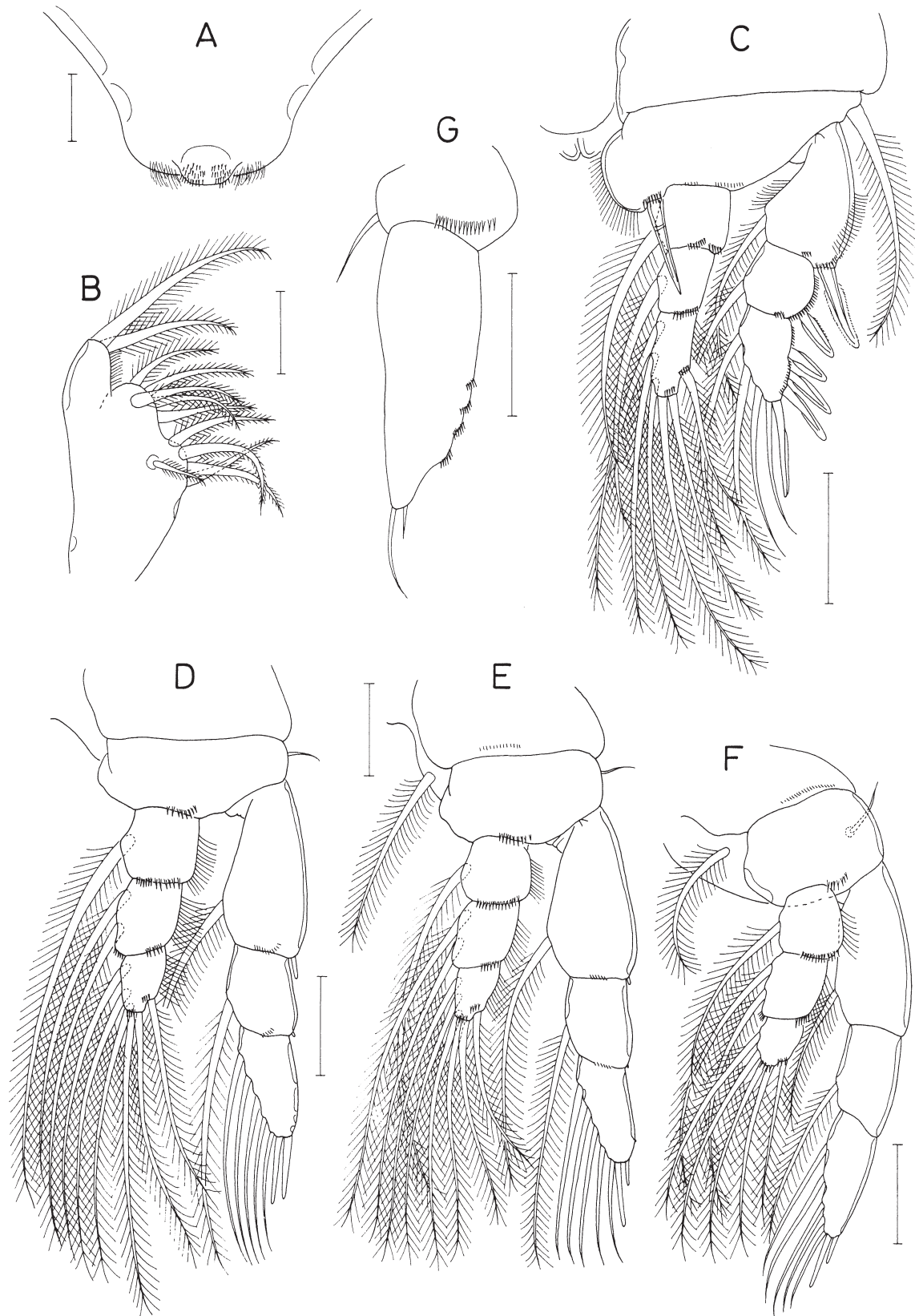
**TABLE 4.** Characteristics of species of *Bonnierilla* and *Nobinerilla* **gen. nov.** Abbreviations: A, asymmetrical; A1, antennule; A2, antenna; ba, basis; C, claw; CR, caudal ramus; cx, coxa; enp, endopod; exp, exopod; fur, furrow; L:W, length to width ratio; Met, metasoma; Mnd, mandible; Mx, maxilla, Mx1, maxillule; Mxp, maxilliped; P3-5, legs 3 to 5; s, vestigial seta; S, symmetrical; seg, segment; set, setae; sym, symmetry; ter, terminal segment; wng, wings; X, absent; + present.

Species	Met wng	CR set	CR L:W	Mnd enp	Mx1 exp	Mx1 enp	Mx enp3	Mx Prx	Mxp	P sym	P1 cx	P2 cx	P3 cx	P4 cx	P1 ba	P1 exp2	P1 enp3	P4 enp	P5 L:W	P5 set
<b><i>Bonnierilla</i></b>																				
<i>B. acollaris</i> Schellenberg, 1922	X	6	2.9	4-9	4	4	3	3+s	10-2	S	X	X	+	+	+	I-1	6	125	3.5	2
<i>B. altera</i> Stock, 1967	X	6	4.1	4-9	4	4	3	3+s	10-2	S	X	X	+	+	+	I-1	5	125	3.4	1
<i>B. brevipes</i> Schellenberg, 1922	X	6	-	3-?	3	3	3	2	9-2	S	X	-	-	-	+	I-1	-	-	-	1
<i>B. curvicaudata</i> Ooishi, 1963	X	6	2.5	4-9	4	4	3	3	10-2	S	X	s	s	S	+	I-1	6	125	4.2	1
<i>B. longipes</i> (Kerschner, 1879)	X	6	-	4-7	-	-	2	3	9-2	S	+	-	X	-	+	I-1	5	?	=4	2
<i>B. mollia</i> Ho, 1984	X	6	2.3	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	6	125	4.0	1
<i>B. projecta</i> Stock, 1967	fur	6	-	4-6	4	2	3	3	7-2	S	+	+	+	+	+	I-1	6	17	2.9	2
<i>B. similis</i> Illg & Dudley, 1961	X	6	4-5	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	5	125	=4	1
<i>B. yangpoensis</i> Kim & Moon, 2011	X	6	-	4-8	4	2	3	3	7-2	S	+	+	+	+	+	I-1	6	125	3.3	2
<i>B. typica</i> <b>sp. nov.</b>	X	6	4.6	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	6	125	2.5	2
<i>B. reniformis</i> <b>sp. nov.</b>	X	6	3.4	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	6	125	2.7	2
<i>B. eurypodata</i> <b>sp. nov.</b>	X	6	2.8	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	6	125	2.3	1
<i>B. rugosa</i> <b>sp. nov.</b>	X	6	5.2	4-9	4	4	3	3	10-2	S	X	X	X	X	+	I-1	6	125	5.7	2
<i>B. tenuipedis</i> <b>sp. nov.</b>	X	-	?	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	5	125	6.1	1
<i>B. cheliphora</i> <b>sp. nov.</b>	X	5+C	4.7	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	5	125	5.3	2
<i>B. tahitiensis</i> <b>sp. nov.</b>	X	6+C	4.0	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	5	125	4.7	1
<i>B. quadridens</i> <b>sp. nov.</b>	fur	6+c	3.8	4-9	4	4	3	3	10-2	S	X	X	+	+	+	I-1	5	125	5.1	1+s
<i>B. dinardensis</i> <b>sp. nov.</b>	w	6	4.8	4-8	4	4	3	3	10-2	S	X	X	X	X	+	I-1	5	125	4.8	2
<b><i>Nobinerilla</i></b>																				
<i>N. alata</i> <b>gen. et sp. nov.</b>	+	6	2.1	4-6	4	4	2	3	8-1	A	X	X	+	X	+	I-1	5	015	3.5	1
<i>N. armata</i> (Schellenberg, 1922)	X	5+sp		4-6	-	3	-	3	10-1	?	X	X	X	X	X	I-0	-	005	-	3?
<i>N. filipes</i> (Stock, 1967)	X	6	3.1	4-5	4	3	2	3	10-1	A	X	X	s	s	X	I-0	5	125	6.3	2
<i>N. exilipes</i> <b>gen. et sp. nov.</b>	X	6	2.1	4-5	4	3	2	3	10-1	A	X	X	+	s	X	I-0	5	125	4.4	2
<i>N. mammillata</i> <b>gen. et sp. nov.</b>	X	6	3.5	4-7	4	4	2	3	10-1	A	X	X	+	X	+	I-1	5	015	2.1	1
<i>N. ovata</i> <b>gen. et sp. nov.</b>	+	6	2.5	4-7	4	4	2	3	10-1	A	X	X	+	X	+	I-1	5	005	4.8	1
<i>N. minuta</i> <b>gen. et sp. nov.</b>	+	6	2.1	4-6	4	4	2	2	8-1	A	X	X	+	X	+	I-1	5	005	2.7	1
<i>N. paucisetata</i> <b>gen. et sp. nov.</b>	+	6	2.8	4-6	4	4	2	3	10-1	A	X	X	+	X	+	I-1	5	004	3.6	1



**FIGURE 170.** *Bonnierilla reniformis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C-I, 0.05 mm.





**FIGURE 171.** *Bonnierilla reniformis* sp. nov., female. A, labrum; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, B, 0.05 mm; C-G, 0.1 mm.

**Remarks.** *Bonnierilla reniformis* **sp. nov.** is very similar to *B. iboensis* **sp. nov.** They were found associated with the same species of ascidian host in nearby geographic regions and their appendages, including the characteristic exopod of leg 5, are very alike. However, the differences between these two species in the caudal ramus and rostrum are significant. The caudal ramus of *B. reniformis* **sp. nov.** is significantly broader than that of *B. iboensis* **sp. nov.**, about 3.4 times longer than wide (vs. 4.6 times longer than wide in *B. iboensis* **sp. nov.**), and the rostrum is wider than long (vs. longer than wide in *B. iboensis* **sp. nov.**).

***Bonnierilla eurypodata* sp. nov.**

(Figs. 172, 173)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21284) and dissected paratype (♀, figured) from *Polycarpa papillata* (Sluiter, 1886), CORAIL 2, DW146, New Caledonia, Chesterfield Plateau (19°37'0.0012"S, 158°16'16.7952"E), depth 44 m, B. Richer de Forges-IRD coll., 30 July 1988.

**Etymology.** The specific name is derived from the Greek *eurý* (=broad) and *pod* (=a foot) and refers to the relatively broad exopodal segment of leg 5.

**Description of female.** Body (Fig. 172A) compressed, inflated, 2.45 mm long. Cephalosome well-defined from metasome; metasome unsegmented. Free urosome (Fig. 172B) stout, 5-segmented. Caudal rami widely separated from each other; each ramus (Fig. 172C) fusiform, about 2.8 times longer than wide (110×40 µm) and about 1.3 times longer than anal somite, armed with 6 naked setae; 2 proximal setae as long as width of ramus, located at 40 and 64% of ramus length; distal 4 setae shorter than width of ramus.

Rostrum (Fig. 172D) wider than long, strongly tapering, with rounded apex. Antennule (Fig. 172E) obscurely 8-segmented; armature formula 3, 15, 9+aesthetasc, 4, 3+aesthetasc, 1, 2+aesthetasc, and 7+aesthetasc; all setae naked; 1 seta on second segment rod-shaped. Antenna (Fig. 172F) 4-segmented; coxa unarmed; basis with 2 minute vestigial setae distally; first endopodal segment with 1 small seta subdistally; compound distal endopodal segment 3.1 times longer than wide and about 1.5 times longer than first endopodal segment, armed with 8 setae (distal 3 blunt at tip) plus strongly curved terminal claw, less than half length of segment.

Labrum (Fig. 172G) with patches of setules posterolaterally and spinules on posteromedian lobe. Mandible (Fig. 172H) bearing 5 teeth on coxal gnathobase and 3 needle-like spinules between distal second and third teeth; palp armed as usual: 1 seta on basis, 5 on exopod, 4 on first endopodal segment and 9 on second. Paragnath (Fig. 173A) with large dentiform process apically.

Maxillule (Fig. 172I) not specialized, armed with 9 setae on arthrite, 1 on coxal endite, 2 on coxal epipodite, 3 on basis, 4 each on exopod and endopod. Maxilla (Fig. 172J) 5-segmented; syncoxa with 8 setae (3, 1, 2, and 2); basis with claw bearing setules on both margins, plus 1 seta and 1 rudimentary seta; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 173B) incompletely 2-segmented with 10 setae on first segment and 2 setae on second.

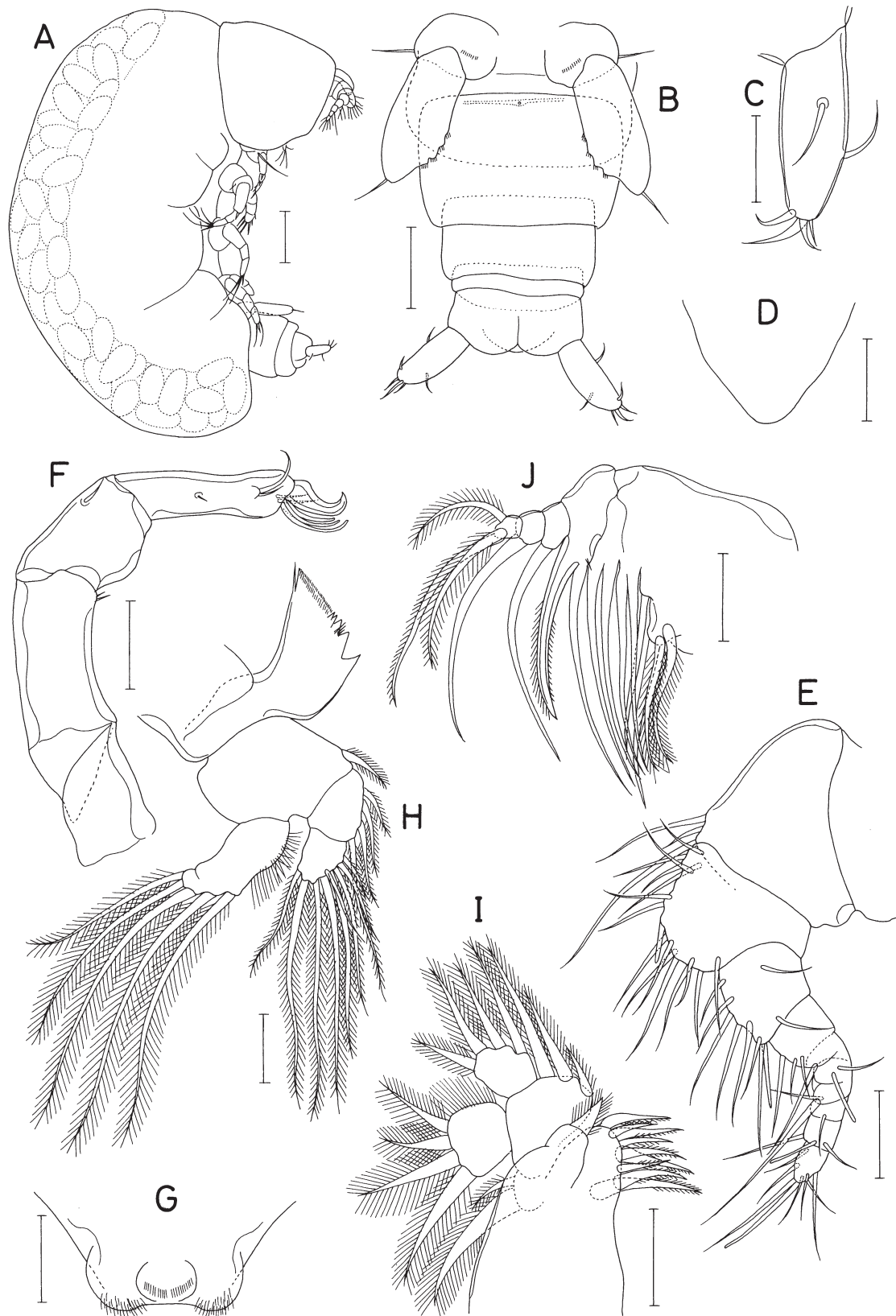
Legs 1–4 (Fig. 173C–F) with 3-segmented rami. Inner coxal seta absent in legs 1 and 2, but present in legs 3 and 4. Outer seta on basis large and plumose in leg 1 but small and naked in legs 2–4. Inner distal spine on basis of leg 1 naked, 49 µm long, extending beyond distal border of first endopodal segment. Exopods of legs 2–4 each about 1.8 times longer than endopods. First and second exopodal segments of legs 2–4 lacking outer spines or with rudimentary spines. Third exopodal segment of legs 2–4 bearing only 2 spines; with inner setae naked. Third exopodal segment of leg 2 with 2 spines and 5 setae (armature formula I, I, 5) in holotype, but abnormally with 2 spines and 4 setae (armature formula I, I, 4; Fig. 173D) in dissected specimen. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	0-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	0-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 2

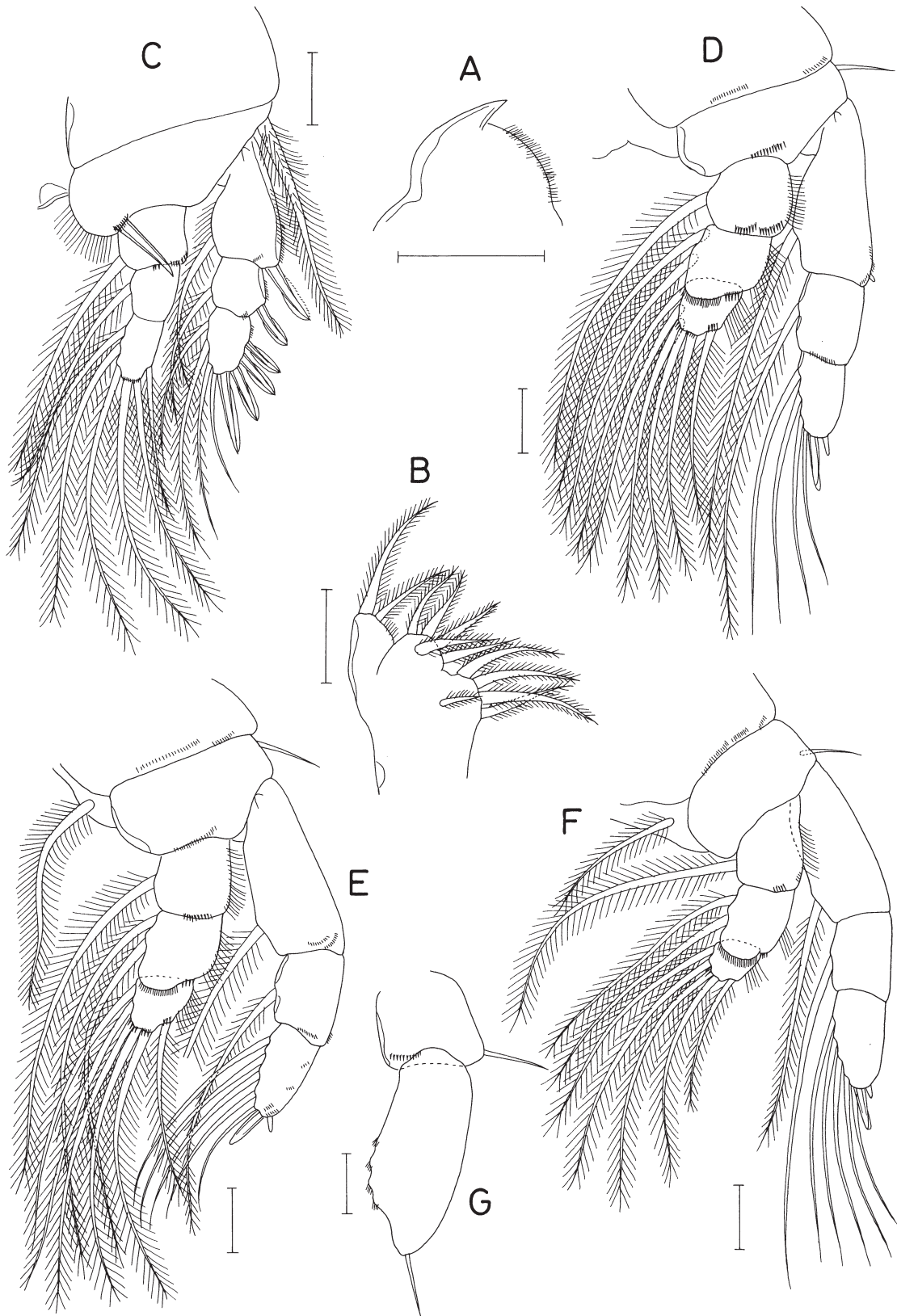
Leg 5 (Fig. 173G) 2-segmented; coxa short with naked outer distal seta and row of minute spinules at inner distal region; exopodal segment stout, about 2.3 times longer than wide (173×76 µm) and abruptly narrowing in distal quarter; armed with naked apical seta; 4 rows of minute spinules present on inner margin.

**Male.** Unknown.

**Remarks.** *Bonnierilla eurypodata* **sp. nov.** is a typical form of *Bonnierilla* and is similar to *B. iboensis* **sp. nov.** and *B. reniformis* **sp. nov.**, both described above. The most obvious differences between *B. eurypodata* **sp. nov.** and these other two species are in the dimensions of the caudal ramus and the exopod of leg 5 in the female. The caudal ramus of *B. eurypodata* **sp. nov.** is about 2.8 times longer than wide (110×40 µm) in contrast to 4.6 times longer than wide (206×45 µm) in *B. iboensis* **sp. nov.** and 3.4 times longer than wide (211×63 µm) in *B. reniformis* **sp. nov.** The exopod of leg 5 of *B. eurypodata* **sp. nov.** is 2.3 times longer than wide (173×76 µm), with a single apical seta, in contrast to 2.5 times longer than wide (136×55 µm) in *B. iboensis* **sp. nov.** and 2.7 times longer than wide (203×74 µm) in *B. reniformis* **sp. nov.**, with 2 unequal distal setae in the latter two species. These differences are robust and support the establishment of the new species.



**FIGURE 172.** *Bonnierilla eurypodata* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.2 mm; B, 0.1 mm; C-J, 0.05 mm.



**FIGURE 173.** *Bonnierilla eurypodata* **sp. nov.**, female. A, paragnath; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: 0.05 mm.

***Bonnierilla rugosa* sp. nov.**

(Figs. 174, 175)

**Type material.** Holotype (intact ♀, MNHN-IU-2009-5053) and dissected paratype (young ♀) from *Polycarpa madagascariensis* (Michaelsen, 1912) (MNHN-IT-2008-6553 = MNHN S1 POL.B 547), BENTHEDI, NW Mayotte, Canal of Mozambique, “Suroît”, depth 10-20 m, Vasseur coll., 20 March 1977.

**Etymology.** The specific name refers to the rugose metasome.

**Description of female.** Fully grown adult (holotype) body (Fig. 174A) compressed, 3.00 mm long. Prosoma comprising small cephalosome and unsegmented metasome inflated lengthwise, 2.6×1.1 mm in lateral view, with narrow posterior third, rounded anterior and posterior margins: 2 pairs of small epimera present representing defined dorsal tergite margins of second and third pedigerous somites. Surface of metasome soft, mucus-like, covered with numerous, hemispherical nodules.

Dissected young adult body (Fig. 174B) not inflated, narrow, 2.04 mm long. Metasome indistinctly 4-segmented; second and third pedigerous somites with ventrolateral epimera. Free urosome 5-segmented. Caudal ramus (Fig. 174C) strongly curved ventrally, elongate, about 5.2 times longer than wide (354×68 µm), sclerotized along dorsal margin: armed with 6 naked setae; longest terminal seta 110 µm long; 2 proximal setae located at 37 and 45% of ramus length.

Rostrum (Fig. 174D) small, nearly triangular, 75×118 µm, wider than long, with slightly convex lateral margins. Antennule 357 µm long, 9-segmented (Fig. 174E); first 2 segments broad and distal 7 segments slender; armature formula 4, 22+spine, 16, 4, 11+aesthetasc, 3, 5, 5+aesthetasc, and 7+aesthetasc; setae extremely crowded, all naked. Antenna (Fig. 174F) 4-segmented; coxa, basis, and first endopodal segment unarmed; compound distal endopodal segment 3.1 times longer than wide (100×32 µm) and 1.2 times longer than first endopodal segment; armed with 9 setae (distal 3 blunt tipped) plus terminal claw about half as long as segment.

Labrum (Fig. 174G) ornamented with setules and spinules posteriorly and with indistinct, spinulose posteromedian lobe. Mandibular gnathobase (Fig. 175A) with 6 teeth and 2 subsidiary denticles, 1 on either side of largest distalmost tooth: palp (Fig. 174H) biramous; basis with broad medial seta; exopod with 5 subequal setae; endopod with 4 and 9 setae on first and second segments, respectively. Paragnath rather elongate, well-sclerotized, with small dentiform process mediodistally. Maxillule (Fig. 174I) typical of genus, with 9 setae on atrite, 1 on coxal endite, 2 on epipodite, 3 on basis, and 4 each on exopod and endopod. Maxilla (Fig. 175B) 5-segmented; syncoxa with 9 setae (arranged as 3, 1, 2, and 3 from proximal to distal); basis with large claw plus

1 seta; endopod small with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 175C) unsegmented but divisible into broad proximal and narrow distal parts; armed with 10 medial and 2 apical setae.

Legs 1–4 with 3-segmented rami (Fig. 175D-F); all legs lacking inner coxal seta. Outer seta on basis large (longer than exopod) in leg 1, but small in legs 2–4. Inner distal spine on basis of leg 1 extending to middle of second endopodal segment, 58 µm long. Inner margin of basis of legs 2 and 3 protruding and well-sclerotized. Exopod slightly longer than endopod in leg 1. Exopods elongated in legs 2–4, twice as long as endopod in legs 2 and 3, and 2.6 times longer in leg 4. Exopodal segments of legs 2–4 ornamented with numerous minute spinules on outer distal surfaces; outer spines on exopodal segments of legs 2–4 small, setiform with blunt tips, and mostly obsolete. Armature formula for legs 1–4 as follows:

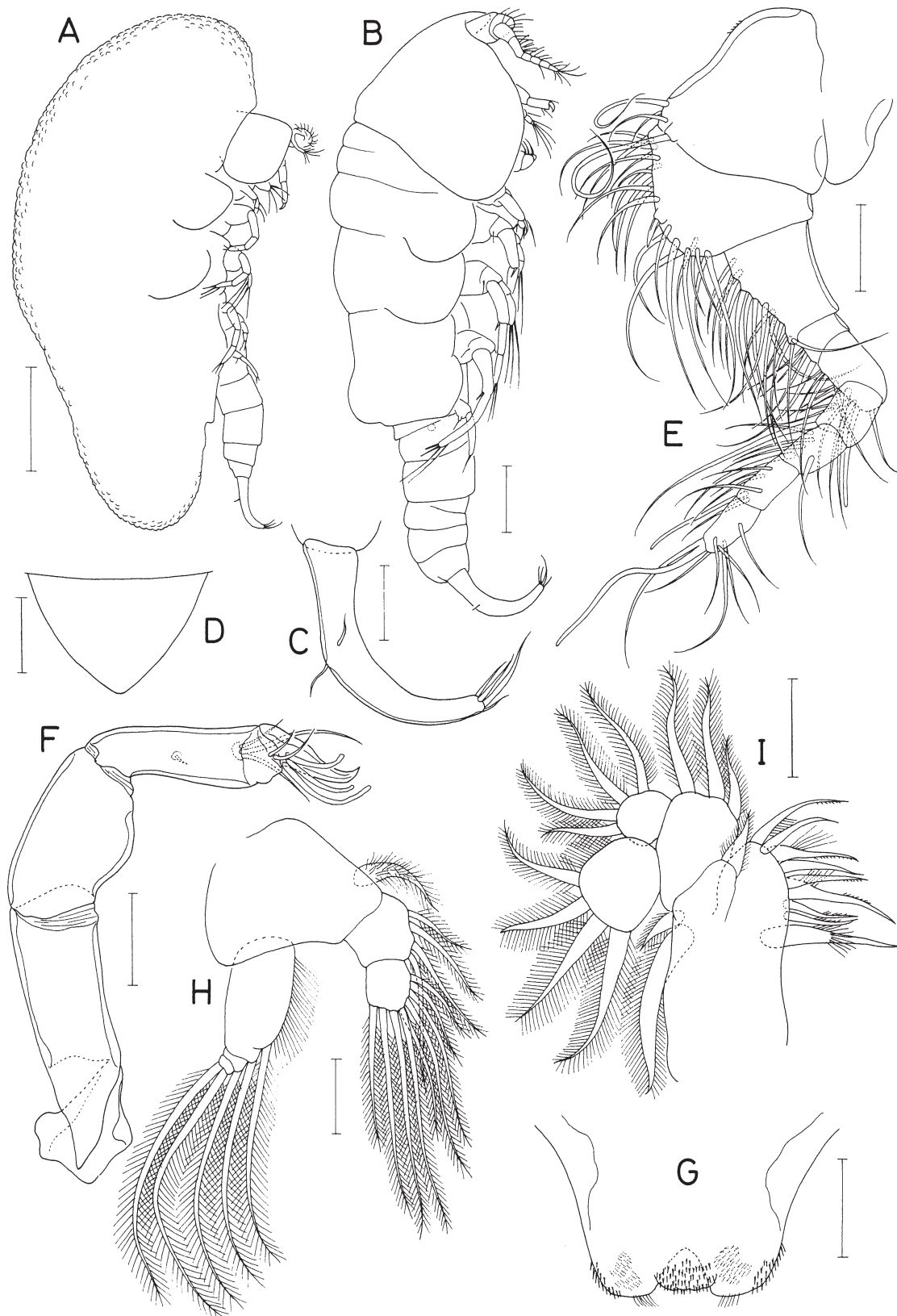
	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-0	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 175G) 2-segmented; protopod short, with 1 naked seta on tapering outer distal process and row of minute spinules near inner distal margin; exopodal segment strongly curved in middle, about 5.7 times longer than wide (215×38 µm), widest at midlength, armed with 2 naked apical setae; ornamented with 5 to 7 rows of minute spinules on inner surface; apical setae on exopod either subequal as in Fig. 175G or very unequal, with one vestigial.

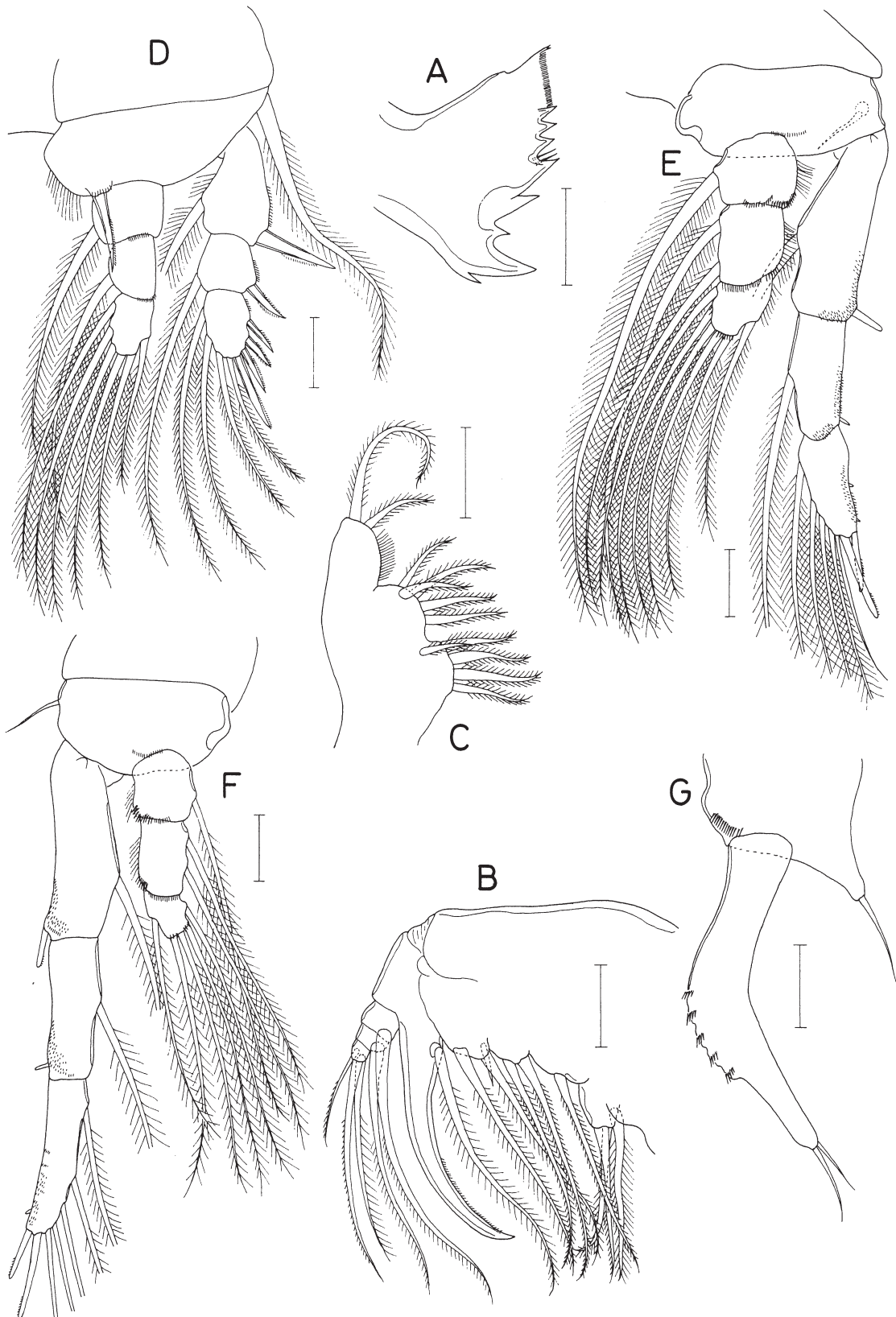
**Male.** Unknown.

**Remarks.** *Bonnierilla rugosa* sp. nov. is similar to *B. mollia* in having a soft mucus-like covering over the metasome in the fully grown adult female, but these two species are quite different in other respects. In *B. rugosa* sp. nov. both the caudal ramus and the free exopodal segment of leg 5 are strongly curved and much more elongate than in *B. mollia*. The exopods of legs 2–4 of *B. rugosa* sp. nov. are elongate but not expanded and they bear small outer spines, unlike *B. mollia* which has expanded exopodal segments on legs 2–4 lacking outer spines.

In general, species of *Bonnierilla* possess an inner seta on the coxa in legs 1 and 2, but lack this inner seta in legs 3 and 4 (Table 4). In this respect *B. rugosa* sp. nov. is unusual because the inner coxal seta is absent in all legs 1–4; this feature is unique within the genus *Bonnierilla* as defined here. It is also shared with *B. armata* Schellenberg, 1922 but this species is transferred below to a new genus.



**FIGURE 174.** *Bonnierilla rugosa* sp. nov., female. A, habitus of fully grown adult; B, habitus of young adult; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandibular palp; I, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, 0.1 mm; D–I, 0.05 mm.



**FIGURE 175.** *Bonnierilla rugosa* sp. nov., female. A, mandibular gnathobase; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: 0.05 mm.

***Bonnierilla tenuipedis* sp. nov.**  
(Figs. 176, 177)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21285) and dissected paratype (♀, figured) (caudal rami lost in both) from *Ascidia sydneiensis* Stimpson, 1855, west islet of Goeland, New Caledonia, depth 12 m, Thomassin coll., 20 March 1977.

**Etymology.** The specific name is derived from the Latin *tenui* (slender) and *ped* (a foot) and alludes to the slender exopod of leg 5.

**Description of female.** Body (Fig. 176A) compressed; length 2.09 mm, excluding caudal rami. Prosome 1.70 mm long, consisting of well-defined cephalosome and unsegmented metasome. Metasome slightly tapering posteriorly, dorsally convex with dorsoventral depth 0.82 mm across middle of metasome. Fifth pedigerous somite fused with metasome. Free urosome (Fig. 176B) 5-segmented: genital somite 100×278 µm, longer dorsally than ventrally, with convex posterodorsal margin. Four abdominal somites approximately 212×267, 176×230, 103×185, and 88×155 µm, respectively. Caudal rami missing.

Rostrum (Fig. 176C) semicircular, distinctly wider than long (101×172 µm), with broadly rounded distal margin. Antennule (Fig. 176D) 233 µm long, 8-segmented; armature formula 3, 16+spine, 10+aesthetasc, 5, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; first and second segments markedly broader than distal segments; setae crowded, naked and mostly long; spine on second segment blunt and pectinate along one margin. Antenna (Fig. 176E) stout, 4-segmented; coxa and basis unarmed; first endopodal segment with 1 seta subdistally; compound distal endopodal segment relatively short, about 2.3 times longer than wide (74×32 µm) and as long as first segment; armed with 8 setae (all attenuated) plus terminal claw 67 µm long, 0.9 times as long as segment.

Labrum (Fig. 176F) with patches of setules posterolaterally and spinules posteromedially. Mandible (Fig. 176G) with 5 teeth and 1 small seta on coxal gnathobase; basis with few setules proximally and 1 seta on distally on medial margin; exopod 2-segmented, with 3 and 2 setae on proximal and distal segments, respectively, outer seta on small distal segment shorter than other 4; endopod incompletely articulated from basis, with 4 and 9 setae on first and second segments, respectively. Paragnath (Fig. 176H) with strong, dentiform process mediolaterally and setules along medial margin. Maxillule (Fig. 176I) not specialized; armed with 10 setae on arthrite, 1 on coxal endite; 2 on epipodite, 3 on basis, and 4 each on exopod and endopod; proximal seta on basis small, one-third as long as distal 2 setae. Maxilla (Fig. 176J) not specialized, armed with 3 setae on first endite of syncoxa and on third segment of endopod. Maxilliped (Fig. 177A) distinctly 2-segmented with 10 setae on first segment and 2 equal setae on second,

Legs 1–4 (Fig. 177B–E) with 3-segmented rami. Inner coxal seta absent in legs 1 and 2, but present in legs 3 and 4. Outer seta on basis large, broad, slightly longer than exopod in leg 1, but very small in legs 2–4. Inner distal spine on basis of leg 1 smooth, 45 µm long, extending to middle of second endopodal segment. Exopod 1.4 times longer than endopod in leg 1, about 1.6 times longer in legs 2 and 3, and 1.7 times longer in leg 4. First exopodal segment of legs 2–4 as long as second and third exopodal segments combined, and about 2.7, 2.9 and 3.6 times as long as wide in legs 2–4, respectively; ornamented with minute spinules scattered over anterior (ventral) surface. Third exopodal segment of legs 2–4 slender. Inner setae on exopodal segments of legs 2–4 small, shorter than segment. Outer margin of endopod naked in leg 1, but densely setulose in legs 2–4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	I-1; I-1; I, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 177F) 2-segmented; protopod short, with 1 small seta at outer distal corner and row of small spinules at inner distal corner; exopodal segment elongate, slender, about 6.1 times longer than wide (141×23 µm), with naked apical seta and 4 rows of spinules on inner margin.

**Male.** Unknown.

**Remarks.** This new species is characterised by the elongate free exopodal segment of leg 5, which is more than 6 times longer than wide. Although a similarly elongate exopod is also present on leg 5 in *B. filipes* Stock, 1967, the latter species has 2 pinnate setae on the exopod of leg 5 compared to only a single naked seta in the new species, and exhibits many other different character states (see below). *Bonnierilla rugosa* sp. nov. also has an elongate exopod of leg 5, but its exopod is strongly curved, and the caudal rami are also strongly curved, whereas in *B. tenuipedis* sp. nov. the exopodal segment of leg 5 is not curved.

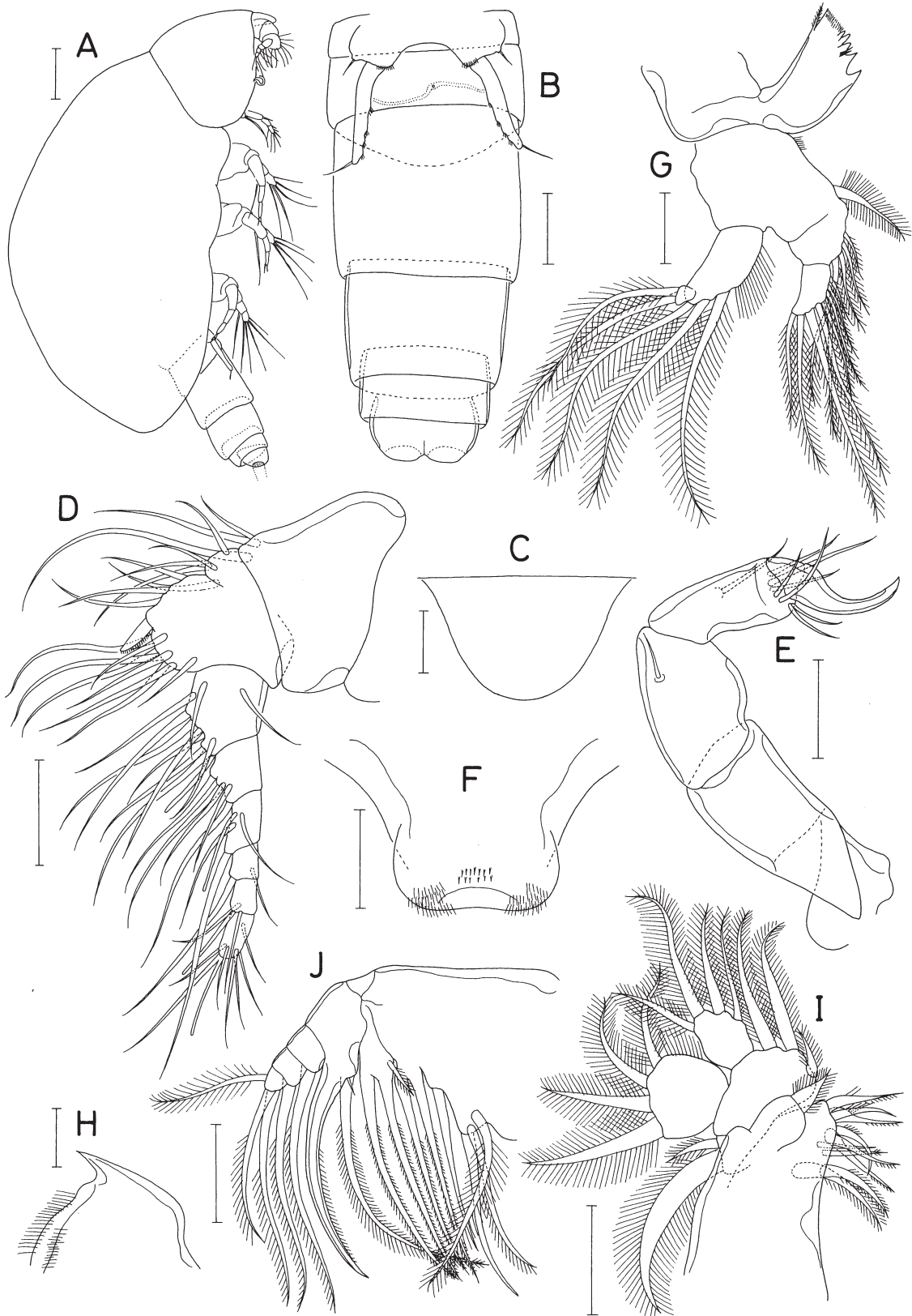
***Bonnierilla cheliphora* sp. nov.**  
(Figs. 178, 179)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21286), paratype (intact ♀, MNHN-IU-2014-21287), and dissected paratype (♀, figured) from *Herdmania momus* (Savigny, 1816), Canal Woodin, New Caledonia, depth 32 m, Monniot coll., 12 March 1987.

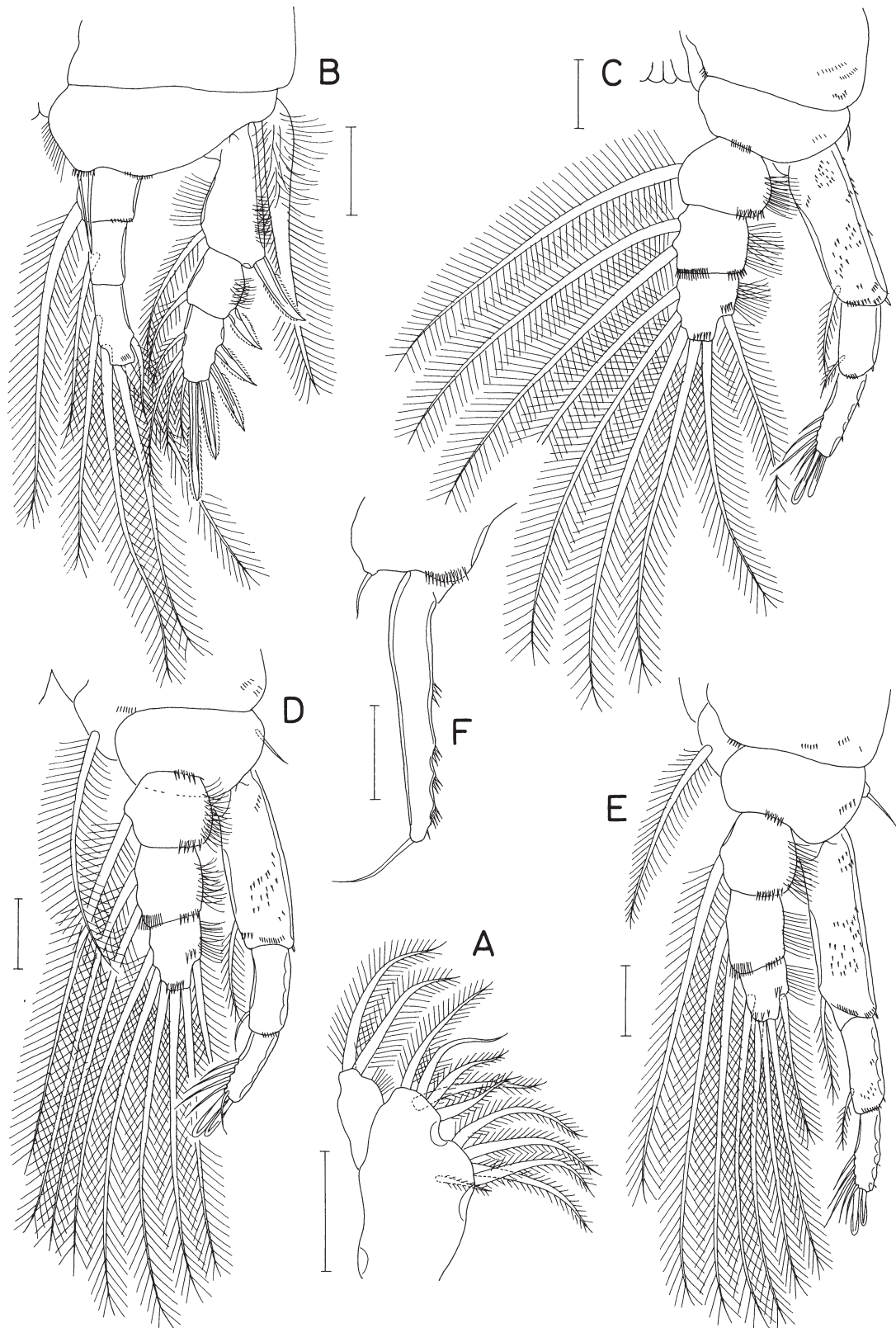
**Additional material.** 2 ♀♀ (MNHN-IU-2018-1841) from *H. momus*, Récif Néokumbi, New Caledonia, 1987.

**Etymology.** The specific name is derived from the Greek *chel* (claw) and *phor* (carry), referring to the presence of a claw on the caudal ramus.

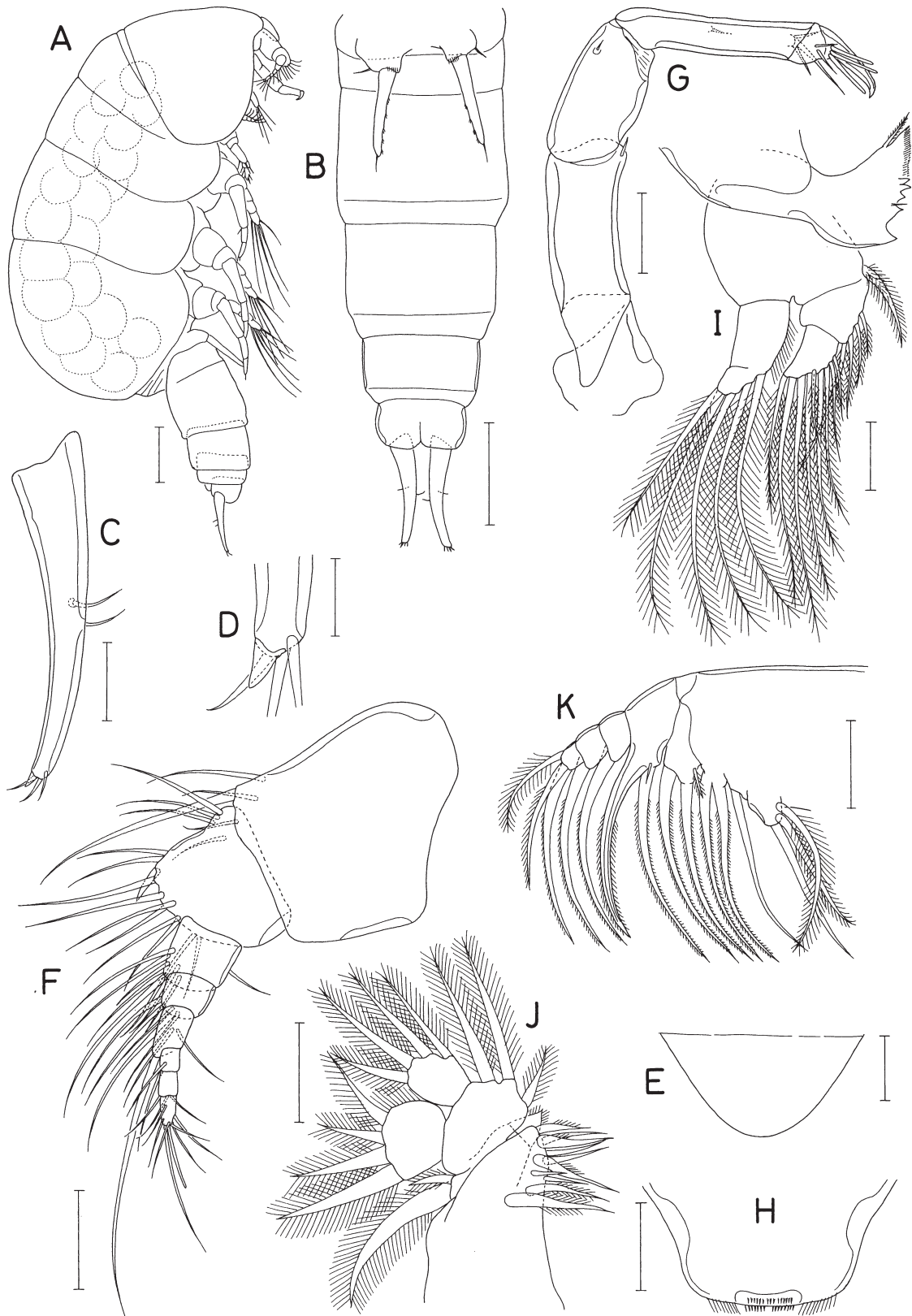




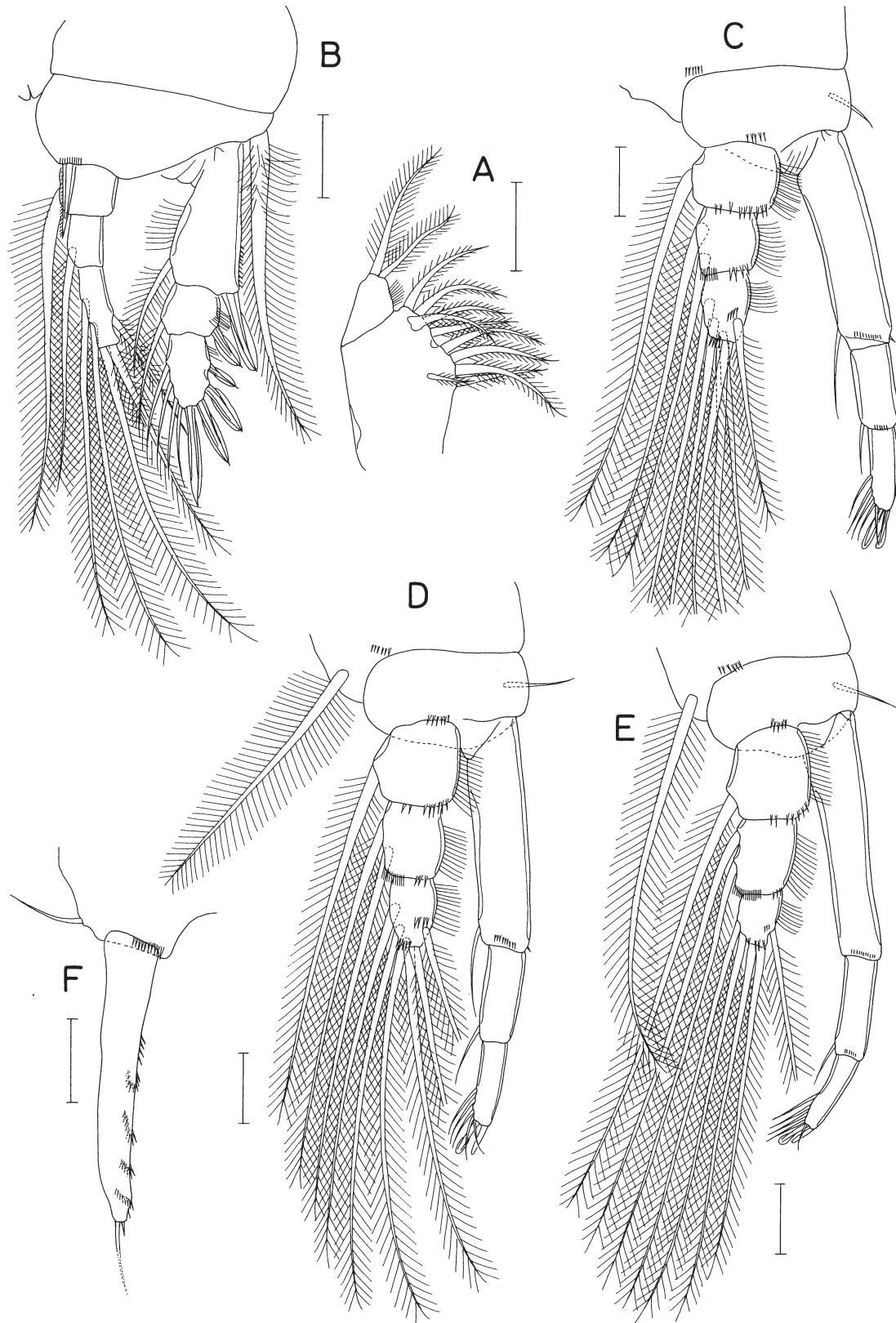
**FIGURE 176.** *Bonnierilla tenuipedis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scale bars: A, 0.2 mm; B, 0.1 mm; C–G, I, J, 0.05 mm; H, 0.02 mm.



**FIGURE 177.** *Bonnierilla tenuipedis* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.05 mm.



**FIGURE 178.** *Bonnierilla cheliphora* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, distal part of caudal ramus; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule; K, maxilla. Scale bars: A, B, 0.2 mm; C, E–K, 0.05 mm; D, 0.02 mm.



**FIGURE 179.** *Bonnierilla cheliphora* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

**Description of female.** Body (Fig. 178A) compressed; body length 2.05 mm. Cephalosome well-defined from metasome; metasome of unexpanded, dissected specimen (Fig. 178A) 4-segmented, but unsegmented in swollen specimen. Fifth pedigerous somite fused with metasome. Free urosome (Fig. 178B) 5-segmented: genital somite very short, 77×327 µm; abdominal somites gradually shorter and narrower towards posterior; 273×336, 227×295, 127×232, and 90×177 µm, respectively. Anal somite distinctly shorter than third abdominal somite. Caudal ramus (Fig. 178C) slender, curved, gradually narrowing distally, about 4.7 times longer than wide (227×48 µm): armed with 5 setae and 1 claw (2 setae at mid-length and 3 setae+1 claw distally); two middle setae located at 50 and 55% of ramus length; distal claw articulated at base, short and conical (Fig. 178D); all setae small, shorter than maximum width of ramus.

Rostrum (Fig. 178E) about twice as wide as long (80×156 µm), semicircular, with rounded distal margin. Antennule (Fig. 178F) 8-segmented; armature formula 3, 15+spine, 8, 5, 3, 2, 3, and 7+aesthetasc; first and second segments much broader than distal segments; all setae naked. Antenna (Fig. 178G) slender; coxa unarmed; basis 2.3 times longer than wide, with 1 small seta distally; first endopodal segment 1.5 times longer than wide, with 1 small seta subdistally; compound distal segment about 4.6 times longer than wide (120×26 µm) and 1.5 times longer than first; armed with 9 setae (distal 3 blunt at tip) plus terminal claw, less than half length of segment.

Labrum (Fig. 178H) ornamented with setules on both sides of posterior margin and spinules in middle. Mandible (Fig. 178I) with 5 teeth on cutting margin of coxa; basis with 1 seta, 5 setae on exopod, 4 on first endopodal segment and 9 on second; distal outer seta on exopod about two-thirds as long as other 4 setae on exopod. Maxillule (Fig. 178J) with very broad, conical seta on coxal endite, otherwise similar to *B. tenuipedis* sp. nov. described above. Maxilla (Fig. 178K) also as in *B. tenuipedis* sp. nov. Maxilliped (Fig. 179A) distinctly 2-segmented with 10 setae on first segment and 2 setae on second.

Legs 1–4 (Fig. 179B–E) with 3-segmented rami. Inner coxal seta absent in legs 1 and 2, but present in legs 3 and 4. Outer seta on basis large, longer than exopod in leg 1, but small in legs 2–4. Inner distal spine basis of leg 1 extending beyond distal border of first endopodal segment, spinulose along inner margin. Third endopodal segment of leg 1 bearing 5 setae. Exopod 1.5 times longer than endopod in leg 1, about 1.9 times longer in legs 2 and 3, and twice as long in leg 4. In legs 2–4 first exopodal segment elongate, distinctly longer than second and third segments combined, 3.7 times longer than wide in leg 2, 4.1 times longer in leg 3, and 4.3 times longer in leg 4. Inner setae on exopods of legs 2–4 small and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	0-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	0-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	0-0; 0-1; I, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 179F) 2-segmented; protopod short, with 1 naked seta at outer distal corner and row of spinules along inner distal border; exopod elongate, 5.3 times longer than wide (170×32 µm), with straight sides but narrowing slightly towards tip; armed with 2 very unequal setae distally and with 4 rows of spinules on inner surface.

**Male.** Unknown.

**Remarks.** This new species is characterised by the possession of a short, conical claw on the caudal ramus, which represents a transformed seta. This caudal claw has not been recorded before, except in *B. armata*, in which the presence of a spine in distal part of the caudal ramus was mentioned by Schellenberg (1922). *Bonnierilla armata* differs from *B. cheliphora* sp. nov. in various characters: *B. armata* lacks an inner coxal seta in all biramous swimming legs, and there is no inner distal spine on the basis of leg 1. In contrast inner coxal setae are present in legs 3 and 4 of the new species and the inner spine is present on the basis of leg 1. In addition, the second segment of the maxilliped bears only a single seta in *B. armata* compared to 2 setae in *B. cheliphora* sp. nov.

***Bonnierilla tahitiensis* sp. nov.**

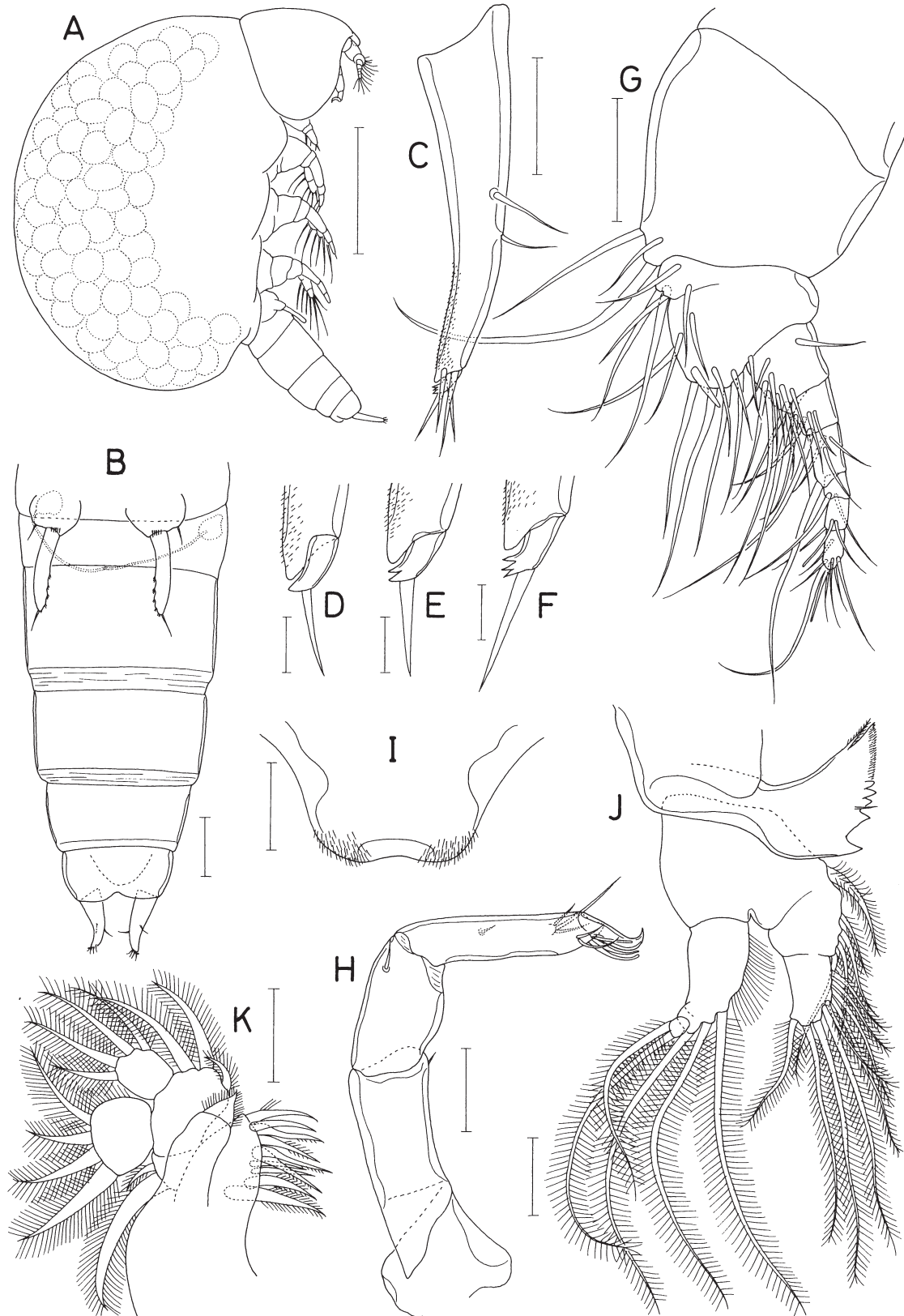
(Figs. 180, 181)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21288), paratypes (5 intact ♀♀, MNHN-IU-2014-21289), and dissected paratype (♀, figured) from *Herdmania momus* (Savigny, 1816), passe de Tapuaerha, Tahiti, depth 10–30 m, Monniot coll., June 1984.

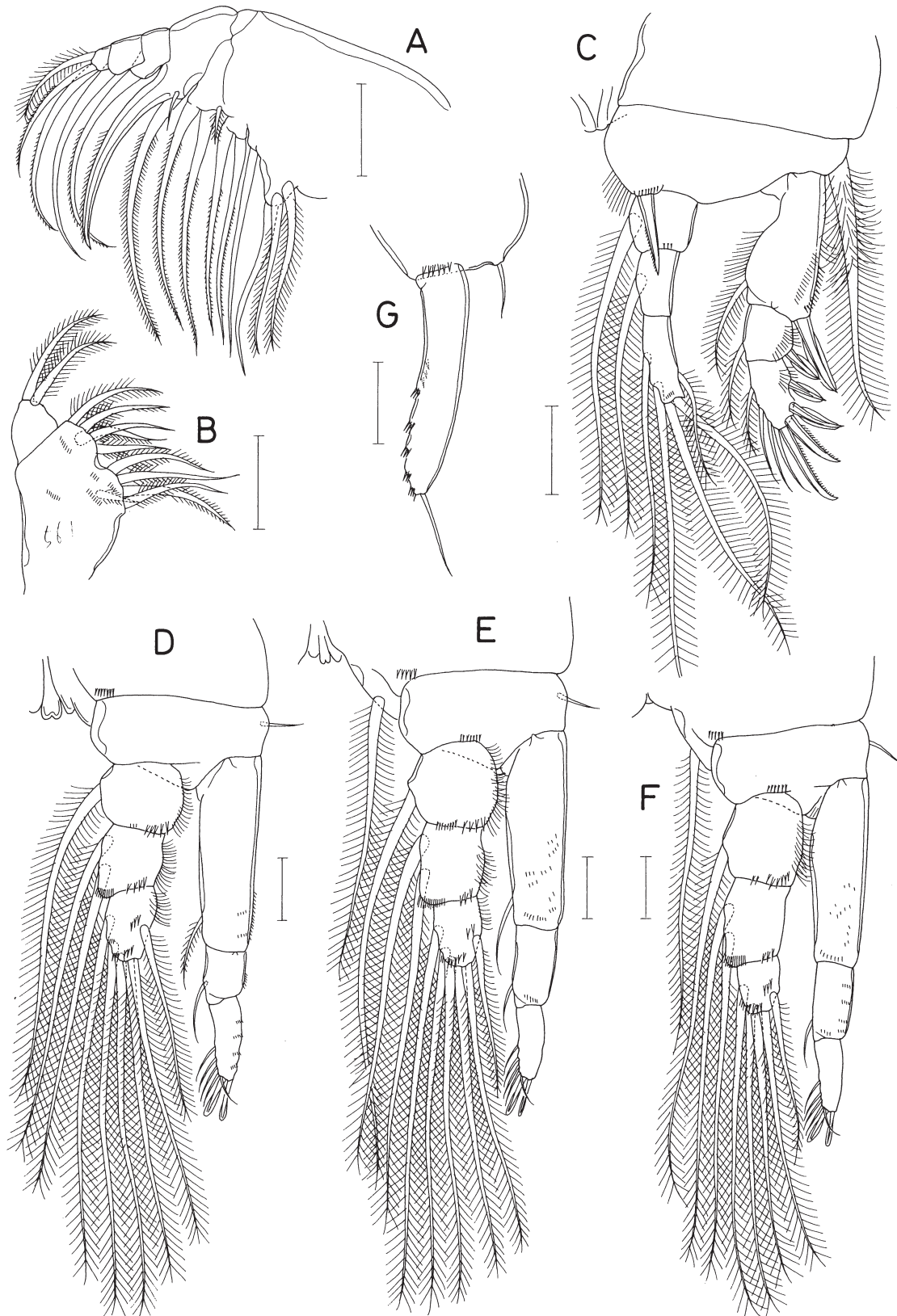
**Additional material.** 7 ♀♀ (MNHN-IU-2018-1842) from *H. momus*, Moorea M6, Tahiti; 7 ♀♀ (MNHN-IU-2018-1843) from *H. momus*, Moorea M18, Tahiti; 1 ♀ (MNHN-IU-2018-1844) from *H. momus*, Moorea M5, Tahiti; 1 ♀ (dissected, MNHN-IU-2015-14) from cyst of branchial tissue of *Molgula pedunculata* (Herdman, 1881), Tahiti (17°52.65'S, 149°09.33'W), depth 6 m, 15 April 2013.

**Etymology.** The name of the new species is based on the type locality.

**Description of female.** Body (Fig. 180A) compressed, stout; length 2.25 mm. Prosome 1.68 mm long. Cephalosome clearly defined from unsegmented metasome. Fifth pedigerous somite fused with metasome. Free urosome (Fig. 180B) 5-segmented: genital somite short, 91×353 µm; 4 abdominal somites becoming gradually shorter and narrower towards posterior, 207×331, 153×295, 116×244, and 87×189 µm, respectively. Caudal



**FIGURE 180.** *Bonnierilla tahitiensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D–F, distal tip of caudal ramus showing 3 different forms of caudal claws, 3 distal setae omitted; G, antennule; H, antenna; I, labrum; J, mandible; K, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C, G–K, 0.05 mm; D–F, 0.01 mm.



**FIGURE 181.** *Bonnierilla tahitiensis* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: 0.05 mm.

ramus (Fig. 180C) elongate, curved, gradually narrowing distally, about 4.0 times longer than wide (162×41 µm): armed with 5 naked setae (2 in middle and 3 distal) and 1 distal, flagellate claw (tipped with setule, see Fig. 180D-F); ramus ornamented with numerous minute spinules on distal third of ventral surface; distal flagellate claw simple or bifid or trifid at its ventrodistal apex (Fig. 180D-F); 2 middle setae located at 50 and 62% of ramus length.

Rostrum nearly semicircular, 90×150 µm, similar to that of *B. cheliphora* **sp. nov.**, indistinctly articulated from cephalosome. Antennule (Fig. 180G) 225 µm long, 8-segmented; armature formula 3, 16, 11, 5, 4, 2, 2+aesthetasc, and 7+aesthetasc; first and second segments expanded; setae crowded and generally long, all setae naked. Antenna (Fig. 180H) slender, 4-segmented; coxa broad but unarmed; basis with 1 or 2 minute setal vestiges distally; first endopodal segment with 1 small seta subdistally; compound distal segment about 4.4 times longer than wide (114×26 µm) and 1.5 times longer than first; armed with 9 small setae plus small terminal claw, less than half length of segment.

Labrum (Fig. 180I) simple with setulose posterolateral surfaces and slightly concave posterior margin. Mandible (Fig. 180J) with 5 teeth on coxal gnathobase; basis with 1 mediodistal seta; exopod 2-segmented, with 3 large setae on proximal segment and 2 shorter setae on small distal segment; endopod incompletely defined from basis, armed with 4 and 9 setae on first and second segments, respectively. Maxillule (Fig. 180K) with 10 setae on arthrite, 1 broad, conical seta on coxal endite, 2 on epipodite, 3 on basis (proximal seta much smaller than distal 2), and 4 each on exopod and endopod. Maxilla (Fig. 181A) as usual, bearing 3 setae on first endite of syncoxa and 3 setae on third endopodal segment. Maxilliped (Fig. 181B) distinctly 2-segmented with 10 setae on first segment and 2 subequal setae on second.

Legs 1–4 (Fig. 181C-F) with 3-segmented rami and similar to those of *B. cheliphora* **sp. nov.** Inner distal spine on basis of leg 1 extending beyond distal border of first endopodal segment, 47 µm long. Exopod 1.3 times longer than endopod in leg 1, 1.6 times longer in legs 2 and 3, and 1.5 times longer in leg 4. In legs 2–4, first exopodal segment longer than second and third exopodal segments combined, about 3.4 times longer than wide. Inner setae on exopods of legs 2–4 very small. Armature formula for legs 1–4 as in *B. cheliphora* **sp. nov.**

Leg 5 (Fig. 181G) 2-segmented; protopod short, with 1 seta at outer distal corner and several spinules near base of exopod; exopod about 4.7 times longer than wide (136×29 µm), tipped with 1 naked seta and ornamented with 5 rows of spinules on inner surface.

**Male.** Unknown.

**Remarks.** This new species very similar to *B. cheliphora* **sp. nov.** and occurs on one of the same host species, *Herdmania momus*. Both species have elongate, slightly curved caudal rami, an elongate exopod of leg 5,

and possess a distal claw on the caudal ramus. However, the caudal claw is significantly different between these two species. The caudal claw of *B. cheliphora* **sp. nov.** is simple and conical, whereas in *B. tahitiensis* **sp. nov.** it is always flagellate (tipped with a setule) and may be distally bifid or trifid.

***Bonnierilla quadridens* sp. nov.**

(Figs. 182, 183)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21290), paratype (intact ♀, MNHN-IU-2014-21291), and dissected paratype (♀, figured) from *Herdmania papietensis* (Herdman, 1882), LAGON DW1087, New Caledonia (19°48.3'S, 163°59.5'E), depth 24 m, B. Richer de Forges-IRD coll., 24 October 1989.

**Additional material.** 1 ♀ (dissected) from *H. papietensis*, Yaté, New Caledonia, 14 March 1987.

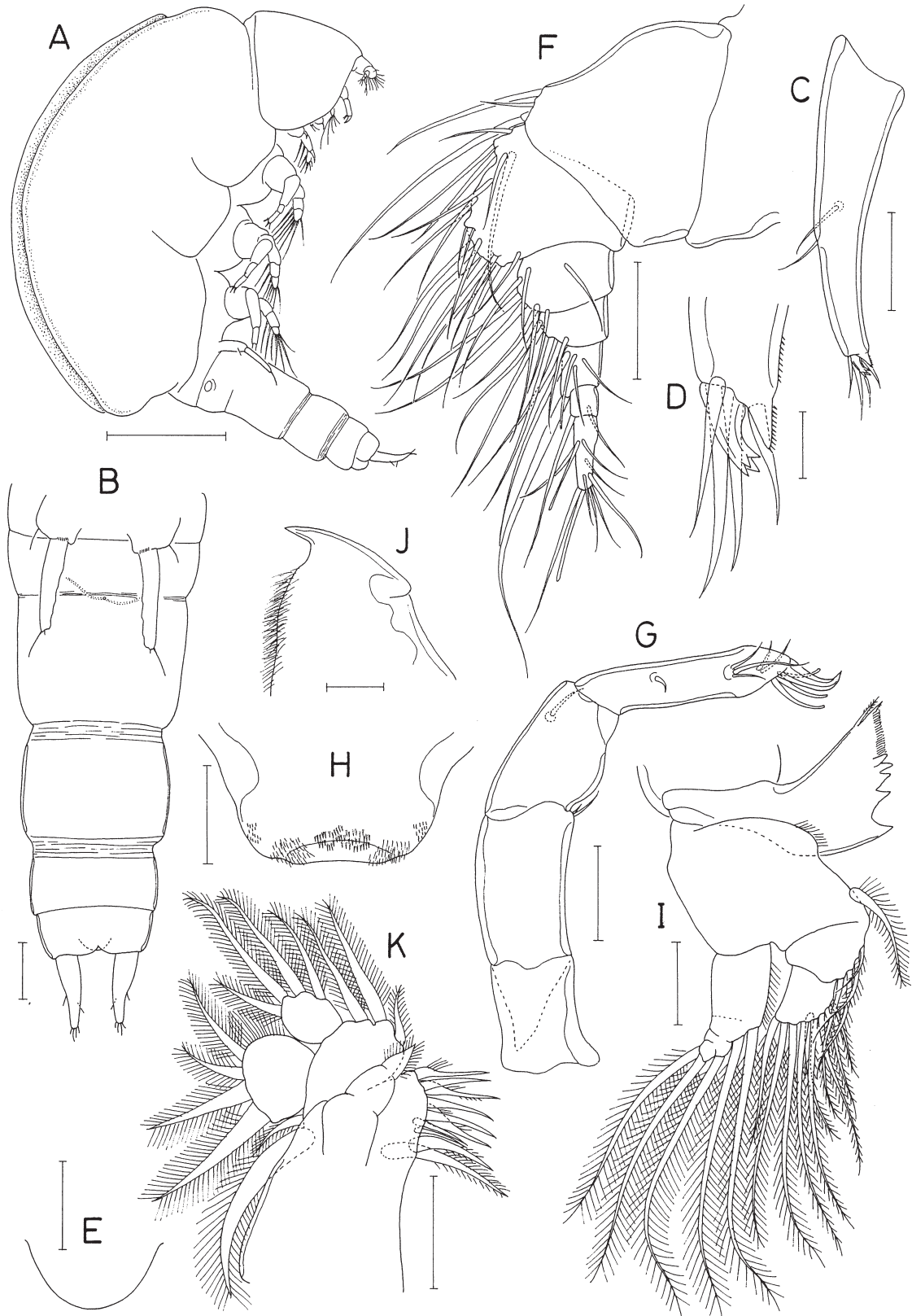
**Etymology.** The specific name refers to the four teeth on the tip of the caudal claw.

**Description of female.** Body (Fig. 182A) compressed, 3.37 mm long. Prosome 2.56 mm long, consisting of distinctly defined cephalosome and unsegmented metasome. Metsome typically with longitudinal furrow along dorsal midline. Fifth pedigerous somite fused to metasome. Free urosome (Fig. 182B) 5-segmented: genital somite short, 96×342 µm; 4 abdominal somites 230×308, 200×265, 115×227, and 77×204 µm, respectively. Caudal ramus (Fig. 182C) slightly curved, narrowing distally, but produced into short conical process at ventrodistal corner; armed with 6 setae (2 near middle and 4 distal) plus 1 distal claw (Fig. 182D); distal claw 15 µm long, slightly curved with quadrifid apex; all setae naked and shorter than width of ramus; 2 middle setae located at 53 and 63% of ramus length.

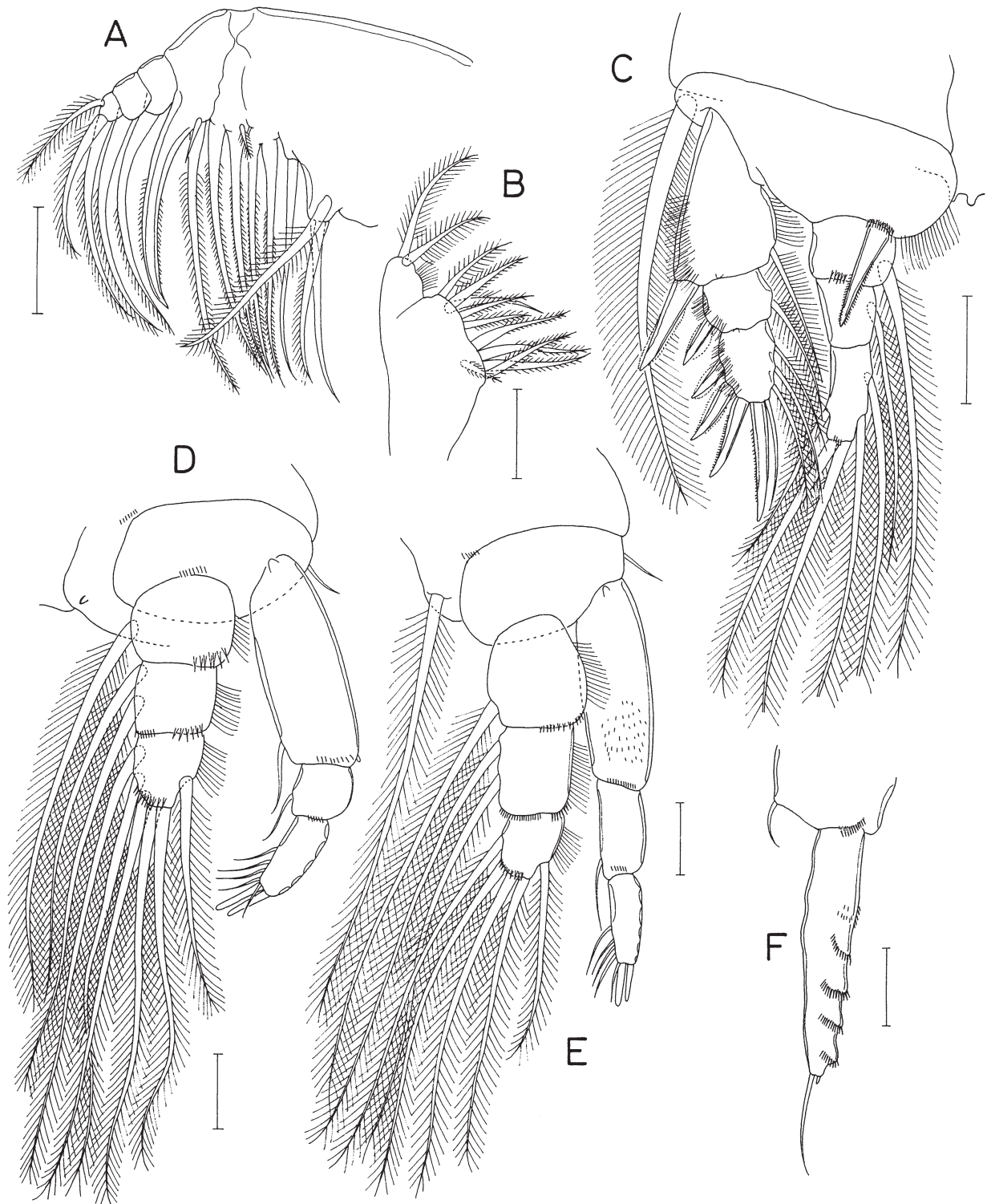
Rostrum (Fig. 182E) semicircular, wider than long. Antennule (Fig. 182F) small, 200 µm long, 7-segmented; armature formula 3, 16+spine, 8, 5, 4+aesthetasc, 2, and 8+2 aesthetascs; first and second segments expanded; setae crowded, naked and generally long. Antenna (Fig. 182G) with short coxa; basis with 2 small setal vestiges distally; first endopodal segment with 1 subdistal seta; compound distal segment 4.0 times longer than wide (100×25 µm) and 1.4 times longer than first; armed with 9 setae (distal 3 blunt at tip) plus terminal claw less than half length of segment.

Labrum (Fig. 182H) ornamented with patches of setules and spinules on posteroventral surface. Mandible (Fig. 182I) with 5 teeth on cutting margin of coxa; basis with proximal patch of small setules and 1 distal seta on medial margin; exopod with 5 setae, distal 2 slightly shorter than proximal 3; endopod with 4 and 9 setae on first and second segments, respectively. Maxillule (Fig. 182K) as usual for genus. Maxilla (Fig. 183A) typical for genus, armed with 3 setae on first endite of syncoxa





**FIGURE 182.** *Bonnierilla quadridens* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, distal part of caudal ramus; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, paragnath; K, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C, E–I, J, 0.05 mm; D, 0.01 mm; J, 0.02 mm.



**FIGURE 183.** *Bonnierilla quadridens* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

and on third endopodal segment. Maxilliped (Fig. 183B) incompletely 2-segmented with 10 setae on first segment and 2 setae on second.

Legs 1–4 with 3-segmented rami (Fig. 183C–E). Inner coxal seta absent in legs 1 and 2, but present in legs

3 and 4. Outer seta on basis large, distinctly longer than exopod, in leg 1, but very small in legs 2–4. Inner distal spine of basis of leg 1 spinulose on both margins, 53  $\mu\text{m}$  long, extending beyond middle of second endopodal segment. Exopod 1.3 times longer than endopod in leg 1,

and 1.5 times longer in legs 2–4. Exopodal segments of leg 1 densely setulose along outer margin. First exopodal segment of legs 2–4 about 2.5 times longer than wide, and longer than second and third segments combined. First exopodal segment of leg 4 lacking inner seta. Inner setae on endopodal segments of legs 2–4 naked and small. Armature formula for legs 1–4 same as that of *B. cheliphora* **sp. nov.**:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	0-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	0-1; 0-1; I, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	0-0; 0-1; I, I, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 183F) with short protopod bearing 1 small outer distal seta and inner distal row of minute spinules; exopod slender, about 5.1 times longer than wide (172×34 µm), with 1 minute seta and 1 larger seta distally (6 and 68 µm, respectively), ornamented with 5 rows of spinules on inner surface.

**Male.** Unknown.

**Remarks.** *Bonnierilla quadridens* **sp. nov.** has a claw on the caudal ramus, as in *B. cheliphora* **sp. nov.** and *B. tahitiensis* **sp. nov.**, both described above. These three species are very alike in many other respects (Table 4) and all of them were found in the South Pacific. They have a similar form and armature formula of legs 1–4, a similar shape of the caudal ramus and leg 5, and the same number of setae elements on mouthparts. One reliable character state that serves to differentiate between them is the armature of the caudal ramus: *B. quadridens* **sp. nov.** has 1 claw and 6 setae, *B. cheliphora* **sp. nov.** has 1 claw and 5 setae, and *B. tahitiensis* **sp. nov.** has 1 flagellate (setule-tipped) claw and 5 setae. The presence of 7 setation elements (6 setae plus an articulated claw) in *B. quadridens* **sp. nov.** is remarkable since the maximum number elsewhere in the family is 6.

***Bonnierilla dinardensis* sp. nov.**

(Figs. 184, 185)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21292) from *Styela coriacea* (Alder & Hancock, 1848) (MNHN-IT-2008-8221 = MNHN S1/STY/137), Les Richardais, Dinard, Atlantic coast of France, Monniot coll., August 1982.

**Etymology.** This species is named after the type locality, Dinard, in France.

**Description of female.** Body (Fig. 184A) stout, compressed; length 2.95 mm. Cephalosome clearly defined from metasome, with angular posterolateral corners on dorsal shield. Metasome inflated, unsegmented, with weak epimera near bases of legs 2 and 3. Free urosome (Fig. 184B) 5-segmented: genital somite

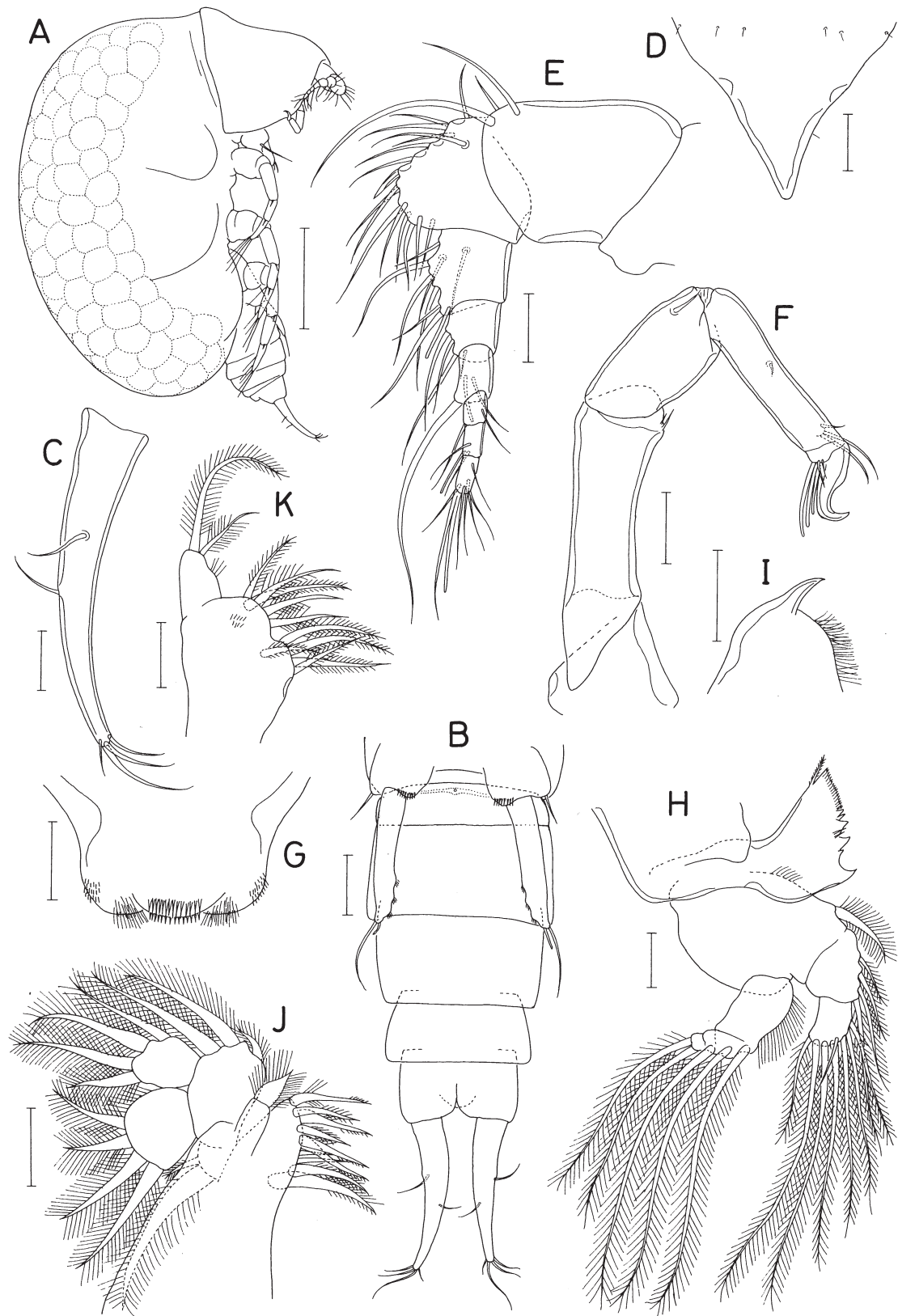
55×300 µm, with minute copulatory pore near anterior border of ventral surface: 4 abdominal somites 165×310, 170×284, 116×247, and 116×203 µm, respectively. Caudal ramus (Fig. 184C) slender, curved, narrowing distally, about 4.8 times longer than wide (278×58 µm) and about 2.4 times longer than anal somite: armed with 6 naked setae; 2 proximal setae located at 36 and 55% of ramus length.

Rostrum (Fig. 184D) flexible, lamellate, wider than long and tapering steeply towards tip. Antennule (Fig. 184E) 8-segmented, bent at right angle between second and third segments; armature formula 3, 15+spine, 8+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 184F) slender, 4-segmented; coxa short; basis about 2.7 times longer than wide, with 2 minute setal vestiges distally; first endopodal segment with 1 seta subdistally; compound distal segment 3.9 times longer than wide (129×33 µm) and about 1.4 times longer than first; armed with 9 small setae plus strongly curved terminal claw, about half as long as second segment.

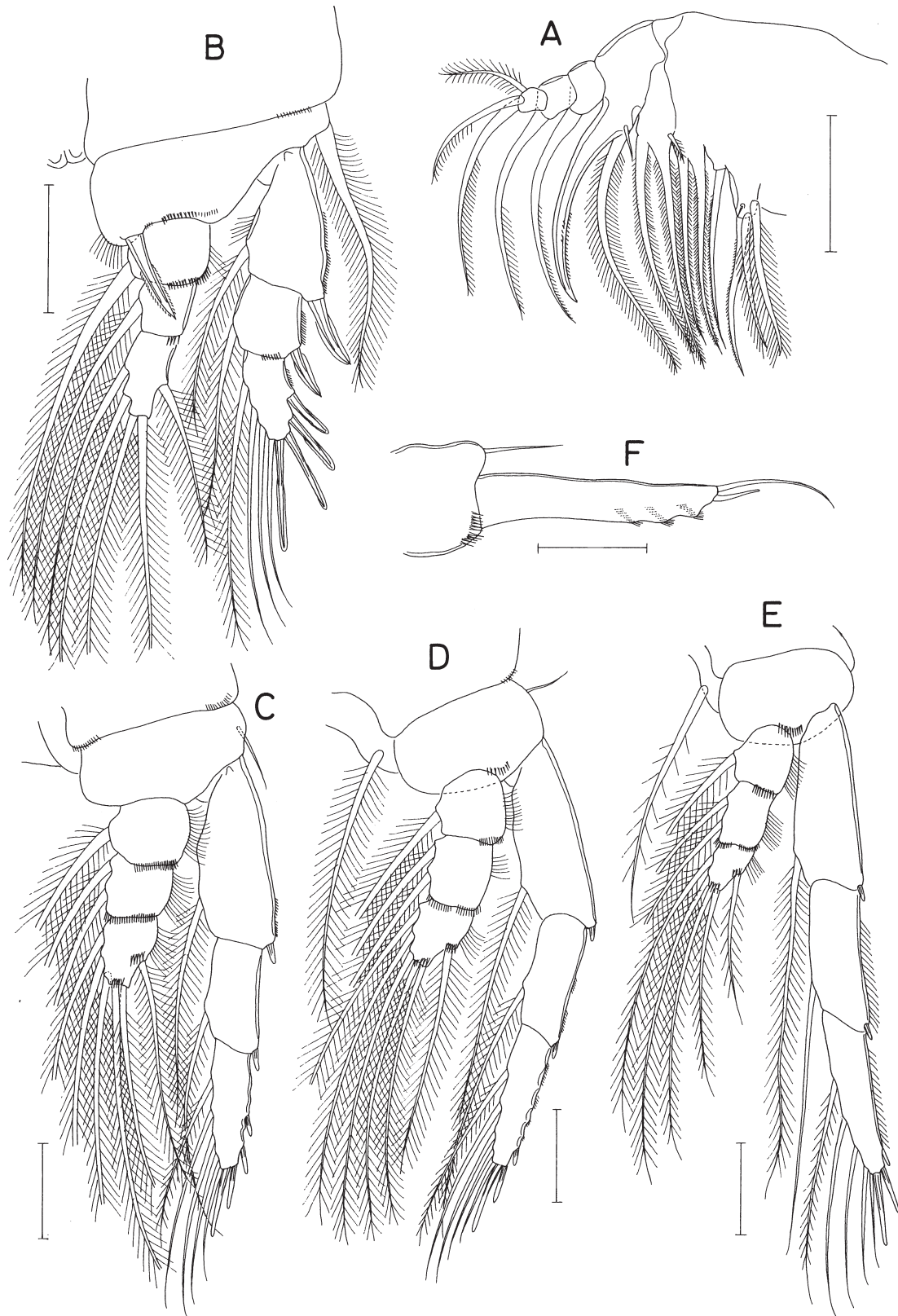
Labrum (Fig. 184G) with short, spinulose posteromedian lobe, patch of minute spinules subdistally on lateral margins, and setules on posterior margin. Mandible (Fig. 184H) with 5 teeth and 1 subsidiary tooth between distal first and second teeth on cutting margin of coxa; basis with proximal patch of setules and 1 distal seta on medial margin; exopod with 5 setae, distal 2 shorter than proximal 3; endopod incompletely articulated from basis, armed with 4 and 8 setae on first and second segments, respectively. Paragnath (Fig. 184I) with strong, claw-like apical process. Maxillule (Fig. 184J) as in *B. quadridens* **sp. nov.** Maxilla (Fig. 185A) with 3 setae and 1 minute setal vestige on first endite of syncoxa, otherwise with usual setation for genus. Maxilliped (Fig. 184K) incompletely 2-segmented; first segment with 10 setae, second with 2 unequal setae, longer seta more than twice length of other seta.

Legs 1–4 (Fig. 185B–E) with 3-segmented rami. Inner coxal seta absent in legs 1 and 2, but well developed in legs 3 and 4. Outer seta on basis large, slightly shorter than exopod in leg 1, small in legs 2 and 3, absent in leg 4. Inner distal spine on basis of leg 1 extending to middle of second endopodal segment, 71 µm long, with serrate margins. Exopod 1.5 times longer than endopod in leg 1, about 2.1 times longer in legs 2 and 3, and 2.7 times longer in leg 4. Ratios of lengths of 3 exopodal segments 85:50:55 in leg 2, 85:60:65 in leg 3, and 85:65:70 in leg 4. Second and third exopodal segments of leg 4 fringed with setules along outer margin; those of legs 1–3 naked or fringed with fine spinules. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	I-1; I-1; II, I, 5	0-1; 0-2; 1, 2, 3



**FIGURE 184.** *Bonnierilla dinardensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule; K, maxilliped. Scale bars: A, 0.1 mm; B, 0.1 mm; C–K, 0.05 mm.



**FIGURE 185.** *Bonnierilla dinardensis* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.1 mm.

Leg 3 0-1 1-0 I-1; I-1; II, I, 5 0-1; 0-2; 1, 2, 3  
 Leg 4 0-1 0-0 I-1; I-1; II, I, 5 0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 185F) with short protopod bearing outer distal seta and inner distal row of spinules; exopod elongate, about 4.8 times longer than wide (218×45 µm), with 3 rows of fine spinules on inner surface; armed with 2 unequal setae distally, smaller distal seta on exopod of right leg 5 shorter than that on left leg 5.

**Male.** Unknown.

**Remarks.** The diagnostic features of *B. dinardensis* **sp. nov.** include: the possession of only 5 setae (rather than 6) on the third endopodal segment of leg 1, the armature of the caudal ramus comprises only 6 setae (lacking any claw or spine), and the maxilliped bears a total of 12 setae. This combination of character states is shared with three congeners, *B. altera*, *B. similis*, and *B. tenuipedis* **sp. nov.** These congeneric species can be differentiated from *B. dinardensis* **sp. nov.** as follows: in *B. altera* the cephalosome has a “collar” (absent in *B. dinardensis* **sp. nov.**), the caudal ramus is about 4.1 times longer than wide (4.8 times in *B. dinardensis* **sp. nov.**), and the exopod of leg 5 is about 3.4 times longer than wide and armed with 1 seta distally (about 4.8 times and with 2 setae in *B. dinardensis* **sp. nov.**). In *B. similis* the antenna bears 3 large, digitiform setae distally (all setae small in *B. dinardensis* **sp. nov.**), the rostrum is elongate (wider than long in *B. dinardensis* **sp. nov.**), and the exopod of leg 5 is about 4 times as long as wide and armed with 1 seta distally (about 4.8 times and with 2 setae in *B. dinardensis* **sp. nov.**). In *B. tenuipedis* **sp. nov.** the rostrum is semicircular (tapering strongly towards tip in *B. dinardensis* **sp. nov.**), the compound distal endopodal segment of the antenna is short, not longer than first endopodal segment (1.4 times longer than first segment in *B. dinardensis* **sp. nov.**), and the third exopodal segment of legs 2–4 bears only 2 spines (3 spines in *B. dinardensis* **sp. nov.**).

***Nobinerilla* gen. nov.**

**Diagnosis.** Body form as in *Bonnierilla*, but generally smaller. Prosome consisting of cephalosome and unsegmented metasome forming brood pouch, usually with 2 pairs of wings (derived from epimera of second and third pedigerous somites). Fifth pedigerous somite fused with metasome. Free urosome 5-segmented, consisting of genital somite and 4-segmented abdomen. Caudal ramus with 6 setae. Rostrum short, strongly tapering. Antennule 7- to 9-segmented with 3 setae on first segment. Antenna 4-segmented; compound distal endopodal segment not elongate, similar in length to first segment. Mandible with 5 setae on exopod; endopod 2-segmented with 4 setae on first segment and less than 8 setae on second. Maxillule with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 4 on exopod and 3 or 4 on endopod. Maxilla

5-segmented; first endite of syncoxa with 3 or 2 setae; endopod 3-segmented, with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped 1-segmented, lacking distal prolongation, armed with 8 to 10 medial setae and single apical seta. Legs 1–4 with 3-segmented rami. Inner coxal seta absent in legs 1 and 2, and usually absent in leg 4. Legs 2–4 asymmetrical between left and right sides; setae on third exopodal segment of right legs blunt and shorter than those of left legs. Inner seta generally absent on first and second endopodal segments of leg 4. Leg 5 consisting of protopodal plate (fused left and right protopods) and free exopod bearing 1 or 2 setae. Generally associated with compound ascidians.

**Type species.** *Nobinerilla alata* **gen. et sp. nov.** by original designation.

**Other included species.** *Nobinerilla filipes* (Stock, 1967) **comb. nov.**, *N. armata* (Schellenberg, 1922) **comb. nov.**, *N. exilipes* **gen. et sp. nov.** *N. mammillata* **gen. et sp. nov.**, *N. ovata* **gen. et sp. nov.**, *N. minuta* **gen. et sp. nov.**, and *N. pauciseta* **gen. et sp. nov.**

**Etymology.** The generic name is an anagram of *Bonnierilla*, which is closely related to the new genus.

**TABLE 5.** Differences between *Bonnierilla* and *Nobinerilla* **gen. nov.**

Characters	<i>Bonnierilla</i>	<i>Nobinerilla</i> <b>gen. nov.</b>
Epimera of metasomal somites	Absent	Usually present
Terminal segment of antenna	Elongate	Stout
Mnd enp2 setation	Usually bearing 9 setae	Armed with less than 8 setae
Maxilla enp3 setation	3 setae	2 setae
Maxilliped	2-segmented, with 2 apical setae on distal segment	1-segmented, with 1 apical seta
Legs 1–4, outer elements on exp	Spines	Setae
Leg 1 enp3	Armed with 5 or 6 setae	Armed with 5 setae
Leg 4 inner seta on expl	Present	typically absent
Symmetry of legs 2–4	Symmetrical	Asymmetrical
Hosts	Solitary ascidians	Mostly colonial ascidians

**Remarks.** The new genus is similar to *Bonnierilla* but differs in the following character states: (1) the metasome usually has 2 pairs of defined epimera; (2) the compound distal endopodal segment of the antenna is stout and is not distinctly longer than the first endopodal segment; (3) the

second endopodal segment of the mandible is armed with less than 8 setae; (4) the third endopodal segment of the maxilla has only 2 setae; (5) the maxilliped is 1-segmented, without a distal prolongation, and is armed with 1 apical seta; (6) the exopods of legs 2–4 have setae as outer armature elements; (7) the first exopodal segment of leg 4 lacks an inner seta; and (8) the left and right legs of leg pairs 2–4 are usually asymmetrical (Table 5). In addition, the third endopodal segment of leg 1 is armed with 5 setae in the new genus, but a few species of *Bonnierilla* also have 5 setae rather than the more typical 6 setae.

Two species currently placed in *Bonnierilla*, *B. filipes* Stock, 1967 and *B. armata* Schellenberg, 1922, are recognized as belonging to the new genus and are formally transferred below. Species of *Nobinerilla* **gen. nov.** usually live in colonial ascidians whereas species of *Bonnierilla* inhabit solitary ascidians.

***Nobinerilla alata* gen. et sp. nov.**

(Figs. 186, 187)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21293), paratypes (2 intact ♀♀, MNHN-IU-2014-21294), and dissected paratype (♀, figured) from *Pycnoclavella flava* (Monniot F., 1988) Chenal du Îlot Canard, New Caledonia, NC 41, depth 22 m, 17 March 1987.

**Etymology.** From the Latin *alat* (=winged), referring to the presence of epimeral wings on the metasome.

**Description of female.** Body (Fig. 186A) small, compressed; length about 1.20 mm. Cephalosome well-defined. Metasome unsegmented with 2 pairs of large wings (epimera) near bases of legs 2 and 3: wings incurved and separated from surface of metasome, forming attenuated posterodistal process with short membrane along dorsal margin. Fifth pedigerous somite fused with metasome. Free urosome (Fig. 186B) 5-segmented: genital somite short but distinctly wider than abdomen; 4 abdominal somites 53×115, 40×106, 40×102, and 49×90 µm, respectively. Caudal ramus (Fig. 186E) about 2.1 times longer than wide (79×37 µm) and about 1.2 times longer than anal somite, gradually narrowing distally: armed with 6 naked setae; outer lateral and dorsal setae located at 55 and 76% of ramus length; longest distal seta about 1.3 times longer than ramus, second longest seta nearly as long as ramus.

Rostrum (Fig. 186C) short and wide, strongly tapering towards obtuse apex. Antennule (Fig. 186D) rather slender, 9-segmented; first and second segments not strongly expanded; eighth segment subdivided by incomplete suture line; armature formula 3, 15, 6, 3+aesthetasc, 1, 3, 2+aesthetasc, 4+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 186F) stout, 4-segmented; coxa and basis unarmed; first endopodal segment with small seta on inner margin; compound distal endopodal segment 40×21 µm, as long as first segment: armed with 8 setae plus

large, strongly curved terminal claw, longer than segment.

Labrum very weak and destroyed during dissection. Mandible (Fig. 186G) with 5 teeth on coxal gnathobase; basis with very small medial seta; exopod with 5 setae, distal outer seta shorter than other 4; endopod indistinctly articulated from basis, with 4 and 6 setae on first and second segments, respectively; outer distal seta on second endopodal segment shorter than other 5 setae. Paragnath (Fig. 186H) with short, blunt process apically and setules on medial margin. Maxillule (Fig. 186I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis and 4 each on exopod and endopod. Maxilla (Fig. 186J) with 9 setae (grouped as 3, 1, 2, and 3) on syncoxa, claw plus 1 seta on basis, and 1, 1, and 2 setae on first to third endopodal segments, respectively. Maxilliped unsegmented (Fig. 187A), lacking distal prolongation; armed with 8 (4+4) setae medially and 1 outer distal seta.

Legs 1–4 (Fig. 187B–F) with 3-segmented rami. Inner coxal seta present in leg 3, but absent in legs 1, 2 and 4. Outer seta on basis large (longer than exopod in leg 1), small in legs 2–4. Inner distal spine on basis of leg 1 extending to distal border of first endopodal segment, 28 µm long. Exopods of legs 2–4 bearing only setae. Legs 2–4 asymmetrical: setae on endopods long on left legs, but those of right legs short and blunt at tip (cf. Fig. 187E and 187F). Exopod slightly longer than endopod in leg 1, and about 1.5 times longer in legs 2–4. Legs 3 and 4 with different armature formula between left and right legs. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Left leg 3	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 3
Right leg 3	0-1	1-0	1-1; 1-1; 1, 1, 5	0-1; 0-2; 1, 2, 3
Left leg 4	0-0	1-0	1-0; 1-0; 2, 1, 4	0-0; 0-0; 1, 2, 2
Right leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-0; 0-1; 1, 2, 2

Leg 5 (Fig. 187G) consisting of short but broad protopodal plate (formed by fused left and right protopods) and free exopodal segments; protopodal plate with 1 seta at each outer distal corner and row of minute spinules near base of exopod; free exopodal segment small, about 3.5 times longer than wide (38×11 µm), lacking ornamentation, armed with 1 seta at outer distal corner.

**Male.** Unknown.

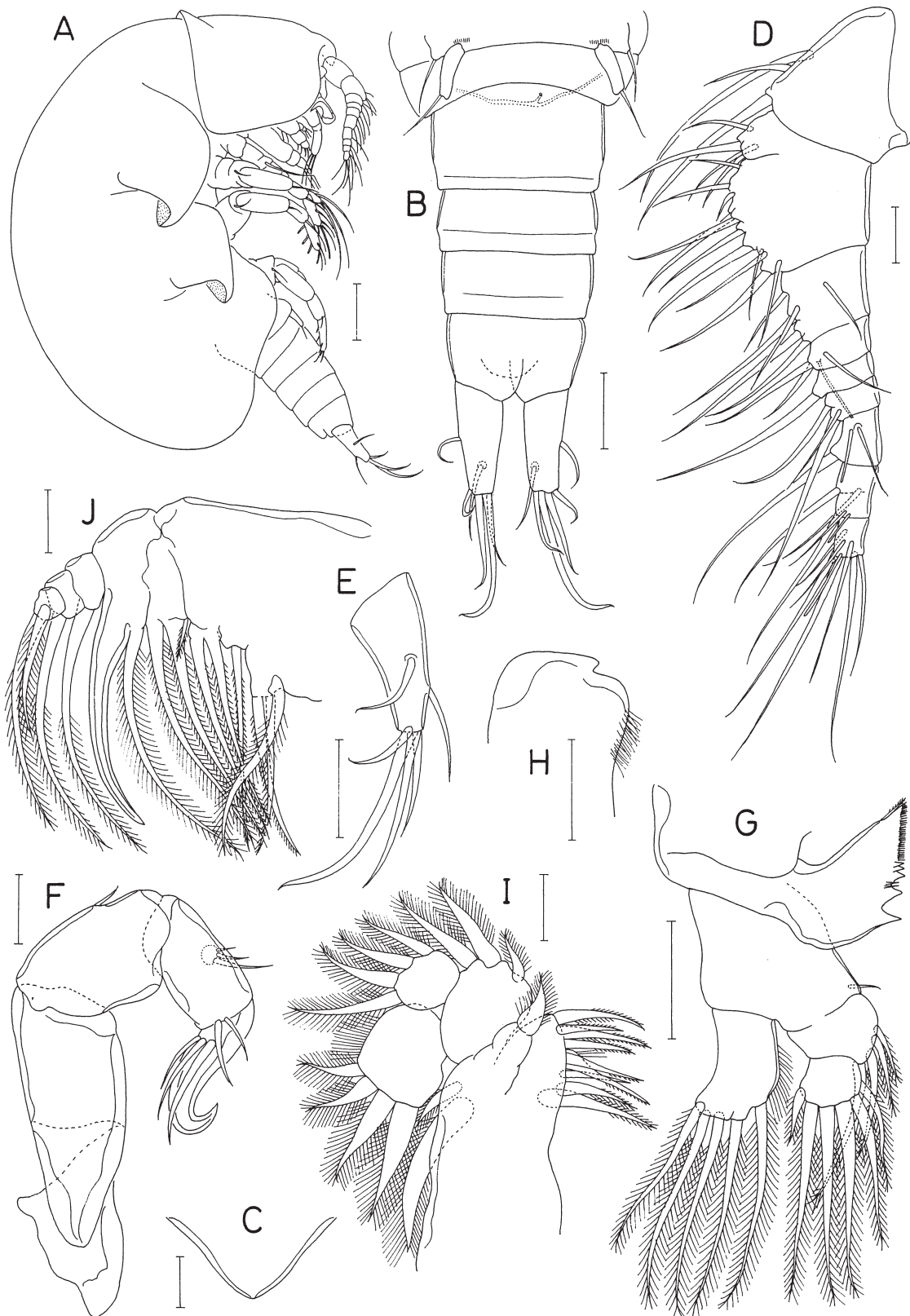
**Remarks.** The distinctive wing-like projections on the metasome have not been recorded previously in related genera.

***Nobinerilla filipes* (Stock, 1967) comb. nov.**

(Figs. 188, 189)

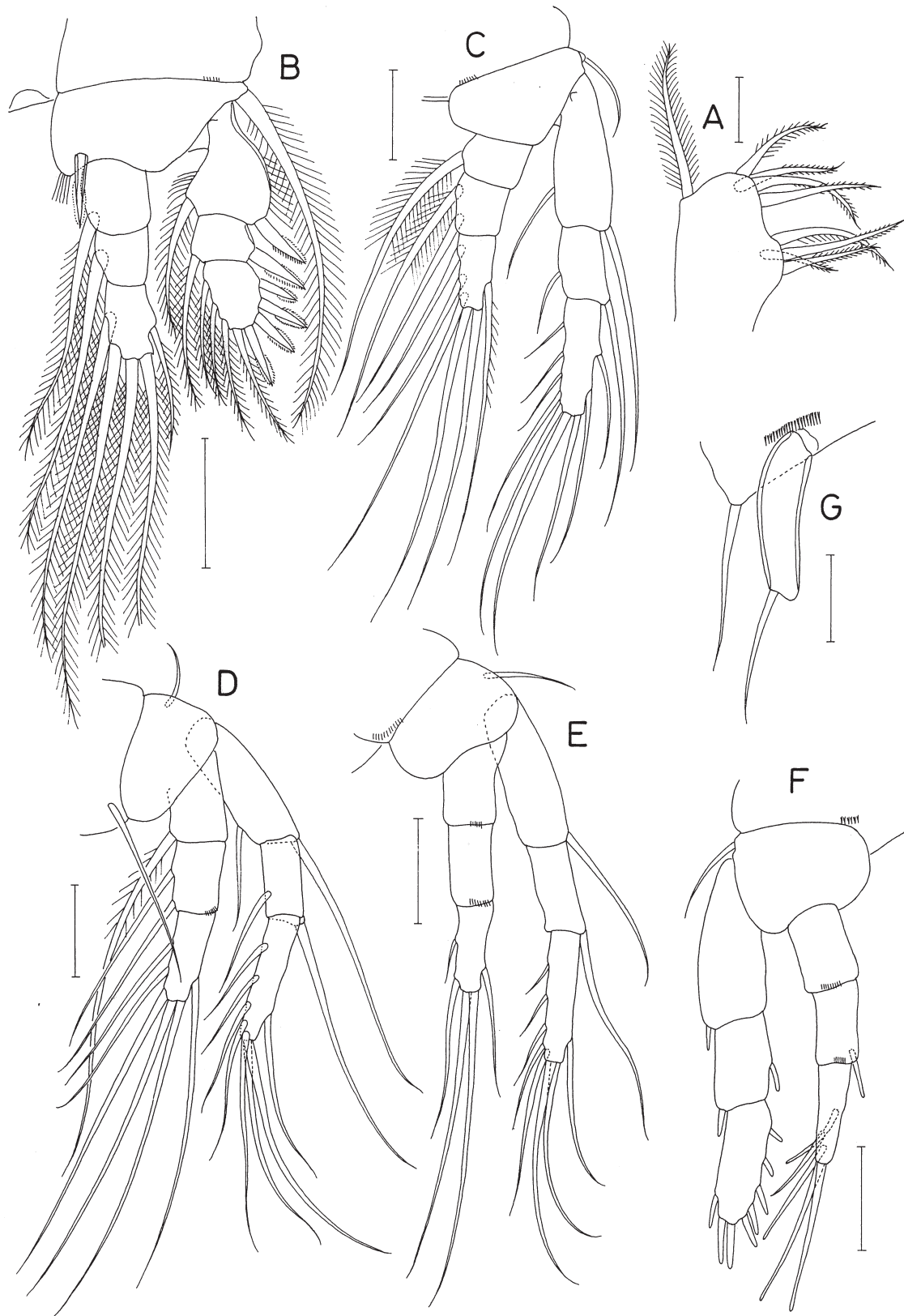
Syn.: *Bonnierilla filipes* Stock, 1967

*Bonnierilla armata* sensu Illg & Dudley, 1961: 61, figs. 19. 20.



**FIGURE 186.** *Nobinerilla alata* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, rostrum; D, antennule; E, caudal ramus; F, antenna; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scale bars: A, 0.1 mm; B, E, G, 0.05 mm; C, D, F, H–J, 0.02 mm.





**FIGURE 187.** *Nobinerilla alata* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, left leg 2; C, left leg 3; E, left leg 4; F, right leg 4; G, leg 5. Scale bars: A, G, 0.02 mm; B–F, 0.05 mm.

**Material examined.** 1 ♀ (dissected and figured) from *Dendrodoa grossularia* (Van Beneden, 1846), Portugal; 1 ♀ (dissected) from *Ascidia iberica* Monniot C. & Monniot F., 1988, Seamount 1 DW 0, (36°32.0'N, 11°37.9'W), Banc de Gorringe, depth 180 m 22 September 1987.

**Description of female.** Body (Fig. 188A) compressed, 2.55 mm long. Prosome 1.81 mm long, comprising small, clearly defined cephalosome and unsegmented, expanded metasome, 0.96 mm in dorsoventral depth. Fifth pedigerous somite fused with metasome. Free urosome (Fig. 188B) 5-segmented: genital somite short, 80×290 µm; 4 abdominal somites 189×290, 153×269, 109×229, and 102×204 µm, respectively. Anal operculum large. Caudal rami widely separated from each other; each ramus (Fig. 188C) about 3.1 times longer than wide (171×55 µm): armed with 6 naked setae; longest distal seta about half as long as ramus; outer lateral and dorsal setae positioned at 48 and 69% of ramus length, respectively.

Rostrum (Fig. 188D) as long as wide, strongly tapering towards blunt apex. Antennule (Fig. 188E) 276 µm long and 7-segmented; armature formula 3, 16, 9, 4, 2+aesthetasc, 4+aesthetasc, and 7+aesthetasc; sixth segment with subdivision in middle; 2 pinnate setae on first segment and 1 each on second and fifth, sixth and seventh segments. Antenna (Fig. 188F) slender, 4-segmented; coxa short and unarmed; basis more than twice as long as wide and unarmed; first endopodal segment about 1.6 times longer than wide (90×56 µm), with 1 seta on medial side; compound distal endopodal segment about 3.6 times longer than wide (127×35 µm); armed with 7 setae plus small terminal claw, less than half as long as segment.

Labrum (Fig. 188G) with large, setulose posteromedial lobe and setulose posterior region. Mandible (Fig. 188H) with 5 teeth and 1 proximal seta on coxal gnathobase; basis with 1 small seta on medial margin; exopod 2-segmented with 3 and 2 setae on first and second segments, respectively; outer distal seta on second segment shorter than other 4 setae; endopod with 4 and 5 setae on first and second segments, respectively; second endopodal segment small and distinctly narrower than first. Paragnath (Fig. 188J) ornamented with 2 dentiform processes apically and setules on medial margin. Maxillule (Fig. 188I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 4 on exopod, 3 each on basis and endopod; endopodal segment much smaller than exopodal segment. Maxilla (Fig. 188K) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with smooth claw plus 1 seta; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 189A) unsegmented with 10 medial setae and 1 outer distal seta.

Leg 1 (Fig. 189B) with 3-segmented rami. Coxa lacking inner seta. Outer seta on basis large, slightly longer than exopod; basis lacking inner distal spine. Second exopodal segment lacking inner seta. Four inner setae on

third exopodal segment small and naked. Endopod slender with small inner setae, but with 3 enlarged distal setae on third segment.

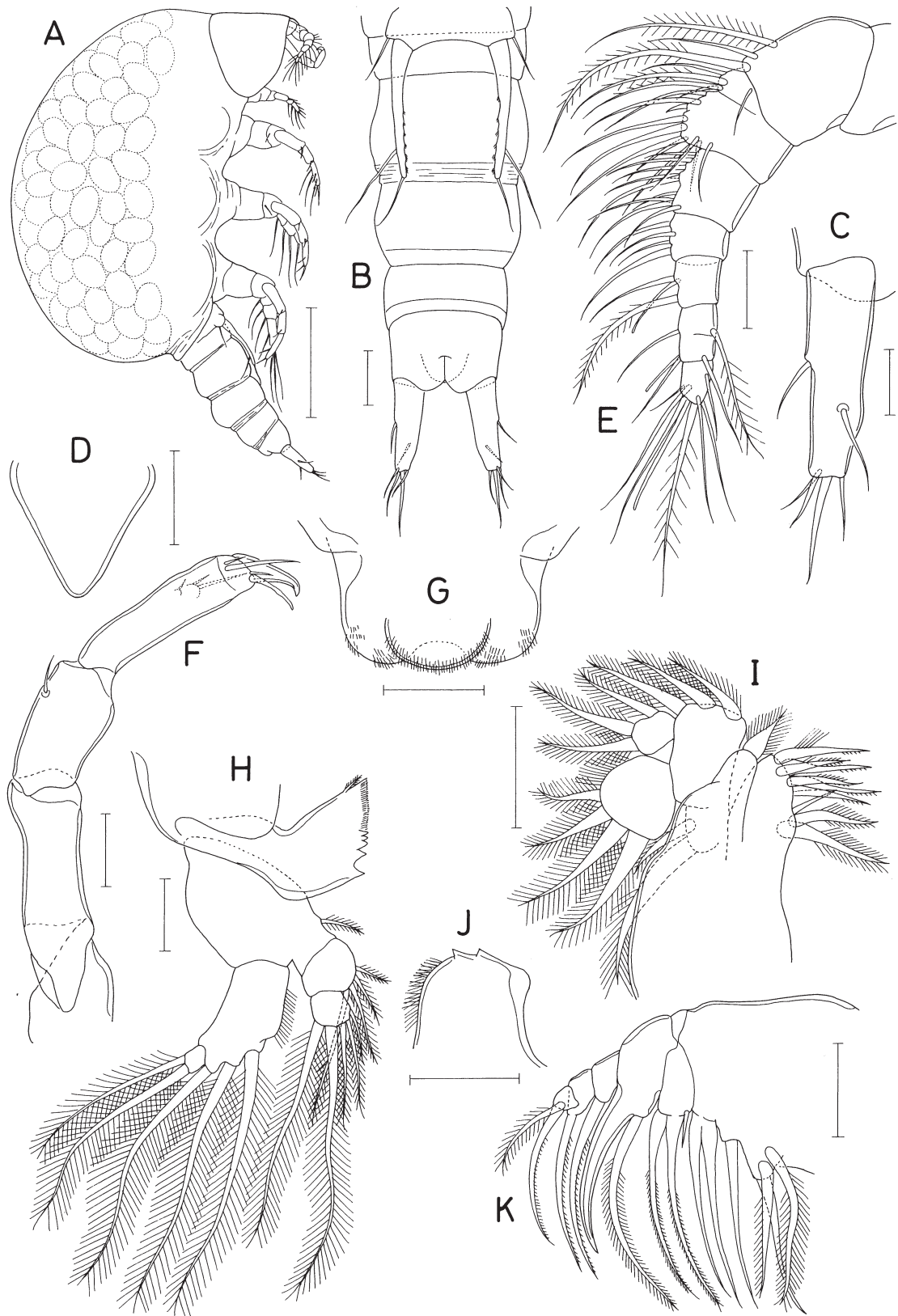
Legs 2–4 (Fig. 189C–E) with 3-segmented rami. Inner coxal seta absent in leg 2, but present, small and naked in left legs 3 and 4, smaller or absent in right legs 3 and 4. Outer seta on basis small and naked in legs 2–4. Exopod 1.8 times longer than endopod in leg 2, about 1.5 times longer in leg 3, and 1.4 times longer in leg 4. All exopodal segments of legs 2–4 bearing slender, naked setae (not spines) on outer margin. Setae on third exopodal segment of right legs 2–4 shorter than those of left legs. Three inner distal setae on third exopodal segment of legs 2–4 much smaller than adjacent proximal and distal setae. First and second endopodal segments with weakly bilobed distal margin densely ornamented with spinules. Third endopodal segment of legs 3 and 4 elongated, longer than first and second segments combined, 4.3 and 4.5 times longer than wide in legs 3 and 4, respectively. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	1-1; I-0; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 2

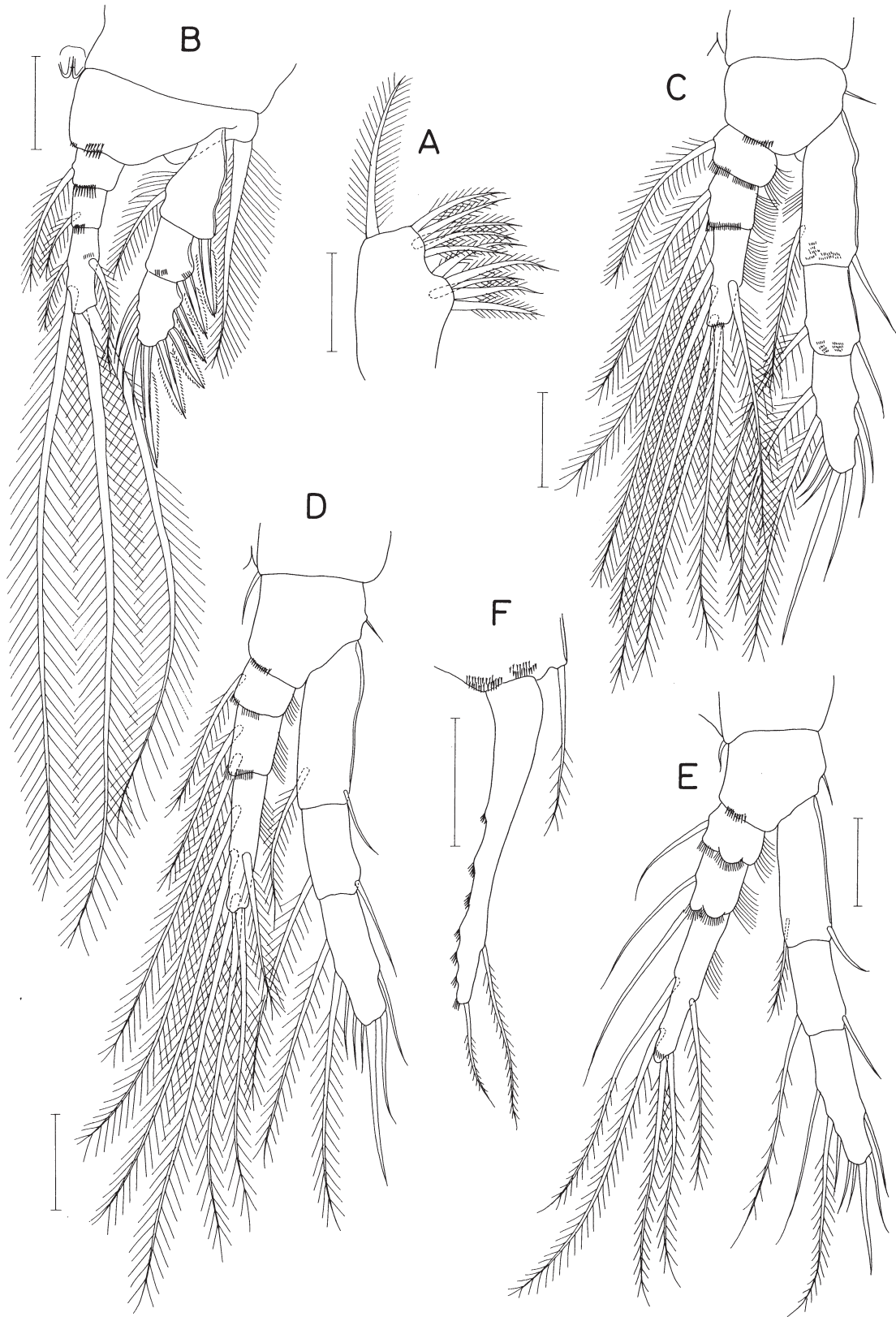
Leg 5 (Fig. 189F) with short protopod bearing pinnate outer distal seta and 1 or 2 patches of minute spinules near base of exopod. Exopodal segment markedly elongate, 6.3 times longer than wide (258×41 µm); 5.9 times longer than wide (295×50 µm) in specimen from *Ascidia iberica*; armed with 1 short distal and 1 long outer subdistal pinnate seta and ornamented with 7 to 10 rows of minute spinules on inner surface. Two setae on exopod of right leg 5 shorter than those of left leg 5.

**Male.** Unknown.

**Remarks.** *Nobinerilla filipes* (Stock, 1967) **comb. nov.** is very similar to *B. armata* and both species are recognized as belonging to the new genus. *Bonnierilla armata* is here transferred to the new genus, as *Nobinerilla armata* (Schellenberg, 1922) **comb. nov.** Both species share the possession of 3 setae on the endopod of the maxillule, the lack of the inner distal spine on the basis of leg 1 and of an inner seta on the second exopodal segment of leg 1, and both species have an elongate exopodal segment on leg 5. Stock (1967) pointed out two noticeable differences between them: in *N. armata* the cephalosome forms a spatulate extension at each posterolateral corner and it possesses 3 setae on the exopod of leg 5. However, the latter feature is questionable even though the figure of Schellenberg (1922) showed 3 setae, because the free exopodal segment of leg 5 is known to carry a maximum of 2 setae in all other notodelphyid copepods, including all the relatively basal genera. We consider it likely that Schellenberg's figure was erroneous.



**FIGURE 188.** *Nobinerilla filipes* (Stock, 1967) **n. comb.**, female. A, habitus, right; B, urosome, ventral; C, caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, paragnath; K, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C–K, 0.05 mm.



**FIGURE 189.** *Nobinerilla filipes* (Stock, 1967) **n. comb.**, female. A, maxilliped; B, leg 1; C, left leg 2; D, left leg 3; E, left leg 4; F, leg 5. Scale bars: A, B, 0.05 mm; C–F, 0.1 mm.

***Nobinerilla exilipes* gen. et sp. nov.**

(Figs. 190, 191)

**Type material;** Holotype (intact ♀, MNHN-IU-2014-21295) and dissected paratype (♀, figured) from *Symplegma alterna* Monniot C., 1988, Uie Bay, New Caledonia, depth 18 m, Monniot coll., 11 March 1987.

**Etymology.** The name is derived from the Latin *exil* (=slender) and *pes* (=a foot) and refers to the slender exopod of leg 5.

**Description of female.** Body (Fig. 190A) compressed, 1.51 mm long. Cephalosome and metasome fused; metasome unsegmented, strongly inflated, 1.13×0.84 mm in lateral view, broad in dorsal two-thirds and narrow in ventral third. Free urosome (Fig. 190B) stout, 5-segmented, gradually narrowing posteriorly: genital somite longest, 102×257 µm; 4 abdominal somites 90×207, 70×180, 50×170, and 75×127 µm, respectively. Caudal ramus (Fig. 190C) 2.1 times longer than wide (74×35 µm) and as long as anal somite: armed with 6 naked setae; outer lateral and dorsal setae positioned at 52 and 67% of ramus length, respectively; distal longest seta slightly longer than caudal ramus.

Rostrum (Fig. 190D) wider than long (68×90 µm) with rounded apex and slightly concave lateral margins. Antennule (Fig. 190E) about 190 µm long and 7-segmented; armature formula: 3, 16, 8+aesthetasc, 4, 2+aesthetasc, 3+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 190F) slender, with short coxa; basis 2.6 times longer than wide, unarmed; first endopodal segment about 1.7 times longer than wide (55×32 µm); compound distal endopodal segment distinctly narrower than first and 4.1 times longer than wide (85×21 µm); armed with 6 small setae plus small terminal claw, about one-third as long as segment.

Labrum (Fig. 190G) with large, densely setulose posteromedian lobe and setulose posterior margin. Mandible (Fig. 190H) with 5 teeth, including 2 small proximal teeth, on coxal gnathobase; basis with small medial seta; exopod with 5 setae, 2 distal setae shorter than proximal 3; endopod with 4 and 5 setae on first and second segments, respectively. Maxillule (Fig. 190I) with 9 setae on arthrite, 1 broad seta on coxal endite; 2 on epipodite; 3 on basis, 4 on exopod, and 3 on endopod. Maxilla (Fig. 191A) 5-segmented; syncoxa with 9 setae (3, 1, 2, and 3 on first to fourth endites, respectively), claw plus 1 seta on basis, and 1, 1, and 2 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 190J) unsegmented with 10 setae medially and 1 outer distal seta.

Legs 1–4 (Fig. 191B–E) with 3-segmented rami. Inner coxal seta absent in legs 1, 2, and right legs 3 and 4, but present in left legs 3 and 4; inner coxal seta on left leg 4 rudimentary. Outer seta on basis large in leg 1, but small in legs 2–4. Inner distal spine absent on basis of leg 1 (Fig. 191B). Second exopodal segment of leg 1 lacking inner seta. Three inner setae on endopod of leg 1 small, shorter

than width of endopod at base. Exopod 1.3 times longer than endopod in leg 1 and 1.4 times longer in legs 2–4. First exopodal segment longer than other exopodal segments in all legs. First and second endopodal segments of legs 2–4 with bilobed, densely setulose anterodistal margins. Third endopodal segment of legs 2–4 not elongate, more or less twice as long as wide and only slightly longer than second endopodal segment. Armature formula for legs 1–4 as in *N. filipes*.

Leg 5 (Fig. 191F) with naked outer distal seta on protopod. Exopod about 4.4 times longer than wide (109×25 µm), with 5 rows of fine spinules on inner surface; distal and subdistal setae subequal in length, both naked.

**Male.** Unknown.

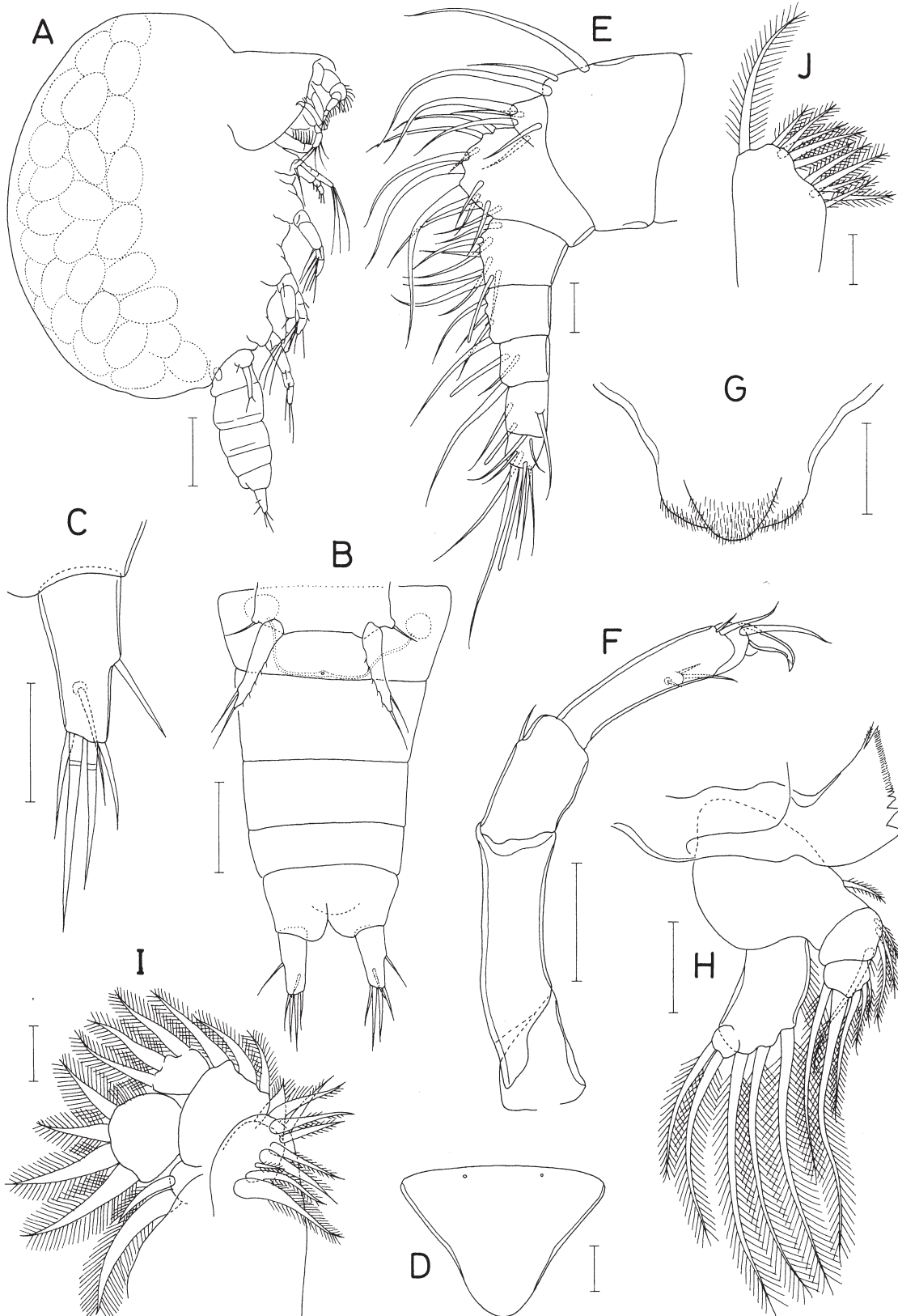
**Remarks.** *Nobinerilla exilipes* gen. et sp. nov. is very similar to *N. filipes*. They have several unusual features in common: (1) the mandible bears only 5 setae on the second endopodal segment; (2) the basis of leg 1 lacks an inner distal spine; (3) the second exopodal segment of leg 1 lacks an inner seta; (4) the endopod of the maxillule has 3 setae; and (5) the positions of the two setae on the elongate exopod of leg 5 are also characteristic, one on the apex and the other subdistally on the outer margin.

Nevertheless, these two species can be separated by the following differences: (1) the body of *N. exilipes* gen. et sp. nov. (1.51 mm long) is much smaller than that of *N. filipes* which is 2.55 and 3.26 mm long in our specimens and 2.28 mm long in the specimen of Illg & Dudley (1961); (2) the caudal ramus of *N. exilipes* gen. et sp. nov. is about 2.1 times longer than wide and the longest caudal seta is slightly longer than the caudal ramus itself, whereas the caudal ramus of *N. filipes* is 3.1 times longer than wide and all its caudal setae are less than half the length of the caudal ramus; (3) all setae on the antennule are naked in *N. exilipes* gen. et sp. nov., whereas several antennular setae are pinnate in *N. filipes*; (4) the third endopodal segment of legs 3 and 4 of *N. exilipes* gen. et sp. nov. is not elongate, and is only slightly longer than the second exopodal segment and about twice as long as wide, compared to that of *N. filipes* which is elongate, more than twice as long as the second endopodal segment and more than 4 times longer than wide; and (5) the exopod of leg 5 of *N. exilipes* gen. et sp. nov. (109 µm long, 4.4 times longer than wide) is distinctly shorter than that of *N. filipes* (258 µm long, 6.3 times longer than wide in our specimen). These differences are sufficient to justify the establishment of the new species.

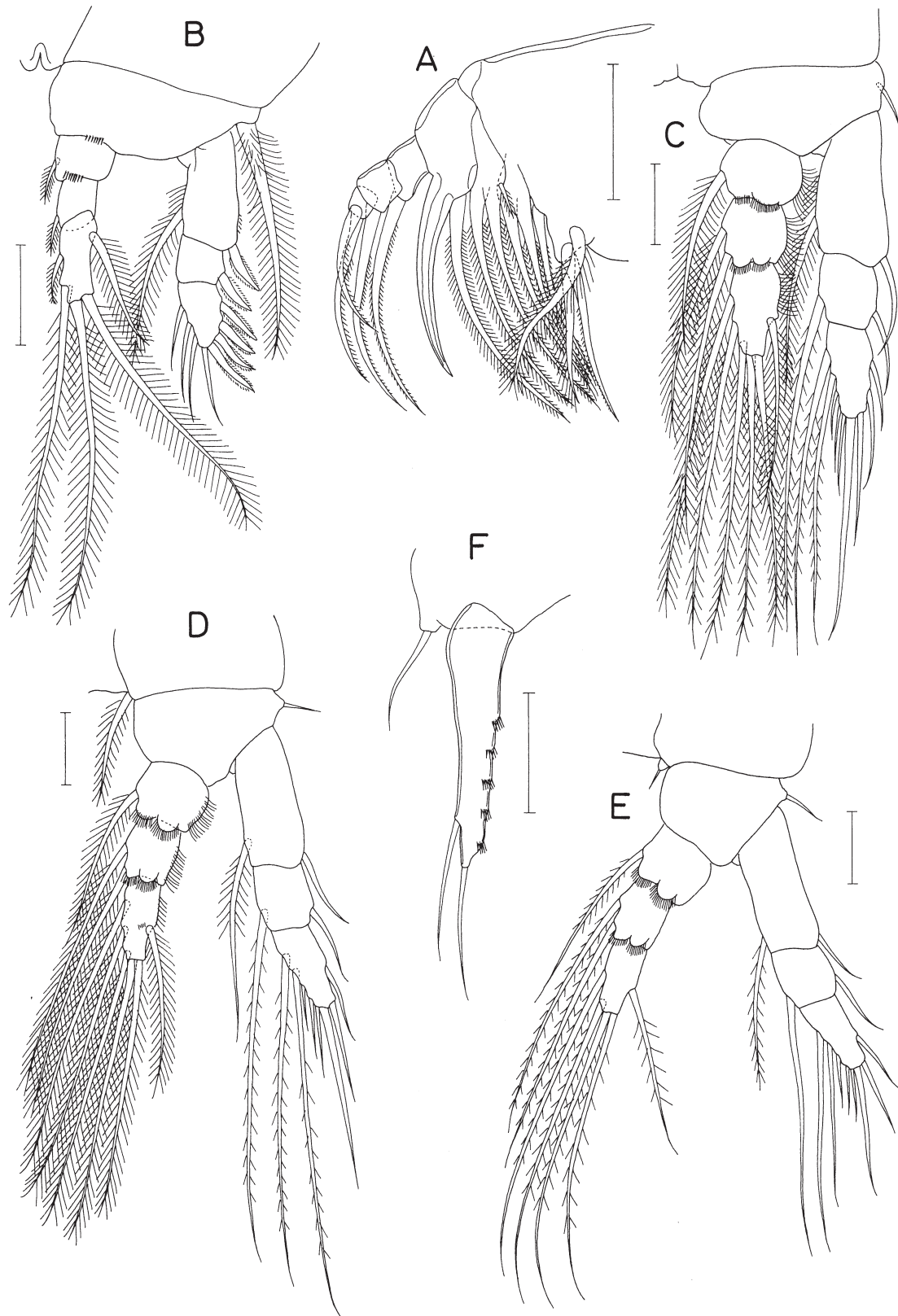
***Nobinerilla mammillata* gen. et sp. nov.**

(Figs. 192, 193)

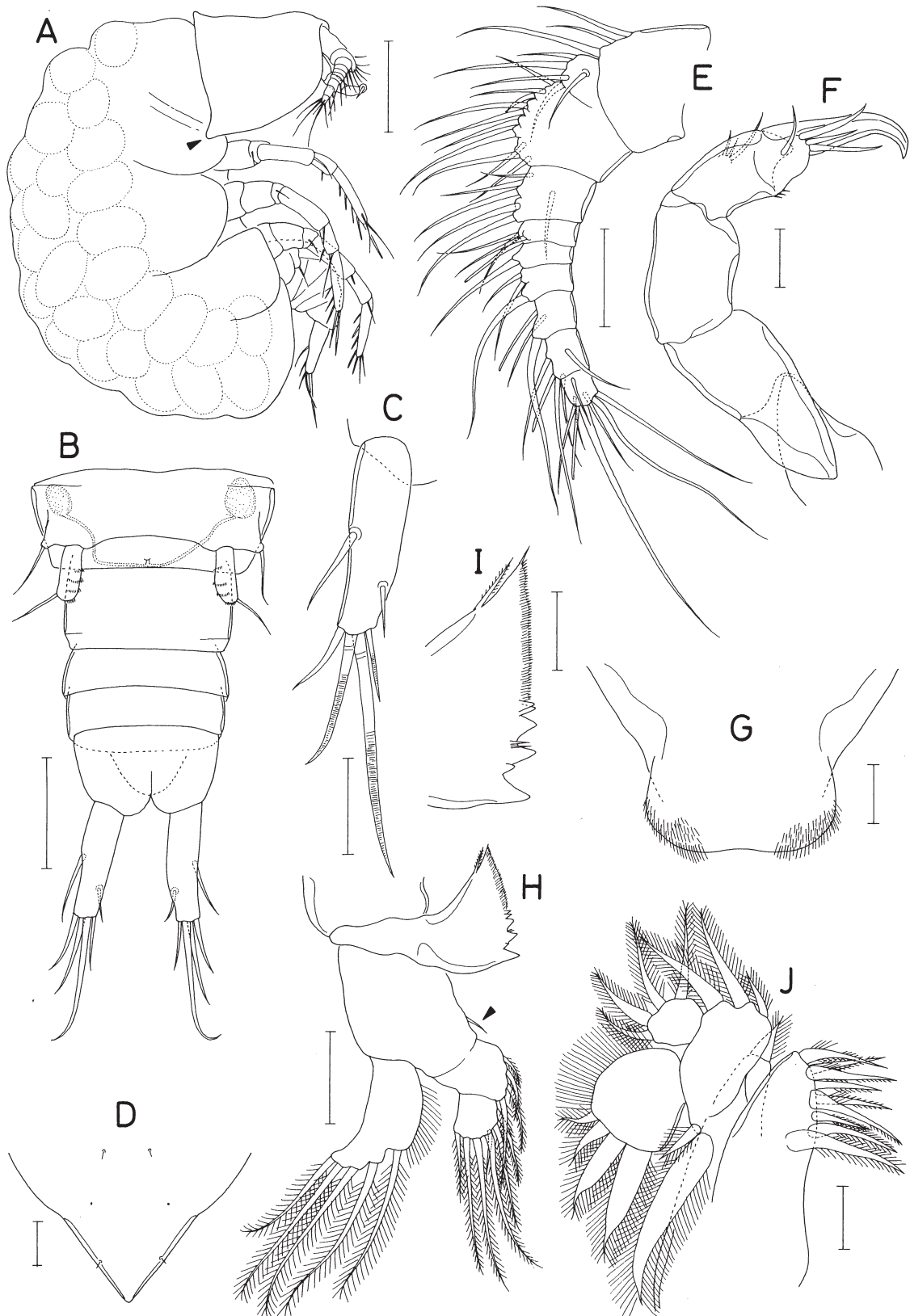
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21296), paratypes (5 intact ♀♀, MNHN-IU-2-14-21297), and dissected paratypes (2 ♀♀, figured) from *Eudistoma amplum* (Sluiter, 1909) (MNHN-IT-2008-3949 = MNHN



**FIGURE 190.** *Nobinerilla exilipes* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilliped. Scale bars: A, 0.2 mm; B, 0.1 mm; C, F–H, 0.05 mm; D, E, I, J, 0.02 mm.

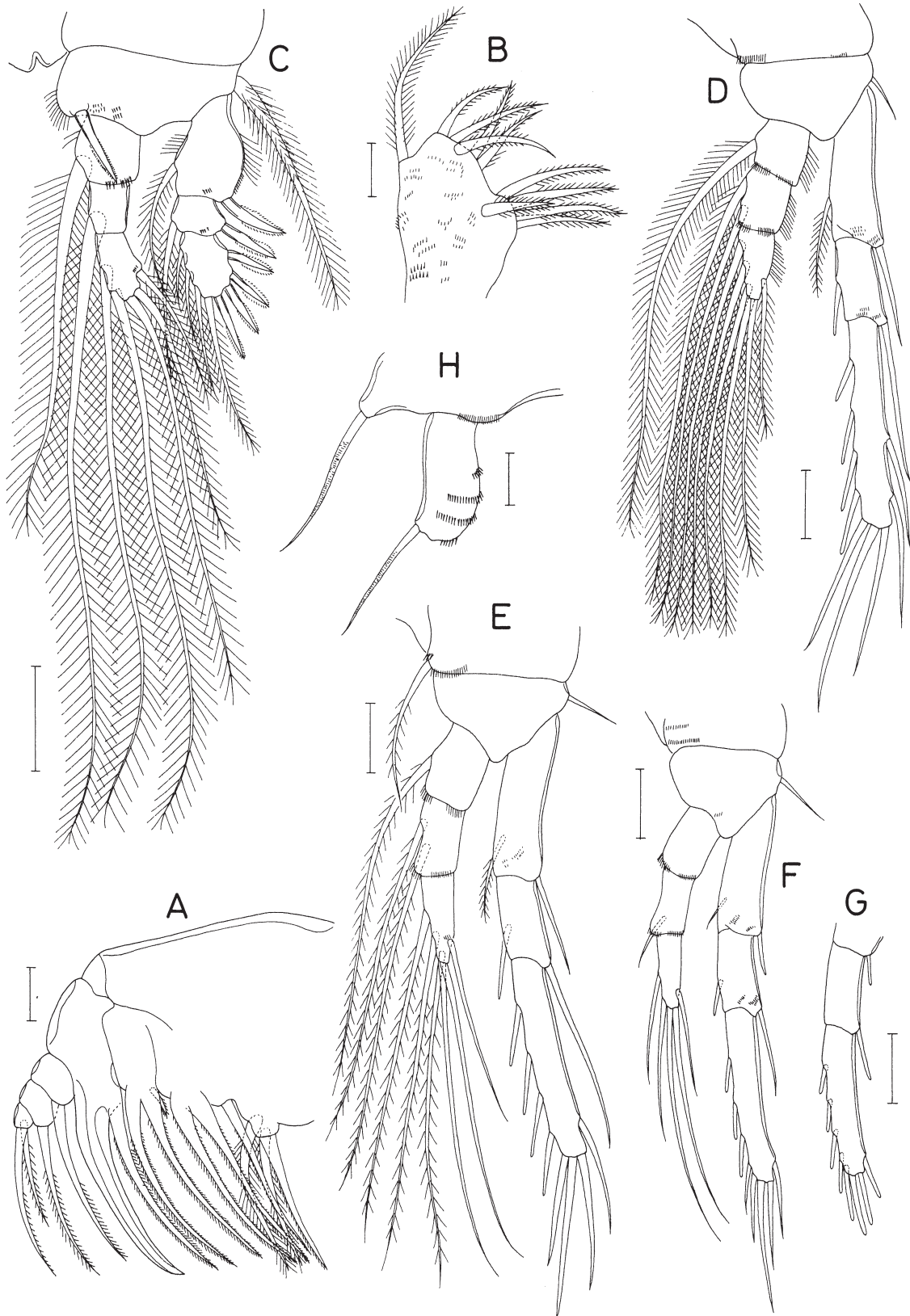


**FIGURE 191.** *Nobinerilla exilipes* gen. et sp. nov., female. A, maxilla; B, leg 1; C, left leg 2; D, left leg 3; E, left leg 4; F, leg 5. Scale bars: 0.05 mm.



**FIGURE 192.** *Nobinerilla mammillata* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible with seta on basis marked by arrowhead; I, mandibular gnathobase; J, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C, E, H, 0.05 mm; D, F, G, I, J, 0.02 mm.





**FIGURE 193.** *Nobinerilla mammillata* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, left leg 2; E, left leg 3; F, left leg 4; G, distal segments of right leg 4. Scale bars: A, B, H, 0.02 mm; C, D–G, 0.05 mm.

A3/EUD/84), CRRF OCDN 1174-L, Palau Islands, Venture ML (cave dwelling), depth 1 m, 05 July 1993.

**Additional material.** 1 ♀ (dissected) from *E. amplum*, OCDN 5053-A, Palau; 1 ♀ (dissected) from *Eudistoma* sp., Papua New Guinea (10°06.33'S, 150°57.68'E), depth 7 m, 20 January 2002.

**Etymology.** The specific name is derived from the Latin *mammill* (a teat), alluding to the shape of the posterolateral processes on the cephalosome.

**Description of female.** Body (Fig. 192A) compressed, strongly curved, and relatively small (length 1.45 mm). Cephalosome forming small nipple-shaped processes (arrowhead in Fig. 192A) at posterolateral corners of dorsal shield. Metasome unsegmented with thin, soft exoskeleton; fifth pedigerous somite incorporated into metasome. Free urosome (Fig. 192B) 5-segmented: genital somite much wider than first abdominal somite. Anal somite with large anal operculum. Caudal ramus (Fig. 192C) 3.5 times longer than wide (104×30 µm) and 1.3 times longer than anal somite, slightly narrowing distally: armed with 6 naked setae; outer lateral and dorsal setae located at 50 and 75% of ramus length, respectively; distal largest seta 127 µm long, longer than ramus; second largest seta 72 µm long.

Rostrum (Fig. 192D) wider than long, strongly tapering and narrowing at mid-length towards angular apex. Antennule (Fig. 192E) clearly 9-segmented; armature formula 3, 14+spine, 7, 3+aesthetasc, 1, 3, 2+aesthetasc, 5, and 7+aesthetasc; all setae naked. Antenna (Fig. 192F) stout, 4-segmented; coxa, basis and first endopodal segment unarmed; compound distal endopodal segment about 1.8 times longer than wide (42×24 µm), as long as first segment; armed with 7 setae (all attenuated) plus terminal claw, longer than segment.

Labrum (Fig. 192G) simple, covered with dense setules posterolaterally. Mandible (Fig. 192H) with 5 teeth and 1 subsidiary tooth between distal first and second teeth on coxal gnathobase (Fig. 192I); basis with 1 small seta on medial margin (arrowhead in Fig. 192H); exopod unsegmented with 5 setae, distalmost seta shorter than other 4; endopod incompletely articulated from basis, with 4 and 7 setae on first and second segments, respectively. Paragnath with 1 short process apically and setules on medial margin. Maxillule (Fig. 192J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, and 4 each on exopod and endopod; exopodal segment broadened, 2 outer setae broad and 2 inner setae much shorter than outer setae. Maxilla (Fig. 193A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with strong claw plus 1 seta; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 193B) 1-segmented and armed with 10 medial setae and 1 outer distal seta; surface ornamented with minute scattered spinules.

Legs 1–4 (Fig. 193C–F) with 3-segmented rami. Inner coxal seta absent in legs 1 and 2, present in legs 3 and 4.

Inner coxal seta of leg 4 short and naked, absent in some specimens (as in Fig. 193F). Outer seta on basis large (longer than exopod) in leg 1, but small in legs 2–4. Inner distal spine on basis of leg 1 extending to distal border of first endopodal segment, 39 µm long. Exopod 1.1 times longer than endopod in leg 1, about 2.4 times longer in leg 2, and 1.9 times longer in legs 3 and 4. Third exopodal segment in legs 2–4 elongated, distinctly longer than first segment. Exopods of legs 2–4 bearing only setae. Distal setae on third exopodal segment of legs 2–4 attenuated in left legs, but short and blunt tipped in right legs (cf. Fig. 193F and G). Inner seta on first exopodal segment of leg 4 vestigial. Inner setae on endopod of leg 1 very large. First endopodal segment of leg 4 lacking inner seta. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-0; 0-1; 1, 2, 2

Leg 5 (Fig. 193H) 2-segmented. Left and right protopods fused to form wide protopodal plate armed with 1 seta at each outer distal corner, and ornamented with row of minute spinules near base of exopod; exopodal segment stout, about 2.0 times longer than wide (45×22 µm), armed with 1 seta (50 µm long) at outer distal corner and ornamented with 4 rows of minute spinules on inner surface.

**Male.** Unknown.

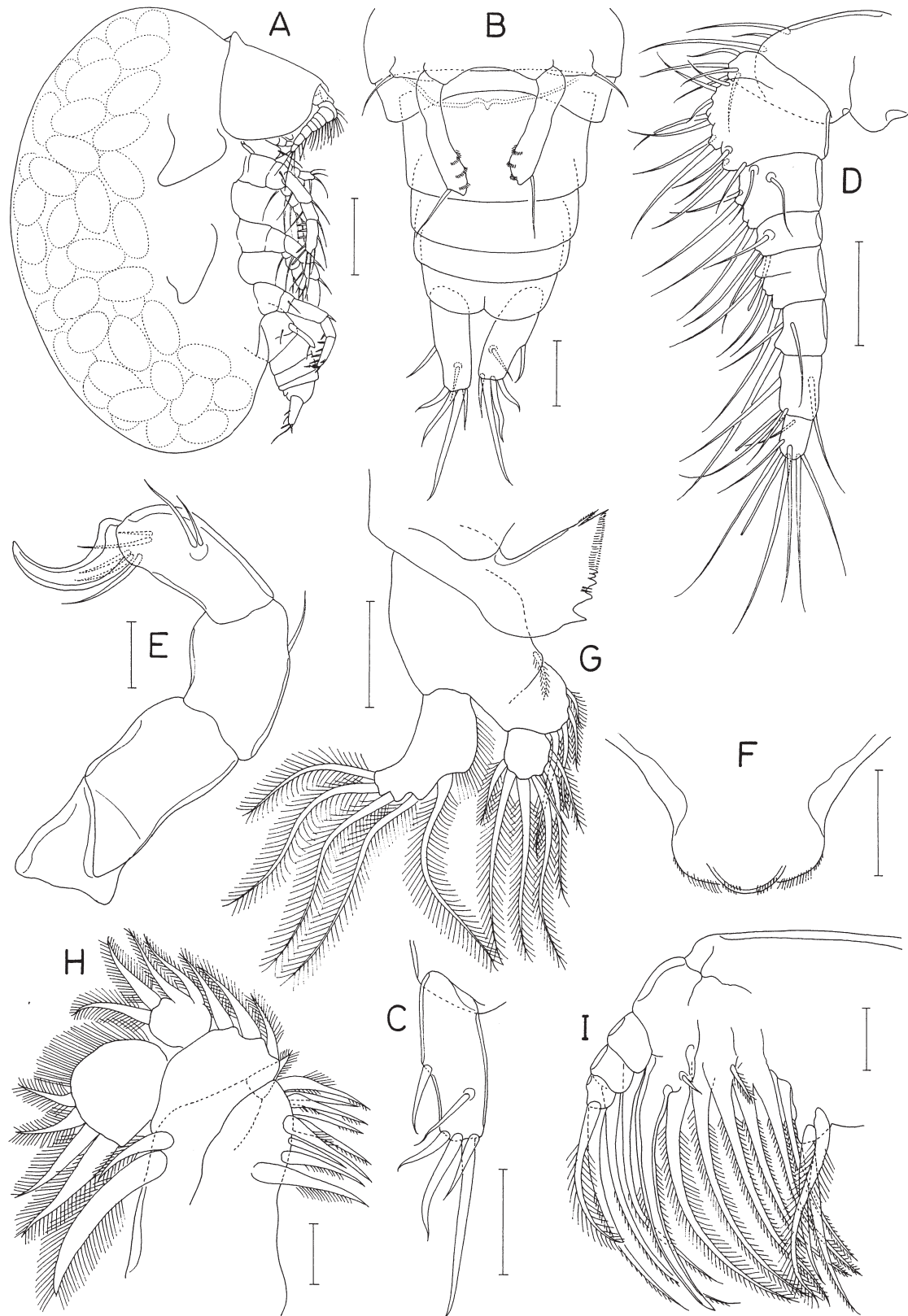
**Remarks.** The nipple-shaped processes at the posterolateral corners of the cephalosome are a diagnostic feature of *N. mammillata* **gen. et sp. nov.** Schellenberg (1922) recorded the presence of similar processes in *N. armata*, but the latter species can be distinguished by having 3 setae on the endopod of the maxillule (cf. 4 in the new species), and in lacking the inner seta on the second exopodal segment of leg 1 (cf. seta present). The possession of 7 setae on the second endopodal segment of the mandible also is a diagnostic feature of the new species when compared to 6 setae in the type species *N. alata* **gen. et sp. nov.** and *N. armata*, and 5 setae in *N. filipes* and *N. exilipes* **gen. et sp. nov.** (Table 4)

***Nobinerilla ovata* gen. et sp. nov.**

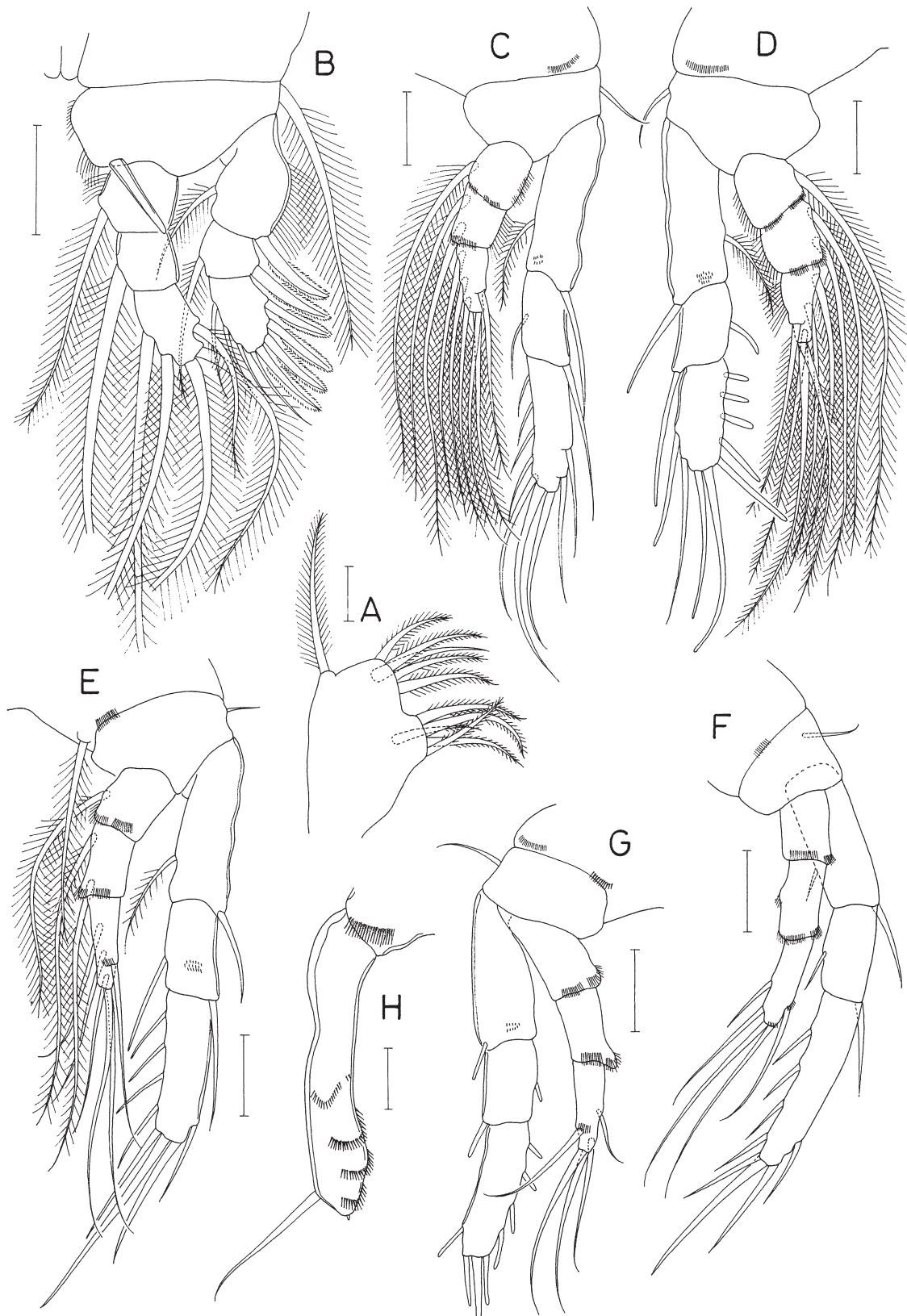
(Figs. 194, 195)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21298), paratypes (4 intact ♀♀, MNHN-IU-2014-21299), and dissected paratypes (2 ♀♀, figured) from *Eudistoma hospitale* Monniot F., 1998, Papua New Guinea (09°05'S, 149°19'E), 22 January 2002.

**Etymology.** The specific name refers to the ovoid prosome of this species.



**FIGURE 194.** *Nobinerilla ovata* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus, dorsal; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla. Scale bars: A, 0.2 mm; B–D, F, G, 0.05 mm; E, H, I, 0.02 mm.



**FIGURE 195.** *Nobinerilla ovata* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, left leg 2; D, right leg 2; E, left leg 3; F, left leg 4; G, right leg 4; H, exopod of leg 5. Scale bars: A, H, 0.02 mm; B–G, 0.05 mm.

**Description of female.** Body (Fig. 194A) compressed, oval in lateral view, 1.80 mm long. Cephalosome, with rounded posterolateral corners, distinctly defined from metasome. Metasome unsegmented, bearing 2 pairs of small epimeral wings; wings tapering distally towards rounded apex. Free urosome (Fig. 194B) 5-segmented: genital somite short and wide; first abdominal somite longest. Caudal ramus (Fig. 194C) about 2.5 times longer than wide (81×32 µm): armed with 6 thick, naked setae; outer lateral and dorsal setae positioned at 56% and 75% of ramus length, respectively; longest seta 85 µm long, slightly longer than ramus; all other setae shorter than ramus.

Rostrum short, more than twice as wide as long, with rounded apex. Antennule (Fig. 194D) 224 µm long, 8-segmented; fifth segment with partial subdivision on anterior surface; armature formula 3, 16, 6, 3+aesthetasc, 4, 3, 4+aesthetasc, 7+aesthetasc; setae generally short, all naked. Antenna (Fig. 194E) 4-segmented; coxa unarmed; basis also unarmed, about 1.3 times longer than wide; first endopodal segment slightly shorter than basis, armed with 1 inner seta; compound distal endopodal segment twice as long as wide (46×23 µm) and 1.2 times longer than first; armed with 7 setae plus large terminal claw, as long as segment.

Labrum (Fig. 194F) with minute setules on posterior margin and short, spinulose posteromedian lobe. Mandible (Fig. 194G) with 5 teeth on coxal gnathobase; basis with 1 medial seta; exopod with 5 setae, outer distal seta shorter than other 4 setae; endopod incompletely articulated from basis, with 4 and 7 setae on first and second segments, respectively. Paragnath densely setulose on medial margin; with short, blunt apical process. Maxillule (Fig. 194H) with 9 setae on arthrite, 1 broad seta on coxal endite, 2 on epipodite, 3 on basis, and 4 each on exopod and endopod; exopod distinctly larger than endopod. Maxilla (Fig. 194I) with 9 setae on syncoxa, claw plus 2 setae on basis, and 1, 1, and 2 setae on first to third endopodal segments, respectively; claw on basis elongate, with spinules on both margins. Maxilliped (Fig. 195A) unsegmented, truncate apically, armed with 10 medial setae and 1 outer distal seta.

Legs 1–4 (Fig. 195B–G) with 3-segmented rami. Inner coxal seta present in leg 3, absent in legs 1, 2, and 4. Outer seta on basis large in leg 1, small in legs 2–4. Inner distal spine on basis of leg 1 slightly longer than first endopodal segment, smooth, 40 µm long. Left and right legs in legs 2–4 exhibiting same armature formula, but left exopods longer than right and armed with attenuated setae. Setae on right exopods of leg 2–4 blunt at tip and shorter than those of left exopods. In left legs 2–4 exopod about 2.1 times longer than endopod in leg 2, about 1.8 times longer in legs 3 and 4. These ratios smaller in right legs 2–4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 3
Left leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-0; 0-0; 1, 2, 2
Right leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-0; 0-0; 1, 2, 2

Leg 5 consisting of short protopodal plate and free exopod; protopodal plate with outer distal seta and row of fine spinules near base of exopod on each side; exopod (Fig. 195H) elongate, narrowing at proximal third, about 4.8 times longer than wide (101×21 µm); armed with 1 seta at outer distal corner and 1 setal vestige at inner distal corner; ornamented with 4 rows of minute spinules on inner side.

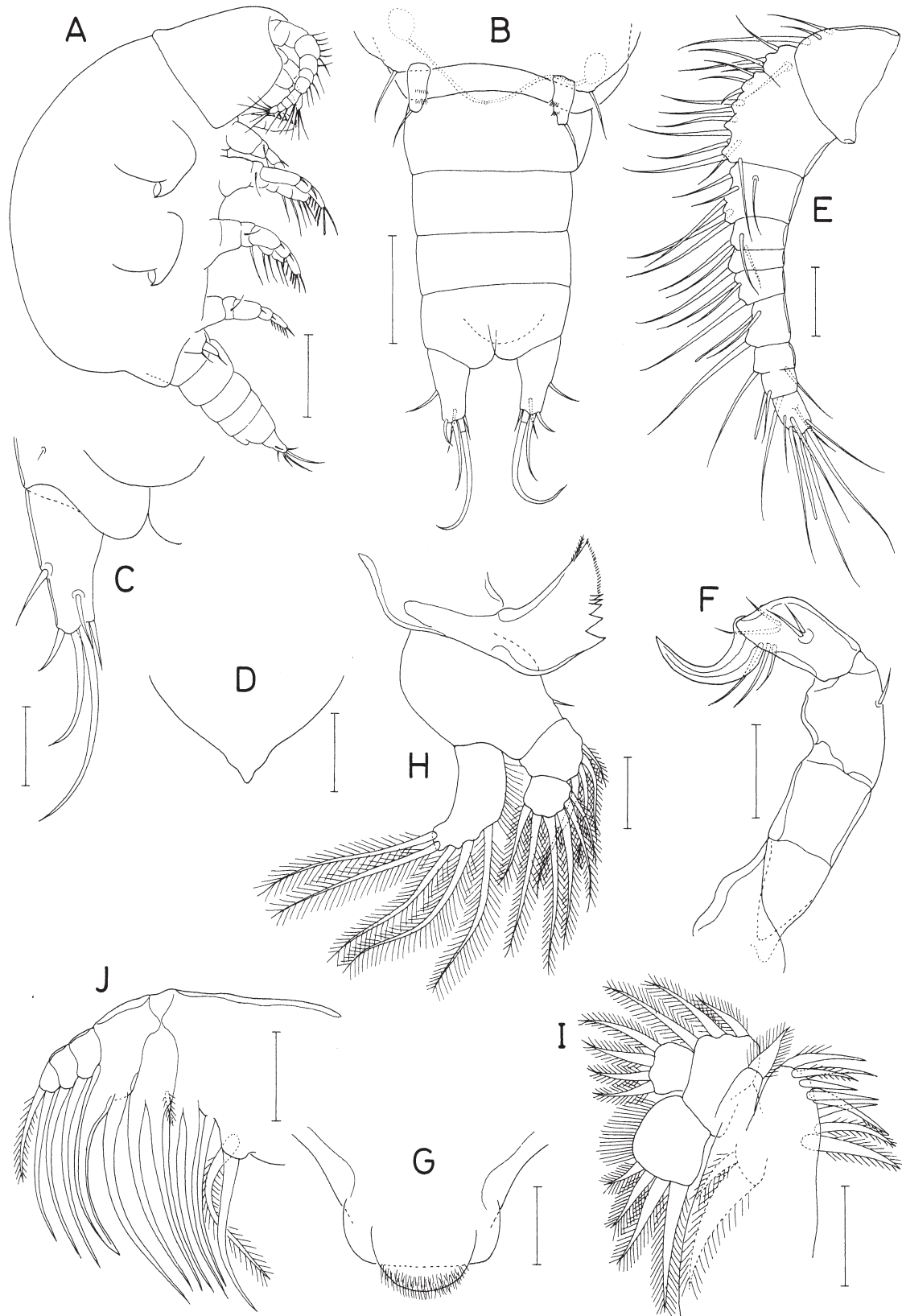
**Remarks.** *Nobinerilla ovata* **gen. et sp. nov.** has metasomal wings derived from the epimera of the second and third pedigerous somites, as in *N. alata* **gen. et sp. nov.** and other species described below. However, unlike any other similar species, it possesses 7 setae on the second endopodal segment of the mandible. Although this character state is shared with *N. mammillata* **gen. et sp. nov.** (Table 4), metasomal wings are not found in *N. mammillata* **gen. et sp. nov.**, and the inner seta on the second endopodal segment of leg 4 is not observable in *N. ovata* **gen. et sp. nov.** (cf. present in *N. mammillata* **gen. et sp. nov.**).

***Nobinerilla minuta* gen. et sp. nov.**  
(Figs. 196, 197)

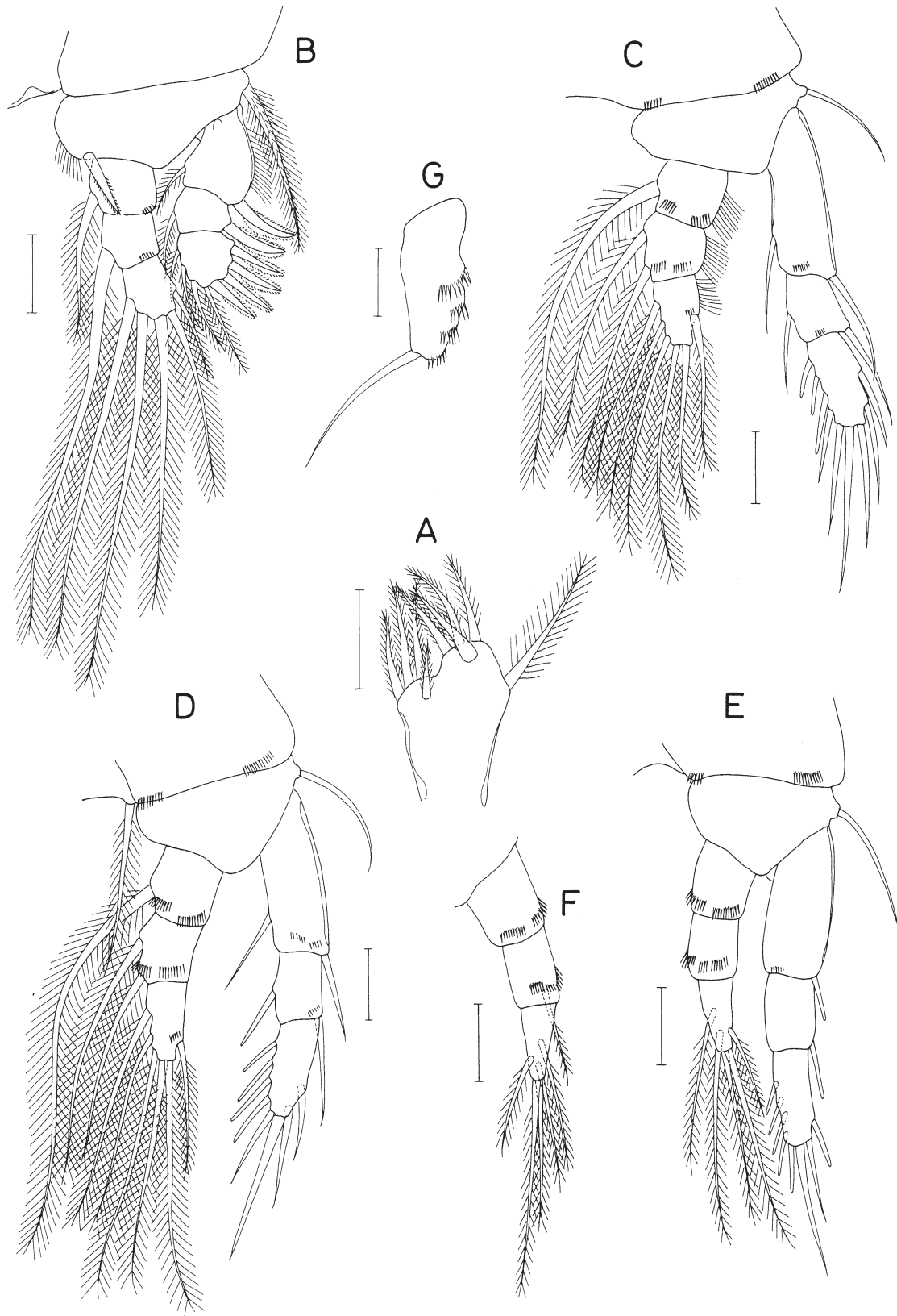
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21300), paratypes (2 intact ♀♀, MNHN-IU-2014-21301), and dissected paratype (♀, figured) from *Pseudodistoma poculum* Monniot F. & Monniot C., 1996 (Holotype MNHN-IT-2008-7380 = MNHN A1/PSE/28), OCDN 0104-V, Kuop Atoll, Chuuk State, Micronesia (07°00.00'N, 151°56.05'E), depth 30 m, 01 June 1992.

**Etymology.** The name is derived from the Latin *minut* (=small), referring to the small body of the new species.

**Description of female.** Body (Fig. 196A) small, 0.70 mm long. Cephalosome well-defined from metasome, with angular posterolateral corners. Metasome unsegmented, slightly swollen dorsally, with thin, soft exoskeleton and 2 pairs of lateral wings: each wing forming pointed posterolateral process ornamented with membranous fringe along dorsal margin. Free urosome (Fig. 196B) 5-segmented; 4 abdominal somites 35×88, 29×75, 26×72, and 35×69 µm, respectively. Anal operculum large. Caudal ramus (Fig. 196C) tapering, 2.05 times longer than wide (39×19 µm): armed with 6 naked setae; longest and second longest setae 56 and 33 µm long; outer lateral and dorsal setae located at 57 and 77% of ramus length, respectively.



**FIGURE 196.** *Nobinerilla minuta* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.1 mm; B, 0.05 mm; C–J, 0.02 mm.



**FIGURE 197.** *Nobinerilla minuta* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, left leg 2; D, left leg 3; E, left leg 4; F, endopod of right leg 4; G, exopod of leg 5. Scale bars: A–F, 0.02 mm; G, 0.01 mm.

Rostrum (Fig. 196D) short, much wider than long, apical part distinctly narrower. Antennule (Fig. 196E) 125 µm long, 9-segmented; armature formula 3, 16, 6, 4, 1, 3, 2+aesthetasc, 4+aesthetasc, and 7+aesthetasc; eighth segment with incomplete subdivision in middle; all setae naked. Antenna (Fig. 196F) 4-segmented; coxa and basis unarmed; first endopodal segment with 1 seta on inner margin; compound distal endopodal segment slightly longer than first and about 1.9 times longer than wide (25×13 µm); armed with 7 setae plus relatively large, strongly curved terminal claw, slightly longer than segment.

Labrum (Fig. 196G) with large, setulose posteromedian lobe. Mandible (Fig. 196H) with 5 teeth on coxal gnathobase; basis with rudimentary medial seta; exopod with 5 subequal setae; endopod with 4 and 6 setae on first and second segments, respectively. Maxillule (Fig. 196I) as in *N. ovata* **gen. et sp. nov.** Maxilla (Fig. 196J) 5-segmented; syncoxa with 8 setae, first endite characteristically with only 2 setae; basis with claw plus 1 seta; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 197A) unsegmented with 8 (4+4) medial setae plus 1 outer distal seta.

Legs 1–4 (Fig. 197B–E) with 3-segmented rami. Inner coxal seta present in leg 3, absent in legs 1, 2, and 4. Outer seta on basis large, plumose, as long as exopod in leg 1, smaller and naked in legs 2–4. Exopod subequal in length to endopod in leg 1, 1.8 times longer in leg 2, and 1.5 times longer in legs 3 and 4. All setae on exopods of right legs 2–4 blunt at tip and shorter than those of left legs. Second endopodal segment of right leg 4 bearing inner seta (Fig. 197F) but seta absent in left leg 4 (Fig. 197E). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 3
Left leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 0-0; 1, 2, 2
Right leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 0-1; 1, 2, 2

Leg 5 (Fig. 196B) consisting of 1 seta on protopod incorporated into somite, plus free exopod; exopodal segment (Fig. 197G) small, about 2.7 times longer than wide (24×9 µm), with 1 outer distal seta (25 µm long) and 4 rows of spinules on inner surface.

**Male.** Unknown.

**Remarks.** *Nobinerilla minuta* **gen. et sp. nov.** is similar to the type species *N. alata* **gen. et sp. nov.** in several respects. They both have a 9-segmented antennule, 6 setae on the second endopodal segment of the mandible, and 9 setae (8 medial and 1 outer distal) on the maxilliped. However, the shape of the exopod of leg 5 is quite different: it is about 2.7 times longer than wide and ornamented with spinule rows in *N. minuta* **gen. et**

**sp. nov.** but about 3.5 times longer than wide and naked (without spinule rows) in *N. alata* **gen. et sp. nov.** The most striking feature of the setation of *N. minuta* **gen. et sp. nov.** is the possession of only 2 setae on the first endite of the syncoxa of the maxilla. This characteristic serves to distinguish the new species from all congeneric species.

***Nobinerilla paucisetata* gen. et sp. nov.**  
(Figs. 198, 199)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21302) and dissected paratype (♀, figured) from *Aplidium nadaense* (Nishikawa, 1980) (MNHN-IT-2008-576 = MNHN A1 /APL.B/407), Brooker Channel, Calvados Island Chain, Louisiade Archipelago, Papua New Guinea (11°03.09'S, 152°28.62'E), depth 7 m, 01 June 1999.

**Additional material.** 3 ♀♀ (MNHN-IU-2018-1845) and 1 dissected ♀ from *Aplidium californicum* (Ritter & Forsyth, 1917), New Caledonia UA 33.

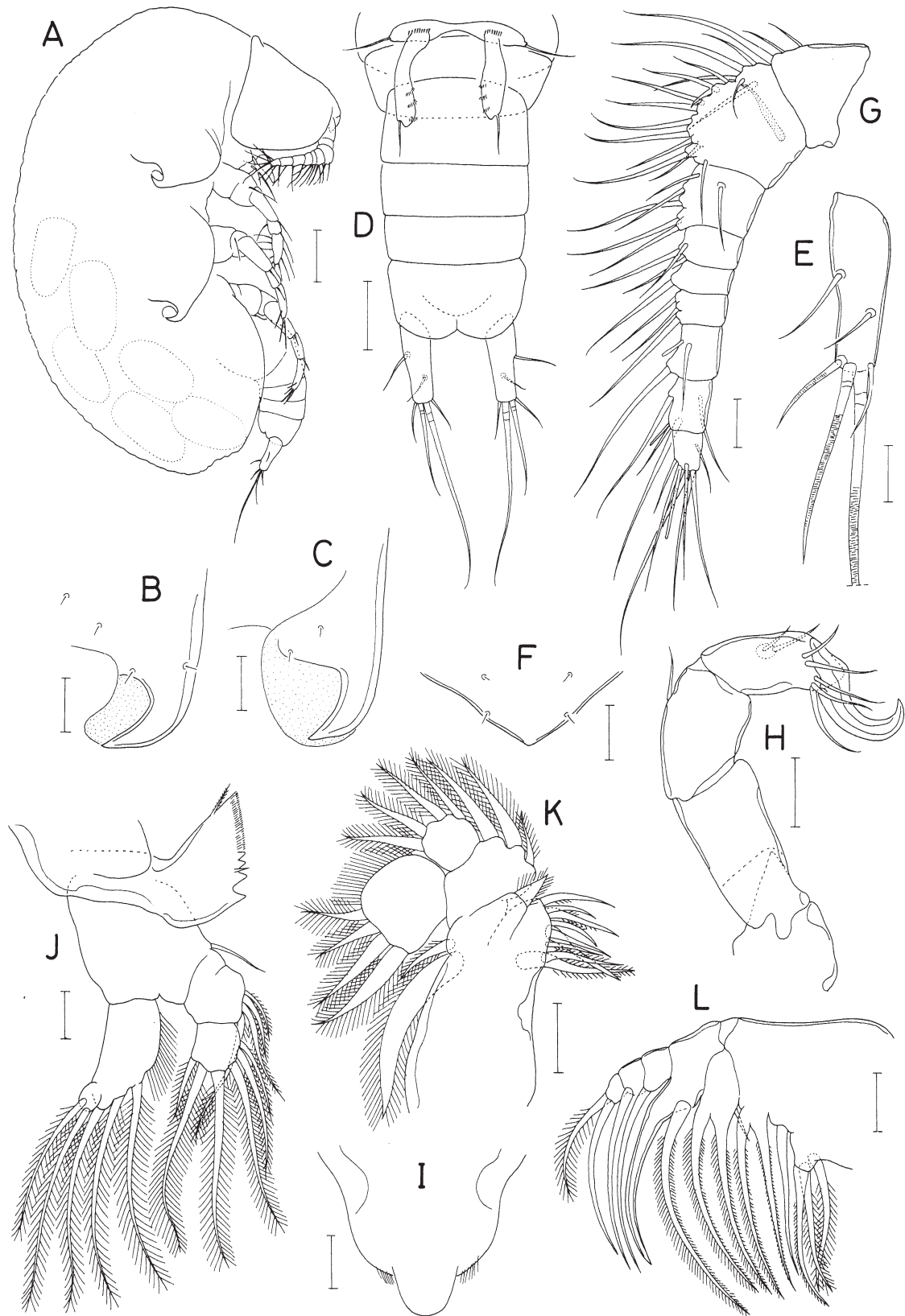
**Etymology.** The specific name is a combination of the Latin *pauci* (=few) and *seta* (=bristle), referring to the low number of setae on the third endopodal segment of leg 4.

**Description of female.** Body (Fig. 198A) compressed, 1.36 mm long. Cephalosome well defined from metasome. Metasome elongate, unsegmented, with very thin, soft exoskeleton and 2 pairs of lateral epimeral wings: both slightly incurved, with claw-like posterodistal process ornamented with membranous fringe along dorsal margin (Fig. 198B, C). Free urosome (Fig. 198D) 5-segmented: genital somite 36×140 µm; 4 abdominal somites 56×109, 40×109, 33×104, and 55×102 µm, respectively: lateral margins of abdomen more-or-less parallel. Caudal rami (Fig. 198E) widely separated from each other, about 2.8 times longer than wide (65×23 µm): armed with 6 naked setae; outer lateral and dorsal setae located at 46 and 68% of ramus length, respectively; longest and second longest setae 136 and 75 µm long, both longer than ramus.

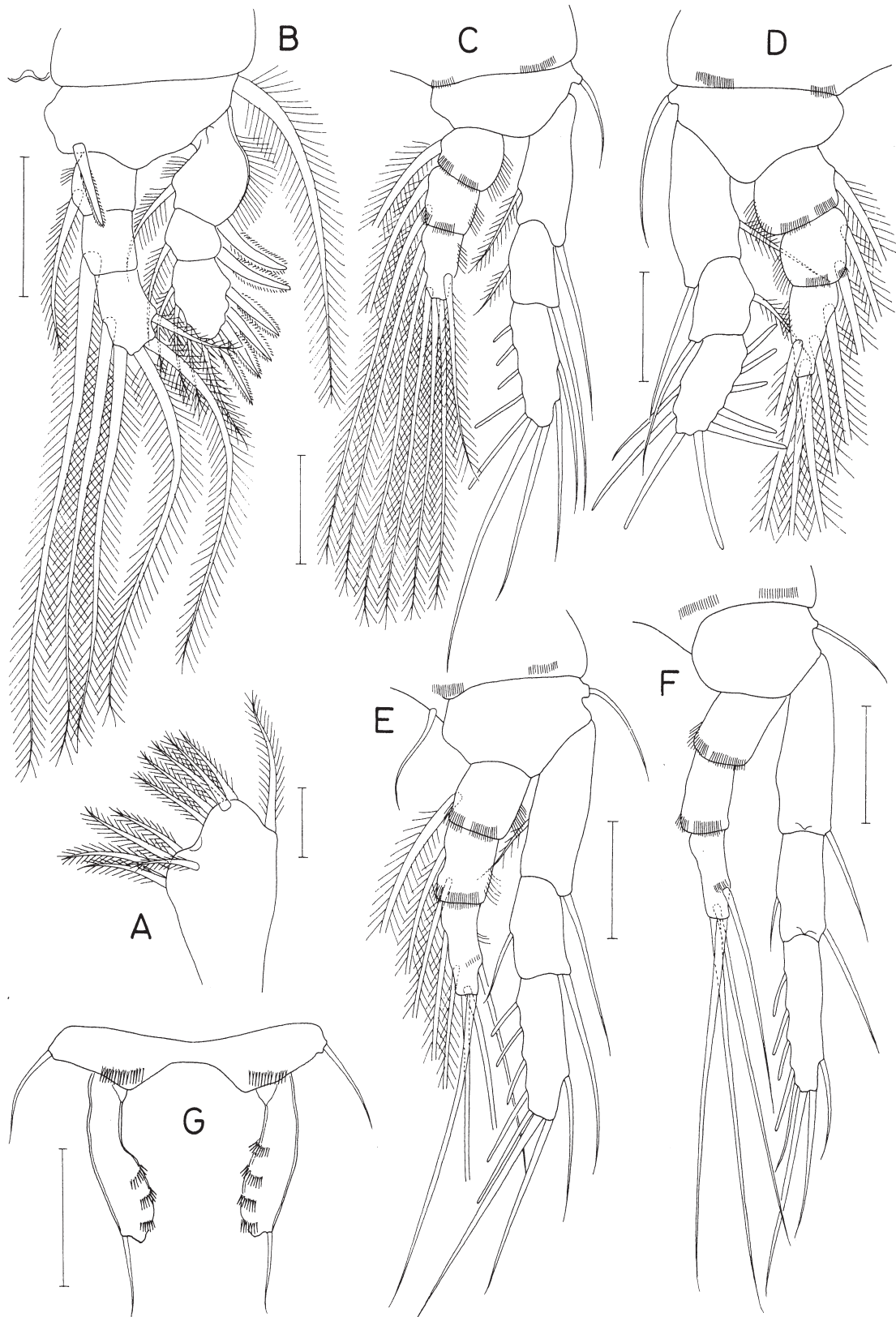
Rostrum (Fig. 198F) much wider than long, steeply tapering. Antennule (Fig. 198G) 195 µm long, 9-segmented; second segment partially subdivided proximally by line of unsclerotized cuticle; armature formula 3, 16, 6, 3, 1, 3, 2+aesthetasc, 4+aesthetasc, and 7+aesthetasc; aesthetascs on seventh and eighth segments very small. Antenna (Fig. 198H) 4-segmented; coxa and basis unarmed; first endopodal segment with 1 seta on inner margin; compound distal endopodal segment about 2.1 times longer than wide (36×17 µm) and as long as first segment; armed with 7 setae plus large and strongly curved terminal claw, longer than segment.

Labrum (Fig. 198I) with large, linguiform posteromedian lobe and ornamented with minute setules on both sides of posterior margin. Mandible (Fig. 198J) with 4 teeth on coxal gnathobase; basis with 1 small, naked seta on medial margin; exopod with 5 setae, outer





**FIGURE 198.** *Nobinerilla paucisetata* gen. et sp. nov., female. A, habitus, right; B, distal part of anterior metasomal wing; C, distal part of posterior metasomal wing; D, urosome, ventral; E, caudal ramus, dorsal; F, rostrum; G, antennule; H, antenna; I, labrum; J, mandible; K, maxillule; L, maxilla. Scale bars: A, 0.1 mm; B, C, E–L, 0.02 mm; D, 0.05 mm.



**FIGURE 199.** *Nobinerilla paucisetata* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, left leg 2; D, right leg 2; E, left leg 3; F, left leg 4; G, left and right legs 5. Scale bars: A, 0.02 mm; B–G, 0.05 mm.

distal seta shorter than other 4; endopod indistinctly articulated from basis, with 4 and 6 setae on first and second segments, respectively. Maxillule (Fig. 198K) armed as in *N. minuta* **gen. et sp. nov.** Maxilla (Fig. 198L) 5-segmented; syncoxa with 9 setae, including 3 setae on first endite; basis with slender claw plus 1 seta; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 199A) unsegmented with 10 medial setae and 1 outer distal seta.

Legs 1–4 (Fig. 199B–F) with 3-segmented rami. Inner coxal seta present in leg 3, absent in legs 1, 2, and 4. Outer seta on basis large (longer than exopod) in leg 1, small in legs 2–4. Inner distal spine on basis of leg 1 extending beyond distal border of first endopodal segment, 30 µm long, with spinulose margins. Exopod of leg 1 slightly longer than endopod. In legs 2–4 both rami of right legs broader than those of left legs (cf. Fig. 199C and D). In left legs 2–4, exopod 1.8 times longer than endopod in legs 2 and 3, and 1.9 times longer in leg 4. Distal setae on third exopodal segment of legs 2–4 attenuated in left legs but blunt at tip and shortened in right legs. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-0; 0-0; 1, 2, 1

Leg 5 (Fig. 199G) consisting of short broad protopodal plate and exopod; protopodal plate with 1 outer distal seta and row of fine spinules near base of exopod; exopodal segment about 3.6 times longer than wide (59×16 µm), with narrow proximal half, armed with 1 seta at outer distal corner, and 4 rows of fine spinules distally on inner surface.

**Male.** Unknown.

**Remarks.** Excluding the new species *N. paucisetata* **gen. et sp. nov.**, all known species of *Nobinerilla* carry 5 setae on the third endopodal segment of leg 4 (Table 4). The unique character state of carrying only 4 setae on this segment serves to characterise *N. paucisetata* **gen. et sp. nov.** and distinguish it from all of its congeners.

In addition, *N. paucisetata* **gen. et sp. nov.** has 6 setae on the second endopodal segment of the mandible, a feature shared only with *N. alata* **gen. et sp. nov.**, *N. armata*, and *N. minuta* **gen. et sp. nov.** However, *N. alata* **gen. et sp. nov.** and *N. minuta* **gen. et sp. nov.** both have 9 setae on the maxilliped compared with 11 in *N. paucisetata* **gen. et sp. nov.** In addition *N. armata* has 3 setae on the endopod of the maxillule whereas there are 4 in *N. paucisetata* **gen. et sp. nov.** The latter species is not confusable with these three species.

## Genus *Doropygopsis* Sars, 1921

**Diagnosis.** Body of female comprising cephalosome, metasome of 4 well-defined pedigerous somites, and free urosome. Fourth pedigerous somite forming brood pouch, partly incorporating fifth pedigerous somite. Free urosome 5-segmented in female, 6-segmented in male. Caudal ramus with 6 setae. Antennule 9-segmented in female. Antenna 4-segmented comprising coxa, basis and 2-segmented endopod; exopod absent. Mandible consisting of coxa, basis, exopod and endopod; exopod armed with 5 setae; endopod with 4 and 10 setae on first and second segments, respectively. Maxillule armed with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, and 4 on exopod; endopod 2-segmented, armed with 3 or 5 and 4 setae on first and second segments, respectively. Maxilla with strong claw plus 2 setae on basis. Maxilliped 3-segmented with 9, 1 and 4 setae on first to third segments, respectively. Legs 1–4 with 3-segmented rami: inner coxal seta present in leg 1, absent in legs 2–4; outer setation elements on exopods of legs 2–4 setiform. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	1-0/1; 1-1; 2, 1, 5	0-0; 0-0; 1, 2, 2

Leg 5 consisting of protopod fused to somite at base, plus elongate free exopodal segment armed with 2 setae distally.

**Type species:** *Doropygopsis longicauda* (Aurivillius, 1882), by original monotypy.

**Remarks.** Sars (1921) established this genus to accommodate *D. longicauda* and based his decision partly on the characters of the newly discovered male, the antennules of which are described as “distinctly prehensile”, unlike those of *Doropygus*. The antennule of male *D. longicauda* is 10-segmented and geniculate (inferred from Sars’s (1921) description of the last two segments together forming a “movable terminal part admitting to be impinged against the preceding part”). Two additional species have been placed in *Doropygopsis*, *D. novemsetiferus* (Schellenberg, 1922), redescribed below, and *D. arctica* Marchenkov, 1998.

### *Doropygopsis novemsetifera* (Schellenberg, 1922) (Figs. 200, 201)

**Material examined.** 1 ♀ (dissected and figured) from *Polycarpa mytiligera* (Savigny, 1816), Masa Bareika, Red Sea; 1 copepodid V ♀ (dissected) from *Polycarpa nigricans* Heller, 1878, Ibo, Mozambique, 1995; 4 ♀♀ (MNHN-IU-2018-1846) from *Pyura styeliformis* Monniot F. & Monniot C., 2001 Palau (07°16.80'N, 134°25.92'E),

depth 0.5 m, 06 April 2004; 3 ♀♀ (MNHN-IU-2018-1847) and 1 dissected ♀ from *Pyura gangelion* (Savigny, 1816), Ibo, Mozambique, 1995; 1 ♀ (MNHN-IU-2009-2471) and 1 dissected ♀ from *Pyura vittata* (Stimpson, 1852), Raja Ampat, West Papua, Indonesia (00°27.289'N, 130°29.580'E), depth 1 m, 26 November 2007; 1 ♀ (MNHN-IU-2018-1848) and 1 dissected ♀ from *Pyura pantex* (Savigny, 1816), Victoria, Seychelles, 1995.

**Description of Female.** Body (Fig. 200A) narrow. Body length variable, 5.6 mm long in figured specimen from *Polycarpa mytiligera*, 2.3–2.9 mm in specimens from other hosts. Prosome consisting of cephalosome and 4-segmented metasome; second and third pedigerous somites with well-developed, rounded epimera: fourth pedigerous somite forming brood pouch, largely incorporating fifth pedigerous somite. Free urosome (Fig. 200B) slender, 5-segmented; genital somite short, 218×553 µm; 4 abdominal somites 450×436, 450×407, 364×364, and 290×320 µm, respectively. Caudal ramus (Fig. 200C) elongate, about 7.6 times longer than wide (662×87 µm) and 2.3 times longer than anal somite, distal margin with rounded ventral protrusion; armed with 6 small setae; outer proximal and dorsal setae positioned at 26 and 68% of ramus length, respectively; all setae naked.

Rostrum (Fig. 200D) tapering. Antennule (Fig. 200E, Fig. 30) indistinctly 9-segmented; articulation between eighth and ninth segments incomplete; sixth segment with 2 incomplete sutures on posterior side; armature formula 3, 17, 5, 7, 10, 9, 3, 4+aesthetasc, and 7+aesthetasc; setae extremely crowded; 3 or 4 setae on proximal segments pinnate. Antenna (Fig. 200F) slender, 4-segmented, including short, unarmed coxa; basis with 1 small vestigial seta distally; first endopodal segment with 1 inner seta subdistally; compound distal endopodal segment 4 to 5 times longer than wide; armed with 10 small setae plus small terminal claw, about one-third as long as segment.

Labrum (Fig. 200G) with concave free posterior margin bearing setules on both sides; concavity largely occluded by broad posteromedian lobe bearing spinules on ventral surface and along posterior margin. Mandible with 6 teeth on coxal gnathobase (Fig. 200H); basis with 1 medial seta; exopod with 5 setae, distalmost seta shorter than other 4 and naked, or with minute spinules along margins; endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 200I) bearing small denticle mediodistally and ornamented with setules on medial margin. Maxillule (Fig. 200J) with 10 setae on arthrite, 1 broad-based seta on coxal endite, 2 unequal setae on epipodite, and 4 setae on exopod; endopod 2-segmented, with 5 setae on first segment and 4 setae on short second. Maxilla (Fig. 201A) with 10 setae on syncoxa (4, 1, 2, and 3 on first to fourth endites, respectively), 1 strong claw plus 2 setae on basis, and 1, 1, and 4 setae on first to third endopodal segments, respectively. Maxilliped (Fig. 201B) 3-segmented with 9, 1, and 4 setae on first to

third segments, respectively; first segment ornamented with several oblique rows of minute spinules.

Legs 1–4 with 3-segmented rami (Fig. 201C–E). Inner coxal seta large in leg 1, but absent in legs 2–4. Outer seta on basis small in legs 1–4. Outer spine on first exopodal segment of leg 1 large, extending well beyond distal border of second exopodal segment; outer spine on second exopodal segment and first outer spine on third exopodal segment small, about one-third as long as outer spine on first segment. First exopodal segment of leg 4 with or without inner seta (probability about 50%, such variation observed even in single individual): first and second endopodal segments lacking inner seta. Armature formula for legs 1–4 as in generic diagnosis.

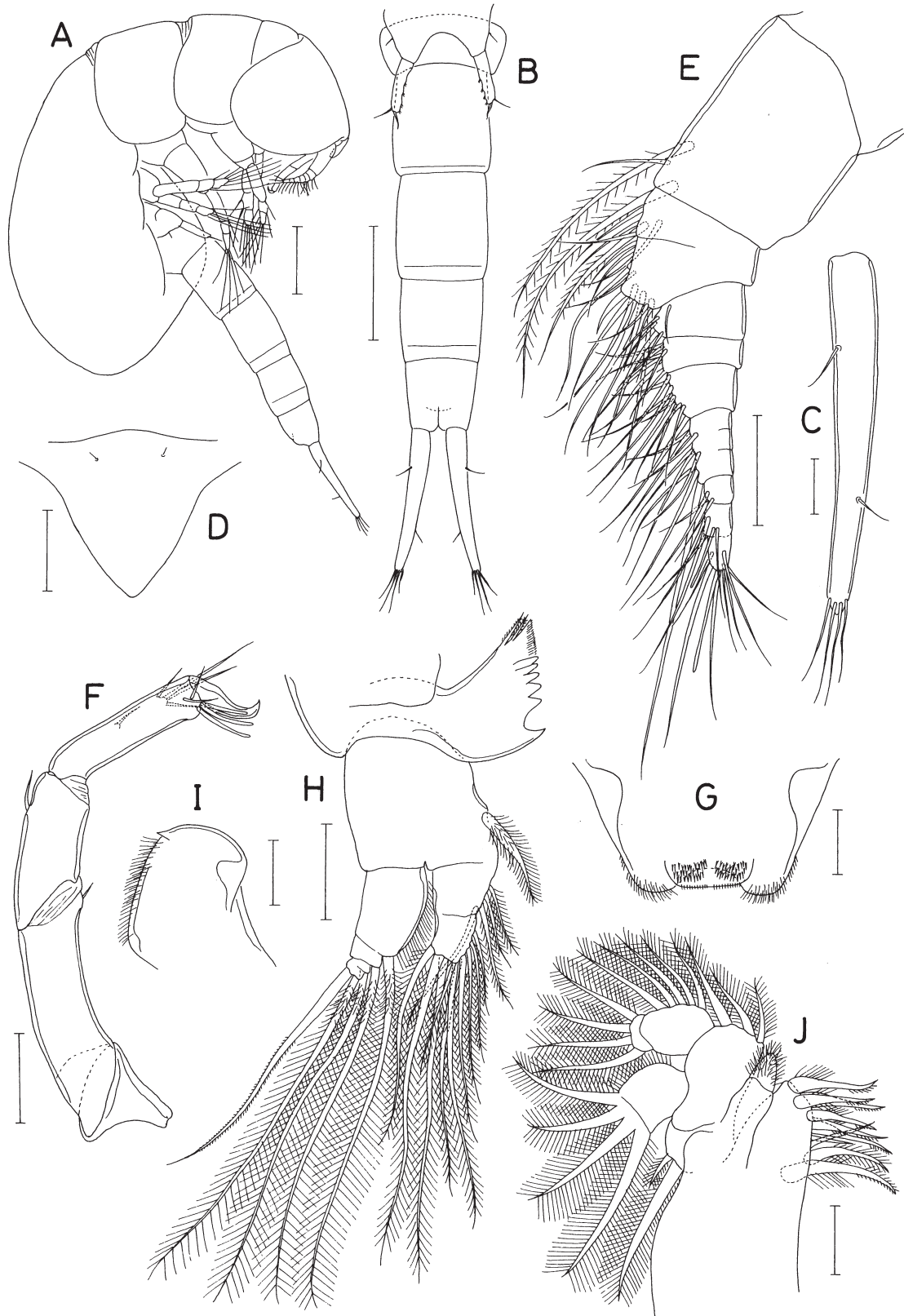
Leg 5 (Fig. 201F) 2-segmented; protopod fused to somite, armed with 1 small outer seta but unornamented; free exopodal segment about 3.9 times longer than wide (232×60 µm), armed with broad distal and slender subdistal setae; ornamented with 4 oblique rows of minute setules on dorsomedial surface.

**Copepodid V female.** Body length 2.21 mm. Abdomen comprising 3 segments. Caudal ramus about 5.9 times longer than wide. Antennule 9-segmented; armature formula 2, 15, 6, 7, 9, 5, 1, 4, and 11+aesthetasc. Antenna as in adult. Mandible with 6 teeth on coxal gnathobase; exopod with 5 setae; endopod with 3 and 9 setae on first and second segments, respectively. Maxillule as in adult, except first endopodal segment bearing 4 setae. Maxilla with 3 setae on first endite of syncoxa, otherwise as in adult. Maxilliped 3-segmented with 7 (3+4), 1, and 4 setae on first to third segments, respectively. First exopodal segment of leg 4 with rudimentary inner seta, otherwise legs 1–5 with same armature as in adult.

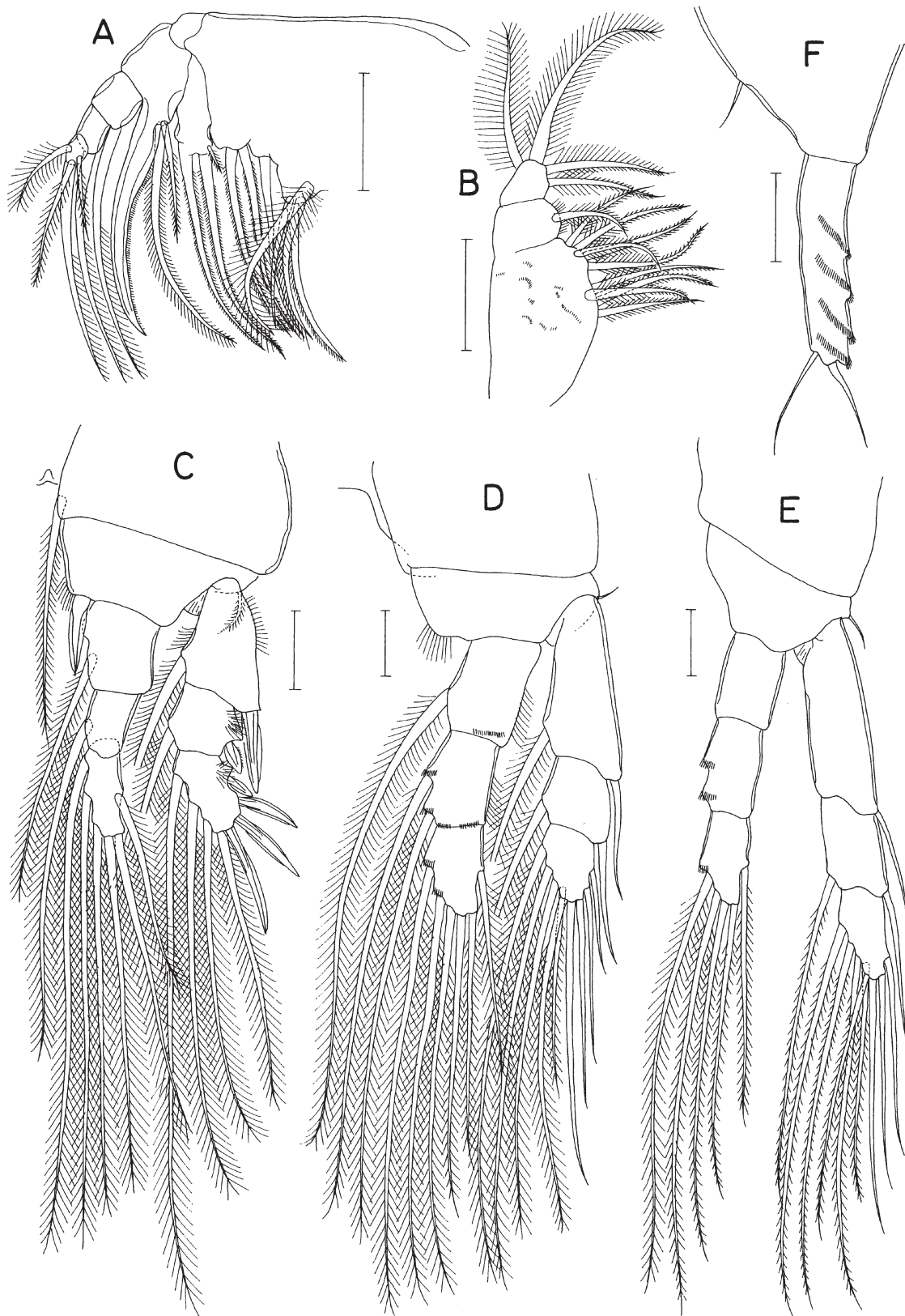
**Male.** Unknown.

**Remarks.** Schellenberg (1922) recorded this species (as *Doropygus novemsetiferus*) as an associate of *Styela canopus* Savigny, 1816 and *Pyura gangelion* (Savigny, 1816) in the Gulf of Suez. Illg (1958) transferred it to the genus *Doropygopsis* and Stock (1967) subsequently reported it from the Red Sea. The present record extends the known distributional range of *D. novemsetifera* to include the Indian Ocean south to Mozambique and east to the Seychelles, and the western Pacific Ocean from Palau to western Papua in Indonesia. The most distinctive feature of this species is the presence of 9 setae on the endopod of the maxillule (Illg, 1958; Stock, 1967). The specific name is emended here to *novemsetifera* since *Doropygopsis* is feminine.

The antennule of *D. novemsetifera* carries numerous supernumerary setae on the more distal segments (Fig. 30). The fifth segment (XXVII–XX) carries 10 setae where the maximum elsewhere in the family is 7; the sixth segment (XXI–XXIII) carries 9 setae where the maximum elsewhere is 4 setae plus 1 aesthetasc, the seventh segment (XXIV) carries 3 setae (maximum 2) and the eighth (XXV) carries 4 setae plus and aesthetasc.



**FIGURE 200.** *Doropygopsis novemsetifera* (Schellenberg, 1922), female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, B, 0.5 mm; C–F, H, 0.1 mm; G, I, J, 0.05 mm.



**FIGURE 201.** *Doropygopsis novemsetifera* (Schellenberg, 1922), female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.1 mm.

Ancestral segment XXV normally carries a maximum of 2 setae plus 1 aesthetasc in any copepod (Boxshall & Huys, 1998), and the presence of 2 additional setae is shared with *Paranotodelphys saccata* and *P. polycarpae* (Fig. 30).

### Genus *Doropygella* Sars, 1921

**Diagnosis.** Body of female comprising cephalosome and 4-segmented metasome: fourth pedigerous somite forming brood pouch, largely incorporating fifth pedigerous somite. Free urosome 5-segmented in female, 6-segmented in male. Caudal ramus with 6 setae or mix of 2 setae and 4 spines. Antennule 9-segmented, typically with proximal 2 segments inflated. Antenna 4-segmented including coxa, basis, and 2-segmented endopod; exopod absent. Mandible consisting of coxa, basis, exopod and endopod; exopod armed with 5 setae and endopod with 4 and 10 setae on first and second segments, respectively. Maxillule armed with 9 or 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 4 each on basis and exopod; endopod 2-segmented with total of 6 or 7 setae. Maxilla bearing claw plus 2 setae on basis. Maxilliped 2- or (typically) 3-segmented with 9 or 10 setae in total; middle segment (when expressed) unarmed; distal segment with 3 (sometimes 2) setae. Legs 1–4 with 3-segmented rami; inner coxal setae absent. Armature formula for legs 1–4 typically as follows (but some setal elements on third endopodal segment of legs 2–4 transformed into spines in some species):

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; II, II, 5	0-1; 0-2; 1, II, I+2
Leg 3	0-0	1-0	I-1; I-1; II, II, 4	0-1; 0-2; 1, II, I+2
Leg 4	0-0	1-0	I-1; I-1; I, II, 4	0-1; 0-2; 1, II, I+1

Leg 5 consisting of protopod typically fused to somite plus free exopodal segment armed with 2 (or 1) slender setal elements.

**Type species.** *Doropygella thorelli* (Aurivillius, 1882), by original monotypy.

**Remarks.** Sars (1921) established this genus to accommodate *D. thorelli* on the basis of “several peculiarities, both as regards the outward appearance of the body and the structure of some of the appendages”. Unfortunately, Sars did not specify the nature of the peculiarities which he regarded as of generic significance although the unsegmented condition of the mandibular exopod is diagnostic. Illg (1958) explored the distinction between *Doropygella* and *Doropygus* and recognized a lineage he referred to as “the *thorelli-normani* line”, which he considered represented a natural grouping. As a consequence, Illg (1958) transferred three species from *Doropygus* to *Doropygella*: *D. normani* (Brady, 1878),

*D. porcicauda* (Brady, 1878), and *D. psyllus* (Thorell, 1859). Two new species have been added subsequently, *D. hastalae* Monniot, C., 1981 and *D. spinicauda* Monniot, C., 1961. A further two new species are described here and the type species is redescribed based on new material.

### *Doropygella thorelli* (Aurivillius, 1882)

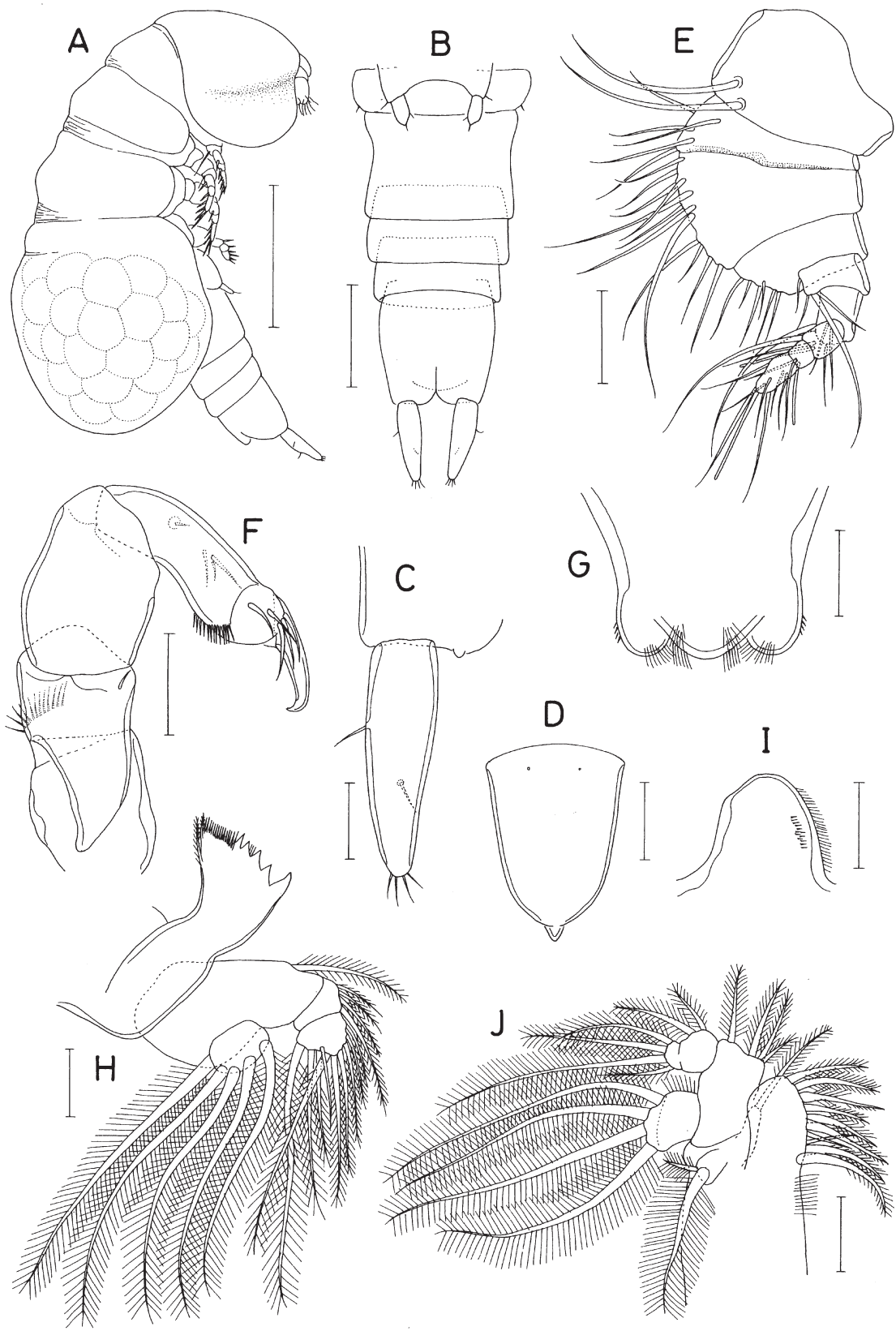
(Figs. 202–204)

**Material examined.** 3 ♀♀ (MNHN-IU-2018-1922) and dissected 1 ♀ and 1 ♂ from *Styela sigma* Hartmeyer, 1912, French Guiana (07°10'N, 52°59'W), GUYANE 2014 Cruise, Stn CP 4364, N/O “Hermano Gines”, depth 397–399 m, MNHN—convention APA-973-1 coll., 01 August 2014.

**Description of female.** Body (Fig. 202A) stout, slightly dorsoventrally depressed, 2.33 mm long. Dorsal cephalic shield strongly expanded ventrolaterally, completely concealing cephalothoracic appendages in lateral view (Fig. 202A). First pedigerous somite free: second and third pedigerous somites with weakly developed epimera; fourth pedigerous somite expanded to form almost spherical brood pouch, largely incorporating fifth pedigerous somite. Free urosome (Fig. 202B) 5-segmented; genital somite short; 4 abdominal somites 214×300, 150×272, 122×250, and 236×226 µm, respectively. Anal somite with small, nipple-shaped tubercle on distal margin medial to base of caudal ramus. Caudal ramus (Fig. 202C) about 3.3 times longer than wide (155×47 µm) and about two thirds as long as anal somite: armed with 6 small setae; outer proximal and dorsal setae located at 38 and 61% of ramus length, respectively; all setae short (at most half as long as ramus width).

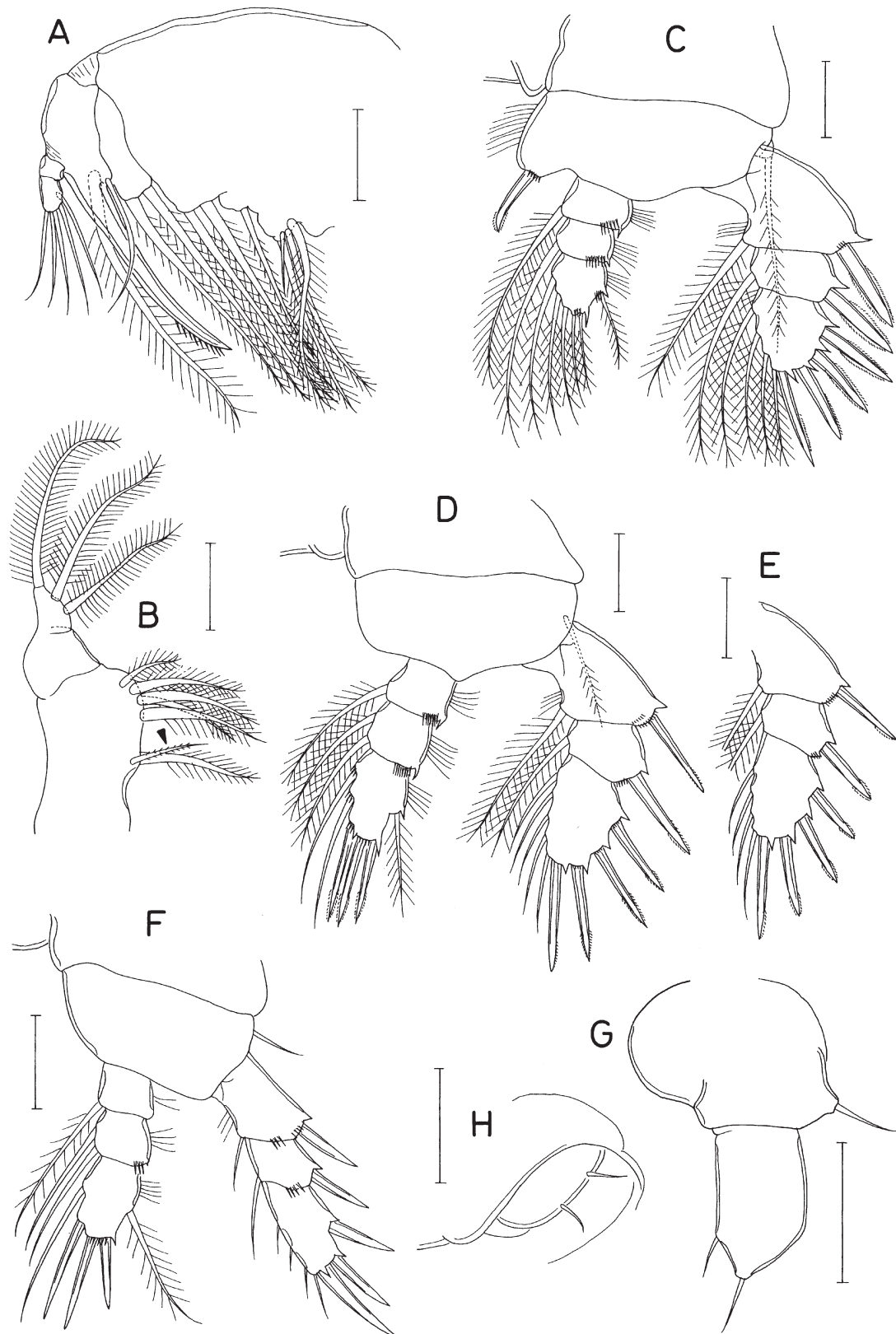
Rostrum (Fig. 202D) gradually narrowing distally, longer than wide (127×89 µm), with rounded distal margin and apical tubercle. Antennule (Fig. 202E) 9-segmented; first to fourth segments greatly broadened, fifth to apical segments cylindrical; articulation between second and third segments incomplete; armature formula 2, 5, 12, 6, 4, 3, 4+aesthetasc, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 202F) stout, 4-segmented; coxa unarmed; basis short, with 1 small seta distally and row of setules on medial surface; first endopodal segment unarmed, longer and wider than basis; compound distal endopodal segment about 3.1 times longer than wide (109×35 µm), slightly longer than first; armed with 9 small setae and row of spinules subdistally, plus terminal claw half as long as segment.

Labrum (Fig. 202G) with trilobate, setulose posterior margin and few spinules subdistally on lateral margins. Mandible (Fig. 202H) with 5 teeth on coxal gnathobase; basis with relatively long seta on medial margin; exopod short, unsegmented with 5 equally large setae; endopod armed with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 202I) ornamented with

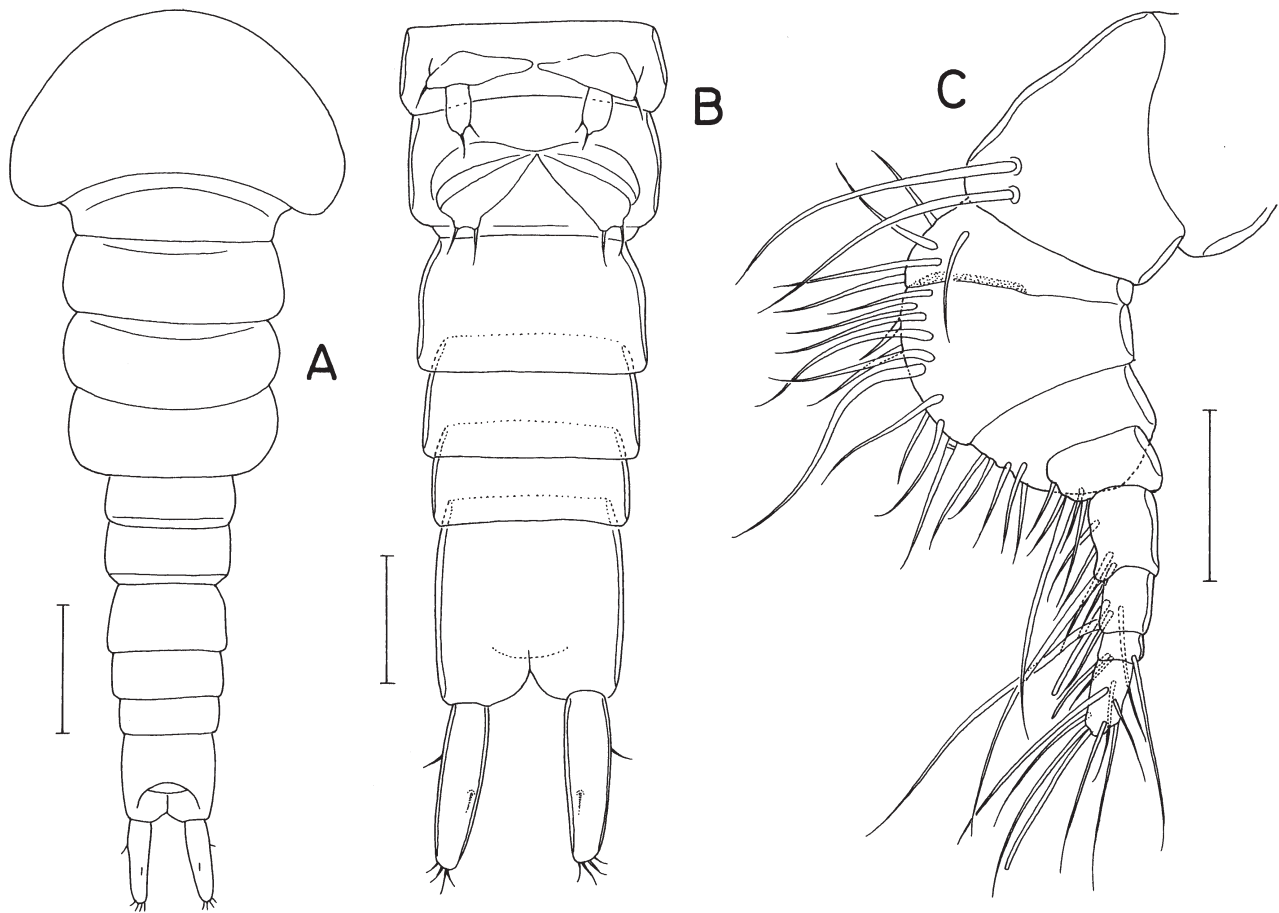


**FIGURE 202.** *Doropygella thorelli* (Aurivillius, 1882), female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C–J, 0.05 mm.





**FIGURE 203.** *Doropygella thorelli* (Aurivillius, 1882), female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4; G, leg 5; H, genital aperture. Scale bars: 0.05 mm.



**FIGURE 204.** *Doropygella thorelli* (Aurivillius, 1882), male. A, habitus, dorsal; B, urosome, ventral; C, antennule. Scale bars: A, 0.2 mm; B, 0.1 mm; C, 0.05 mm.

setules plus few spinules on medial surface; distal margin smooth. Maxillule (Fig. 202J) with 10 setae on arthrite, 1 slender seta on coxal endite, 2 on epipodite; 4 each on basis and exopod; endopod incompletely 2-segmented, bearing 2 and 4 setae on first and second segments, respectively. Maxilla (Fig. 203A) 4-segmented; syncoxa with 4 (1 small and naked), 1, 2, and 2 setae on first to fourth endites, respectively; basis with slender claw plus 2 setae; 2-segmented endopod very small, first segment unarmed, second with 5 slender naked setae. Maxilliped (Fig. 203B) 3-segmented, articulations between segments incomplete; first segment with 7 or 6 setae, smaller proximal seta (indicated by arrowhead in Fig. 203B) present or absent in different specimens; second segment unarmed and unornamented; third segment narrow with 3 setae.

Legs 1–4 rami 3-segmented (Fig. 203C–F) with exopods and endopods widely separated from each other. Inner coxal seta absent in legs 1–4. Basis of leg 1 broad with protruding inner distal corner bearing slender spine, 45  $\mu$ m long. Third endopodal segments of legs 2–4 each bearing 3 spines distally. Spines on both rami elongate

and straight. Inner setae on third exopodal segment of legs 2–4 small and naked. Armature formula for legs 1–4 as in generic diagnosis.

Leg 5 (Fig. 203G) 2-segmented; protopod with 1 outer distal seta; exopod short, about 1.6 times longer than wide (54 $\times$ 33  $\mu$ m), with attenuated distal region and armed with 2 small setae (1 distal and 1 inner subdistal). Leg 6 (Fig. 203H) represented by 2 small setae in genital region laterally on somite.

**Description of male.** Body (Fig. 204A) dorsoventrally depressed, divisible into broad cephalosome, narrower metasome, and slender urosome. Body length 1.40 mm; prosome 745  $\mu$ m long. Cephalosome twice as wide as long. Metasome comprising first to fourth pedigerous somites, with parallel lateral margins. Urosome (Fig. 204B) cylindrical, 6-segmented, consisting of well-defined fifth pedigerous somite, genital somite, and 4 free abdominal somites. Anal somite longest of urosomites, 159 $\times$ 150  $\mu$ m. Caudal ramus about 3.7 times longer than wide (134 $\times$ 36  $\mu$ m) and slightly shorter than anal somite.

Rostrum as in female. Antennule (Fig. 204C) 9-segmented, similar to that of female; armature formula 2,

5, 12, 6, 4, 5, 3+aesthetasc, 2+aesthetasc, and 7+aesthetasc. Antenna, mouthparts and legs 1–4 all as in female.

Leg 5 protopod broad; exopod similar to that of female. Leg 6 (Fig. 204B) represented by 2 equal setae on genital operculum.

**Remarks.** This material can be unequivocally identified as *Doropygella thorelli* by the characteristic form of the rostrum, maxilla, maxilliped, and leg 5. These features are in accord with the descriptions of Aurivillius (1882) and Sars (1921). The discovery of this species on the Atlantic coast of South America is remarkable since it had previously been found only in the North Atlantic, ranging from Norway and Sweden in the east to Greenland and the Davis Strait in the west (Illg, 1958).

***Doropygella calla* sp. nov.**

(Figs. 205, 206)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21303), paratypes (2 intact ♀♀, MNHN-IU-2014-21304), and dissected paratype (♀, figured) from *Culeolus hospitalis* Monniot F. & Monniot C., 2003 (MNHN-IT-2008-2474 = MNHN S2/CUL/52), Vanuatu, SE Santo, Guyot Bougainville, “Alis” (16°01’S, 166°40’E), depth 1014–1050 m, Bouchet & Richer de Forges-IRD coll., 10 October 1994.

**Etymology.** The specific name is derived from the Latin *callo* (= thick skinned), referring to the thick, rigid exoskeleton of the new species.

**Description of female.** Body (Fig. 205A) distinctly segmented with rigid exoskeleton. Body length 4.35 mm; prosome about 3.2 mm long. Cephalosome very broad, with ventrolaterally expanded dorsal cephalic shield. First pedigerous somite free, with large ventral tubercle just anterior to intercoxal plate of leg 1 (Fig. 206D). Second and third pedigerous somites each with well-developed, rounded epimera. Fourth pedigerous somite forming sub-circular brood pouch, tapering in distal third (in lateral view) towards pointed posterodorsal margin. Free urosome (Fig. 205B) 5-segmented; genital somite short; 4 free abdominal somites expanded posteriorly, 459×474, 326×430, 237×356, and 422×378 µm, respectively. Caudal ramus (Fig. 205C) about 4.1 times longer than wide (441×107 µm) and slightly longer than anal somite, gradually narrowing distally, with distal part attenuated: armed with very small, thin setae; 4 distal setae hardly visible; outer proximal and dorsal setae about half as long as width of ramus at base, located at 35 and 63% of ramus length, respectively.

Rostrum (Fig. 205D) longer than wide; proximal two-thirds with nearly parallel lateral margins, distal third acutely convex. Antennule (Fig. 205E) 9-segmented; first 3 segments greatly broadened, distal 6 segments slender, cylindrical; armature formula 2, 17, 6, 2, 4, 4, 2, 3, and 7+aesthetasc; all setae thin and naked. Antenna (Fig.

205F) robust, comprising coxobasis and 2-segmented endopod; coxobasis unarmed, narrowing in middle, ornamented with few setules in mid inner margin; first endopodal segment wider than long, unarmed; compound distal endopodal segment much narrower than proximal segments, about 3.3 times longer than wide (167×50 µm); armed with 10 small setae and row of fine spinules at outer subdistal region, plus terminal claw about half as long as segment.

Labrum (Fig. 206A) with trilobate, setulose free posterior margin. Mandible (Fig. 205G) with 5 teeth on coxal gnathobase; basis with 1 seta on medial margin; exopod short, unsegmented with 5 large, equal setae; endopod with 4 and 10 setae on first and second segments, respectively. Maxillule (Fig. 205H) with 10 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 4 on basis (proximal seta small), 4 on exopod, and 6 on endopod; endopod subdivided by incomplete lateral suture into proximal part bearing 2 medial setae and short distal part bearing 4 setae. Maxilla (Fig. 206B) 4-segmented; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites, respectively, one seta on first endite short and naked; basis with slender claw plus 1 seta; 2-segmented endopod very small, first segment unarmed, second segment bearing 5 small naked setae. Maxilliped (Fig. 206C) 3-segmented, articulation incomplete between first and second segments; first segment with 6 setae (1 proximal and 5 distal) and ornamented with scattered minute spinules; second segment unarmed but with few setules on inner margin; small third segment with 3 large setae.

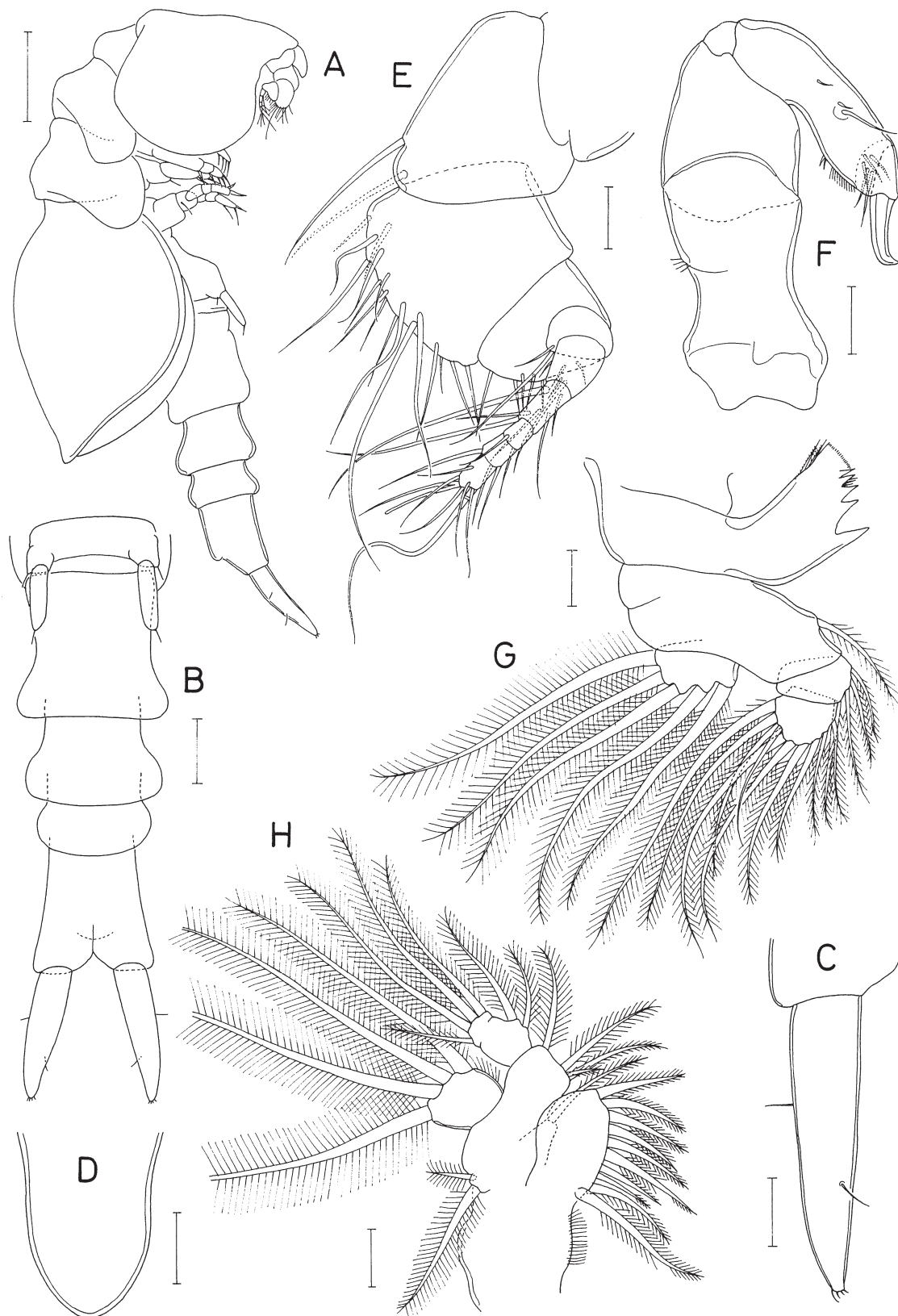
Legs 1–4 (Fig. 206D–G) with broad coxa and basis and 3-segmented rami: exopods and endopods well-separated from each other. Inner coxal seta absent in all legs. Spines on exopods and endopod strong, with smooth unornamented margins. Inner setae on second and third exopodal segments of leg 4 small and naked. Second endopodal segment of leg 4 with 1 or 2 inner setae. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; III, I, 40-1;	0-2; 1, II, II+1
Leg 3	0-0	1-0	I-1; I-1; III, I, 4	0-1; 0-1; 1, II, II+1
Leg 4	0-0	1-0	I-0; I-1; II, I, 3	0-1; 0-1 (or 0-2); 1, II, I+1

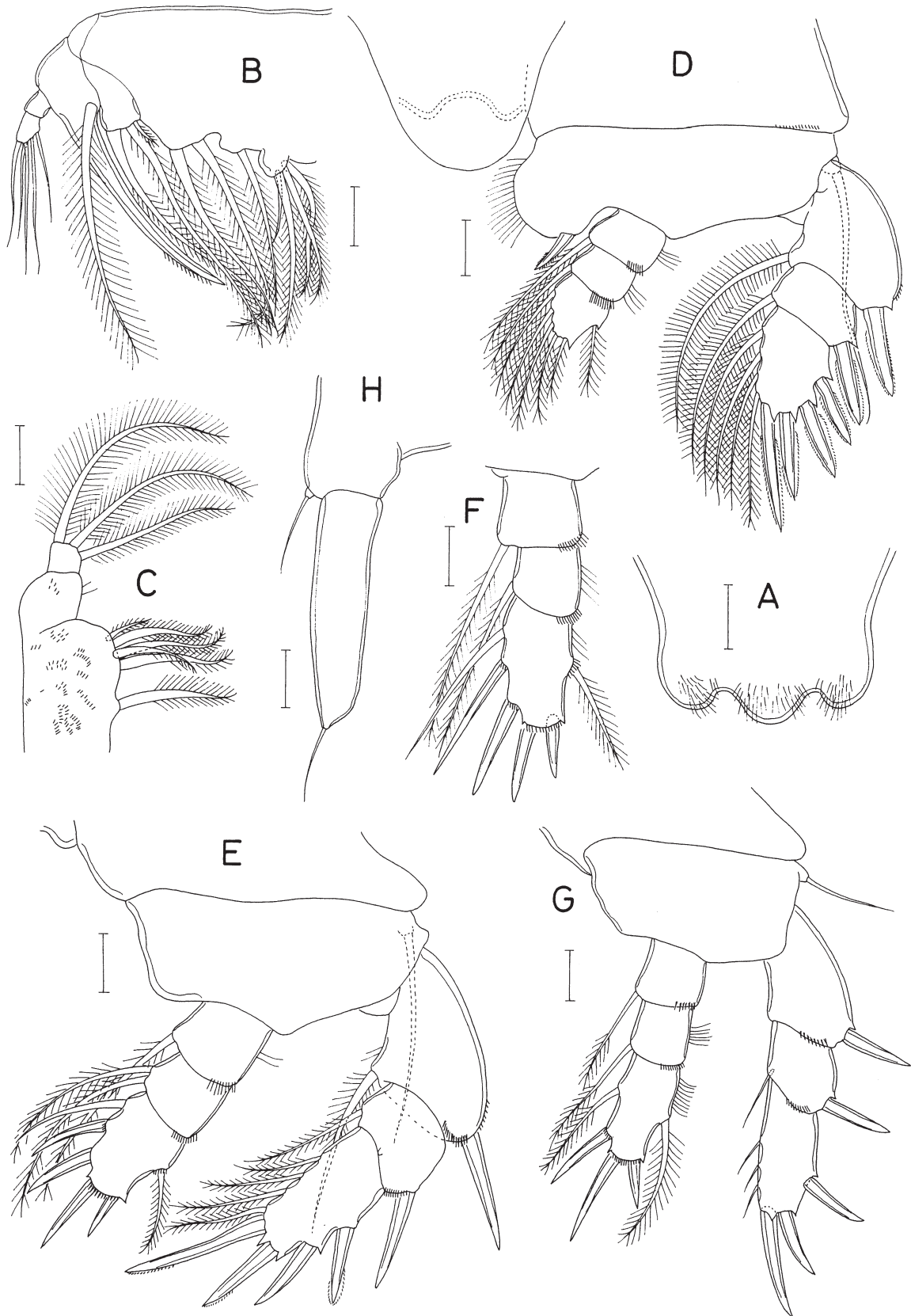
Leg 5 (Fig. 206H) consisting of protopod and exopod; protopod with thin outer distal seta; free exopodal segment about 3.8 times longer than wide (215×56 µm), bearing thin seta on attenuated apex; segment unornamented, lacking any spinule rows. Leg 6 absent.

**Male.** Unknown.

**Remarks.** Among its congeners, *Doropygella calla* sp. nov. is most similar to the type species, *D. thorelli*, because both these two species share the possession of a



**FIGURE 205.** *Doropygella calla* sp. nov., female. A, habitus, right; B, ursome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, 0.1 mm; D–H, 0.05 mm.



**FIGURE 206.** *Doropygella calla* sp. nov., female. A, labrum; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, endopod of leg 3; G, leg 4; H, leg 5. Scale bars: 0.05 mm.

small 2-segmented endopod on the maxilla, which has an unarmed first segment and bears 5 setae on the second, and both have spines on the third endopodal segments of legs 2–4.

The salient differences between the new species and *D. thorelli* are: (1) the free exopodal segment of leg 5 is short (only 1.6 times longer than wide) in *D. thorelli*, but elongate (3.8 times longer than wide) in *D. calla* **sp. nov.**; (2) the third exopodal segment of leg 2 is armed with 4 spines and 5 setae (formula III, I, 5) in *D. thorelli*, but with 4 spines and 4 setae (III, I, 4) in *D. calla* **sp. nov.**; (3) the third endopodal segment of legs 2 and 3 is armed with 3 spines and 3 setae (1, II, I+2) in *D. thorelli*, but with 4 spines and 2 setae (1, II, II+1) in *D. calla* **sp. nov.**; (4) the first exopodal segment of leg 4 bears an inner seta in *D. thorelli*, but this seta is absent in *D. calla* **sp. nov.**; and (5) the third exopodal segment of leg 4 is armed with 3 spines and 4 setae (II, I, 4) in *D. thorelli*, but with 3 spines and 3 setae (II, I, 3) in *D. calla* **sp. nov.** These differences are sufficient to justify the establishment of the new species.

***Doropygella corsensis* n. sp.**

(Figs. 207, 208)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21305) from *Phallusia fumigata* (Grube, 1864) (MNHN-IT-2008-6126 = MNHN P5/PHA/49), Solenzara, Corsica, France, Monniot coll., 1982.

**Etymology.** The new species is named after Corse, the French name for Corsica, the type locality.

**Description of female.** Body (Fig. 207A) slightly dorsoventrally depressed, 2.68 mm long. Prosome consisting of cephalosome and obscurely segmented metasome, with pedigerous somites defined only by weak dorsal and lateral constrictions. Second and third pedigerous somites with weakly defined epimera; fourth pedigerous somite forming strongly inflated, bulbous brood pouch, slightly longer than wide and slightly longer than anterior part of prosome. Free urosome (Fig. 207B) distinctly 5-segmented; genital somite much wider than long, 85×273 µm; 4 abdominal somites 173×227, 167×200, 94×170, and 100×215 µm, respectively. Caudal ramus (Fig. 207C) slender, about 5.3 times longer than wide (190×36 µm) and 1.9 times longer than anal somite: armed with 2 small setae and 4 small, distal spines; 2 setae located at 22 and 62% of ramus length; 4 distal spines claw-like, at most 12 µm long, less than distal width of ramus.

Rostrum (Fig. 207D) as long as wide, tapering from broad base towards rounded apex. Antennule (Fig. 207E) slender, 198 µm long, 9-segmented; first and second segments broadened; armature formula 3, 15+2 spines, 6, 4+aesthetasc, 2, 4, 3+aesthetasc, 2, 9+aesthetasc; 2 large setae on first segment pinnate, all other setae

naked. Antenna (Fig. 207F) slender, 4-segmented; coxa unarmed; basis also unarmed, 2.7 times longer than wide; first endopodal segment with 1 seta subdistally, twice as long as wide; compound distal endopodal segment about 4.6 times longer than wide (100×22 µm) and 1.7 times longer than first endopodal segment, slightly expanded distally; armed with 7 small setae (all attenuated) plus small terminal claw, about one-third as long as segment.

Labrum (Fig. 207G) with trilobate, setulose posterior margin. Mandible (Fig. 207H) with 4 teeth on coxal gnathobase; basis with 1 medial seta; exopod with 5 subequal setae; endopod with 4 and 10 setae on first and second segments, respectively; second segment ornamented with thick setules along outer margin. Maxillule (Fig. 207I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 4 on basis (second proximal seta short and thin), 4 on exopod, and 5 and 2 on first and second endopodal segments, respectively; second segment much smaller than first. Maxilla (Fig. 208A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with strong claw (spinulose along distal half of concave margin) plus 2 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 208B) incompletely 2-segmented with 8 setae (4 proximal and 4 distal) on first segment and 2 apical setae on second.

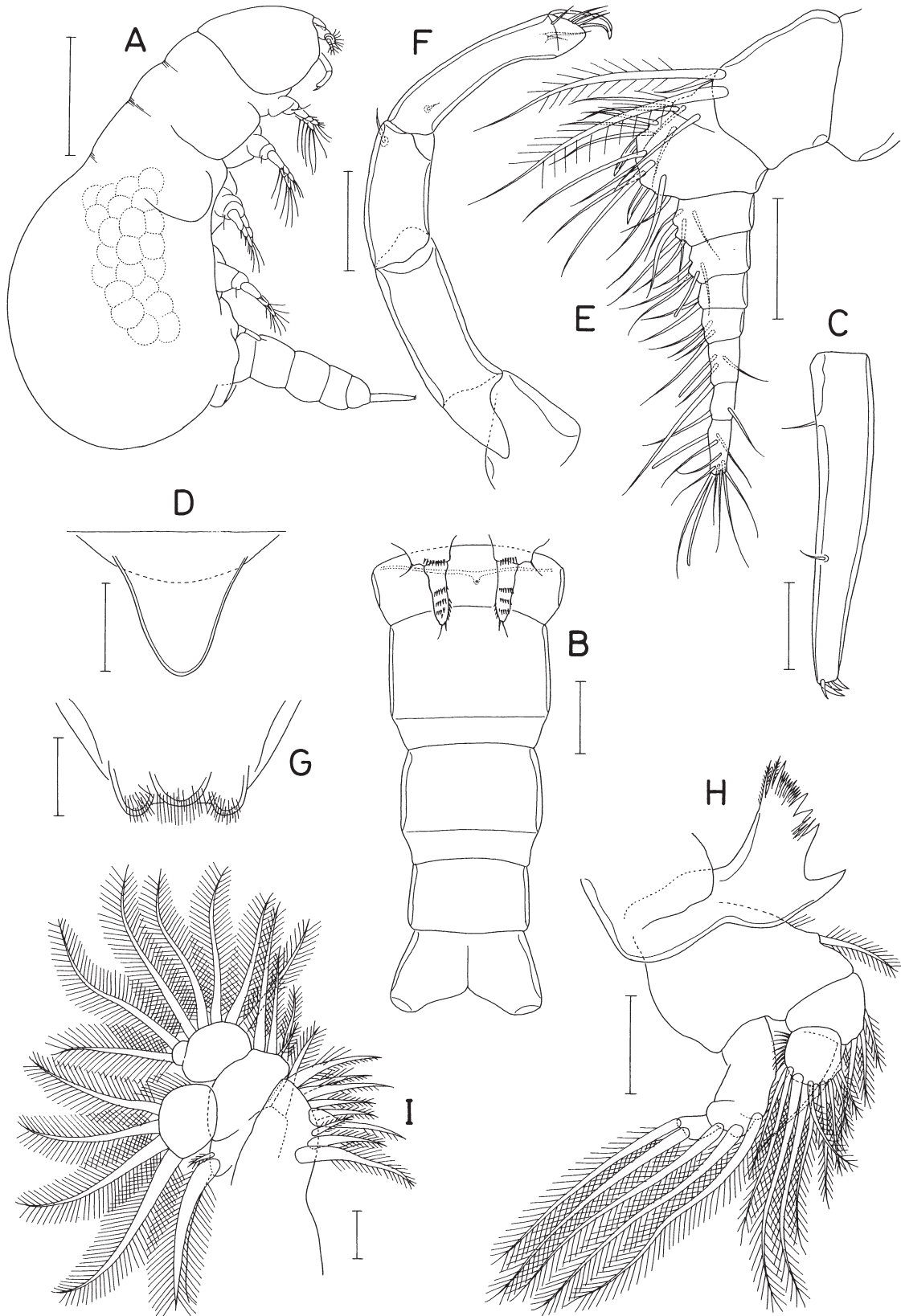
Legs 1–4 with 3-segmented rami (Fig. 208C–F). Inner coxal seta absent in legs 1–4. Inner distal spine on basis of leg 1 setiform, spinulose, 68 µm long, extending to distal border of second endopodal segment. First exopodal segment of legs 3 and 4 lacking inner seta. Inner setae on endopod of leg 4 rudimentary. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; III, I, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-0	1-0	I-0; I-1; II, I, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-0	1-0	I-0; I-1; II, I, 5	0-1; 0-2; 1, 2, 2

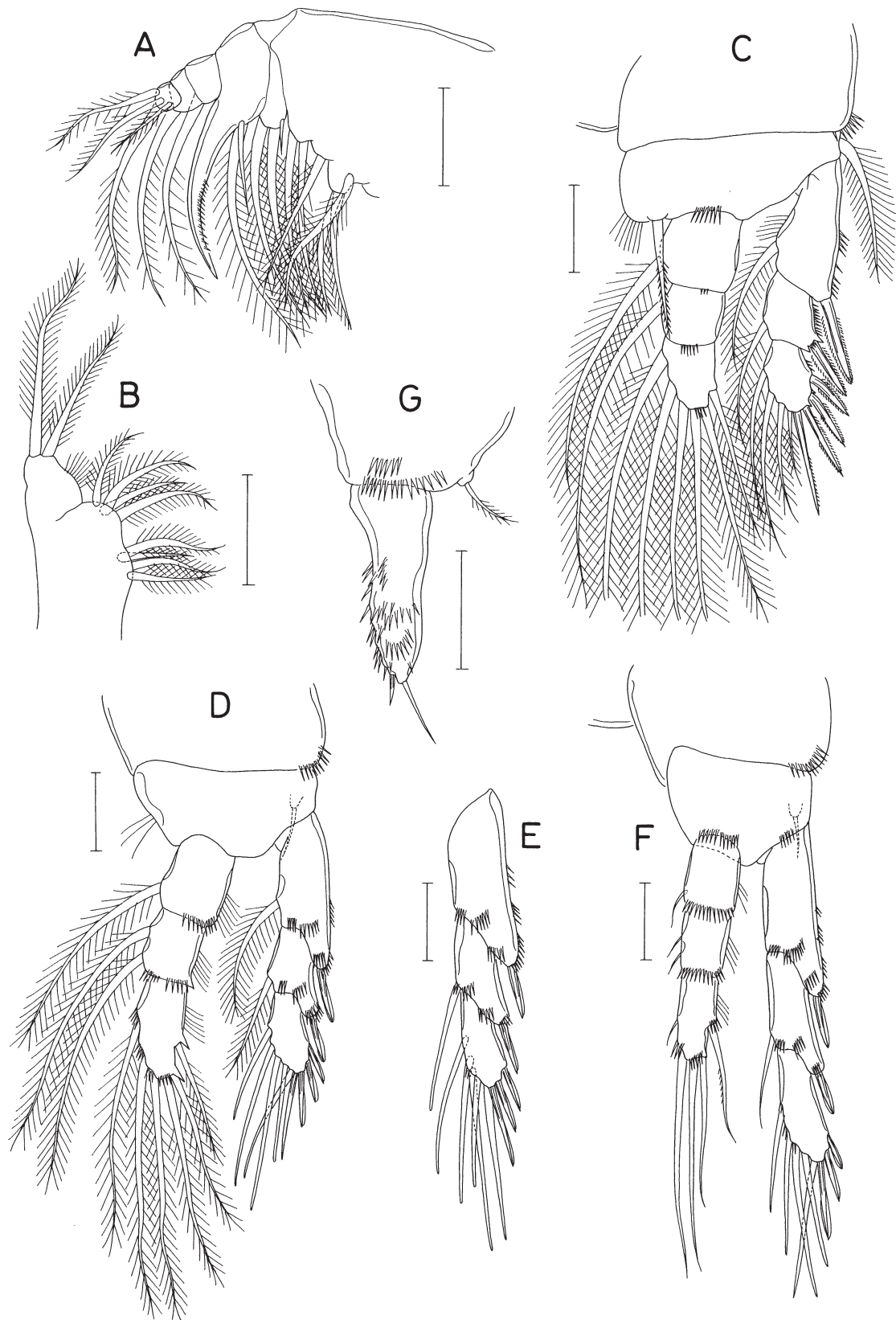
Leg 5 (Fig. 208G) 2-segmented; protopod with 2 rows of spinules on distal border and armed with pinnate outer distal seta; free exopodal segment about 2.4 times longer than wide (83×35 µm), tapering distally, densely spinulose and armed with naked apical seta and small subdistal spine.

**Male.** Unknown.

**Remarks.** *Doropygella corsensis* **sp. nov.** and *D. normani* have several unusual features in common including the presence of distal spines on the caudal ramus, 2 spines on the second segment of the antennule, and an ornamentation of setules along the outer margin of the second endopodal segment of the mandible. Brady (1878) illustrated these features for *D. normani*. These detailed similarities suggest that the two species might be considered as conspecific, but there are some significant



**FIGURE 207.** *Doropygella corsensis* sp. nov., female. A, habitus, right; B, urosome, ventral (caudal rami missing); C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C–F, H, 0.05 mm; G, I, 0.02 mm.



**FIGURE 208.** *Doropygella corsensis* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4; G, leg 5. Scale bars: 0.05 mm.



differences. In *D. normani* the maxilliped is unsegmented and distally truncate (vs. incompletely 2-segmented, with a narrow second segment in *D. corsensis* **sp. nov.**), and according to Brady the outer spines of legs 3 and 4 are replaced by long setae (vs. the exopods of legs 3 and 4 bear outer spines in *D. corsensis* **sp. nov.**). In addition, leg 2 of *D. normani* also differs from that of *D. corsensis* **sp. nov.**, although Brady's illustration for leg 2 was shown as having an inner coxal seta and large, pinnate outer setae on the exopod, which is so unusual that it requires confirmation.

## Genus *Doropygus* Thorell, 1859

**Diagnosis.** Body of female comprising cephalosome and inflated metasome consisting of 3 more-or-less well defined pedigerous somites plus fourth pedigerous somite, forming brood pouch and largely incorporating fifth pedigerous somite. Free urosome 5-segmented in female and 6-segmented in male. Caudal ramus with 6 setae. Antennule typically 9-segmented. Antenna 4-segmented including coxa, basis and 2-segmented endopod; exopod represented by small knob bearing 1 or 2 setal vestiges, by minute seta on basis surface, or absent. Mandible consisting of coxa, basis, exopod and endopod; exopod typically armed with 5 setae; endopod with 3 or 4 and 9 or 10 setae on first and second segments, respectively. Maxillule armed with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on basis; exopod with 3 or 4 setae, endopod with 2 or 3 setae. Maxilla bearing 3 setal elements on basis, with distal element claw-like or setiform according to species. Maxilliped indistinctly segmented, although typically with partial suture dividing medial armature of 9 setae from apical part bearing 2 setae. Leg 1 with 3-segmented exopod and 2- or 3-segmented endopod. Legs 2–4 with 3-segmented exopods and 2-segmented endopods; exopods bearing setiform outer armature elements. Armature formula for legs 1–4 in type species (*D. pulex*) as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	1-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 4
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 3, 3

Leg 5 typically consisting of protopod fused to pedigerous somite and elongate free exopodal segment armed with 2 distal setation elements.

**Type species:** *Doropygus pulex* Thorell, 1859, by original monotypy.

**Remarks.** Illg (1958) considered the diagnosis and composition of *Doropygus* at length. He tightened up the generic diagnosis and transferred several species to more appropriate genera; placing three former *Doropygus* species in a new genus, *Pygodelphys* Illg, 1958,

moving three more to *Doropygella* and another one to *Doropygopsis*. In addition, he by-passed the taxonomic paralysis caused largely by Hesse (1866a,b, 1869, 1871) who, over the course of five years had described no less than 21 new species from the coast of France, all inadequately. The treatment of these as species inquirenda allowed the study of *Doropygus* to move forwards. Illg (1958) also treated *Doropygus cylindrififormis* Schellenberg, 1922 as *incertae sedis*.

At the time of his revision Illg (1958) recognized 15 species as valid but since then a further 19 species have been added to the genus. Of these, we consider that *D. apicatus* Stock, 1967 and *D. curvipes* Gotto, 1975 are both junior synonyms of *D. humilis* Stock, 1967 (see discussion after redescription of *D. humilis* below). In addition, *D. catalai* Illg, 1970 is transferred to *Chelipygus* **gen. nov.** (see below) and *D. pyurus* Oldewage, 1994 is so inadequately described (Oldewage, 1994) that its identity is unrecognizable, so it is here treated as a *species inquirendum*.

*Doropygus* is a large genus so for ease of navigating this species richness we have grouped species into loose artificial assemblages based on the setation of the exopod and endopod of the maxillule (Table 6). These groupings are based on phenotype and we have not assessed their monophyletic status by analysis of their phylogenetic relationships. Therefore, we do not propose any formal taxonomic status for these groups.

### Group A (maxillule with 4 setae on exopod and 3 setae on endopod)

#### *Doropygus globosus* Jones, 1974

(Figs. 209, 210)

**Material examined.** 1 ♀ (MNHN-IU-2018-1848) and 1 dissected ♀ (figured) from *Corella eumyota* Traustedt, 1882, Portobello, New Zealand; 1 ♀ (MNHN-IU-2018-1921) from *C. eumyota*, New Zealand; 1 ♀ (MNHN-IU-2009-5193) and 1 dissected ♀ from *Corella brewinae* Monniot F., 2013, Stewart Island, New Zealand, collected by H. Filhol, 1875; 1 copepodid ♀ (dissected) from *C. eumyota*, Portobello, New Zealand, 14 September 2012.

**Description of female.** Body (Fig. 209A) slightly compressed and moderately stout; body length 2.72 mm. Cephalosome rather small, clearly defined from metasome. Metasome gradually broadening posteriorly; pedigerous somites defined only by dorsal constrictions. Fourth pedigerous somite forming brood pouch, subovate in lateral view; incorporating fifth pedigerous somite. Free urosome (Fig. 209B) gradually narrowing posteriorly, 5-segmented; genital somite 200×383 µm; 4 abdominal somites 250×320, 210×255, 122×214, and 128×224 µm, respectively. Distal part of anal somite and caudal rami divergent. Caudal ramus (Fig. 209C) about 3.2 times longer than wide (133×42 µm) and slightly longer than

**TABLE 6.** Characteristics of valid *Doropygus* species (excluding *D. pyurus* Oldewage, 1994, see text). Abbreviations: A1, antennule; A2, antenna; ba, basis; CR, caudal ramus; exp, endopod; exp, exopod; L:W, length to width ratio; Mnd, mandible; Mx, maxilla, Mx1, maxillule; Mxp, maxilliped; P3-5, legs 3 to 5; s, vestigial seta; seg, segment; ter, terminal segment; X, absent; + present.

Species	CR L:W	A1 segs	A2 ter L:W	Mnd exp	Mnd exp1	Mnd exp2	Mx1 exp	Mx1 exp	Mx ba	claw	Setae	ter	seg	Mxp	P3 exp1	P4 exp1	P5 exp	L:W
<b>Group A</b>																		
<i>D. elegans</i> Ooishi, 1963	5.1	7	3.2	4+s	4	10	4	3	X	4	4	9+2	1-1	1-1	1-1	1-1	2.8	
<i>D. globosus</i> Jones, 1974	3.17	9	2.3	4+s	4	10	4	3	+	4	4	9+2	1-1	1-1	1-1	1-1	3.45	
<i>D. kerguelensis</i> Schellenberg, 1922	6.25	9	4.39	5	4	10	4	3	X	4	4	9+2	1-1	1-1	1-1	1-1	2.59	
<i>D. mirabilis</i> McKinnon, 1984	3.5	9	=4.5	4+s	4	9	4	3	X	4	4	9+2	1-1	1-1	1-1	1-1	5.5	
<i>D. platythorax</i> Jones, 1974	8	9	=5	5	4	9	4	3	X	3	3	9+2	1-1	1-1	1-0	1-0	3.5	
<i>D. rigidus</i> Ooishi, 1962	6.1	9	=4	5	4	10	4	3	X	4	4	9+2	1-1	1-1	1-1	1-1	3.0	
<i>D. spiniferus</i> Schellenberg, 1922	-	-	-	3+ss	-	-	4	3	-	-	-	-	1-?	1-?	1-?	1-?	5	
<i>D. spinosus</i> Jones, 1979	5.6	9	=4	4+s	4	10	4	3	X	4	4	9+2	1-1	1-1	1-0	1-0	4.4	
<i>D. trisetosus</i> Schellenberg, 1922	-	-	-	4	-	-	4	3	-	-	-	-	1-?	1-?	1-?	1-?	4	
<i>D. tuberculatus</i> sp. nov.	5.48	9	4.26	4+s	4	10	4	3	+	4	4	9+2	1-1	1-1	1-1	1-1	2.83	
<i>D. reticulatus</i> sp. nov.	7.4	9	5.23	5	4	9	4	3	X	4	4	9+2	1-1	1-1	1-0	1-0	4.5	
<i>D. caribbensis</i> sp. nov.	6.0	9	4.0	5	4	10	4	3	X	4	4	9+2	1-1	1-1	1-0	1-0	5.31	
<i>D. tenuicaudatus</i> sp. nov.	12.2	9	5.58	5	4	9	4	3	X	4	4	9+2	1-0	1-0	1-0	1-0	6.25	
<i>D. gracilis</i> sp. nov.	9.06	9	4.40	4+s	4	10	4	3	X	4	4	9+2	1-1	1-1	1-0	1-0	3.26	
<i>D. adenensis</i> sp. nov.	5.97	9	4.19	5	4	10	4	3	X	4	4	9+2	1-1	1-1	1-0	1-0	2.75	
<i>D. molgulae</i> sp. nov.	5.88	9	4.11	5	4	10	(4	3)	X	4	4	9+2	1-1	1-1	1-0	1-0	2.43	

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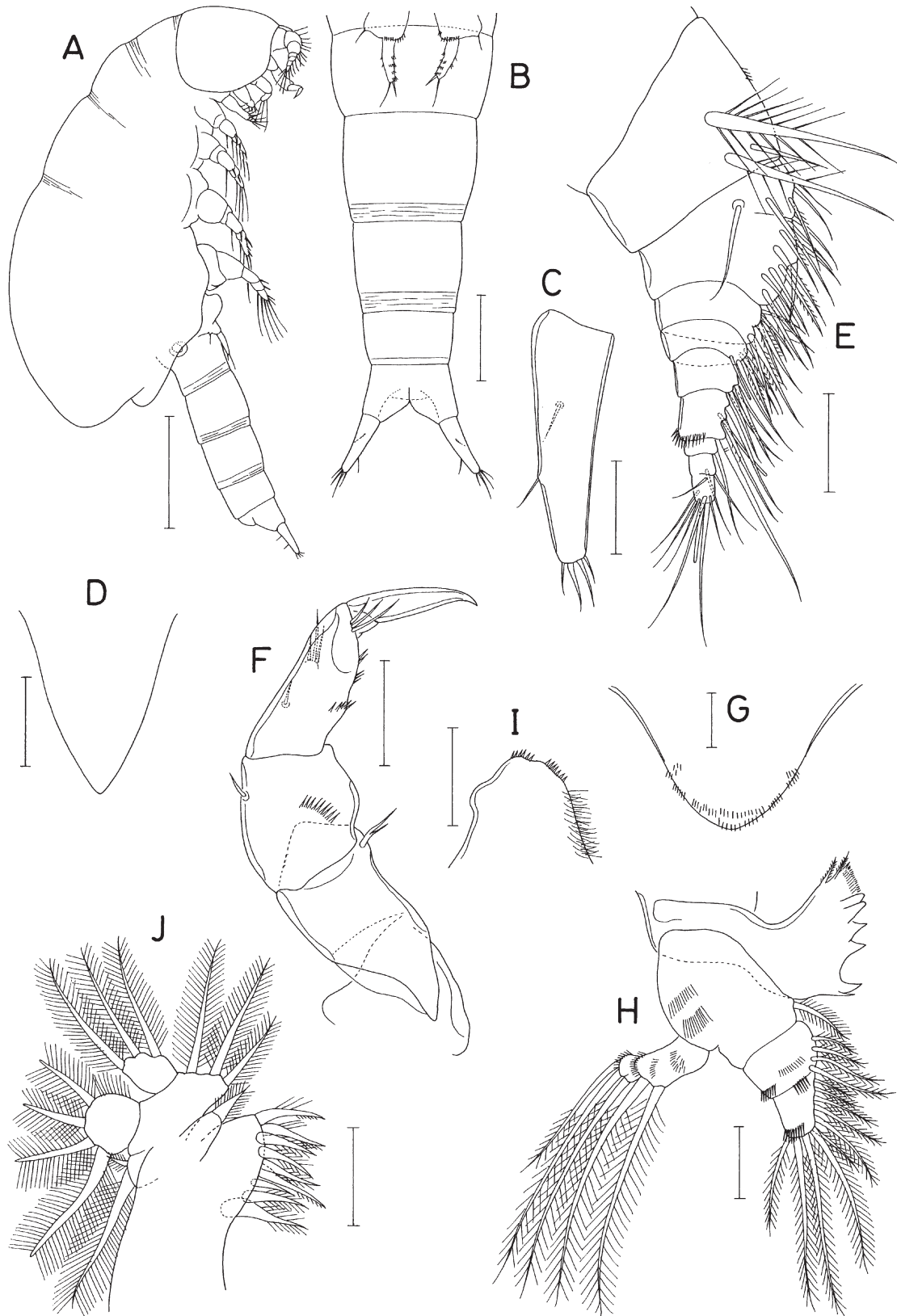
TABLE 6. (Continued)

Species	CR L:W	A1 segs	A2 ter L:W	Mnd exp	Mnd enp1	Mnd enp2	Mx1 exp	Mx1 emp	Mx ba claw	Setae ter seg	Mxp	P3 exp1	P4 exp1	P5 exp L:W
<b>Group B</b>														
<i>D. demissus</i> Aurivillius, 1885	5	9	=2	5	4	10	3+s	3	+	4	9+2	1-1	1-1	=5
<i>D. profundus</i> Illg, 1958	4.5	9	4	5	4	10	3+s	3	X	4	9+2	1-1	1-0	=4
<i>D. bayeri</i> Illg, 1958	=3	9	=2.5	5	4	9	3	3	X	3	9+2	1-1	1-0	=3
<i>D. curvatus</i> Gray, 1938	=3?	8	=2.5	4	2	10	3	3	X	3	9+2	?	?	2
<i>D. fernaldi</i> Illg, 1958	=2.5	9	=2	5	4	10	3	3	X	3	9+2	1-1	1-0	2.5
<i>D. hummi</i> Illg, 1958	<4	9	=2	5	4	10	3	3	X	3	7+2	1-1	1-0	3.5
<i>D. laticornis</i> Wilson, 1932	5.0	8	<3	4	4	9	3	3	X	3	8+2	1-1	1-0	>4
<i>D. mohri</i> Illg, 1958	=6	9	-	5	4	10	3	3	+	4	9+2	1-1	1-1	2.5
<i>D. seclusus</i> Illg, 1958	=4	9	=2.5	4	4	10	3	3	+	4	9+2	1-1	1-1	5
<i>D. antarcticus</i> <b>sp. nov.</b>	7.01	9	=4	5	4	10	3+s	3	+	4	9+2	1-1	1-1	4.27
<i>D. martiniquensis</i> <b>sp. nov.</b>	3.20	9	3.28	5	4	9	3	3	X	3	8+2	1-0	1-0	3.97
<i>D. elongatus</i> <b>sp. nov.</b>	2.88	9	6.19	5	4	9	3	3	X	3	8+2	1-0	1-0	4.15
<i>D. rotundus</i> <b>sp. nov.</b>	2.79	9	5.23	5	4	9	3	3	X	3	8+2	1-0	1-0	3.05

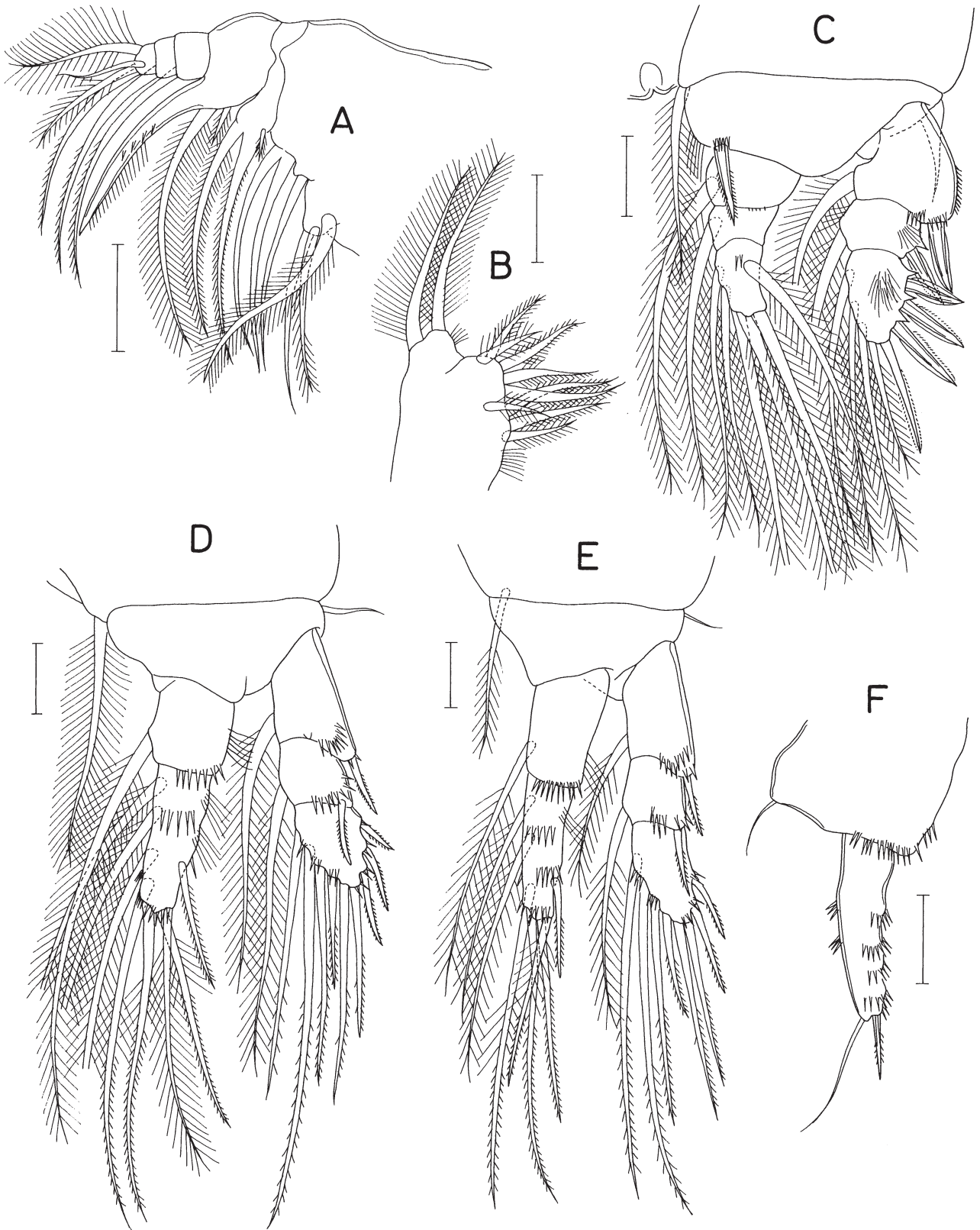
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TABLE 6. (Continued)

Species	CR L:W	A1 segs	A2 ter L:W	Mind exp	Mnd emp1	Mnd emp2	Mx1 exp	Mx1 emp	Mx ba claw	Setae ter seg	Mxp	P3 exp1	P4 exp1	P5 exp L:W
<b>Group C</b>														
<i>D. brevipes</i> Ho, 1984	=2.8	9	=4	4	3	7	4	2	+	3	9+2	1-1	1-0	=1.5
<i>D. dakarensis</i> Monniot, 1966	=2.4	9	=4.5	4	4	8	4	2	X	3	9+3	1-1	1-1	=2.5
<i>D. depressus</i> Stock, 1967	=4.7	9	5.5	5	4	10	4	2	X	4	9+2	1-1	1-0	2.4
<i>D. depressus</i> [herein]	7.85	9	5.55	5	4	10	4	2	X	4	9+2	1-1	1-0	2.41
<i>D. flexus</i> Gotto, 1975	4.08	8	4.53	4	4	8	4	2	X	3	9+2	1-1	1-1	2.06
<i>D. hoi</i> Seo & Lee, 1997	=5	9	=4	5	4	8	4	2	X	4	9+2	1-1	1-1	=3
<i>D. humilis</i> Stock, 1967	3.06	9	4.31	4+s	4	8	4	2	X	3	9+2	1-1	1-1	3-4
<i>D. longimatrix</i> Schellenberg, 1922	-	9	>5	5	?	-	4	2	X	-	9+2	-	-	-
<i>D. louisae</i> Jones, 1979	3	9	=4	4+s	4	7	4	2	X	3	8+2	1-1	1-1	2.5
<i>D. pinguis</i> Ooishi, 1962	4.07	9	4.33	4+s	4	8	4	2	X	3	9+2	1-1	1-1	3.63
<i>D. pulex</i> Thorell, 1859	4.5	8	4	4	4	8	4	2	X	3	9+2	1-1	1-1	-
<i>D. monnitorum</i> sp. nov.	5.97	9	3.34	4	4	9	4	2	X	3	9+2	1-1	1-1	3.90
<i>D. nasutus</i> sp. nov.	3.96	9	2.05	4	4	9	4	2	X	3	9+2	1-1	1-1	2.30
<i>D. leptobrachus</i> sp. nov.	3.76	9	5.42	4	4	9	4	2	X	3	9+2	1-1	1-1	2.10
<i>D. parahumilis</i> sp. nov.	5.43	9	5.82	4+s	4	8	4	2	X	3	8+2	1-1	1-1	4.46
<i>D. breviuncinatus</i> sp. nov.	4.18	9	4.41	4	4	8	4	2	X	3	9+2	1-1	1-1	2.71
<i>D. rectiuncinatus</i> sp. nov.	5.11	9	3.90	4	4	8	4	2	X	3	9+2	1-1	1-1	2.98
<b>Group D</b>														
<i>D. reductus</i> Stock, 1970	4	7	=4	4	2	8	3	2	X	3	8+1	1-1	1-1	=3.4
<i>D. schellenbergi</i> Illg, 1958	4	9	=3	4	3(4)	9(7)	3	2	X	3	6(8)+2	1-1	1-1	<4
<i>D. corsu</i> sp. nov.	3.78	9	4.41	4	4	9	3	2	X	3	9+2	1-1	1-1	3.58
<i>D. callosus</i> sp. nov.	3.18	9	3.38	4	4	8	3	2	X	3	9+2	1-1	1-1	4.25



**FIGURE 209.** *Doropygus globosus* Jones, 1974, female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C–F, H–J, 0.05 mm; G, 0.02 mm.



**FIGURE 210.** *Doropygus globosus* Jones, 1974, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

anal somite: armed with 6 small setae; caudal setae at most half as long as width of ramus at base; 2 proximal setae positioned at 37 and 67% of ramus length.

Rostrum (Fig. 209D) longer than wide, tapering towards slightly angular or rounded apex. Antennule (Fig. 209E) broad, 9-segmented; articulation between terminal 2 segments obscure; armature formula 3, 16, 7, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae extremely crowded; 2 larger setae on first segment ornamented with large, stiff setules; most setae on second to fifth segments ornamented with short spinules along margins; sixth segment with row of spinules along distal border. Antenna (Fig. 209F) stout, 4-segmented; coxa short and unarmed; basis slightly longer than wide, with slender knob-like process (representing exopod) at outer distal corner, bearing 2 vestigial setae; first endopodal segment expanded, as long as wide, with 1 small seta on inner margin and row of spinules in middle; compound distal endopodal segment 2.3 times longer than wide (74×32 µm) and 1.3 times longer than first, ornamented with 3 rows of spinules; armed with 7 small setae plus terminal claw, 60 µm long, slightly shorter than segment.

Labrum (Fig. 209G) simple with convex distal margin bearing scattered minute setules. Mandible (Fig. 209H) with 5 teeth and 1 subsidiary, spinule-like denticle on distal side of distalmost tooth; basis with 1 seta on medial margin and 2 rows of fine setules on ventral surface; exopod armed with 5 setae and ornamented with several patches of minute spinules on ventral surface, distalmost seta half as long as other 4 setae; endopod 2-segmented with 4 setae and several rows of minute spinules on broad first segment and 10 setae and 1 distal row of minute spinules on second. Paragnath (Fig. 209I) lobate, bearing setules on medial surface and spinules on distal margin. Maxillule (Fig. 209J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 4 on exopod and 3 on endopod. Maxilla (Fig. 210A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with strong claw bearing setules on concave margin plus 2 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 210B) incompletely 2-segmented (suture line limited to medial third); first segment with 9 setae and second with 2 setae.

Leg 1 (Fig. 210C) with 3-segmented rami; outer seta on basis broadened proximally; inner distal spine on basis spinulose, longer than first endopodal segment; first exopodal segment ornamented with spinules on outer margin and outer distal surface; second and third exopodal segments each with tuft of setules on ventral (anterior) surface. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 210D, E); rami armed with setae rather than spines; outer and distal setae mostly spinulose. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 210F) 2-segmented: protopod broad with thin seta at outer distal corner and spinules along inner distal border: free exopodal segment about 3.5 times longer than wide (100×29 µm), nearly rectangular, armed with slender spine and thin seta distally; ornamented with 4 rows of spinules on dorsomedial surface and 2 rows of spinules on outer surface.

**Male.** Unknown.

**Remarks.** The material examined includes specimens extracted from the type host (*Corella eumyota*) collected from close to the type locality (Wellington Harbour) in New Zealand. The general similarity between our specimens and those described by Jones (1974) strongly suggests that they belong to *D. globosus*. However, there are differences between our specimens and the figures of Jones (1974) in terms of body form, in the shape of the caudal ramus and leg 5, and in the setation of the maxilla. After consideration of the close similarities in the shape of the antenna, the presence of spinulose outer setae on the exopods of legs 2–4, and the characteristic, proximally swollen outer seta on the basis of leg 1, we conclude that, on balance, the evidence indicates that our material is conspecific with *D. globosus* and that the apparent differences are largely explained by the poor state of the material examined by Jones (1974).

### *Doropygus kerguelensis* Schellenberg, 1922

(Figs. 211–213)

**Material examined.** 2 ♀♀ (MNHN-IU-2018-1850) and 1 dissected ♀ from *Molgula* sp., Subantarctic (49°14'N, 67°48'E), depth 202–208 m, 21 September 2010; 12 ♀♀ (MNHN-IU-2018-1851) and dissected 3 ♀♀, 1 ♂ from *Ascidia meridionalis* Herdman, 1880, Subantarctic (48°48'N, 70°09'E), depth 103–104 m, 04 September 2010; 1 ♀, 1 ♂ (MNHN-IU-2018-1852) and 1 dissected ♀ from *Molgula macquariensis* Kott, 1954, Kerguelen MD04 Stn A3D6; 1 ♀, 2 ♂♂ (MNHN-IU-2018-1853) from *M. macquariensis*, Kerguelen; 1 ♀, 1 ♂ (MNHN-IU-2009-5183) and 1 dissected ♀ from *M. pedunculata* Herdman, 1881, POKER III, Stn CE06-049B = 31 (48°430'S, 67°585'E), depth 212 m; 1 ♀ (MNHN-IU-2009-5154) and 1 dissected ♀ from *M. pedunculata*, POKER III, Stn 133 (46°935'S, 68°820'E), depth 665 m = 665–706 m; 5 ♀♀, 5 ♂♂ (MNHN-IU-2009-5185) and dissected 1 ♀, 1 ♂ from *Molgula* sp., POKER III, Stn CE06.163 = 167 (51°88'S, 70°675'E), depth 382 m; 11 ♀♀, 6 ♂♂ (MNHN-IU-2009-5186) from *Molgula* sp., POKER III, Stn CE06.048 = 30 (48°397'S, 67°338'E), depth 385 m; 15 young ♀♀, 30 ♂♂ (MNHN-IU-2009-

5187) and 1 dissected young ♀ from *Molgula* sp., POKER III, Stn CE06-039A (47°986'S, 67°154'E), depth 487 m; 2 ♀♀ (MNHN-IU-2009-5715) from *Molgula pedunculata*, POKER III, Stn CE06-133; 1 ♀, 3 ♂♂ (MNHN-IU-2009-5717) from *Molgula* sp., POKER III, Stn CE06-119 (46°224'S, 68°600'E), depth 165 m; 37 ♀♀, 3 ♂♂ (MNHN-IU-2009-5718) from *M. pedunculata*, Expedition MD03, Navire Oceanographique "Marion Dufresne", Stn 2-7-CB02 (49°33'S, 70°47'E), depth 130 m, 04 April 1974; 12 ♀♀ (MNHN-IU-2009-5719) from *M. pedunculata*, MD42/SIBEX, Stn 001, Mola 251 (51°15.0'S, 71°41.2'E), depth 285 m, 12 January 1985; 8 ♀♀, 8 ♂♂ (MNHN-IU-2009-5720) from *Molgula* sp., POKER III, Stn CE06-059 (48°606'S, 67°44'E), depth 220 m; 1 ♀, 8 young ♀♀, 10 ♂♂ (MNHN-IU-2009-5721) from *M. pedunculata*, POKER III, Stn CE06-040 = 25 (48°751'S, 67°010'E), depth 331 m; 4 ♀♀, 12 ♂♂ (MNHN-IU-2009-5729) from *M. pedunculata*, MD42/SIBEX, Stn. ?, Mol A 251 (51°15.0'S, 71°41.2'E), depth 285 m, 12 January 1985; 4 ♀♀, 12 ♂♂ (MNHN-IU-2009-5730) from *M. pedunculata*, Pridz Bay, Stn 22-CP70, (67°000'S, 73°372'E), depth 490 m.

**Supplementary description of female.** Body (Fig. 211A) narrow, slightly depressed, 3.85 mm long. Metasome obscurely 4-segmented with fourth pedigerous somite forming bulbous brood pouch, largely incorporating fifth pedigerous somite. Free urosome (Fig. 211B) slender, 5-segmented: genital somite 160×364 µm, shorter than other urosomites; 4 abdominal somites 314×345, 258×308, 215×258, and 185×234 µm, respectively. Caudal ramus (Fig. 211C) elongate, about 6.3 times longer than wide (406×65 µm) and about twice as long as anal somite; armed with 6 small setae; all caudal setae shorter than width of caudal ramus; 2 proximal setae located at 26 and 65% of ramus length.

Rostrum (Fig. 211D) longer than wide, tapering towards rounded apex. Antennule (Fig. 211E) 440 µm long, 9-segmented; proximal segments weakly expanded; armature formula 3, 17, 6, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; most of large setae pinnate with setules perpendicular to long axis of seta. Antenna (Fig. 211F) slender, 4 segmented; short coxa unarmed; basis about twice as long as wide, with small (exopodal) knob tipped by 2 vestigial setae at outer distal corner and 1 small seta at inner distal region; first endopodal segment 1.5 times longer than wide, with 1 seta on inner margin; compound distal endopodal segment twice as long as first and 4.4 times longer than wide (180×41 µm); armed with 10 small setae (3 distal setae blunt at tip) and ornamented with minute spinules on outer margin; terminal claw small, less than half length of segment.

Labrum (Fig. 211G) densely setulose posteriorly and with large setulose posteromedian lobe. Mandible (Fig. 211H) with 5 teeth on coxal gnathobase; basis with 1 seta on medial margin; exopod 4-segmented with 1, 1, 1, and 2 setae on first to fourth segments, respectively, distalmost

seta slightly shorter than other 4; first endopodal segment fused with or indistinctly articulated from basis and armed with 4 setae medially; ornamented with row of spinules at outer distal corner and patch of minute spinules ventrodistally; second endopodal segment with 10 setae. Maxillule (Fig. 211I) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 4 on exopod and 3 on endopod. Maxilla (Fig. 212A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 3 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively; 2 of 4 setae on third endopodal segment naked, one half length of other. Maxilliped (Fig. 212B) unsegmented, armed with 9 medial setae and 2 apical setae on short, narrow distal part; ornamented with tuft of setules proximally.

Leg 1 (Fig. 212C) with 3-segmented rami; inner distal spine on basis 90 µm long, extending to distal border of second endopodal segment; outer margin of first exopodal segment slightly notched at distal third; first outer spine of exopod 88 µm long, twice as long as second and third outer spines. First exopodal segment of leg 4 lacking inner seta in some specimens; third exopodal segment armed with 9 or occasionally 8 setae (in case of 8 setae, first outer seta may be lost, this seta indicated by an arrowhead in Fig. 212E). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-0/1; 1-1; 3 (or 2), 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 212F) with broad protopod bearing extremely thin outer seta and row of spinules at inner distal corner; free exopodal segment about 2.6 times longer than wide (179×69 µm), armed with 1 short seta and 1 longer seta distally and ornamented with 4 rows of minute spinules on dorsomedial surface.

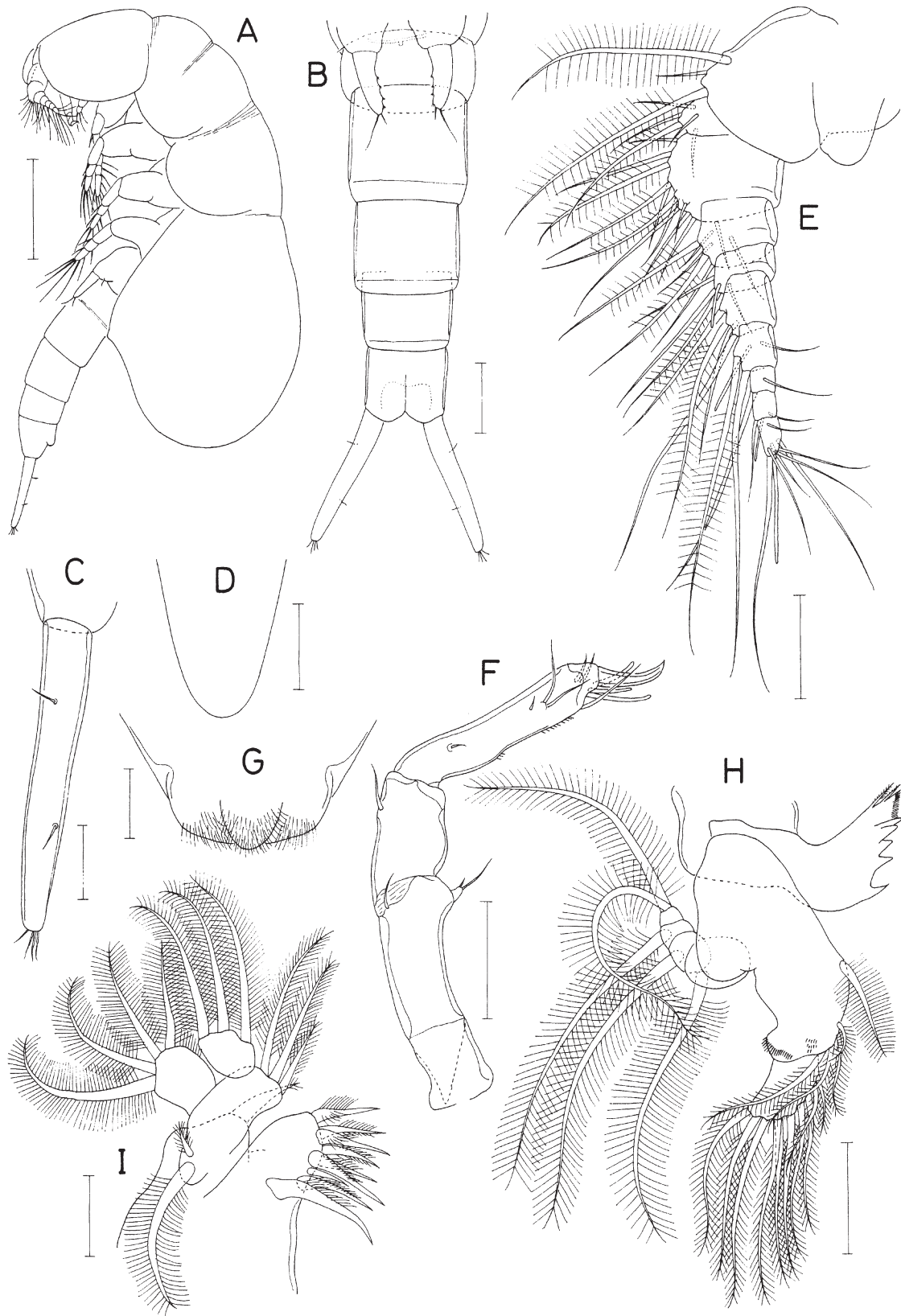
**Description of male.** Body (Fig. 213A) slender, 1.98 mm long. Cephalosome much broader than remaining part of body. Urosome 6-segmented: first to third free abdominal somites longer than wide; other 3 urosomites wider than long. Caudal ramus about 6.4 times longer than wide (212×33 µm) and 2.2 times longer than anal somite.

Rostrum, antennule, antenna, and all mouthparts as in female. Armature formula for legs 1–3 also as in female. First exopodal segment of leg 4 (Fig. 213B) with or without inner seta, as in female; third exopodal segment of leg 4 with 8 setae (formula 2, 1, 5).

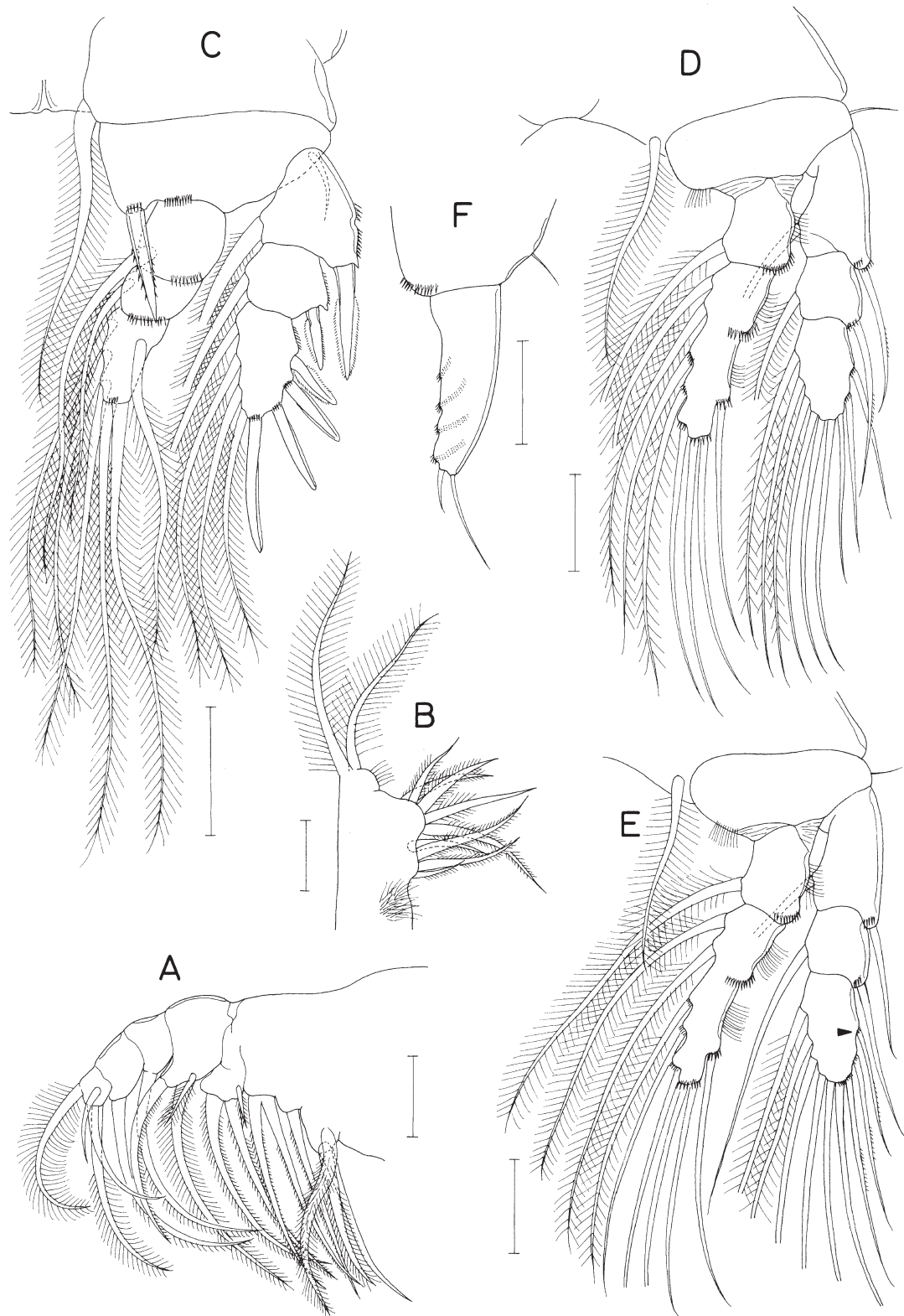
Leg 5 (Fig. 213C) armed and ornamented as in female. Exopodal segment about 3.2 times longer than wide (92×29 µm). Leg 6 represented by 2 naked setae on genital operculum.

**Remarks.** *Doropygus kerguelensis* was originally described as *D. trisetosus* var. *kerguelensis* (Schellenberg,



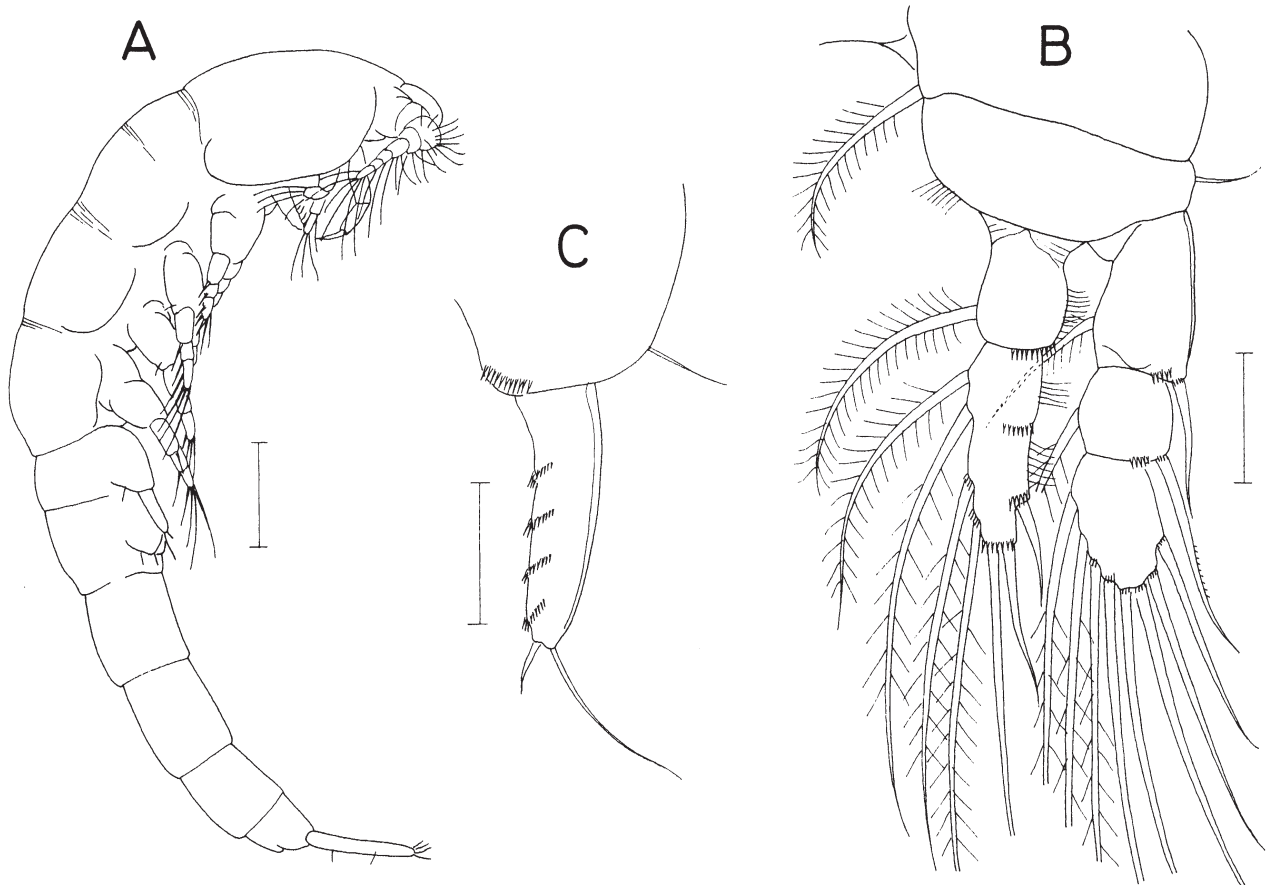


**FIGURE 211.** *Doropygus kerguelensis* Schellenberg, 1922, female. A, habitus, left; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C–F, H, 0.1 mm; G, I, 0.05 mm.



6185

**FIGURE 212.** *Doropygus kerguelensis* Schellenberg, 1922, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, 0.05 mm; C–F, 0.1 mm.



**FIGURE 213.** *Doropygus kerguelensis* Schellenberg, 1922, male. A, habitus, right; B, leg 4; C, leg 5. Scale bars: A, 0.2 mm; B, C, 0.05 mm.

1922) but later raised to species level (Sewell, 1949; Illg, 1958). The key features of Schellenberg's brief description included the following: (1) the caudal ramus is twice as long as the anal somite; (2) the fifth seta on the mandibular exopod is shorter than the fourth; (3) the endopod of the maxillule bears 3 setae; (4) the first outer seta on the exopod of leg 1 is twice as long as the second and third; (5) the second and third outer setae on the exopods of legs 2–4 are about twice as long as the third exopodal segment; (6) the free exopodal segment of leg 5 is 2.5 times longer than wide and has 4 indentations on the inner margin. All of these features are exhibited by our examined specimens, which are therefore identified as *D. kerguelensis*.

It is interesting to note that the basis of the antenna carries a small knob tipped with 2 vestigial setae at its outer distal angle. This structure is here interpreted as a vestige of the antennal exopod. A similar structure is present in the same position on the distal margin of the basis in *D. globosus*, although it somewhat resembles a bifurcate seta.

***Doropygus tuberculatus* sp. nov.**

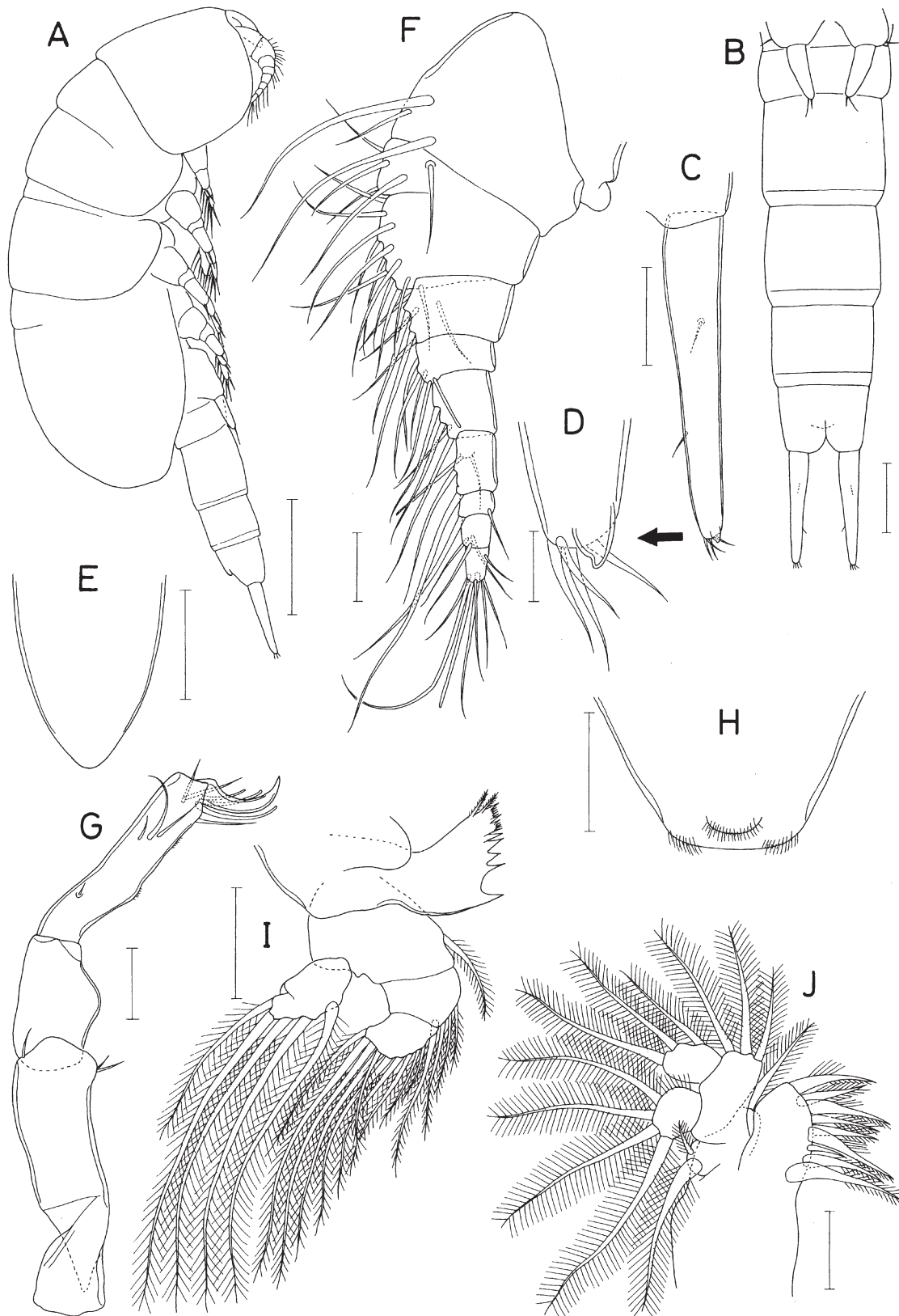
(Figs. 214, 215)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21306) and paratype (♀, dissected and mounted on a slide, MNHN-IU-2014-21307) from *Molgula pedunculata* (Herdman, 1881), CEAMARC/cruise, Terre Adelie, Antarctic (67°02'S, 140°00'E), depth 180–205 m, 30 December 2007.

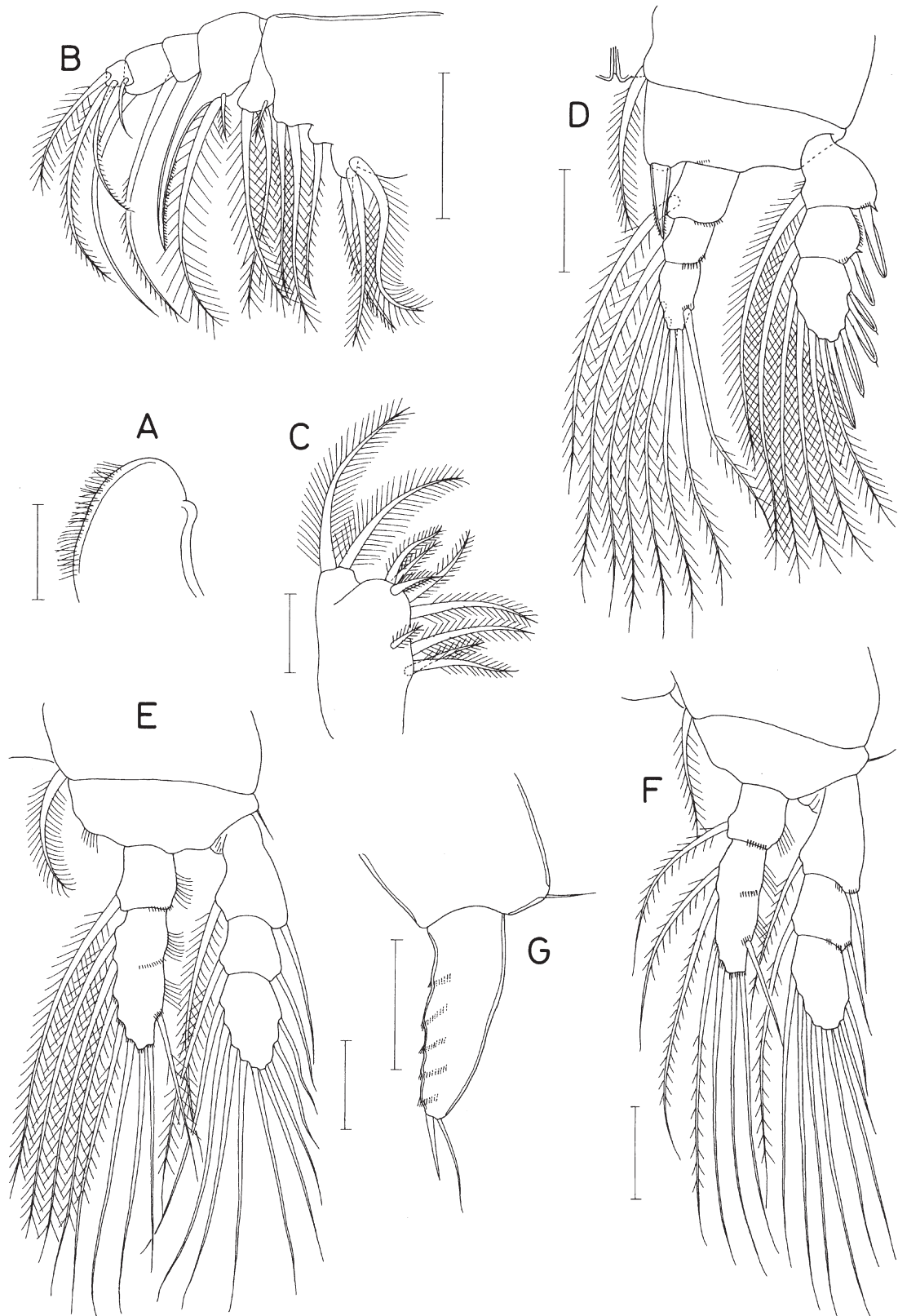
**Additional material.** 1 ♀ (dissected) from *Molgula hodgsoni* Herdman, 1910, South Georgia Island, South Atlantic.

**Etymology.** The specific name refers to the presence of the tapering distal tubercle on the caudal ramus.

**Description of female.** Body (Fig. 214A) of non-ovigerous adult slender, with small brood pouch. Body length 3.37 mm. Metasome 4-segmented with fifth pedigerous somite incorporated into brood pouch. Free urosome (Fig. 214B) 5-segmented: genital somite short, 150×378 µm; 4 abdominal somites 306×363, 299×340, 230×300, and 190×265 µm, respectively. Caudal ramus (Fig. 214C) slender, 5.5 times longer than wide (334×61 µm), gradually narrowing distally; armed with 6 small



**FIGURE 214.** *Doropygus tuberculatus* **sp. nov.**, female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, detail of distal part of caudal ramus; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, E, H, I, 0.1 mm; D, 0.02 mm; F, G, J, 0.05 mm.



**FIGURE 215.** *Doropygus tuberculatus* sp. nov., female. A, paragnath; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A, C, 0.05 mm; B, D–G, 0.1 mm.

setae and tapering distal tubercle (arrowed in Fig. 214D); all setae shorter than width of ramus at base; 2 proximal setae positioned at 34 and 68% of ramus length.

Body of ovigerous adult 4.75 mm long, with expanded, ovoid brood pouch. Metasomal somites defined only by surface constrictions. Caudal ramus twice as long as anal somite and 6.2 times longer than wide, armed with 6 setae and distal tubercle.

Rostrum (Fig. 214E) longer than wide, narrowing towards rounded apex. Antennule (Fig. 214F) 9-segmented, segments broader near base, gradually narrowing distally; armature formula 3, 17, 6, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 214G) slender, 4-segmented; coxa short and unarmed; basis more than twice as long as wide, with 3 small setae, 2 at outer distal corner (representing exopod) and 1 at inner distal corner; first endopodal segment unarmed, 0.6 times as long as basis, with protruding outer margin; compound distal endopodal segment 4.3 times longer than wide (149×35 µm); armed with 9 small setae (distal 3 blunt at tip) plus slender terminal claw, less than half as long as segment.

Labrum (Fig. 214H) with almost straight posterior margin bearing setules on both sides and small, setulose posteromedian lobe. Mandible (Fig. 214I) with 5 acute teeth on coxal gnathobase; basis with 1 seta on medial margin; exopod with 5 setae, shorter distalmost seta half as long as other 4; endopod with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 215A) as simple lobe bearing setules on medial margin. Maxillule (Fig. 214J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 4 on exopod and 3 on endopod. Maxilla (Fig. 215B) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with slender claw (spinulose along distal half of concave margin) plus 2 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 215C) incompletely 2-segmented; first segment with 9 (4 proximal and 5 distal) setae medially; short second segment with 2 setae apically.

Leg 1 (Fig. 215D) with 3-segmented rami; outer seta absent on basis; inner distal spine on basis broad, spinulose and 73 µm long, extending to middle of second endopodal segment; outer spines on exopod fringed with narrow membranes. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 215E, F); outer seta on basis vestigial; exopod bearing setae only. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	0-1	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 215G) 2-segmented: protopod broad, unornamented, but armed with small, naked seta at outer

distal corner; free exopodal segment gradually narrowing distally, 2.8 times longer than wide (164×58 µm), ornamented with 5 rows of fine spinules on dorsomedial surface, and armed with 2 naked distal setae, inner shorter than outer.

**Male.** Unknown.

**Remarks.** *Doropygus tuberculatus* **sp. nov.** closely resembles *D. kerguelensis* (redescribed above). Both species may be found in the same ascidian host, *Molgula pedunculata* at localities around Antarctica. *Doropygus tuberculatus* **sp. nov.** can be distinguished from *D. kerguelensis* by the presence of a distal tubercle on the caudal ramus (this tubercle is absent in *D. kerguelensis*), the armature of 1 claw plus 2 setae on the basis of the maxilla (3 setae in *D. kerguelensis*), by having naked setae on the antennule (most of the large setae are pinnate in *D. kerguelensis*), and by the presence of 5 spinule rows on the exopod of leg 5 (only 4 spinule rows in *D. kerguelensis*). These consistent differences support the establishment of the new species.

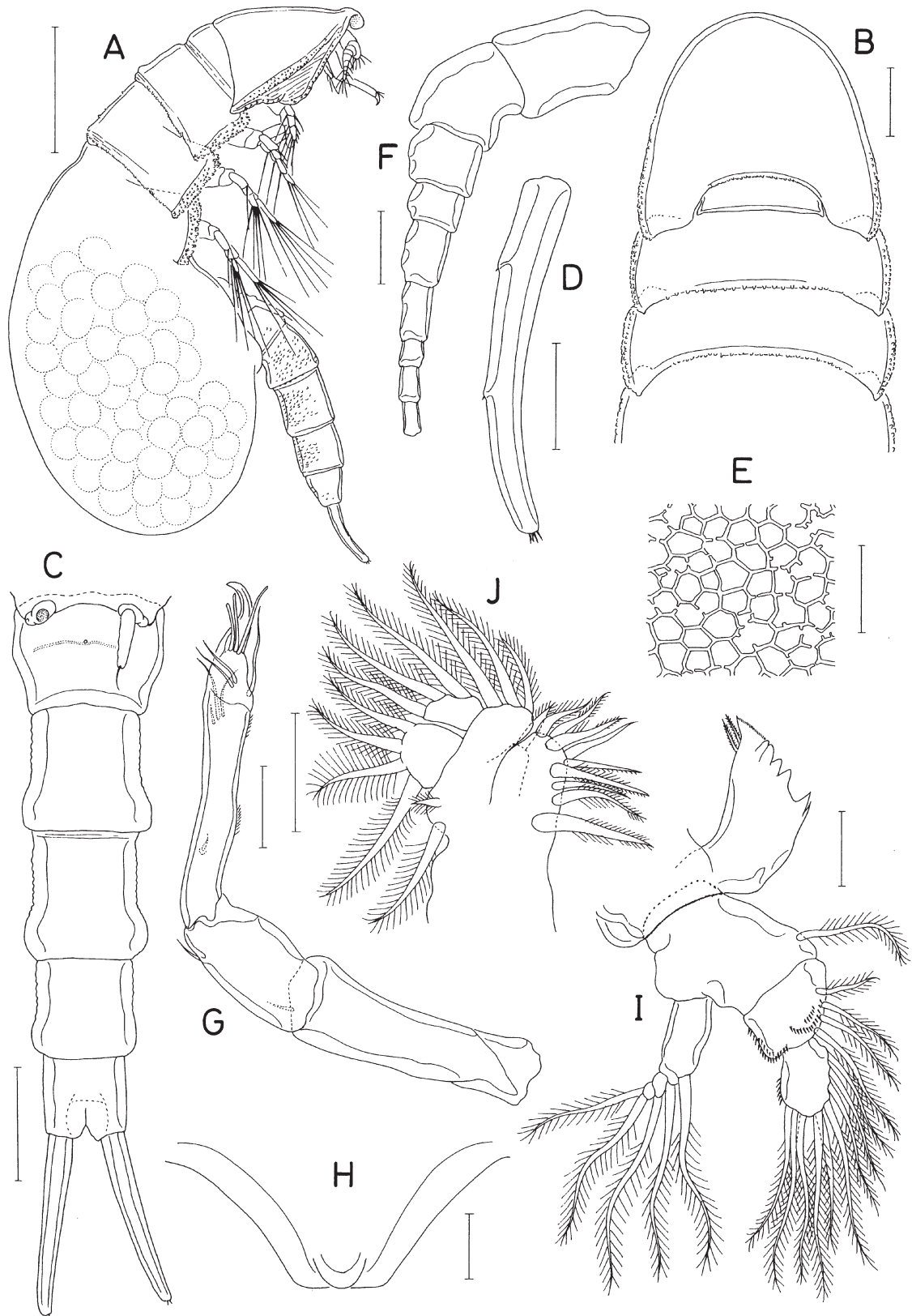
***Doropygus reticulatus* sp. nov.**

(Figs. 216, 217)

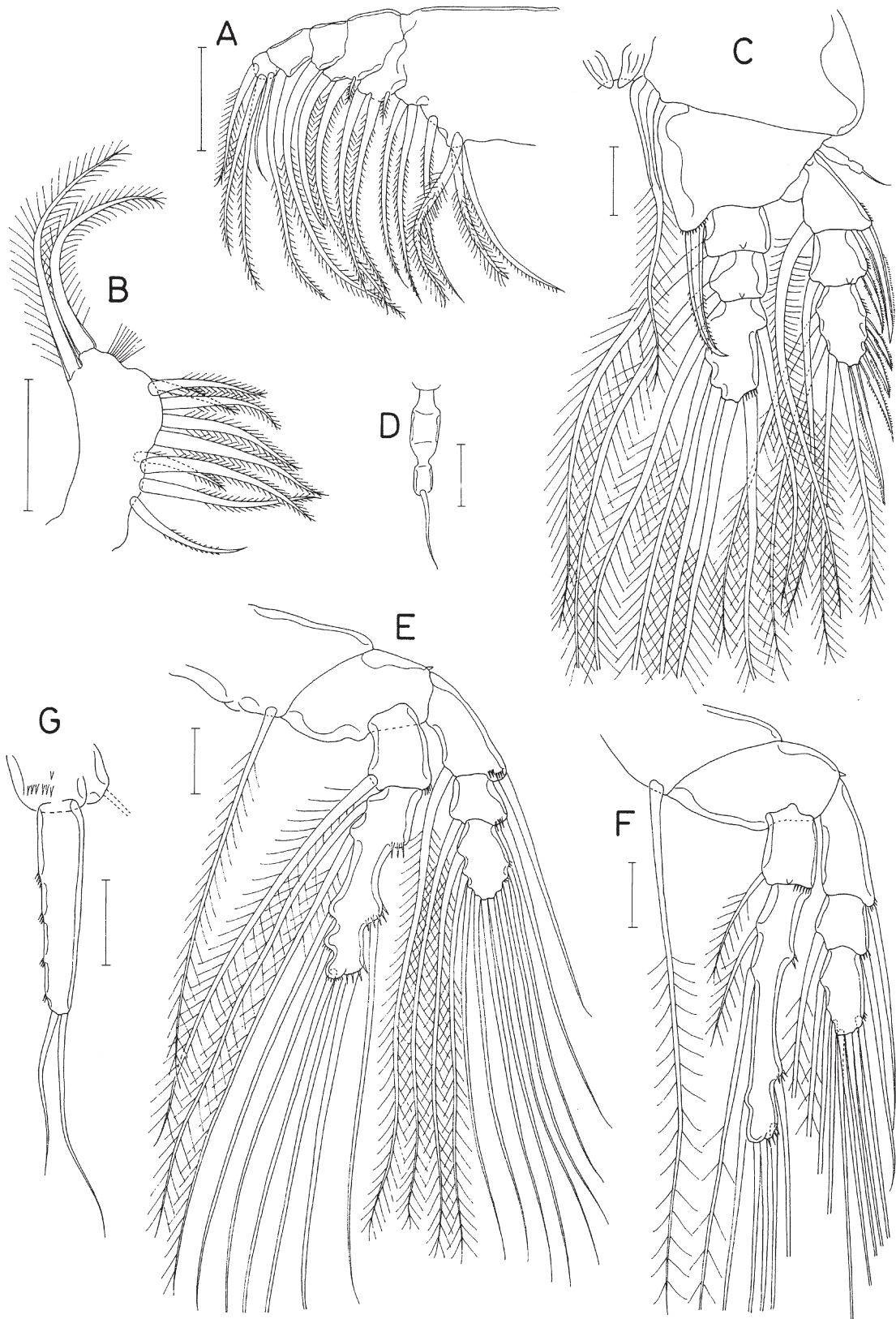
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21308) and paratype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21309) from *Pyura arenosa* (Herdman, 1881) (MNHN-IT-2008-7399 = MNHN S2/PUY/484), CRRF 0PHG 1713-U, Vietnam (08°41.12'N, 106°36.80'E), depth 0-1 m, 29 July 2008.

**Etymology.** The specific name refers to the surface reticulation on the exoskeleton of the prosomites.

**Description of female.** Body (Fig. 216A) clearly segmented, length 3.04 mm; with thick, rigid exoskeleton. External surface of all prosomal somites reticulate, with polygonal sculpturing (Fig. 216E). Cephalosome and first to third pedigerous somites dorsoventrally depressed. Posterolateral corners of dorsal cephalic shield extended posteriorly beyond distal border of first pedigerous somite; corners angular in dorsal view (Fig. 216B), but tapering and pointed in lateral view. First pedigerous somite small (Fig. 216B), half as wide as cephalic shield. Second to fourth pedigerous somites each with well-developed epimera. Cephalic shield and epimera of second to fourth pedigerous somites thickened laterally, ornamented with minute surface granulation along lateral margins. Posterodorsal margins of second and third pedigerous somites concave and fringed with surface granulation. Fourth pedigerous somite expanded to form nearly oval brood pouch, longer than cephalosome plus anterior pedigerous somites combined, its epimera confined to anterior 20% of somite length, near base of leg 4. Free urosome (Fig. 216C) slender, 5-segmented, with thick exoskeleton and surface granulation (not shown in Fig. 216C, but visible in Fig. 216A). Genital somite



**FIGURE 216.** *Doropygus reticulatus* sp. nov., female. A, habitus, right; B, anterior part of prosome, dorsal; C, urosome, ventral; D, right caudal ramus, lateral; E, dorsal reticulation on surface of prosome; F, antennule, setal armature omitted; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, 0.5 mm; B, C, 0.2 mm; D, 0.1 mm; E–H, J, 0.05 mm; I, 0.02 mm.



**FIGURE 217.** *Doropygus reticulatus* **sp. nov.**, female. A, maxilla; B, maxilliped; C, leg 1; D, outer seta on basis of leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A–C, E–G, 0.05 mm; D, 0.02 mm.



192×269 µm, narrow in posterior half. Four abdominal somites 212×269, 231×223, 173×188, and 138×150 µm, respectively, with first to third abdominal somites expanded posteriorly. Caudal ramus (Fig. 216D) slender, slightly arched ventrally, about 7.4 times longer than wide (340×46 µm) and about 2.5 times longer than anal somite; carrying vestiges of 6 setae, 2 proximal setae located at 27 and 64% of ramus length.

Rostrum represented by broad, blunt apical lobe of cephalosome. Antennule (Fig. 216F) slender and 9-segmented; setae strongly entangled, not countable. Antenna (Fig. 216G) slender, 4-segmented; coxa short and unarmed; basis 99×53 µm, with 1 small seta distally; first endopodal segment 83×50 µm, with 1 small seta on inner margin; compound distal endopodal segment 5.2 times longer than wide (162×31 µm) and twice as long as first endopodal segment, ornamented with 2 groups of minute spinules on outer margin; armed with 10 small setae plus small terminal claw, about one-third as long as segment.

Labrum (Fig. 216H) with smooth sides, strongly tapering to narrow, linear free posterior margin, with small posteromedial lobe. Mandible (Fig. 216I) with 5 major teeth, 1 distal subsidiary tooth, and 2 small proximal setae on coxal gnathobase; basis with 1 seta on medial margin; exopod with 5 setae, distal outer seta slightly shorter than other 4; first endopodal segment bearing 4 setae and spinules near outer distal and medioventral surfaces; second endopodal segment with 9 setae and spinules on outer margin. Maxillule (Fig. 216J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 4 on exopod and 3 on endopod. Maxilla (Fig. 217A) 5-segmented; syncoxa with 9 setae (grouped as 3, 1, 2, and 3); basis with 3 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 217B) unsegmented, elongate, armed with 9 setae on medial margin and 2 subequal setae apically.

Leg 1 (Fig. 217C) with 3-segmented rami. Inner coxal seta broadened and highly sclerotized in proximal part, extending beyond tip of inner distal spine on basis. Outer seta (Fig. 217D) on basis spiniform, constricted proximally and in distal third, with slender flagellate tip. Inner distal spine on basis extending to middle of third endopodal segment, curved, spinulose along distal half. Outer spine on first exopodal segment large, twice as long as outer spine on second segment.

Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 217E, F); endopods distinctly longer than exopods. Legs 2 and 3 with same setation. Inner coxal seta elongate, much longer than endopod. Outer seta on basis rudimentary, scarcely visible. Outer setae on exopods longer than ramus. Proximal 2 inner setae on endopod of leg 4 shorter than other endopodal setae. Second endopodal segment of legs 2–4 elongated, with uneven lateral margins. Second endopodal segment of leg 4 longer than exopod. First exopodal segment of

leg 4 lacking inner seta. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 2, 4	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-0; 1-1; 2, 2, 4	0-1; 2, 2, 3

Leg 5 (Fig. 217G) 2-segmented: protopod short, with several spinules near base of exopod and 1 outer distal seta (this seta missing in observed specimens); free exopodal segment slender, gradually narrowing distally, 4.5 times longer than wide (126×28 µm), with 2 long setae distally (outer seta 140 µm long, inner 103 µm) and 4 rows of spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** In the genus *Doropygus* there are ten species currently known to have a maxillule combining the presence of 4 setae on the exopod with 3 setae on the endopod, as found in *D. reticulatus* **sp. nov.** Among these species, *D. rigidus* Ooishi, 1962 and probably *D. platythorax* Jones, 1974 have, like the new species, a highly sclerotized, rigid exoskeleton but the surface reticulation of the prosomites, as found in the new species, has not been reported in any of those ten species.

These ten species typically have elongate caudal rami and three are known to have caudal rami which are more than 6 times as long as wide, as in *D. reticulatus* **sp. nov.** These three species are *D. kerguelensis*, *D. platythorax*, and *D. rigidus*. However, all three of these species have a much broader free exopodal segment of leg 5, which is up to 3.5 times as long as wide in contrast to 4.5 times in *D. reticulatus* **sp. nov.** In two other species, *D. spiniferus* Schellenberg, 1922 and *D. trisetosus* Schellenberg, 1922 the information available on their caudal rami is incomplete but it is reported that in both species the caudal ramus is 1.5 times longer than the anal somite. Fortunately, *Doropygus reticulatus* **sp. nov.** is readily distinguishable from these two species because its caudal ramus is 2.5 times longer than the anal somite.

The characteristic shape of the outer seta on the basis of leg 1 may be a diagnostic feature of *D. reticulatus* **sp. nov.** allowing it to be differentiated from its congeners.

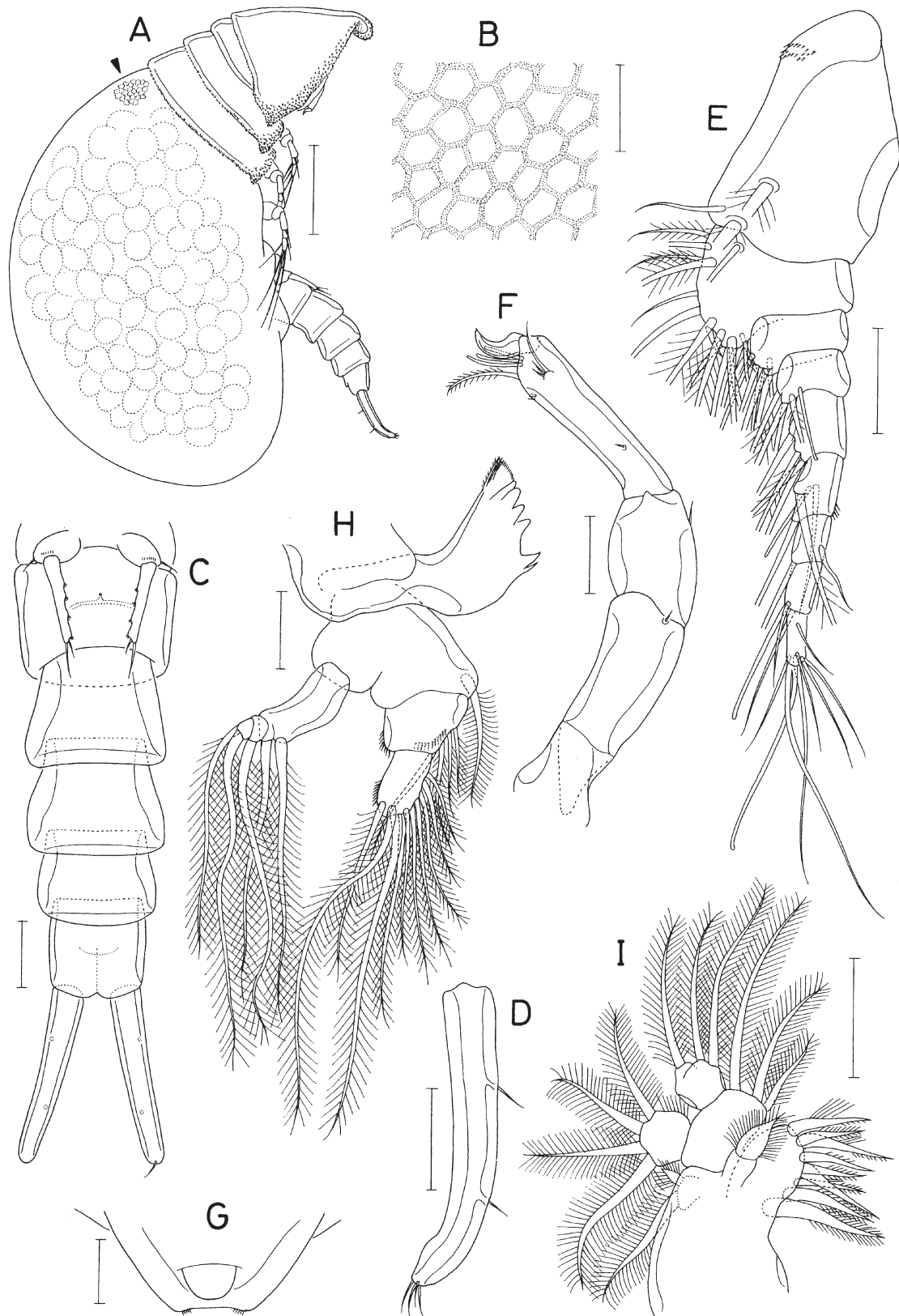
#### *Doropygus caribbensis* **sp. nov.**

(Figs. 218, 219)

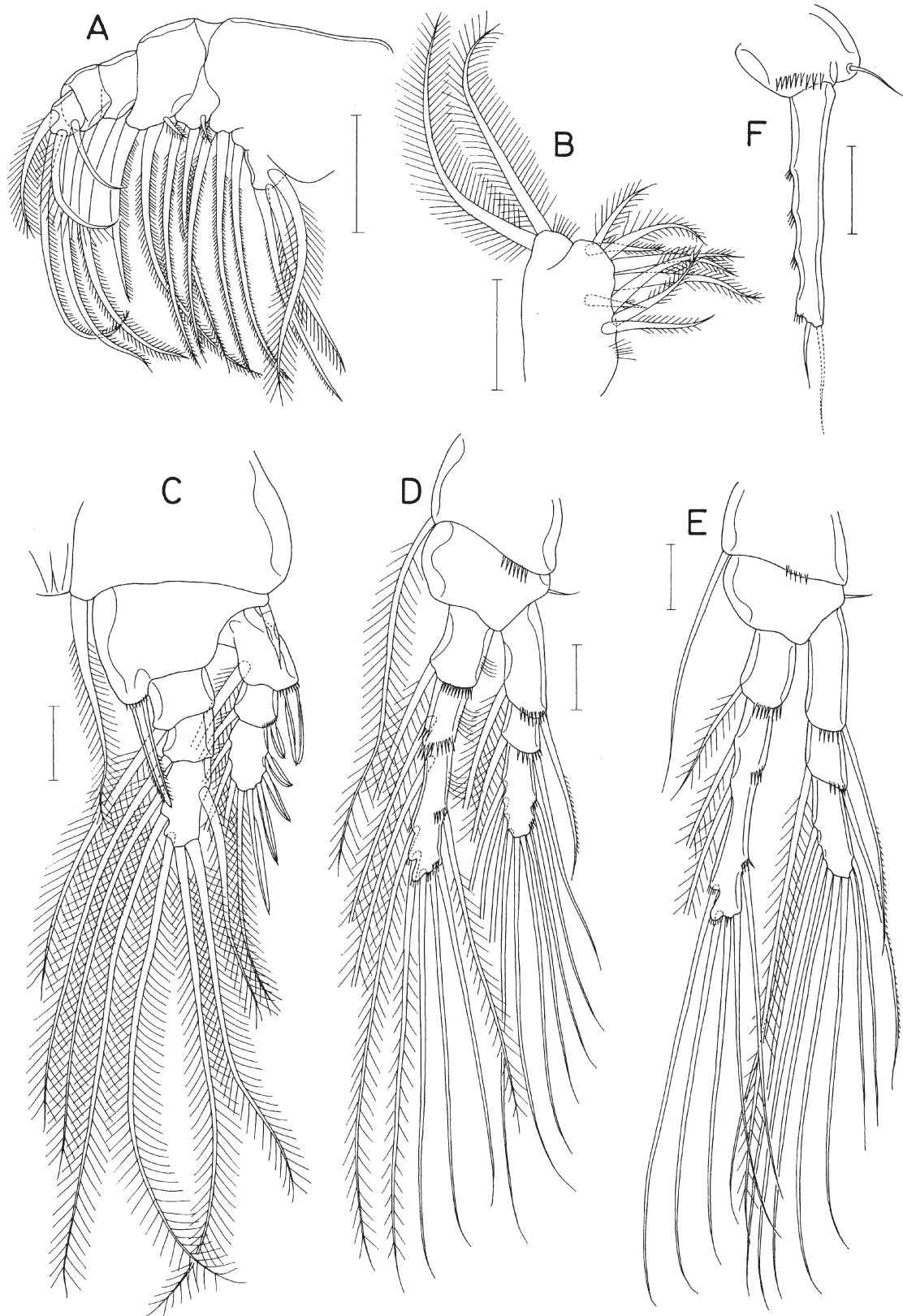
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21310) from *Polycarpa multiplicata* Monniot C., 1983 (MNHN-IT-2008-6569 = MNHN S1 POL.B 162), St. François, Guadeloupe 83-15, diving, Monniot coll., 30 March 1983.

**Etymology.** The new species is named after its geographical origin, the Caribbean.

**Description of female.** Body (Fig. 218A) clearly



**FIGURE 218.** *Doropygus caribbensis* sp. nov., female. A, habitus, right; B, reticulation on dorsal surface of prosome; C, urosome, ventral; D, left caudal ramus, lateral; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.5 mm; B, E–I, 0.05 mm; C, D, 0.1 mm.



**FIGURE 219.** *Doropygus caribbensis* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

segmented; length 2.81 mm. Body with thick rigid exoskeleton, as in *D. reticulatus* **sp. nov.**, but dorsal surface of cephalosome and first to third pedigerous somites smooth, without reticulation. Dorsal cephalic shield and second and third pedigerous somites ornamented with surface granulation along lateral and posterodorsal margins. Fourth pedigerous somite greatly expanded, forming brood pouch, dorsal surface reticulated with hexagonal sculptures (Fig. 218B; indicated by arrowhead in Fig. 218A); about twice as long as anterior part of prosome, 1.3 times longer than wide in lateral view, with straight ventral margin and rounded dorsal and posterior margins. Free urosome (Fig. 218C) 5-segmented: genital somite rectangular, 181×259 µm; first to third abdominal somites strongly sclerotized, each broadening posteriorly, 182×218, 171×215, and 135×182 µm, respectively. Anal somite quadrate, 145×149 µm. Caudal ramus (Fig. 218D) slender, curved ventrally, 6.0 times longer than wide (300×50 µm) and 2.1 times longer than anal somite; armed with 6 small, thin setae; 2 proximal setae located at 32 and 71% of ramus length; all setae shorter than ramus width.

Rostrum as blunt, broad apical process on cephalosome (Fig. 218A). Antennule (Fig. 218E) 313 µm long, 9-segmented; first and second segments distinctly broader than remaining segments; armature formula 3, 17, 6, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae crowded, many pinnate. Antenna (Fig. 218F) 4-segmented; coxa unarmed; basis 97×51 µm, with 1 small seta distally; first endopodal segment 75×56 µm, with 1 small seta subdistally; compound distal endopodal segment slender, 4.0 times longer than wide (132×33 µm); armed with 8 setae (including 1 subdistal pinnate and 3 distal, bluntly tipped setae) plus small terminal claw, one-third as long as segment.

Labrum (Fig. 218G) tapering from broad base to narrow posterior margin, ornamented with minute setules on both sides; posteromedian lobe small and smooth. Mandible (Fig. 218H) with 5 teeth, 1 distal subsidiary tooth and 2 small proximal setae on coxal gnathobase; basis with 1 seta mediolaterally; exopod slender, with 5 setae, third and fourth setae slightly longer than other 3; first endopodal segment armed with 4 setae and ornamented with spinules at inner and outer distal corners; second endopodal segment with 10 setae and ornamented with spinules on distal outer margin; 2 distal setae on second segment distinctly larger than other 8. Maxillule (Fig. 218I) and maxilla (Fig. 219A) armed as in *D. reticulatus* **sp. nov.**, but seta on coxal endite of maxillule broader. Maxilliped (Fig. 219B) incompletely 2-segmented; first segment with 9 setae and proximal patch of setules; second segment small with 2 apical setae and setules on medial margin.

Leg 1 (Fig. 219C) with 3-segmented rami. Inner coxal seta elongate, extending about to tip of inner spine on basis. Outer seta on basis lanceolate: inner distal spine

on basis 76 µm long, spinulose along distal half, and extending to middle of third endopodal segment. Outer spine on first exopodal segment large, twice as long as spine on second segment.

Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 219D, E); both rami slender; endopods longer than exopods. Inner coxal seta of legs 2 and 3 pinnate, extending about to distal margin of endopod; that of leg 4 naked and extending to middle of second endopodal segment. Outer seta on basis of legs 2–4 small. Second endopodal segment of leg 4 slightly shorter than entire exopod. First exopodal segment of leg 4 lacking inner seta. Armature formula for legs 1–4 as in *D. reticulatus* **sp. nov.**

Leg 5 (Fig. 219F) 2-segmented: protopod with 1 seta at outer distal corner and row of spinules along distal border; free exopodal segment slender about 5.3 times longer than wide (138×26 µm), armed with 2 setae distally and 4 rows of small spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** *Doropygus caribbensis* **sp. nov.** is similar to *D. reticulatus* **sp. nov.** in having a thickened and highly sclerotized exoskeleton and in having reticulate ornamentation over the surface of the brood pouch. They differ in the shape and length of the inner coxal setae of legs 1–4, and in the shape of the outer seta on the basis of leg 1. Important additional differences between *D. caribbensis* **sp. nov.** and other similar species are summarised in Table 7.

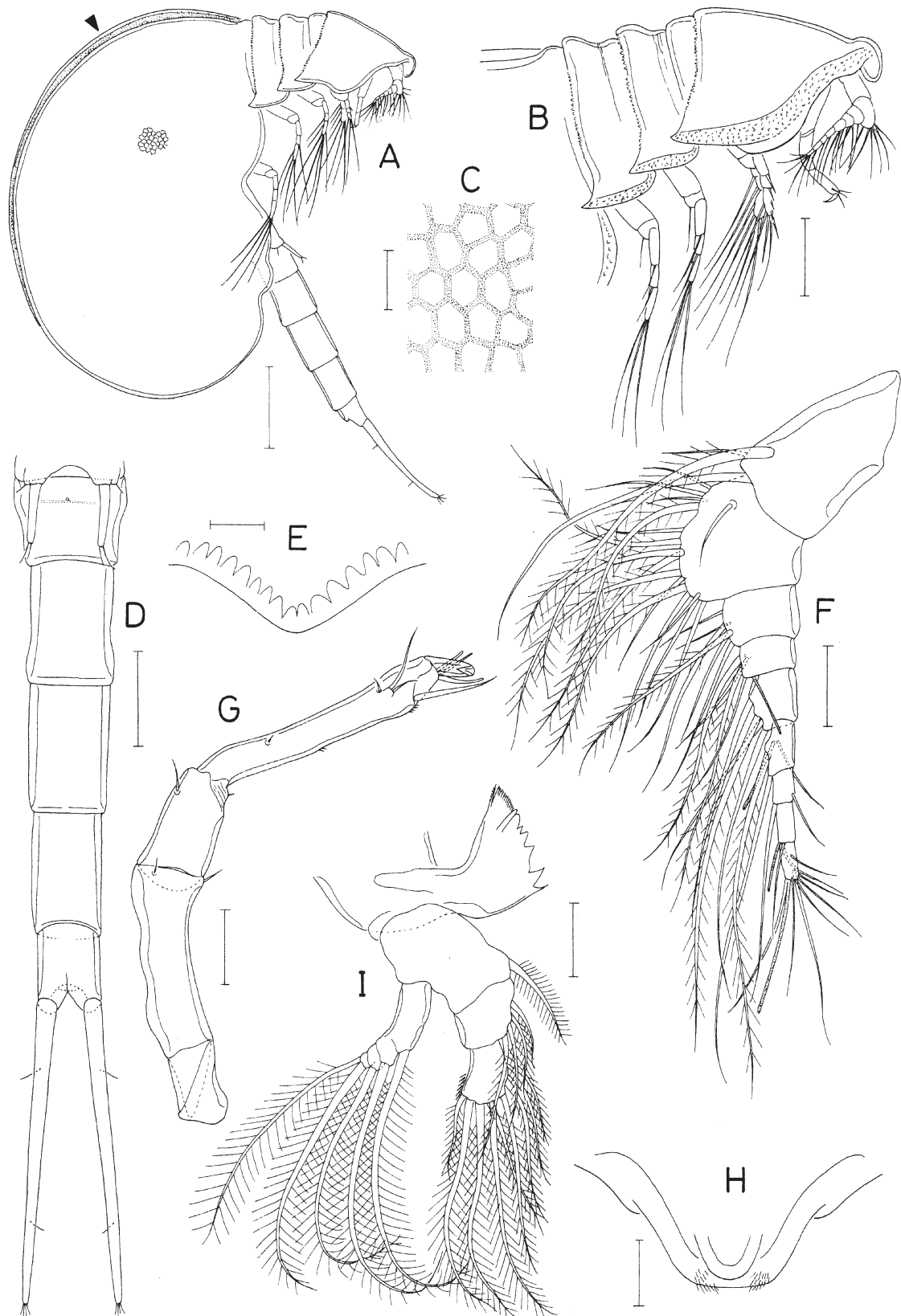
#### ***Doropygus tenuicaudatus* sp. nov.**

(Figs. 220, 221)

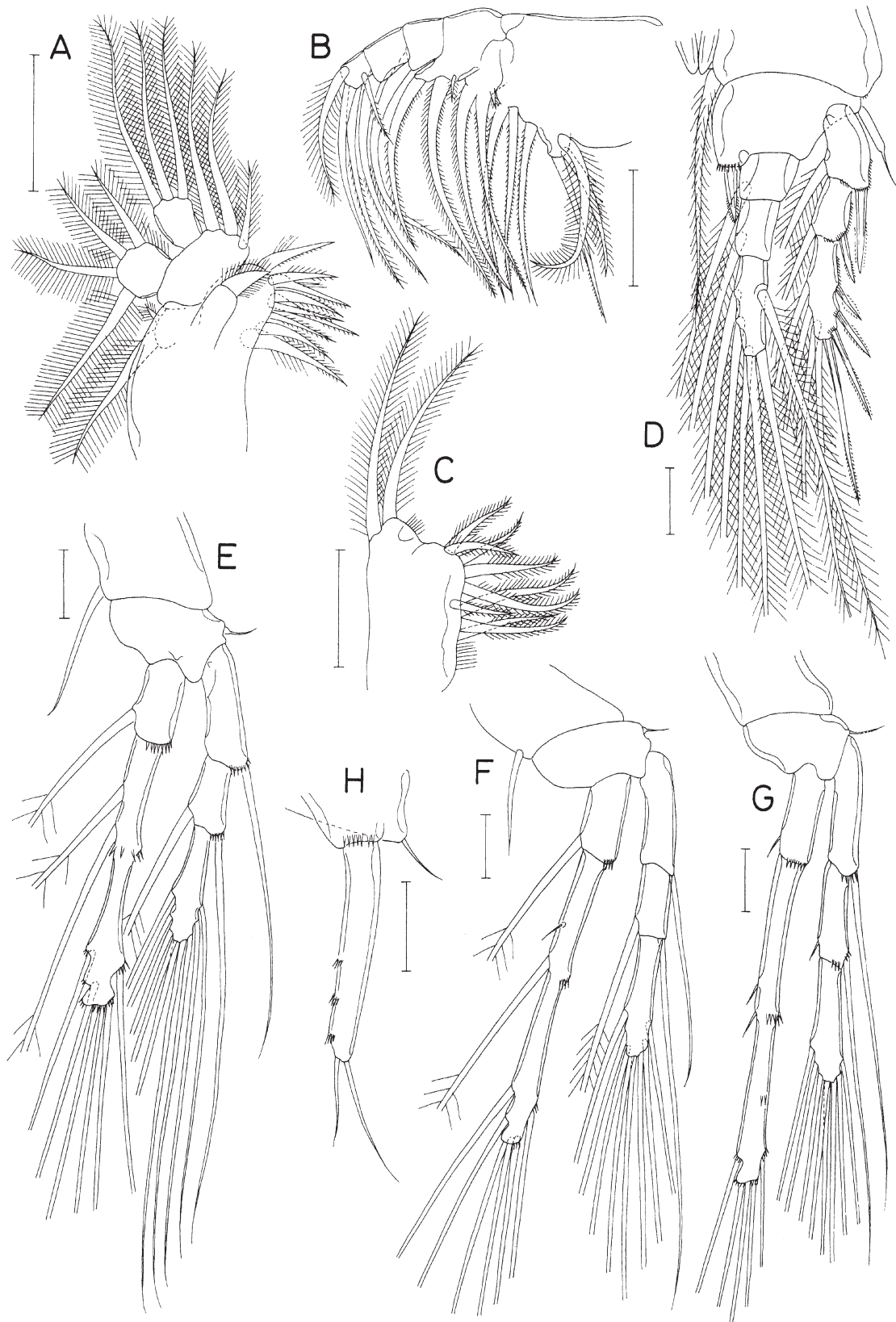
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21311) and paratype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21312) from *Herdmania mauritiana* (Drasche, 1884) (MNHN-IT-2008-4578 = MNHN S2/HER/22), CRRF CRCHO 239, Malakal Harbor, Koror, Palau (07°19.88'N, 134°27.50'E), depth 1 m, 28 January 1998.

**Etymology.** The specific name combines the Latin words *tenu* (=slender) and *cauda* (=tail), alluding to the slender urosome of the new species.

**Description of female.** Body (Fig. 220A) with thick, rigid exoskeleton; body length 4.57 mm. Prosome 5-segmented: cephalosome and first to third pedigerous somites dorsoventrally depressed. Dorsal cephalic shield and second and third pedigerous somites each with thickened lateral margins marked with surface granulation, acutely pointed posterolateral corners, and with fine serrations along posterodorsal margin (Fig. 220B). Fourth pedigerous somite forming large brood pouch, more than twice as long as anterior part of prosome, characteristically strongly compressed, disc-shaped and rounded both dorsally and posteriorly in lateral view,



**FIGURE 220.** *Doropygus tenuicaudatus* sp. nov., female. A, habitus, right view showing dorsal groove on brood pouch (arrowhead); B, anterior part of prosome, right; C, reticulation on dorsal surface of prosome; D, urosome, ventral; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible. Scale bars: A, 0.1 mm; B, D, 0.2 mm; C, E–I, 0.05 mm.



**FIGURE 221.** *Doropygus tenuicaudatus* sp. nov., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4; H, leg 5. Scale bars: 0.05 mm.

**TABLE 7.** Differentiation of three new species of *Doropygus*

Characters	<i>D. reticulatus</i> sp. nov.	<i>D. caribbensis</i> sp. nov.	<i>D. tenuicaudatus</i> sp. nov.
Caudal ramus, length/width ratio	7.4 : 1	6.0 : 1	12.2 : 1
Caudal ramus/anal somite, length ratio	2.5 : 1	2.1 : 1	4.0 : 1
Surface reticulation	Present on all prosomal somites	On brood pouch only	On brood pouch only
Mnd enp2 setation	9 setae	10 setae	9 setae
Inner seta on exp1 of leg 3	Present	Present	Absent
Leg 5 exopod, length/width ratio	4.5 : 1	5.3 : 1	6.3 : 1
Host genera and distributions	<i>Pyura</i> (Viet Nam)	<i>Polycarpa</i> (Guadeloupe)	<i>Herdmania</i> (Palau)

with dorsal groove (indicated by arrowhead in Fig. 220A) along midline. Cephalic shield to third pedigerous somites with smooth dorsal surfaces, but external surface of brood pouch reticulated with polygonal sculpturing (Fig. 220C). Free urosome (Fig. 220D) 5-segmented, extremely narrow; genital somite 154×241 µm, narrowing in posterior half. Four abdominal somites each longer than wide, 250×186, 273×168, 255×150, and 168×132 µm. Caudal ramus (Fig. 220D) thin, about 12 times longer than wide (673×55 µm) and 4.0 times longer than anal somite; armed with 6 minute setae; outer proximal and dorsal setae located at 25 and 72% of ramus length, respectively.

Rostrum (Fig. 220E) as short, broad anterior process on cephalosome. Antennule (Fig. 220F) 327 µm long, 9-segmented; armature formula 3, 16, 6, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae crowded and mostly long, larger setae pinnate. Antenna (Fig. 220G) slender, 4-segmented; coxa short and unarmed; basis about 3 times longer than wide, broad distally, armed with 2 small setae (1 outer distal and 1 inner distal); first endopodal segment about 1.6 times longer than wide, with 1 small seta subdistally on inner margin; compound distal endopodal segment elongate, about 5.6 times longer than wide (173×31 µm) and 2.3 times longer than first endopodal segment; armed with 8 setae and few minute spinules, plus small terminal claw, less than one-third as long as segment.

Labrum (Fig. 220H) with narrow, straight posterior margin bearing patch of minute setules on both sides and large, smooth posteromedian lobe. Mandible (Fig. 220I) with 7 teeth, distalmost seta thin, acutely pointed, and 1 small proximal seta; basis with 1 seta distally on medial margin; exopod slender, with 5 setae, distalmost seta more slender and shorter than other 4; endopod with 4 and 9 setae on first and second segments, respectively; second endopodal segment ornamented with spinules on distal half of outer margin. Maxillule (Fig. 221A) with 9 setae on arthrite, 1 broad seta on coxal endite; 2 on epipodite, 3 on basis (proximal seta markedly shorter than distal 2), 4 on exopod, and 3 on endopod. Maxilla (Fig. 221B) 5-segmented; syncoxa with 9 setae (3, 1,

2, and 3); basis with 3 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 221C) unsegmented, but with partial suture between broad proximal and short, narrow distal parts; armed with 9 setae medially and 2 setae apically.

Leg 1 (Fig. 221D) with 3-segmented rami. Inner coxal seta plumose, extending to middle of third endopodal segment. Outer seta on basis digitiform basally and flagellate distally. Inner distal spine of basis stout, 42 µm long, spinulose along distal half. Distal spine on third exopodal segment elongated, about 1.7 times longer than segment.

Legs 2–4 (Fig. 221E–G) with 3-segmented exopods and 2-segmented endopods; both rami very slender and with endopods distinctly longer than exopods; first exopodal segment lacking inner seta. Inner coxal seta of legs 2 and 3 naked, short (not extending beyond distal border of first endopodal segment); inner coxal seta of leg 4 rudimentary, almost invisible. Outer seta on basis of legs 2–4 minute. Setae on exopods elongate, mostly longer than ramus. Proximal inner seta on second endopodal segment of leg 3, proximal 3 setae on endopod of leg 4, and inner seta on second exopodal segment of leg 4 rudimentary. Second endopodal segment as long as entire exopod in legs 2 and 3, and longer than entire exopod in leg 4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	1-0; 1-1; 3, 2, 4	0-1; 1, 3, 4
Leg 3	0-1	1-0	1-0; 1-1; 2, 2, 4	0-1; 1, 3, 4
Leg 4	0-1	1-0	1-0; 1-1; 2, 2, 4	0-1; 1, 3, 3

Leg 5 (Fig. 221H) 2-segmented: protopod short with 1 seta at outer distal corner and several spinules on distal border; free exopodal segment elongate, about 6.3 times longer than wide (125×20 µm), with parallel lateral margins, armed with 2 unequal setae distally, and ornamented with 3 rows of spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** *Doropygus tenuicaudatus* sp. nov. has thick exoskeleton and the surface of the brood pouch is reticulated, as found in *D. reticulatus* sp. nov. and *D. caribbensis* sp. nov. It cannot be confused with either of these two species or with any other congeneric species, because of the extreme elongation of the caudal rami, which are about 12 times longer than wide. In comparison, the largest recorded length:width ratio of the caudal ramus in other species of *Doropygus* is 8:1 in *D. platythorax* (see Jones, 1974). Other significant differences between *D. tenuicaudatus* sp. nov., *D. reticulatus* sp. nov., and *D. caribbensis* sp. nov. are summarised in Table 7.

***Doropygus gracilis* sp. nov.**

(Figs. 222, 223)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21313) from *Molguloides vitrea* (Sluiter, 1904) (MNHN-IT-2008-5883 = MNHN S3/MOL.B/36), KARUBAR Expedition, between Kai Island and Tanimbar, Indonesia, depth 350 m, 21 October - 05 November 1991.

**Etymology.** The specific name is from the Latin *gracil* (=slender) and alludes to the slender body form of the new species.

**Description of female.** Body (Fig. 222A) slender, 3.60 mm long. Prosome 2.60 mm long, slightly depressed. Dorsal cephalic shield relatively small, well-defined. Metasome with 4 pedigerous somites delimited only by weak dorsal wrinkles. Fourth pedigerous somite forming brood pouch, much longer than wide. Free urosome 5-segmented. Caudal ramus (Fig. 222B) elongate, about 9.1 times longer than wide (444×49 µm) and about 1.7 times longer than anal somite; armed with 6 setae (outer proximal, dorsal, and 4 distal); setae small, all shorter than maximum width of ramus; outer proximal and dorsal setae positioned at 28 and 67% of ramus length, respectively.

Rostrum (Fig. 222C) 125×167 µm, triangular, with blunt apex. Antennule (Fig. 222D) 300 µm long, 9-segmented, tapering distally from broader proximal segments, curved; armature formula 3, 16+aesthetasc, 5?, 3?, 3? 2, 2, 2, and 7+aesthetasc; setae crowded, generally long, many pinnate. Antenna (Fig. 222E) slender, 4-segmented; short coxa unarmed; basis 120×50 µm, bearing 1 small seta distally and 1 small papilliform knob (exopod) tipped with 1 large seta (137 µm long) and 1 minute seta; first endopodal segment 89×50 µm, with 1 small seta subdistally on inner margin; compound distal endopodal segment about 4.2 times longer than wide (131×31 µm); armed with 9 setae arranged as 1, 3, 2, and 3 (3 distal setae bluntly tipped), plus elongate terminal claw, 100 µm long and 0.76 times as long as segment.

Labrum (Fig. 222F) with hemispherical posteromedian lobe and ornamented with scattered setules on posterior margin. Mandible (Fig. 222G) with 5 pointed teeth and

2 small setae on coxal gnathobase: basis with 1 seta mediodistally; exopod 3-segmented, with 1, 1, and 3 setae on first to third segments, respectively; distalmost seta rudimentary, naked; other 4 setae large, subequal in length; endopod with 4 and 9 setae on first and second segments, respectively. Paragnath (Fig. 223A) setulose on medial surface; apex angular. Maxillule (Fig. 222H) armed with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 4 on exopod, and 3 on endopod. Maxilla (Fig. 223B) 5-segmented; syncoxa with 9 setae arranged as 3, 1, 2, and 3; basis with 3 setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 222I) incompletely segmented; first segment armed with 9 setae (4 proximal and 5 distal) and ornamented with tuft of setules proximally; small second segment tipped with 2 setae and ornamented with setules on medial margin.

Leg 1 (Fig. 223C) with 3-segmented rami. Inner distal spine on basis 61 µm long, extending beyond distal border of first endopodal segment; outer spines on exopod slender, that of first exopodal segment large, extending to base of second spine on third exopodal segment. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 223D, E). Inner seta on coxa well-developed, but outer seta on basis very small; outer setae on exopods and distal setae on endopods naked. Leg 4 lacking inner seta on first exopodal segment. Armature formula for legs 1–4 as follows:

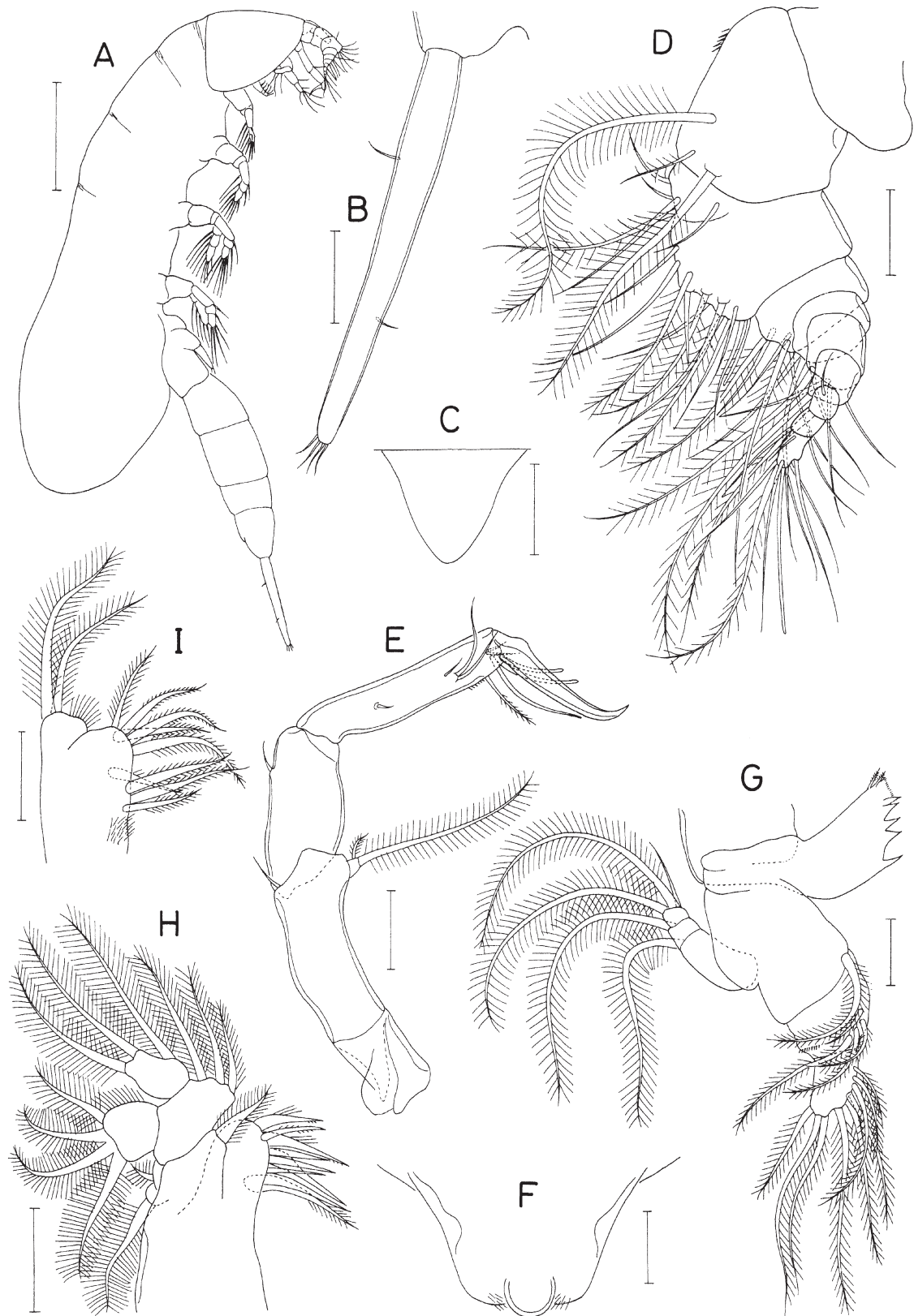
	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-0; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 223F) 2-segmented: protopod wider than long, not articulated at base, with 1 thin seta on outer margin and spinules on distal border; free exopodal segment about 3.3 times longer than wide (140×43 µm), tapering in distal third, with 2 unequal setae distally (100 and 50 µm long, respectively) and 4 rows of minute spinules on dorsomedial surface.

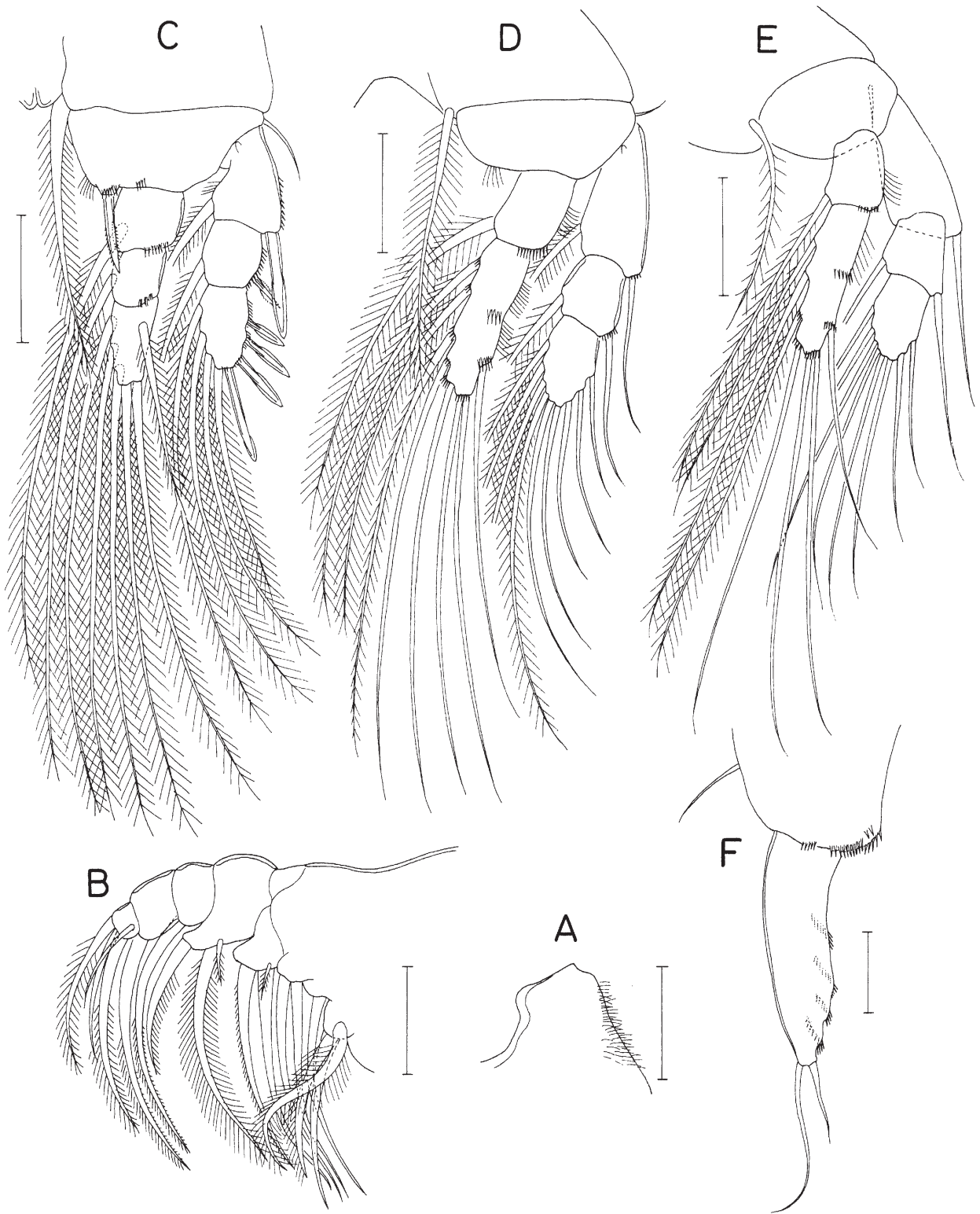
**Male.** Unknown.

**Remarks.** As a striking feature of *Doropygus gracilis* sp. nov., the antenna bears a large seta on a small knob (representing the exopod) located at the outer distal angle of the basis. In the Notodelphyidae this feature is an attribute of some relatively primitive genera, such as the members of the *Botachus*-group (e.g. *Goniodelphys* and *Periproctia*), and some species of *Doropygopsis*. In other respects, the new species conforms to the generic diagnosis of *Doropygus*. Thus, for example, the form and armature of the caudal ramus, maxilliped and leg 5, and the segmentation and armature of the swimming legs are all typical for *Doropygus*. In addition to the large seta on the basis of the antenna, the slender body, the elongate caudal ramus, and the small size of the distalmost seta





**FIGURE 222.** *Doropygus gracilis* sp. nov., female. A, habitus, right; B, right caudal ramus, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilliped. Scale bars: A, 0.5 mm; B, C, 0.1 mm; D–I, 0.05 mm.



**FIGURE 223.** *Doropygus gracilis* sp. nov., female. A, paragnath; B, maxilla; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, F, 0.05 mm; C–E, 0.1 mm.

on the mandibular exopod are features that serve to distinguish the new species from its congeners.

***Doropygus adenensis* sp. nov.**

(Fig. 224, 225)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21314) from *Molguloides monocarpa* (Millar, 1959) (MNHN-IT-2008-5866 = MNHN S3/MOL.B/28), METEOR CRUISE 5, Gulf of Aden, “Meteor”, Stn 271 (12°56.7' N.- 12°55.9' N, 47°47.0' E - 47°47.4' E), depth 2276-2282 m, 14 March 1987.

**Etymology.** The name of the type locality, Gulf of Aden, provides the name of the new species.

**Description of female.** Body (Fig. 224A) relatively small, 2.45 mm long; prosome length 2.18 mm. Dorsal cephalic shield with indistinctly defined posterior border. First to fourth pedigerous somites separated from each other only by weak dorsal constrictions. Fourth pedigerous somite forming spherical brood pouch, not longer than wide. Free urosome (Fig. 224B) small, 5-segmented. Caudal ramus (Fig. 224C) slender, about 6.0 times longer than wide (191×32 µm) and about 1.7 times longer than anal somite; armed with 6 small setae; proximal and subdistal setae positioned at 33 and 93% of ramus length, respectively.

Rostrum (Fig. 224D) triangular, 93×103 µm, with bluntly rounded angles. Antennule (Fig. 224E) 220 µm long, 9-segmented; first and second segments expanded; armature formula 3, 13, 3, 5, 3, 2, 2, 2, and 7+aesthetasc; all setae naked and thin. Antenna (Fig. 224F) 4-segmented; coxa short and unarmed; basis 86×38 µm, with 1 small seta distally and 1 large seta (59 µm long) plus 1 minute seta at outer distal corner (representing exopod); first endopodal segment 55×36 µm, with 1 seta subdistally on inner margin; compound distal endopodal segment about 4.1 times longer than wide (85×21 µm); armed with 10 setae arranged as 1, 3, 1, 2 and 3 (with 3 distal setae bluntly tipped) plus slender terminal claw 46 µm long.

Labrum (Fig. 224G) as in preceding species. Mandible (Fig. 224H) with coxa bearing 5 acute teeth on medial margin of gnathobase and 2 small setae and 1 dentiform process at proximal corner: basis with 1 seta subdistally on medial margin; exopod armed with 5 large setae, proximal seta slightly shorter; endopod armed with 4 and 10 setae on first and second segments, respectively. Paragnath (Fig. 225A) truncated apically, with setules on medial surface. Maxillule (Fig. 224I) armed as in *D. gracilis* sp. nov., with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 4 on exopod, and 3 on endopod. Maxilla (Fig. 224J) 5-segmented; syncoxa with 8 setae arranged as 3, 1, 2, and 2; basis with 3 setae, distal seta slightly less than half length of long middle seta; endopod with 1, 1, and 4 setae on first to

third segments, respectively. Maxilliped (Fig. 225B) 2-segmented; first segment with 9 setae (4 proximal and 5 distal) and tuft of setules proximally; second segment narrow, tipped with 2 unequal setae.

Leg 1 (Fig. 225C) with 3-segmented rami; inner seta on coxa and outer seta on basis distinct, both pinnate; inner distal spine on basis 61 µm long; spines on exopod slender, that of first exopodal segment 68 µm long. Legs 2–4 each with 3-segmented exopod and 2-segmented endopod; inner seta on coxa pinnate and as long as that of leg 1; outer seta on basis rudimentary. Armature formula for legs 1–4 as in *D. gracilis* sp. nov.

Leg 5 (Fig. 225F) 2-segmented: protopod wider than long, not articulated at base, with thin seta on outer margin and spinules on distal border; free exopodal segment, narrowing distally, about 2.8 times longer than wide (88×32 µm), with 2 unequal setae distally, longer medial seta 33 µm, and 4 rows of minute spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** *Doropygus adenensis* sp. nov. resembles *D. gracilis* sp. nov. in having a large exopodal seta located at the outer distal corner of the basis of the antenna. It can be distinguished from the latter species by its smaller body with a spherical brood pouch, its shorter caudal rami, the smaller, naked setae on the antennule, the possession of 5 large setae on the mandibular exopod (in contrast to 4 large setae and 1 vestigial seta in *D. gracilis* sp. nov.), and the possession of only 2 setae (without a small proximal seta) on the fourth endite of the syncoxa of the maxilla. These differences justify the establishment of the new species.

**Group B (maxillule with 3 setae on exopod and endopod)**

***Doropygus antarcticus* sp. nov.**

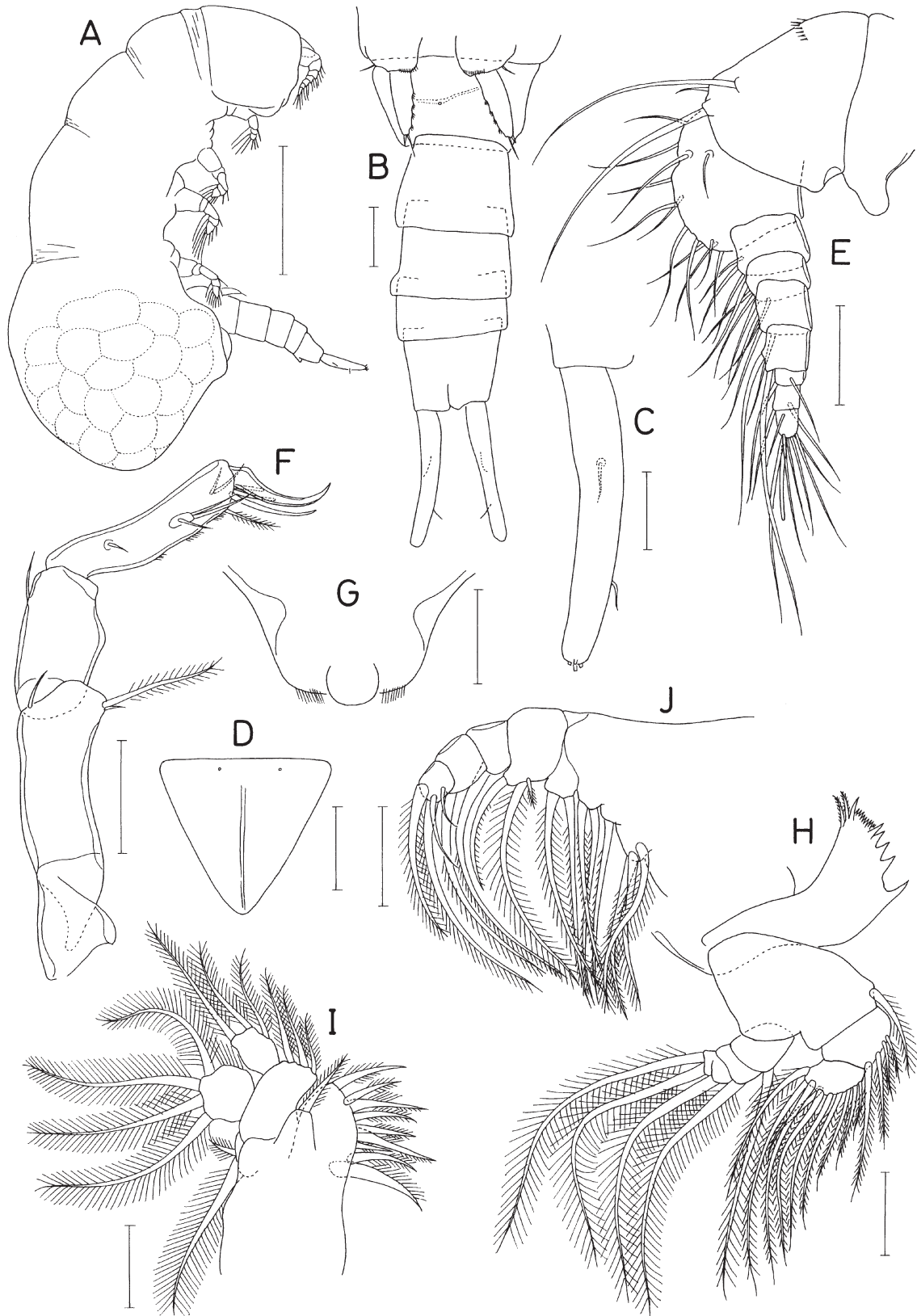
(Figs. 226, 227)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21315) from *Cnemidocarpa pfefferi* Michaelsen, 1898, Antarctic (66°11'S, 143°21'E), CEAMARC 62EV303 (Beam Trawl AAD), Terre Adélie, “Aurora Australis” (66°11'S, 143°21'E), depth 532-550 m, IPEV-AAD-MNHN coll., 04 January 2008.

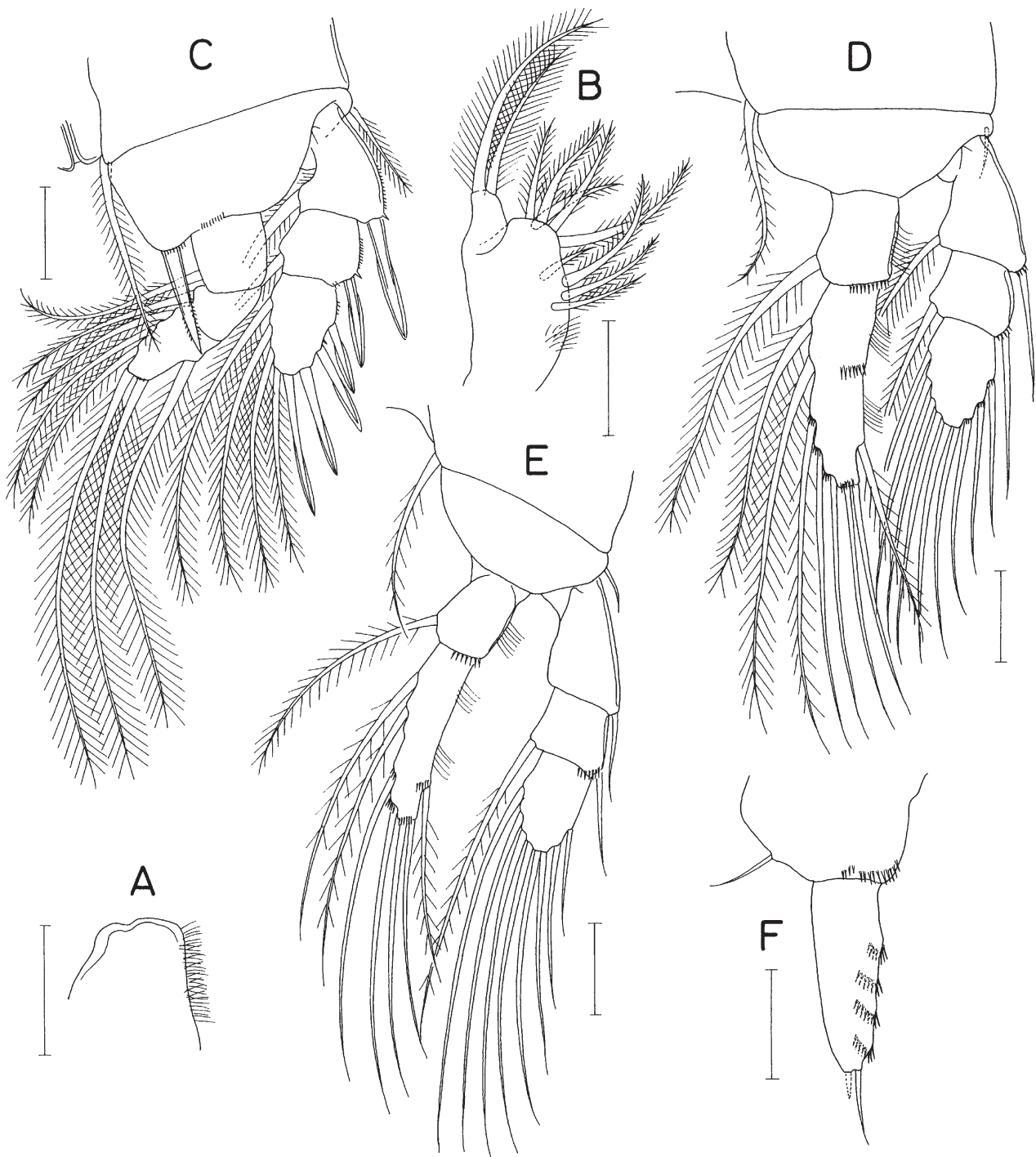
**Additional material.** 1 copepodid V ♀ (dissected) from *Cnemidocarpa drygalskii* (Hartmeyer, 1911), Antarctic Stn 65EV322 (65°48'S, 143°04'E), depth 750-788 m, 05 January 2008.

**Etymology.** This species is named after the geographic region where the type locality is located.

**Description of female.** Body (Fig. 226A) narrow, 4.85 mm long; prosome 3.92 mm long, indistinctly segmented. Dorsal cephalic shield distinct; second and third pedigerous somites each with weakly developed



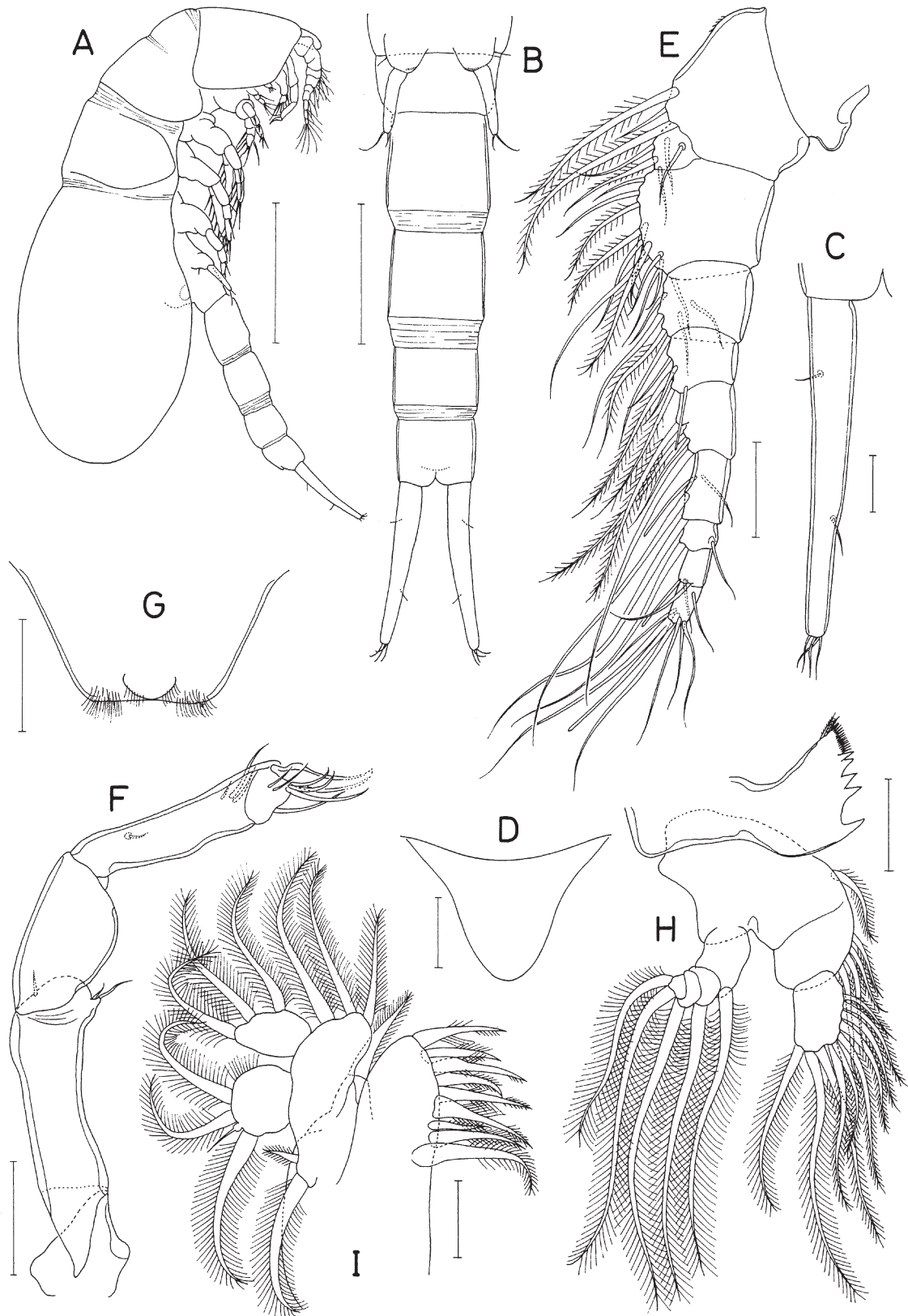
**FIGURE 224.** *Doropygus adenensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C–J, 0.05 mm.



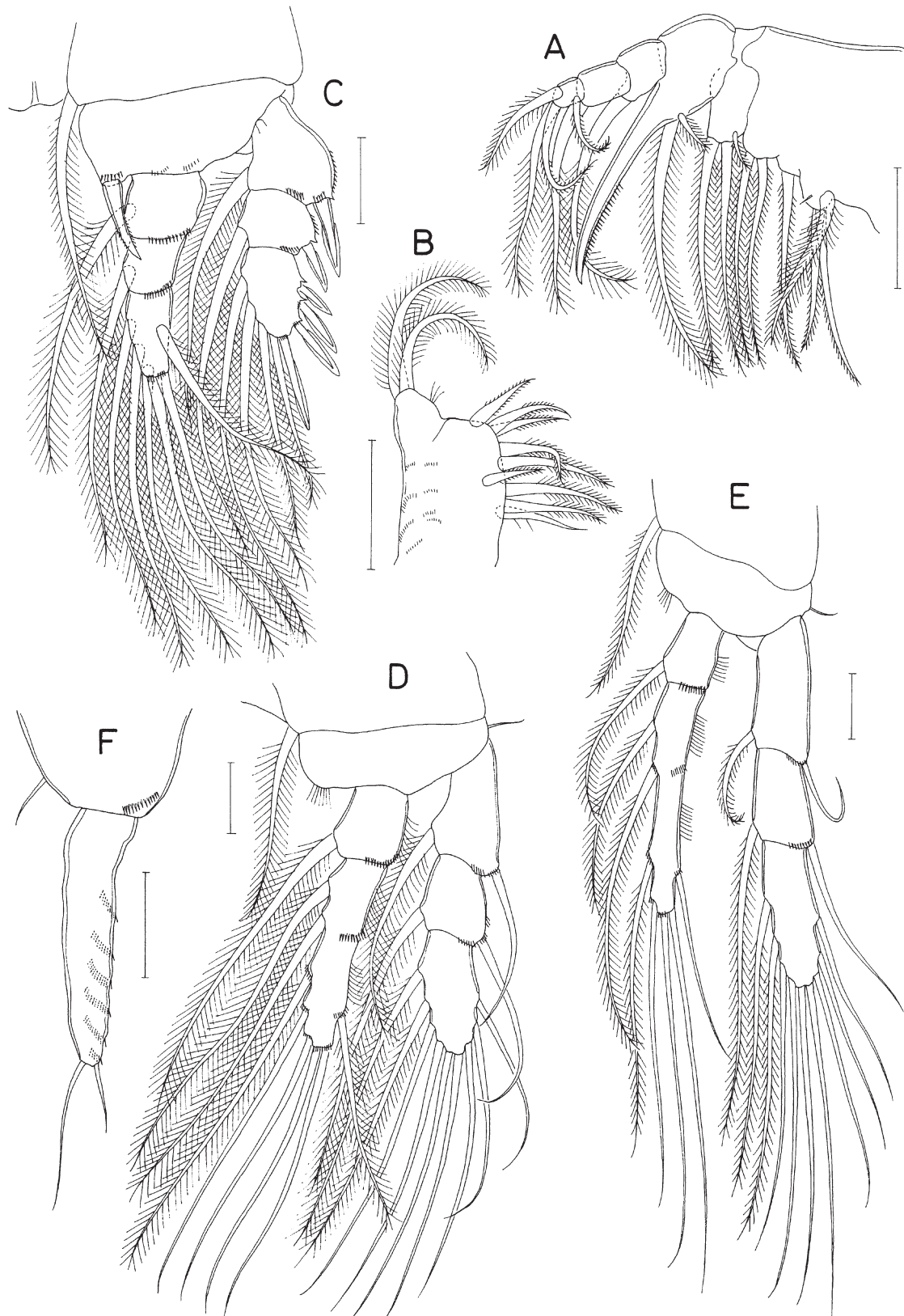
**FIGURE 225.** *Doropygus adenensis* sp. nov., female. A, paragnath; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

epimera. Fourth pedigerous somite forming elongated, oval brood pouch (about 1.5 times longer than wide in lateral view). Free urosome (Fig. 226B) slender, inserted anteriorly on brood pouch. Genital somite  $215 \times 449 \mu\text{m}$ , twice as wide as long; 4 free abdominal somites  $431 \times 369$ ,  $412 \times 345$ ,  $252 \times 308$ , and  $234 \times 283 \mu\text{m}$ , respectively.

Caudal ramus (Fig. 226C) slender, gradually narrowing distally, about 7.0 times longer than wide ( $596 \times 85 \mu\text{m}$ ) and about 2.5 times longer than anal somite: armed with 6 small setae; outer proximal and dorsal setae positioned at 23% and 66% of ramus length, respectively; setae at most as long as width of ramus at base.



**FIGURE 226.** *Doropygus antarcticus* sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum, antennule; E, antenna; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 1 mm; B, 0.5 mm; C–H, 0.1 mm; I, 0.05 mm.



**FIGURE 227.** *Doropygus antarcticus* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.1 mm.

Rostrum (Fig. 226D) tapering towards rounded apex. Antennule (Fig. 226E) narrow, 660 µm long, and 9-segmented; proximal 2 segments only slightly wider than third segment; armature formula 3, 17, 6, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; larger setae on first to fifth segments typically pinnate. Antenna (Fig. 226F) consisting of coxa, basis, and 2-segmented endopod; coxa short and unarmed; basis 192×67 µm with 2 small (exopodal) setae at outer distal corner and 1 small inner seta distally; first endopodal segment 121×79 µm, unarmed, with convex outer margin; compound distal endopodal segment 4.1 times longer than wide (196×48 µm), armed with 10 small setae plus slender terminal claw.

Labrum (Fig. 226G) with slightly concave posterior margin bearing tufts of setules on either side of small setulose posteromedian lobe. Mandible (Fig. 226H) comprising coxa and palp; coxa with 5 teeth on cutting margin of gnathobase: basis with 1 seta on medial margin; exopod 4-segmented, with 1, 1, 1, and 2 setae on first to fourth segments, respectively, outer seta on distal segment shorter (about 0.6 times as long as other 4 setae): endopod 2-segmented and incompletely articulated from basis, armed with 4 setae on first segment and 10 setae on second: all setae on mandible pinnate. Maxillule (Fig. 226I) with 9 setae on arthrite; coxal endite with 1 seta, epipodite with 1 small and 1 long seta: basis with 3 setae on medial margin, proximal seta shorter than distal 2; exopod with 3 setae and 1 small papilliform knob tipped with 1 thin setule between bases of first and second outer setae; endopod narrower than exopod, armed with 3 setae. Maxilla (Fig. 227A) 5-segmented: syncoxa with 3 (plus 1 minute vestigial seta), 1, 2, and 3 setae on first to fourth endites, respectively: basis with strong claw bearing spinules distally on concave margin plus 2 unequal setae; endopod with 1, 1, and 4 setae on first to third segments, respectively. Maxilliped (Fig. 227B) incompletely 2-segmented: first segment armed with 9 setae on medial margin and ornamented with several rows on minute spinules on outer surface; second segment small, narrow, armed with 2 equal apical setae.

Leg 1 with both rami 3-segmented (Fig. 227C): lacking outer seta on basis; inner distal spine on basis 98 µm long, extending beyond distal border of first endopodal segment.

Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 227D, E); exopods slightly longer than endopods; outer seta on basis rudimentary; outer setae on exopods long and naked; distal setae of exopods and endopods naked. First exopodal segment about twice as long as wide in legs 2 and 3, and 2.4 times longer than wide in leg 4. Third exopodal segment about twice as long as wide in legs 2 and 3, and 2.9 times longer than wide in leg 4. Second endopodal segment of legs 2–4 slender, 4 times longer than wide and 2.6 times longer than first endopodal segment in legs 2 and 3, and 5.4 times longer than wide

and 3.2 times longer than first endopodal segment in leg 4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	0-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 2, 4	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 3, 2, 4	0-1; 1, 2, 4

Leg 5 (Fig. 227F) consisting of protopod fused with somite, with small, naked seta on outer margin and row of fine spinules at inner distal corner, and slender free exopodal segment, 4.3 times longer than wide (239×56 µm), armed with 2 naked setae distally, inner less than half as long as outer; segment ornamented with 6 oblique rows of spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** The exopod of the maxillule of *D. antarcticus* **sp. nov.** is characterised by having 3 setae plus a setule-tipped knob, which is probably the vestige of a seta. A similar exopodal armature has been recorded for two other species, *D. demissus* Aurivillius, 1885 and *D. profundus* Illg, 1958. According to Illg (1958), the setation of the maxillary exopod of *D. demissus* can vary between three states: 3 setae, 3 setae plus a vestigial seta, or 4 well-developed setae. Unlike *D. demissus*, both *D. antarcticus* **sp. nov.** and *D. profundus* seem to consistently exhibit the characteristic armature of the maxillary exopod, as did the copepodid V juvenile of *D. antarcticus* **sp. nov.**

*Doropygus antarcticus* **sp. nov.** is easily distinguishable from these two congeners by the proportional length of the caudal ramus. In *D. antarcticus* **sp. nov.** the caudal ramus is about 7.0 times longer than wide and about 2.5 times longer than the anal somite, compared to 5 and 4.5 times longer than wide in *D. demissus* and *D. profundus*, respectively, as described by Illg (1958) and less than twice as long as the anal somite, as figured by Illg (1958) for the latter two species.

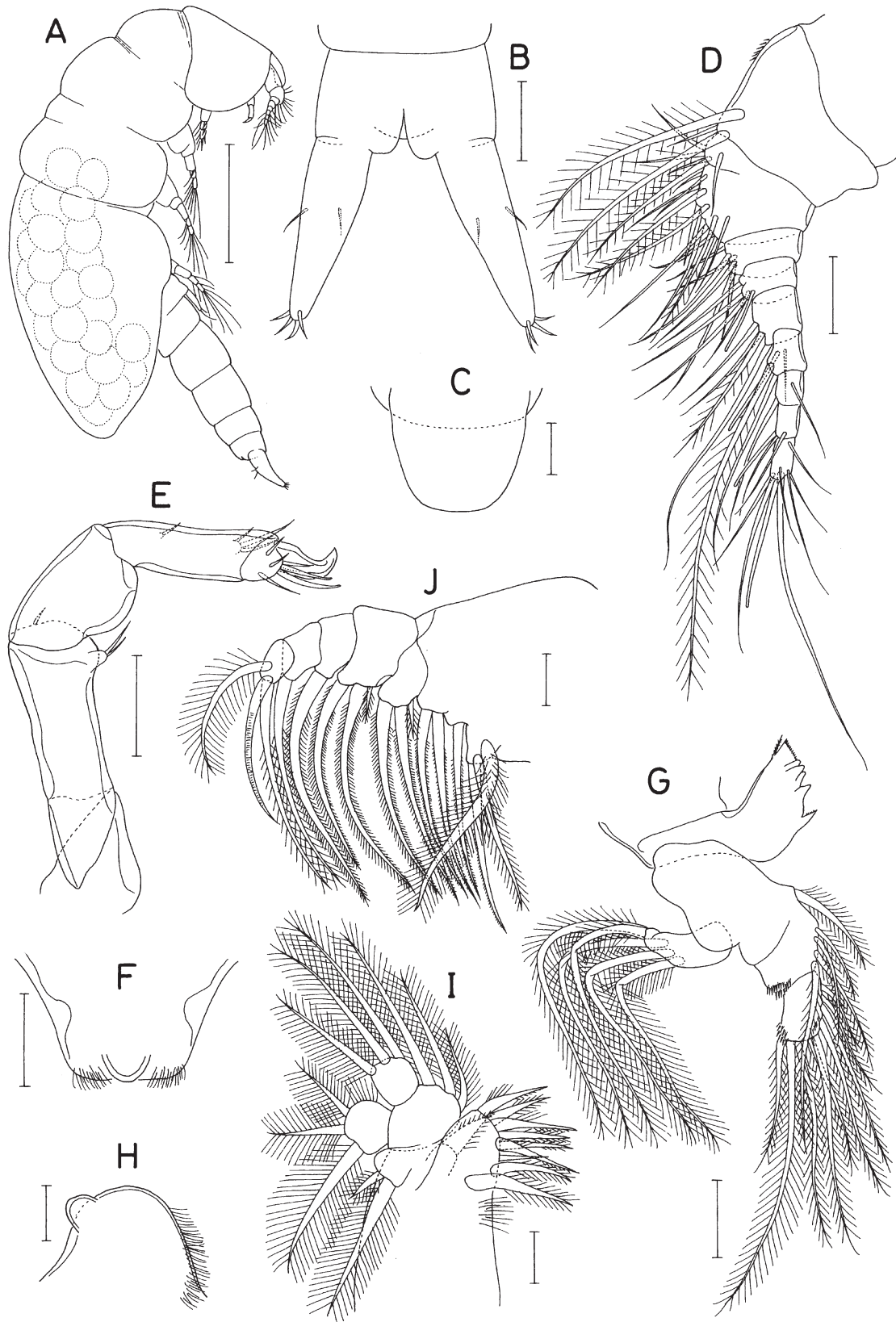
#### *Doropygus martiniquensis* **sp. nov.**

(Figs. 228, 229)

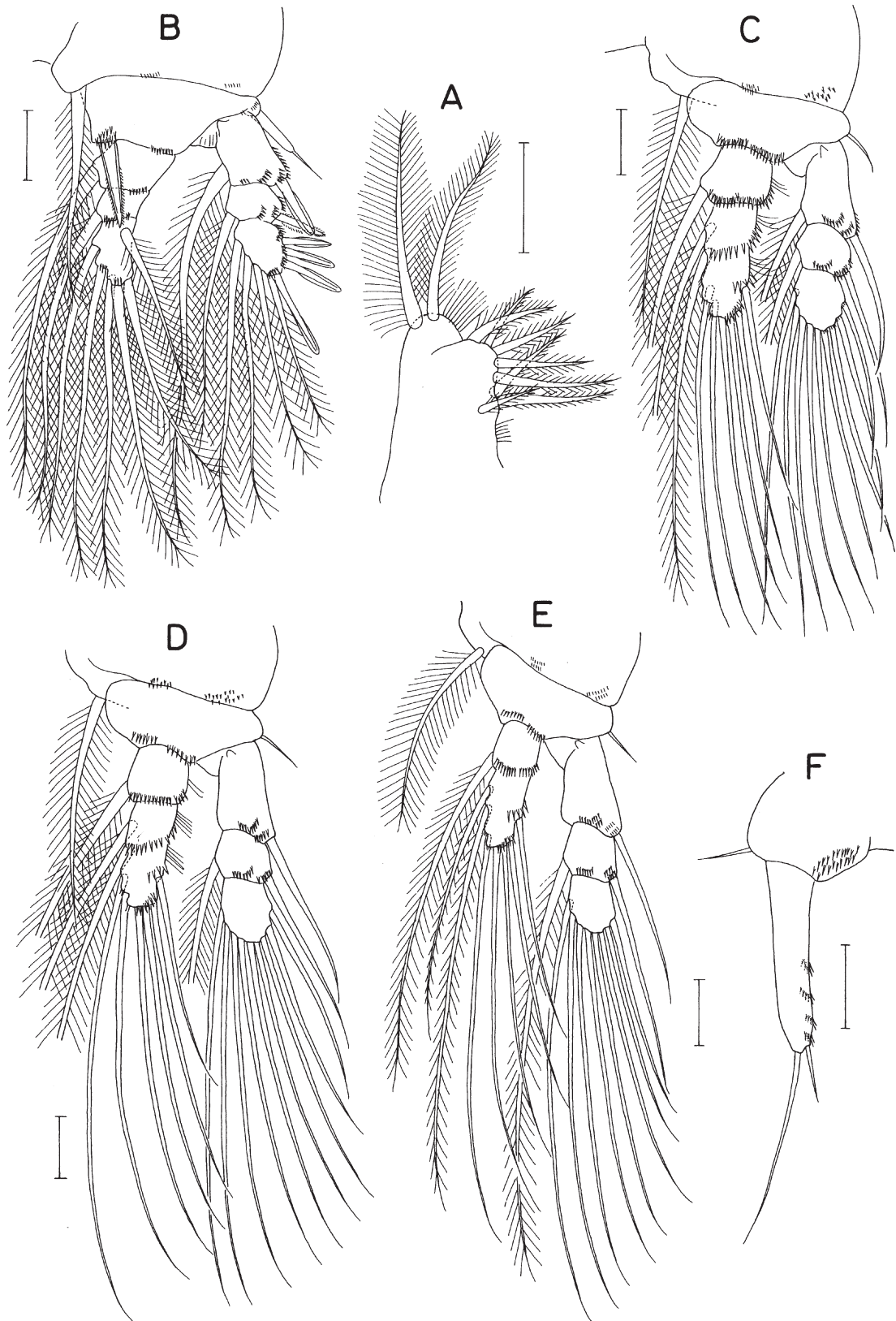
**Type material.** Holotype (intact ♀, MNHN-IU-2017-2080), paratypes (7 intact ♀♀, MNHN-IU-2014-21316), and dissected paratype (♀, figured) from *Pyura vannamei* Monniot C., 1994, MADIBENTHOS Stn. AB 189, SE Pointe Caracoli, Martinique (14°44.1'N, 60°50.8'W), depth 16 m, MNHN coll., 18 September 2016.

**Additional material.** 6 ♀♀ (MNHN-IU-2017-2078) from *P. vannamei*, Martinique (14°38'N, 60°51.2'W), MADIBENTHOS Stn AR 188, depth 5–14 m, 17 September 2016; 2 ♀♀ (MNHN-IU-2017-2081) from *P. vannamei*, Martinique (14°38'N, 60°51.2'W), MADIBENTHOS Stn AR 188, depth 5–14 m, 17 September 2016.





**FIGURE 228.** *Doropygus martiniquensis* sp. nov., female. A, habitus, right; B, anal somite and caudal rami, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C–G, 0.05 mm; H–J, 0.02 mm.



**FIGURE 229.** *Doropygus martiniquensis* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

**Etymology.** The specific name is derived from the name of the type locality, Martinique.

**Description of female.** Body (Fig. 228A) narrow, laterally compressed, 2.73 mm long; prosome 2.25 mm long. Dorsal cephalic shield clearly defined. Pedigerous somites not articulated but delimited by constrictions. Fourth pedigerous somite forming conical brood pouch with blunt posterior margin, 1.03×0.69 mm in lateral view, occupying about 46% of prosomal length. Fifth pedigerous somite fused with brood pouch. Free urosome 5-segmented: abdominal somites becoming shorter posteriorly. Caudal rami (Fig. 228B) divergent, widely separated from each other; each ramus tapering and only partially articulated from anal somite (on outer side), about 3.2 times longer than wide (205×64 µm) and twice as long as anal somite: armed with 6 small setae; all setae shorter than width of ramus at base; outer proximal and dorsal setae characteristically positioned together at same level (40% length of ramus).

Rostrum (Fig. 228C) weak, spatulate, nearly as long as wide. Antennule (Fig. 228D) 300 µm long, 9-segmented, gradually narrowing distally; armature formula 3, 17, 6, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 2 pinnate setae on first segment, 3 on second, and 1 each on fifth and sixth; first segment ornamented with minute spinules on anterior margin. Antenna (Fig. 228E) with unarmed coxa; basis with small knob at outer distal corner (representing exopod), tipped with 2 small setae, plus 1 small seta on distal margin; first endopodal segment inflated outwards, unarmed; compound distal endopodal segment about 3.3 times longer than wide (82×25 µm); armed with 10 small setae plus small terminal claw, less than half as long as segment.

Labrum (Fig. 228F) with linear, setulose posterior margin and smooth posteromedian lobe. Mandible (Fig. 228G) with 5 teeth and 1 small seta on coxal gnathobase; basis with 1 seta distally on medial margin; exopod unsegmented with 5 equally long setae; endopod incompletely articulated from basis, armed with 4 and 9 setae on first and second segments, respectively, and ornamented with patch of fine spinules at outer distal corner of each segment; second distal outer seta on second endopodal segment markedly larger than other setae on endopod. Paragnath (Fig. 228H) as small lobe bearing semicircular lobule outer distally; densely setulose on medial margin. Maxillule (Fig. 228I) with 9 setae and proximal tuft of setules on arthrite, 1 moderately broad seta on coxal endite, 2 unequal setae on epipodite, 3 setae (increasingly in length from proximal to distal) on medial margin of basis; exopod with 3 setae, outermost seta about twice as long as inner 2; endopod also with 3 setae distally, outermost seta slightly shorter than inner 2. Maxilla (Fig. 228J) 5-segmented; syncoxa with 9 setae arranged as 3, 1, 2, and 3; basis with 3 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively; one of setae on

third endopodal segment naked and wrinkled. Maxilliped (Fig. 229A) incompletely 2-segmented; articulation confined to medial half of limb; first segment with 8 setae; second segment with 2 equal, large setae distally.

Leg 1 (Fig. 229B) biramous with 3-segmented rami. Outer seta on basis broad proximally and flagellate distally. Inner distal spine on basis 53 µm long, extending slightly beyond distal border of second endopodal segment. Legs 2–4 (Fig. 229C–E) biramous, with 3-segmented exopods and 2-segmented endopods; exopod nearly equal in length to endopod in leg 2, slightly longer in leg 3, and distinctly longer in leg 4. Inner coxal seta well-developed, about 1.5 times longer than endopod and extending about to distal end of endopod. Outer seta on basis small. Legs 3 and 4 lacking inner seta on first exopodal segment. Outer setae on first and second exopodal segments and all setae on third exopodal segment of legs 2–4 naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	1-1; 1-1; 3, 2, 4	0-1; 1, 2, 5
Leg 3	0-1	1-0	1-0; 1-1; 3, 2, 4	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-0; 1-1; 2, 2, 4	0-1; 1, 2, 4

Leg 5 (Fig. 229F) 2-segmented: protopod wider than long, not defined from brood pouch, with small naked seta at outer distal corner and patch of spinules on inner side; free exopodal segment slender, about 4 times longer than wide (115×29 µm) with nearly parallel margins; ornamented with 4 rows of spinules on dorsomedial surface; armed with 2 unequal naked setae distally, outer seta more than 3 times longer than inner.

**Male.** Unknown.

**Remarks.** The morphology of the cephalic appendages and legs of this new species are very similar to those of the two new species described below. These three species are compared below, in the remarks section of *D. rotundus* **sp. nov.** and their distinguishing character states are summarised in Table 8.

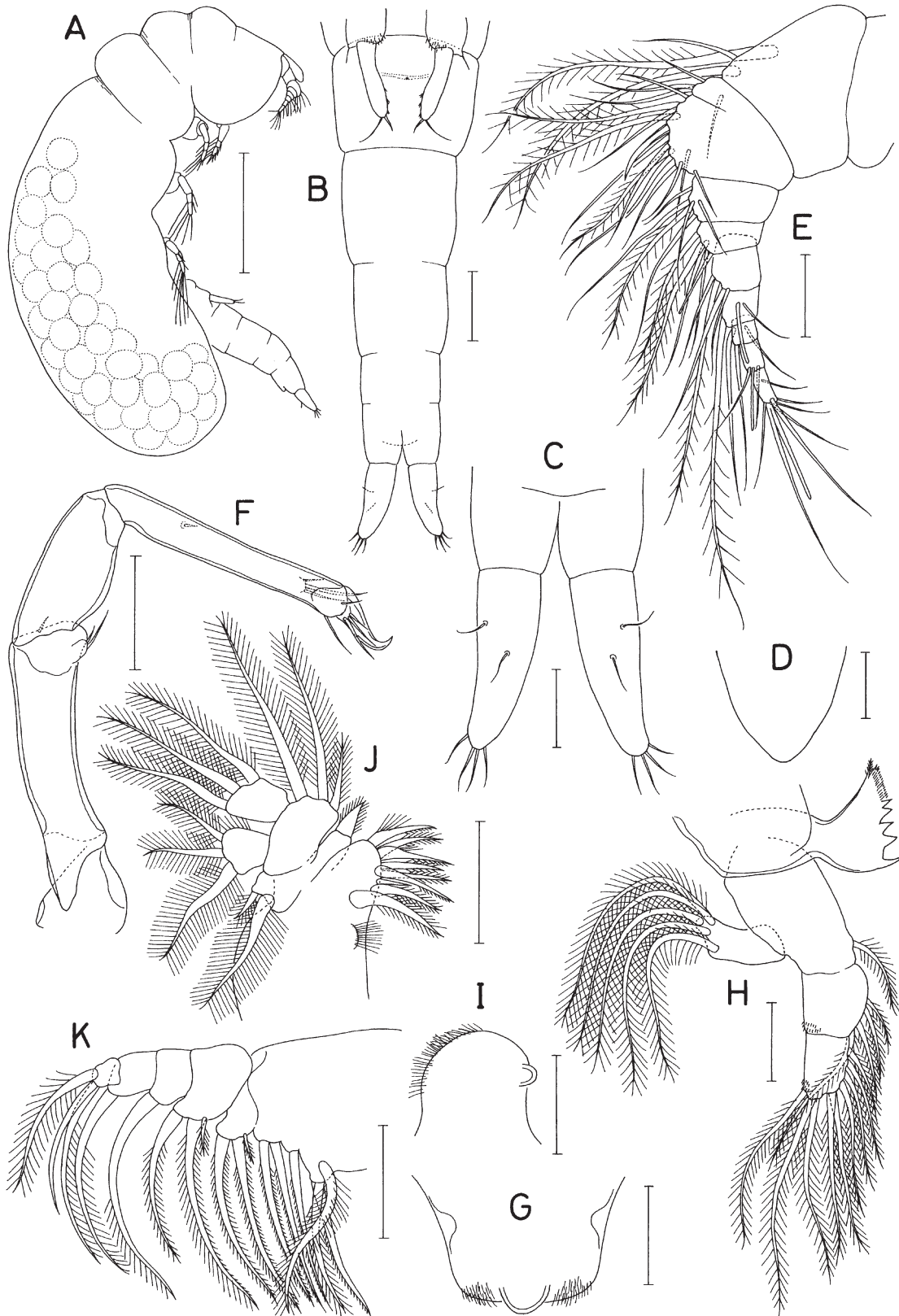
***Doropygus elongatus* sp. nov.**

(Figs. 230, 231)

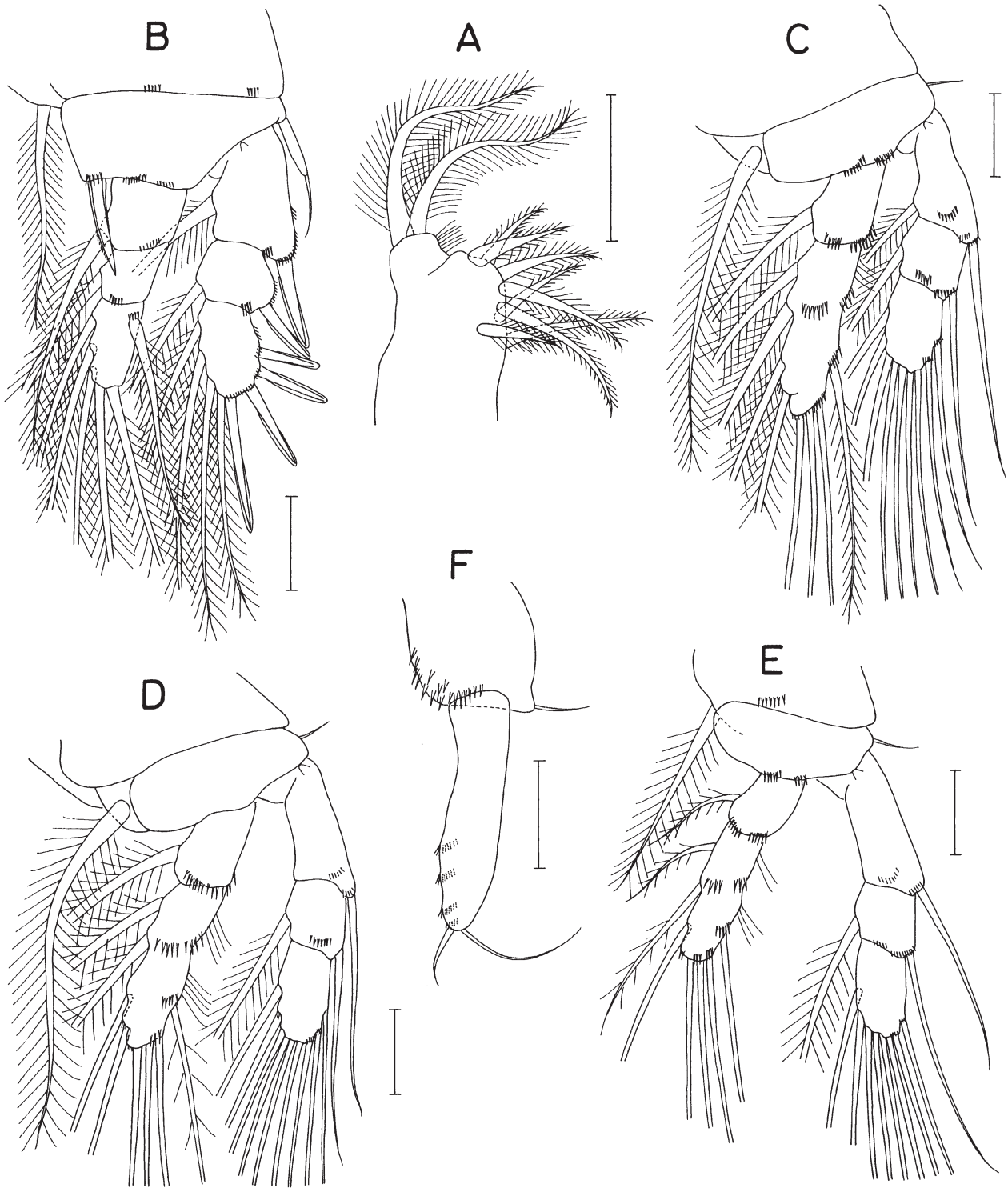
**Type material.** Holotype (intact ♀, MNHN-IU-2017-2171), paratypes (2 intact ♀♀, MNHN-IU-2014-21317), and dissected paratype (♀, figured) from *Pyura ocellata* Monniot F., 2016, N/O “Hermano Gines”, Stn CP 4386, French Guiana (05°38.4'N, 52°29.2'W), depth 46–47 m, MNHN - convention APA-973-1 coll., 05 August 2014.

**Etymology.** The specific name of the new species refers to the elongate prosome of the female.

**Description of female.** Body (Fig. 230A) slightly bilaterally compressed, 2.64 mm long. Prosome elongate, curved ventrally; somites defined only by weak surface



**FIGURE 230.** *Doropygus elongatus* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal rami, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule; K, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C–K, 0.05 mm.



**FIGURE 231.** *Doropygus elongatus* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

constrictions. Dorsal cephalic shield obscurely defined from first pedigerous somite. Brood pouch formed by fusion of third and fourth pedigerous somites, elongate, slightly curved ventrally and more than twice as long as wide in lateral view, with nearly parallel dorsal and ventral margins and almost truncate apex. Free urosome (Fig. 230B) slender, indistinctly 5-segmented, gradually narrowing posteriorly; genital and 4 weakly defined abdominal somites 140×215, 152×173, 133×140, 72×118, and 88×115 µm, respectively. Caudal ramus (Fig. 230C) about 2.9 times longer than wide (121×42 µm) and about 1.4 times longer than anal somite, narrowing distally: armed with 6 thin setae; 2 proximal setae positioned at 30 and 46% of ramus length; all setae naked and shorter than width of ramus at base.

Rostrum (Fig. 230D) weak, tapering, as long as wide. Antennule (Fig. 230E) 250 µm long, 9-segmented; first and second segments much broader than distal segments; armature formula 3, 16+spine, 6, 4+aesthetasc, 4, 2+aesthetasc, 3, 2+aesthetasc, and 7+aesthetasc; setae generally long; 2 pinnate setae on each of first, second and fourth segments, and 1 on each of third, fifth and sixth segments; all other setae naked. Antenna (Fig. 230F) slender, 4-segmented; coxa short and unarmed; basis with 3 small setae, 2 on tip of outer distal knob (representing exopod) and 1 on distal border; first endopodal segment unarmed; compound distal endopodal segment elongate, about 6.2 times longer than wide (130×21 µm); armed with 9 small setae plus small terminal claw, about one-third as long as segment.

Labrum (Fig. 230G) setulose on either side of smooth, semicircular posteromedian lobe. Mandible (Fig. 230H) with 5 sharp teeth on coxal gnathobase; basis with 1 seta on medial margin; exopod unsegmented with 5 equal setae; endopod 2-segmented, incompletely articulated from basis, with 4 and 9 setae on first and second segments, respectively; both endopodal segments ornamented with patch of minute spinules at outer distal corner. Paragnath (Fig. 230I) as small lobe with setulose medial surface and sclerotized semicircular lobule subdistally on outer margin. Maxillule (Fig. 230J), maxilla (Fig. 230K) and maxilliped (Fig. 231A) as in *D. martiniquensis* **sp. nov.**

Leg 1 (Fig. 231B) biramous, with 3-segmented rami. Outer seta on basis broad proximally and flagellate distally. Inner distal spine on basis 53 µm long, extending to middle of second endopodal segment. Legs 2–4 (Fig. 231C–E) with 3-segmented exopods and 2-segmented endopods: exopod as long as endopod in legs 2 and 3, but longer than endopod in leg 4. Inner coxal seta about 1.4 times as long as endopod, extending beyond distal tip of endopod in legs 2 and 3; as long as endopod, but not extending beyond tip of endopod in leg 4. Outer seta on basis small. Inner setae on endopod shorter than in *D. martiniquensis* **sp. nov.** Armature formula for legs 1–4 as in *D. martiniquensis* **sp. nov.**

Leg 5 (Fig. 231F) 2-segmented: protopod similar to

that of *D. martiniquensis* **sp. nov.**; free exopodal segment 4.2 times longer than wide (112×27 µm), armed and ornamented as in *D. martiniquensis* **sp. nov.**, but slightly constricted in proximal quarter.

**Male.** Unknown.

**Remarks.** See the remarks section for the following species summarised in Table 8.

### *Doropygus rotundus* **sp. nov.**

(Figs. 232, 233)

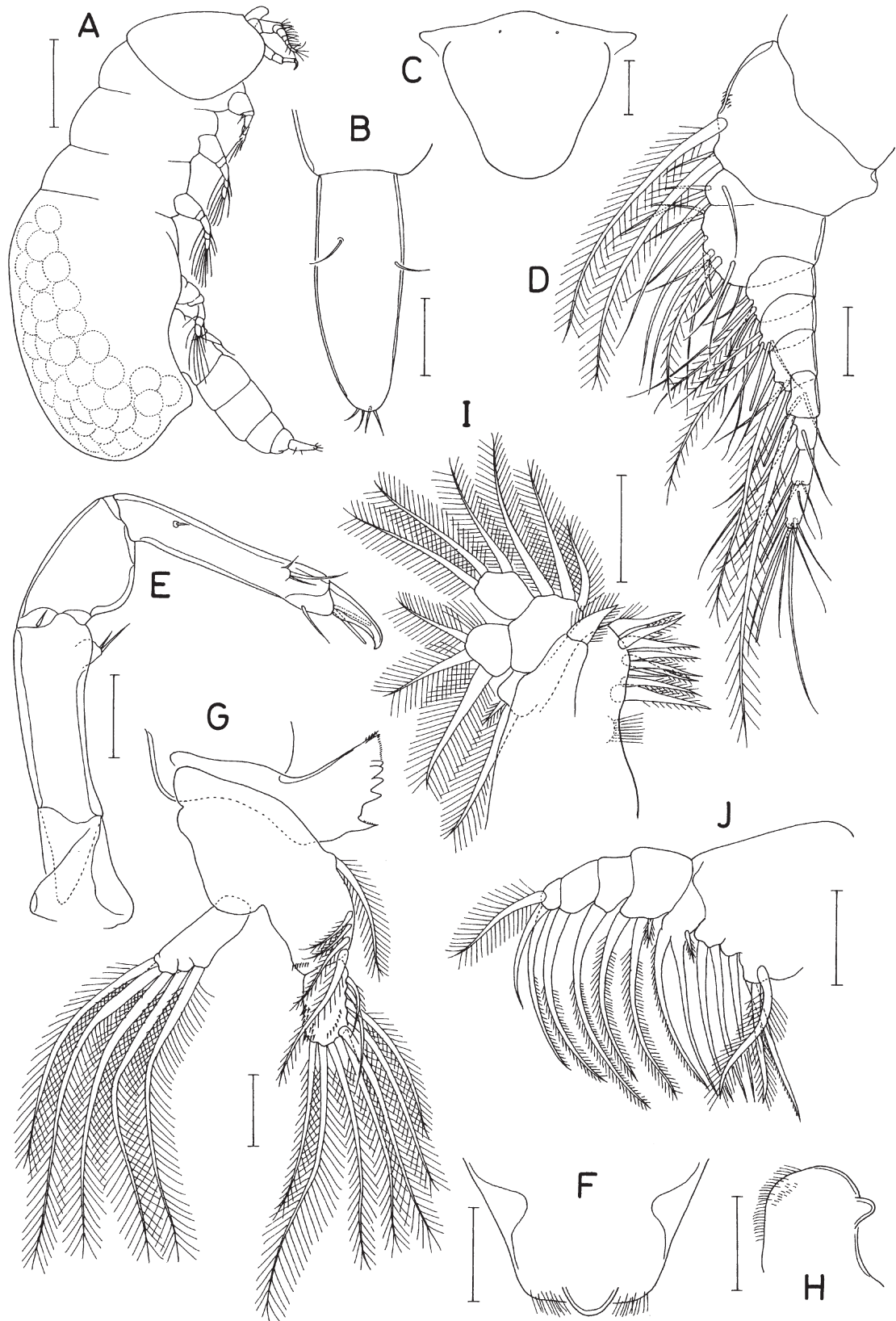
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2015-9) from *Pyura vittata* (Stimpson, 1852) (MNHN-IT-2008-XXXX = MNHN S2/PUY/495), GUYANE 2014 CP4348, French Guiana, N/O “Hermano Gines” (05°46’N, 51°23’W), depth 115 m, MNHN - convention APA-973-1 coll., 27 July 2014.

**Etymology.** The specific name is derived from the Latin *rotund* (=round) and refers to the rounded brood pouch.

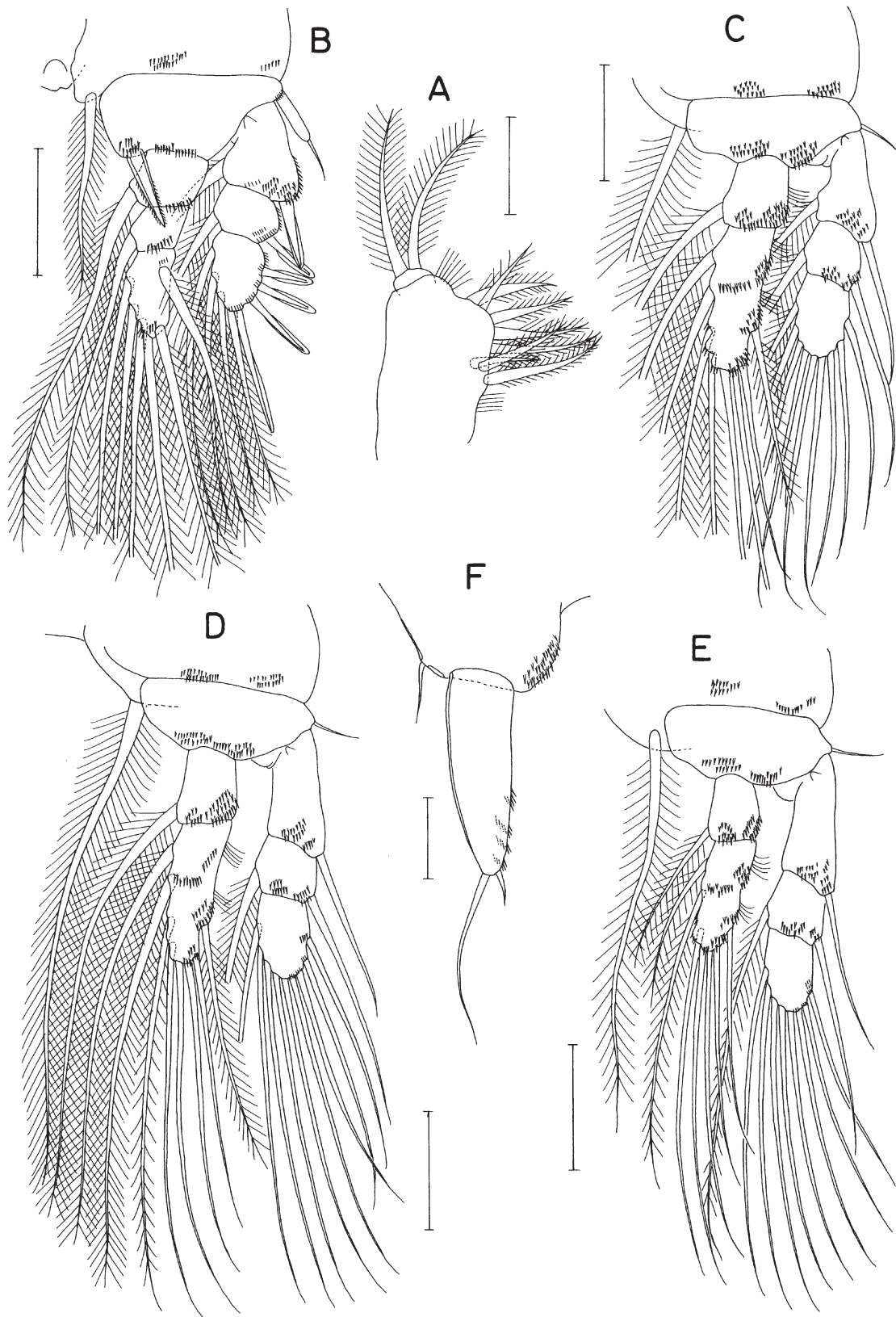
**Description of female.** Body (Fig. 232A) slightly compressed, 3.30 mm long. Dorsal cephalic shield well-defined posteriorly but pedigerous somites incompletely separated. Fourth pedigerous somite forming stout brood pouch with rounded posterior margin. Free urosome 5-segmented. Caudal ramus (Fig. 232B) stout, about 2.8 times longer than wide (156×56 µm); armed with 6 small, thin setae; 2 proximal setae positioned at 28 and 38% of ramus length, respectively; both inner and outer margins slightly convex; all setae shorter than maximum width of ramus.

Rostrum (Fig. 232C) wider than long, sub-spatulate, narrowing distally towards broadly rounded apex. Antennule (Fig. 232D) 9-segmented; first and second segments distinctly broader than distal segments; armature formula 3, 16+spine, 6, 4+aesthetasc, 4, 2+aesthetasc, 3, 2+aesthetasc, and 7+aesthetasc; 2 pinnate setae on each of first and fourth segments and 1 each on second, third, fifth and sixth segments; all other setae naked. Antenna (Fig. 232E) slender and 4-segmented; coxa unarmed; basis with 3 small setae, 2 on tip of small subdistal knob (representing exopod) plus seta on distal border; first endopodal segment unarmed with protuberant outer margin; compound distal endopodal segment elongate, about 5.2 times longer than wide (136×26 µm); armed with 7 small setae plus small terminal claw, less than half length of segment.

Labrum (Fig. 232F) and paragnath (Fig. 232H) as in *D. elongatus* **sp. nov.** Mandible (Fig. 232G) with 5 teeth on coxal gnathobase, distalmost tooth bearing minute spinules along proximal margin; basis with 1 seta on medial margin; exopod unsegmented with 5 setae (distalmost seta about 0.7 times as long as other 4 setae); first endopodal segment fused with basis, with 4 setae medially and row of minute spinules at outer distal corner; second endopodal



**FIGURE 232.** *Doropygus rotundus* sp. nov., female. A, habitus, right; B, left caudal ramus, dorsal; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scale bars: A, 0.5 mm; B–J, 0.05 mm.



**FIGURE 233.** *Doropygus rotundus* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: A, F, 0.05 mm; B–E, 0.1 mm.



**TABLE 8.** Morphological differences between the females of three new species of *Doropygus* described from the tropical West Atlantic.

Characters	<i>D. martiniquensis</i> sp. nov.	<i>D. elongatus</i> sp. nov.	<i>D. rotundus</i> sp. nov.
Body length	2.73 mm	2.64 mm	3.30 mm
Form of brood pouch	Conical	Elongate, truncate distally	Stout, rounded distally
L/W ratio of caudal ramus	3.20 (205×64 µm)	2.88 (121×42 µm)	2.79 (156×56 µm)
L/W ratio of enp2 segment of antenna	3.28 (82×25 µm)	6.19 (130×21 µm)	5.23 (136×26 µm)
Length of inner coxal seta of leg 4	About 1.5 times as long as endopod	As long as endopod	More than twice as long as endopod
L/W ratio and form of exopodal segment of leg 5	3.97 (115×29 µm), with parallel margins	4.15 (112×27 µm), constricted at proximal quarter	3.05 (124×41 µm), tapering
Host	<i>Pyura lignosa</i>	<i>Pyura ocellata</i>	<i>Pyura vittata</i>

segment armed with 9 setae (second outer distal seta longest), and ornamented with fine spinules at outer and inner distal corners. Maxillule (Fig. 232I) and maxilla (Fig. 232J) armed as in *D. elongatus* sp. nov. Maxilliped (Fig. 233A) 2-segmented; first segment with 8 setae on medial margin; second segment small, with 2 equal setae distally.

Leg 1 (Fig. 233B) biramous with 3-segmented rami. Outer seta on basis broad proximally and flagellate distally. Inner distal spine on basis 68 µm long, extending to middle of second endopodal segment. Legs 2–4 (Fig. 233C–E) with 3-segmented exopods and 2-segmented endopods. Inner coxal seta well-developed, more than twice as long as entire endopod. Outer seta on basis small and naked. Exopod as long as endopod in leg 2, slightly longer in leg 3, and 1.4 times longer in leg 4. Armature formula for legs 1–4 as in *D. martiniquensis* sp. nov.

Leg 5 (Fig. 233F) 2-segmented: protopod wider than long, not articulated at base, with small, naked seta at outer distal corner and patch of spinules on inner surface; free exopodal segment gradually narrowing distally, about 3.1 times longer than wide (125×41 µm), armed distally with inner and outer setae (longer outer seta about 5 times longer than inner seta), ornamented with 4 rows of fine spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** The three new species, *D. martiniquensis* sp. nov., *D. elongatus* sp. nov. and *D. rotundus* sp. nov. described above, are all associated with ascidians of the genus *Pyura* in the tropical West Atlantic. These three are very alike in terms of the morphology of their cephalic appendages and all three have the same armature formula for the legs. In addition, they also share two unusual features: firstly, the first segment of the maxilliped bears 8 setae (not 9 as usual), and secondly, the first exopodal segment lacks an inner seta in legs 3 and 4. Interestingly, these three species are easily distinguishable from one another without dissection by the characteristic form of the brood pouch, i.e., which is distally conical in *D. martiniquensis* sp. nov., elongate and posteriorly truncate in *D. elongatus* sp. nov., and stout and rounded posteriorly

in *D. rotundus* sp. nov. In addition, the length of the inner coxal seta on leg 1 is a reliable character to use to differentiate between them: it is about 1.5 times longer than the endopod in *D. martiniquensis* sp. nov., as long as the endopod in *D. elongatus* sp. nov., and more than twice as long as the endopod in *D. rotundus* sp. nov. The relative length and shape of the caudal ramus, the second endopodal segment of the antenna, and the exopod of leg 5 also exhibit differences (as summarised in Table 8).

### Group C (maxillule with 4 setae on exopod and 2 setae on endopod)

#### *Doropygus pulex* Thorell, 1859

(Figs. 234, 235)

**Material examined.** 4 ♀♀ (MNHN-IU-2018-1854) and 2 dissected ♀♀ from *Asciidiella aspersa* (Müller, 1776), Porto Vecchio, Corsica, 1987; 8 ♀♀ (MNHN-IU-2018-1855) and 3 dissected ♀♀ from *A. aspersa*, Etang de Leucate, Mediterranean coast of France, collected by Clanzig, 1985.

5 ♀♀ (MNHN-IU-2018-1856) and 1 dissected ♀ from *Polycarpa pomaria* (Savigny, 1816) off Banyuls, Mediterranean coast of France, depth 300 m; 15 ♀♀ (MNHN-II-2018-1857) from *P. pomaria* off Banyuls; 58 ♀♀, 8 ♂♂ (MNHN-IU-1858) from *P. pomaria*, Kristineberg, Sweden, 1962.

1 ♀ (MNHN-IU-2018-1859) and 1 dissected ♀ from *Ascidia mentula* Müller, 1776, Bergen, Norway; 2 ♀♀ (MNHN-IU-2018-1860) from *A. mentula* Kristineberg, Sweden.

54 ♀♀ (MNHN-IU-2018-1861) and 2 dissected ♀♀ from *Microcosmus sabatieri* Roule, 1885, Bonifacio, Corsica.

26 ♀♀, 12 ♂♂ (MNHN-IU-2009-5194) and 1 dissected ♀ from *Pyura dura* (Heller, 1877) Marina de Fiori, Porto Vecchio, Corsica, 1992

2 ♀♀ (MNHN-IU-2018-1862) and 1 dissected ♀ from *Pyura squamulosa* (Alder, 1863), trawl, Banyuls.

49 ♀♀, 6 ♂♂ ((MNHN-IU-2009-5192) and 1 dissected ♀ from *Pyura tessellata* (Forbes, 1848) Marina di Fiori Creek, Porto Vecchio, Corsica

**Supplementary description of female** (from *Asciidiella aspersa*). Body (Fig. 234A) slightly compressed laterally, 2.90 mm long. Prosome 2.27 mm long, distinctly 5-segmented. Dorsal cephalic shield large. Fourth pedigerous somite forming elliptical brood pouch widest in middle, 1.09×0.77 μm in lateral view, tapering posteriorly towards rounded apex. Free urosome (Fig. 234B) slender, cylindrical, 5-segmented: genital somite 159×295 μm, distinctly wider than long; 4 abdominal somites wider than long, 218×255, 205×250, 159×245, and 159×255 μm, respectively. Anal somite broadened posteriorly, with deep posteromedian incision. Caudal rami divergent; each ramus (Fig. 234C) about 4.1 times longer than wide (276×67 μm) and about 1.7 times longer than anal somite, gradually narrowing distally towards unsclerotized, weak distal third: armed with 6 rudimentary setae; lateral and dorsal setae located at 25 and 58% of ramus length, respectively.

Rostrum (Fig. 234D) unsclerotized, flexible, longer than wide (89×73 μm), weakly tapering towards rounded or bluntly nipple-shaped apex. Antennule (Fig. 234E) 280 μm long, 9-segmented with distal 3 segments incompletely articulated; armature formula 3, 17, 6, 4+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae generally small, all naked. Antenna (Fig. 234F) 4-segmented, coxa short; basis 85×50 μm, with 1 small seta distally and 1 vestigial seta subdistally on outer margin; first endopodal segment 67×42 μm, with 1 small seta subdistally; compound distal endopodal segment 3.2 times longer than wide (83×26 μm); armed with 6 setae (2 of distal 3 setae indistinct) plus large terminal claw, 72 μm long, 0.87 times as long as segment.

Labrum (Fig. 234G) with setulose distal margin and sparsely setulose, linguiform posteromedian lobe. Mandible (Fig. 234H) with 5 teeth on coxal gnathobase and 2 small proximal setae; sharply pointed distalmost tooth with minute spinules along proximal margin: basis with 1 subdistal seta on medial margin; exopod 4-segmented with 4 large setae of equal length; endopod incompletely articulated from basis and 2-segmented; first segment armed with 3 or 4 setae and ornamented with oblique mediolateral row of spinules on ventral surface; second segment armed with 8 or 9 setae, second outer distal seta longest, more than twice as long as outermost distal seta and about 1.2 times longer than second longest (third outer distal seta). Setation of first and second segments of mandibular endopod variable in 6 dissected specimens: 3-8, 3-8, 4-8, 4-9, and 4-9, with no variation between left and right mandibles in 5 specimens, but 4-8 on right mandible and 4-9 on left mandible in 1 specimen. Paragnath (Fig. 234I) with semicircular, sclerotized outer lobule subdistally, few minute spinules apically, and setules along medial margin. Maxillule (Fig. 234J) with

9 setae on arthrite; coxal endite bearing broad seta (wider than long) with pointed tip; epipodite with 2 very unequal setae; basis with 3 setae on medial margin; exopod with 4 setae on distal margin (3 medial setae equal in length, outermost seta 1.5 times longer than other 3); endopod smaller than exopod, with 2 subequal setae. Maxilla (Fig. 235A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with 3 setae, distalmost about half as long as middle seta; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 235B) incompletely 2-segmented; first segment with 9 setae; short second segment with 2 large, subequal setae.

Leg 1 (Fig. 235C) biramous with 3-segmented rami. Inner coxal seta extending at most to distal border of second endopodal segment; outer seta on basis with flagellate tip and several setules distally. Inner distal spine on basis 55 μm long, extending to distal border of first endopodal segment, finely spinulose distally. Outer spines on exopod slender, flanged with membrane distally.

Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 235D, E); exopod and endopod similar in length in legs 2 and 3, but exopod slightly longer than endopod in leg 4. Inner coxal seta extending to middle of compound distal endopodal segment in legs 2 and 3, but that of leg 4 small and naked, extending to distal border of basis. Outer seta on basis rudimentary, hardly visible. Most of setae on exopods and distal setae on endopods finely spinulose distally. Two proximal setae on endopod and inner seta on first exopodal segment of leg 4 short. Armature formula for legs 1–4 as follows:

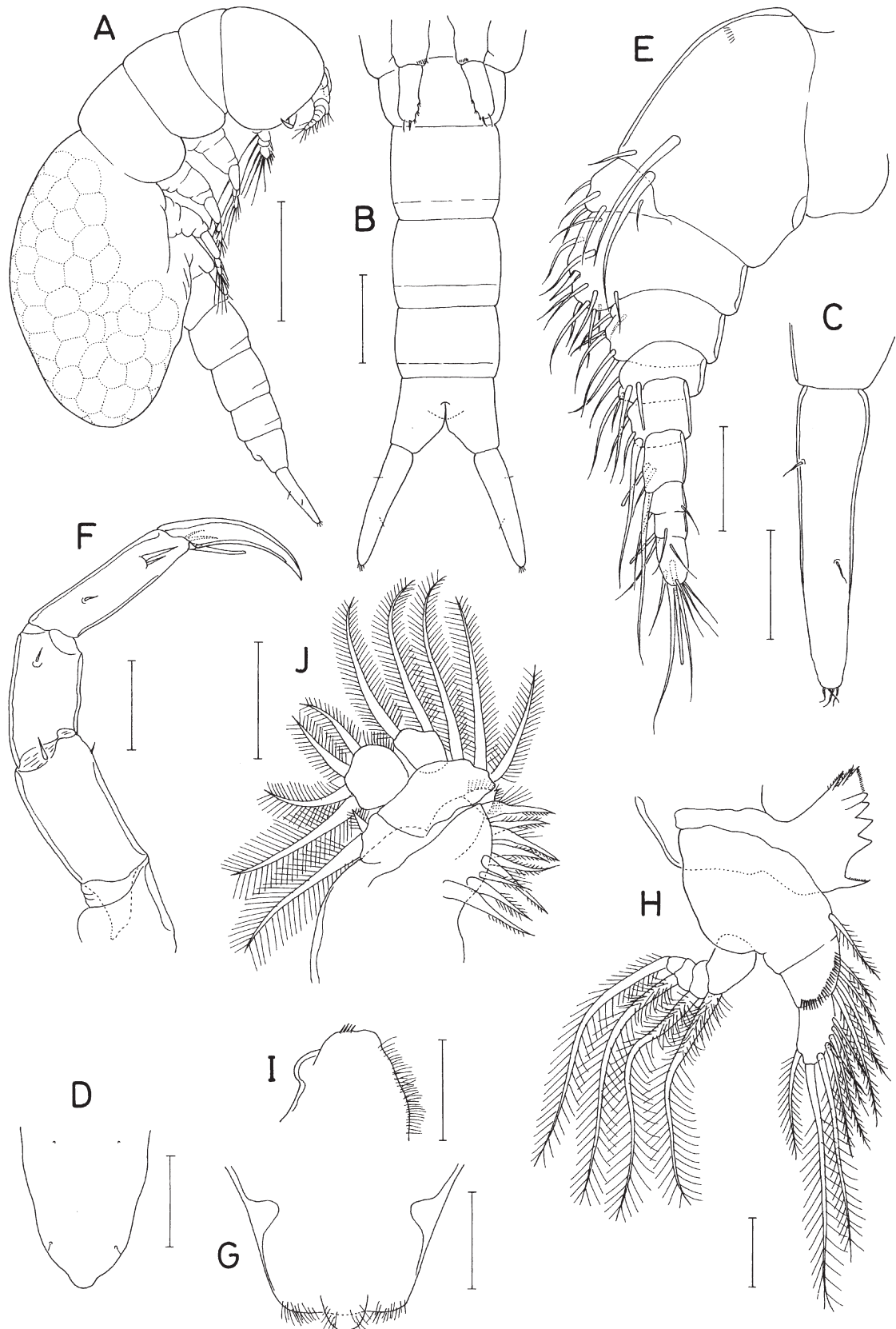
	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 4
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 3, 3

Leg 5 (Fig. 235F) consisting of protopod not articulated at base, armed with vestigial seta at outer subdistal region and row of about 15 spinules at mediolateral corner, plus free exopodal segment, about 2.5 times longer than wide, with rounded outer distal corner; armed distally with 1 short, broad seta and 1 longer thread-like seta; ornamented with 3 oblique rows of fine spinules on dorsomedial surface.

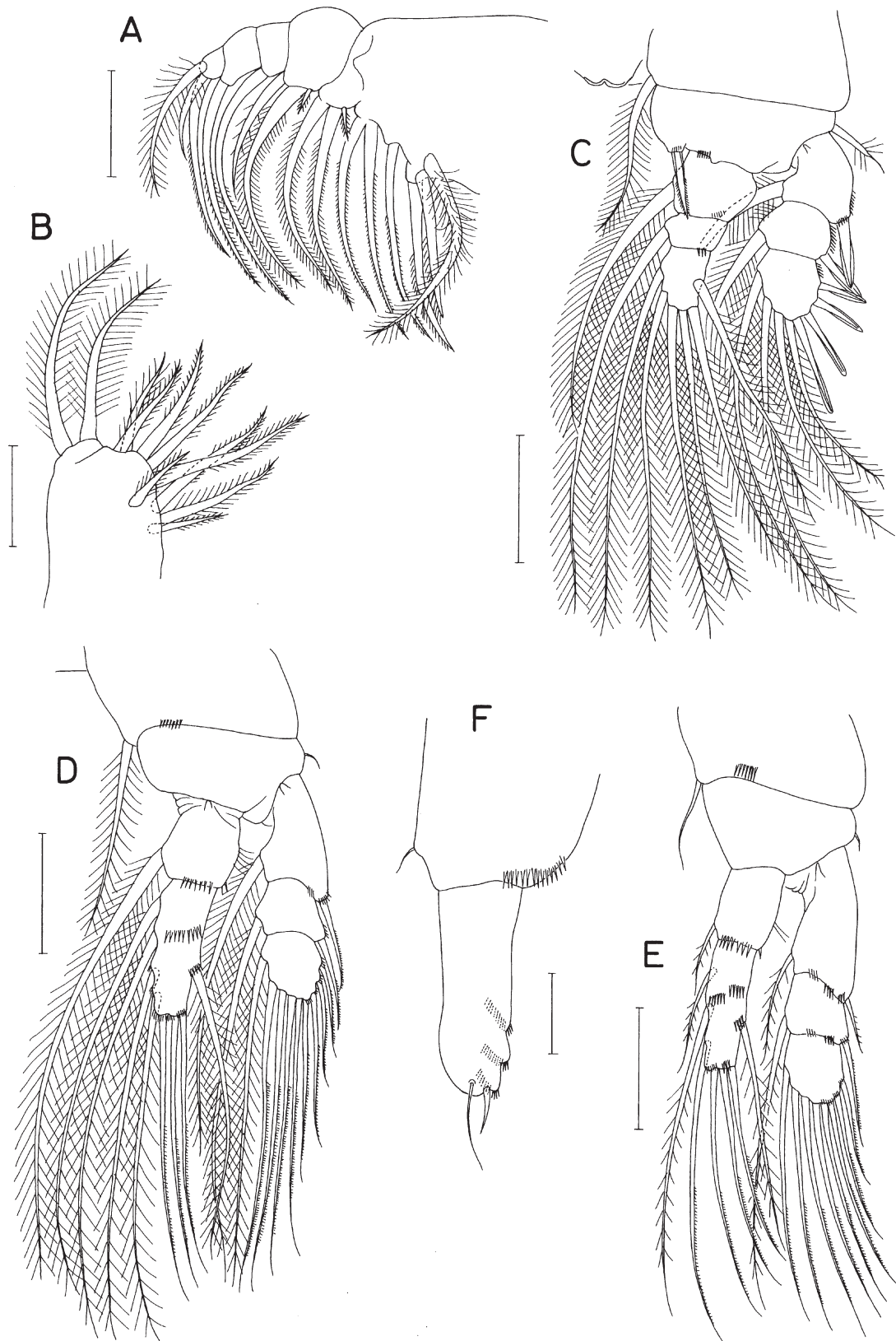
**Male.** Not examined.

**Remarks.** *Doropygus pulex* is the type species of the genus but has been rather poorly defined. According to both Lang (1948) and Gotto (1975), it is likely that more than one species has been referred to *D. pulex*. Gotto (1975) recognized that there are different taxa within the *D. pulex* complex, which differ in the number of setae on the second endopodal segment of the mandible (8 or 9) and in the relative size of the terminal claw of the antenna (small or at least half as long as the compound distal endopodal segment).

In his original description of *D. pulex*, Thorell (1859)



**FIGURE 234.** *Doropygus pulex* Thorell, 1859, female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, 0.1 mm; D–J, 0.05 mm.



**FIGURE 235.** *Doropygus pulex* Thorell, 1859, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, F, 0.05 mm; C–E, 0.1 mm.

listed five species of ascidians as type hosts, as follows: *Ascidia virginea* Müller, 1776 (as *A. venosa*), *Ascidella aspersa* (as *Ascidia aspersa*), *Ciona intestinalis* (as *Ascidia canina*), *Corella parallelogramma* (as *Ascidia parallelogramma*), and “*Cynthia lurida*” (an invalid name according to WoRMS). Copepods belonging to the *D. pulex* complex from one of the above type hosts, *Ascidella aspersa*, were available to us for a study. The body form of the examined specimens from *A. aspersa* is very similar to that illustrated by Thorell (1859) and the antenna bears a large terminal claw, as in the illustration given by Thorell. Thorell’s illustration of the mandible shows the exopod bearing 4 large setae of equal length but the second endopodal segment bears only 7 setae. We consider it likely that he overlooked the mediobasal seta on the second endopodal segment; this seta is prone to being overlooked because it is small, positioned dorsally (so not in the same plane as the other setae) and is overlapped by a larger adjacent seta. We infer, therefore, that the typical setation of the mandibular endopod of *D. pulex* s. str. is 3 or 4 (4 is common) on the first segment and 8 or 9 (8 is common) on the second segment. Considering these attributes, we conclude that the copepod material from one of the type hosts (*A. aspersa*) described above can be identified as *D. pulex* s. str. with a high degree of confidence. We also suspect that the variability in setation on the mandibular endopod might have been the root cause of the earlier confusion surrounding the diagnosis of *D. pulex*.

The features of the specimens from *Polycarpa pomaria* conform well with those of the specimens from *A. aspersa*. However, material examined here from six other species of ascidians cannot be separated into robust groupings due to variability, especially in the shape of the brood pouch and the proportions of the caudal rami. We note that all lie within the following ranges of character states: (1) The caudal rami are between 4.1 and 6.3 times longer than wide, and 1.7 to 2.5 times longer than the anal somite; (2) the compound distal endopodal segment of the antenna is 3.0 to 3.8 times longer than wide; (3) the terminal claw of the antenna is 0.55 to 0.9 times as long as the distal endopodal segment; (4) the mandibular exopod is armed with 4 equally large setae; (5) the first segment of the mandibular endopod is armed with 3 or 4 setae and ornamented with one oblique row of spinules; (6) the second segment of the mandibular endopod is armed with 8 or 9 setae; (7) the maxillular exopod and endopod are armed with 4 and 2 setae, respectively, and the seta on the coxal endite is broad and up to twice as long as wide; (8) in the maxilla, the first endite of the syncoxa and the terminal segment of the endopod are armed with 3 setae, and the basis is armed with 3 setae (lacking a differentiated claw); (9) the maxilliped is incompletely 2-segmented and armed with 9 setae on the first segment and 2 setae on the second segment; (10) the outer seta on the basis of leg 1 is cylindrical proximally and has

a flagellate distal tip; and (11) the exopodal segment of leg 5 is about 2.4 times longer than wide. This general set of character states serves to define *D. pulex* s. str. but we consider that it will be necessary in the future to use molecular data to fully explore the limits to such variation and establish robust species boundaries.

### ***Doropygus nasutus* sp. nov.**

(Figs. 236–238)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21318), paratypes (intact, 24 ♀♀, 2 ♂♂, MNHN-IU-2014-21319, and dissected paratypes (2 ♀♀, 1 ♂, figured) from *Pyura microcosmus* (Savigny, 1816), Roscoff, France, Monniot coll., date unknown.

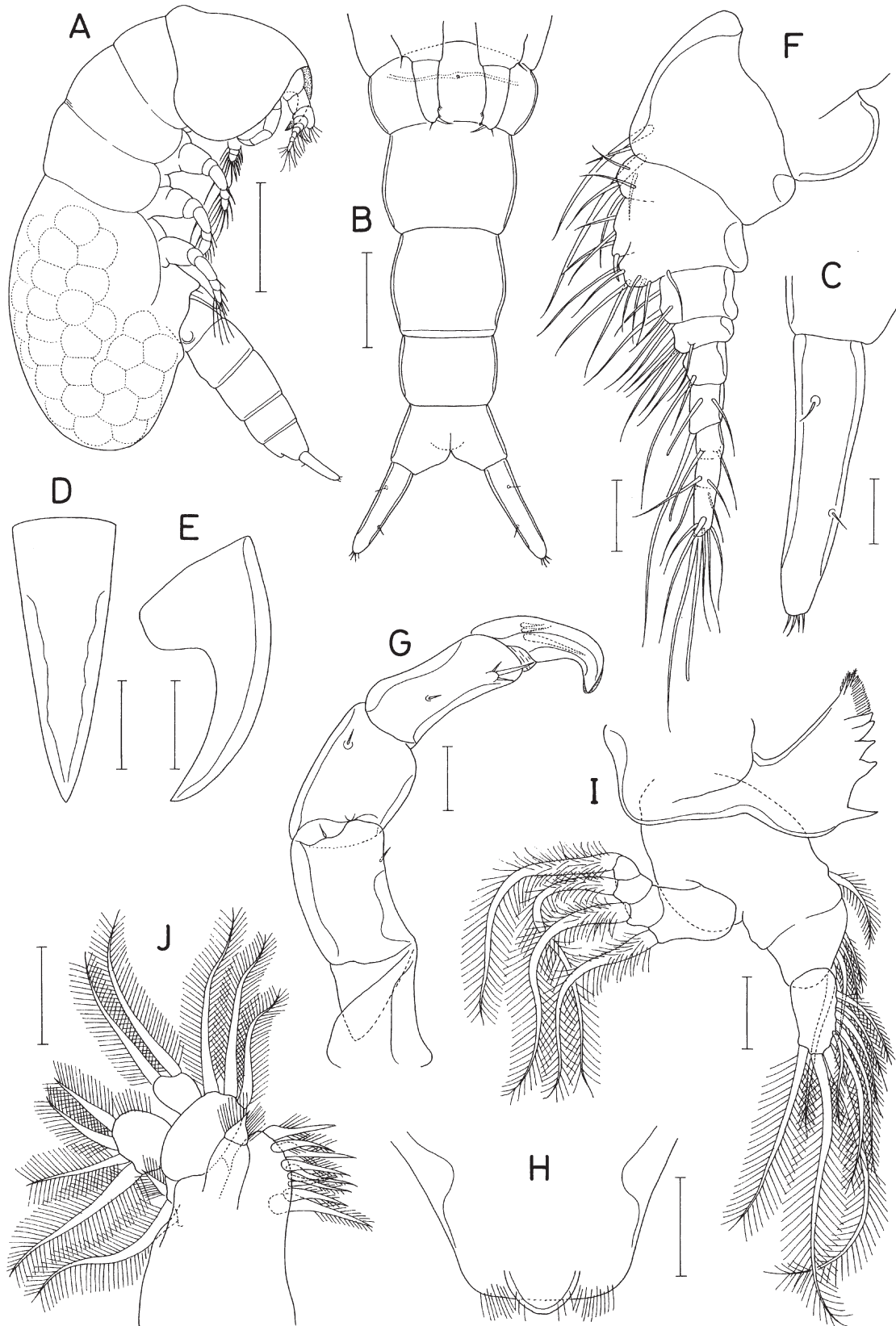
**Additional material.** All from *P. microcosmus*: 8 ♀♀ (MNHN-IU-2018-1863), Roscoff, France; 11 ♀♀ (MNHN-IU-2018-1864), Roscoff; 8 ♀♀, 2 ♂♂ (MNHN-IU-2018-1865), Petit Chevreuil, Dinard, France; 25 ♀♀, 1 ♂ (MNHN-IU-2018-1866) and 1 dissected ♀, Roscoff.

**Etymology.** The specific name is derived from the Latin *nasut* (=nose), alluding to the large rostrum of the new species.

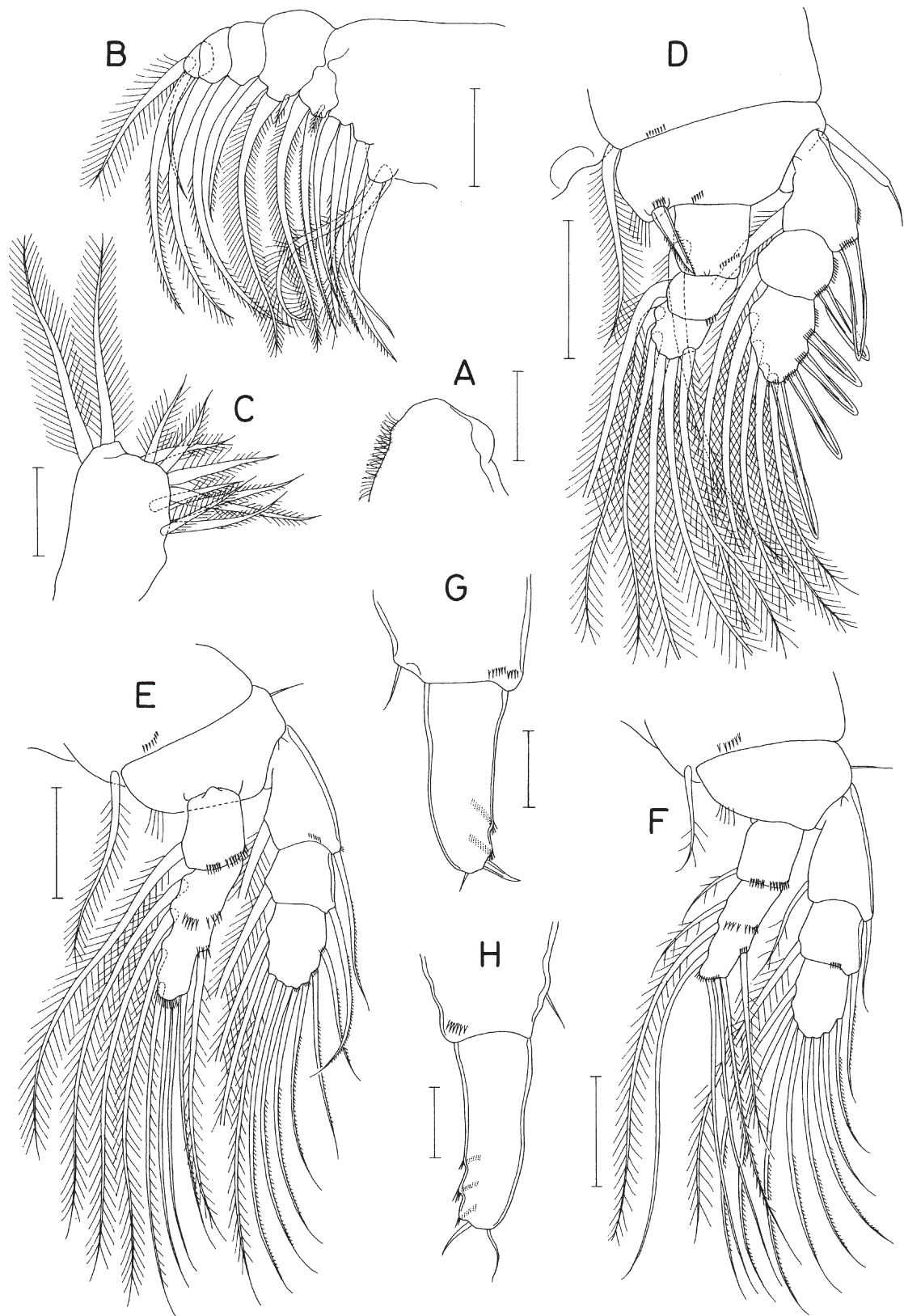
**Description of female.** Body (Fig. 236A) slightly compressed, rather stout; body length 2.97 mm. Prosoma 2.39 mm long, 5-segmented. Dorsal cephalic shield expanded laterally, slightly produced posterodorsally. Fourth pedigerous somite forming elliptical brood pouch, about 1.5 times longer than wide and rounded posteriorly. Free urosome (Fig. 236B) 5-segmented; genital somite 132×359 µm; 4 abdominal somites 214×282, 214×245, 145×205, and 123×245 µm, respectively. Anal somite and caudal rami divergent. Caudal ramus (Fig. 236C) gradually narrowing distally, about 4.0 times longer than wide (218×55 µm); armed with 6 rudimentary setae; two proximal setae located at 24 and 62% of ramus length.

Rostrum (Fig. 236D, E) characteristically large (more than half length of cephalic shield), highly sclerotized and about 3.6 times longer than wide (337×93 µm), tapering peg-like in ventral view (Fig. 236D), gently curved and hook-like in lateral view (Fig. 236E), and clearly articulated at base. Antennule (Fig. 236F) 360 µm long, 7-segmented, but terminal segment bearing traces of 2 incompletely expressed articulations; third to terminal segments much narrower than proximal 2 segments; armature formula 3, 16+spine, 5, 5, 3, 2+aesthetasc, 11+2 aesthetascs; all setae naked. Antenna (Fig. 236G) robust, 4-segmented; coxa unarmed; basis 113×73 µm, with 2 small setae; first endopodal segment 90×76 µm, with 1 small seta; compound distal endopodal segment about 2.0 times longer than wide (105×54 µm); armed with 7 setae (3 apparently located proximally on terminal claw) plus stout terminal claw 106 µm long, as long as segment, and blunt tipped.

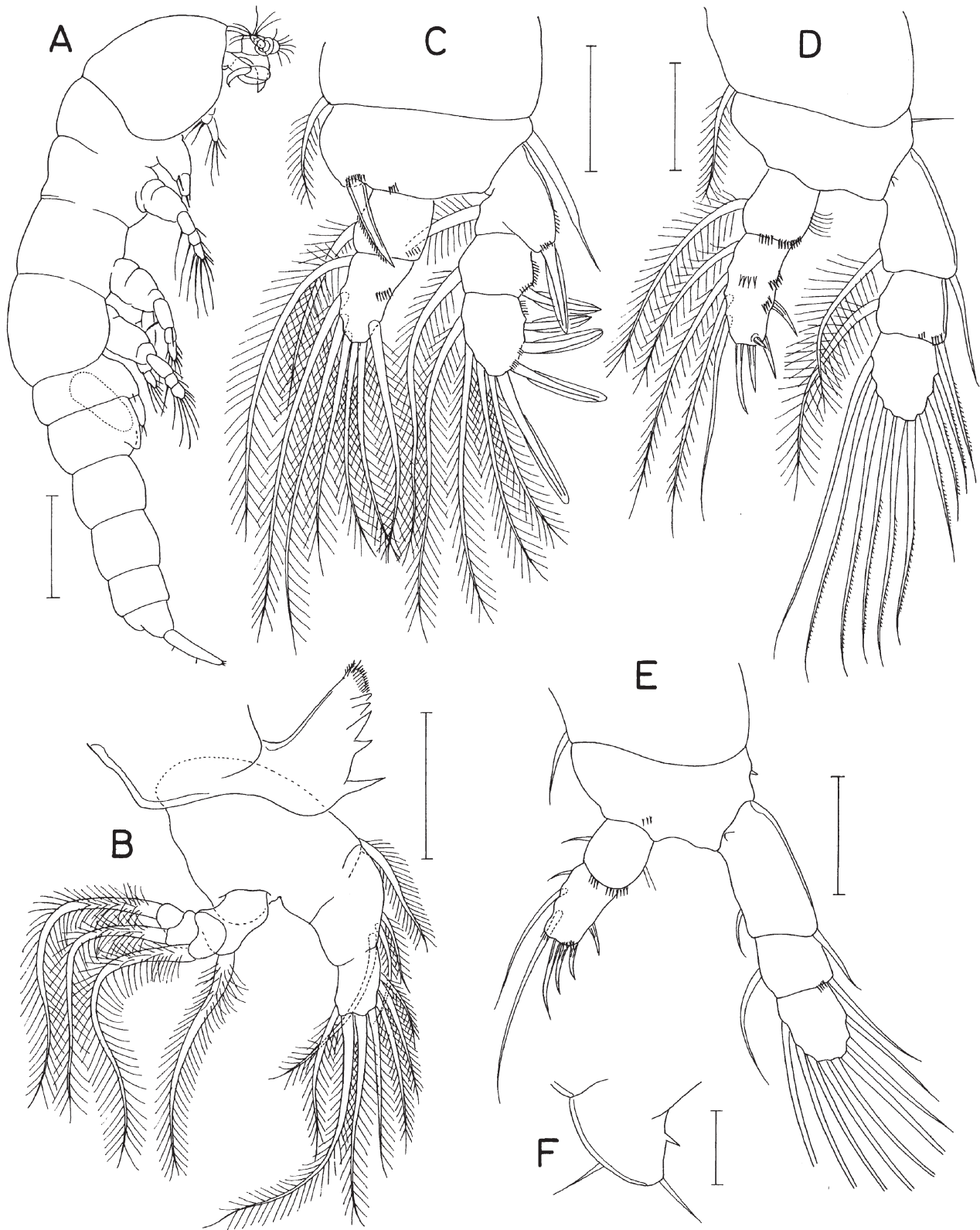
Labrum (Fig. 236H) as in *D. pulex*. Mandible (Fig.



**FIGURE 236.** *Doropygus nasutus* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum, ventral; E, rostrum, right; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, F–J, 0.05 mm; D, E, 0.1 mm.



**FIGURE 237.** *Doropygus nasutus* sp. nov., female. A, paragnath; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, H, leg 5. Scale bars: A–C, G, H, 0.05 mm; D–F, 0.1 mm.



**FIGURE 238.** *Doropygus nasutus* sp. nov., male. A, habitus, right; B, mandible; C, leg 1; D, leg 2; E, leg 4; F, leg 6. Scale bars: A, 0.2 mm; B–E, 0.05 mm; F, 0.02 mm.



236I) with 5 teeth and 2 small proximal setae on coxal gnathobase; setation of basis, exopod and first endopodal segment as in *D. pulex*, but first endopodal segment lacking row of spinules and second endopodal segment armed with 9 setae; 2 largest distal setae on second endopodal segment equal in length. Paragnath (Fig. 237A) ornamented only with medial margin setules. Maxillule (Fig. 236J), maxilla (Fig. 237B), and maxilliped (Fig. 237C) as in *D. pulex*.

Leg 1 (Fig. 237D), leg 2 (Fig. 237E), leg 3, and leg 4 (Fig. 237F) armed as in *D. pulex*. Outer seta on basis of leg 1 naked, with flagellate tip. Inner coxal seta of leg 4 sparsely pinnate.

Leg 5 (Fig. 237G, H) similar to that of *D. pulex*: protopod bearing row of about 10 minute spinules at inner distal corner; free exopodal segment about 2.5 times longer than wide, armed with 2 setae distally (setal lengths variable, inner seta spiniform), ornamented with 2 or 3 rows of fine spinules on dorsomedial surface.

**Description of male.** Body (Fig. 238A) narrower than that of female, 1.45 mm long. Pedigerous somites incompletely segmented. Urosome 6-segmented. Caudal ramus about 4.9 times longer than wide (132×27 µm).

Rostrum as in female. Antennule also as in female, but aesthetascs better developed and thicker than in female. Antenna robust as in female, but terminal claw pointed distally. Labrum as in female. Mandible (Fig. 238B) bearing only 3 setae on first endopodal segment and 7 setae on second. Paragnath, maxillule, maxilla, and maxilliped as in female.

Legs 1–4 with 3-segmented exopods and 2-segmented endopods (Fig. 238C–E); endopods shorter than exopods. Outer and distal setae on endopods of legs 2–4 transformed into short spines. Second endopodal segments of legs 2 and 3 each bearing small offset spinous process, articulated at base (not included in armature formula), on anterior surface near outer distal corner. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 1, 2, 4
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; I, III, 4
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; I, III, 3

Leg 5 as in female; exopodal segment 2.2 times longer than wide (61×28 µm), with parallel outer and inner margins, 2 distal setae, and 3 medial rows of fine spinules. Leg 6 (Fig. 238F) represented by 2 equal setae and 1 small, spiniform inner process distally on genital operculum.

**Remarks.** *Doropygus nasutus* sp. nov. can be distinguished from other members of the *D. pulex* complex by the large, strong rostrum which is more than half the length of the dorsal cephalic shield and clearly visible without dissection. The robust antenna is also distinctive. In addition, unlike in *D. pulex* s. str., the brood

pouch is rounded, rather than tapering posteriorly. In the present study, this species was discovered only from *Pyura microcosmus* and all the specimens of *Doropygus* collected from this species of ascidian host are *D. nasutus* sp. nov. This may suggest that other species of *Doropygus* previously recorded from *P. microcosmus* might be referable to *D. nasutus* sp. nov.

***Doropygus monniotorum* sp. nov.**  
(Fig. 239, 240)

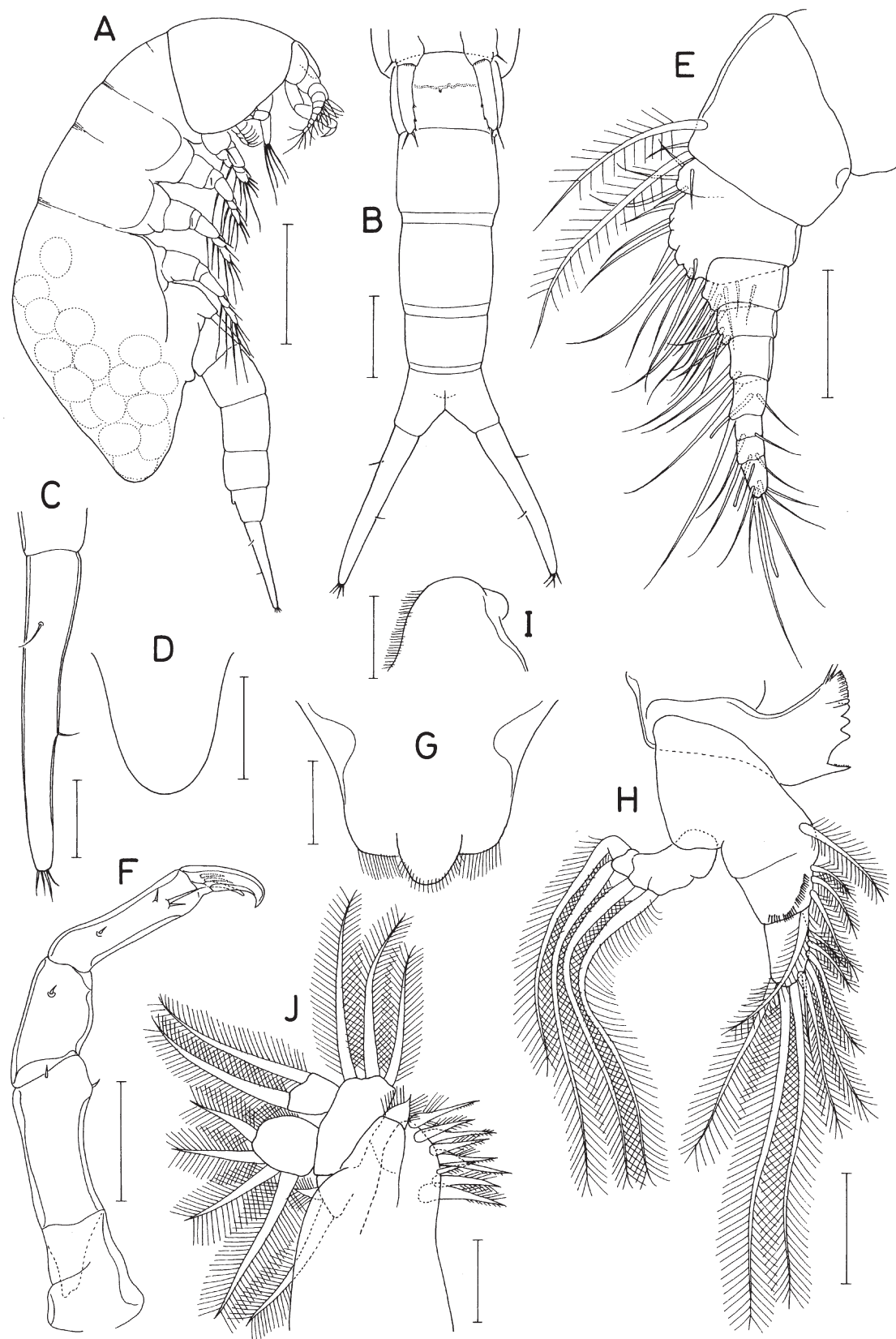
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21320), paratypes (3 intact ♀♀, MNHN-IU-2014-21321), and dissected paratypes (2 ♀♀, figured) from *Hartmeyera bouillonii* Monniot C. & Monniot F., 1976 (Syntype MNHN-IT-2008-4551 = MNHNS2/HAR/2), MRAC-ULB (Musée Royal de l’Afrique Centrale et Université Libre de Bruxelles) Stn 338, Inhaca I., Mozambique (26°03’S, 32°54’E), 07 August 1969.

**Additional material.** 3 ♀♀ (MNHN-IU-2018-1867) from *Polycarpa arenosa* Monniot C. & Monniot F., 1976, Inhaca Is., Mozambique, 07 August 1969.

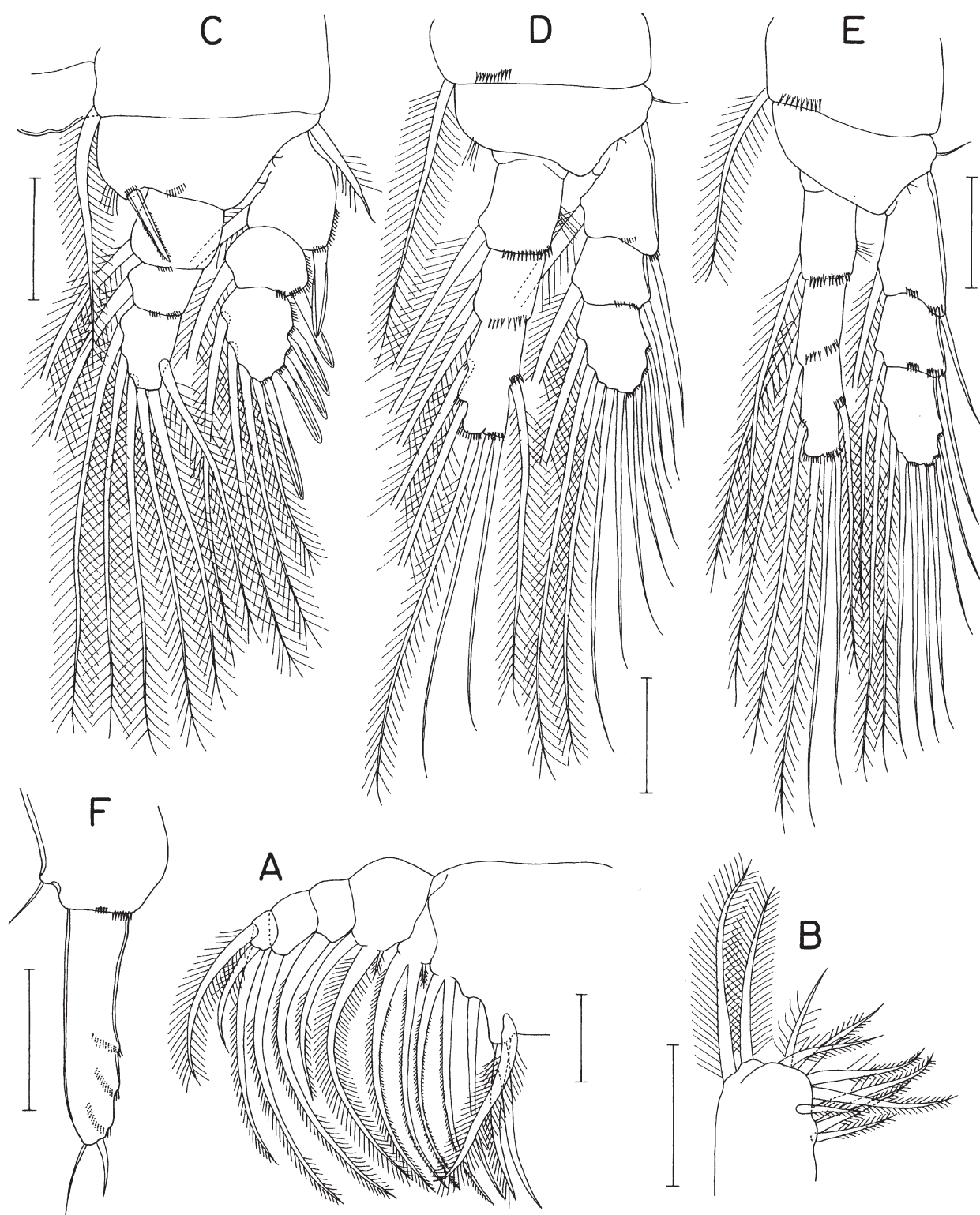
**Etymology.** The new species is named after Drs. Claude and Françoise Monniot, who collected the type specimens of this species.

**Description of female.** Body (Fig. 239A) narrow, laterally compressed. Body length of ovigerous female 3.27 mm in dissected specimen: prosome 2.32 mm long. Dorsal cephalic shield distinctly defined. Articulations between pedigerous somites indistinct. Brood pouch (fourth pedigerous somite) about 1.7 times longer than wide, strongly tapering posteriorly in lateral view. Free urosome (Fig. 239B) slender, cylindrical, 5-segmented: genital somite 190×282 µm; 4 abdominal somites 223×257, 223×236, 140×205, and 159×260 µm, respectively. Anal somite with broad and deep posteromedial incision. Caudal rami divergent, elongate; each ramus (Fig. 239C) somewhat variable in length, about 6.0 times longer than wide (418×70 µm) in figured specimen (only 5.0 times longer than wide in another dissected specimen) and 2.6 times longer than anal somite; armed with 6 rudimentary setae; 2 proximal setae located at 23 and 57% of ramus length.

Rostrum (Fig. 239D) longer than wide, weakly tapering towards rounded apex. Antennule (Fig. 239E) about 370 µm long, 9-segmented; first and second segments distinctly broader than distal segments; articulations between three distal segments incomplete; armature formula 3, 17, 6, 5, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 2 setae on first segment pinnate and larger than other setae, all other setae naked. Antenna (Fig. 239F) moderately slender, 4-segmented; coxa unarmed; basis 147×69 µm, with 2 small setae; first endopodal segment 90×58 µm, not expanded, with 1 small seta; compound distal endopodal segment about 3.3 times longer than



**FIGURE 239.** *Doropygus monniotorum* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, parnath; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C–F, H, 0.1 mm; G, I, J, 0.05 mm.



**FIGURE 240.** *Doropygus monnitorum* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, 0.05 mm; B–F, 0.1 mm.

wide (127×38 µm); armed with 7 setae plus terminal claw 74 µm long, 0.58 times as long as segment.

Labrum (Fig. 239G) as in *D. pulex*. Mandible (Fig. 239H) different from *D. pulex* in having distalmost seta on exopodal segment distinctly shorter, about 0.7 times as long as other 3 proximal setae, and in second endopodal segment bearing 9 setae. Paragnath (Fig. 239I) with semicircular lobule at outer distal corner and setulose medial margin. Maxillule (Fig. 239J), maxilla (Fig. 240A), and maxilliped (Fig. 240B) as in *D. pulex*.

Leg 1 (Fig. 240C) with 3-segmented rami, armed as in *D. pulex*. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 240D, E); endopod longer than exopod in legs 2 and 3, but similar in length to exopod in leg 4. Inner coxal seta and inner setae on endopod of leg 4 well-developed, all pinnate. Armature formula for legs 1–4 as in *D. pulex*.

Leg 5 (Fig. 240F) slender: protopod not articulated at base, with 1 small outer seta subdistally and row of minute spinules at inner distal corner; free exopodal segment 3.9 times longer than wide (164×42 µm); armed distally with 2 setae of different thickness and length and ornamented with 3 oblique rows of minute spinules on dorsomedial surface.

Male. Unknown.

**Remarks.** *Doropygus monniotorum* sp. nov. belongs to the *D. pulex* complex. Differences from *D. pulex* are: (1) the brood pouch invariably tapers more strongly; (2) the caudal ramus is more elongate (more than 5.0 times longer than wide), and is more than twice as long as the anal somite; (3) the setae on the antennule are better developed and the 2 large setae on first segment are pinnate; (4) the terminal claw of the antenna is 0.58 times as long as the compound distal endopodal segment; (5) the distalmost (fourth) seta on the mandibular exopod is about 0.7 times as long as the other 3 setae; and (6) the exopod of leg 5 is more slender (3.9 times longer than wide).

### *Doropygus leptobranchius* sp. nov.

(Figs. 241, 242)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21322), paratypes (22 intact ♀♀, MNHN-IU-2014-21323), and dissected paratypes (3 ♀♀, figured) (most with caudal rami missing) from *Microcosmus vulgaris* Heller, 1877 (MNHN-IT-2008-5255 = MNHN S2/MIC/31), trawl, Banyuls on Mediterranean coast of France, Monniot coll., 1961.

**Additional material.** 1 ♀ (MNHN-IU-2017-2169) from *M. vulgaris*, Mediterranean (42°13.67'N, 09°37.43'E), MEDITS 2016 Stn M16-4, depth 109 m; 1 ♀ (MNHN-IU-2017-2173) from *M. vulgaris*, Mediterranean (41°50.74'N, 09°27.53'E), MEDITS 2016, Stn M16-3, depth 72 m.

**Etymology.** This species name is derived from the

Greek *lept* (=slender) and *brachi* (=arm), and alludes to the slender antenna.

**Description of female.** Body (Fig. 241A) rather stout, weakly bilaterally compressed; body length 3.10 mm. Prosome 2.50 mm long, distinctly segmented, consisting of cephalosome and 4 pedigerous somites. Fourth pedigerous somite forming brood pouch about 1.4 times longer than wide in lateral view, weakly tapering posteriorly. Free urosome 5-segmented, gradually narrowing posteriorly; genital somite 190×400 µm; 4 abdominal somites gradually shorter, 223×318, 200×277, 127×232, and 120×227 µm. Anal somite with shallow posteromedian incision. Caudal ramus (Fig. 241B) about 3.8 times longer than wide (188×50 µm) and about 1.6 times longer than anal somite; armed with 6 small setae; 2 proximal setae positioned at 27 and 61% of ramus length.

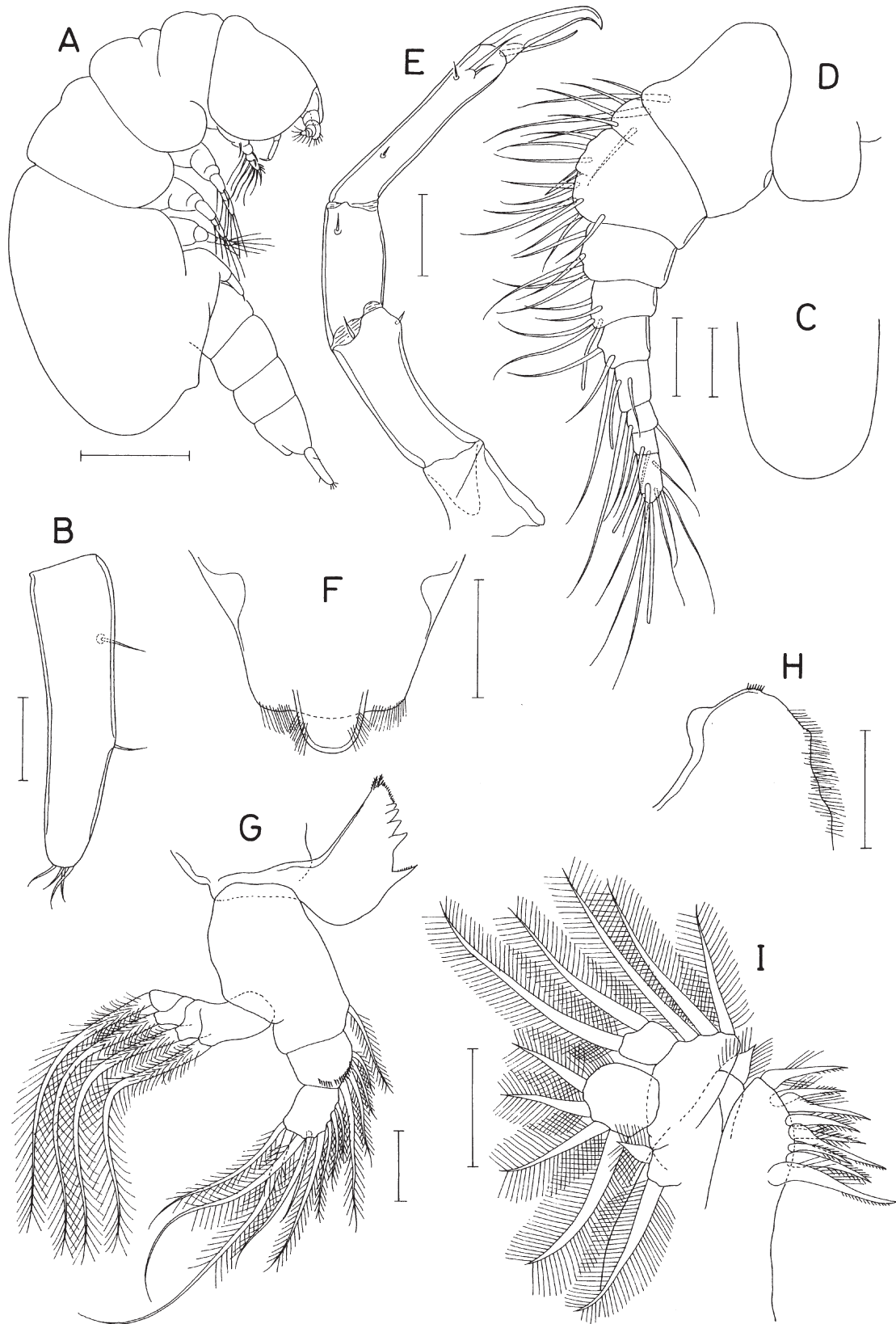
Rostrum (Fig. 241C) longer than wide, spatulate, with parallel lateral margins and broadly rounded apex. Antennule (Fig. 241D) 390 µm long, 9-segmented; articulations between 3 terminal segments indistinct; armature formula 3, 17, 5, 4+aesthetasc, 3, 2+aesthetasc, and 7+aesthetasc; setae moderately long, all naked. Antenna (Fig. 241E) slender, 4-segmented; short coxa unarmed; basis 98×44 µm, with 1 seta distally and 1 tiny seta near outer distal corner; first endopodal segment 73×39 µm, with 1 small seta subdistally; compound distal endopodal segment elongate, about 5.4 times longer than wide (130×24 µm); armed with 5 setae arranged as 1, 1, 2, and 1 (with distalmost seta more than half length of terminal claw) plus terminal claw 77 µm long, 0.59 times as long as segment.

Labrum (Fig. 241F) with well-developed, linguiform posteromedian lobe ornamented with setules on both sides; posterior margin setulose. Mandible (Fig. 241G) with 5 teeth and 2 small setae on coxal gnathobase; distalmost tooth sharply pointed, with minute spinules on proximal margin: basis with 1 seta mediodistally; exopod 4-segmented with 4 equally large setae, 1 per segment; endopod distinctly articulated from basis, 2-segmented; first segment with 4 setae on medial margin and row of minute spinules on mediodistal border; second segment with 9 setae, second outer seta on distal margin longest, 1.2 times longer than second longest third seta. Paragnath (Fig. 241H), maxillule (Fig. 241I), maxilla (Fig. 242A), and maxilliped (Fig. 242B) as in *D. pulex*.

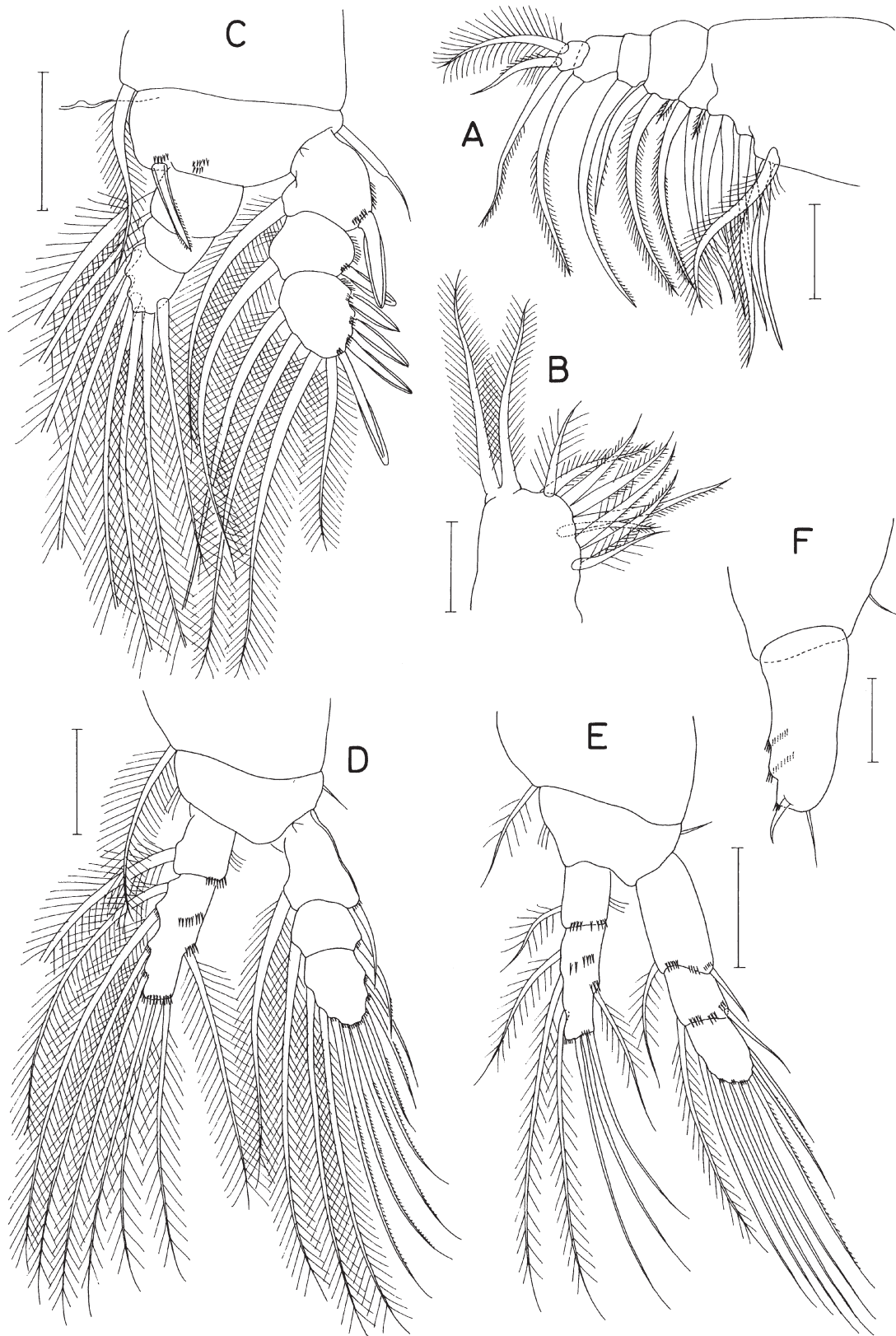
Leg 1 (Fig. 242C) biramous with 3-segmented rami. Outer seta on basis naked, abruptly thinning to flagellate tip. Inner distal spine on basis 67 µm long, extending beyond distal border of first endopodal segment. Legs 2–4 similar to those of *D. pulex* (Fig. 242D, E). Leg 5 (Fig. 242F) similar to that of *D. pulex*, but free exopodal segment shorter, 2.1 times longer than wide (107×51 µm).

Male. Unknown.

**Remarks.** Illg & Dudley (1961) redescribed *D.*



**FIGURE 241.** *Doropygus leptobrachus* sp. nov., female. A, habitus, right; B, right caudal ramus, medial; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule. Scale bars: A, 0.5 mm; B–I, 0.05 mm.



**FIGURE 242.** *Doropygus leptobrachus* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, F, 0.05 mm; C–E, 0.1 mm.

*pulex* based on specimens taken from *Microcosmus sulcatus* Coquebert, 1797 collected in the Mediterranean. This ascidian is now recognized as a synonym of *M. vulgaris* (WoRMS Editorial Board, 2020). The type material of *D. leptobranchius* **sp. nov.** described above was collected from the same ascidian host species and in the same geographical region. However, our specimens exhibit two significant differences from the redescription of Illg & Dudley, even though the form of the rostrum and the distal armature of the antenna are the same as those of Illg & Dudley's specimens. First, the caudal ramus of *D. leptobranchius* **sp. nov.** is 3.8 times longer than wide and about 1.6 times longer than anal somite, in contrast to 5.7 times longer than wide and 2.6 times longer than anal somite in Illg & Dudley's specimens (as measured by Illg & Dudley, 1961). Second, in the antenna of *D. leptobranchius* **sp. nov.** the basis and the first and second endopodal segments are 98, 73, and 130  $\mu\text{m}$  long, respectively, thus the second (compound distal) endopodal segment is markedly longer than the basis in contrast to the proportional lengths 6.7 : 4.0 : 5.6 in Illg & Dudley's specimens where this segment is shorter than the basis. The slender form of the second endopodal segment of the antenna of *D. leptobranchius* **sp. nov.** was confirmed in all available specimens after dissection or without dissection. Other differences, such as the presence of 8 setae on the second endopodal segment of the mandible in Illg & Dudley's specimens, were not considered as part of the justification for establishing the new species because of possible variability.

***Doropygus flexus* Gotto, 1975**  
(Fig. 243)

**Material examined.** 1 ♀ (MNHN-IU-2018-1868) and 1 dissected ♀ from *Pyura praeputialis* (Heller, 1878), Sydney, Australia, 1846.

**Supplementary description of female.** Body (Fig. 243A) 2.95 mm long; prosome stout, 2.09 mm long. Cephalic shield well-defined posteriorly. Metasome gradually broadening posteriorly, not segmented but with 4 pedigerous somites discernible by weak dorsal and lateral constrictions. Fourth pedigerous somite forming brood pouch, slightly longer than wide, with rounded posterior margin in lateral view. Free urosome (Fig. 243B) narrow, 5-segmented: genital somite 180×380 $\mu\text{m}$ ; 4 abdominal somites 268×273, 273×252, 205×214, and 127×232  $\mu\text{m}$ , respectively. Anal somite broader posteriorly, with wide posteromedian incision. Caudal ramus (Fig. 243C) about 4.1 times longer than wide (253×62  $\mu\text{m}$ ), gradually narrowing distally; armed with 6 small setae; 2 proximal setae positioned at 28 and 70% of ramus length; all setae shorter than width of ramus at base.

Rostrum (Fig. 243D) slightly longer than wide, narrowing distally towards rounded distal margin.

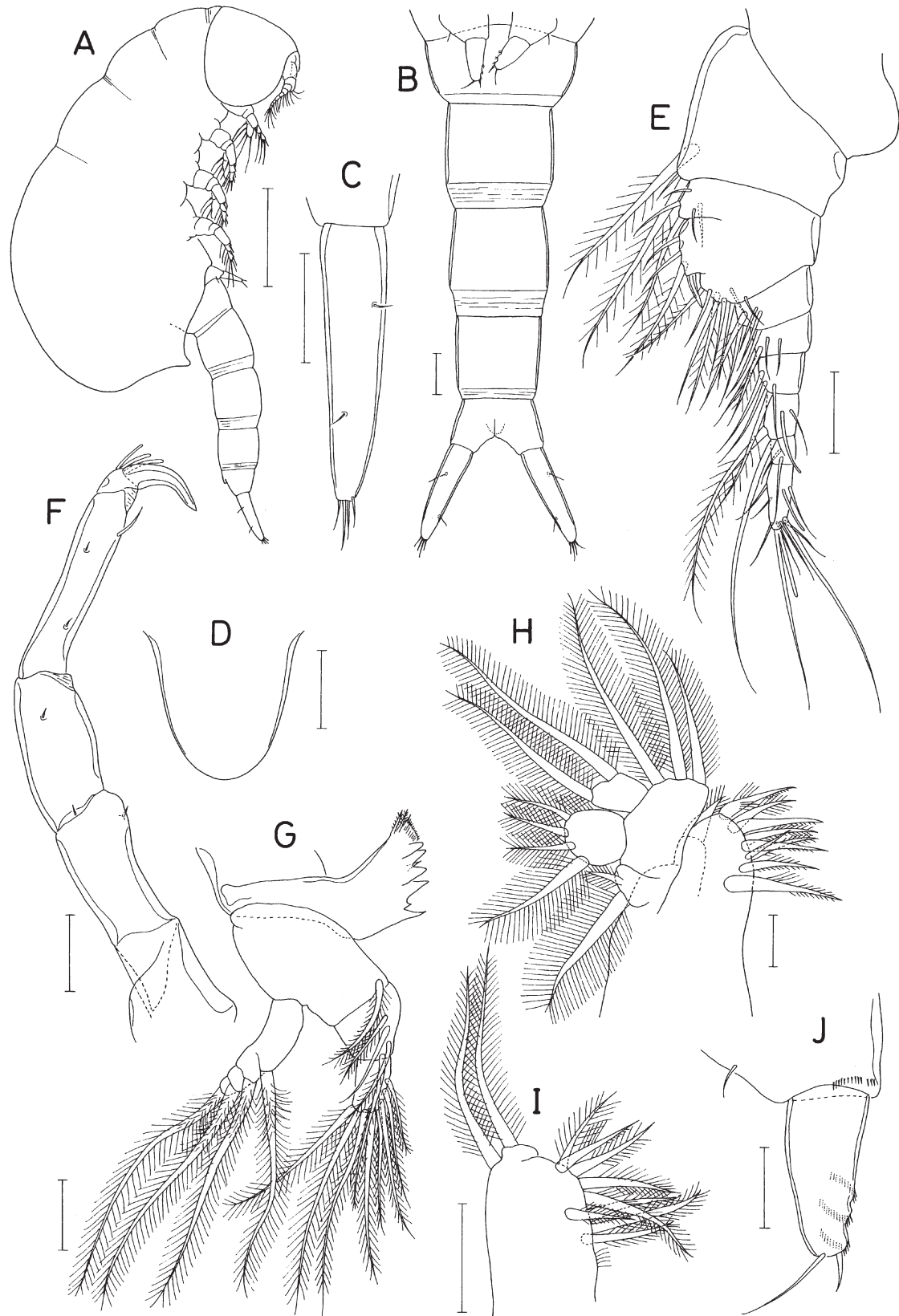
Antennule (Fig. 243E) about 310  $\mu\text{m}$  long, 8-segmented; first and second segments expanded; armature formula 3, 16+spine, 5, 4, 4, 3+aesthetasc, 2, and 9+2 aesthetascs; 2 pinnate setae present on first segment, 4 on second, and 1 each on third to sixth segments. Antenna (Fig. 243F) 4-segmented; basis (second segment) 102×50  $\mu\text{m}$ , with 2 minute setae on distal region; first endopodal segment 89×50  $\mu\text{m}$ , with 1 small seta subdistally; second endopodal segment about 4.5 times longer than wide (136×30  $\mu\text{m}$ ) and about 1.3 times longer than basis; armed with 6 setae, including 3 subequal, small, bluntly tipped setae inserted on base of terminal claw; terminal claw short, 53  $\mu\text{m}$  long, about 0.4 times as long as segment.

Labrum as in *D. pulex*. Mandible (Fig. 243G) with 5 teeth, 2 small proximal setae on coxal gnathobase, and 2 small subsidiary denticles each between 2 distal teeth and between proximal second and third teeth: basis with 1 seta mediolaterally; exopod 4-segmented with 4 equal setae (1 per segment); endopod with 4 and 8 setae on first and second segments, respectively; second and third outer distal setae equal in length, longer than other setae on endopod. Paragnath as lamellate lobe bearing setules on medial margin and shallow, rounded protuberance on outer margin; distal apex smooth, without spinules. Maxillule (Fig. 243H) with 9 setae on arthrite: seta on coxal endite tapering, more than twice as long as wide; epipodite with 1 small and 1 large seta: basis with 3 setae on medial margin; 2 distal setae subequal and longer than proximal: exopod with 4 setae distally, 3 medial setae equal in length, 25  $\mu\text{m}$  long, outermost seta longest, 48  $\mu\text{m}$  long; endopod smaller than exopod with 2 large, subequal setae. Maxilla and maxilliped (Fig. 243I) as in *D. pulex*.

Legs 1–4 as in *D. pulex* but inner coxal seta of leg 1 larger, extending beyond distal tip of endopod. Leg 5 (Fig. 243J) with broad protopod bearing small outer seta and inner distal row of minute spinules: free exopodal segment gradually narrowing distally, about 2.1 times longer than wide (103×50  $\mu\text{m}$ ); armed with 2 unequal setae distally (slender outer seta 2.5 times longer than inner); ornamented with 3 oblique rows of minute spinules on dorsomedial surface.

**Male.** Not available in present study.

**Remarks.** The two female specimens of this species examined here were collected from the type host at the type locality. Gotto (1975) differentiated this species from *D. pulex* by the possession of the 3 blunt distal setae on the terminal endopodal segment of the antenna and by the evenly circular posterior margin of the brood pouch. As additional differences from *D. pulex*, the terminal claw of the antenna is short, only about 0.4 times as long as the compound distal endopodal segment (in *D. pulex* and other relatives described above, it is more than 0.5 times as long), the latter segment is distinctly longer than the basis, the setae on the antennule are longer and many of them are pinnate, and the exopodal segment of leg 5 gradually narrows distally, and is without a distal expansion.



**FIGURE 243.** *Doropygus flexus* Gotto, 1975, female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilliped; J, leg 5. Scale bars: A, 0.5 mm; B, C, 0.1 mm; D–G, I, J, 0.05 mm; H, 0.02 mm.



***Doropygus humilis* Stock, 1967**  
(Fig. 244)

Syn.: *Doropygus curvipes* Gotto, 1975: 169, fig. 3. **new synonym.**  
*Doropygus apicatus* Stock, 1967, **new synonym.**

**Material examined.** 2 ♀♀ (MNHN-IU-2018-1869) and 1 dissected ♀ (figured) from *Styela canopus* (Savigny, 1816): Bermuda; 1 ♀ (MNHN-IU-2018-1870) and 1 dissected ♀ from *S. canopus*, Madagascar (24°59'S, 47°05'E), depth 15-17 m, 09 May 2010.

1 ♀ (MNHN-IU-2018-1871) from *Distomus hupferi* (Michaelsen, 1904) Biaçores; 3 ♀♀ (MNHN-IU-2018-1872) and 1 dissected ♀ from *D. hupferi*, Biaçores.

1 ♀ (dissected) from *Polycarpa cartilaginea* (Sluiter, 1898): Guadeloupe.

3 ♀♀ (MNHN-IU-2018-1873) and 1 dissected ♀ from *Microcosmus exasperatus* Heller, 1878, Noumea, New Caledonia.

1 ♀ (dissected) from *Stolonica inhacae* (Millar, 1956), Ibo, Mozambique.

1 ♀ (dissected) from *Polycarpa plantei* Monniot C., 2002, Victoria harbour, Mahé Is., Seychelles, collected by Richmond, 1995.

1 ♀ (MNHN-IU-2018-1919) from *Pyura ocellata* Monniot F., 2016, French Guiana (05°38.4'N, 52°29.2'W), Stn CP 4386, depth 46-47 m, 05 Aug 2014.

1 ♀ (MNHN-IU-2017-2174, dissected) from *Polycarpa salutis* Monniot F., 2016, (06°31'N, 52°36'W), GUYANE 2014, Stn CP 4381, depth 114-118 m, 04 August 2014.

**Supplementary description of female.** Body (Fig. 244A) relatively narrow; body length 2.96 mm: prosome 2.24 mm long. Dorsal cephalic shield distinctly defined. Metasome indistinctly segmented. Fourth pedigerous somite forming elongate oval hood pouch, almost twice as long as wide, longer than anterior part of prosome, with rounded posterior margin. Free urosome slender, 5-segmented. Anal somite characteristically tapering posteriorly, with deep posteromedian incision. Caudal ramus (Fig. 244B) tapering evenly towards apex, 3.1 times longer than wide (159×52 µm) and 1.85 times longer than anal somite; 2 proximal setae positioned at 26 and 63% of ramus length.

Rostrum (Fig. 244C) triangular, slightly longer than wide, evenly tapering towards blunt apex. Antennule 9-segmented; first and second segments much broader than distal segments; armature formula 3, 16, 3, 3, 5, 3, 2, 2+aesthetasc, and 7+aesthetasc; setae crowded and generally long; 2 larger setae on first segment about twice as long as width of segment; 2 pinnate setae on first segment, 3 on second, and 1 each on third, fifth, and sixth. Antenna (Fig. 244D) narrow, 4-segmented; coxa short; basis twice as long as wide (97×48 µm), with 2 setae distally; first endopodal segment unarmed, 1.8 times longer than wide (77×43 µm); compound distal endopodal

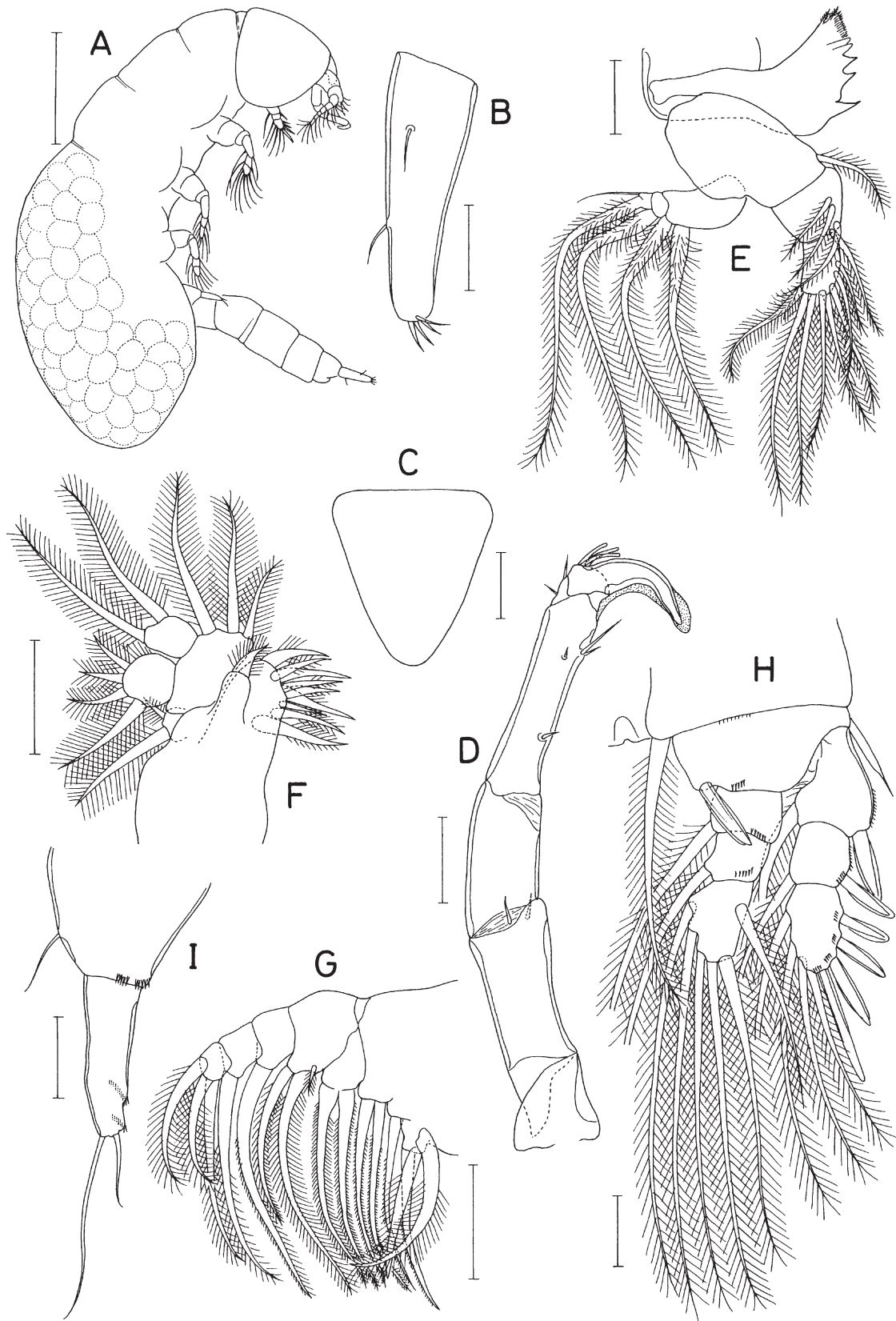
segment about 4.3 times longer than wide (137×32 µm); armed with 9 setae (3 distal subequal in length and at most one-third as long as terminal claw) plus terminal claw 75 µm long, 0.55 times as long as segment, gently curved with blunt tip, claw fringed with hyaline membrane along concave margin and distal part of convex margin.

Labrum as in *D. pulex*. Mandible (Fig. 244E) with coxa and basis same as in *D. pulex*; exopod indistinctly segmented, armed with 4 large equal setae and 1 rudimentary, thread-like seta distally, latter occasionally absent: endopod indistinctly articulated from basis, armed with 4 and 8 setae on first and second segments, respectively; 2 largest distal setae on second segment subequal in length. Paragnath lacking spinules at apex. Maxillule (Fig. 244F) with 9 setae on arthrite; seta on coxal endite more than twice as long as wide; epipodite with 2 very unequal setae; basis with 3 unequal setae on medial margin; exopod with 4 setae distally, medial 3 subequally small, longer outer seta about twice length of medial 3; endopod with 2 large, subequal setae. Maxilla (Fig. 244G) with 8 setae on syncoxa (lacking proximal small seta on fourth endite), 3 setae on basis, and 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped as in *D. pulex*, with 9 setae on first segment and 2 subequal, large setae on short second segment.

Leg 1 (Fig. 244H) segmented and armed as in *D. pulex*, but inner coxal seta large (extending beyond distal tip of endopod); outer seta on basis flagellate distally and naked or weakly pinnate; inner distal spine on basis 54 µm, extending beyond distal border of first endopodal segment, fringed with membrane along lateral margins. Legs 2-4 as in *D. pulex*, except that inner coxal seta and inner setae on endopod larger and densely pinnate, and basis of leg 4 lacking outer seta.

Leg 5 (Fig. 244I) with protopod bearing thin outer seta and mediolateral row of minute spinules; exopod 2.7 to 4.1 times longer than wide, armed with 2 thin, unequal setae distally and 2 or 3 rows of minute spinules on dorsomedial surface; longer outer seta as long as exopodal segment, about 2.5 times longer than inner seta.

**Remarks.** Stock (1967) described *D. humilis* as an associate of an unidentified solitary ascidian (a member of either the Styelidae or the Pyuridae) collected in the Red Sea. *Doropygus curvipes* Gotto, 1975, which was described as an associate of *Cnemidocarpa radicata* (Herdman, 1832) (as *C. etheridgii* Herdman, 1899) in Sydney Harbour, Australia (Gotto, 1975), is here synonymised with *D. humilis* as there are no significant differences between these two species. Seo & Lee (1998) also reported this species under the name *D. curvipes* found in *Styela clava* Herdman, 1881 on the eastern coast of Korea. In the present account, eight additional ascidian species are reported as hosts of *D. humilis*, not only from the Indo-Pacific but also from the Atlantic Ocean. The wide geographical distribution of *D. humilis* may be linked to the global introductions of certain ascidian



**FIGURE 244.** *Doropygus humilis* Stock, 1967, female. A, habitus, right; B, right caudal ramus, medial; C, rostrum; D, antenna; E, mandible; F, maxillule; G, maxilla; H, leg 1; I, leg 5. Scale bars: A, 0.5 mm; B–I, 0.05 mm.

species, such as *Styela canopus*, that are known to serve as hosts of this copepod.

*Doropygus apicatus* Stock, 1967 was originally described mainly on the basis of the female, but the specimens examined by Stock (1967) were juvenile females; as indicated by his illustrated mandible which contains internally the developing gnathobase of the next moult stage. The antenna of *D. apicatus* has the same characteristic blunt terminal claw bearing hyaline membrane as found in *D. humilis*, and we consider that *D. apicatus* is probably based on copepodid stages of *D. humilis*. Here we propose to treat *D. apicatus* as a junior subjective synonym of *D. humilis*.

*Doropygus humilis*, as a member of the *D. pulex* complex, is distinguishable from other species of the complex by its characteristic antenna in which the terminal claw is fringed with hyaline membrane. This feature has not previously been reported in other species of *Doropygus*.

### ***Doropygus parahumilis* sp. nov.**

(Figs. 245, 246)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21324) from *Herdmania pallida* (Heller, 1878) (MNHN-IT-2008-4649 = MNHN S2/HER/44), Djibouti, Case du Général, Monniot coll., 15 October 1996.

**Etymology.** The name of the new species refers to its similarity to *D. humilis*.

**Description of female.** Body (Fig. 245A) narrow, slightly compressed. Body length 3.65 mm: prosome 2.82 mm long. Dorsal cephalic shield clearly defined. Metasome unsegmented; 4 pedigerous somites indistinctly defined only by 3 surface constrictions. Fourth pedigerous somite forming elongate oval brood pouch about 1.8 times longer than wide; with rounded posterior margin. Free urosome (Fig. 245B) slender, cylindrical, 5-segmented; genital somite 192×277 µm; 4 abdominal somites 269×277, 254×262, 161×227, and 154×269 µm, respectively. Articulations incomplete between genital and first abdominal somites and between third abdominal and anal somites. Anal somite divergent, broadening distally, with deep and wide posteromedian incision. Caudal rami (Fig. 245B) also divergent; each ramus about 5.4 times longer than wide (369×68 µm) and 2.4 times longer than anal somite, gradually narrowing distally: armed with 6 small setae; 2 proximal setae located at 29 and 66% of ramus length; all setae short, less than half width of ramus at base.

Rostrum (Fig. 245C) 135×133 µm, well-defined from cephalosome, widest at proximal third, with rounded distal margin. Antennule (Fig. 245D) 408 µm long, 9-segmented; 2 proximal segments much wider than distal segments; armature formula 3, 13+spine, 5, 5, 4, 4, 2,

2+aesthetasc, and 7+aesthetasc; 2 pinnate setae on first segment, 4 on second, 2 on each of third and fifth, and 1 on each of fourth and sixth segments. Antenna (Fig. 245E) slender; coxa short and unarmed; basis 154×60 µm, with 1 rudimentary seta at outer distal corner; first endopodal segment 115×54 µm, unarmed; compound distal endopodal segment elongate, about 5.8 times longer than wide (192×33 µm); armed with 8 small setae (all attenuated distally) plus slightly curved terminal claw 73 µm long, 0.38 times as long as segment, ornamented with hyaline fringe along concave margin and distal part of convex margin.

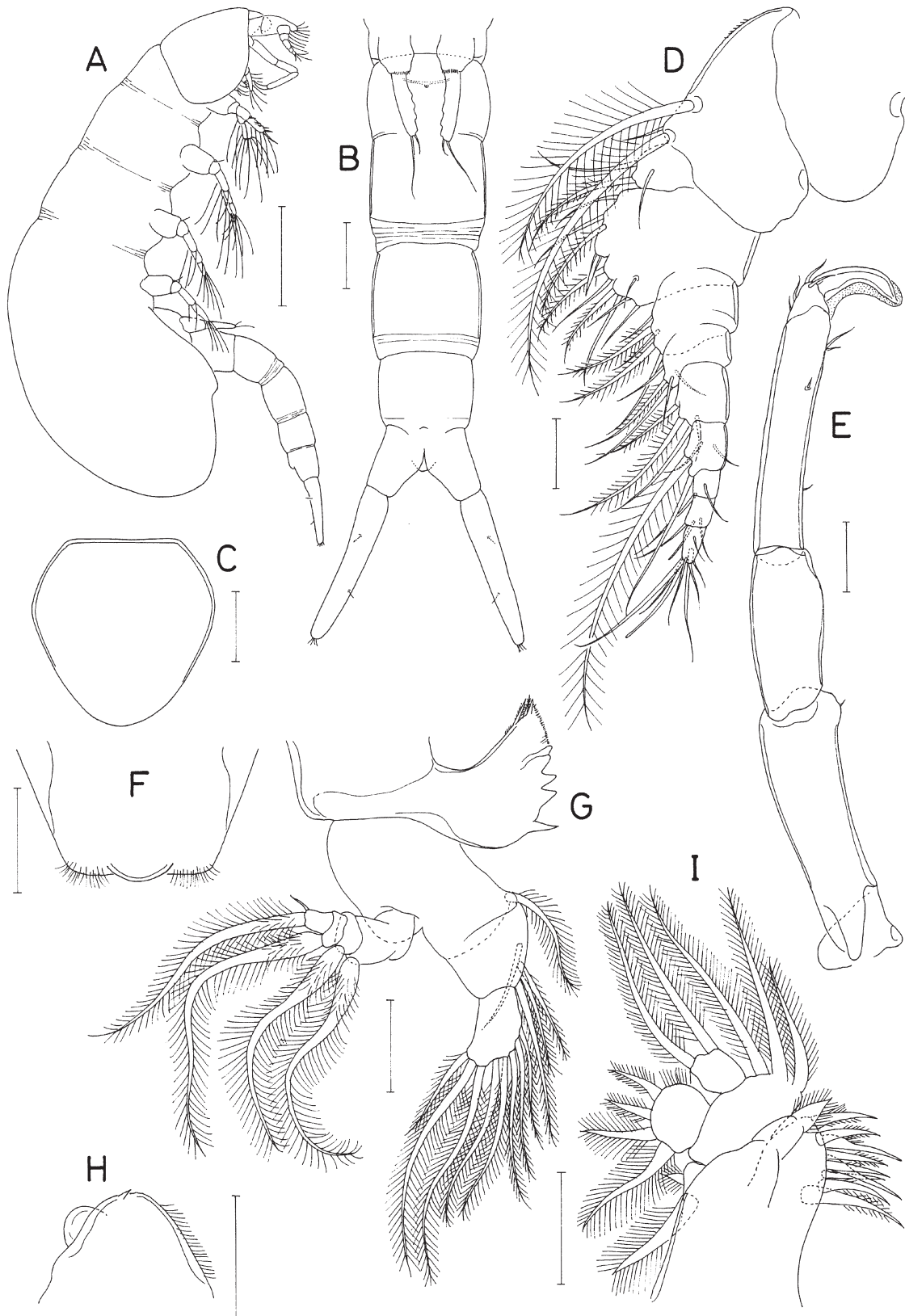
Labrum (Fig. 245F) with short, smooth posteromedian lobe; posterior margin setulose. Mandible (Fig. 245G) with 5 teeth and 2 small proximal setae on coxal gnathobase: basis with 1 seta mediodistally; exopod 4-segmented; first to third segments each with 1 large seta; last segment with 1 large and 1 vestigial seta; 4 large setae equal in length; endopod incompletely articulated from basis, armed with 4 and 8 setae on first and second segments, respectively; second and third outer setae on distal margin longest, more than twice length of outermost distal seta. Paragnath (Fig. 245H) with well-developed, semicircular outer lobe subdistally, small denticle at apex, and setules along medial margin. Maxillule (Fig. 245I) as in *D. humilis*, but seta on coxal endite broader, twice as long as wide. Maxilla (Fig. 246A) 5-segmented; syncoxa armed with 3, 1, 2, and 2 setae on first to fourth endites, respectively; basis with 3 setae, distal seta half length of middle seta; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 246B) unsegmented but with short, transverse suture subdistally on medial side; armed with 8 medial and 2 apical setae.

Leg 1 (Fig. 246C) with 3-segmented rami. Inner coxal seta extending to distal tip of endopod. Outer seta on basis evenly attenuated. Inner distal spine on basis 67 µm long, extending slightly beyond distal border of first endopodal segment. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 246D, E). Inner coxal seta of legs 2 and 3 extending to middle of second endopodal segment, that of leg 4 shorter, extending to distal border of first endopodal segment. Outer seta on basis of legs 2–4 rudimentary. All setae on exopods of legs 2–4 naked. Armature formula for legs 1–4 as in *D. pulex*.

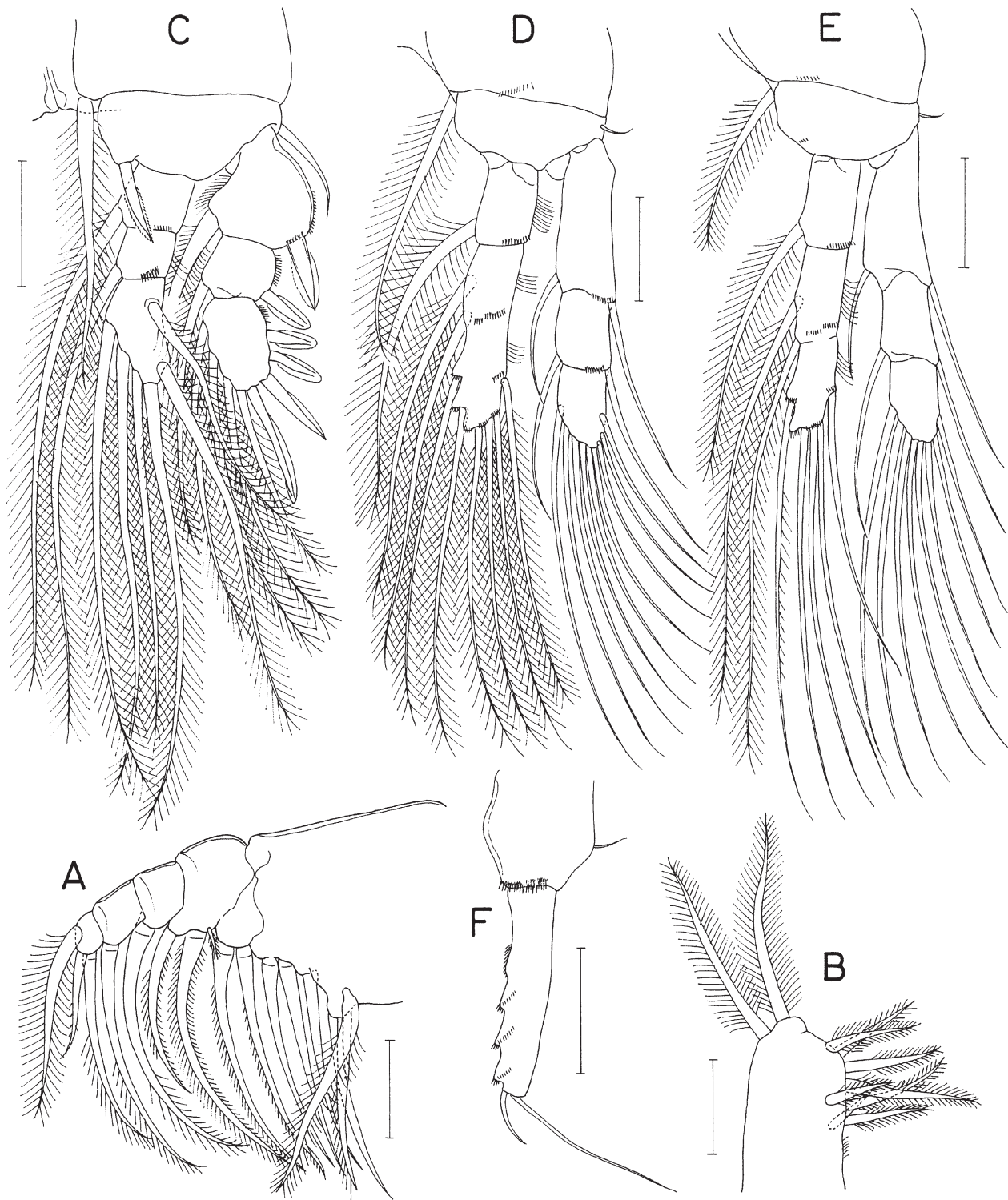
Leg 5 (Fig. 246F) consisting of protopod and exopod: protopod with 1 small seta on outer margin and row of minute spinules along distal border; exopod slender, about 4.5 times longer than wide (165×37 µm), armed with 2 unequal setae distally and ornamented with 4 oblique rows of minute spinules on dorsomedial surface; outer seta 154 µm long, slightly shorter than exopodal segment, inner seta 50 µm, about one-third length of outer seta.

**Male.** Unknown.

**Remarks.** *Doropygus parahumilis* sp. nov. is similar to *D. humilis* in having a membranous hyaline fringe on the antennal claw. It can be differentiated from the latter



**FIGURE 245.** *Doropygus parahumilis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C–I, 0.05 mm.



**FIGURE 246.** *Doropygus parahumilis* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, 0.05 mm; C–F, 0.1 mm.

species by the following character states: (1) the caudal ramus is longer, 369  $\mu\text{m}$  long and 5.4 times longer than wide (vs. 159  $\mu\text{m}$  long and 3.1 times longer than wide in *D. humilis*); (2) the distal endopodal segment of the antenna is longer, 192  $\mu\text{m}$ , and about 5.8 times as long as wide (vs. 137  $\mu\text{m}$  long and about 4.3 times as long as wide in *D. humilis*); (3) the terminal claw of the antenna is shorter, 0.38 times as long as the distal endopodal segment (vs. 0.55 times as long in *D. humilis*); (4) the maxilliped bears 8 medial and 2 apical setae (vs. 9 medial and 2 apical in *D. humilis*); and (5) the exopodal segment of leg 5 is longer, 4.5 times longer than wide (vs. 2.8 times longer in *D. humilis*). These and other differences are summarised in Table 9.

***Doropygus breviuncinatus* sp. nov.**

(Figs. 247, 248)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21325) and dissected paratype (♀, figured) from *Herdmania momus* (Savigny, 1816), Mont Dore, New Caledonia, Monniot coll.

**Etymology.** The specific name is derived from Latin *brevi* (=short) and *uncinat* (=hooked) and alludes to the short terminal claw of the antenna.

**Description of female.** Body (Fig. 247A) narrow, similar in form to *D. humilis*. Body length 2.75 mm: prosome 2.10 mm long. Dorsal cephalic shield well-defined; metasome indistinctly segmented. Fourth pedigerous somite forming brood pouch, about 1.4 times longer than wide in lateral view, slightly shorter than anterior prosome. Free urosome (Fig. 247B) 5-segmented, cylindrical: genital somite 123×314  $\mu\text{m}$ ; 4 abdominal somites 205×282, 173×266, 155×244, and 109×216  $\mu\text{m}$ , respectively. Anal somite broadened posteriorly, with deep posteromedian incision. Caudal ramus (Fig. 247C) gradually narrowing distally, about 4.2 times longer than wide (284×68  $\mu\text{m}$ ) and 2.6 times longer than anal somite; armed with 6 very small setae; all setae less than half width of ramus at base; 2 proximal setae positioned at 27 and 62% of ramus length.

Rostrum (Fig. 247D) consisting of broad proximal third (173  $\mu\text{m}$  wide) and narrower tapering distal two-thirds (103  $\mu\text{m}$  wide). Antennule 9-segmented (Fig. 247E); 2 proximal segments much broader than distal segments; setae highly entangled, generally of medium-length, several setae sparsely pinnate. Antenna (Fig. 247F) slender, 4-segmented; coxa short and unarmed; basis 120×45  $\mu\text{m}$ , subdistally bearing small knob (exopod) tipped with minute vestigial seta; first endopodal segment 93×47  $\mu\text{m}$ , unarmed, ornamented with patch of minute spinules near middle; compound distal endopodal segment elongate, about 4.4 times longer than wide (128×29  $\mu\text{m}$ ); armed with several small setae (distal 3 positioned at base of terminal claw, blunt at tip, subequal

in length) plus slightly curved terminal claw (Fig. 247G) with blunt tip, 55  $\mu\text{m}$  long, 0.43 times as long as segment; claw ornamented with hyaline membranous fringe along concave margin and on tip.

Labrum (Fig. 247H) with semicircular posteromedian lobe; posterior margin setulose. Mandible (Fig. 247I) with 4 teeth on coxal gnathobase; palp as in *D. humilis* except exopod bearing 4 large setae only. Paragnath (Fig. 247J) with distinct outer subdistal lobule; apical region smooth, without spinules or denticles. Maxillule (Fig. 247K) as in *D. humilis*. Maxilla (Fig. 247L) distal syncoxal endite with only 2 setae as in *D. humilis*. Maxilliped (Fig. 248A) incompletely 2-segmented, armed with 9 and 2 setae on first and second segments, respectively.

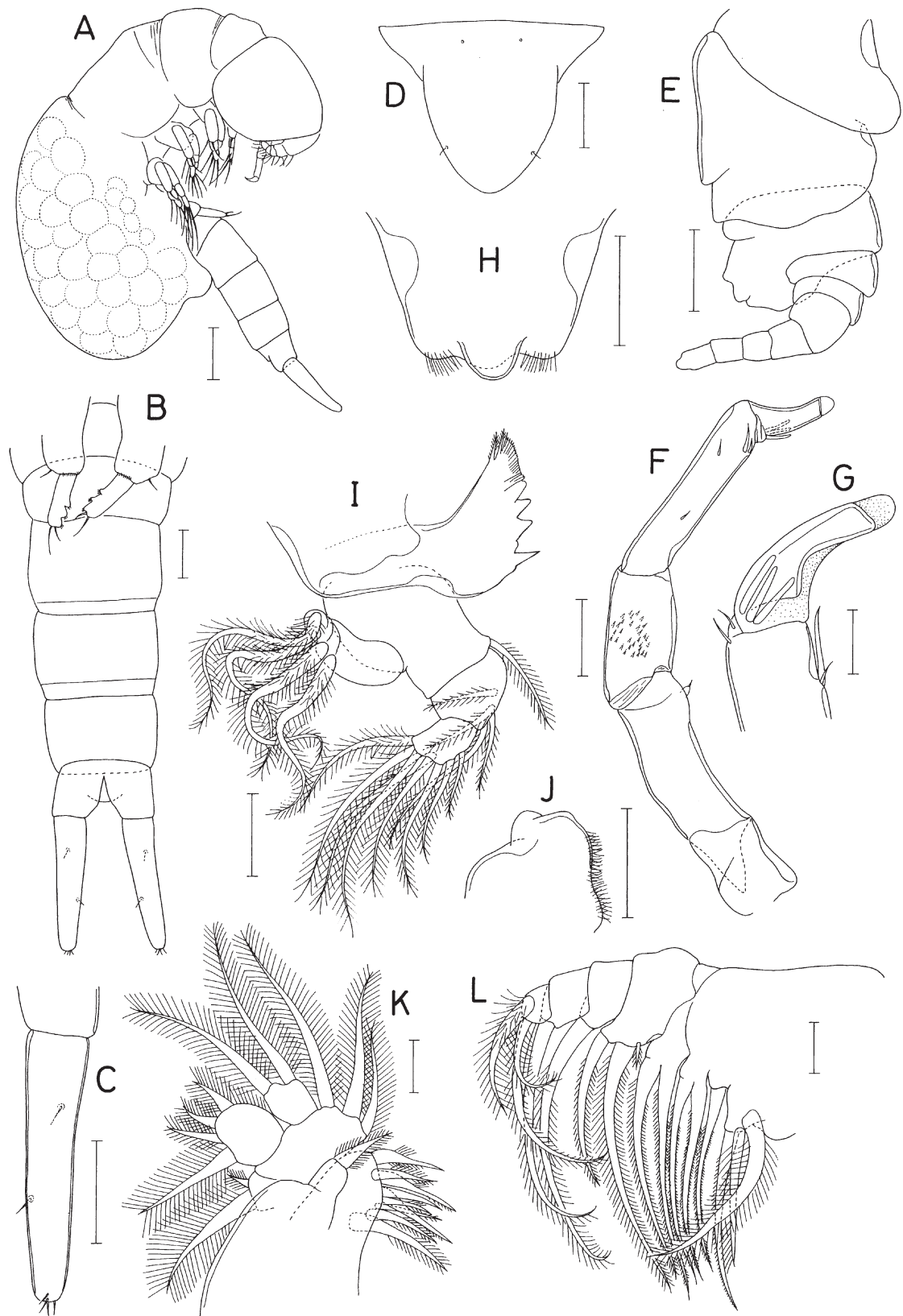
Leg 1 (Fig. 248B) similar to that of *D. humilis* but inner distal spine on basis shorter, 42  $\mu\text{m}$  long, and spinulose along distal half. Legs 2–4 lacking outer seta on basis (Fig. 248C, D); outer setae on second and third exopodal segments unilaterally pinnate along outer margin. Inner coxal seta of leg 4 sparsely pinnate and extending slightly beyond distal border of first endopodal segment. Third exopodal segment of legs 2–4 shorter than wide. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	0-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 4
Leg 4	0-1	0-0	1-1; 1-1; 2, 1, 5	0-1; 1, 3, 3

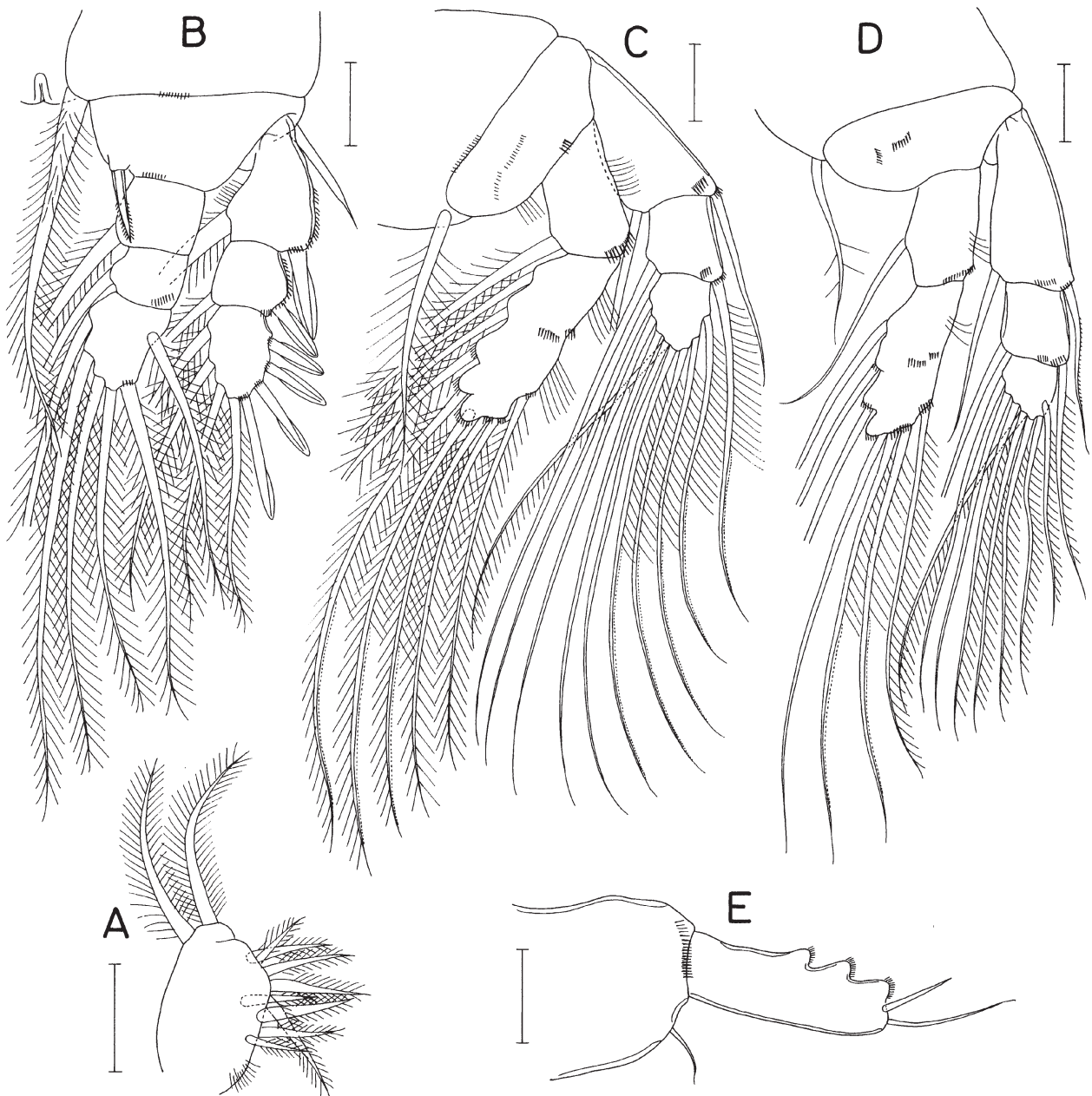
Leg 5 (Fig. 248E) extending slightly beyond ventrodistal border of genital somite. Protopod as in *D. humilis*; exopodal segment about 2.7 times longer than wide (111×41  $\mu\text{m}$ ) with wavy medial margin; armed distally with 2 setae of 70  $\mu\text{m}$  and 38  $\mu\text{m}$  in length and ornamented with 3 rows of minute spinules on medial surface.

**Male.** Unknown.

**Remarks.** *Doropygus breviuncinatus* sp. nov. resembles *D. humilis* and *D. parahumilis* sp. nov. in having a membranous hyaline fringe on the terminal claw of the antenna, but can be readily distinguished from the latter two species by: the proportional length of the caudal ramus of *D. breviuncinatus* sp. nov. is longer than that of *D. humilis*, but shorter than that of *D. parahumilis* sp. nov. In addition, the terminal claw of the antenna of *D. breviuncinatus* sp. nov. is short (55  $\mu\text{m}$  long) and truncate, in contrast to those of its two congeners, which narrow distally and are more than 70  $\mu\text{m}$  long. Finally, the basis of legs 2–4 of *D. breviuncinatus* sp. nov. lacks an outer seta which is present, although small, in both of the other two congeneric species. Other differences are summarised in Table 9.



**FIGURE 247.** *Doropygus breviuncinatus* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennular segments (with setation omitted); F, antenna; G, distal armature of antenna; H, labrum; I, mandible; J, parnath; K, maxillule; L, maxilla. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D–F, H–J, 0.05 mm; G, K, L, 0.02 mm.



**FIGURE 248.** *Doropygus breviuncinatus* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Scale bars: 0.05 mm.

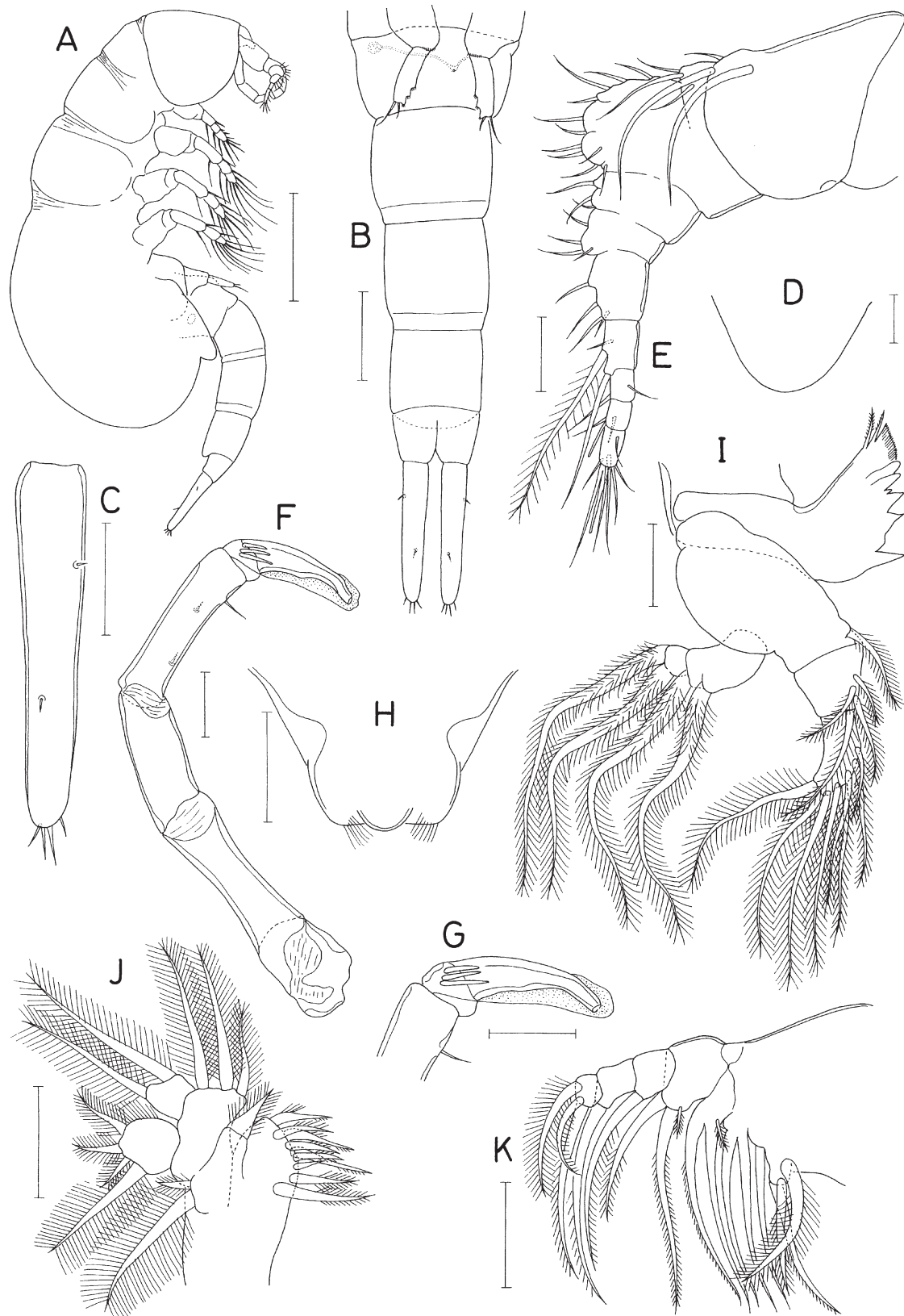
***Doropygus rectiuncinatus* sp. nov.**  
(Figs. 249, 250)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21326) from *Polycarpa pedunculata* Heller, 1878 (MNHN-IT-2008-6623 = MNHN S1/POL.B/417), Île des Pins, New Caledonia, Laboute coll., 1989.

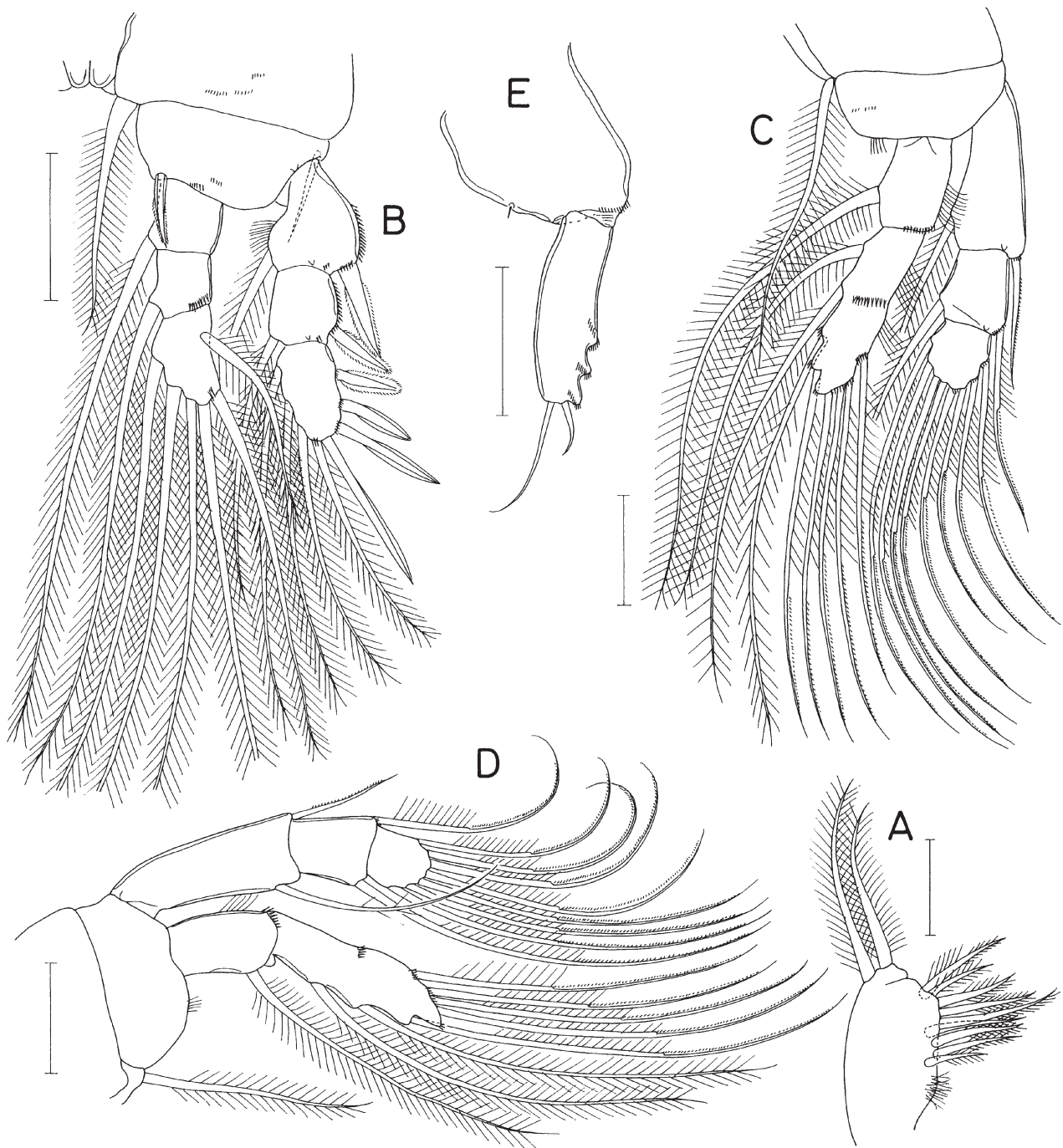
**Etymology.** The specific name is derived from the Latin *rect* (=straight) and *uncinat* (=hooked) and alludes to the almost straight terminal claw of the antenna.

**Description of female.** Body (Fig. 249A) narrow; 3.30 mm in length; prosome 2.31 mm long. Dorsal cephalic shield well-defined. Metasome incompletely 4-segmented. Fourth pedigerous somite forming brood pouch, 1.3 times longer than wide in lateral view, with rounded posterior margin. Free urosome (Fig. 249B) 5-segmented, slender, and cylindrical: genital somite 159×360µm; 4 abdominal somites 250×273, 250×236, 186×205, and 114×195 µm, respectively. Anal somite narrowing posteriorly, with deep posteromedian incision. Caudal rami parallel, not divergent (Fig. 249C), about 5.1 times longer than wide





**FIGURE 249.** *Doropygus rectiuncinatus* sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, distal part of antenna; H, labrum; I, mandible; J, maxillule; K, maxilla. Scale bars: A, 0.5 mm; B, 0.2 mm; C, 0.1 mm; D, 0.02 mm; E–K, 0.05 mm.



**FIGURE 250.** *Doropygus rectiuncinatus* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Scale bars: A, 0.05 mm; B–E, 0.1 mm.

(327×64 μm) and gradually narrowing distally: armed with 6 small setae; all setae shorter than width of ramus at base; 2 proximal setae rudimentary, positioned at 28 and 65% of ramus length.

Rostrum (Fig. 249D) short, semicircular. Antennule (Fig. 249E) 360 μm long, 9-segmented; 3 articulations between second to fifth segments indistinct; first and second segments broad; armature formula 3, 14, 3, 4, 4,

3, 2, 2+aesthetasc, and 7+aesthetasc; setae generally very small, except 2 on first segment and 2 on sixth segment (one of setae on sixth segment pinnate); all other setae naked. Antenna (Fig. 249F) slender, 4-segmented; coxa short and unarmed; basis unarmed, 145×47 μm, about 3 times longer than wide; first endopodal segment also unarmed, 93×42 μm, 2.2 times longer than wide; compound distal endopodal segment 140×36 μm, 3.9

**TABLE 9.** Morphological differences between the four species of *Doropygus* bearing a membranous hyaline fringe on the terminal claw of the antenna.

Characters	<i>D. humilis</i>	<i>D. parahumilis</i> sp. nov.	<i>D. breviuncinatus</i> sp. nov.	<i>D. rectiuncinatus</i> sp. nov.
Prosome length	2.24 mm	2.70 mm	2.05 mm	2.20 mm
L:W ratio of caudal ramus	3.1:1	5.4:1	4.2:1	5.1:1
Caudal ramus dimensions	159×52 µm	369×68 µm	284×68 µm	327×64 µm
L:W ratio of antenna enp2	4.28:1	5.82:1	4.41:1	3.89:1
Antenna enp2 dimensions	137×32 µm	192×33 µm	128×29 µm	140×36 µm
Length of terminal claw of antenna	75 µm	73 µm	55 µm	102 µm
Length ratio of claw to enp2 of antenna	0.55:1	0.38:1	0.43:1	0.73:1
Setation of mxp seg 1	9 setae	8 setae	9 setae	9 setae
L:W ratio of leg 4 exp	2.8:1	4.5:1	2.7:1	3.0:1
Dimensions of leg 4 exp	100×36 µm	165×37 µm	111×41 µm	131×44 µm
Distribution	Cosmopolitan	Djibouti	New Caledonia	New Caledonia

times longer than wide; armed with 6 small setae (distal 3 setae slightly unequal in length and positioned at base of terminal claw) plus relatively large, almost straight, terminal claw (Fig. 249G), 102 µm long, 0.73 times as long as segment, with membranous hyaline fringe along concave margin and around tip.

Labrum (Fig. 249H) bearing short, smooth posteromedian lobe; posterior margin with tuft of setules on each side. Mandible (Fig. 249I) with 5 teeth, 2 small proximal setae on coxal gnathobase, and 1 small subsidiary denticle between proximal second and third teeth: basis with 1 seta mediolaterally; exopod with 4 large setae of equal length; endopod with 4 and 8 setae on first and second segments, respectively; 4 distal setae on second endopodal segment subequal in length. Paragnath not examined. Maxillule (Fig. 249J) armed with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 4 on exopod and 2 on endopod; seta on coxal endite attenuated, more than twice as long as wide; 3 medial setae on exopod increasing in length from outer to medial, all less than half length of larger outermost seta. Maxilla (Fig. 249K) with 3 (not 2) setae on fourth endite of syncoxa, otherwise as in *D. humilis*, *D. parahumilis* sp. nov., and *D. breviuncinatus* sp. nov. Maxilliped (Fig. 250A) incompletely 2-segmented, armed with 9 setae on first segment and 2 on second.

Leg 1 (Fig. 250B) with 3-segmented rami. Inner coxal seta extending to distal border of second endopodal segment. Outer seta on basis evenly attenuated. Inner distal spine on basis slender, 49 µm long, extending just to distal border of first endopodal segment, with minute spinules along margins. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 250C, D); basis lacking outer seta; third exopodal segment wider than long. Setae on second and third exopodal segments and distal setae on second endopodal segment unilaterally pinnate along proximal half of outer margin and finely

spinulose distally. Armature formula for legs 1–4 as in *D. breviuncinatus* sp. nov.

Leg 5 (Fig. 250E) protopod with 1 rudimentary seta on outer margin and row of minute spinules at mediolateral corner: free exopodal segment about 3.0 times longer than wide (131×44 µm), armed distally with 2 unequal setae (82 and 38 µm, respectively), ornamented with 3 rows on minute spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** This is the fourth species of *Doropygus* known to have a membranous hyaline fringe along the terminal claw of the antenna, as also found in *D. humilis*, *D. parahumilis* sp. nov. and *D. breviuncinatus* sp. nov. Unlike the latter three species, *D. rectiuncinatus* sp. nov. has a nearly straight terminal claw on the antenna, which is also relatively longer (102 µm), 0.73 times as long as the compound distal endopodal segment. In comparison, the next longest terminal claw is found in *D. humilis*, which is 75 µm long but only 0.55 times as long as the segment. Other differences include; the setae on the antennule of *D. rectiuncinatus* sp. nov. are markedly smaller than those of the other three species, and the fourth endite of the maxillary syncoxa bears 3 setae rather than only 2 (the small proximal seta is lost in the other three species). The main differences between these four species are listed in Table 9.

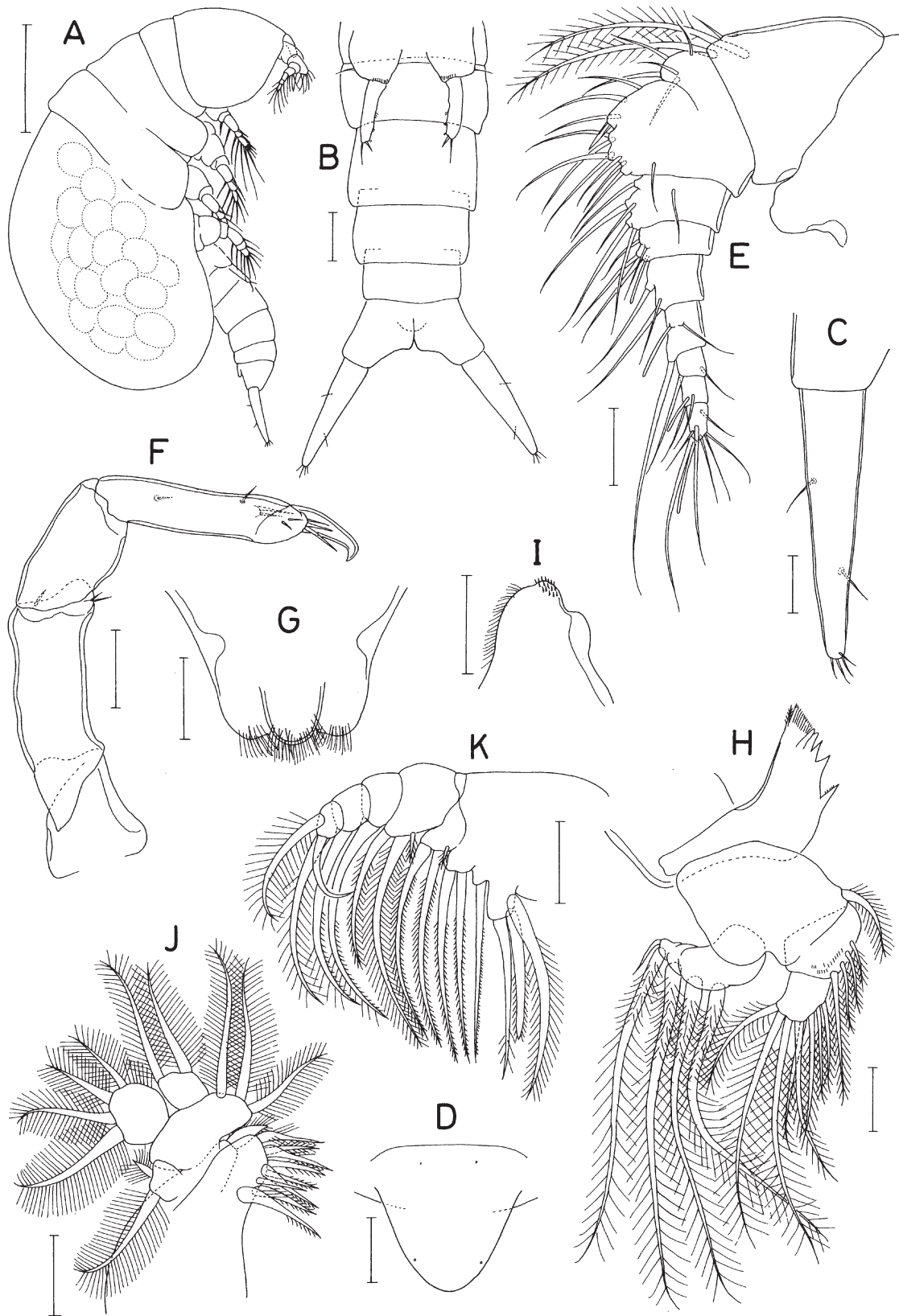
### *Doropygus pinguis* Ooishi, 1962

(Figs. 251, 252)

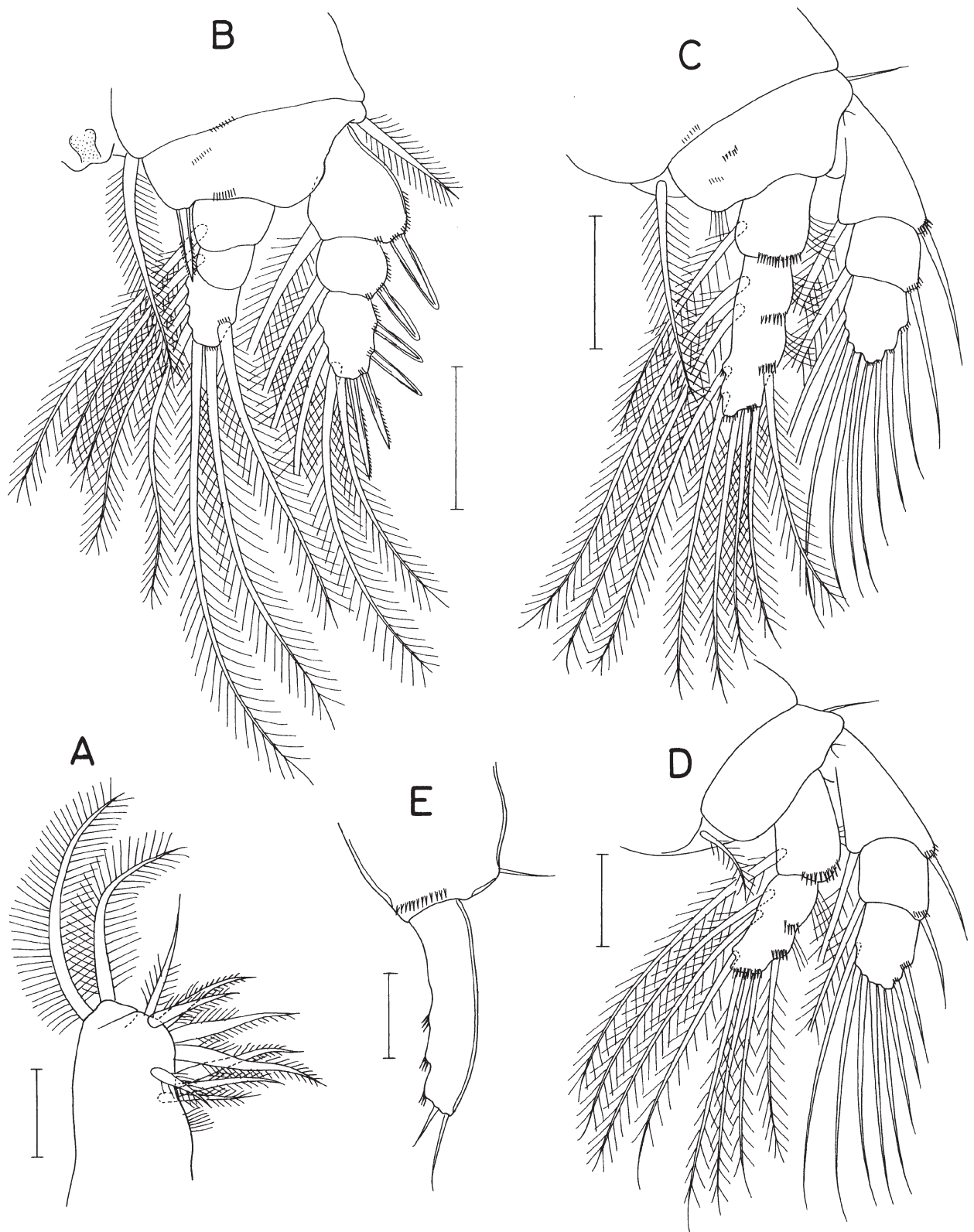
Syn.: *Doropygus pulex pinguis* Ooishi, 1962: 16, fig. 5, 6.

*Doropygus pinguis*: Seo & Lee, 1997: 550, figs. 8–10; Kim, 2012: 55, figs. 28, 29.

**Material examined.** 1 ♀ (dissected, (MNHN-IU-2017-2165) from *Polyandrocarpa zorritensis* (Van Name, 1931), Kochi, Japan, 1993.



**FIGURE 251.** *Doropygus pinguis* Ooishi, 1962, female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule; K, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C–K, 0.05 mm.



**FIGURE 252.** *Doropygus pinguis* Ooishi, 1962, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Scale bars: A, D, E, 0.05 mm; B, C, 0.1 mm.

**Description of female.** Body (Fig. 251A) stout, 2.73 mm long. Prosome 2.18 µm long, incompletely 5-segmented. Dorsal cephalic shield well-defined; metasome gradually becoming broader posteriorly. Fourth pedigerous somite swollen and forming brood pouch, about 1.3 times longer than wide in lateral view, with convex dorsal margin and broadly rounded posterior margin. Free urosome (Fig. 251B) 5-segmented: genital somite 136×300 µm; 4 abdominal somites, 164×264, 155×240, 109×205, and 136×295 µm, respectively. Anal somite wider posteriorly, strongly divergent together with caudal rami, with wide postomedian incision. Caudal ramus (Fig. 251C) evenly tapering, about 4.1 times longer than wide (236×58 µm) and about 1.7 times longer than anal somite: armed with 6 small, thin setae; outer proximal and dorsal setae positioned at 34 and 68% of ramus length, respectively.

Rostrum (Fig. 251D) weak, as long as wide, nearly semicircular. Antennule (Fig. 251E) 320 µm long, 9-segmented, tapering distally; armature formula 3, 16+spine, 6, 4+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 2 larger setae on first segment pinnate, all other setae naked. Antenna (Fig. 251F) 4-segmented; coxa unarmed; basis 120×54 µm, with 3 small setae distally, 2 inserted on small knob (representing exopod) at outer distal corner; first endopodal segment unarmed, 74×53 µm; compound distal endopodal segment 4.0 times longer than wide (120×30 µm) and as long as basis; armed with 9 small setae arranged as 1, 1, 2, 2, and 3 (all attenuated at tip) plus terminal claw about half as long as segment.

Labrum (Fig. 251G) with large, linguiform posteromedian lobe; posterior margin and lobe all densely setulose. Mandible (Fig. 251H) consisting of coxa, basis, exopod and endopod: coxa with 5 teeth and 1 small proximal seta on medial margin of gnathobase; basis with 1 seta mediodistally; exopod armed with 4 equally large setae and 1 small, vestigial seta distally; endopod incompletely articulated from basis, armed with 4 and 8 setae on first and second segments, respectively; first endopodal segment ornamented with minute spinules on ventral surface. Paragnath (Fig. 251I) as small lobe bearing patch of minute spinules apically and setules on medial margin. Maxillule (Fig. 251J) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 4 on exopod and 2 on endopod; seta on coxal endite about twice as long as wide; 4 setae on exopod increasing in length from medial to outer. Maxilla (Fig. 251K) 5-segmented, armed with 3, 1, 2, and 3 setae on first to fourth endites of syncoxa, 3 setae on basis, and 1, 1, and 3 setae, respectively, on first to third endopodal segments. Maxilliped (Fig. 252A) incompletely 2-segmented and armed with 9 setae on first segment and 2 large setae on short second segment.

Leg 1 (Fig. 252B) with 3-segmented rami; exopod distinctly longer than endopod. Outer seta on basis pinnate and evenly attenuated. Inner distal spine on basis 55 µm

long, finely spinulose along margins. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 252C, D); endopod subequal in length to exopod in legs 2 and 3, but slightly shorter in leg 4. Inner coxal seta large in legs 2 and 3, but small in leg 4. Outer seta on basis small and naked in legs 2–4. Outer setae on exopods and all setae on third exopodal segment naked in legs 2–4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 4
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 3, 3

Leg 5 (Fig. 252E) comprising protopod with 1 outer seta subdistally and row of minute spinules near base of exopod, plus free exopodal segment about 3.6 times longer than wide (127×35 µm), armed with 2 setae distally (47 and 27 µm long, respectively), ornamented with 3 rows of minute spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** This species was first described by Ooishi (1962) as a subspecies of *Doropygus pulex*, but was subsequently raised to species level by Seo & Lee (1997). The form and length of the body, and the armature of the cephalic appendages and legs of our single female specimen show no significant differences from the original description of *D. pinguis* by Ooishi (1962). There are some differences, such as the relative size of the distalmost small seta on the mandibular exopod and the pinnation of antennular setae, but these are minor.

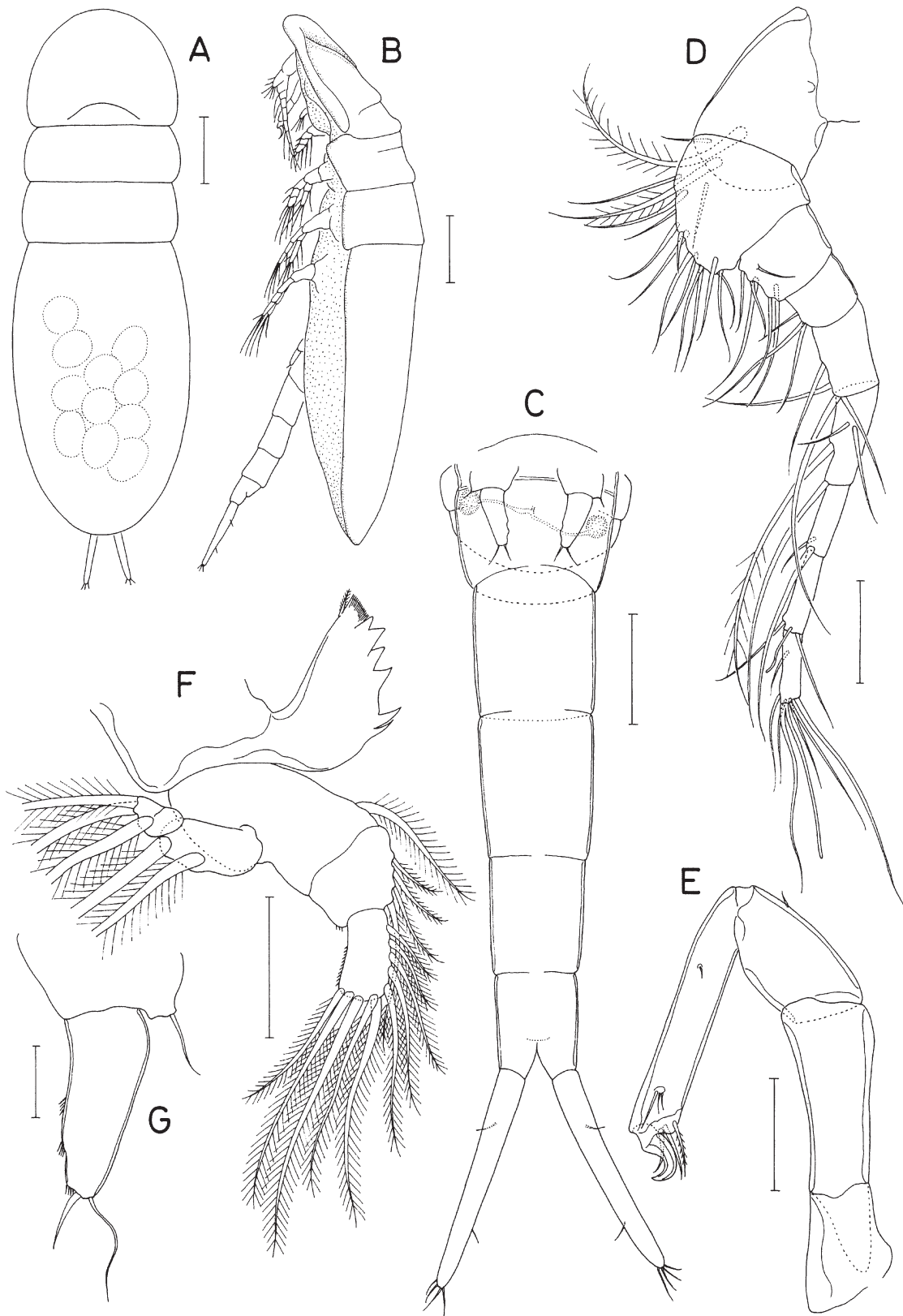
In the genus *Doropygus* only three species have the maxillule bearing 4 setae on the exopod and 2 setae on the endopod, combined with the mandibular exopod bearing 4 large setae plus a vestigial seta, as in *D. pinguis*. *Doropygus pinguis* is distinguished from these congeners (*D. humilis*, *D. louisiae* Jones, 1979, and *D. parahumilis* **sp. nov.**) by having a typical terminal claw on the antenna (cf. the claw is fringed with a membranous hyaline fringe in both *D. humilis* and *D. parahumilis* **sp. nov.**), by the presence of 8 setae on the second endopodal segment of the mandible (7 setae in *D. louisiae* according to Jones, 1979), and 9 setae on the first maxilliped segment (8 setae in *D. louisiae* and *D. parahumilis* **sp. nov.**).

### *Doropygus depressus* Stock, 1967

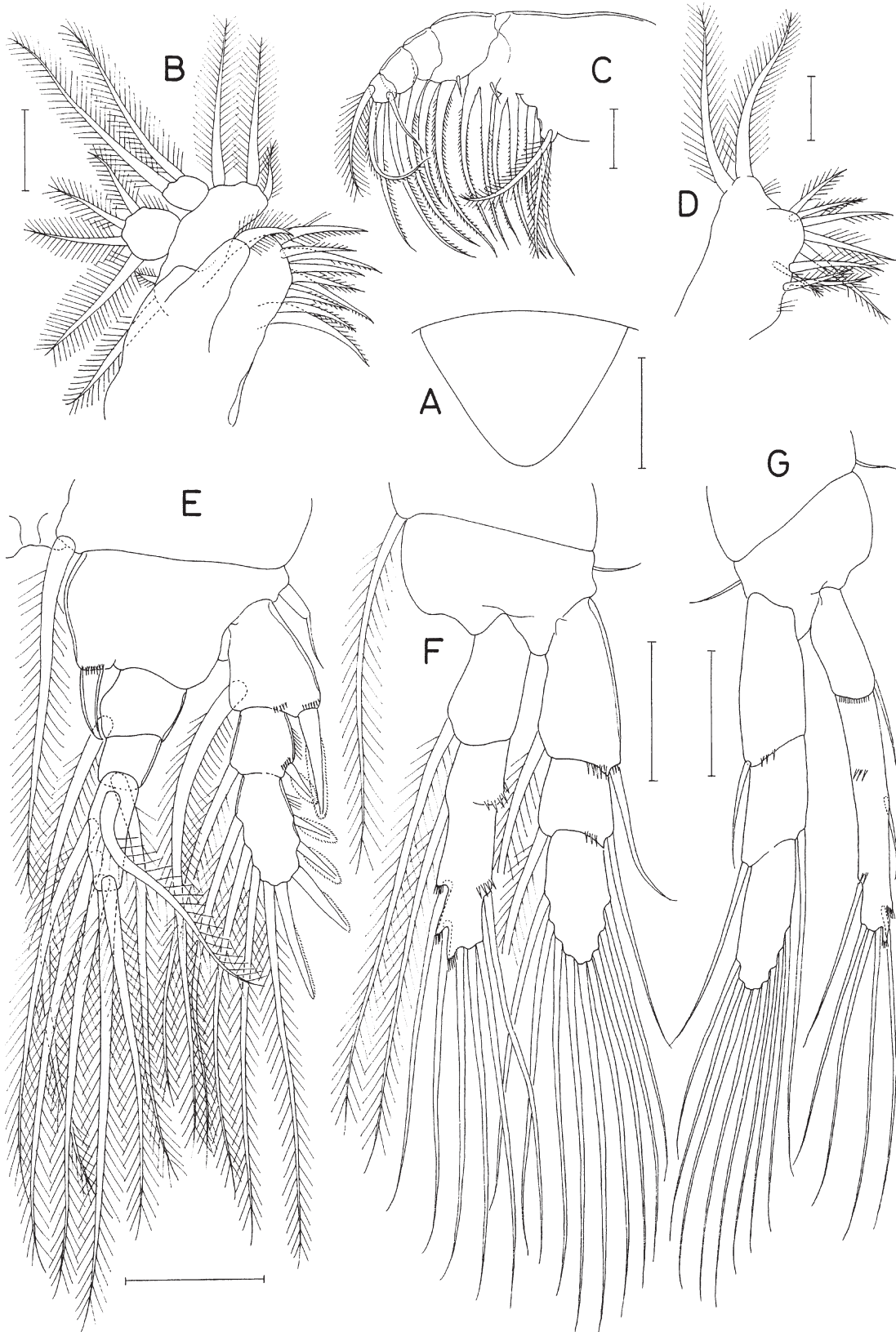
(Figs. 253, 254)

**Material examined.** 20 ♀♀ (MNHN-IU-2018-1874) and 1 dissected ♀ from *Herdmania momus* (Savigny, 1816), Muscat, Gulf of Oman; 12 ♀♀ (MNHN-IU-2018-1875) and 2 dissected ♀♀ (figured) from *Herdmania coutieri* Monniot C., 2002, Bahrain (26°12.47'N, 50°58.14'E) depth 5 m, 25 October 1994.

**Description of female.** Body (Fig. 253A, B)



**FIGURE 253.** *Doropygus depressus* Stock, 1967, female. A, habitus, dorsal; B, habitus, left; C, urosome, ventral; D, antennule; E, antenna; F, mandible; G, leg 5. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D–F, 0.05 mm; G, 0.02 mm.



**FIGURE 254.** *Doropygus depressus* Stock, 1967, female. A, rostrum; B, maxillule; C, maxilla; D, maxilliped; E, leg 1; F, leg 2; G, leg 4. Scale bars: A, 0.1 mm; B–D, 0.02 mm; E–G, 0.05 mm.



extremely dorsoventrally flattened: body length 1.74 mm. Prosome 1.62 mm, 4-segmented, consisting of cephalothorax and second to fourth pedigerous somites well defined by lateral constrictions, but dorsal suture lines faint. Cephalothorax 363×467 µm, more depressed than metasome. Second and third pedigerous somites 178×480 and 185×480 µm, respectively. Fourth pedigerous somite forming elongate brood pouch, 889×548 µm, 1.62 times longer than wide; brood pouch concealing most of urosome in dorsal view, with only tips of caudal rami visible. Fifth pedigerous somite not articulated from fourth, expanded posterodorsally. Urosome (Fig. 253C) slender, gradually narrowing towards posterior end, indistinctly 6-segmented: genital somite 94×150 µm; 4 abdominal somites 120×113, 130×107, 107×89, and 91×79 µm, respectively. Anal somite slightly narrowing posteriorly, with deep posteromedian incision. Caudal rami (Fig. 253C) divergent, elongate; each ramus about 7.9 times longer than wide (204×26 µm) and about 2.2 times longer than anal somite; armed with 6 thin setae, 2 proximal setae positioned at 23 and 72% of ramus length.

Rostrum (Fig. 254A) triangular with rounded apex. Antennule (Fig. 253D) slender, 360 µm long, as long as cephalothorax, and 9-segmented; armature formula 3, 14, 6, 3, 4, 4, 2, 2+aesthetasc, and 7+aesthetasc; 2 pinnate setae on first segment and 1 on sixth. Antenna (Fig. 253E) slender and 4-segmented; coxal and basis unarmed; first endopodal segment with 1 small seta subdistally; compound distal endopodal segment about 5.6 times longer than wide (111×20 µm); armed with about 7 small setae plus small terminal claw, about 0.3 times as long as segment.

Labrum with shallow posteromedian lobe; posterior margin with setules on both sides. Mandible (Fig. 253F) with 5 teeth, 1 subsidiary tooth on distal side of distalmost tooth, and 1 small proximal seta on coxal gnathobase: basis with 1 large seta subdistally on medial margin; exopod with 5 equally large setae; endopod 2-segmented; first segment with 4 setae on medial margin and several spinules on outer distal corner; second segment with 10 setae, 5 on medial and 5 on distal margins, and fine spinules along outer margin. Maxillule (Fig. 254B) armed with 9 setae on arthrite, 1 on coxal endite, 2 on coxal epipodite, 3 on basis, 4 on exopod, and 2 on endopod; proximal seta on basis shorter than distal 2 setae; 4 setae on exopod increasing in length from medial to outer. Maxilla (Fig. 254C) armed with 9 setae on syncoxa (arranged as 3, 1, 2, and 3), 3 on basis, and 1, 1, and 4 on first to third endopodal segments. Maxilliped (Fig. 254D) unsegmented but with short trace of suture subdistally on medial side; armed with 9 medial and 2 large apical setae.

Leg 1 (Fig. 254E) with 3-segmented rami. Outer seta on basis broad proximally and flagellate distally. Inner distal spine on basis robust, smooth, extending to

distal border of first endopodal segment. First exopodal segment much broader than distal segments; outer spine large, extending to base of first outer spine of third exopodal segment. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 254F, G). Inner coxal seta large in legs 2 and 3, but rudimentary in leg 4. Outer seta on basis small and naked in legs 2–4. Most setae on legs 2 and 3, and all setae on leg 4 naked, except 2 inner proximal setae on both rami of legs 2 and 3. Second endopodal segment of legs 2 and 3 armed with 7 setae, that of leg 4 with 6 setae. First exopodal segment of leg 4 lacking inner seta; endopod of leg 4 slender. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 3
Leg 4	0-1	1-0	1-0; 1-1; 2, 1, 5	0-1; 1, 3, 2

Leg 5 (Fig. 253G) rather small: protopod with small seta at outer distal corner; free exopodal segment gradually narrowing distally, 3.5 times longer than wide (53×22 µm), armed distally with 2 setae (17 and 33 µm long), ornamented with 3 rows on minute spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** As Stock (1967) mentioned in his original description, the habitus of this species is very unusual in having an extremely flattened prosome. His description regarding the armature of the mandible, maxillule, and maxilliped is revised in the above redescription. One of the two samples we examined was obtained from the type host, *Herdmania momus* collected in the Gulf of Oman, not far from the type locality in the Red Sea

#### Group D (maxillae with 3 setae on exopod and 2 setae on endopod)

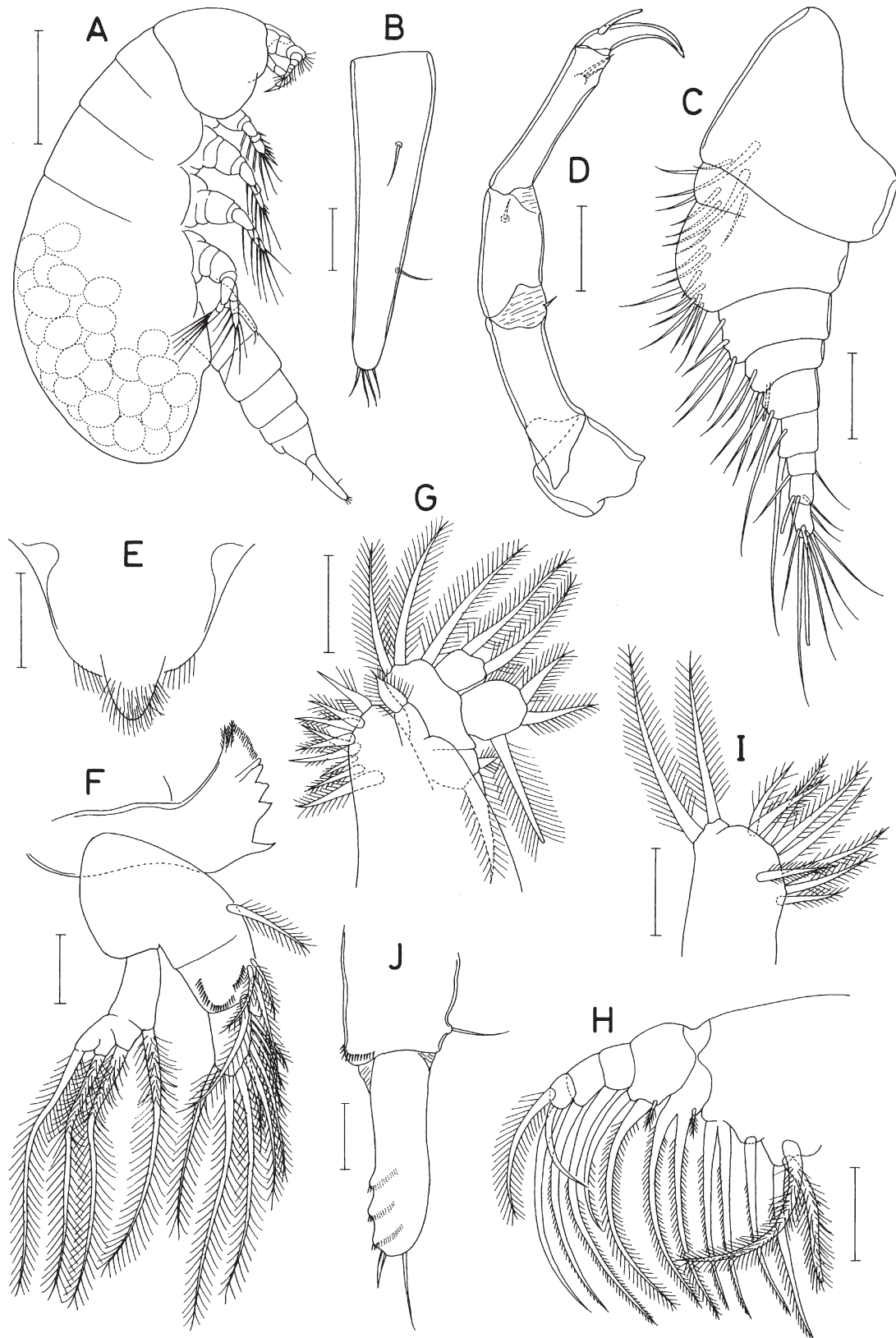
##### *Doropygus corsu* sp. nov.

(Figs. 255, 256)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21327) and dissected paratype (♀, figured) from *Molgula amesophleba* (Codreanu & Mack-Fira, 1956), Porto Vecchio, Corsica, Monniot coll.

**Etymology.** The specific name means pertaining to Corsica in the Mediterranean.

**Description of female.** Body (Fig. 255A) 2.90 mm long. Prosome 2.04 mm long, gradually increasing in width posteriorly, with gently arched dorsal margin. Dorsal cephalic shield well-defined posteriorly and expanded ventrolaterally. Metasome incompletely 4-segmented. Fourth pedigerous somite forming brood pouch about 1.5 times longer than wide in lateral view, with rounded posterior margin. Free urosome 5-segmented. Caudal ramus (Fig. 255B) 3.8 times longer than wide (261×69



**FIGURE 255.** *Doropygus corsu* sp. nov., female. A, habitus, right; B, left caudal ramus, lateral; C, antennule; D, antenna; E, labrum; F, mandible; G, maxillule; H, maxilla; I, maxilliped; J, leg 5. Scale bars: A, 0.5 mm; B–J, 0.05 mm.

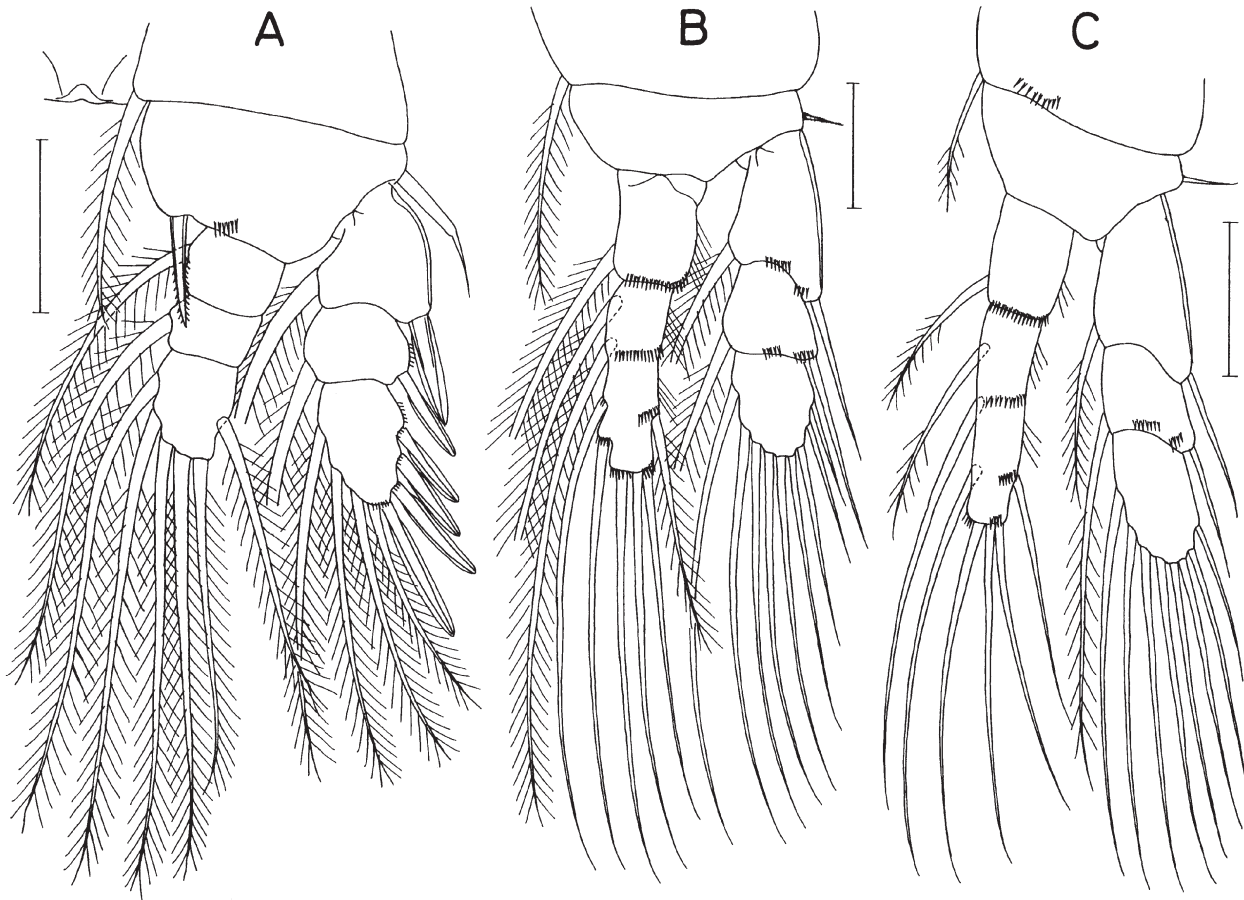


FIGURE 256. *Doropygus corsu* sp. nov., female. A, leg 1; B, leg 2; C, leg 4. Scale bars: 0.1 mm.

$\mu\text{m}$ ) and about 1.5 times longer than anal somite, gradually narrowing distally: armed with 6 small setae; setae at most half width of ramus at base; 2 proximal setae located at 30 and 69% of ramus length.

Rostrum short and semicircular. Antennule (Fig. 255C) about  $310\ \mu\text{m}$  long, 9-segmented, tapering; armature formula 3, 16, 5, 4+aesthetasc, 3, 2, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked and typically short. Antenna (Fig. 255D) slender, 4-segmented, including unarmed coxa; basis  $84 \times 36\ \mu\text{m}$  with 1 small seta distally; first endopodal segment  $65 \times 37\ \mu\text{m}$ , with 1 small seta subdistally; compound distal endopodal segment about 4.2 times longer than wide ( $93 \times 22\ \mu\text{m}$ ); armed with 2 setae subdistally plus terminal claw  $62\ \mu\text{m}$  long, 0.67 times as long as segment, with 1 blunt seta proximally.

Labrum (Fig. 255E) densely ornamented with setules along posterior margin; posteromedian lobe linguiform and densely setulose. Mandible (Fig. 255F) similar to that of *D. pulex*; exopod armed with 4 large setae; first endopodal segment armed with 4 setae and ornamented with curved row of fine spinules on ventral surface; second endopodal segment with 9 setae. Maxillule (Fig. 255G) with 9 setae on arthrite, 1 on coxal endite, 2 on

epipodite, 3 on exopod, and 2 on endopod; seta on coxal endite broad, twice as long as wide, pointed at tip; outer seta on exopod with blunt tip. Maxilla (Fig. 56H) as in *D. pulex*, armed with 9 setae on syncoxa, 3 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively. Maxilliped (Fig. 255I) with short trace of articulation mediodistally, armed with 9 setae medially and 2 setae apically.

Leg 1 (Fig. 256A) with 3-segmented rami. Outer seta on basis naked, flagellate distally. Inner distal spine on basis  $59\ \mu\text{m}$  long, extending to middle of second endopodal segment. Outer spines on exopod fringed with membrane along both margins. Legs 2–4 with 3-segmented exopods and 2-segmented endopods; exopods and endopods subequal in length (Fig. 256B, C). Inner coxal seta of leg 4 smaller than that of legs 1–3, but pinnate as in legs 1–3. Outer setae on exopods and distal setae on both rami naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 4
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 3, 2

Leg 5 (Fig. 255J) similar to that of *D. pulex*; protopod with 1 outer seta and distal row of spinules; free exopodal segment about 3.6 times longer than wide (154×43 µm), with rounded distal margin, armed with 1 spine and 1 seta distally; ornamented with 3 rows of fine spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** There are two species in *Doropygus* which have a combination of 3 setae on the exopod and 2 setae on the endopod of the maxillule: *D. reductus* Stock, 1970 known from the West Indies (Stock, 1970) and *D. schellenbergi* Illg, 1958 known from off the Atlantic coast of Georgia, United States of America (Illg, 1958). As Stock (1970) illustrated, *D. reductus* has a *Notodelphys*-like body form, 2 and 8 setae, respectively, on the first and second endopodal segments of the mandible, a blunt, bulbous seta on the coxal endite of the maxillule, 9 setae on the maxilliped (8 medial and 1 outer subdistal), a 2-segmented endopod of leg 1, and 2 large setae distally on the free exopodal segment of leg 5. In all these features *D. reductus* clearly differs from *D. corsu* **sp. nov.**, as described above.

The armature of the mandible and maxilliped of *D. schellenbergi* are uncertain, because in its original description this species was said to have 4 and 7 setae, respectively, on the first and second endopodal segments of the mandible, and 8 setae on the medial margin of the maxilliped. However, the accompanying illustrations show 3 and 9 setae on the mandibular endopod and 7 setae on the medial margin of the maxilliped. This inconsistency makes comparisons problematic, however, in *D. schellenbergi* the free exopodal segment of leg 5 tapers in the distal quarter, as described and illustrated by Illg (1958). Using this character, *D. schellenbergi* is easy to separate from *D. corsu* **sp. nov.**

### ***Doropygus callosus* sp. nov.**

(Figs. 257, 258)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21328), paratypes (3 intact ♀♀, MNHN-IU-2014-21329), and dissected paratypes (2 ♀♀, figured) from *Eusynstyela floridana* (Van Name, 1921) (MNHN-IT-2008-4366 = MNHN S1/POL.A/11), Basse-Terre, Guadeloupe, depth 20 m, J. Vacelet coll., 07 April 1981.

**Etymology.** The specific name is from the Latin *callo* (=thick-skinned) and refers to the thick sclerotization of the body.

**Description of female.** Body (Fig. 257A) stout, slightly compressed. Body length 2.55 mm: prosome 2.10 mm long. Dorsal cephalic shield well-defined. Metasome obscurely 4-segmented, broadening posteriorly. Fourth pedigerous somite strongly expanded to form brood pouch, as long as anterior part of prosome and 1.2 times longer than wide in lateral view, with rounded posterior

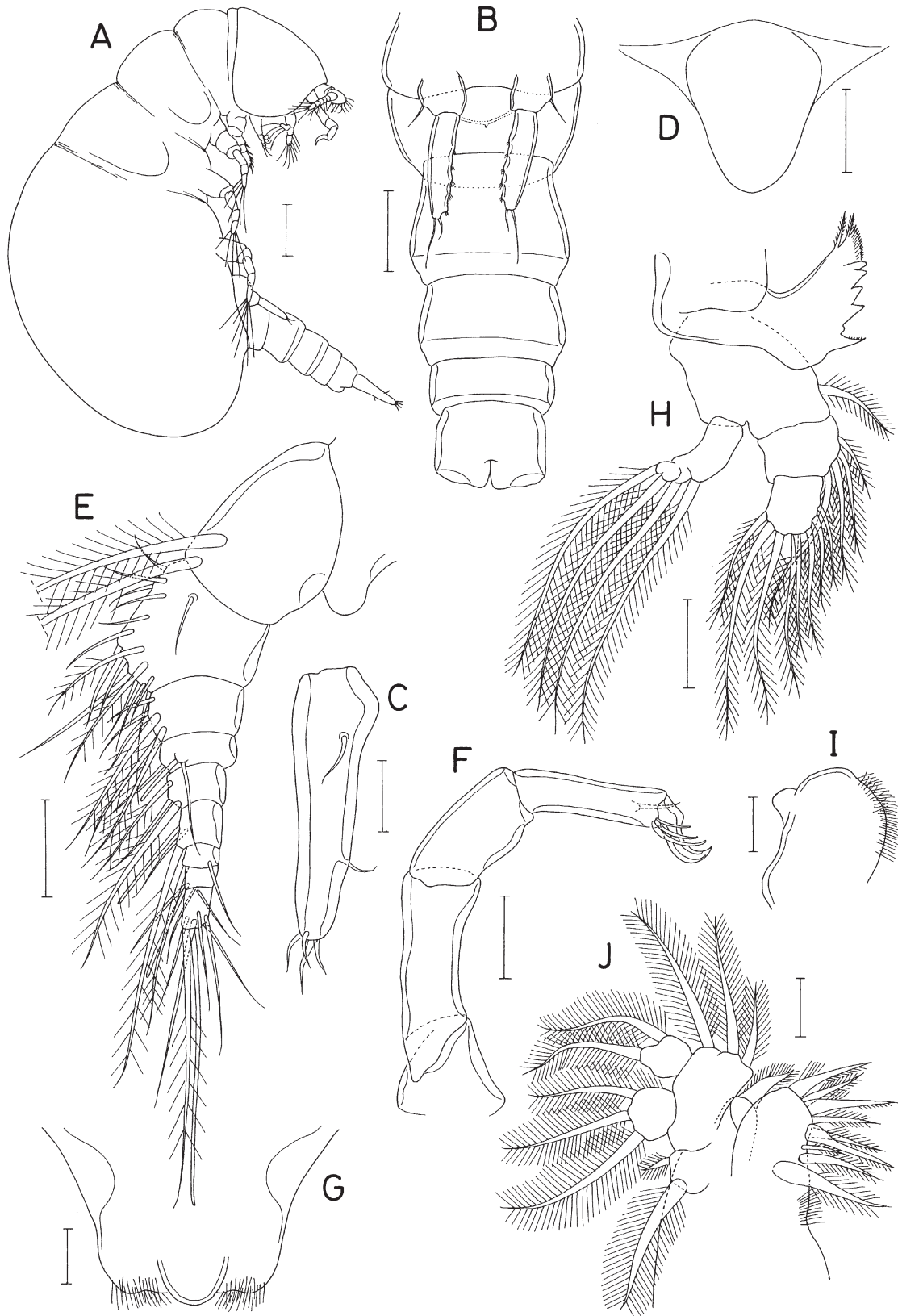
margin. Free urosome (Fig. 257B) well-sclerotized, 5-segmented: genital somite narrowing posteriorly, 120×240 µm; 4 abdominal somites 143×202, 102×200, 59×184, and 91×139 µm, respectively. First abdominal somite broader posteriorly. Anal somite with short posteromedian incision. Caudal ramus (Fig. 257C) about 3.2 times longer than wide (194×61 µm) and more than twice as long as anal somite, heavily sclerotized, with rounded swelling proximally on ventral margin: armed with 6 small setae, all less than 0.2 times as long as ramus and shorter than maximum width of ramus.

Rostrum (Fig. 257D) small, weak, 103×82 µm, tapering towards rounded apex. Antennule (Fig. 257E) relatively slender, about 260 µm long, 9-segmented; armature formula 2, 16, 6, 2+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae crowded, many densely pinnate. Antenna (Fig. 257F) 4-segmented; coxa short; basis 102×47 µm, unarmed; first endopodal segment 68×44 µm, also unarmed; compound distal endopodal segment slender, 3.3 times longer than wide (86×26 µm); armed with 4 setae (1 subdistal and 3 distal) plus strongly curved terminal claw, 50 µm long, 0.58 times as long as segment.

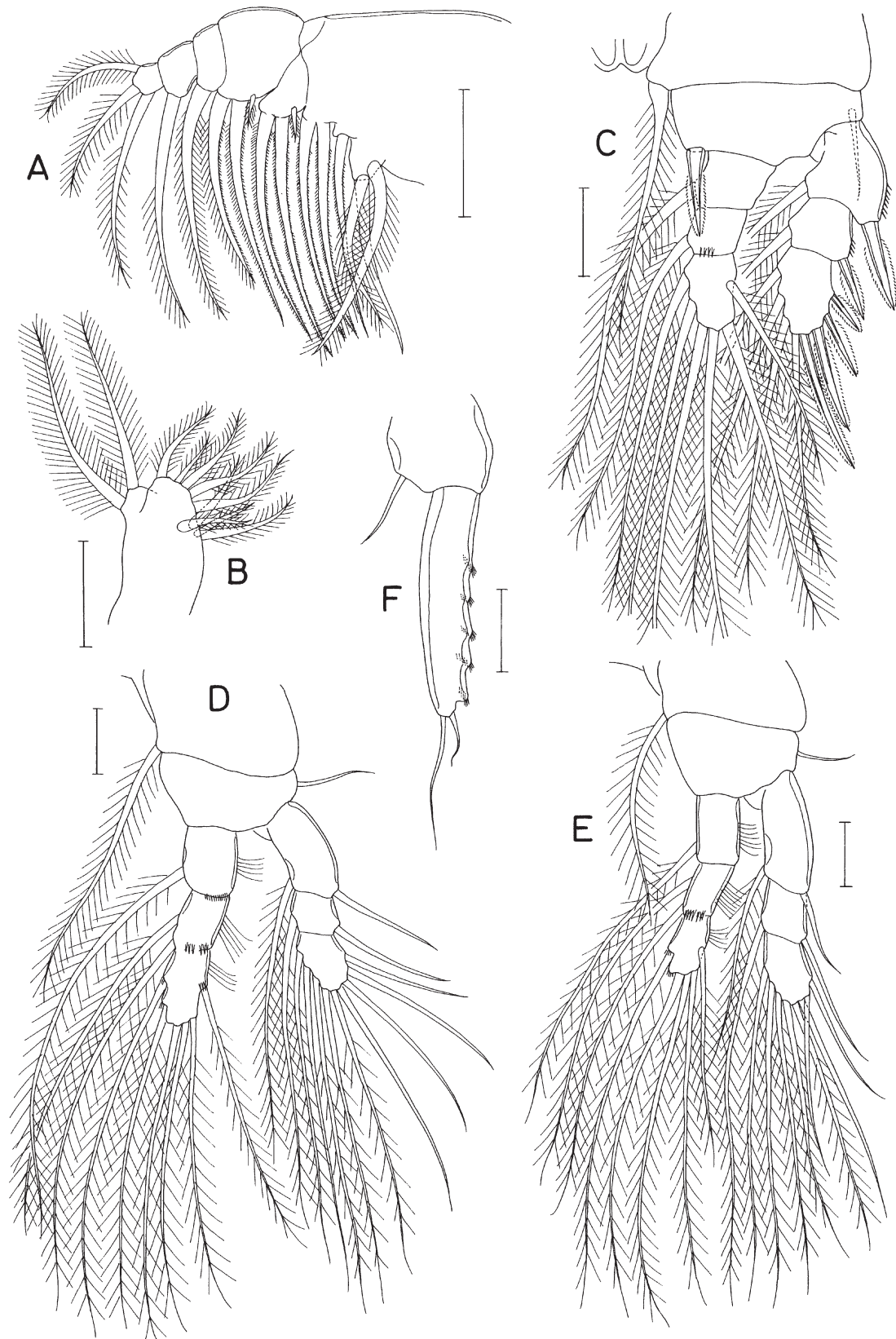
Labrum (Fig. 257G) with large, smooth posteromedian lobe and setulose posterior margin. Mandible (Fig. 257H) with 5 teeth and 2 small proximal setae on coxal gnathobase; basis with 1 seta on medial margin; exopod slender, armed with 4 large, subequal setae; endopod armed with 4 and 8 setae on first and second segments, respectively; outermost distal seta on second endopodal segment about half as long as adjacent seta. Paragnath (Fig. 257I) with distinct outer subdistal lobule and dense setules on medial margin. Maxillule (Fig. 257J) armed with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on medial margin of basis, 3 on exopod and 2 on endopod; seta on coxal endite about twice as long as wide. Maxilla (Fig. 258A) armed with 9 setae on syncoxa, 3 on basis, and 1, 1, and 3 on first to third endopodal segments, respectively; distal seta on basis 0.8 times as long as middle seta. Maxilliped (Fig. 258B) incompletely 2-segmented with 9 setae on first segment and 2 large setae on short second segment.

Leg 1 (Fig. 258C) with 3-segmented rami. Outer seta on basis evenly attenuated. Inner distal spine on basis 52 µm long, extending to middle of second endopodal segment, with serrate margins. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 258D, E), but with compound second endopodal segment bearing trace of suture line as vestige of original segmentation. Outer seta on basis small and naked. Inner coxal seta of leg 4 large, pinnate, only slightly shorter than that of legs 2 and 3. Outer setae on exopods naked; all other setae pinnate. Armature formula for legs 1–4 as in *D. corsu* **sp. nov.**

Leg 5 (Fig. 258F) extending to middle of genital somite: protopod unornamented, but armed with outer margin seta; free exopodal segment elongate, about 4.3 times longer



**FIGURE 257.** *Doropygus callosus* sp. nov., female. A, habitus right; B, urosome, ventral (caudal rami omitted); C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C–F, H, 0.05 mm; G, I, J, 0.02 mm.



**FIGURE 258.** *Doropygus callosus* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.05 mm.

than wide (136×32 µm) with nearly parallel margins; armed distally with 2 unequal setae, and ornamented with 5 rows of minute spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** *Doropygus callosus* **sp. nov.** shares the possession of a maxillule bearing 3 setae on the exopod and 2 setae on the endopod with *D. reductus*, *D. schellenbergi*, and *D. corsu* **sp. nov.** It is distinguishable from *D. reductus* by the possession of a 4-segmented abdomen (cf. 3-segmented abdomen in *D. reductus*), 4 setae on the first endopodal segment of the mandible (cf. 2 setae in *D. reductus*), 11 setae on the maxilliped (cf. 9 setae in *D. reductus*), and a 3-segmented endopod on leg 1 (cf. 2-segmented in *D. reductus*). It can be separated from *D. schellenbergi* by the possession of short setae on the caudal ramus (according to Illg, 1958, the longest distal caudal seta in *D. schellenbergi* is more than a third as long as ramus), and 11 setae on the maxilliped (10 or fewer in *D. schellenbergi*). Finally, *D. callosus* **sp. nov.** can be distinguished from *D. corsu* **sp. nov.** by the possession of long, pinnate setae on the antennule (setae short and naked in *D. corsu* **sp. nov.**), 8 setae on the second endopodal segment the mandible (9 setae in *D. corsu* **sp. nov.**), a thin, evenly attenuating outer seta (seta flagellate distally in *D. corsu* **sp. nov.**) on the basis of leg 1, and in having a narrower exopodal segment on leg 5.

### *Notopygus* **gen. nov.**

**Diagnosis.** Body of female inflated; prosome bulbous, indistinctly segmented. Brood pouch occupying most of metasome. Free urosome 5-segmented in female and 6-segmented in male. Caudal ramus with 6 armature elements, at least one transformed to spine. Antennule 9- or 10-segmented with 3 setae on first segment. Antenna 4-segmented including coxa, basis, and 2-segmented endopod; exopod reduced to small knob with minute setal vestiges, or absent. Mandible consisting of coxa, basis, exopod, and endopod; exopod armed with 4 large setae, and endopod with 4 and 10 setae on first and second segments, respectively. Maxillule armed with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, and 3 on each basis and endopod; exopod with 3 setae and additional setal vestige. Maxilla with well-developed claw on basis. Maxilliped obscurely 2-segmented with 9 setae on first segment and 2 setae on second. Leg 1 with 3-segmented exopod and 2- or 3-segmented endopod; outer seta on basis small as in legs 2–4. Legs 2–4 each with 3-segmented exopod and 2-segmented endopod; exopods bearing setae or setiform spines as outer armature elements. Third exopodal segment of leg 4 armed with 9 elements as in legs 2 and 3. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1, 1, 2, 4

Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1, 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 4

Leg 5 consisting of protopod fused with pedigerous somite and free exopod armed with 1 spine and 1 seta distally.

**Etymology.** From Greek *noto* (“southern”) and *pygus*, the ending of many genera in the Notodelphyidae. It alludes to the South African distribution of the three known species of the genus. Gender masculine.

**Type species.** *Notopygus unispinatus* **gen. et sp. nov.** by original designation.

**Other included species.** *Notopygus trispinatus* **gen. et sp. nov.** and *N. minutispinatus* **gen. et sp. nov.**

**Remarks.** *Notopygus* **gen. nov.** can be separated from the closely related genus *Doropygus* by three main characters states: (1) one or more of the setal elements on the caudal ramus is transformed into a spine; (2) the metasome is swollen and bulbous; and (3) the third exopodal segment of leg 4 bears a total of 9 (rather than 8) armature elements. The last of these character states appears to be plesiomorphic relative to the state exhibited in *Doropygus* species.

### *Notopygus unispinatus* **gen. et sp. nov.**

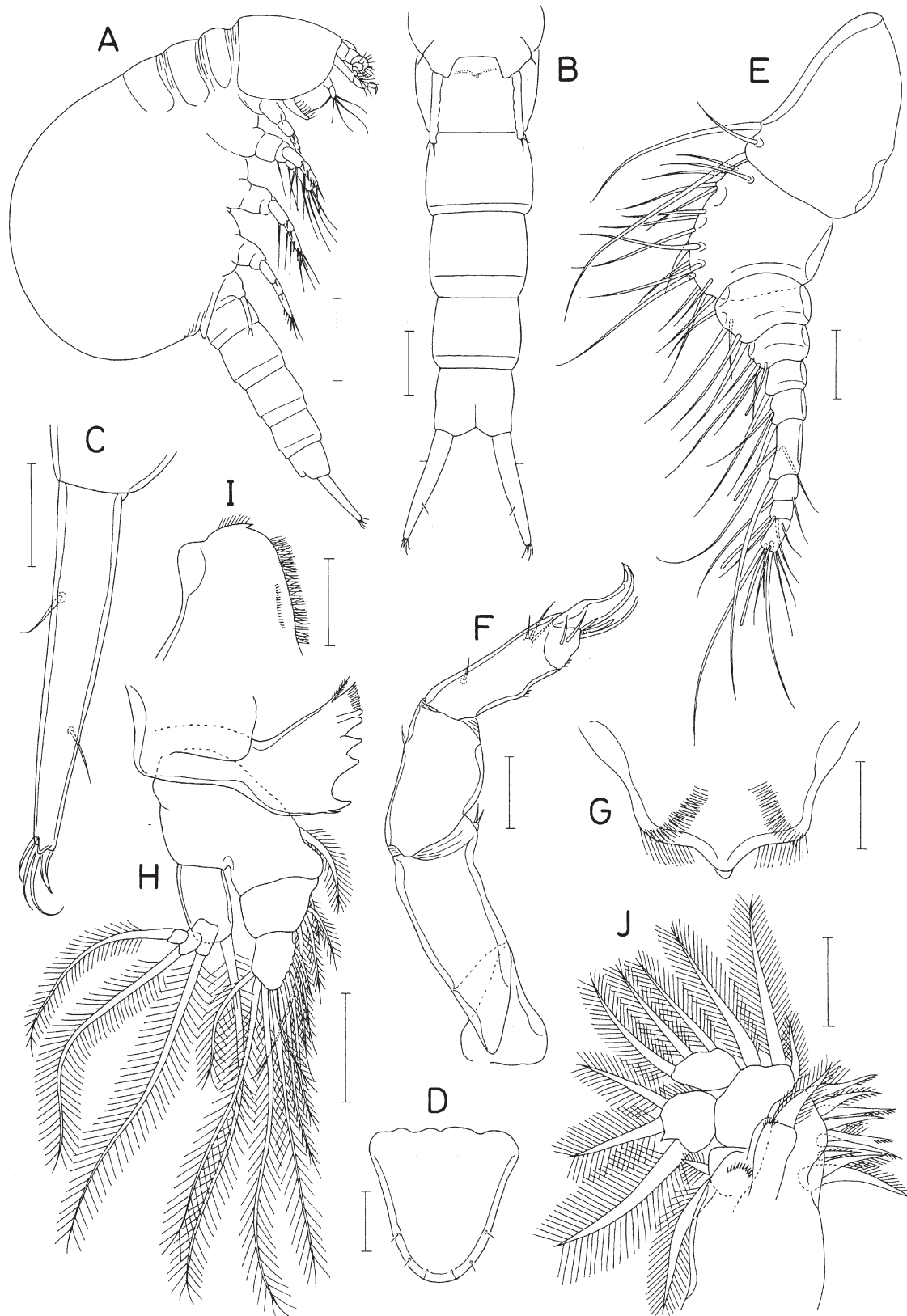
(Figs. 259–261)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21330), allotype (♂, MNHN-IU-2014-21331), paratypes (35 intact ♀♀, MNHN-IU-2014-21332), and dissected paratypes (2 ♀♀, 1 ♂, figured) from *Ascidia multitentaculata* (Hartmeyer, 1912), Saldana Bay Harbour, South Africa, SAA 67, Griffiths coll., 28 August 1994.

**Etymology.** The specific name is from the Latin *uni* (=single) and *spin* (=spine), referring to the presence of a single spine on the caudal ramus.

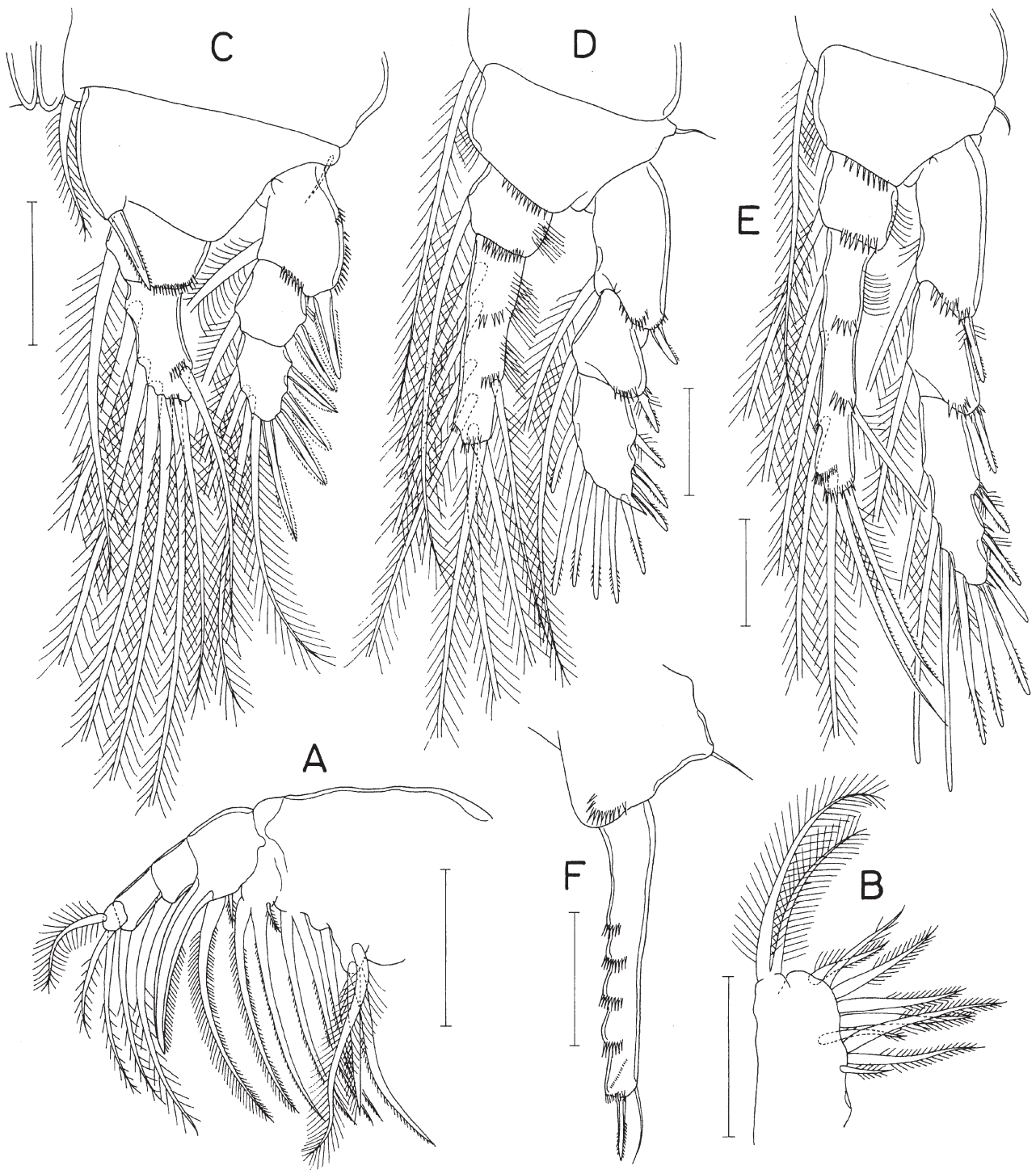
**Description of female.** Body (Fig. 259A) compressed, 4.21 mm long; prosome 2.53 mm long. Dorsal cephalic shield well-defined; metasome indistinctly segmented, bulbous, distinctly broadening posteriorly, retaining vestiges of 3 tergites. Globular brood pouch formed by markedly inflated third and fourth pedigerous somites, much longer than anterior part of prosome. Free urosome (Fig. 259B) slender, cylindrical, 5-segmented: genital somite 260×385 µm; 4 abdominal somites 262×335, 262×302, 225×280, and 210×247 µm, respectively. Anal somite with nearly parallel lateral margins and shallow posteromedian incision. Caudal ramus (Fig. 259C) slender, 5.9 times longer than wide (377×64 µm) but gradually narrowing distally, with 1 small tubercle distally; armed with 5 setae; outer proximal and dorsal setae positioned at 31 and 65% of ramus length, respectively; 3 distal setae unequal in length; distal spine 40 µm long, articulated at base.

Rostrum (Fig. 259D) 129×127 µm, well-sclerotized, narrowing distally towards rounded apical margin bearing

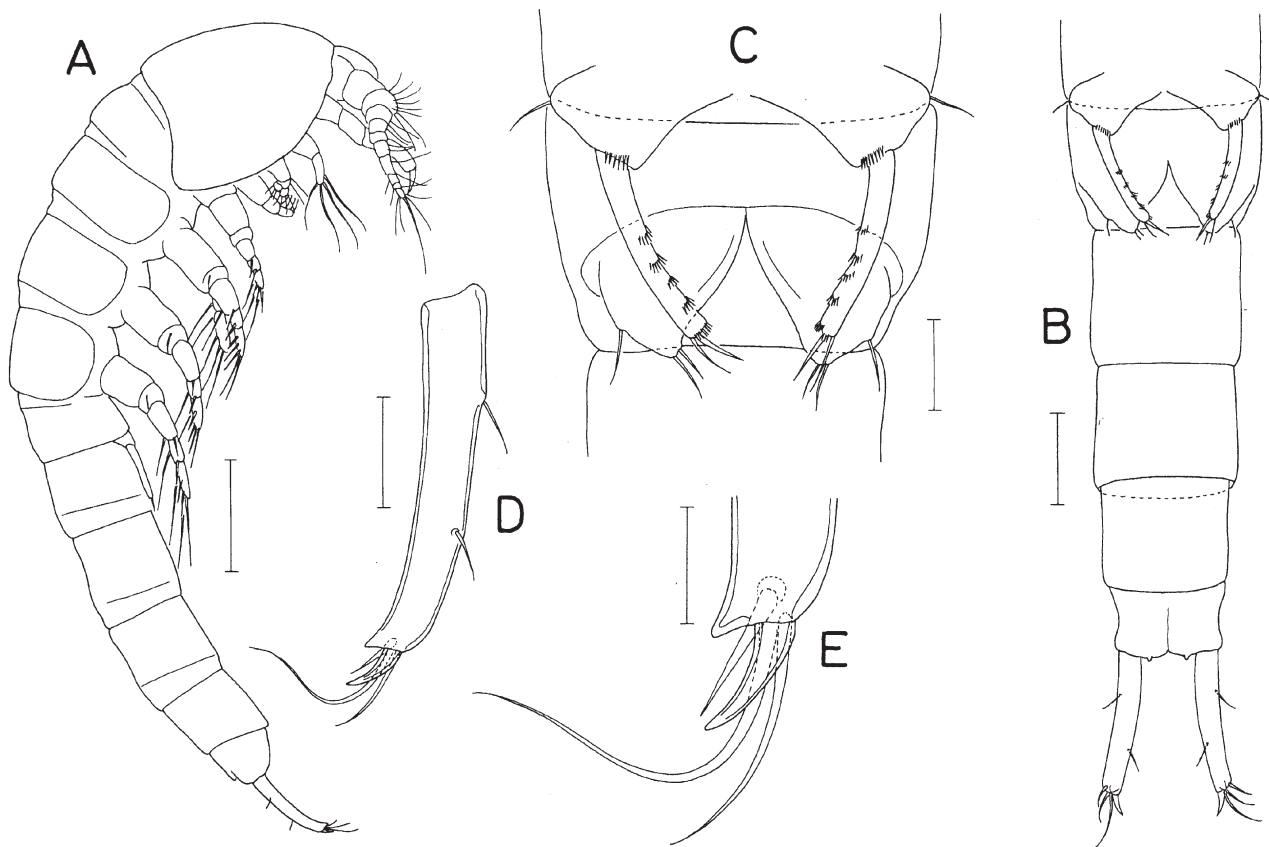


**FIGURE 259.** *Notopygus unispinatus* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, parnath; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, H, 0.1 mm; D–G, I, J, 0.05 mm.





**FIGURE 260.** *Notopygus unispinatus* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.1 mm.



**FIGURE 261.** *Notopygus unispinatus* gen. et sp. nov., male. A, habitus, right; B, urosome, ventral; C, anterior part of urosome, ventral; D, caudal ramus; E, distal part of caudal ramus. Scale bars: A, 0.2 mm; B, 0.1 mm; C, D, 0.05 mm; E, 0.02 mm.

several sensillae. Antennule (Fig. 259E) slender, 405  $\mu$ m long, 10-segmented; first and second segments distinctly broader than other segments; armature formula 3, 17, 5, 4+aesthetasc, 1, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked; aesthetascs thin, difficult to distinguish from setae. Antenna (Fig. 259F) 4-segmented; coxa short and unarmed; basis 109 $\times$ 60  $\mu$ m, with small knob at outer distal corner (exopod) tipped with 2 minute setal vestiges; first endopodal segment 90 $\times$ 59  $\mu$ m, with 1 small seta on subdistal inner margin; compound distal endopodal segment about 2.8 times longer than wide (105 $\times$ 38  $\mu$ m) and about 1.2 times longer than first endopodal segment; armed with 9 setae (including 3 unequal, bluntly tipped distal setae) and 2 groups of spinules; terminal claw 68  $\mu$ m long, strongly curved, 0.65 times as long as segment.

Labrum (Fig. 259G) with paired rows of setules running from ventral surface to posterior margin; posterior margin protruding in middle. Mandible (Fig. 259H) with 5 teeth, 1 small subsidiary tooth on distal margin, and 1 small proximal seta on coxal gnathobase: basis with 1 seta on medial margin; exopod 4-segmented; 3 distal segments much narrower than first, each segment with 1 seta,

distalmost seta shorter than other setae: endopod with 4 and 10 setae on first and second segments, respectively; outermost distal seta less than half length of adjacent seta. Paragnath (Fig. 259I) with setules and 1 denticle apically, and setules and row of minute spinules on medial surface. Maxillule (Fig. 259J) consisting of precoxa, coxa, basis, exopod and endopod; precoxa with 9 setae on arthrite, row of minute spinules on dorsal surface near base of coxal endite; coxa with endite bearing 1 seta and several minute spinules at tip and epipodite bearing 2 unequal setae; basis with 1 small proximal seta and 2 long distal setae on medial margin; exopod with 3 setae and 1 pointed process between outer and middle setae; endopod with 3 equal setae. Maxilla (Fig. 260A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with claw ornamented with setules along concave margin plus 2 unequal setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 260B) unsegmented but with short indentation subdistally on medial side; armed with 9 setae on medial margin and 2 unequal apical setae.

Legs 1–4 biramous with 3-segmented exopods and

2-segmented endopods (Fig. 260C-E); endopods shorter than exopods in all legs. Inner coxal seta of leg 1 extending to distal margin of basis, but that of legs 2–4 much longer, extending beyond middle of second endopodal segment. Outer seta on basis of legs 1–4 rudimentary and naked. Inner distal spine on basis of leg 1 extending to distal border of first endopodal segment, 60 µm long. Outer margin of first exopodal segment with spinules in leg 1, but smooth in legs 2–4. Outer setae on exopods of legs 2–4 spiniform, bluntly tipped. Distal setae on third exopodal segment of legs 2–4 shortened and bluntly tipped. Third exopodal segment of legs 2 and 3 terminating in spiniform process. Third exopodal segment of leg 4 armed with 9 armature elements (setae). Second endopodal segment of legs 2–4 slender. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 1, 2, 4
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 260F) consisting of broad protopod not articulated at base, armed with small seta at outer distal corner and ornamented with row of spinules near base of exopod, plus elongate free exopodal segment, extending beyond posterior border of genital somite, about 5.5 times longer than wide (218×40 µm), with parallel lateral margins; armed distally with slender spine (48 µm long) and small seta (subequal in length to spine), ornamented with 5 rows of minute spinules on dorsomedial surface.

**Description of male.** Body (Fig. 261A) curved ventrally, slender, not expanded: body length 1.78 mm. Prosome 5-segmented with broad cephalosome and 4 well-defined pedigerous somites. Urosome (Fig. 261B) 6-segmented, but with fifth pedigerous somite indistinctly articulated from prosome. Genital somite 131×218 µm, narrowing posteriorly, with well-developed paired genital opercula ventrally (Fig. 261C). Four free abdominal somites 153×167, 135×164, 109×145, and 73×127 µm, respectively. Anal somite with slightly concave lateral margins and small paired papillae on distal margin. Caudal ramus (Fig. 261D) slender, slightly curved, about 5.8 times longer than wide (174×30 µm): armed with 5 setae and 1 spine, plus 1 distal tubercle; one of distal setae much longer than others (Fig. 261E).

Antennule segmented and armed as in female, but aesthetasc on penultimate segment short (length about 0.3 of segment width). Rostrum, antenna, mouthparts, and legs 1–4 as in female.

Leg 5 (Fig. 261C) similar to that of female; exopodal segment about 6.9 times longer than wide (94×14 µm), armed distally with 2 subequal setae. Leg 6 (Fig. 261C) represented by 3 small setae (2 distal and 1 on outer margin) on genital operculum.

**Remarks.** The sexual dimorphism exhibited by the

type species is on an unusually small scale. Apart from the basic body form, sexual dimorphism was observed in the length of an antennular aesthetasc, in the slightly more elongate exopodal segment on leg 5 and in the form of leg 6.

***Notopygus trispinatus* gen. et sp. nov.**

(Figs. 262–264)

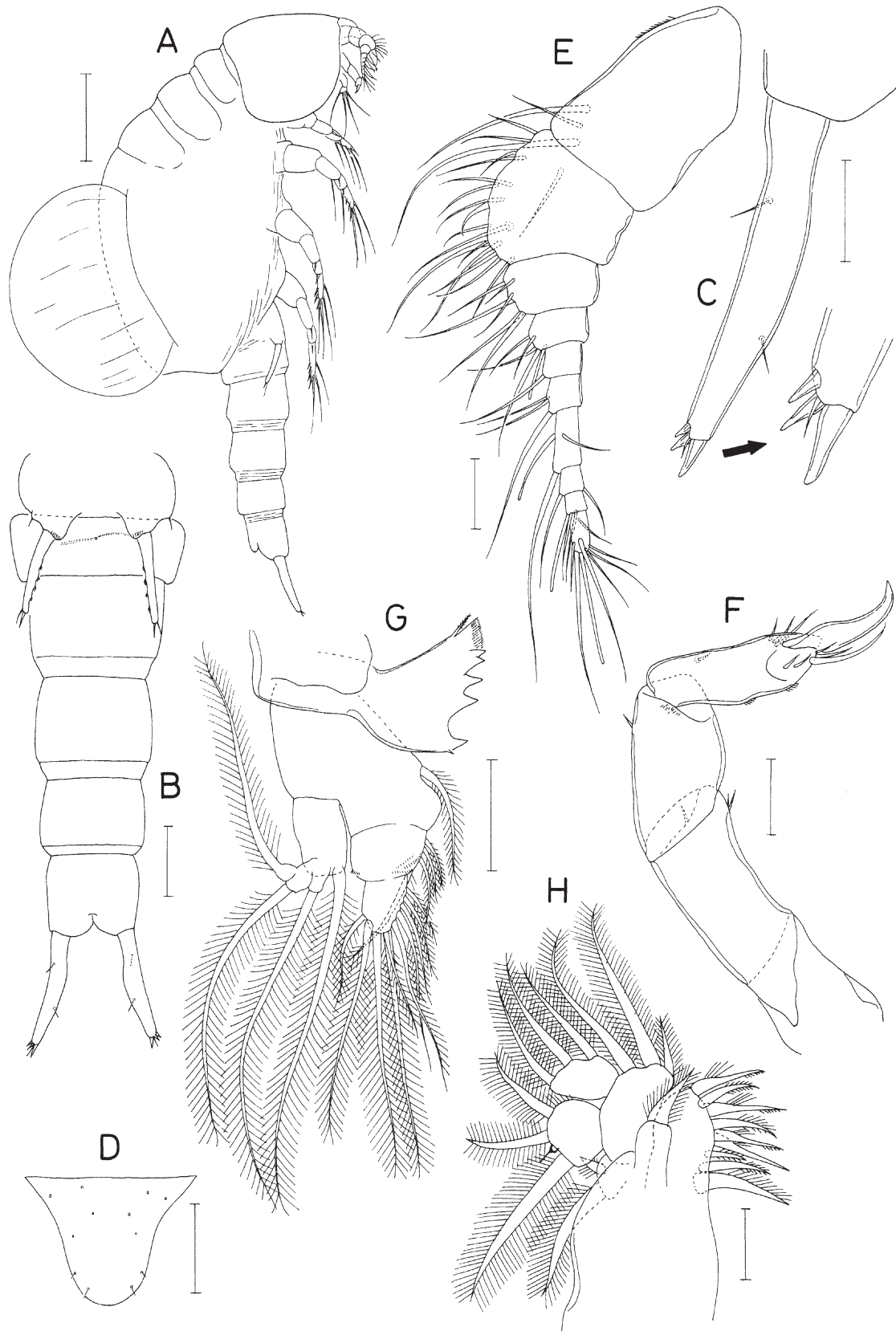
**Type material.** Holotype (intact ♂, MNHN-IU-2014-21333), paratypes (4 intact ♂♂, MNHN-IU-2014-22334), and dissected paratypes (1 ♀, 1 ♂, figured) from *Ascidia incrassata* Heller, 1878, Saldana Bay, South Africa, SAA 67, Griffiths coll., 28 August 1994.

**Etymology.** The specific name is a combination of *tri* (=three) and *spin* (=spine), referring to the presence of the three spines on the caudal ramus.

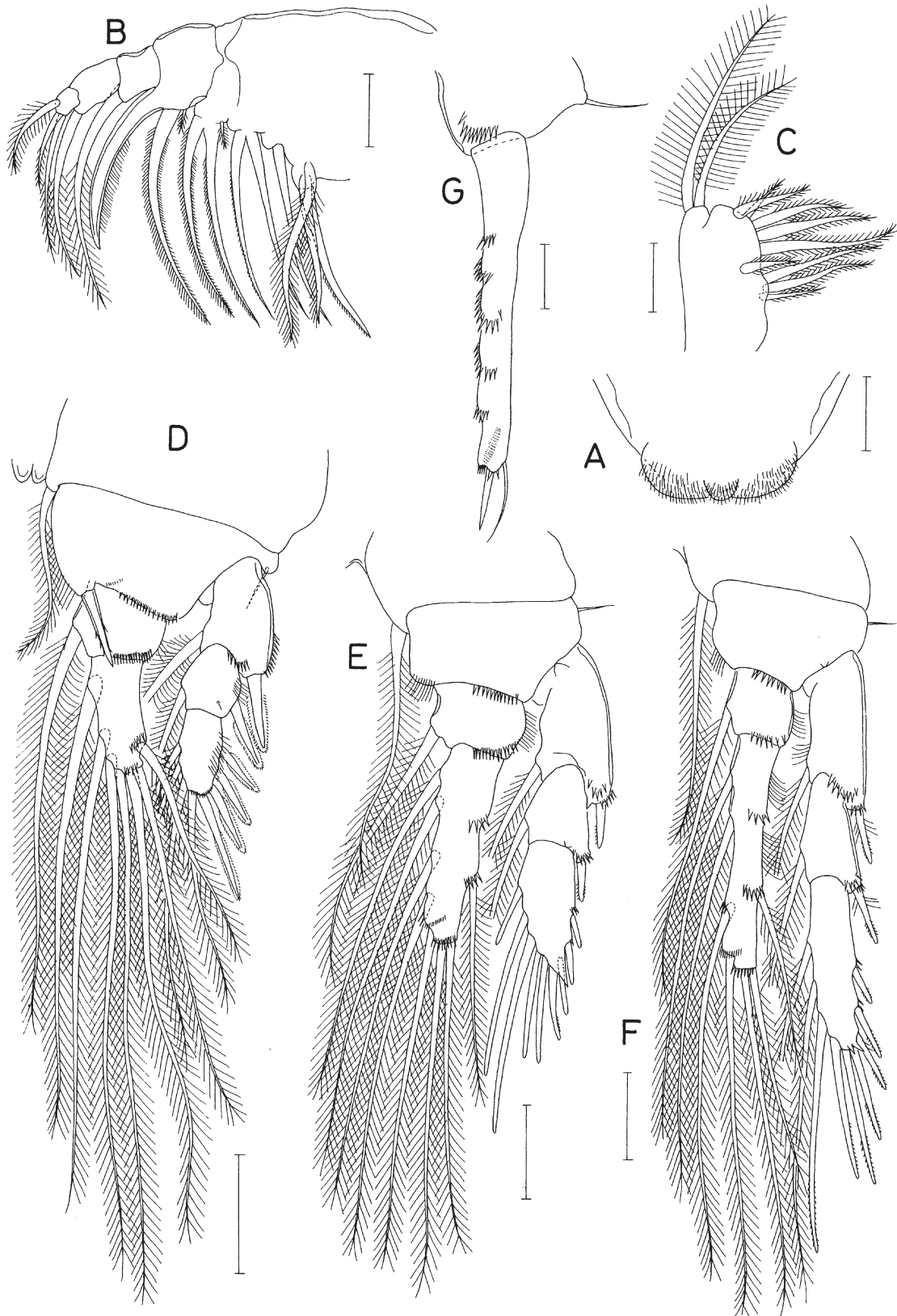
**Description of female.** Body (Fig. 262A) slightly compressed; length 3.50 mm. Prosome consisting of well-defined cephalosome and inflated metasome, broadening posteriorly, with vestiges of 3 dorsal tergites plus large, thin-walled, balloon-like swelling on posterodorsal surface. Fifth pedigerous somite fused with fourth. Free urosome (Fig. 262B) 5-segmented, gradually narrowing posteriorly: genital somite 160×509 µm, slightly narrowing posteriorly; 4 abdominal somites 290×393, 298×338, 218×309, and 233×269 µm, respectively. Anal somite with shallow posteromedial incision. Caudal rami slender, widely separated from each other; each ramus (Fig. 262C) about 5.3 times longer than wide, slightly constricted at proximal fifth: armed with 3 spines distally and 3 setae (including distal seta); outer proximal and dorsal setae located at 29 and 67% of ramus length, respectively; 3 distal spines unequal, largest apical seta 38 µm, smaller spines 23 and 18 µm long; all 3 setae thin, shorter than width of ramus.

Rostrum (Fig. 262D) small, 145×197 µm, tapering strongly in proximal third and tapering weakly in distal two-thirds towards rounded apex; surface ornamented with minute sensillae. Antennule (Fig. 262E) slender, 410 µm long, 10-segmented; 3 proximal segments broader than distal segments; armature formula 3, 17, 6, 4+aesthetasc, 1, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae generally short and thin, all naked. Antenna (Fig. 262F) moderately stout, 4-segmented; coxa short and unarmed; basis 113×64 µm, bearing small inner distal seta plus 2 outer distal setae (representing exopod); first endopodal segment 89×64 µm, with 1 small subdistal seta on medial margin; compound distal endopodal segment about 2.7 times longer than wide (109×40 µm) and ornamented with 2 patches of minute spinules on outer margin: armed with 9 setae (outer distal seta distinctly larger) plus large terminal claw, 82 µm, 0.75 times as long as segment.

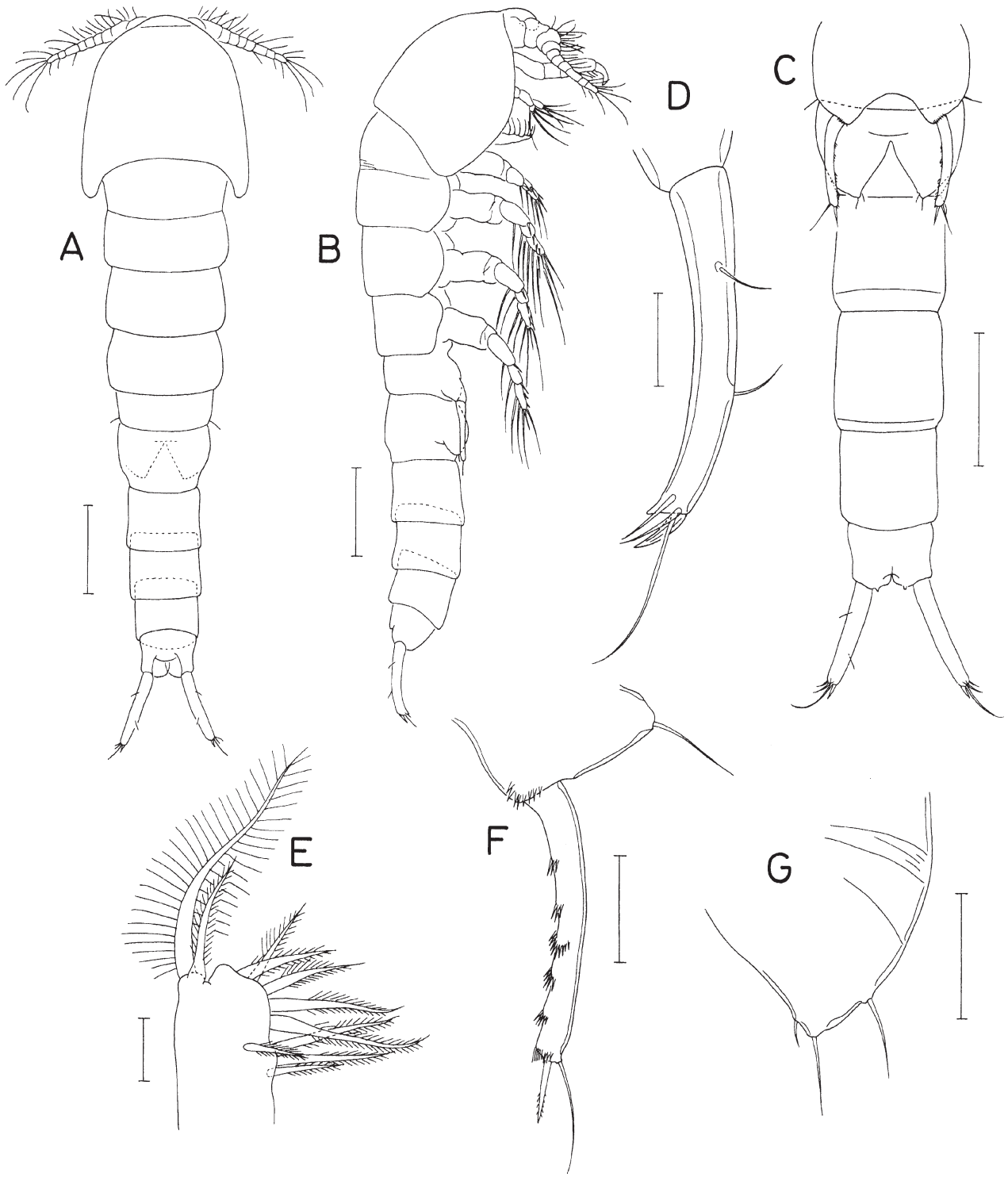
Labrum (Fig. 263A) densely setulose along posterior margin and on small posteromedial lobe. Mandible (Fig.



**FIGURE 262.** *Notopygus trispinatus* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral with inset showing detail of armature at tip; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, D, G, 0.1 mm; E, F, H, 0.05 mm.



**FIGURE 263.** *Notopygus trispinatus* gen. et sp. nov., female. A, labrum; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A–C, G, 0.05 mm; D–F, 0.1 mm.



**FIGURE 264.** *Notopygus trispinatus* gen. et sp. nov., male. A, habitus, dorsal; B, habitus, right; C, urosome, ventral; D, caudal ramus; E, maxilliped; F, leg 5; G, leg 6. Scale bars: A–C, 0.2 mm; D, F, G, 0.05 mm; E, 0.02 mm.

262G) with coxal gnathobase bearing 5 teeth, 1 small proximal seta, and 1 minute subsidiary tooth on distal margin at base of distalmost tooth: basis with 1 seta on medial margin; exopod obscurely 4-segmented, armed with 4 large, subequal setae; endopod 2-segmented; first segment incompletely articulated from basis, armed with 4 setae on medial margin and ornamented with minute spinules on outer distal corner and mediolateral region, second segment distinctly narrower than first, armed with 10 setae. Maxillule (Fig. 262H) bearing 9 setae on arthrite; coxal endite tipped with 1 seta, epipodite with 2 unequal setae: basis with short proximal seta and 2 distal setae (equal in length and about 3 times longer than proximal seta): exopod with 3 setae distally (2 equal medial and 1 larger outer) plus 1 minute lobe (representing setal vestige) tipped with setule between outer and middle setae: endopod with 3 subequal setae. Maxilla (Fig. 263B) 5-segmented; syncoxa with 9 setae arranged as 3, 1, 2, and 3; basis with strong claw bearing setules along concave margin plus 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 263C) unsegmented but with partial suture subdistally on medial side, and armed with 9 medial and 2 apical setae.

Legs 1–4 biramous with 3-segmented exopods and 2-segmented endopods (Fig. 263D–F); exopods longer than endopods in all legs. Inner coxal seta well-developed and pinnate; outer seta on basis minute. Inner distal spine on basis of leg 1 extending slightly beyond distal border of first endopodal segment, ornamented with few marginal spinules. Distal tip of third exopodal segment terminating in pointed process in legs 2 and 3, but in 2 slender processes in leg 4. Distal endopodal segment of leg 4 elongate, about 4 times longer than first; outer and distal setae on exopod of legs 2–4 bluntly tipped. Armature formula for legs 1–4 as in *N. unispinatus* **gen. et sp. nov.**

Leg 5 (Fig. 263G) consisting of short protopod not articulated at base, armed with 1 naked seta at outer distal corner and row of spinules near base of exopod plus free exopodal segment elongate, 6.0 times longer than wide (264×44 µm); armed distally with 1 spine and 1 naked seta, ornamented with 6 rows of spinules on dorsomedial surface.

**Description of male.** Body (Fig. 264A, B) slender, cylindrical; length 1.67 mm. Prosome clearly segmented: dorsal cephalic shield distinctly broader than metasome; with posterolateral corners extended posteriorly. Urosome (Fig. 264C) 6-segmented: fifth pedigerous somite free from metasome. Genital somite 136×227 µm; first and second abdominal somites equal in length, each slightly longer than wide. Anal somite bearing pair of small papillae on posterior margin, just medial to bases of caudal rami. Caudal ramus (Fig. 264D) about 5.8 times longer than wide (191×33 µm) and 1.9 times longer than anal somite, curved ventrally with pointed ventrodistal corner: armed with 1 spine (distal) and 5 setae (3 distal, 1 proximal, and 1 middle), 1 distal seta much longer than others.

Rostrum as in female. First and second segments of

antennule less expanded than in female, but with same setation pattern. Antenna, labrum, mandible, maxillule, and maxilla all as in female. Maxilliped (Fig. 264E) unsegmented and armed with 9 medial and 2 apical setae as in female, but 2 apical setae very unequal, medial seta half length of outer.

Legs 1–4 as in female. Leg 5 (Fig. 264F) with broad free exopodal segment about 7.3 times longer than wide (132×18 µm); distal seta about twice length of spine. Leg 6 (Fig. 264G) represented by 3 small setae on genital operculum (medial seta smaller than other 2).

**Remarks.** It is probable that the balloon-like dorsal structure on the fourth pedigerous somite in the female of this species is simply a swelling of the epidermis, and should probably be considered to be an artefact. In other respects, *Notopygus trispinatus* **gen. et sp. nov.** is very similar to the type species, *N. unispinatus* **gen. et sp. nov.** The form of the antennule, antenna, mouthparts and legs 1–5 are all similar, and both species were discovered from the same genus of ascidian hosts in South African waters. One significant difference between them is the possession of 3 spines and 3 setae on the caudal ramus in female *N. trispinatus* **gen. et sp. nov.**, compared to only 1 spine and 5 setae in *N. unispinatus* **gen. et sp. nov.** Another notable difference is that the female genital somite of *N. trispinatus* **gen. et sp. nov.** is about 3 times wider than long compared to about 1.5 times wider than long in the type species.

The free exopodal segment of leg 5 of *N. trispinatus* **gen. et sp. nov.** is 264 µm long in the female and 132 µm in the male, whereas these dimensions are 218 µm in the female and 94 µm in the male of *N. unispinatus* **gen. et sp. nov.** So the segment is larger in *N. trispinatus* **gen. et sp. nov.**, even though it is the smaller of the two species, with a body length of only 3.50 mm in female and 1.67 mm in male compared to 4.21 mm in the female and 1.78 µm in the male of *N. unispinatus* **gen. et sp. nov.**

The number of spinule rows on the free exopodal segment of leg 5 appears to be consistent within each of these species, 6 rows are present in *N. trispinatus* **gen. et sp. nov.** but only 5 in *N. unispinatus* **gen. et sp. nov.** These differences are sufficient to justify the establishment of a separate species.

***Notopygus minutispinatus* gen. et sp. nov.**  
(Figs. 265, 266)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21335), paratypes (2 intact ♀♀, MNHN-IU-2014-21336), and dissected paratype (♀, figured) from *Pyura stolonifera* (Heller, 1878) (MNHN-IT-2008-7777 = MNHN S2/PUY/XXX, lames 306), MRAC-ULB (Musée Royal de l'Afrique Centrale et Université Libre de Bruxelles), Inhaca Is, Mozambique (26°03'S, 32°54'E), depth 10–20 m, 07 August 1969.

**Etymology.** The specific name is derived from the Latin *minut* (=small) and *spin* (=spine) and refers to the small size of the apical spines on the caudal ramus.

**Description of female.** Body (Fig. 265A) 4.36 mm long; prosome 3.60 mm long, with well-defined dorsal cephalic shield and bulbous metasome. Cephalosome to second pedigerous somite divided by weak constrictions; third and fourth pedigerous somites fused to form greatly inflated brood pouch. Free urosome (Fig. 265B) 5-segmented, gradually narrowing posteriorly: genital somite 270×502 µm, with copulatory pore at anterior quarter on ventral surface; 4 abdominal somites 364×393, 327×335, 182×276, and 167×247 µm, respectively. Caudal ramus (Fig. 265C) about 4.1 times longer than wide (264×64 µm), with nearly parallel margins in proximal third but gradually narrowing in distal two-thirds: armed with 2 small setae and 4 minute distal spines; 2 setae positioned at 34 and 63% of ramus length, both setae about half as long as width of ramus at base; distal spines blunt, at most 13 µm long, scarcely visible at low magnification.

Rostrum (Fig. 265D) about 110×136 µm, gently tapering proximally and steeply tapering in distal third. Antennule (Fig. 265E) 345 µm long, 9-segmented; first and second segments much broader than distal segments; fifth segment subdivided on posterior side; armature formula 3, 17, 5, 5, 4, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae generally small, all naked. Antenna (Fig. 265F) 4-segmented; coxa unarmed; basis 127×69 µm, with 2 vestigial setae on small knob (representing exopod) subdistally on outer margin; first endopodal segment 90×64 µm, with 1 small seta on inner margin; compound distal endopodal segment about 3.2 times longer than wide (120×38 µm): armed with 7 setae arranged as 1, 3, 1, and 2 plus terminal claw about 76 µm long, strongly curved at tip.

Labrum as in *N. trispinatus gen. et sp. nov.* Mandible (Fig. 265G) with 5 teeth and 1 small seta on coxal gnathobase: basis with 1 seta and row of minute spinules on subdistal medial margin: exopod 3-segmented and armed with 4 subequal setae (1, 1, and 2 setae on first to third segments): endopod 2-segmented; first segment with 4 unequal setae on medial margin and minute spinules scattered over ventral surface; second segment narrower than first, armed with 10 setae of various lengths. Paragnath (Fig. 265H) as small lobe with setules on medial margin, minute spinules mediodistally, and small rounded outer process distally. Maxillule (Fig. 265I) consisting of precoxa, coxa, basis, exopod and endopod: precoxa with 9 setae on arthrite; coxa with 1 seta on endite and 2 very unequal setae on epipodite; basis with 3 (2 long distal and 1 short proximal) setae on medial margin and row of several minute spinules near base of each distal seta; exopod with 3 setae distally and 1 minute vestigial seta between outer and middle setae; endopod with 3 equal setae. Maxilla (Fig. 265J) 5-segmented; syncoxa with 9 setae arranged as 3, 1, 2, and 3; basis with

1 strong claw bearing setules along concave margin plus 2 unequal setae; endopod slender, with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 266A) incompletely 2-segmented; first segment with 9 setae medially; small second segment with 2 equal apical setae.

Leg 1 (Fig. 266B) with 3-segmented rami. Outer seta on basis small. Inner distal spine on basis 50 µm long, not extending to distal border of first endopodal segment. First and second exopodal segments with dense tuft of setules on outer side. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 266C, D); exopods longer than endopods. Outer seta on basis small as in leg 1. Outer setae on exopods attenuated and naked. All setae on third exopodal segment of legs 2–4 and 3 distal setae on second endopodal segment of leg 4 naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 266E) 2-segmented: protopod broad, not articulated at base, with 1 small seta on oblique outer margin and row of several spinules near base of exopod; free exopodal segment nearly rectangular and about 3.1 times longer than wide (182×58 µm); armed distally with slender spine (49 µm long) and thin seta (55 µm long); ornamented with 3 rows of minute spinules on dorsomedial surface.

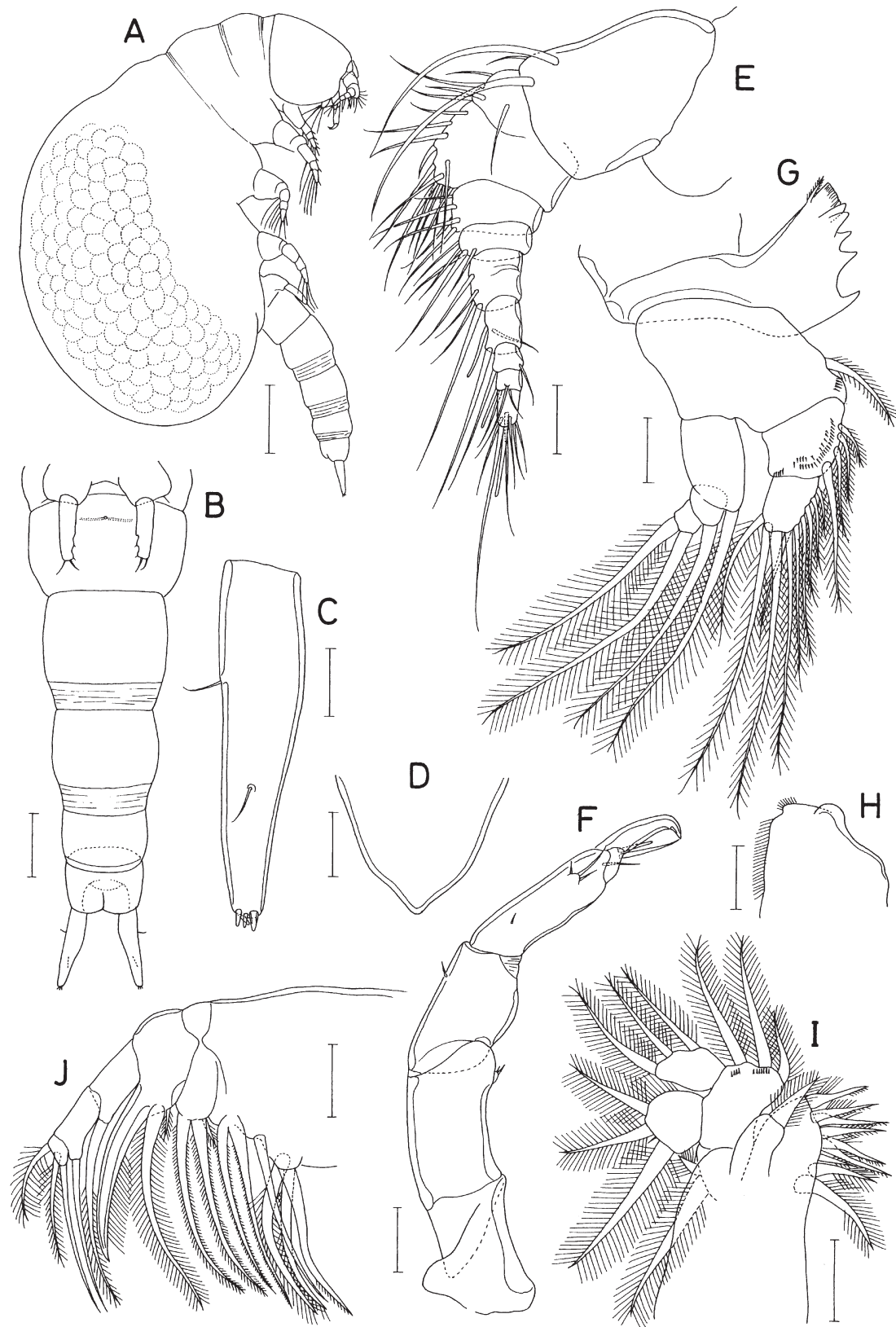
**Male.** Unknown.

**Remarks.** *Notopygus minutispinatus gen. et sp. nov.* can be readily differentiated from its two congeners by the possession of 4 spines and 2 setae on the caudal ramus of the female, and by the 3-segmented endopod of leg 1. In contrast, the type species *N. unispinatus gen. et sp. nov.* has only 1 spine and 5 setae on the caudal ramus, and *N. trispinatus gen. et sp. nov.* has 3 spines and 3 setae. Both these species have a 2-segmented endopod on leg 1 whereas in *N. minutispinatus gen. et sp. nov.* this ramus is 3-segmented.

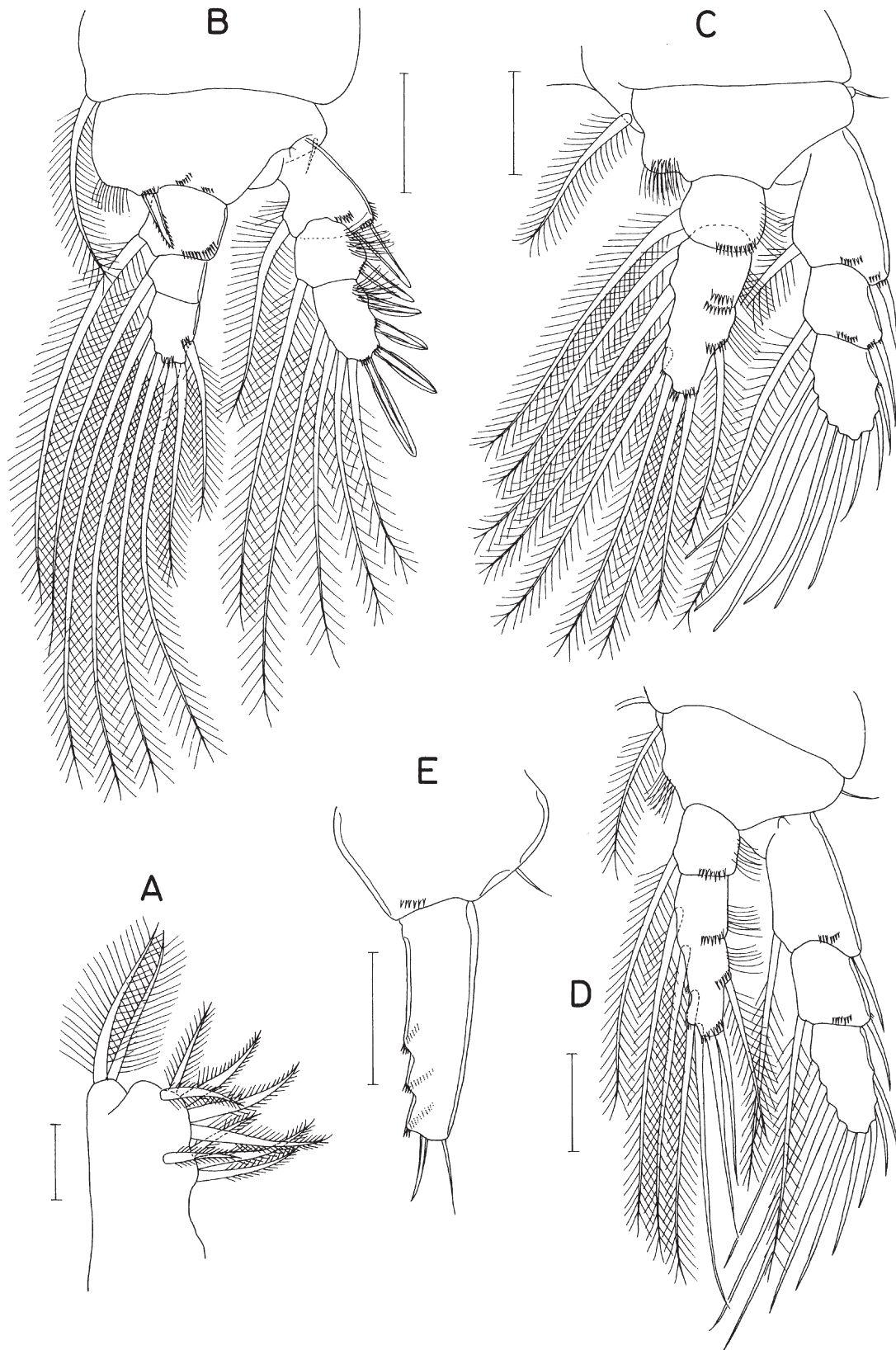
### *Chelipygus gen. nov.*

**Diagnosis.** Body of female consisting of swollen prosome and narrow, cylindrical urosome. Cephalosome well-defined by dorsal cephalic shield. Metasome unsegmented, strongly inflated, forming brood pouch incorporating fifth pedigerous somite. Free urosome 5-segmented. Caudal ramus armed with 4 spines + 2 setae, or 3 spines + 3 setae. Rostrum present. Antennule 8- to 10-segmented. Antenna uniramous and 4-segmented, composed of coxa, basis and 2-segmented endopod. Mandible as in *Doropygus*; exopod with 5 setae (distalmost seta may be vestigial);





**FIGURE 265.** *Notopygus minutispinatus* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scale bars: A, 0.5 mm; B, 0.2 mm; C–J, 0.05 mm.



**FIGURE 266.** *Notopygus minutispinatus* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Scale bars: A, 0.05 mm; B–E, 0.1 mm.

endopod with 4 setae on first segment and 8 or 9 setae on second. Maxillule armed with 3 setae on basis, 4 setae on exopod and 2 on endopod. Maxilla lacking claw on basis; endopod 3-segmented with 3 or 4 setae on terminal segment. Maxilliped indistinctly 2-segmented, armed with 9 setae on first segment and 2 setae on second. Leg 1 with 3-segmented rami; basis with inner distal spine. Legs 2–4 each with 3-segmented exopod and 2- or 3-segmented endopod. Third exopodal segment of leg 4 armed with only 8 armature elements. Leg 5 consisting of protopod and free exopodal segment bearing 2 distal elements.

**Etymology.** The name of the new genus is from the Greek *chel* (=claw) and *pygus*, the ending of many taxa within the family Notodelphyidae. It refers to the presence of the spines on the caudal ramus. Gender masculine.

**Type species.** *Chelipygus bulbosus* **gen. et sp. nov.**, by original designation.

**Other included species.** *Chelipygus dinardensis* **gen. et sp. nov.** and *C. catalai* (Illg, 1970) **comb. nov.** (originally *Doropygus catalai* Illg, 1970).

**Remarks.** *Chelipygus* **gen. nov.** is superficially similar to *Bonnierilla* in having the brood pouch of the adult female consisting of the entire unsegmented metasome (comprising pedigerous somites 1 to 4). However, it differs from *Bonnierilla* because it is characterised by the endopod of the maxillule usually being armed with 4 setae, the 2-segmented condition of the maxilliped which has an elongate second segment, legs 1 and 2 usually lack the inner coxal seta, the elongate exopods of the swimming legs, and the enlarged outer seta on the basis of leg 1.

*Chelipygus* **gen. nov.** is similar to *Notopygus* **gen. nov.** in having an inflated prosome and spines on the caudal rami, but can be separated from the latter genus by the possession of 5 setae (or 4 setae plus a vestigial seta) on the mandibular exopod, less than 10 setae on the mandibular endopod, 4 and 2 setae on the exopod and endopod, respectively, of the maxillule (instead of 3 setae on both rami as in *Notopygus* **gen. nov.**), no differentiated claw on the basis of the maxilla, and a total of 8 armature elements on the third exopodal segment of leg 4 (instead of 9 elements as in *Notopygus* **gen. nov.**).

*Doropygus catalai* Illg, 1970 was originally described as an associate of *Ascidia sydneyensis samea* (Oka, 1935) sampled in New Caledonia (Illg, 1970). Kim (2012) rediscovered this species in Korea and observed that its caudal rami carry 3 spines and 3 setae, and it shares the other character states of *Chelipygus* **gen. nov.**, as listed in the generic diagnosis. It is here transferred to the new genus as *Chelipygus catalai* (Illg, 1970) **comb. nov.**

### ***Chelipygus bulbosus* gen. et sp. nov.**

(Figs. 267, 268)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21337), paratypes (2 intact ♀♀, MNHN-IU-2014-21338),

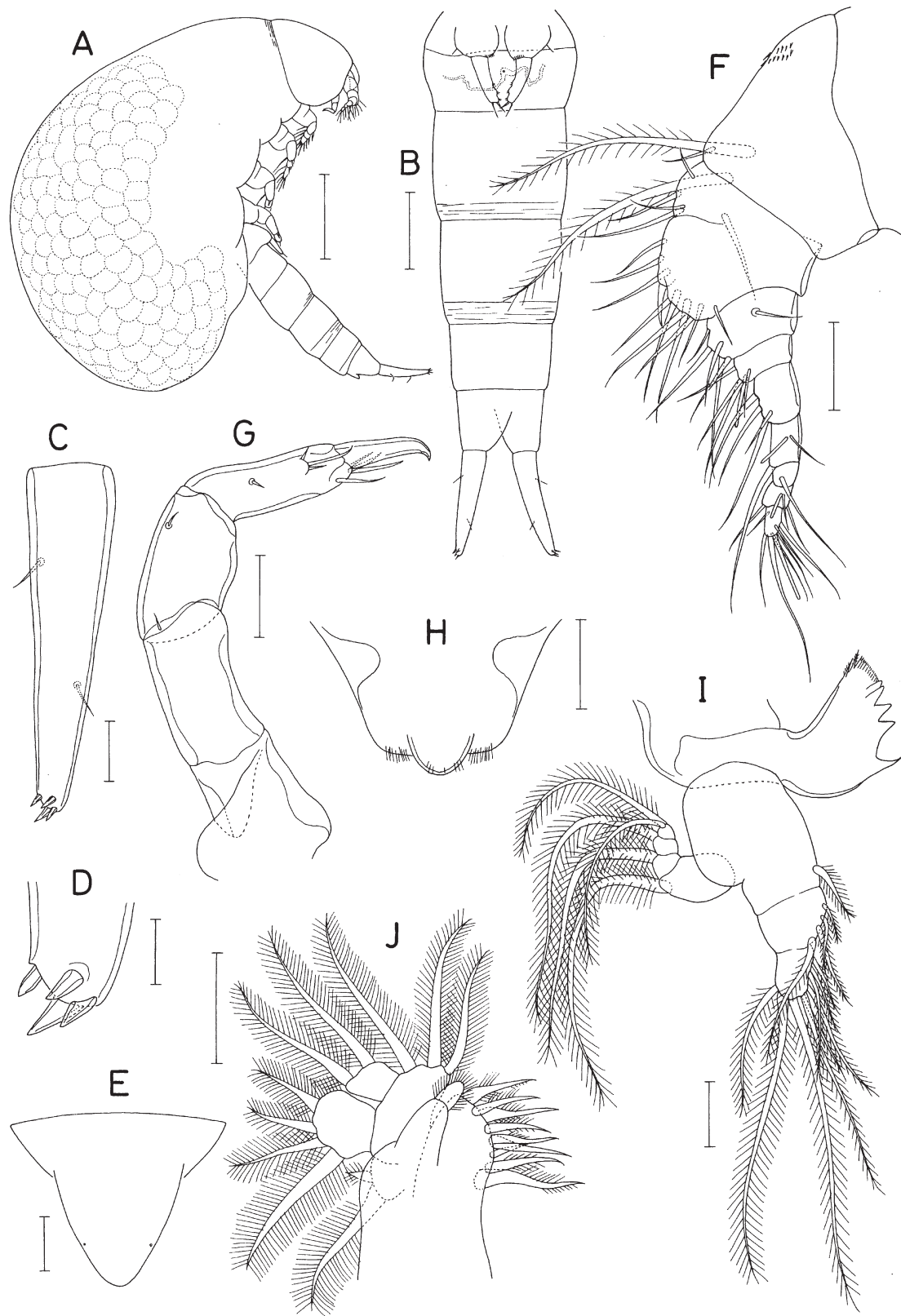
and dissected paratype (♀, figured) from *Molgula amesophleba* (Codreanu & Mack-Fira, 1956), Etang de Leucate on Mediterranean coast of France, Clanzig coll., 1985.

**Etymology.** The specific name refers to the bulbous prosome of the new species.

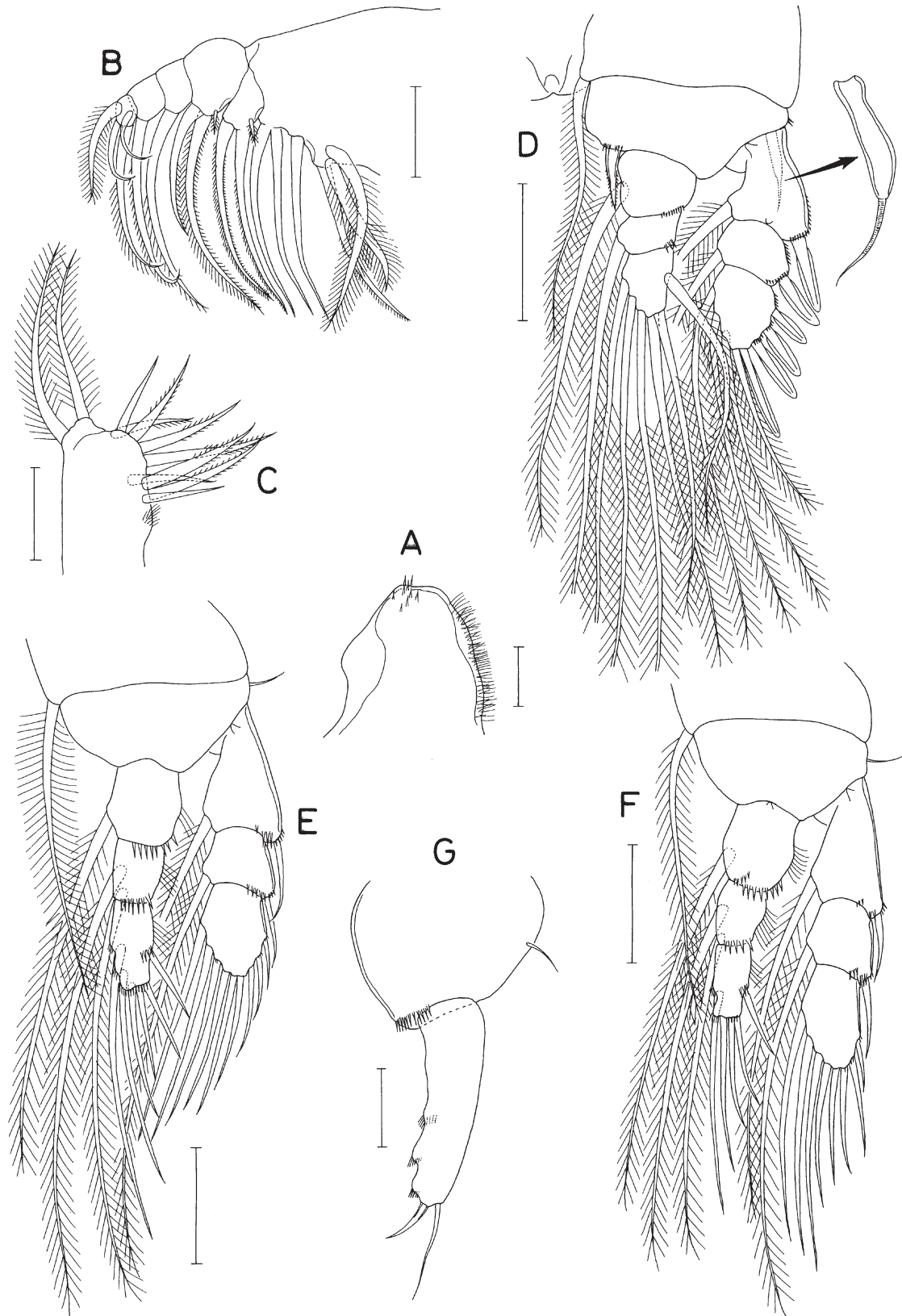
**Description of female.** Body (Fig. 267A) slightly compressed: body length 3.40 mm. Prosome 2.45 mm long, consisting of small cephalosome with well defined cephalic shield and strongly inflated, unsegmented metasome. Metasome bulbous, gradually broadening posteriorly; entire metasome forming brood pouch. Free urosome (Fig. 267B) 5-segmented, cylindrical, gradually narrowing distally: genital and 4 abdominal somites 158×406, 297×358, 273×320, 176×273, and 158×230 µm, respectively. Anal somite with deep posteromedian incision. Caudal ramus (Fig. 267C) evenly tapering distally, 3.9 times longer than wide (293×75 µm) and 1.85 times longer than anal somite: armed with 2 naked setae (outer proximal and dorsal) and 4 distal spines; outer proximal and dorsal setae short (less than half width of ramus at base), located at 29 and 63% of ramus length, respectively; 4 distal spines (Fig. 267D) small, conical, largest 15 µm and smallest 11 µm long.

Rostrum (Fig. 267E) 158×198 µm, consisting of broad, steeply tapering proximal third, weakly tapering in distal two-thirds towards blunt apex. Antennule (Fig. 267F) 303 µm long, 9-segmented; first and second segments markedly broader than more distal segments; armature formula 3, 16, 6, 4+aesthetasc, 4, 2+aesthetasc, 2, 2+aesthetasc, 7+aesthetasc; first segment ornamented with proximal patch of minute spinules on anterior surface; 2 large pinnate setae on first segment, all other setae naked and much smaller. Antenna (Fig. 267G) 4-segmented; coxa unarmed; basis 98×53 µm, with 1 small seta distally; first endopodal segment 76×55 µm, with 1 small seta subdistally; compound distal endopodal segment 88×35 µm, armed with 8 small setae (arranged as 1, 3, 1, and 3) plus terminal claw about 60 µm long, 0.68 times as long as segment.

Labrum (Fig. 267H) with large, semicircular posteromedian lobe. Mandible (Fig. 267I) with 5 teeth and 1 small seta on coxal gnathobase, distalmost tooth acutely pointed; basis with 1 seta subdistally on medial margin; exopod with 5 setae, 2 distal setae shorter than proximal 3; endopod indistinctly articulated from basis, armed with 4 and 9 setae on first and second segments, respectively; 2 distal setae on second segment distinctly longer than other setae. Paragnath (Fig. 268A) with scattered spinules on apex and dense setules on medial margin. Maxillule (Fig. 267J) with 9 setae on arthrite, 1 broad, blunt seta on coxal endite, 2 unequal setae on epipodite, 3 subequal setae on medial margin of basis, 4 setae on exopod (outer seta distinctly larger than medial 3), and 2 setae on endopod; endopod much smaller than exopod. Maxilla (Fig. 268B) armed with 9 setae on



**FIGURE 267.** *Chelipygus bulbosus* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, distal tip of caudal ramus; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, E–J, 0.05 mm; D, 0.02 mm.



**FIGURE 268.** *Chelipygus bulbosus* gen. et sp. nov., female. A, paragnath; B, maxilla; C, maxilliped; D, leg 1, with inset showing outer basal seta; E, leg 2; F, leg 4; G, leg 5. Scale bars: A, 0.02 mm; B, C, G, 0.05 mm; D–F, 0.1 mm.

syncoxa (arranged as 3, 1, 2, and 3), 3 on basis, and 1, 1, and 4 on first to third endopodal segments, respectively; distal seta on basis about half as long as middle seta; 2 of 4 setae on third endopodal segment small and naked. Maxilliped (Fig. 268C) incompletely 2-segmented; first segment with 9 setae medially; short second segment with 2 setae apically.

Legs 1–4 with 3-segmented rami (Fig. 268D–F). Inner coxal seta of legs 1–4 large, extending to distal tip of endopod. Outer seta on basis of leg 1 broad, sclerotized, and tipped with thin flagellum (Fig. 268D inset). Inner distal spine on basis of leg 1 short, 45 µm long, not reaching distal border of first endopodal segment. Outer setae on exopod of leg 1 and all setae on third exopodal segment of legs 2–4 naked and shorter than inner setae on exopod. Inner and distal setae on third endopodal segment of legs 2–4 also naked and shorter than inner setae on endopod. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-1; 1, 2, 2

Leg 5 (Fig. 268G) protopod wider than long, not articulated with somite, with small seta on outer margin and row of small spinules distally; free exopodal segment about 3.2 times longer than wide (136×42 µm), armed distally with slender spine (33 µm long) and thin seta (66 µm long), ornamented with 3 rows of minute spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** The 3-segmented condition of the endopods of legs 2–4 seems to be the most prominent feature separating the type species from its two congeners, *C. catalai* and *C. dinardensis* **gen. et sp. nov.** described below, both of which have 2-segmented endopods. The presence of 4 setae on the third endopodal segment of the maxilla is another distinguishing feature of *C. bulbosus* **gen. et sp. nov.**, since the other two species both have only 3 setae on this segment.

### *Chelipygus dinardensis* **gen. et sp. nov.**

(Figs. 269, 270)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21339) and dissected paratype (♀, figured) from *Molgula bleizi* (Lacaze-Duthiers, 1877) (MNHN-IT-2008-5425 = MNHN S3/MOL.A/206), La Rance, Dinard, France, Monniot coll., 1982.

**Additional material.** 2 ♀♀ (MNHN-IU-2018-1876) from *M. bleizi*, Morgat; 1 ♀ (MNHN-IU-2018-1877) and 1 dissected ♀ from *M. bleizi*, Morgat; 1 ♀ (MNHN-IU-2018-1878) from *M. complanata* Alder & Hancock, 1870, Carteret; 1 ♀ (MNHN-IU-2018-1879) from *M. citrina*

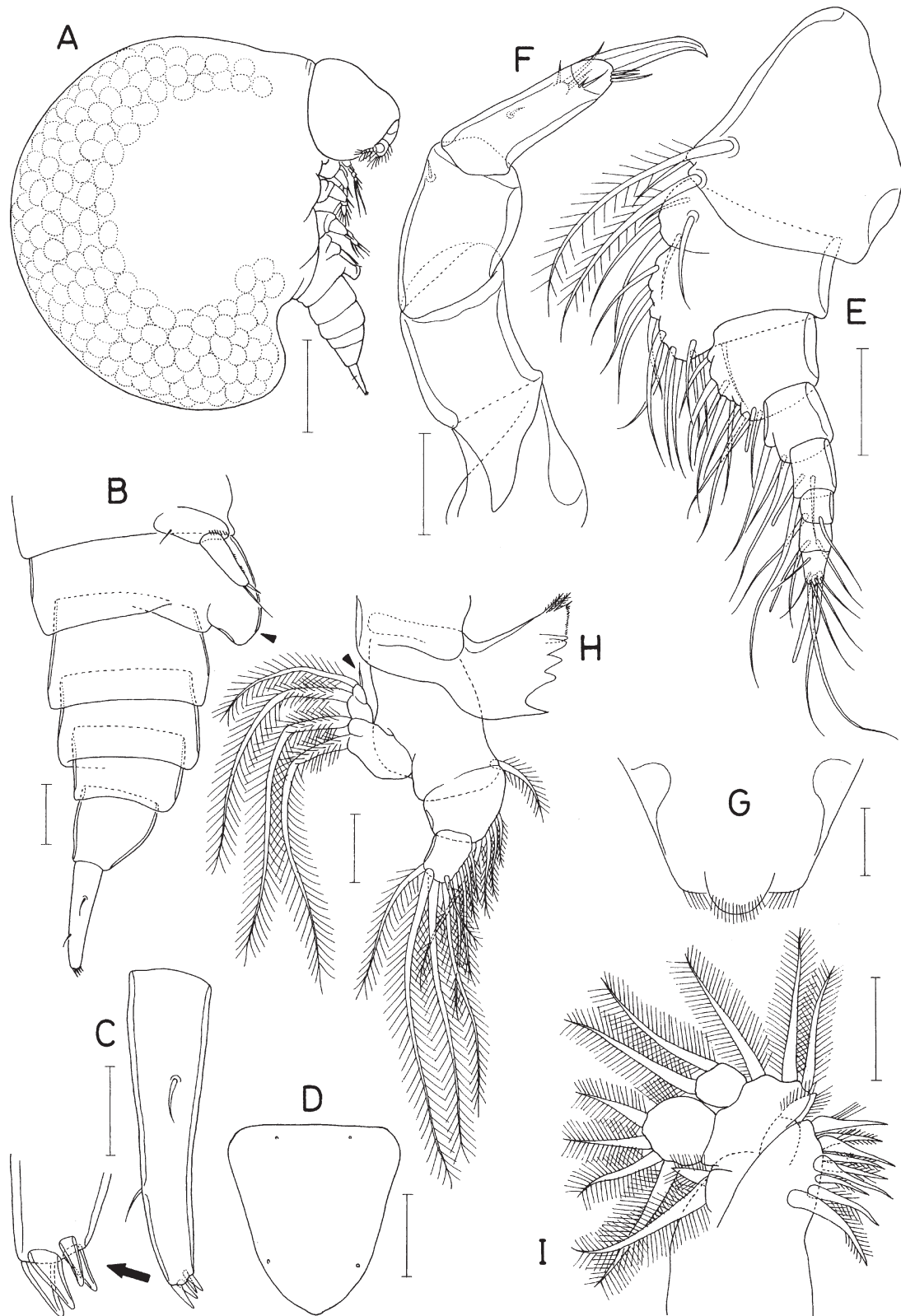
Alder & Hancock, 1848, Dinard; 1 ♀ (dissected) from *M. complanata*, Saint-Vaast-La-Hougue, France.

**Etymology.** The name of the type locality, Dinard on the Atlantic coast of France, is the basis for the specific name of the new species.

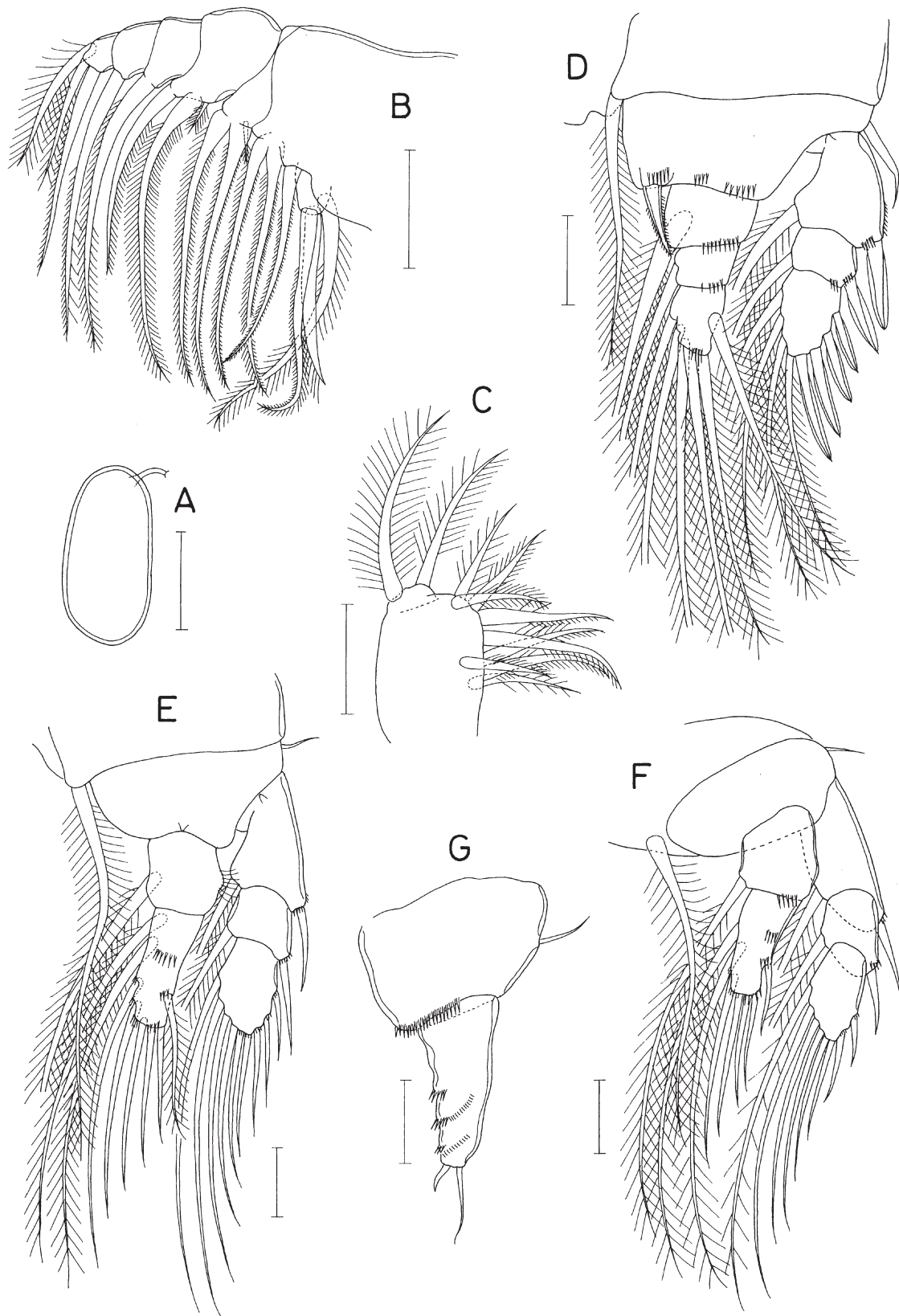
**Description of female.** Body (Fig. 269A) strongly compressed laterally: body length 3.26 mm. Prosoma consisting of small cephalosome with well developed dorsal shield and unsegmented, dorsally inflated metasome. Metasome not divided, lacking any trace of suture lines or constrictions, entire metasome forming brood pouch. Dorsal inflation of metasome variable according to reproductive status of individual female, 2.01×1.72 mm in lateral view in strongly inflated specimen (Fig. 269A). Free urosome (Fig. 269B) short, 5-segmented. Genital somite characteristically with large, robust posteroventral protuberance (indicated by arrowhead in Fig. 269B) with rounded tip in middle of distal margin. Caudal ramus (Fig. 269C) gradually narrowing distally, 3.8 times longer than wide (179×47 µm) and about 1.3 times longer than anal somite: armed with 2 setae (outer proximal and dorsal) and 4 small distal spines; outer proximal and dorsal setae positioned at 35 and 70% of ramus length, respectively, about half as long as width of ramus at base; distal spines conical, at most 15 µm long, bluntly tipped. Spermatophore (Fig. 270A) detached from female elliptical, 91×45 µm.

Rostrum (Fig. 269D) subtriangular, 108×103 µm, slightly longer than wide, with gently tapering proximal three quarters and tapering more steeply in distal quarter. Antennule (Fig. 269E) 274 µm long, 8-segmented; first and second segments much broader than distal segments; armature formula 3, 17, 9+aesthetasc, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 2 large setae on first segment pinnate, all other setae naked. Antenna (Fig. 269F) stout, 4-segmented; coxa unarmed; basis 75×55 µm, unarmed; first endopodal segment 64×54 µm, with small seta subdistally on medial side; compound distal endopodal segment markedly narrower than proximal segments, gradually narrowing distally, about 2.1 times longer than wide (73×35 µm); armed with 9 setae (arranged as 1, 3, 2, and 3) plus terminal claw about 65 µm long, only slightly shorter than segment.

Labrum (Fig. 269G) with setulose posterior margin and large, setulose posteromedian lobe. Mandible (Fig. 269H) with 5 teeth and 2 small setae on gnathobase: basis with 1 seta at mediodistal corner; exopod with 5 setae; 3 proximal setae equally large; fourth seta shorter, (half length of proximal setae), distalmost seta vestigial (arrowhead in Fig. 269H); endopod 2-segmented, incompletely articulated from basis; first segment with 4 setae on medial margin; second segment distinctly narrower than first, armed with 9 setae. Maxillule (Fig. 269I) with 9 setae on arthrite, 1 broad, blunt seta on coxal endite, 2 unequal setae on epipodite, 3 setae on medial margin of basis (proximal seta slightly shorter than distal 2), 4 setae on exopod (3 equally long medial and



**FIGURE 269.** *Chelipygus dinardensis* gen. et sp. nov., female. A, habitus, right; B, urosome, right, showing posteroventral protuberance (arrowhead); C, right caudal ramus, lateral view with inset showing detail of armature at tip; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible showing vestigial seta on exopod (arrowhead); I, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C–I, 0.05 mm.



**FIGURE 270.** *Chelipygus dinardensis* gen. et sp. nov., female. A, spermatophore; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: 0.05 mm.



1 longer outer), and 2 setae on endopod. Maxilla (Fig. 270B) armed with 9 setae on syncoxa (arranged as 3, 1, 2, and 3), 3 setae on basis (distal seta 0.7 times length of middle seta), and 1, 1, and 3 setae, respectively, on first to third endopodal segments. Maxilliped (Fig. 270C) incompletely 2-segmented, articulation present on only one surface; armed with 9 setae on first and 2 setae on short second segment.

Leg 1 (Fig. 270D) with 3-segmented rami. Outer seta on basis naked, thinner (flagellate) in distal third. Inner distal spine on basis 42 µm long, spinulose, extending to distal border of first endopodal segment. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 270E, F); exopods slightly longer than endopods. Inner seta on coxa relatively longer than in leg 1. Outer and distal setae on exopods naked. Distal setae on endopods naked and shortened. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1, 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 270G) protopod indistinctly articulated from somite, broad, with seta on outer margin and row of spinules on distal border; free exopodal segment about 1.9 times longer than wide (98×52 µm), gradually narrowing distally, with slightly irregular margins; armed distally with small, spiniform medial seta (18 µm long) and longer outer seta (47 µm long); ornamented with 3 rows of spinules on dorsomedial surface.

**Male.** Unknown.

**Remarks.** The large ventrodiscal protuberance on the genital somite seems to be the most distinctive feature of *Chelippygus dinardensis* **gen. et sp. nov.** It is unique and serves to differentiate it not only from its congeners but also from species of closely related genera. The small size of the distalmost seta on the apex of the mandibular exopod is also a characteristic feature, distinguishing *C. dinardensis* **gen. et sp. nov.** from both of its congeneric species.

### Genus *Sesir* Stock, 1967

**Diagnosis.** Female body elongate, cylindrical; 4 pedigerous somites discernible by weak constrictions; second to fourth pedigerous somites forming brood pouch. Free urosome cylindrical, unsegmented. Caudal ramus armed with 6 setae. Antennule 8-segmented. Antenna 4-segmented; comprising coxa, basis and 2-segmented endopod; exopod absent. Mandible with 1 seta on basis; 5 setae on exopod, endopod 2-segmented, armed with 4 and 9 setae on first and second segments, respectively. Maxillule with 6 setae on arthrite; coxal endite and

epipodite absent; basis with 1 seta mediolaterally; exopod and endopod lobate and not articulated from basis, each armed with 3 setae distally. Maxilla 5-segmented; syncoxa with 5 setae, basis with 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped unsegmented, armed with 8 medial and 2 apical setae. Legs 1–3 with 3-segmented rami, leg 4 with 3-segmented exopod and 2-segmented endopod. Legs 1–4 lacking inner coxal seta. Outer seta on basis absent in leg 4. Basis, exopods and endopods heavily ornamented with rows of spinules. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, 2, 3	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 4	0-1; 0-1; 1, 2, 3
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 4	0-1; 0-1; 1, 2, 3
Leg 4	0-0	0-0	1-1; 1-1; 2, 1, 3	0-0; 0, 2, 1

Leg 5 consisting of unarmed protopod fused to somite plus free exopodal segment with 1 distal seta.

**Type species:** *Sesir parvipes* Stock, 1967, by original designation.

**Remarks.** This genus is monotypic. The type species is redescribed below based on the study of new material.

### *Sesir parvipes* Stock, 1967

(Figs. 271, 272)

**Material examined.** 41 ♀♀ (MNHN-IU-2018-1880) and dissected 2 ♀♀, 1 ♂ from *Pyura gangelion* (Savigny, 1816), Djibouti, 13 October 1996.

**Description of female.** Body (Fig. 271A) elongate, cylindrical, curved ventrally, body length 1.75 mm. Prosome 1.39 mm in length; cephalosome small, 4 pedigerous somites discernible by weak constrictions, increasing in length from first to fourth. Second to fourth pedigerous somites forming slender brood pouch. Free urosome (Fig. 271B) cylindrical, unsegmented, gradually narrowing posteriorly, about 330×100 µm, excluding caudal rami. Caudal ramus (Fig. 271C) tapering distally, about 3.7 times longer than wide (115×31 µm), incompletely articulated from abdomen: armed with 2 proximal and 4 distal setae; distal setae not articulated at base, longest seta 64 µm long, inner seta rudimentary; 2 proximal setae positioned at 24 and 29% of ramus length.

Rostrum (Fig. 271D) articulated at base, plate-like, 73×67 µm, gradually broadening to maximum width at 60% of rostral length, then strongly tapering towards blunt apex. Antennule (Fig. 271E) tapering, 163 µm long, 8-segmented; articulations between distal 3 segments incomplete; armature formula 3, 16, 9+aesthetasc, 6, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna 4-segmented; coxa short and unarmed; basis 40×17 µm, with vestigial seta at outer distal corner

(representing exopod); first endopodal segment 28×22 µm, with seta subdistally on inner margin; compound distal endopodal segment armed with 8 setae (arranged as 1, 3, 2, and 2) and ornamented with 2 groups of spinules on outer margin; slender terminal claw 30 µm long, half as long as segment.

Labrum weak, damaged during dissection. Mandible (Fig. 271F) with slender, elongate coxal gnathobase bearing 6 acutely pointed teeth only: basis with tuft of setules proximally and 1 seta subdistally on medial margin; exopod armed with 5 large setae (proximalmost seta slightly shorter than distal 4); endopod incompletely articulated from basis, 2-segmented, armed with 4 and 9 setae on first and second segments, respectively; larger distal setae on second segment naked. Maxillule (Fig. 271G) with 6 setae on arthrite; coxal endite and epipodite absent; basis with 1 seta mediolaterally; exopod and endopod lobate, not articulated from basis, each armed with 3 setae distally. Maxilla (Fig. 271H) 5-segmented, strongly flexed between syncoxa and basis; syncoxa with 5 setae arranged as 2, 1, 1, and 1; basis with 2 setae; endopod with 1, 1, and 3 setae on first to third segments, respectively; seta on first and second endopodal segments and one seta on third segment large and ornamented thick setules along convex margin. Maxilliped (Fig. 272A) unsegmented but with small, lobate apical region, armed with 8 medial and 2 unequal apical setae; 8 medial setae grouped as 4 and 4; one seta from each group shorter and broader than others.

Legs 1–3 with 3-segmented rami, leg 4 with 3-segmented exopod and 2-segmented endopod. Basis, exopods and endopods heavily ornamented with rows of spinules along outer margin and on anterodistal surface. Legs 1–4 lacking inner seta on coxa (Fig. 272B, C). Outer seta on basis large and pinnate in leg 1, small in legs 2 and 3, and absent in leg 4 (Fig. 272C). Inner distal spine on basis of leg 1 proximally pinnate and distally spinulose, slightly shorter than first endopodal segment. All setae on leg 4 naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, 2, 3	0-1; 0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 4	0-1; 0-1; 1, 2, 3
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 4	0-1; 0-1; 1, 2, 3
Leg 4	0-0	0-0	1-1; 1-1; 2, 1, 3	0-0; 0, 2, 1

Leg 5 (Fig. 271B, 272D) rudimentary, consisting of unarmed protopod fused with somite plus oval exopodal segment, about 1.7 times longer than wide (31×18 µm): armed with 1 seta (13 µm long) distally.

**Description of male.** Body (Fig. 272E) small, ventrally curved, narrowing posteriorly. Body length 0.61 µm. Cephalic shield much wider than pedigerous somites. Urosome (Fig. 272F) tapering, incompletely 6-segmented with fifth pedigerous somite obscurely defined from fourth. Genital somite 59×98 µm; 4 abdominal somites

63×78, 48×59, 43×44, and 12×33 µm, respectively. Cuticle of genital and first and second abdominal somites each with conspicuous transverse band of sclerotization proximally. Anal somite (Fig. 272G) very short, with transverse sclerotization band in middle. Caudal ramus (Fig. 272G) short, but longer than anal somite and 1.5 times longer than wide (18×12 µm): armed with 1 claw and 4 setae; claw 22 µm long; largest seta 57 µm long, 3.2 times longer than caudal ramus.

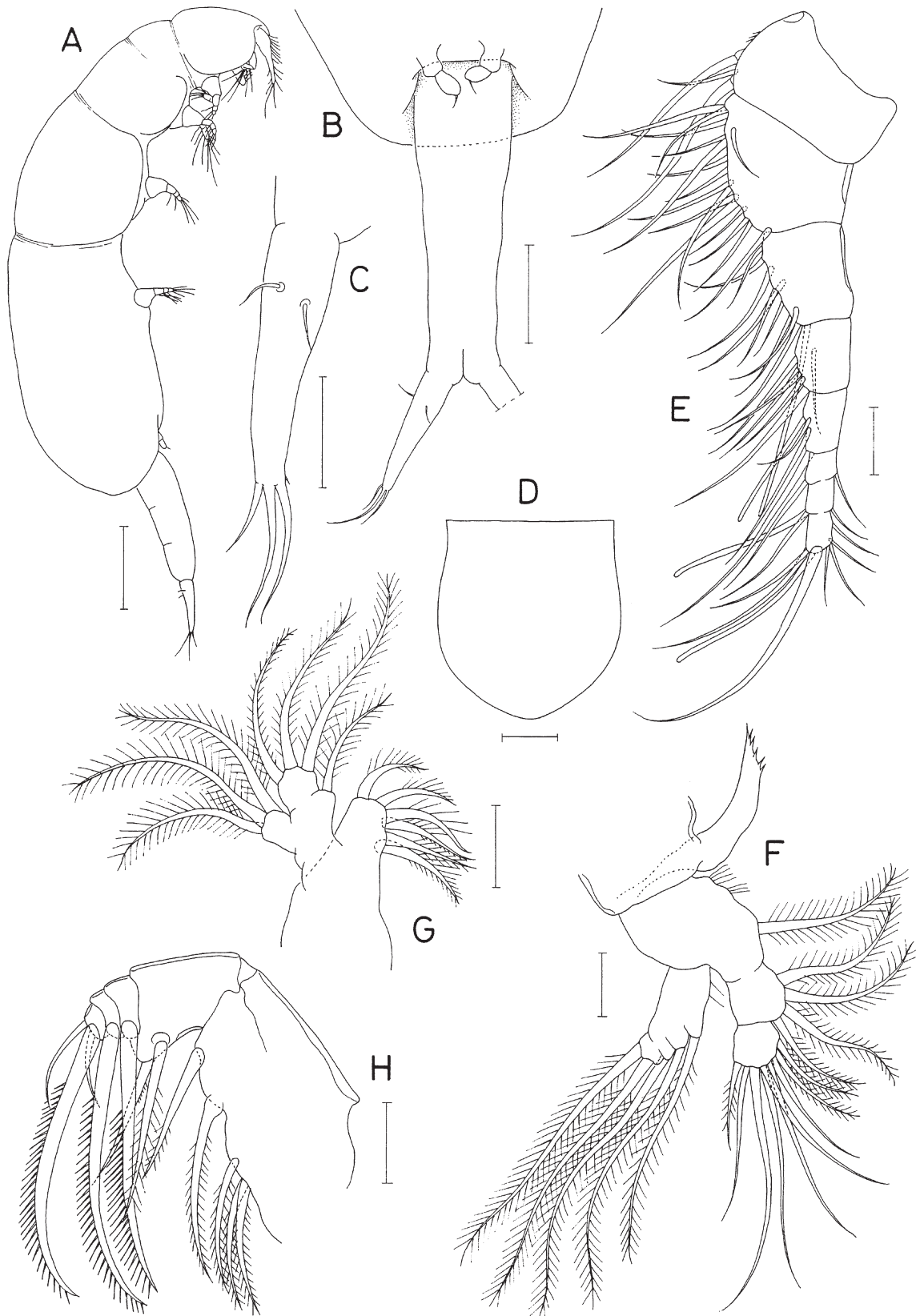
Rostrum, antennule, antenna, mouthparts, and legs 1–4 as in female.

Leg 5 (Fig. 272F) 2-segmented: protopod very short, unarmed but ornamented with row of minute spinules ventrodistally; free exopodal segment, 19×9 µm, subrectangular, armed distally with 1 seta, and ornamented with spinules on inner margin. Leg 6 (Fig. 272F) represented by small seta on apex of genital operculum.

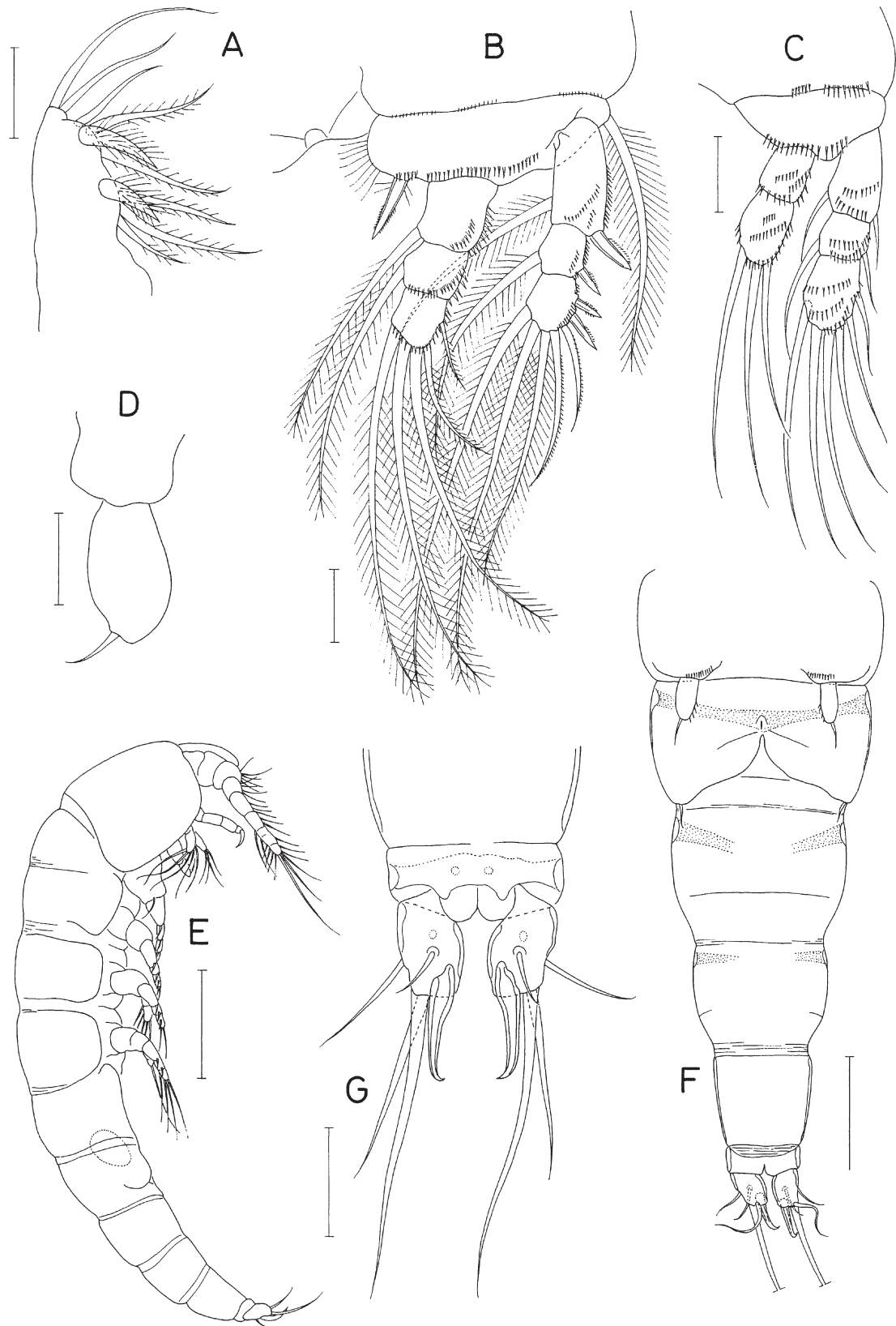
**Remarks.** Stock (1967) described this species based on two females collected in the Dahlak Archipelago in the Red Sea. Our specimens were collected from the coast of Djibouti, close to the type locality. They exhibit a few differences from the original description, as follows: (1) the body is not clearly segmented, and this is undoubtedly because the newly-observed specimens are fully grown, expanded females; (2) the second endopodal segment of the mandible is armed with 9 setae (not 8 as in the original description); (3) the maxillular arthrite is armed with 6 setae (not 7); (4) the protopod of leg 4 is not broadened as in the original description. These differences probably reflect inaccuracies in the original description. The important morphological features of this species, such as the characteristic form of the maxillule, maxilla and coxal gnathobase of mandible, and the leg armature are all consistent with the original description.

### *Sympygus* gen. nov.

**Diagnosis.** Body of female laterally compressed, *Doropygus*-shaped, covered with thick exoskeleton. Prosome clearly 5-segmented, comprising cephalosome and 4 pedigerous somites; fourth pedigerous somite forming brood pouch, largely incorporating fifth pedigerous somite. Free urosome 5-segmented. Caudal ramus armed with 6 setae. Rostrum short, fused at base. Antennule slender, 9-segmented. Antenna consisting of coxa, basis, and 2-segmented endopod with terminal claw; exopod absent. Mandible with narrow coxal gnathobase bearing 2 teeth; basis with 1 seta; exopod with 4 setae; endopod 2-segmented with 4 and 10 setae on first and second segments, respectively. Maxillule with 8 setae on arthrite; coxa with 2 setae on epipodite, but endite absent; exopod and endopod fused with basis forming complex lacking any subdivision, armed with total of 7 setae. Maxilla 5-segmented; syncoxa with 3, 2, and 2 setae on first to third endites, respectively; basis with 2



**FIGURE 271.** *Sesir parvipes* Stock, 1967, female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, mandible; G, maxillule; H, maxilla. Scale bars: A, 0.2 mm; B, 0.1 mm; C, 0.05 mm; D–H, 0.02 mm.



**FIGURE 272.** *Sesir parvipes* Stock, 1967, female. A, maxilliped; B, leg 1; C, leg 4; D, leg 5. Male: E, habitus, right; F, urosome, ventral; G, anal somite and caudal rami, dorsal. Scale bars: A–D, G, 0.02 mm; E, 0.1 mm; F, 0.05 mm.

setae; endopod 3-segmented with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped unsegmented with 5 medial and 2 apical setae. Legs 1–4 segmented and armed as in *Doropygus*. Leg 4 lacking inner coxal seta and inner seta on first exopodal segment. Leg 5 small, but 2-segmented; armed with 1 seta on protopod and 2 setae on free exopodal segment.

**Type species.** *Sympygus punctatus* gen. et sp. nov., by original designation.

**Etymology.** The generic name is derived from the Greek *sym* (=together) and *pygus*, the ending of many generic names in the family Notodelphyidae. It alludes to the fusion of the basis, exopod and endopod of the maxillule. Gender masculine.

**Remarks.** The characteristic features of *Sympygus* gen. nov. are displayed by the maxillule which lacks a coxal endite, and in which the basis, exopod and endopod are all fused to form a single complex. Although this form of maxillule resembles that of *Sesir* in part, it cannot be placed in *Sesir* due to the other major differences in body form. In addition, in *Sesir* both the coxal endite and the epipodite are lacking from the maxillule, whereas the new genus retains a normal epipodite with 2 setae, and the armature of legs 1–5 is reduced in *Sesir*, but not in *Sympygus* gen. nov.

In the Notodelphyidae the fusion of the exopod, the endopod, or both rami with the basis of the maxillule has been reported in several other genera, including *Demoixys* Illg & Dudley, 1961, *Mesoixys* Illg & Dudley, 1965, and *Paralobodelphys* Gotto, 1981. However, *Sympygus* gen. nov. is not related to these genera because they have an inflated or globular body form, the segmentation and setation of swimming legs are significantly reduced, and leg 5 is vestigial or absent.

### *Sympygus punctatus* gen. et sp. nov.

(Figs. 273, 274)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21340), paratypes (2 intact ♀♀, MNHN-IU-2014-21341), and dissected paratypes (2 ♀♀, figured) from *Cnemidocarpa pedata* (Herdman, 1881) (MNHN-IT-2008-2243 = MNHN S1/CNE/207), CRRF OM 91-5561-F, Sarawak, NW of Miri, Malaysia (05°53.34'N, 112°39.72'E), depth 6 m, 31 March 2003.

**Etymology.** The specific name is derived from the Latin *punctat*, meaning “marked with punctures”. It alludes to the numerous pits ornamenting the body surface of the new species.

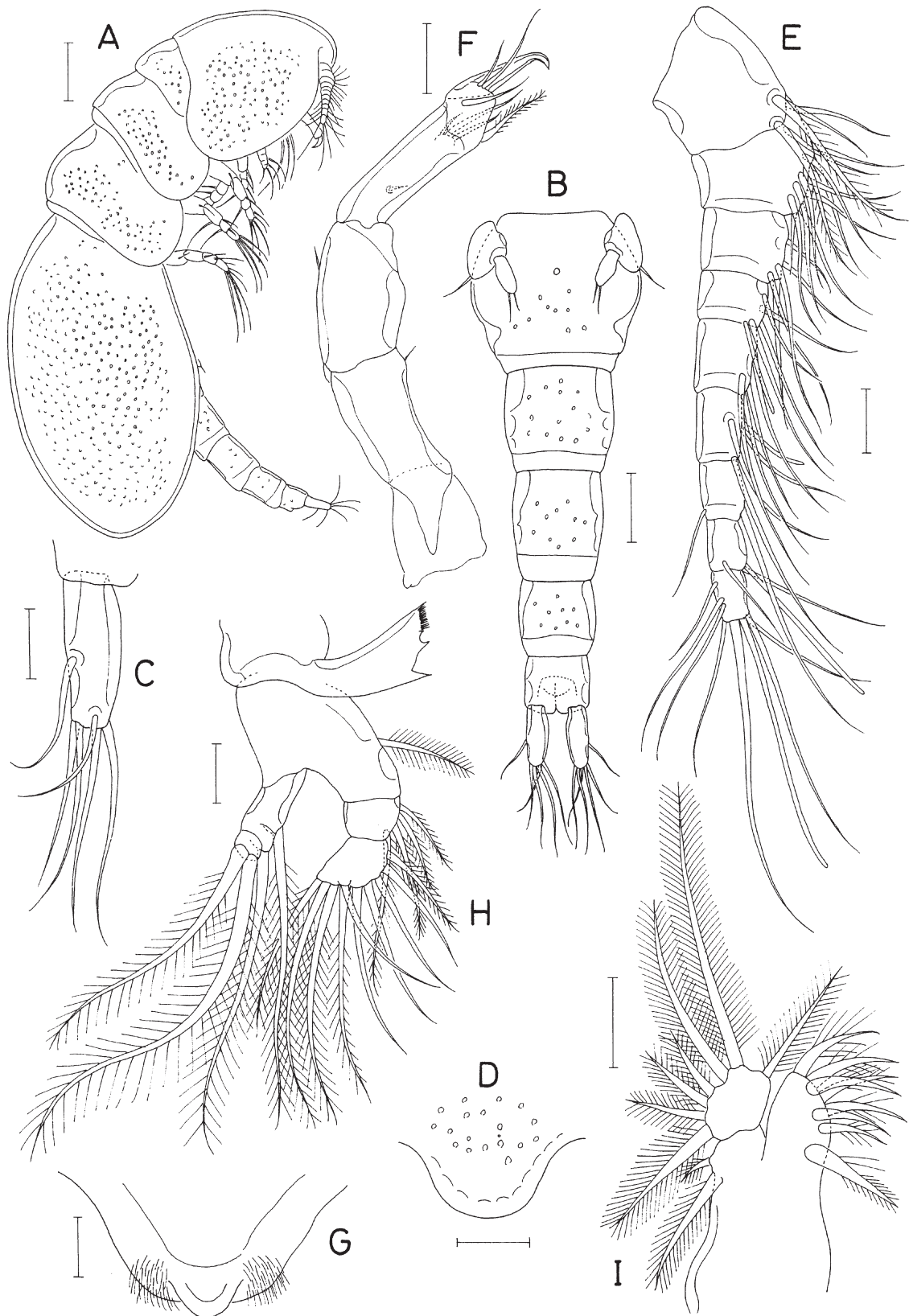
**Description of female.** Body (Fig. 273A) compressed, *Doropygus*-shaped, with firm, thick exoskeleton ornamented with numerous pore-like pits on surface. Body length 1.14 mm; prosome 1.03 mm long, clearly 5-segmented. Dorsal cephalic shield broad, expanded ventrolaterally. Fourth pedigerous somite forming elliptical

brood pouch, 510×320 µm in lateral view. Free urosome (Fig. 273B) slender, gradually narrowing posteriorly, well-sclerotized, 5-segmented: genital somite 113×128 µm, with convex lateral margins; 4 abdominal somites 74×84, 81×67, 56×57, and 41×48 µm, respectively. Anal somite with shallow posteromedian incision. Caudal ramus (Fig. 273C) about 2.6 times longer than wide (46×18 µm) but only slightly longer than anal somite: armed with 6 long, naked setae (outer proximal, dorsal, and 4 distal); outer proximal seta positioned slightly distal to midlength of ramus; dorsal seta positioned subdistally.

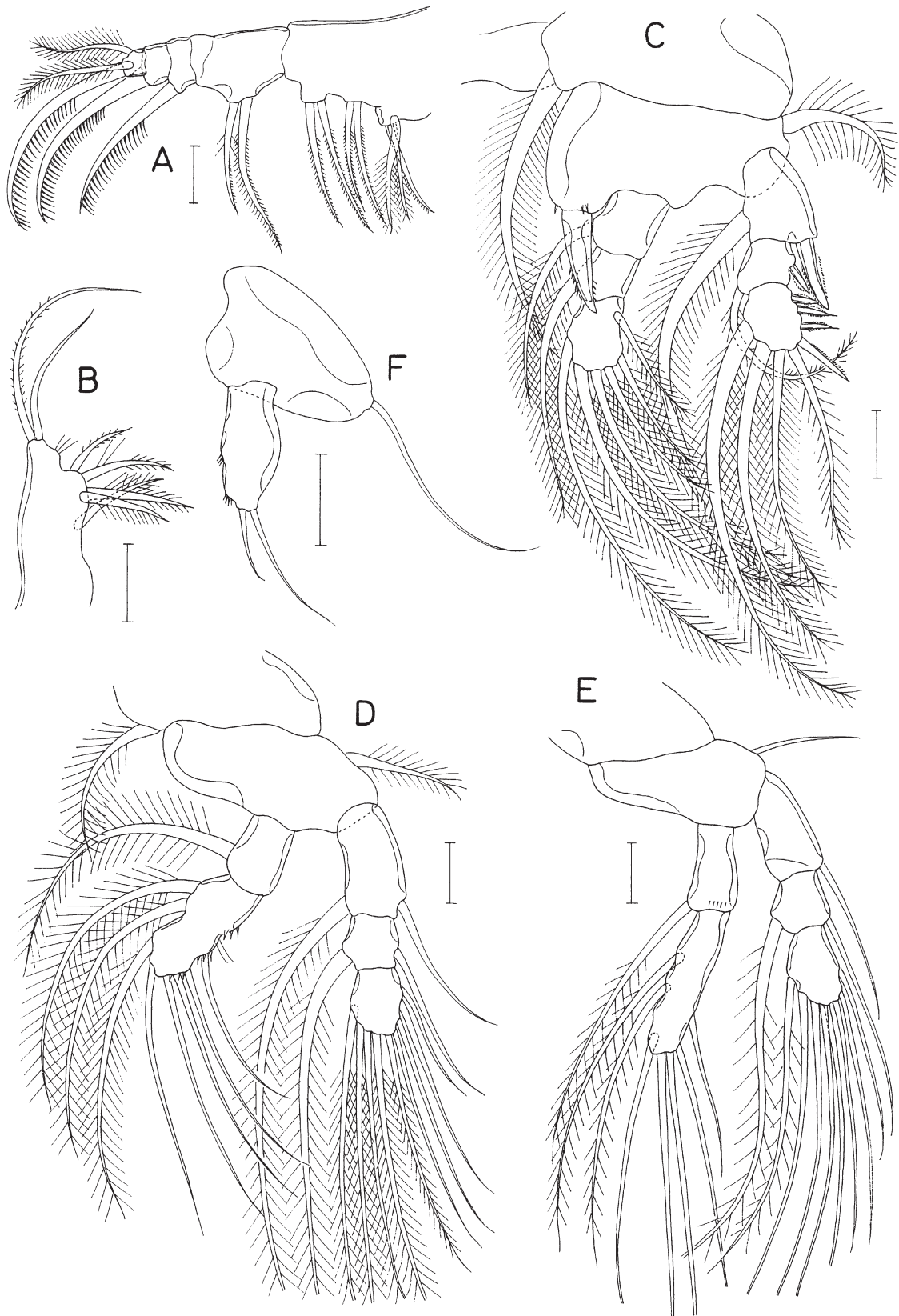
Rostrum (Fig. 273D) as short anteroventral prominence on frontal margin of cephalosome, not articulated at base. Antennule (Fig. 273E) slender, 194 µm long, 9-segmented; proximal segments not markedly broader; armature formula 3, 12, 5, 4+aesthetasc, 4, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; setae crowded, 2 pinnate setae on first segment, all other setae naked. Antenna (Fig. 273F) 4-segmented; short coxa unarmed; basis 37×22 µm, with vestigial seta at outer distal corner; first endopodal segment 39×24 µm, with small seta subdistally on inner margin; compound distal segment about 3.0 times longer than wide (48×16 µm): armed with 8 setae arranged as 1, 3, 1, 1, and 2 (all setae attenuated at tip) plus terminal claw about 23 µm long.

Labrum (Fig. 273G) with smooth, semicircular posteromedian lobe and patches of setules posterolaterally. Mandible (Fig. 273H) with narrow coxal gnathobase bearing 2 teeth on cutting edge: basis with 1 seta on medial margin; exopod armed with 4 setae, third seta larger than others; endopod 2-segmented, armed with 4 setae on first segment and 10 setae (5 mediobasal setae naked) on second. Maxillule (Fig. 273I) with produced arthrite bearing 8 setae; coxa with 2 unequal setae on epipodite, but lacking endite; basis, exopod and endopod fully fused with one another, forming single complex armed with 7 setae, second medial seta much larger than others. Maxilla (Fig. 274A) 5-segmented; syncoxa with 3 endites bearing 3, 2, and 2 setae, respectively, on first to third endites; basis with 2 setae, distal seta two-thirds length of proximal; endopod with 1, 1, and 3 setae on first to third segments, respectively; 3 endopodal setae (1 on each segment) ornamented with array of thick, comb-like setules along concave margin. Maxilliped (Fig. 274B) unsegmented but divisible into broad proximal and narrow distal parts; armed with 5 medial setae on proximal part and 2 unequal apical setae.

Leg 1 (Fig. 274C) biramous with 3-segmented rami. Inner coxal seta broad, extending to distal tip of endopod. Inner distal spine on basis robust, 31 µm long, reaching beyond distal border of second endopodal segment. Inner seta on first exopodal segment and 2 proximal inner setae on third exopodal segment broadened. Outer spines on second and third exopodal segments small. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig.



**FIGURE 273.** *Sympygus punctatus* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.1 mm; B, D, 0.05 mm; C, E–I, 0.02 mm.



**FIGURE 274.** *Sympygus punctatus* **gen. et sp. nov.**, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

274D, E). Inner coxal seta absent in leg 4. Outer and distal setae on exopods and endopods of legs 2–4 naked. Leg 4 lacking inner seta on first exopodal segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 3, 2
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 4
Leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-1; 1, 3, 3

Leg 5 (Fig. 274F) 2-segmented: protopod expanded distolaterally, much wider than long, armed with large, naked seta at outer distal corner; free exopodal segment about 2.2 times longer than wide (28×13 µm), broad in middle; armed with 2 unequal, naked setae distally (long outer and short inner), ornamented with 2 clusters of fine spinules on medial surface.

**Male.** Unknown.

**Remarks.** This distinctive species is currently known only from the type locality in Malaysia.

### *Vaoda* gen. nov.

**Diagnosis.** Body dorsoventrally depressed in female, narrower in male. Prosoma consisting of cephalosome and 4 pedigerous somites: dorsal cephalic shield and second and third pedigerous somites of female each with well-developed epimera. Fourth pedigerous somite forming brood pouch, much longer than other pedigerous somites. Free urosome 5-segmented in female and 6-segmented in male. Rostrum well-developed. Antennule 9-segmented. Antenna 4-segmented; endopod 2-segmented with small terminal claw, exopod represented by 2 vestigial setae. Mandible with 5 teeth on coxal gnathobase; basis with 1 seta; exopod of female with 4 setae, distalmost seta enlarged; exopod of male with 5 subequal setae; endopod with 3 and 7 setae on first and second segments, respectively. Maxillule with well-defined arthrite, coxal endite and epipodite; basis fused with exopod and endopod forming complex armed with reduced number of setae. Maxilla 3-segmented with unsegmented endopod bearing 3 setae. Maxilliped unsegmented, armed with 7 setae medially and 2 setae apically in female, but only 5 setae medially and 2 setae apically in male. Leg 1 with 3-segmented rami; inner coxal seta large; basis with inner distal spine; first endopodal segment with rudimentary inner seta. Legs 2–4 with 3-segmented exopods and 2-segmented endopods; coxa lacking inner seta. Leg 4 without inner seta on first segment of both rami. Leg 5 small, protopod slender with outer naked seta, exopodal segment with 2 unequal apical setae. Leg 6 absent in female; represented by 3 setae on genital operculum in male.

**Type and only species.** *Vaoda depressa* gen. et sp. nov., by original designation.

**Etymology.** The new generic name is an anagram of Davao, the type locality of the type species. Gender feminine.

**Remarks.** The new genus shares the fusion of the basis, exopod and endopod of the maxillule with *Sympygus* gen. nov. and with *Sesir*, and all three genera share a swimming leg setation pattern which is not significantly reduced. *Vaoda* gen. nov. can be distinguished from the other two genera by a number of features: (1) the body of the female is dorsoventrally depressed, whereas in *Sympygus* gen. nov. the body is bilaterally compressed and in *Sesir* it is cylindrical and there is no expressed segmentation in the urosome; (2) the mandibular exopod is armed with 4 setae in *Vaoda* gen. nov. and *Sympygus* gen. nov. compared to 5 setae in *Sesir*; (3) the maxillule possesses a coxal endite which is lacking in both *Sympygus* gen. nov. and *Sesir*; (4) the endopod of the maxilla is unsegmented, compared to 3-segmented in *Sympygus* gen. nov. and *Sesir*; and (5) the setation of legs 1–4 is better developed than in *Sesir*, but less developed than in *Sympygus* gen. nov.

### *Vaoda depressa* gen. et sp. nov.

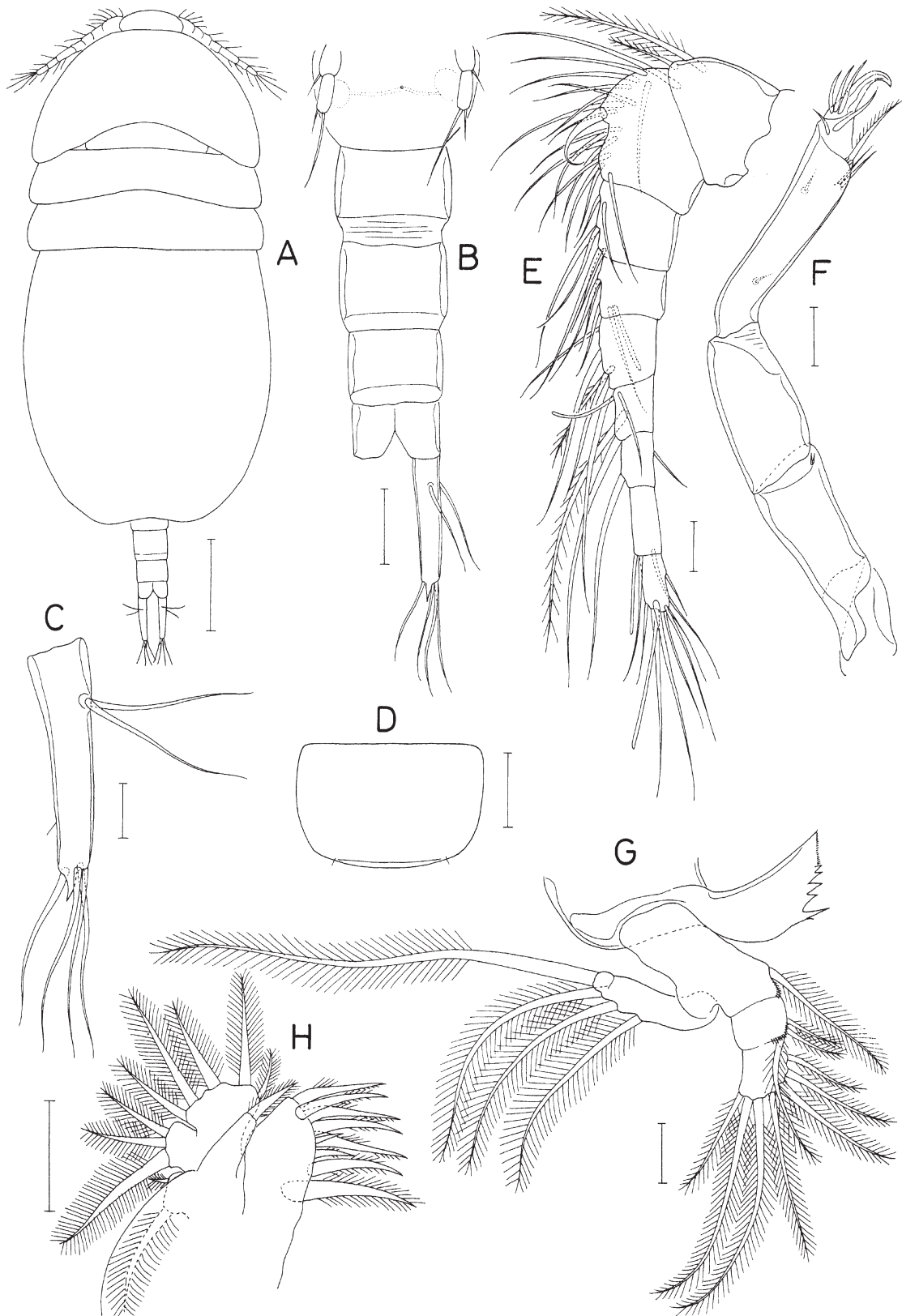
(Figs. 275–277)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21342), paratypes (intact, 3 ♀♀, 1 ♂, MNHN-IU-2014-21343), and dissected paratypes (2 ♀♀, 1 ♂, figured) from *Herdmania mauritiana* (Drasche, 1884) (MNHN-IT-2008-4577 = MNHN S2/HER/17), CRRF CRCHO 3497-L, Davao, the Philippines (07°05.89'N, 125°47.58'E), depth 8 m, 02 April 1996.

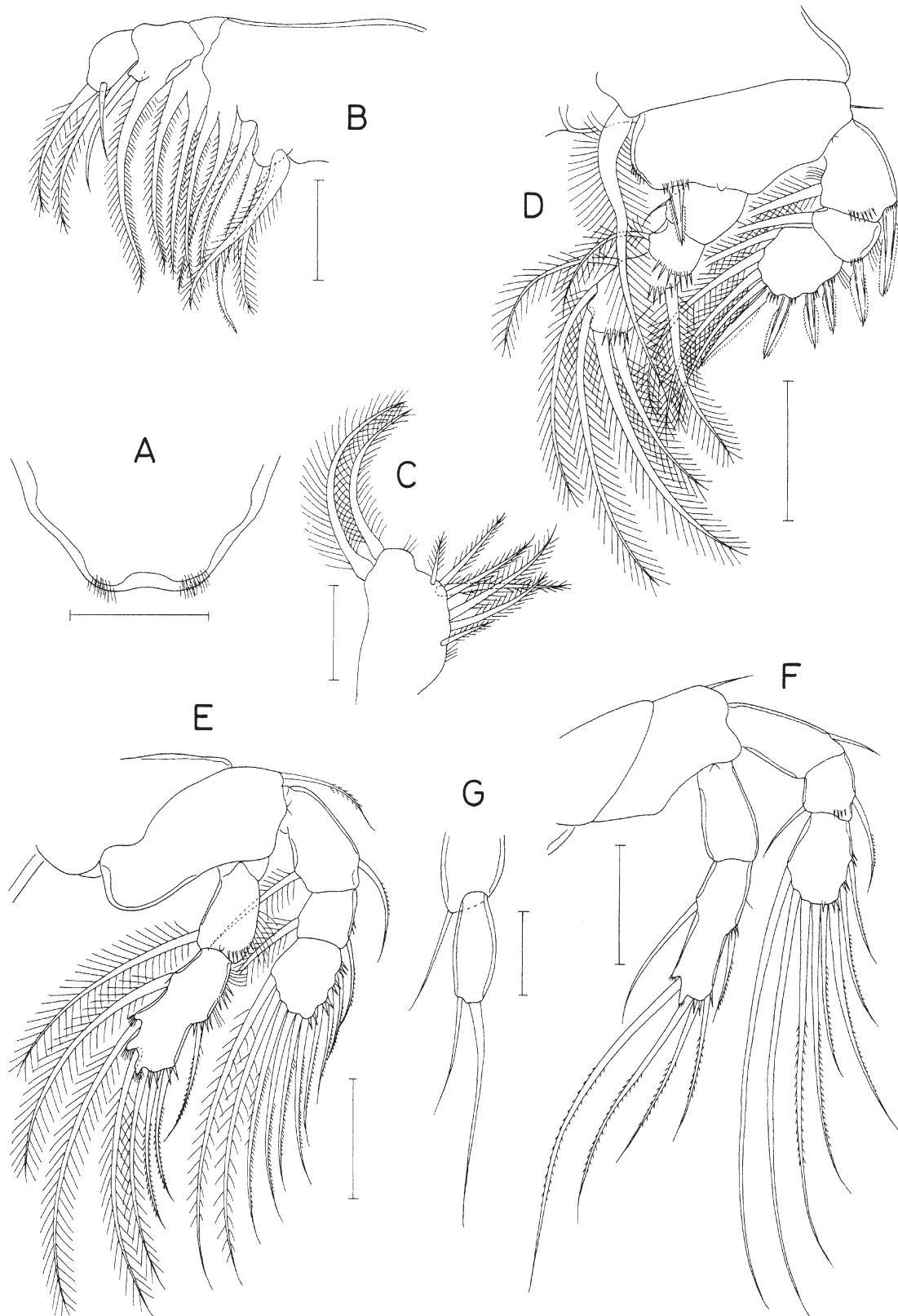
**Etymology.** The specific name refers to the strongly depressed body.

**Description of female.** Body (Fig. 275A) extremely dorsoventrally flattened: body length 1.36 mm. Prosoma 5-segmented, with parallel lateral margins. Dorsal cephalic shield semicircular, 260×490 µm, with concave posterior margin and rounded posterolateral corners. First pedigerous somite short and narrow, without epimera; second and third pedigerous somites short, 90×500 and 125×510 µm, respectively, each with well-developed epimera. Fourth pedigerous somite forming brood pouch, 590×535 µm, with weakly convex lateral margins and slightly concave posterior margin. Free urosome (Fig. 275B) narrow, 5-segmented; genital somite about 75×112 µm, with convex lateral margins; 4 abdominal somites 53×80, 67×73, 50×64, and 35×58 µm, respectively. Anal somite with deep posteromedian incision. Caudal ramus (Fig. 275C) about 4.1 times longer than wide (95×23 µm) and 2.7 times longer than anal somite, terminating in hook-like process: armed with 6 setae (2 proximal and 4 distal), all setae naked, subequal in length, about three-quarters as long as ramus; 2 proximal setae positioned together at 28% of ramus length.

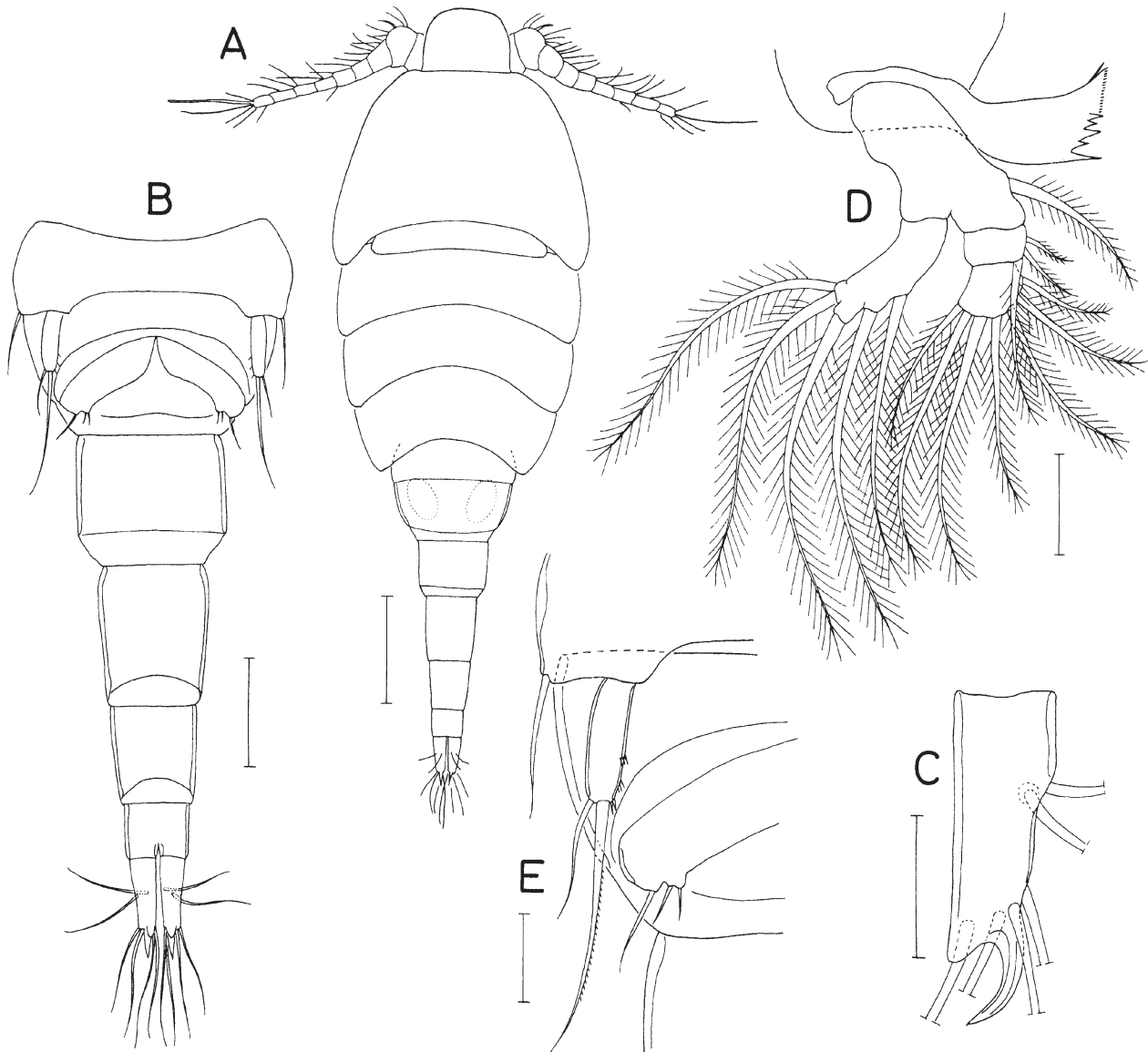




**FIGURE 275.** *Vaoda depressa* gen. et sp. nov., female. A, habitus, dorsal; B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule. Scale bars: A, 0.2 mm; B, D, 0.05 mm; C, E–H, 0.02 mm.



**FIGURE 276.** *Vaoda depressa* **gen. et sp. nov.**, female. A, labrum; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A, D–F, 0.05 mm; B, C, G, 0.02 mm.



**FIGURE 277.** *Vaoda depressa* gen. et sp. nov., male. A, habitus, dorsal; B, urosome, ventral; C, right caudal ramus, lateral; D, mandible; E, legs 5 and 6, ventral. Scale bars: A, 0.1 mm; B, 0.05 mm; C–E, 0.02 mm.

Rostrum (Fig. 275D) plate-like, subrectangular, wider than long ( $85 \times 127 \mu\text{m}$ ), well-defined at base, with slightly convex lateral and distal margins. Antennule (Fig. 275E) rather slender,  $240 \mu\text{m}$  long, 9-segmented; articulation between fifth and sixth segments faint; armature formula 3, 17, 6, 4+aesthetasc, 5, 3+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; 2 pinnate setae on first segment, 1 each on fifth and sixth, all other setae naked. Antenna (Fig. 275F) slender, 4-segmented; coxa unarmed; basis  $53 \times 26 \mu\text{m}$ , with pair of minute setal vestiges at outer distal corner; first endopodal segment unarmed,  $50 \times 27 \mu\text{m}$ ; compound distal endopodal segment about 4.6 times longer than wide ( $82 \times 18 \mu\text{m}$ ); armed with 10 small setae (arranged as 1, 1, 2, 1, 2, and 3) plus small terminal claw, about  $25 \mu\text{m}$  long, 0.3 times as long as segment.

Labrum (Fig. 276A) simple, with narrow posterior margin bearing tuft of setules on each side. Mandible (Fig. 275G) bearing 5 pointed teeth on narrow coxal gnathobase; distalmost tooth accompanied on distal margin with spinule-like, minute subsidiary tooth: basis with 1 seta subdistally and fine spinules distally on medial margin; exopod elongate, armed with 3 subequal, short setae proximally and 1 large distal seta (more than twice length of proximal setae); endopod 2-segmented; first segment with 3 setae and fine spinules at mediolaterally; second segment with 7 setae, second and third outer setae on distal margin longer than other endopodal setae. Maxillule (Fig. 275H) with 9 setae on arthrite, 1 on coxal endite and 2 on epipodite; exopod and endopod fused with basis; exopod demarcated from fused endopod and basis

by incision, armed with 3 setae distally; fused endopod and basis with 5 setae, 3 on endopodal part and remaining 2 on basis part. Maxilla (Fig. 276B) 3-segmented, comprising syncoxa, basis, and 1-segmented endopod; syncoxa with 8 setae arranged as 3, 1, 2, and 2 on first to fourth endites, respectively; basis with 2 setae, distal seta slender, naked, about half length of proximal seta; endopod with 3 setae, smallest seta naked. Maxilliped (Fig. 276C) unsegmented but with shallow constriction subdistally on medial side, armed with 7 setae (3 proximal and 4 distal) on medial margin and 2 larger setae distally.

Leg 1 (Fig. 276D) with 3-segmented rami. Inner coxal seta large, broad proximally, extending beyond distal tip of endopod. Basis with rudimentary outer seta and fine spinules on medial margin and at base of inner distal spine. Inner distal spine on basis 23 µm long, slightly longer than first endopodal segment. Inner seta on first endopodal segment rudimentary, setule-like. Legs 2–4 (Figs. 276E, F) with 3-segmented exopods and 2-segmented endopods: rami equal in length. Coxa of leg 3 lacking inner seta. Outer seta on basis larger than that of leg 1. Exopodal and compound second endopodal segments ornamented with spinules on outer and distal margins, mainly at bases of outer and distal setae. First segments of both rami of leg 4 lacking inner seta. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	I-1; I-1; III, I, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 3
Leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-0; 1, 3, 2

Leg 5 (Fig. 276G) small, slender; protopod slightly longer than wide, not articulated at base, armed with 1 naked seta at outer distal corner; free exopodal segment fusiform, 26×10 µm, armed with 2 naked setae distally; outer seta 29 µm, inner seta 55 µm.

**Description of male.** Body (Fig. 277A) much smaller and narrower than female, slightly depressed: body length 0.77 mm. Prosome fusiform, 436×264 µm: first pedigerous somite much shorter and narrower than other prosomites; second to fourth pedigerous somites subequal in length, each with concave posterior margin. Urosome (Fig. 277B) 6-segmented. Fifth pedigerous somite clearly articulated from prosome, wider than genital somite. Genital somite 68×121 µm, narrowing posteriorly; abdomen narrowing posteriorly, somites 60×70, 67×52, 45×42, and 27×32 µm, respectively. Caudal ramus (Fig. 277C) 3.7 times longer than wide (52×14 µm), armed as in female.

Rostrum large, directed anteriorly (Fig. 277A), 68×95 µm. Antennule and antenna as in female. Mandible (Fig. 277D) differing from that of female in having 1 small seta on proximal margin of gnathobase and 5 subequal setae on exopod. Labrum, maxillule and maxilla as in female. Maxilliped armed with 5 medial (2 proximal+3 distal) and 2 apical setae.

Legs 1–4 as female. Leg 5 (Fig. 277E) consisting

of short, broad protopod with seta at outer distal corner and free exopodal segment about 3.1 times longer than wide (28×9 µm), armed with 2 unequal setae distally, ornamented with 3 groups of minute spinules on medial side. Leg 6 (Fig. 277E) represented by 3 small setae on distal margin of genital operculum.

**Remarks.** The body form of the new species is superficially similar to some species of *Notodelphys* and *Paranotodelphys*, but differs fundamentally from these genera in the morphology of the maxillule (with both rami fused to the basis in *Vaoda* gen. nov.), the maxilla (with an unsegmented endopod in *Vaoda* gen. nov.), the unsegmented, lobate maxilliped in *Vaoda* gen. nov., and in the reduced segmentation and setation of legs 2–4.

### *Gosbia* gen. nov.

**Diagnosis (female).** Body small and slightly dorsoventrally depressed. Prosome comprising cephalosome and 4-segmented metasome, with pedigerous somites defined only by dorsal and lateral constrictions: brood pouch small. Free urosome 5-segmented. Caudal ramus armed with 6 setae. Rostrum well-developed. Antennule 8-segmented. Antenna 4-segmented, with 1 large seta on basis representing exopod; endopod 2-segmented with small terminal claw. Mandible with 5 teeth on coxal gnathobase; exopod with 4 setae; endopod 2-segmented, with 1 seta on first segment and 5 setae on second. Maxillule with 5 setae on arthrite; coxal endite and epipodite present, each with 1 seta; basis with 2 setae; exopod and endopod small, with 3 and 2 setae, respectively. Maxilla 4-segmented; syncoxa with 9 setae arranged as 3, 1, 2, and 3; basis with strong claw plus 2 setae; endopod 2-segmented with 1 and 4 setae on first and second segments, respectively. Maxilliped unsegmented, armed with 10 medial setae and 1 apical seta. Legs 1–4 with 3-segmented rami. Inner coxal seta absent in legs 1–4. Leg 1 with inner distal spine on basis. Leg 4 without outer element on first exopodal segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; II, I, 4	0-1; 0-1; 1, 2, 2
Legs 2 & 3	0-0	1-0	I-1; I-1; II, I, 5	0-1; 0-1; 1, 2, 1
Leg 4	0-0	1-0	0-1; I-1; II, I, 5	0-1; 0-1; 1, 2, 2

Leg 5 rudimentary, bilobed, with 1 seta on apex of each lobe.

**Type species.** *Gosbia pusilla* gen. et sp. nov., by original designation.

**Etymology.** The generic name *Gosbia* is an anagram of BIOGAS (Biologie Gascogne) which was a French deep-sea research program. Gender feminine.

**Remarks.** *Bysone* Stock, 1967 and *Gosbia* gen. nov. have similarly reduced setal armature on the mandible and

the maxillule, and both have a rudimentary leg 5. However, *Gosbia* **gen. nov.** can be separated from *Bysonie* and other similar genera, such as *Thoracodelphys* and *Sesir*, by the presence of 3-segmented rami in all swimming legs and by the presence of a large seta representing the exopod on the antenna. In *Bysonie* and related genera, the endopods of legs 2–4 are all 2-segmented, and the antenna either lacks any trace of the exopod, or retains only a minute setal vestige.

### *Gosbia pusilla* **gen. et sp. nov.**

(Figs. 278, 279)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21344), paratypes (2 intact ♀♀, MNHN-IU-2014-21345), and dissected paratype (♀, figured) from *Minipera papillosa* Monniot C. & Monniot F., 1974, BIOGAS\$ cruise, Stn DS55, Gulf of Gascogne, off Atlantic coast of France, “Jean Charcot” (47°35'N, 09°41'W), depth 4125 m, 22 February 1974.

**Additional material.** 1 ♀ (dissected) from *M. papillosa*, BIOGAS4 DS75, Gulf of Gascogne (47°31'N, 9°07.8'W), depth 2906 m, 23 February 1974; 1 ♀ (MNHN-IU-2018-1881) from *M. papillosa*, West Ireland, Chain 106; 1 ♀ (MNHN-IU-2018-1882) from *M. papillosa*, Southwest Ireland, Chain 106 Stn 326, depth 3859 m, 1972.

**Etymology.** The specific name is derived from the Latin *pusill* (=very small) and refers to the small body of the new species.

**Description of female.** Body (Fig. 278A) small, slightly depressed; body length 773 µm. Prosome 480 µm long, consisting of relatively large cephalosome and 4-segmented metasome, with thin, soft cuticle: dorsal and ventral margins of prosome nearly parallel: pedigerous somites defined only by dorsal and lateral constrictions. Free urosome (Fig. 278B) 5-segmented: genital somite 23×98 µm; 4 abdominal somites 39×83, 41×71, 32×65, and 59×67 µm, respectively. Surface of posterior abdominal somites ornamented with long setules. Caudal ramus (Fig. 278C) about 4.2 times longer than wide (74×17.5 µm) and gradually narrowing distally, ornamented with scattered setules: armed with 6 setae; setae longer than maximum width of ramus; 2 proximal setae located at 24 and 36% of ramus length.

Rostrum (Fig. 278D) large, elongate, 71×35 µm, narrowing distally, constricted near proximal third, with small notch in apex. Antennule (Fig. 278E) 112 µm long, 8-segmented; armature formula 2, 15, 5, 3, 2, 3, 5 and 7+aesthetasc; larger seta on first segment pinnate, all other setae naked. Antenna (Fig. 278F) 4-segmented; coxa unarmed; basis 29×17 µm, armed with 1 large, pinnate seta (37 µm long) representing exopod at outer distal corner; first endopodal segment 35×17 µm, unarmed, slightly longer than basis; compound distal endopodal segment about 4.2 times longer than wide (50×12 µm)

and ornamented with row of spinules on distal part of outer margin: armed with 6 setae (arranged as 1, 2, and 3) plus slender terminal claw, 22 µm long, less than half length of segment.

Labrum (Fig. 278G) with large, spinulose posteromedian lobe and convex posterior margin ornamented with setules on both sides. Mandible (Fig. 278H) with coxa bearing 5 teeth and 2 small setae on cutting margin of gnathobase: basis with 1 seta on medial margin; exopod with 4 setae; second and third setae longer than first and fourth; endopod with 1 and 5 setae on first and second segments, respectively; mediobasal seta on second segment much longer than other setae on either ramus. Maxillule (Fig. 278I) armed with 5 setae on arthrite, 1 on each coxal endite and epipodite, 2 on basis, 3 on exopod and 2 on endopod; exopod and endopod small but clearly defined. Maxilla (Fig. 278J) 4-segmented; syncoxa with 9 setae arranged as 3, 1, 2, and 3; basis with strong claw bearing minute spinules on concave margin plus 2 unequal setae (proximal seta needle-like); endopod 2-segmented with 1 seta on first, and 4 setae on second segment. Maxilliped (Fig. 278K) unsegmented, tapering distally, with traces of 2 transverse suture lines; armed with 10 medial setae and 1 apical seta.

Legs 1–4 biramous with 3-segmented rami (Fig. 279A–C); coxa lacking inner seta; outer seta on basis shorter than first exopodal segment. Inner distal spine on basis of leg 1 slender, spinulose, 23 µm long. First endopodal segment of leg 1 with pointed outer distal corner; second endopodal segment with bicuspid outer distal corner. Setae on leg 4 short and naked. First exopodal segment of leg 4 lacking outer element. Armature formula for legs 1–4 as in generic diagnosis.

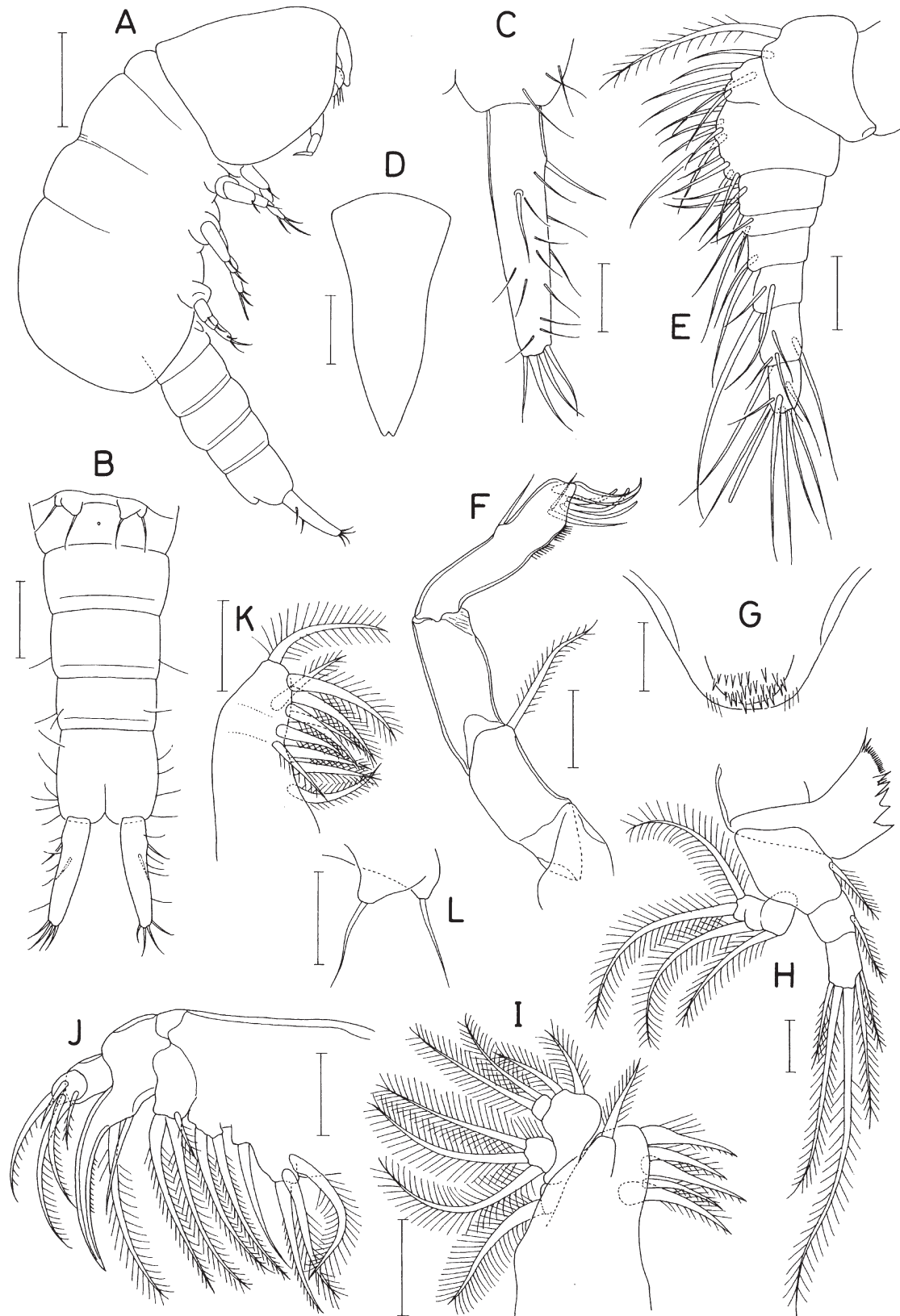
Leg 5 (Fig. 278B, L) rudimentary, represented by 2 small lobes each tipped with naked seta.

**Male.** Unknown.

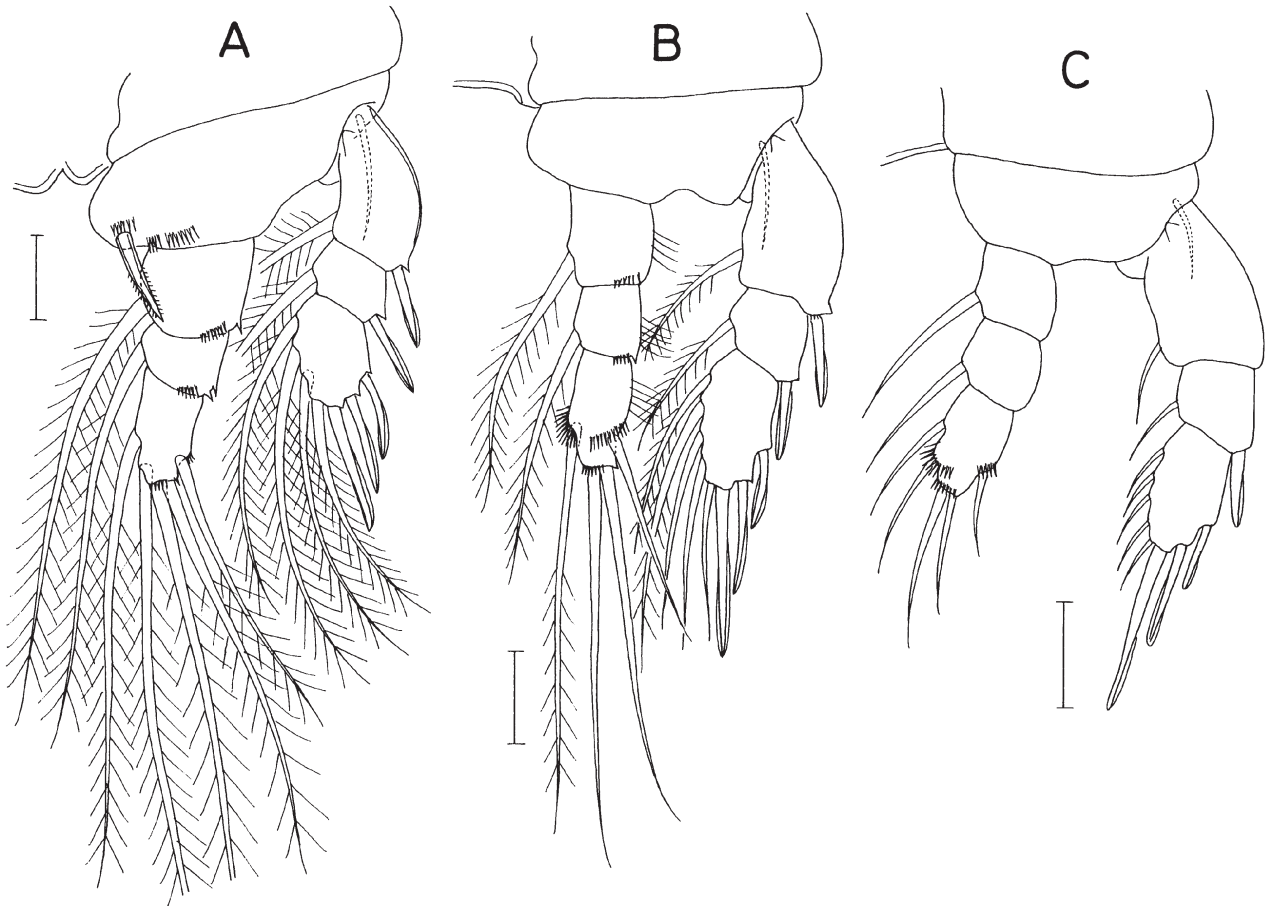
**Remarks.** This copepod is a deep-water species. Its host *Minipera papillosa* is distributed across a wide depth range (750 to 6000 m) in the Atlantic Ocean (Monniot & Monniot, 1987).

### Genus *Thoracodelphys* Stock, 1967

**Diagnosis.** Body of female small. Prosome dorsoventrally depressed and tapering anteriorly. Free urosome 5-segmented. Caudal rami slender, armed with 6 setae or mix of spines plus setae. Rostrum small and short. Antennule small, stout, 6- or 7-segmented; setae generally long. Antenna 4-segmented, including 2-segmented endopod tipped with claw; exopod absent. Mandible with 5 teeth on coxal gnathobase; basis with 1 medial margin seta; exopod with 4 or 5 setae; endopod with 2 and 5 setae on first and second segments, respectively. Maxillule with 7 or 8 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis, 3 on exopod and 2 on endopod. Maxilla 5-



**FIGURE 278.** *Gosbia pusilla* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla; K, maxilliped; L, leg 5. Scale bars: A, 0.1 mm; B, 0.05 mm; C–L, 0.02 mm.



**FIGURE 279.** *Gosbia pusilla* gen. et sp. nov., female. A, leg 1; B, leg 2; C, leg 4. Scale bars: 0.02 mm.

segmented; basis armed only with setae; endopod 3-segmented. Maxilliped unsegmented with 6 to 8 setae medially and 1 outer seta subdistally. Legs 1–4 biramous with 3-segmented exopods and 2-segmented endopods; inner coxal seta absent. Leg 1 with inner distal spine on basis. Second exopodal segment of legs 2–4 with large, bifurcate anterodistal process. Inner seta usually absent on first and second exopodal segments of posterior swimming legs. Armature formula for endopods of legs 1–4: 0-0; 1, 2, 3 (leg 1), 0-1; 1, 2, 5 (legs 2 and 3), and 0-0; 1, 2, 1 (leg 4). Leg 5 reduced, consisting at most of short protopod bearing outer seta and small, lobate exopodal segment bearing 2 setae.

**Type species.** *Thoracodelphys chelipus* Stock, 1967, by original designation.

**Remarks.** When establishing *Thoracodelphys*, Stock (1967) recognized it as a close relative of *Bonnierilla* and separated it from the latter genus by its reduced leg 5, the 2-segmented endopod of leg 1, the reductions in the armature of the maxilliped and maxillary exopod and endopod, and by the reduction in the segmentation and setation of the antennule. Stock & Humes (1970) added a second species, *T. unisetata* Stock & Humes, 1970, and here we describe six new species. The discovery of all

these additional species in the genus has revealed some other shared generic characters, such as the depressed body with its anteriorly tapering prosome, the presence of the bifurcate anterodistal process on the second exopodal segment of legs 2–4, the armature of the mandibular endopod, and the setation pattern of the endopods of legs 1–4. Species within the genus appear to exhibit a trend in caudal setation, with the more distal setae on the caudal rami being transformed into spines.

Females of the known species of *Thoracodelphys* can be identified using the following key:

1. Caudal ramus more than 9 times longer than wide; mandibular exopod armed with 4 setae; third endopodal segment of maxilla with 2 setae ..... *T. quadriseta* sp. nov.
2. Caudal ramus less than 7 times longer than wide; mandibular exopod armed with 5 setae; third endopodal segment of maxilla with 3 setae ..... 2
3. Maxilliped armed with 7 (6+1) setae ..... 3
4. Maxilliped armed with 8 (7+1) or 9 (8+1) setae ..... 4
5. First exopodal segment of legs 2–4 with simple anterodistal process; legs 2 and 3 lacking inner seta ..... *T. chelipus* Stock, 1967

- First exopodal segment of legs 2–4 with bifurcate anterodistal process; legs 2 and 3 with inner seta.....  
 ..... *T. uniseta* Stock & Humes, 1970
4. First exopodal segments of legs 2–4 each with outer spine  
 ..... *T. tertius* **sp. nov.**  
 First exopodal segments of legs 2–4 each with outer seta or lacking outer element ..... 5
5. Maxilliped with 8 (7+1) setae; third exopodal segment of leg 2 armed with total of 8 setae; first exopodal segment of leg 2 lacking outer element..... *T. papuensis* **sp. nov.**  
 Maxilliped with 9 (8+1) setae; third exopodal segment of leg 2 armed with total of 9 setae; first exopodal segment of leg 2 bearing outer seta..... 6
6. Third exopodal segment of leg 3 armed with total of 9 setae; second exopodal segment of leg 1 bearing large outer distal process ..... *T. longiseta* **sp. nov.**  
 Third exopodal segment of leg 3 armed with 8 setae; second exopodal segment of leg 1 lacking outer distal process ... 7
7. First and second exopodal segments of leg 3 each with inner seta; first and second exopodal segments of leg 4 unarmed  
 ..... *T. depressa* **sp. nov.**  
 First and second exopodal segments of leg 3 without inner seta; first and second exopodal segments of leg 4 each with outer seta..... *T. caledonica* **sp. nov.**

***Thoracodelphys tertius* sp. nov.**

(Figs. 280, 281)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21346), paratypes (2 intact ♀♀, MNHN-IU-2014-21347), and dissected paratype (1 ♀, figured) from *Symplegma brakenhielmi* (Michaelsen, 1904) (MNHN-IT-2008-8440 = MNHN S1/SYM/12), Côte sud de Grande Terre, Saint François, Guadeloupe, Stn 18. Monniot coll., 25 December 1980.

**Etymology.** The specific name is derived from the Latin *terti* (=third), as the new species is the third to be discovered in the genus.

**Description of female.** Body (Fig. 280A) dorsoventrally depressed, comprising inflated prosome and small free urosome: body length 1.65 mm. Prosome stout, unsegmented, 1.27 mm long, gradually broadening towards posterior end and tapering anteriorly, in dorsal view. Cephalosome small, fused with metasome, with plane of fusion discernible only by lateral incision: entire metasome forming brood pouch, incorporating fused fifth pedigerous somite. Free urosome (Fig. 280B) 5-segmented, gradually narrowing posteriorly: genital somite 63×178 µm; 4 abdominal somites 73×135, 64×120, 49×109, and 63×100 µm, respectively. Caudal rami slender, widely separated from each other; each ramus (Fig. 280C) about 5.1 times longer than wide (132×26 µm): armed with 6 setae, outer proximal and dorsal setae located at 38 and 76% of ramus length, respectively; 4 distal setae short, subequal in length, 3 spiniform and bluntly tipped.

Rostrum short, wider than long, with rounded apex. Antennule (Fig. 280D) small, stout, 112 µm long, 7-segmented, and strongly tapering from second to distal segments; compound second segment subdivided by 2 incomplete anterior suture lines; armature formula 3, 14+spine, 8, 4+aesthetasc, 1, 4+aesthetasc, and 7+aesthetasc; spine on second segment spinulose; all setae naked, many large; 2 larger setae on first segment especially large, longer than entire antennule. Antenna (Fig. 280E) 4-segmented; coxa unarmed; basis 50×32 µm, bearing 1 small setae near outer distal corner; first endopodal segment 47×32 µm, unarmed; compound distal endopodal segment 59×22 µm, about 2.7 times longer than wide: armed with 7 setae (arranged as 2, 2, and 3 with distal seta as long as terminal claw) plus large terminal claw, about 45 µm long, 0.76 times as long as segment.

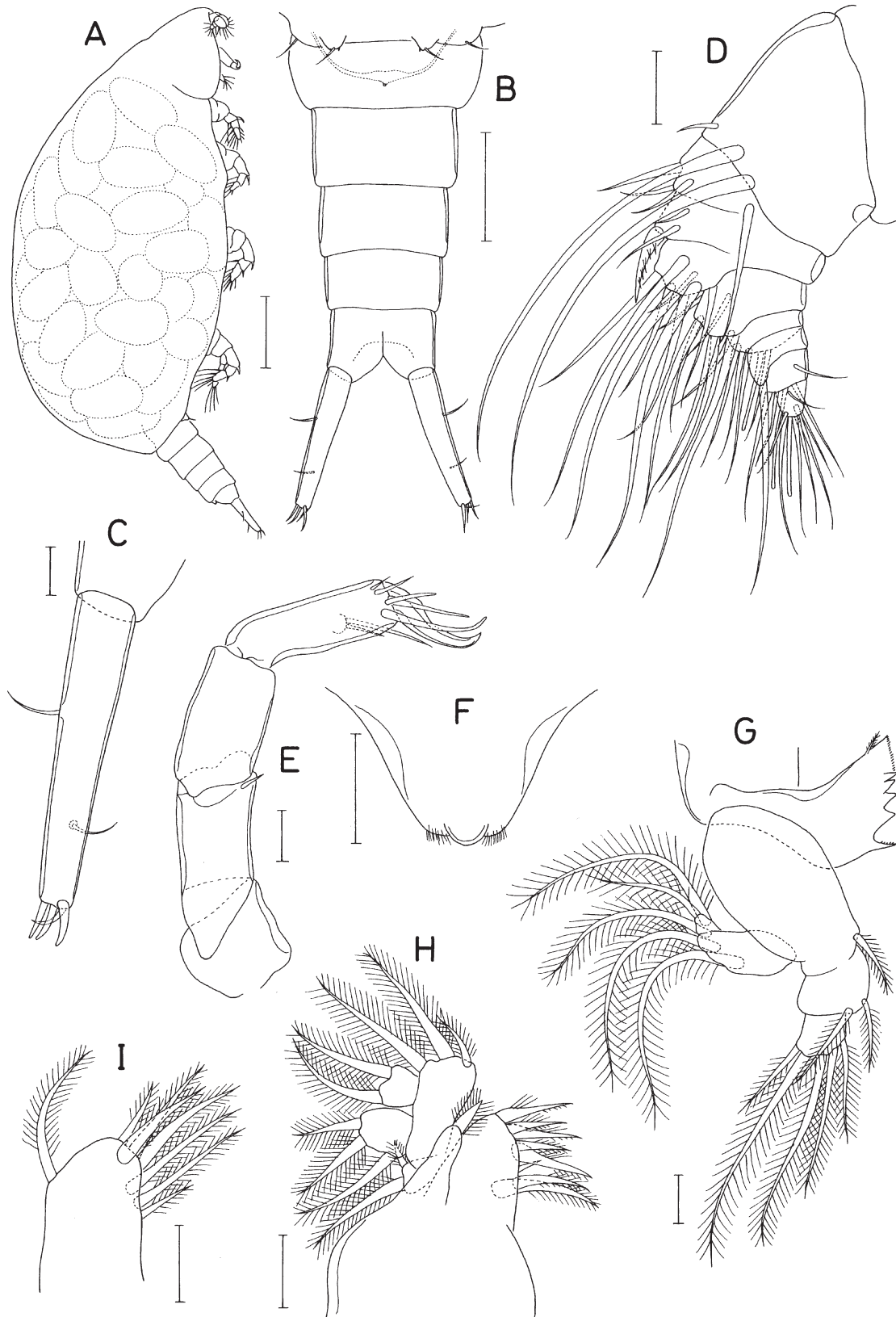
Labrum (Fig. 280F) strongly tapering, with narrow, setulose posterior margin and naked posteromedian lobe. Mandible (Fig. 280G) with 5 teeth and 1 small seta on coxal gnathobase; distalmost tooth acutely pointed, with minute spinules along proximal margin: basis with 1 seta at mediobasal corner; exopod with 5 setae, distalmost about half length of other 4 setae; endopod obscurely articulated from basis, armed with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 280H) bearing 8 setae on arthrite, 1 on coxal endite; 2 on epipodite, 3 on basis, 3 on exopod, and 2 on endopod; proximal seta on basis small, less than half length of distal setae. Maxilla (Fig. 281A) 5-segmented; syncoxa with 9 setae arranged as 3, 1, 2, and 3 on first to fourth endites, respectively; basis with 3 setae, distal seta less than half length of middle seta; endopod 3-segmented with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 280I) unsegmented with oblique distal margin, armed with 7 setae on medial margin and 1 seta at outer corner.

Legs 1–4 (Fig. 281B–E) biramous with 3-segmented exopods and 2-segmented endopods. Inner seta absent on coxa of legs 1–4. Inner distal spine on leg 1 basis 34 µm long, spinulose along margins. First exopodal segment of legs 1–4 bearing outer spine. Second exopodal segment bearing large, spiniform outer distal process, that of leg 4 bifurcate, but that of leg 3 simple or bifurcate. First and second exopodal segments of leg 4 lacking inner seta. First endopodal segment unarmed in legs 1 and 4. Armature formula for legs 1–4 as follows:

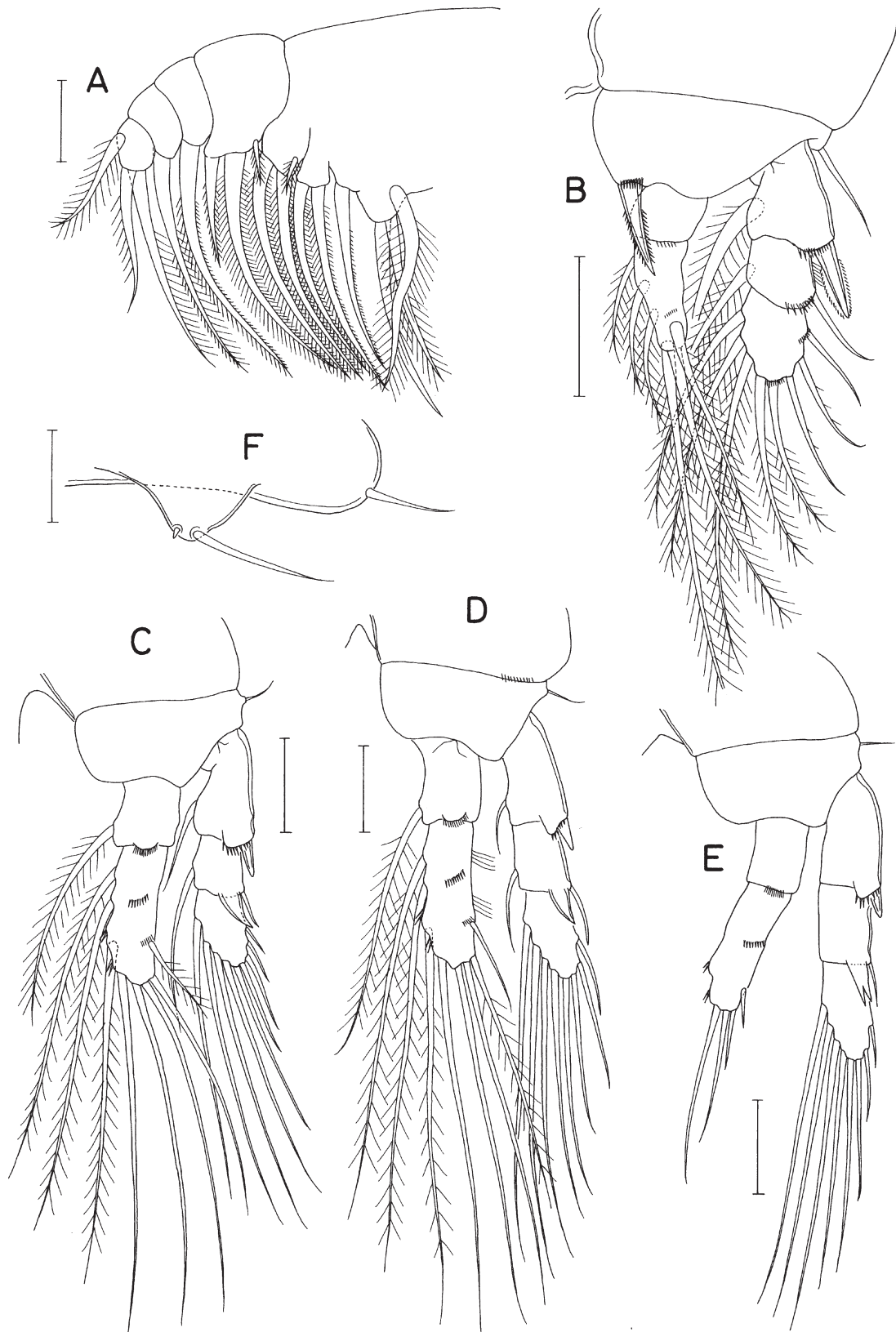
	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 3, 1, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	I-1; I-1; 3, 1, 5	0-1; 1, 3, 4
Leg 3	0-0	1-0	I-1; I-1; 2, 1, 5	0-1; 1, 3, 4
Leg 4	0-0	1-0	I-0; I-0; 2, 1, 5	0-0; 1, 3, 0

Leg 5 (Fig. 281F) represented by 2 small lobes; outer (protopodal) lobe rounded with 1 seta; inner (exopodal) lobe strongly tapering, shorter than wide, not articulated





**FIGURE 280.** *Thoracodelphys tertius* sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilliped. Scale bars: A, 0.2 mm; B, 0.1 mm; C–E, G–I, 0.02 mm; F, 0.05 mm.



**FIGURE 281.** *Thoracodelphys tertius* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: A, F, 0.02 mm; B–E, 0.05 mm.

at base, armed with 1 vestigial inner seta and 1 larger outer apical seta.

**Male.** Unknown.

**Remarks.** The two previously known species of *Thoracodelphys* together with the six new species described herein all exhibit the same setation on the mandibular endopod and on the endopods of legs 1–4. In contrast, the setation of the mandibular exopod and of the first and second exopodal segments of legs 2–4 varies with species. The first exopodal segments of legs 2–4 of *T. tertius* **sp. nov.** each bear an outer spine, unlike the two already described species, *T. chelipus* and *T. uniseta*, each of which carries an outer seta on this segment. The absence of an anterodistal process on the first exopodal segment of legs 2–4, the 7-segmented antennule (6-segmented in *T. chelipus* and *T. uniseta*), and the possession of 7 medial setae (6 in these two species) on the maxilliped are also distinguishing features of this new species.

### *Thoracodelphys quadriseta* **sp. nov.**

(Figs. 282, 283)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21348) from *Botrylloides anceps* (Herdman, 1891), Canal Woodin, Grand Terre, New Caledonia, depth 20 m, Monniot coll., 17 September 1985.

**Etymology.** The specific name refers to the possession by the new species of four setae on the mandibular exopod.

**Description of female.** Body (Fig. 282A) relatively narrow, slightly depressed; body length 1.00 mm. Prosome 727 µm long, with almost truncate posterior margin: cephalosome relatively large, well defined from metasome. Metasome broadening posteriorly, with first to fourth pedigerous somites defined by incomplete dorsal sutures. Free urosome (Fig. 282B) slender: genital somite short but much wider than abdomen, strongly tapering posteriorly, 39×147 µm. Four abdominal somites 70×89, 59×83, 56×76, and 53×71 µm, respectively: anal somite narrowing posteriorly, with deep posteromedian incision. Caudal ramus (Fig. 282C) very slender, about 9.9 times longer than wide (128×13 µm) and about 2.4 times longer than anal somite: probably armed with 5 setae; outer proximal and dorsal setae located at 27 and 71% of ramus length, respectively.

Rostrum short with rounded apex. Antennule (Fig. 282D) 124 µm long, 7-segmented; third and fourth segments subdivided on posterior surface; armature formula 2, 16+spine, 7+aesthetasc, 3, 2+aesthetasc, 3+aesthetasc, and 7+aesthetasc; setae crowded, all naked; setae on first segment larger than other setae, but shorter than entire antennule; spine on second segment ornamented with spinules along anterior margin. Antenna (Fig. 282E) 4-segmented; coxa unarmed; basis and first endopodal segment also unarmed, each 37×25 and 44×26

µm; compound distal endopodal segment about 3.2 times longer than wide (57×18 µm): armed with 5 setae (2 subdistal and 3 distal) plus terminal claw, 31 µm long.

Labrum (Fig. 282F) with semicircular posteromedial lobe and feebly setulose, convex posterior margin. Mandible (Fig. 282G) with 5 pointed teeth and 1 small seta on coxal gnathobase: basis with 1 seta on medial margin; exopod with 4 large setae; endopod 2-segmented; first segment with 2 setae; second segment distinctly narrower than first, armed with 5 setae. Maxillule (Fig. 282H) with 8 setae on arthrite, 1 seta on coxal endite, 2 unequal setae on epipodite, 3 setae (1 small proximal and 2 larger distal) on basis, 3 setae on exopod and 2 setae on endopod. Maxilla (Fig. 282I) 5-segmented; syncoxa with 9 setae (3, 1, 2, and 3 on first to fourth endites, respectively); basis with 3 setae, distal seta less than half length of middle seta; endopod 3-segmented with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 283A) unsegmented with 8 medial setae and 1 outer seta.

Legs 1–4 with 3-segmented exopods and 2-segmented endopods (Fig. 283B–E); inner coxal seta absent. Inner distal spine on basis of leg 1 small, naked, 19 µm long, extending to distal border of first endopodal segment: anterodistal process on first exopodal segment small in legs 1 and 4, but larger in legs 2 and 3. Anterodistal process on second exopodal segment small and simple in leg 1, but large and bifurcate in legs 2–4. First exopodal segment of legs 1–4 bearing large outer distal spine; this spine bluntly tipped extending beyond distal border of second exopodal segment. Outer setae on second and third exopodal segments and distal setae on third exopodal segments of legs 2–4 bluntly tipped. Armature formula for legs 1–4 as in *T. tertius* **sp. nov.** Leg 5 (Fig. 283F) similar to that of *T. tertius* **sp. nov.**, but exopodal segment articulated at base.

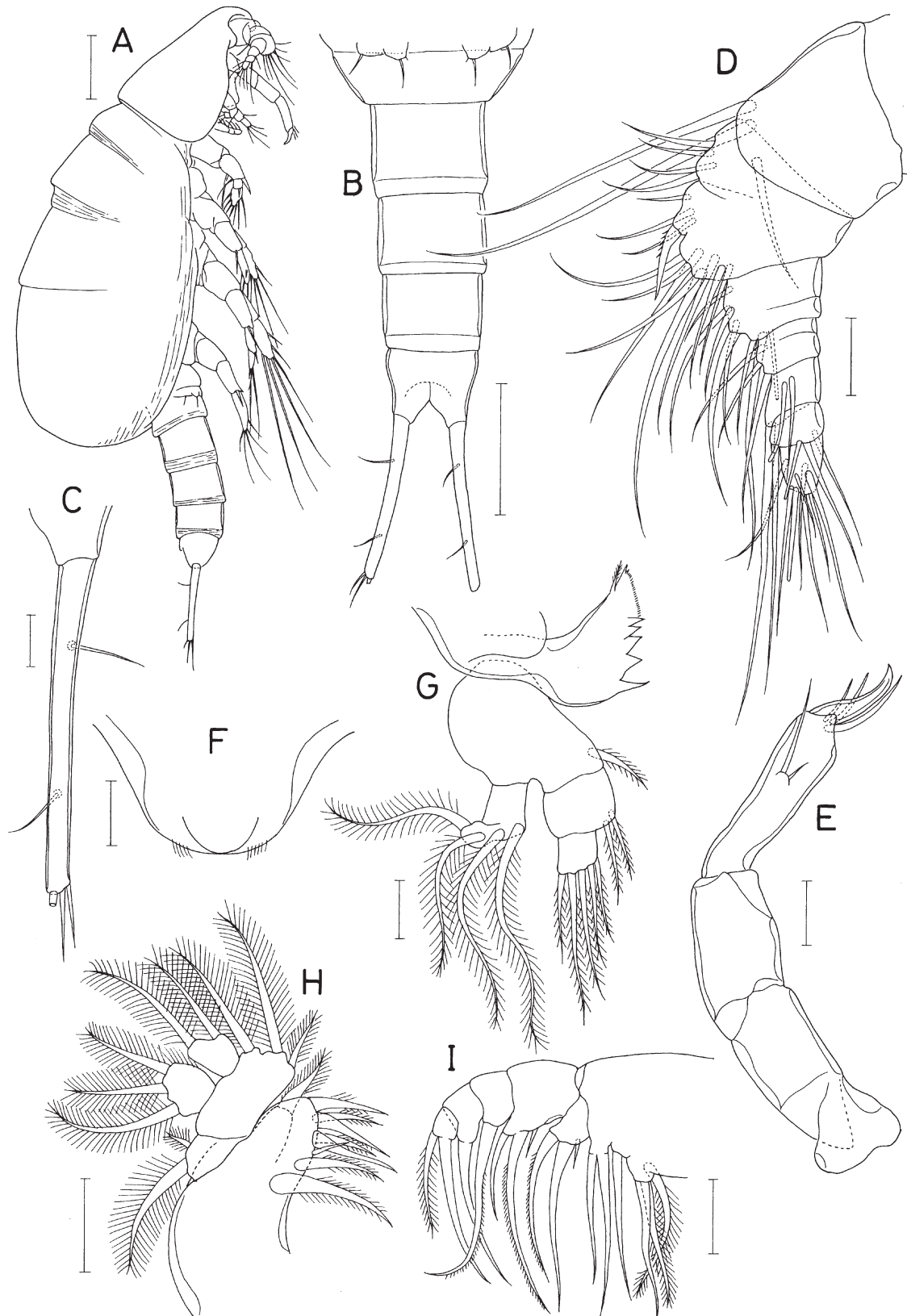
**Male.** Unknown

**Remarks.** This new species is comparable with *T. tertius* **sp. nov.** in having an outer spine, rather than an outer seta, on the first exopodal segment of legs 2–4. But it can be distinguished from *T. tertius* **sp. nov.** and other congeners by two unique features: firstly, the mandibular exopod is armed with 4 setae (instead of 5 setae as in all congeners), and secondly, the maxillary endopod is armed with 1, 1, and 2 setae on the first to third segments, respectively (instead of 1, 1, and 3 as in all congeners). The extremely slender caudal ramus also is a characteristic feature of *T. quadriseta* **sp. nov.**, since it is more than 9 times longer than wide compared to less than 7 times longer than wide in all known congeners.

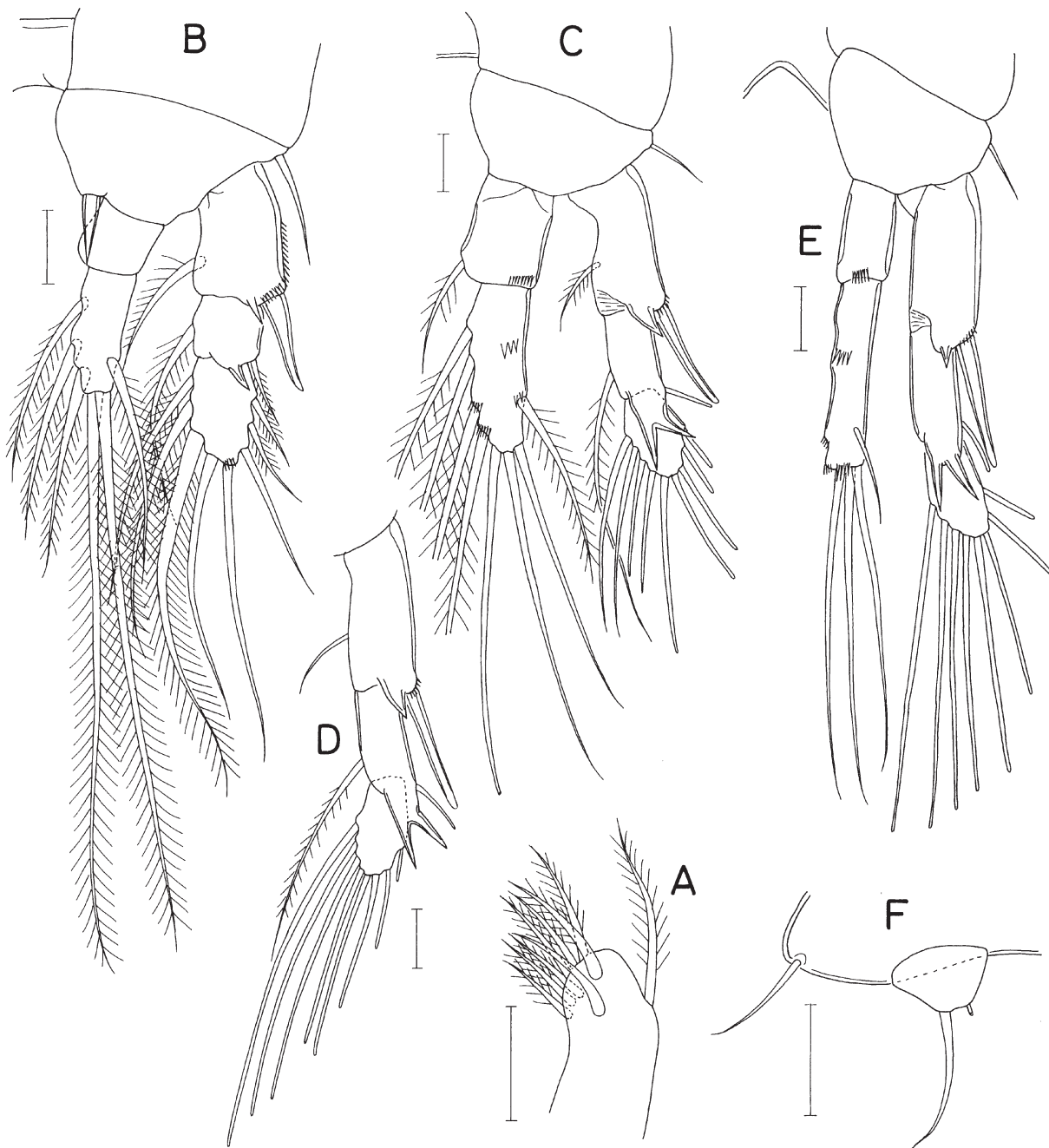
### *Thoracodelphys longiseta* **sp. nov.**

(Figs. 284, 285)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21349) from *Botryllus* sp., Port



**FIGURE 282.** *Thoracodelphys quadriseta* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla. Scale bars: A, B, 0.1 mm; C–I, 0.02 mm.



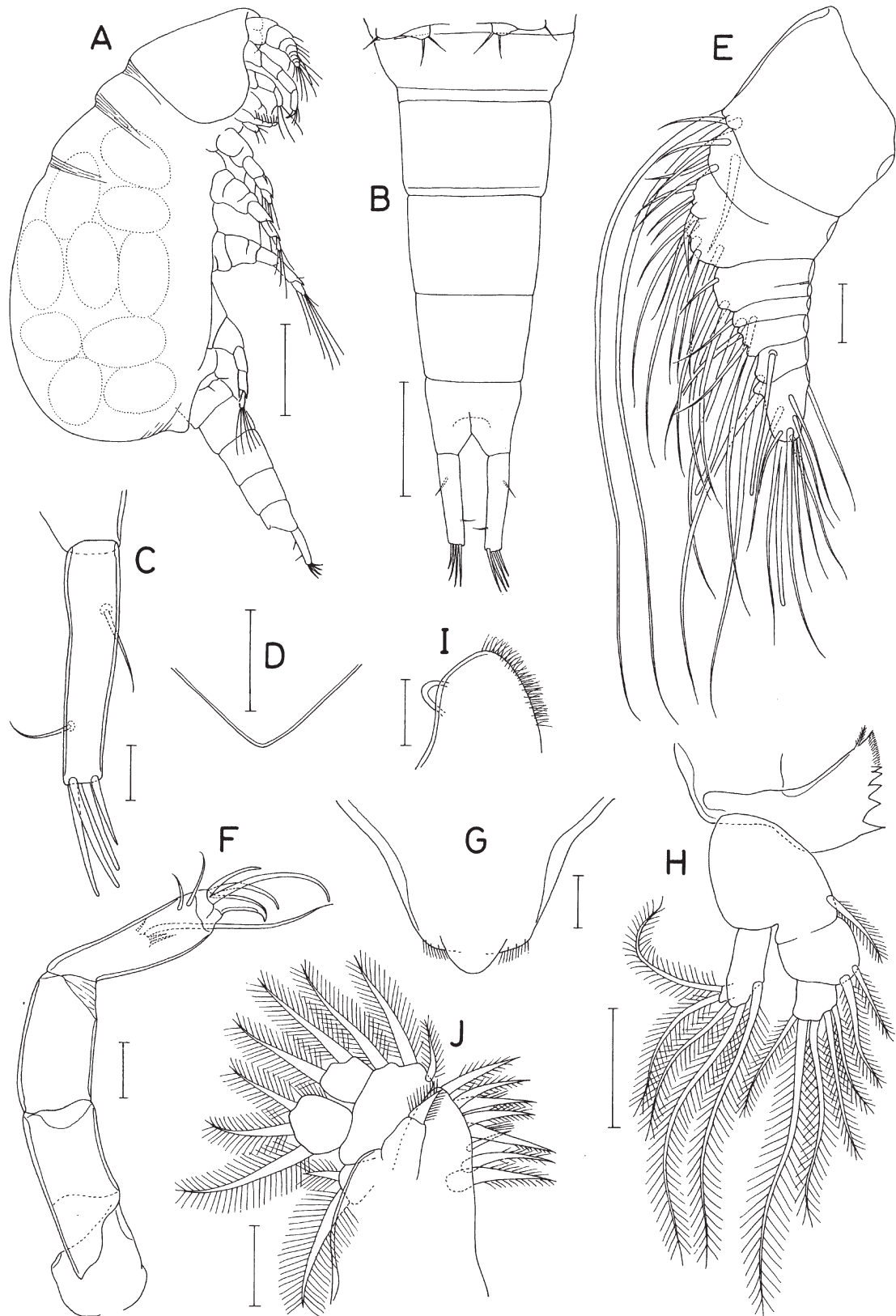
**FIGURE 283.** *Thoracodelphys quadriseta* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, exopod of leg 3; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

of Roi George (October 1829), Stn 90, Port Western, collected by the Australian research vessel, *Astrolabe*.

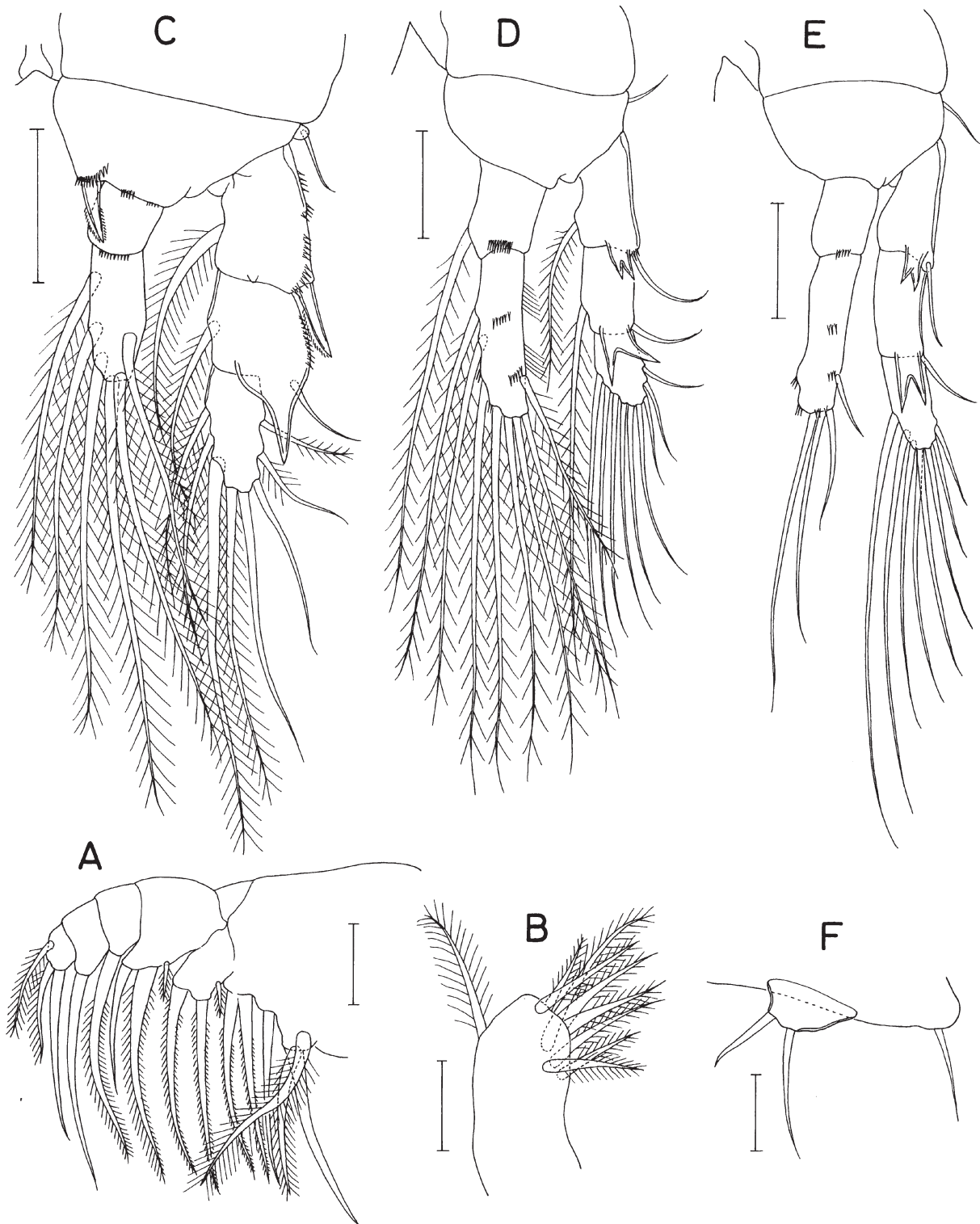
**Etymology.** The specific name refers to the two extremely long setae on the first segment of the female antennule.

**Description of female.** Body (Fig. 284A) slightly depressed and moderately inflated: body length 1.40 mm. Prosome 1.02 mm long, tapering anteriorly, with

convex posterior margin: dorsal cephalic shield clearly defined. Metasome with 2 incomplete dorsal sutures marking planes of fusion between first and second, and between second and third pedigerous somites. Third and fourth pedigerous somites completely fused and forming brood pouch. Free urosome (Fig. 284B) 5-segmented, tapering posteriorly; genital somite much wider than long,  $61 \times 176 \mu\text{m}$ ; 4 abdominal somites  $84 \times 135$ ,  $88 \times 116$ ,



**FIGURE 284.** *Thoracodelphys longiseta* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.2 mm; B, D, 0.1 mm; C, E–G, I, J, 0.02 mm; H, 0.05 mm.



**FIGURE 285.** *Thoracodelphys longiseta* **sp. nov.**, female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A, B, F, 0.02 mm; C–E, 0.05 mm.

Maxillule (Fig. 294I) armed as in *B. brevicaudatus* **sp. nov.**, but seta on coxal endite larger. Maxilla (Fig. 294J) segmented and armed as in *B. brevicaudatus* **sp. nov.** Maxilliped (Fig. 295A) armed with 6 medial setae and 1

outer seta; apex strongly sclerotized.

Leg 1 (Fig. 295B) with 2-segmented rami; inner coxal seta pinnate; outer seta on basis small as in legs 2–4. First exopodal segment lacking inner seta; compound

77×102, and 65×84 µm, respectively. Anal somite with deep posteromedian incision. Caudal ramus (Fig. 284C) 4.3 times longer than wide (86×20 µm): armed with 6 setae (1 proximal, 1 subdistal, and 4 distal); proximal and subdistal setae located at 30 and 76% of ramus length, respectively; 3 of 4 distal setae bluntly tipped; all setae longer than width of ramus at base.

Rostrum (Fig. 284D) short, much wider than long, strongly tapering distally. Antennule (Fig. 284E) 151 µm long, 7-segmented; armature formula 3, 16, 4, 2+aesthetasc, 3, 1+aesthetasc, and 11+aesthetasc; setae crowded, all naked; 2 larger setae on first segment extremely long (about 1.5 times longer than entire antennule). Antenna (Fig. 284F) 4-segmented; short coxa unarmed; basis and first endopodal segment also unarmed, both 45×28 µm; compound distal endopodal segment about 3.1 times longer than wide (59×19 µm): armed with 9 setae arranged as 4, 2, and 3 (1 of 4 proximal setae elongate, longer than segment; longest of 3 distal setae more than twice as long as terminal claw); terminal claw small, about 0.4 times as long as segment.

Labrum (Fig. 285G) with large, semicircular posteromedian lobe and narrow, setulose posterior margin. Mandible (Fig. 284H) with 5 pointed teeth and 1 small seta on coxal gnathobase: basis with 1 seta on medial margin; exopod 2-segmented with 3 setae on first segment and 2 setae on small second segment, 2 proximal setae about twice as long as distal 3: endopod 2-segmented, incompletely articulated from basis; first segment armed with 2 setae; second segment much narrower than first, with 5 setae. Paragnath (Fig. 284I) with prominent lobe on subdistal outer margin, and densely setulose along medial margin. Maxillule (Fig. 284J) armed as in *T. quadriseta* **sp. nov.**, but seta on coxal endite shorter. Maxilla (Fig. 285A) 5-segmented; syncoxa with 9 (3, 1, 2, and 3) setae; basis with 3 setae, distal seta slightly more than half length of middle seta; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 285B) unsegmented with 8 medial and 1 outer subdistal seta.

Legs 1–4 with 3-segmented exopods and 2-segmented endopods (Fig. 285C–E); inner coxal seta absent; outer seta on basis small. Inner distal spine on basis of leg 1 not extending to distal border of first endopodal segment, 22 µm long. Second exopodal segment of leg 1 with large, tapering anterodistal process. First and second exopodal segments of legs 2–4 each with bifurcate anterodistal process. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; 1-1; 3, 1, 4	0-0; 1, 2, 3
Legs 2 & 3	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 3, 4
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 1, 3, 0

Leg 5 (Fig. 285F) consisting of very short protopod bearing 1 seta and small, tapering free exopodal segment, 12×15 µm, armed distally with 2 setae, inner 21 µm long and outer 34 µm.

**Male.** Unknown.

**Remarks.** The two extremely long setae on the first antennular segment and the large anterodistal process on the second exopodal segment of leg 1 serve to characterise *T. longiseta* **sp. nov.** The possession of 9 setae on the third exopodal segment of leg 3 is also an exceptional feature because this segment bears a maximum of 8 setae in all the other known species of the genus.

***Thoracodelphys depressa* sp. nov.**  
(Figs. 286, 287)

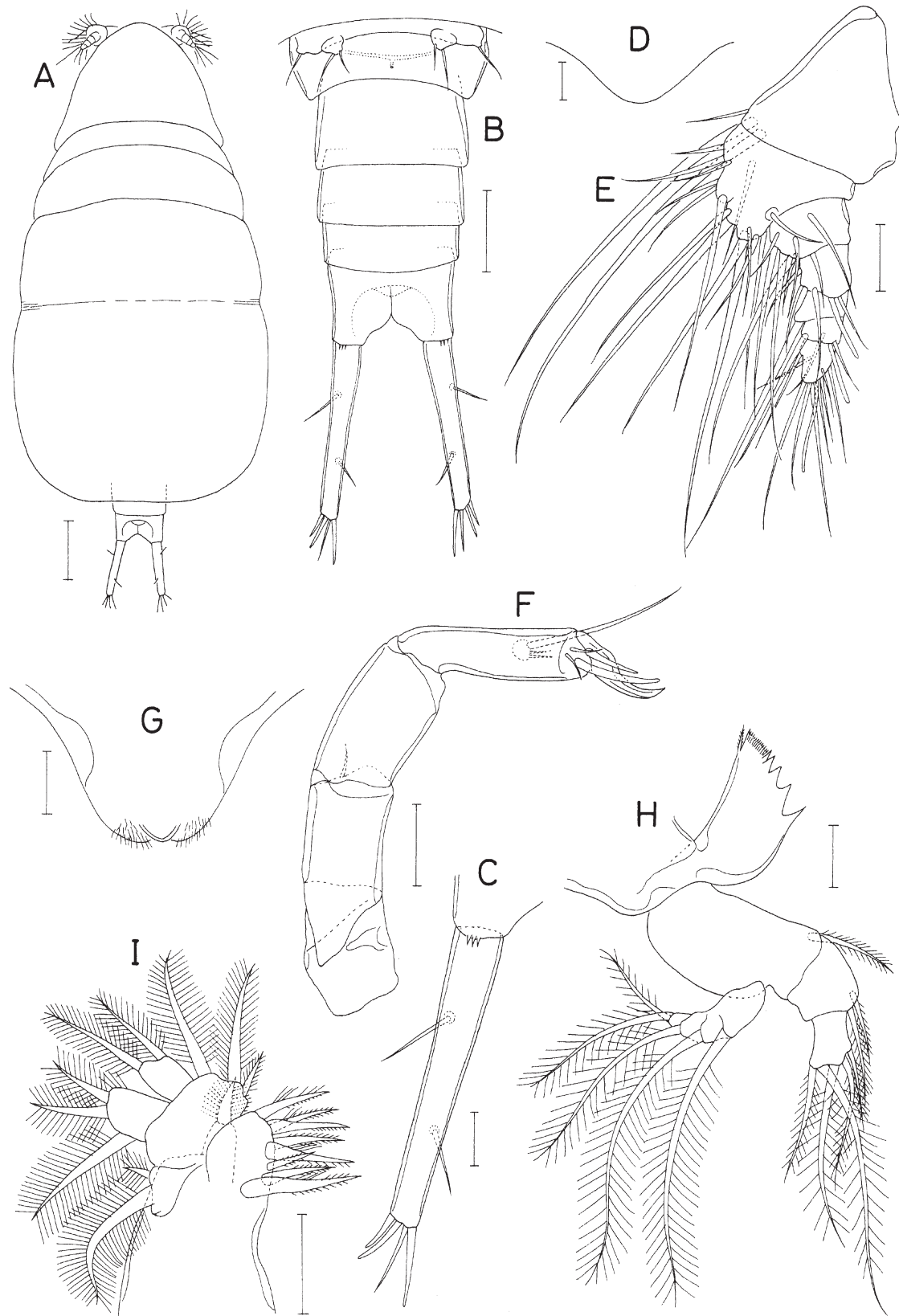
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21350), paratype (intact ♀, MNHN-IU-2014-21351), and dissected paratype (♀, figured) from *Botryllus gregalis* (Sluiter, 1898), AURACEA 1995, Ibo, Mozambique, intertidal, sea grass beds, mangroves and barrier reef, C. Monniot coll., November 1995.

**Etymology.** The specific name refers to the markedly dorsoventrally depressed prosome of the new species.

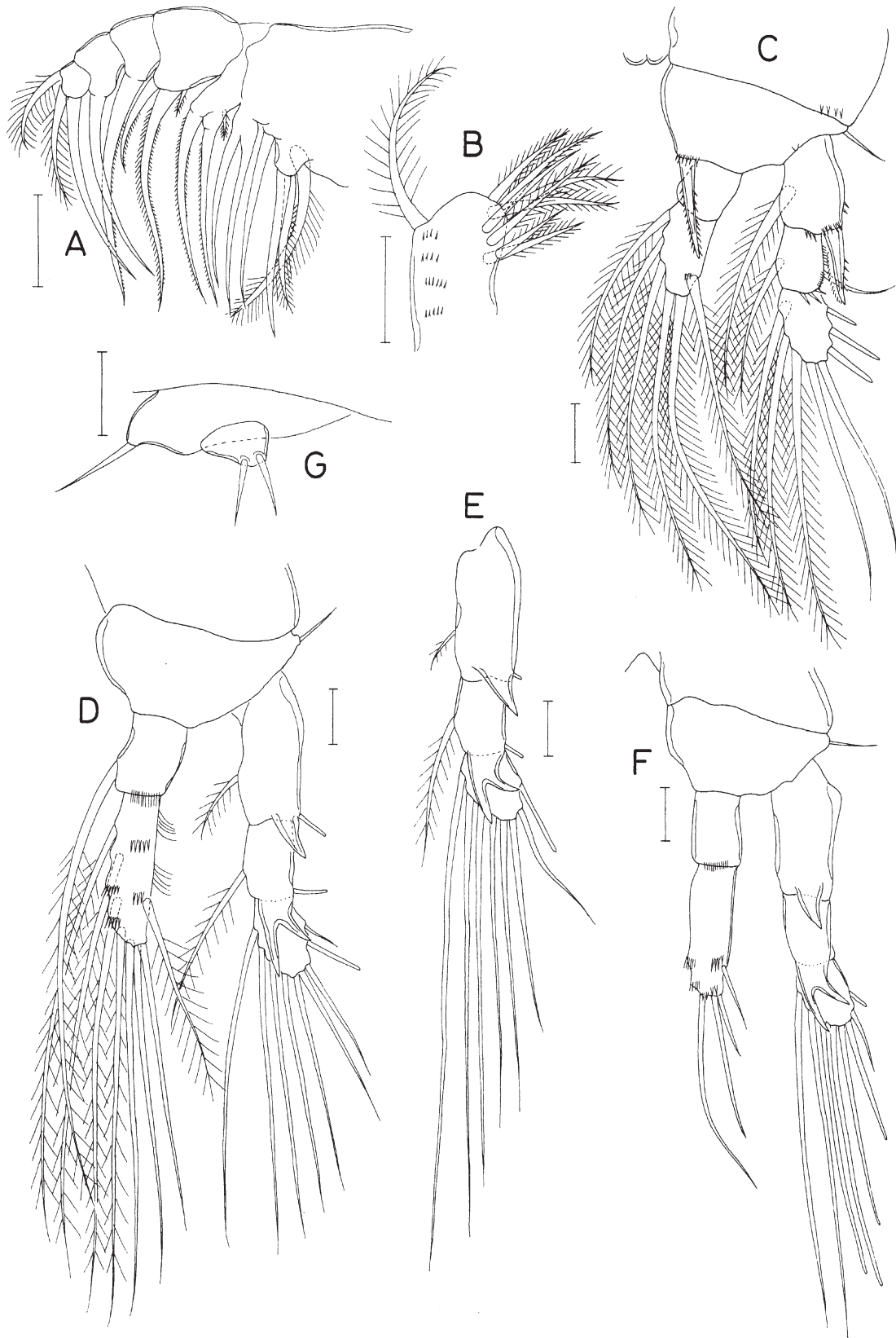
**Description of female.** Body (Fig. 286A) strongly dorsoventrally depressed; body length 0.98 mm. Prosome 0.83 mm long, tapering anteriorly, truncate posteriorly: comprising cephalosome and 4 pedigerous somites, but articulation between third and fourth pedigerous somites indistinct dorsally. Greatest width of prosome 440 µm at level of fourth pedigerous somite. Free urosome (Fig. 286B) 5-segmented: genital somite distinctly wider than abdomen, 39×124 µm; 4 abdominal somites 55×97, 47×90, 38×86, and 59×79 µm, respectively. Anal somite with deep, broad posteromedian incision and 3 small spinules on posteroventral border at base of caudal rami (Fig. 286C). Caudal rami slender, widely separated from each other; each ramus (Fig. 286C) about 6.1 times longer than wide (110×18 µm) and about twice as long as anal somite, gradually narrowing distally: armed with 6 setae (1 proximal, 1 subdistal, and 4 distal); proximal and subdistal setae located at 30 and 68% of ramus length, respectively; 3 of 4 distal setae spiniform, stiff, and bluntly tipped, remaining seta pale and attenuated.

Rostrum (Fig. 286D) short, much wider than long, with rounded apex. Antennule (Fig. 87E) small, 117 µm long, 7-segmented; first and second segments much broader than distal segments; armature formula 3, 14, 8, 4+aesthetasc, 1, 3+aesthetasc, and 9+aesthetasc; setae crowded, naked, and generally long; longest seta on first segment slightly longer than entire antennule. Antenna (Fig. 286F) 4-segmented; coxa short and unarmed; basis 33×20 µm, with 1 small seta distally; first endopodal segment 35×22 µm, unarmed; compound distal endopodal segment 42×13 µm, about 3.2 times longer than wide: armed with 7 setae arranged as 3, 2, and 2 (1 proximal seta long, extending beyond distal tip of terminal claw; 2 distal setae bluntly tipped), plus terminal claw half as long as segment.





**FIGURE 286.** *Thoracodelphys depressa* sp. nov., female. A, habitus, dorsal; B, urosome, ventral; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.1 mm; B, 0.05 mm; C–I, 0.02 mm.



**FIGURE 287.** *Thoracodelphys depressa* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, exopod of leg 3; F, leg 4; G, leg 5. Scale bars: 0.02 mm.

Labrum (Fig. 286G) with small posteromedian lobe and ornamented with setules on distal surface. Mandible (Fig. 286H) with 5 teeth and 1 small seta on coxal gnathobase, distalmost tooth acutely pointed: basis with 1 seta at mediobasal corner; exopod with 5 unequal setae; setae gradually becoming shorter from proximal to distal; shortest seta about one third length of largest; endopod with 2 and 5 setae on first and second segments, respectively; longest second outer seta on distal margin directed mediobasally. Maxillule (Fig. 286I) armed as in *T. longiseta* **sp. nov.**; small proximal seta on basis pale, about one-third as long as middle seta. Maxilla (Fig. 287A) segmented and armed as in *T. longiseta* **sp. nov.**; distal seta on basis less than half length of middle seta. Maxilliped (Fig. 287B) unsegmented, armed with 8 medial setae and 1 outer subdistal seta; ornamented several rows of minute spinules on outer side.

Legs 1–4 with 3-segmented exopods and 2-segmented endopods (Fig. 287C–F). Inner coxal seta absent in legs 1–4. Outer seta on basis small. Inner distal spine on basis of leg 1 elongate, 35 µm long, spinulose, extending to middle of second endopodal segment. Second exopodal segment of leg 1 with 3 spinules on anterodistal margin. Three outer setae on third exopodal segment of leg 1 bluntly tipped in left leg but attenuated in right leg. Outer setae on exopods of legs 2 and 3 small and bluntly tipped. First exopodal segment of legs 1–3 with large, tapering anterodistal process. Second exopodal segment of legs 2–4 with large, bifurcate anterodistal process. First and second exopodal segments and first endopodal segment of leg 4 unarmed. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; 1-1; 3, 1, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	0-0; 0-0; 2, 1, 5	0-0; 1, 3, 0

Leg 5 (Fig. 287G) consisting of short, broad protopod with 1 seta on outer margin, and small, strongly tapering free exopodal segment, 11×16 µm, armed distally with 2 setae; outer seta 15 µm, inner seta 16 µm.

**Male.** Unknown.

**Remarks.** The lack of a setal element (typically a seta in *Thoracodelphys*) on the first and second exopodal segments of leg 4 is a unique feature of *T. depressa* **sp. nov.** within the genus. The strongly depressed prosome and the presence of three small spinules on the posteroventral margin of the anal somite, near the base of the caudal ramus, are also distinguishing features of the new species.

***Thoracodelphys caledonica* sp. nov.**

(Figs. 288, 289)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21352), paratypes (4 intact ♀♀, MNHN-IU-2014-21353), and dissected paratypes (2 ♀♀, figured) from *Symplegma brakenhielmi* (Michaelsen, 1904), Quai des Scientifique, Noumea, New Caledonia, Monniot coll., 24 March 1987.

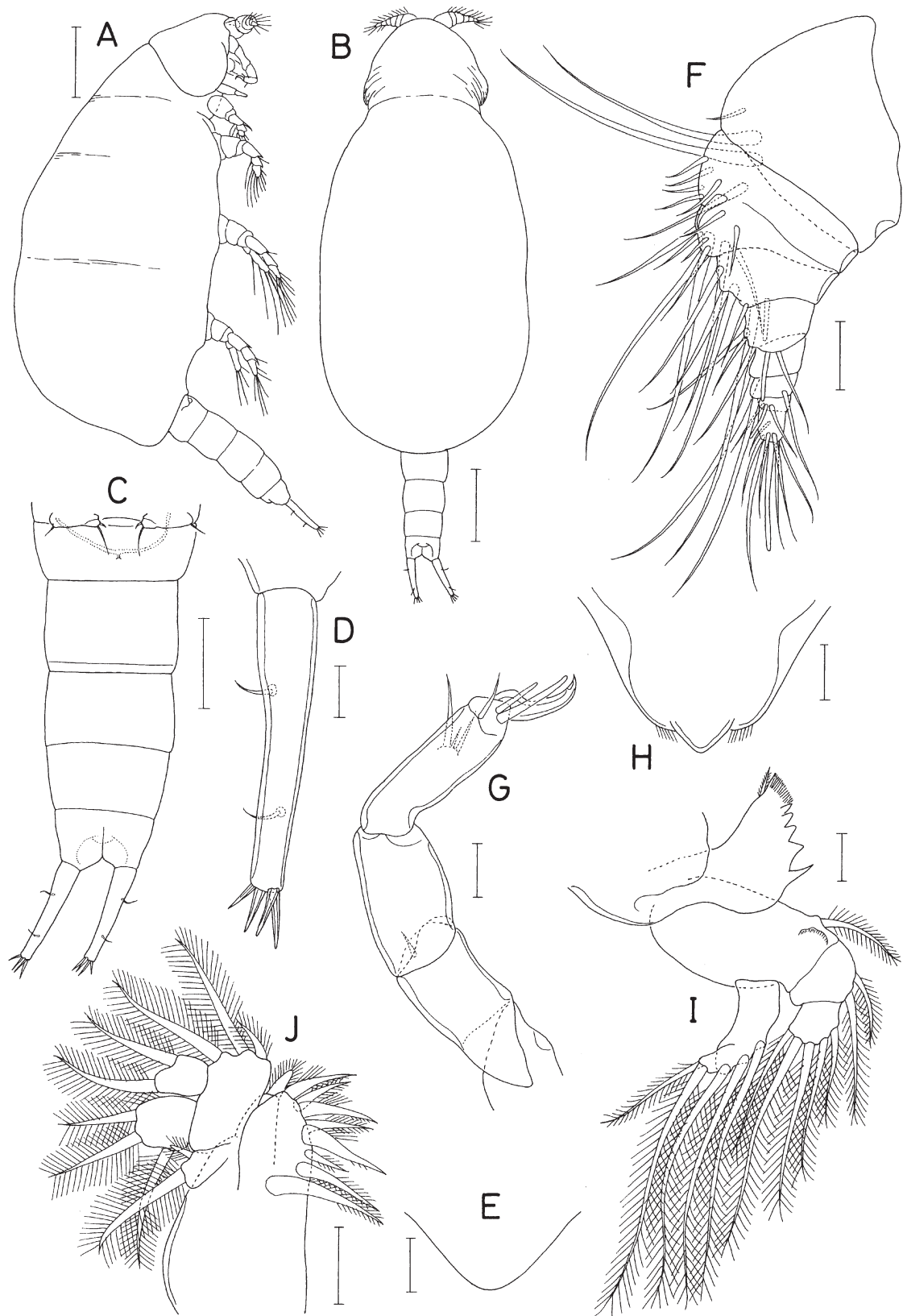
**Additional material.** 6 ♀♀ (MNHN-IU-2018-1883) from *S. brakenhielmi*, Port de Noumea, New Caledonia.

**Etymology.** This species is named after the type locality, New Caledonia.

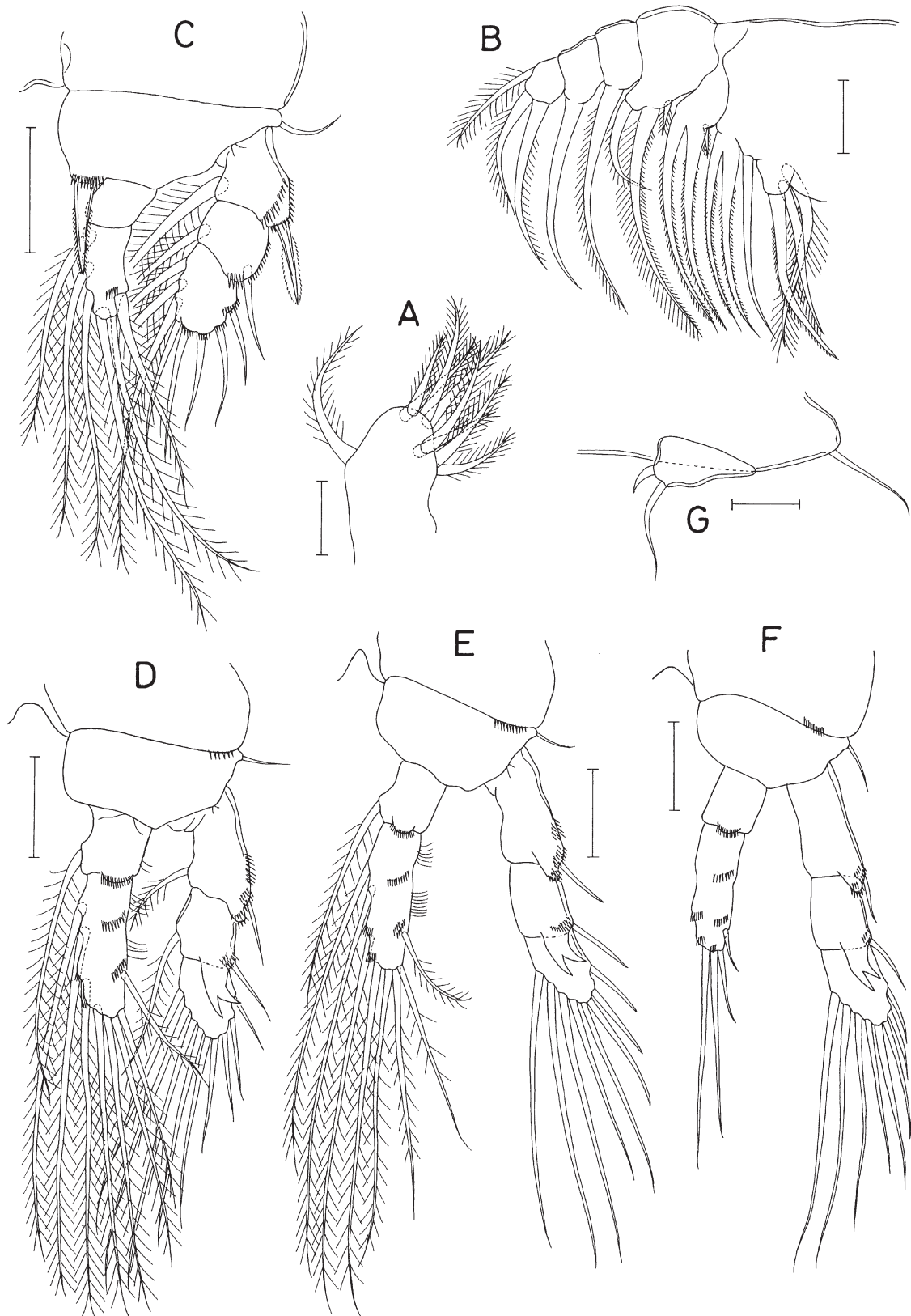
**Description of female.** Body (Fig. 288A, B) 1.65 mm long; prosome 1.25 mm long, slightly depressed, 594 µm in greatest width, 558 µm in greatest dorsoventral depth. Cephalosome weakly defined; metasome unsegmented, but with 3 faint, transverse wrinkles mid-dorsally. Free urosome (Fig. 288C) slender, 5-segmented: genital and 4 abdominal somites 64×180, 100×147, 82×145, 73×136, and 60×110 µm, respectively. Anal somite with broad posteromedian incision. Caudal ramus (Fig. 288D) slender, about 5.1 times longer than wide (118×23 µm), narrowing distally; armed with 2 setae and 4 distal spines; 2 setae located at 33 and 73% of ramus length, shorter than width of ramus at base; 4 distal spines straight, innermost longest 23 µm, and outermost shortest 14 µm.

Rostrum (Fig. 288E) short, much wider than long, with rounded apex. Antennule (Fig. 288F) small, strongly tapering, 130 µm long, 8-segmented; articulation between second and third segments obscure; articulation between 2 terminal segments incomplete; armature formula 3, 16, 5+aesthetasc, 4+aesthetasc, 1, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked; longest seta on first segment shorter than entire antennule. Antenna (Fig. 288G) 4-segmented; coxa short and unarmed; basis 41×30 µm, with 1 small seta distally; first endopodal segment 48×32 µm, unarmed; compound distal endopodal segment about 2.9 times longer than wide (57×20 µm): armed with 6 setae arranged as 3, 1, and 2 (2 distal setae bluntly tipped) plus terminal claw 33 µm long, 0.58 times as long as segment.

Labrum (Fig. 288H) with conical posteromedian lobe; posterior margin setulose. Mandible (Fig. 288I) with 5 teeth and 1 small seta on coxal gnathobase, distalmost tooth acutely pointed: basis with 1 seta subdistally on medial margin and narrow crescent of surface membrane near base of seta; exopod armed with 5 setae; 4 proximal setae equal in length, distal seta small, less than half length of proximal setae; endopod with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 288J) with 8 setae on arthrite, 1 blunt seta on coxal endite, 2 unequal setae on epipodite, 3 setae on medial margin of basis (proximal seta about one-third length of distal setae); exopod and endopod with 3 and 2 setae, respectively. Maxilla (Fig. 289B) 5-segmented and armed as in *T. longiseta* **sp. nov.** Maxilliped (Fig. 289A) unsegmented, armed with 8 medial and 1 outer subdistal setae.



**FIGURE 288.** *Thoracodelphys caledonica* sp. nov., female. A, habitus, right; B, habitus, dorsal; C, urosome, ventral; D, right caudal ramus, ventral; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D–J, 0.02 mm.



**FIGURE 289.** *Thoracodelphys caledonica* sp. nov., female. A, maxilliped; B, maxilla; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, B, G, 0.02 mm; C–F, 0.05 mm.

Legs 1–4 (Fig. 289C–F) each with 3-segmented exopod and 2-segmented endopod; coxa lacking inner seta. Inner distal spine on basis of leg 1 spinulose, 37 µm long, extending to middle of second endopodal segment. First exopodal segment of legs 2–4 with blunt, spinulose anterodistal protrusion. Second exopodal segment of legs 2–4 with bifurcate anterodistal process. First and second exopodal segments of legs 3 and 4 lacking inner seta. Outer and distal setae on exopods of legs 2–4 naked and attenuated. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; 1-1; 3, 1, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-0; 1-0; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 1, 2, 1

Leg 5 (Fig. 289G) rudimentary, consisting of protopod represented by small lobe bearing 1 seta and strongly tapering free exopodal segment 16×31 µm, articulated from protopod, tipped with 2 setae; inner seta 10 µm long, outer seta 32 µm.

**Male.** Unknown.

**Remarks.** In known species of *Thoracodelphys* the first exopodal segments of legs 2–4 usually bear a simple pointed or bifurcate, spiniform anterodistal process. *Thoracodelphys caladonica* sp. nov. and *T. tertius* sp. nov. are exceptions because these segments bear only a blunt protrusion in both of these species. *Thoracodelphys tertius* sp. nov. has 8 (7+1) setae on the maxilliped and an outer spine (rather than an outer seta) on the first exopodal segment of legs 2–4, and is, therefore, readily distinguishable from *T. caledonica* sp. nov. In addition, *T. caledonica* sp. nov. lacks an inner seta on the second exopodal segment of leg 3, a unique loss within the genus.

### *Thoracodelphys papuensis* sp. nov.

(Figs. 290, 291)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21354) from *Botryllus perspicuum* Herdman, 1886, CRRF CRCHO 500, Fringing Reef, Cape Pievost, Papua New Guinea (10°06.43'S, 150°57.84'E), 20 January 2002.

**Etymology.** The species is named after its type locality, Papua New Guinea.

**Description of female.** Body (Fig. 290A) dorsoventrally depressed, 1.24 mm long. Prosome tapering anteriorly, 0.89 mm long. Dorsal cephalic shield with poorly defined posterior margin: metasome with 3 dorsal constrictions defining 4 pedigerous somites; brood pouch extending through second to fourth pedigerous somites and containing eggs. Free urosome (Fig. 290B) 5-segmented; genital and 4 abdominal somites 54×140, 77×112, 65×102, 63×90, and 58×80 µm, respectively.

Anal somite with broad posteromedian incision and parallel lateral margins. Caudal rami widely separated from each other; each ramus (Fig. 290C) 5.2 times longer than wide (104×20 µm) and with nearly parallel lateral margins: armed with 2 setae (outer proximal and dorsal) and 4 distal spines; outer proximal and dorsal setae located at 28 and 60% of ramus length, respectively, both setae longer than width of ramus at base; 4 distal spines slender and all shorter than width of ramus at base, longest spine 17 µm long.

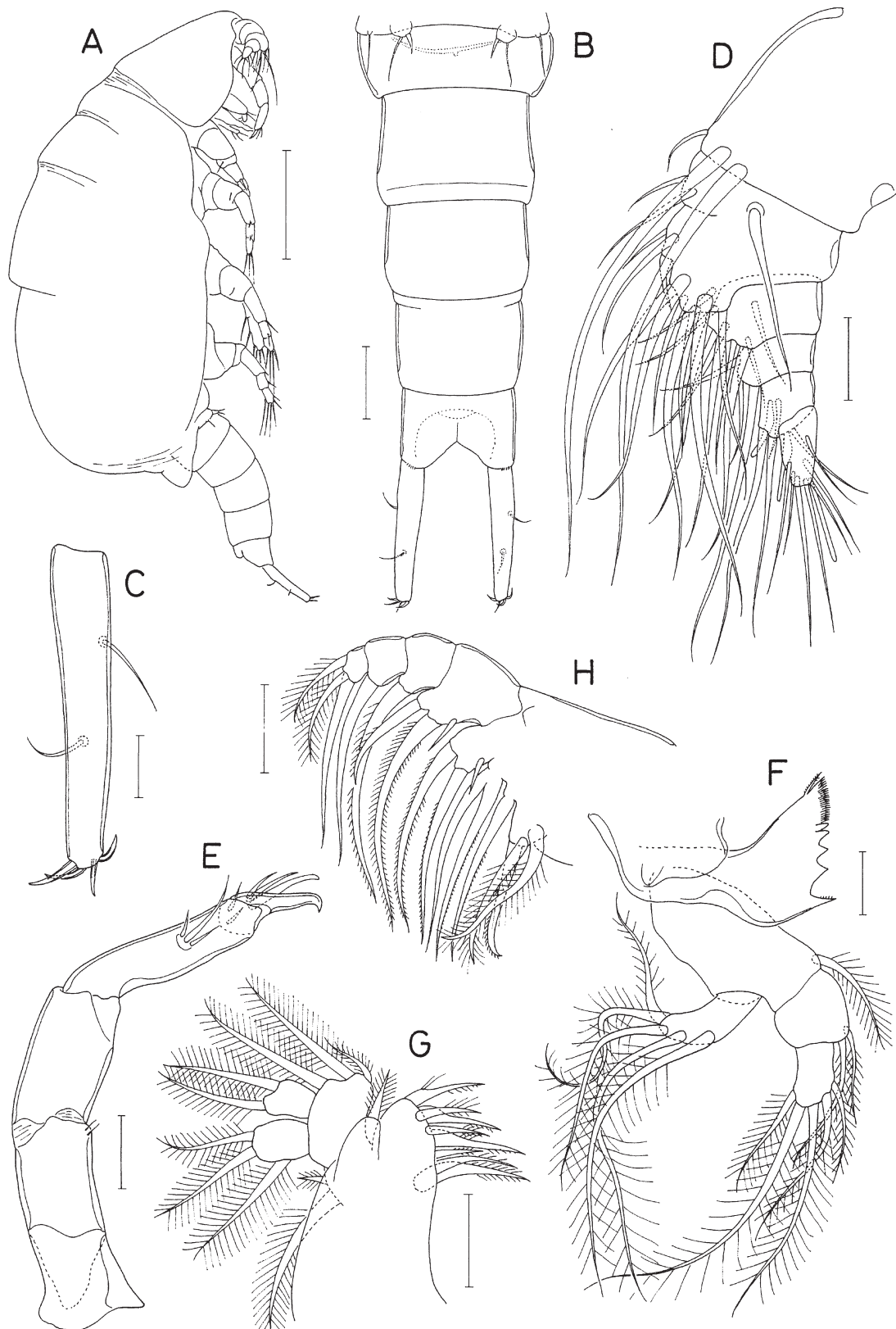
Rostrum small with rounded distal margin. Antennule (Fig. 290D) small, 120 µm long, tapering distally, 6-segmented; armature formula 3, 14, 6+aesthetasc, 4+aesthetasc, 3+aesthetasc, and 7+aesthetasc; setae very crowded, all naked; 2 larger setae on first segment equal and about as long as entire antennule. Antenna (Fig. 290E) 4-segmented; coxa unarmed; basis with 2 minute setal vestiges at outer distal corner representing exopod; first endopodal segment unarmed, slightly longer than basis; compound distal endopodal segment about 3.8 times longer than wide: armed with 8 setae (arranged as 3, 2, and 3) plus terminal claw half as long as segment.

Labrum (Fig. 291A) smooth with large, semicircular posteromedian lobe and convex posterior margin. Mandible (Fig. 290F) with 5 teeth and 1 small seta on coxal gnathobase; distalmost tooth acutely pointed, with minute spinules along proximal margin: basis with 1 seta subdistally on medial margin; exopod armed with 5 setae (distal 3 distinctly shorter than proximal 2); endopod armed with 2 and 5 setae on first and second segments, respectively. Maxillule (Fig. 290G) with 8 setae on arthrite, 1 on coxal endite, 2 on epipodite, 3 on basis (proximal seta about one-third as long as distal 2); 3 on exopod and 2 on endopod. Maxilla (Fig. 290H) segmented and armed as in *T. caledonica* sp. nov. Maxilliped (Fig. 291B) armed with 7 medial and 1 outer subdistal setae.

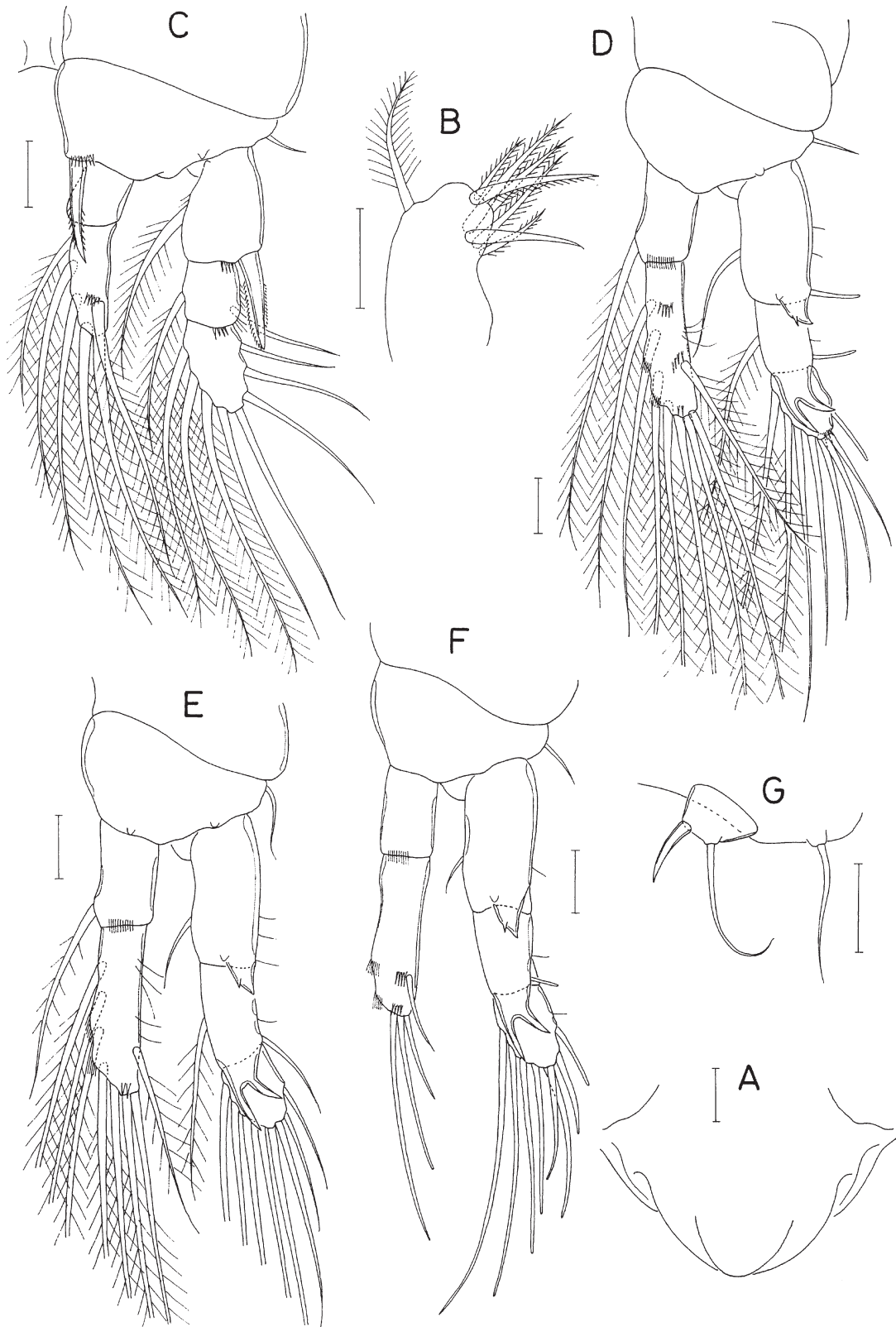
Legs 1–4 (Fig. 291C–F) with 3-segmented exopods and 2-segmented endopods; inner coxal seta absent. Inner distal spine on basis of leg 1 extending beyond distal border of first endopodal segment, 31 µm long, spinulose in distal half. First exopodal segment of legs 2–4 with large, pointed anterodistal process bearing small subsidiary denticle subdistally. Second exopodal segment of legs 2–4 with large, bifurcate anterodistal process. First exopodal segments of legs 3 and 4 lacking outer element, but bearing inner seta. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; 1-1; 3, 1, 4	0-0; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 3	0-0	1-0	0-1; 1-1; 2, 1, 5	0-1; 1, 2, 5
Leg 4	0-0	1-0	0-1; 1-0; 2, 1, 5	0-0; 1, 2, 1

Leg 5 (Fig. 291G) small, represented by 1 lateral seta on ventrodorsal surface of somite and free exopod segment



**FIGURE 290.** *Thoracodelphys papuensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, right caudal ramus, ventral; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla. Scale bars: A, 0.2 mm; B, 0.05 mm; C–H, 0.02 mm.



**FIGURE 291.** *Thoracodelphys papuensis* **sp. nov.**, female. A, labrum; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: 0.02 mm.



12×18 µm, narrowing distally, armed with inner spine (16 µm long) and outer seta (35 µm long).

**Male.** Unknown.

**Remarks.** *Thoracodelphys papuensis* **sp. nov.** has a 6-segmented antennule and 8 setae on the third exopodal segment of leg 2. The combination of these two features is shared by only two other species in the genus, *T. chelipus* and *T. uniseta*. *Thoracodelphys papuensis* **sp. nov.** can be readily distinguished from these two species because its maxilliped is armed with 8 (7+1) setae, in contrast to the 7 (6+1) setae exhibited by *T. chelipus* and *T. uniseta*. The setation of the first exopodal segments of legs 3 and 4 (which lack an outer seta but bear an inner seta; armature formula 0-1) of *T. papuensis* **sp. nov.** is unique within the genus. Other congeneric species have an armature formula for the first exopodal segment ranging from 1-0 to 1-1 or I-1 in leg 3, and 1-0 or I-0 to 0-0 in leg 4.

### Genus *Bysone* Stock & Humes, 1970

**Diagnosis.** Body of female curved ventrally. Prosome expanded posteriorly; third and fourth pedigerous somites or fourth pedigerous somite alone forming brood pouch. Free urosome 5-segmented. Caudal rami armed with 6 setae. Rostrum present. Antennule 6-segmented. Antenna 4-segmented with terminal claw. Mandible consisting of coxal gnathobase with broad cutting margin, and palp comprising basis, 1-segmented exopod bearing 4 setae, and 2-segmented endopod bearing 2 and 5 setae on first and second segments, respectively. Maxillule armed with 7 to 9 setae on arthrite, 1 on endite, 2 on epipodite, 3 on basis, 3 on exopod and 2 on endopod. Maxilla 4- or 5-segmented with 2- or 3-segmented endopod. Maxilliped unsegmented, armed with 5 to 8 setae medially and 1 seta subdistally on outer margin. Leg 1 with 2-segmented rami; inner coxal seta present; basis without inner distal spine; first exopodal segment lacking inner seta. Legs 2–4 with 3-segmented exopods and 2-segmented endopods. Inner coxal seta present or absent on legs 2–4. Leg 5 reduced; exopod lobate or digitiform, armed with 2 setae distally.

**Type species.** *Bysone operculatus* Stock & Humes, 1970, by original designation.

**Remarks.** Like *Thoracodelphys*, *Bysone* carries 2 and 5 setae, respectively, on the first and second endopodal segments of the mandible, and 3 and 2 setae, respectively, on the exopod and endopod of the maxillule. It also has a reduced leg 5, a reduced number of antennular segments, and a maxilliped that is similar to that of *Thoracodelphys*. Unlike *Thoracodelphys*, the body of *Bysone* is not dorsoventrally depressed, the exopod of leg 1 is only 2-segmented, and the inner coxal seta is present at least on leg 1. In addition, the setation of the swimming legs is better developed so that the distal endopodal segments of legs 1 and 4 are armed with 7 setae (in *Thoracodelphys*

the same segment is armed invariably with only 6 setae in leg 1 and with only 4 setae in leg 4). Finally, the bifurcate distal process on surface of the second exopodal segment of legs 2–4, which is typical of species of *Thoracodelphys*, is absent in *Bysone*.

### *Bysone brevicaudatus* **sp. nov.**

(Figs. 292, 293)

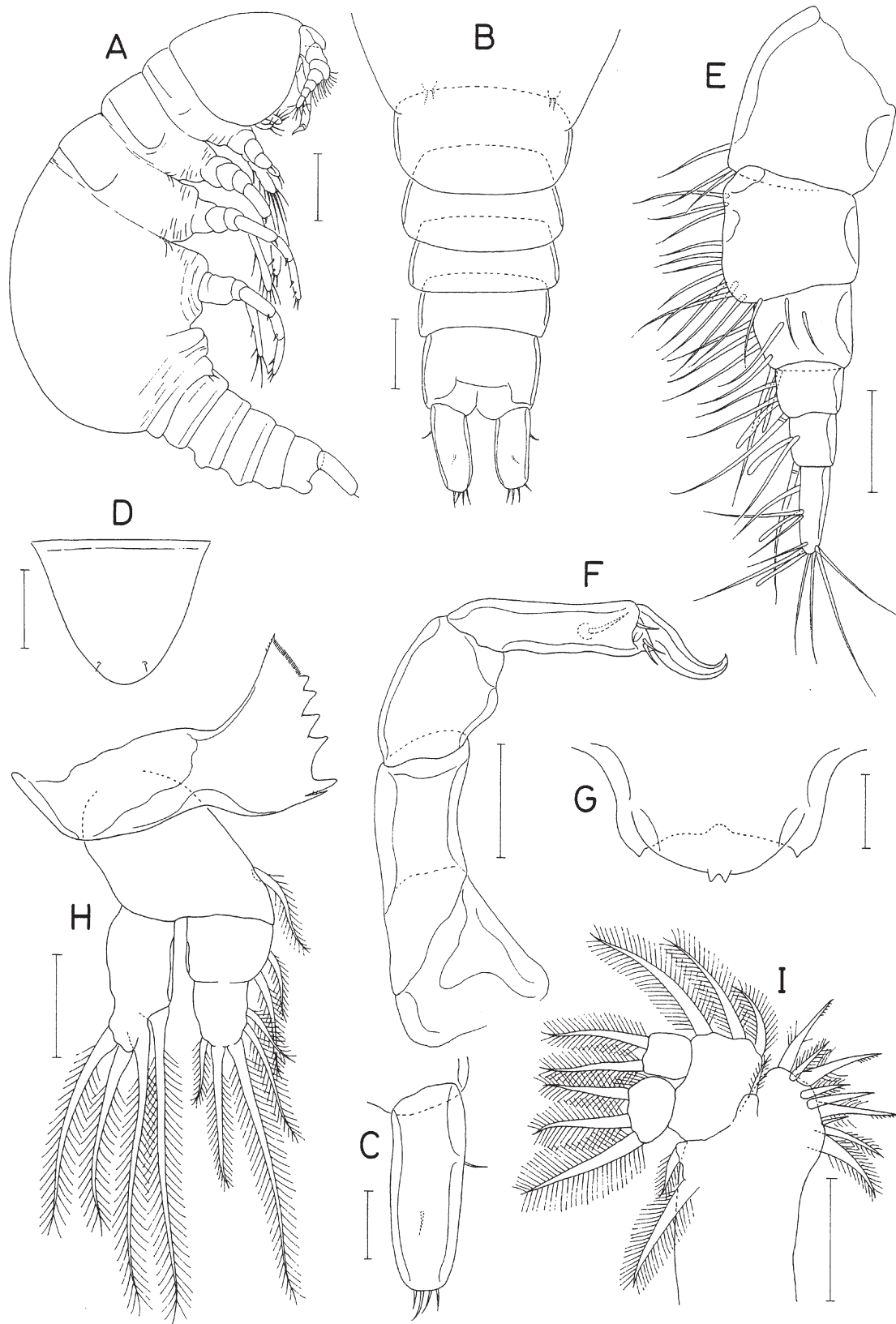
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21355) from *Stolonica multitestis* Monniot C., Monniot F., Griffiths & Schleyer, 2001 (MNHN-IT-2008-8032 = MNHN A1/RIT/25), south of Matemo, Ibo I., Mozambique, Monniot coll., 17 November 1995.

**Etymology.** The specific name is derived from the Latin *brev* (=short) and *caud* (=tail) and refers to the relatively stout caudal rami.

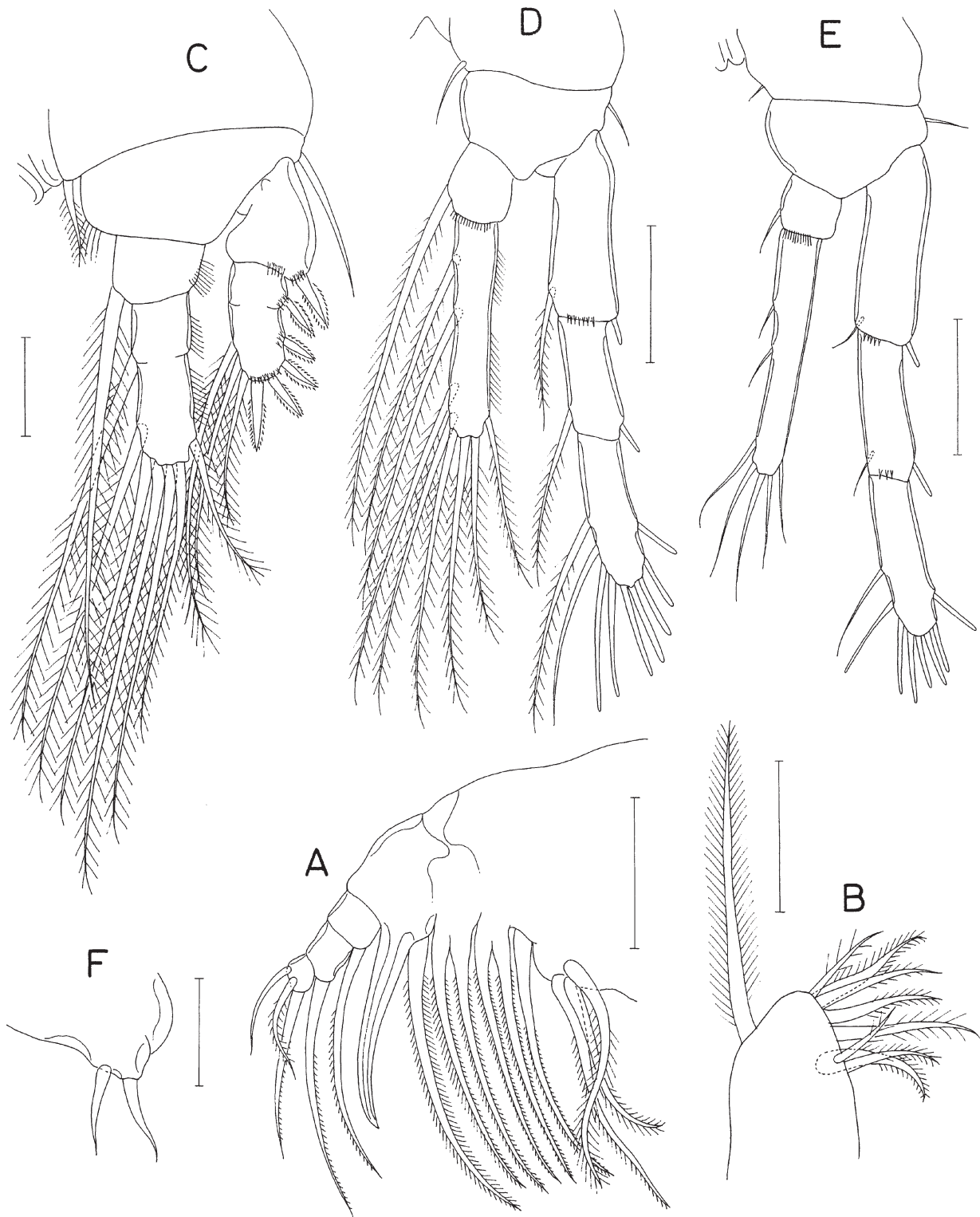
**Description of female.** Body (Fig. 292A) stout, curved ventrally. Prosome 1.40 mm long: dorsal cephalic shield clearly defined; first to fourth pedigerous somites discernible by constrictions; second and third pedigerous somites each with trace of tergite. Third and fourth pedigerous somites forming brood pouch. Free urosome (Fig. 292B) 5-segmented: genital somite well defined ventrally from preceding somite, but dorsally confluent. Anal somite about 1.5 times longer than preceding abdominal somite. Caudal ramus (Fig. 292C) nearly rectangular, about 2.7 times longer than wide (148×54 µm) and as long as anal somite: armed with 6 small setae (outer proximal, ventral, and 4 distal); all setae small, less than half of width of ramus at base; outer proximal and ventral setae located at 38 and 62% of ramus length, respectively.

Rostrum (Fig. 292D) 95×118 µm, indistinctly articulated at base tapering distally towards rounded apex. Antennule (Fig. 292E) 270 µm long, 6-segmented; armature formula 3, 14, 7+aesthetasc, 3+aesthetasc, 2+aesthetasc, and 9+2 aesthetascs; setae naked and short; distal seta on fourth and fifth segment annulated at base. Antenna (Fig. 292F) 4-segmented; coxa, basis, and first endopodal segment unarmed; compound distal endopodal segment about 3.1 times longer than wide (75×24 µm) and 1.3 times longer than first endopodal segment: armed with 1 subdistal and 3 distal setae, plus strongly curved terminal claw, about 0.65 times as long as segment.

Labrum (Fig. 292G) with concave posterior margin, pointed posterolateral corners, and broad posteromedian lobe bearing 2 denticles at apex. Mandible (Fig. 292H) with broad coxal gnathobase bearing 5 teeth and 1 spinule-like subsidiary tooth distally at base of distalmost tooth: basis with 1 seta on medial margin; exopod as long as endopod, armed with 2 long proximal and 2 short distal setae: endopod armed with 2 and 5 setae on first and second segments, respectively; middle seta on second segment



**FIGURE 292.** *Byssone brevicaudatus* sp. nov., female. A, habitus, right; B, urosome, dorsal; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C–I, 0.05 mm.



**FIGURE 293.** *Bysonse brevicaudatus* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: A–C, 0.05 mm; D, E, 0.1 mm; F, 0.02 mm.

markedly longer than other 4 setae. Maxillule (Fig. 292I) with 9 setae on arthrite, 1 thin seta on coxal endite, 2 unequal setae on epipodite, 3 unequal setae on medial margin of basis, 3 setae distally on exopod and 2 setae distally on endopod. Maxilla (Fig. 293A) 5-segmented; syncoxa with 8 setae arranged as 3, 1, 2, and 2; basis with robust claw plus 1 seta; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 293B) unsegmented, armed with 8 medial setae and 1 long outer seta.

Leg 1 (Fig. 293C) small, with 2-segmented rami; second segments of both rami compound, with traces of articulation; inner coxal seta pinnate; outer seta on basis much larger than that of legs 2–4; first exopodal segment lacking inner seta. Legs 2–4 each with 3-segmented exopod and 2-segmented endopod (Fig. 293D, E); both rami elongate; endopod extending to distal border of second exopodal segment; second endopodal segment about 3 times longer than first in legs 2 and 3, about 4 times longer in leg 4. Inner coxal seta present in legs 2–4, but that of leg 4 minute. Outer and distal setae on exopod of leg 2–4 short, naked, and bluntly tipped. Inner setae on exopod and all setae on endopod of leg 4 small and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-0	I-0; IV, I, 3	0-1; 1, 2, 4
Legs 2 & 3	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 1, 2, 5
Leg 4	0-1	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

Leg 5 (Fig. 293F) represented by small ventrodistal lobe bearing 2 small exopodal setae distally; protopodal seta lacking.

**Male.** Unknown.

**Remarks.** The genus *Bystone* has comprised only the type species, *B. operculatus* since it was originally established based on material collected in Madagascar (Stock & Humes, 1970). *Bystone brevicaudatus* **sp. nov.** shares important character states with the type species including: a 6-segmented antennule, 4 setae on the mandibular exopod, 2 and 5 setae, respectively, on the first and second segments of mandibular endopod, a 2-segmented exopod of leg 1, a similar form of maxilliped, and a similar form of the mandibular gnathobase which bears a spinule-like distal subsidiary denticle and has no proximal seta. These similarities are sufficient to confirm the placement of the new species in *Bystone*. The two species can be distinguished by reference to the maxilla, which has a strong claw plus a seta on the basis and the endopod is 3-segmented in the new species. In contrast, *B. operculatus* has the maxillary basis armed with only 2 setae and the endopod is 2-segmented. These differences in the maxilla are significant.

There are other differences between these two species: the maxilliped is armed with 9 (8+1) setae in *B. brevicaudatus* **sp. nov.** (vs. 5+1 setae in *B. operculatus*),

the maxillary arthrite is armed with 9 setae in *B. brevicaudatus* **sp. nov.** (vs. 5 setae in *B. operculatus*), the basis of leg 1 bears an outer seta (vs. seta absent in *B. operculatus*), the second endopodal segment of leg 1 is armed with 7 setae (vs. 6 setae), and leg 5 is short, lobate (vs. digitiform in *B. operculatus*). These differences are sufficient to support the establishment of the new species.

***Bystone bidens* sp. nov.**

(Figs. 294, 295)

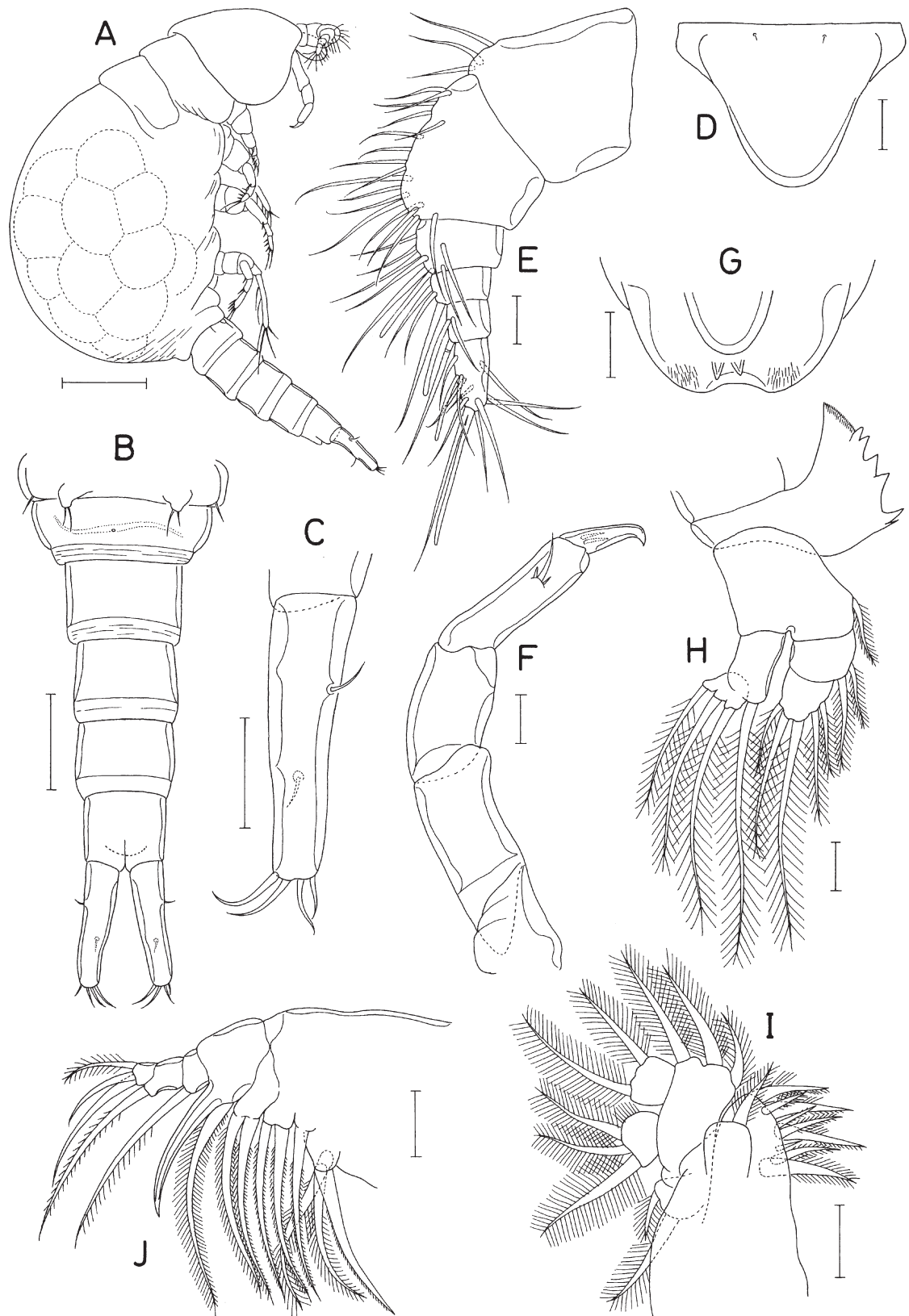
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21356), paratype (intact ♀, MNHN-IU-2014-21357), and dissected paratype (♀, figured) from *Chorizocarpa guttata* Michaelsen, 1904, Canal Woodin, New Caledonia, depth 18m, Monniot coll., 11 March 1987.

**Etymology.** The specific name is the combination of Latin words *bi* (=double) and *dens* (=a tooth), referring to the pair of ventrodistal denticles on the surface of the labrum.

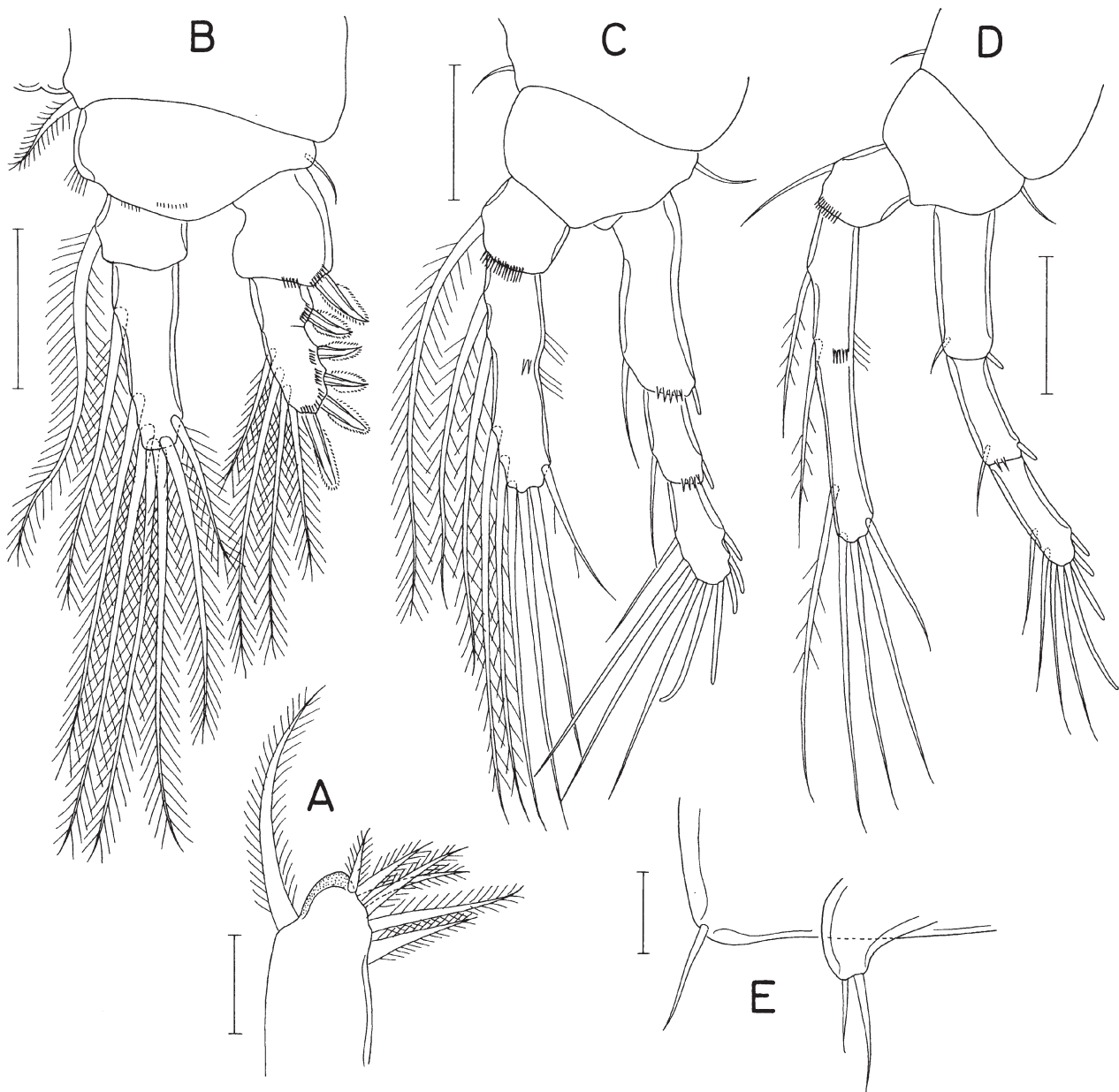
**Description of female.** Body (Fig. 294A) with stout prosome and elongate urosome; body length 1.48 mm. Prosome 0.93 mm long: cephalosome clearly defined from inflated metasome; first and second pedigerous somites defined, but third and fourth pedigerous somites completely fused forming brood pouch. Free urosome (Fig. 294B) slender, 5-segmented: genital somite 68×294 µm, much wider than long; 4 abdominal somites gradually narrowing, 84×193, 84×123, 82×110, and 68×105 µm, respectively. Caudal ramus (Fig. 294C) gradually narrowing distally, 3.6 times longer than wide (130×36 µm): armed with 6 setae; proximal and dorsal setae located at 32 and 63% of ramus length, respectively; all setae shorter than width of ramus at base.

Rostrum (Fig. 294D) 64×89 µm, tapering, with rounded and sclerotized distal margin. Antennule (Fig. 294E) 170 µm long, 6-segmented; armature formula 3, 17, 7+aesthetasc, 3, 2+aesthetasc, and 11+2 aesthetascs; setae naked and relatively short; setae on first segment not enlarged. Antenna (Fig. 294F) 4-segmented; coxa, basis, and first endopodal segment unarmed; compound distal endopodal segment 3.1 times longer than wide: armed with 5 setae (2 located at base of terminal claw) plus terminal claw, 33 µm long.

Labrum (Fig. 294G) bearing smooth ventral lobe, pair of ventrodistal denticles near midline, patches of minute setules ventrodistally, and with concave posterior margin. Mandible (Fig. 294H) with broad coxal gnathobase bearing 5 teeth and 1 distal, spinule-like subsidiary denticle: basis with 1 seta on medial margin; exopod armed with 4 setae; setae becoming gradually shorter from proximal to distal; endopod armed with 2 and 5 setae on first and second segments, respectively; middle seta on second endopodal segment markedly longer than other endopodal setae.



**FIGURE 294.** *Bysone bidens* sp. nov., female. A, habitus, right; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.2 mm; B, 0.1 mm; C, 0.05 mm; D–J, 0.02 mm.



**FIGURE 295.** *Bygone bidens* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Scale bars: A, E, 0.02 mm; B–D, 0.05 mm.

second exopodal segment with short trace of articulation on outer side. Legs 2–4 with rudimentary inner coxal seta (Fig. 295C, D); outer seta on basis also small; all setae on endopod naked; outer setae on exopod small and bluntly tipped. Second endopodal segment of leg 4 elongated, about 4 times longer than first. Armature formula for legs 1–4 as in *B. brevicaudatus* sp. nov., except formula IV, I, 4 for second exopodal segment of leg 1. Leg 5 (Fig. 295E) small, consisting of 1 seta located on slight ventrolateral lobe and lobate tapering exopod, not articulated at base, armed distally with 2 unequal setae.

**Male.** Unknown.

**Remarks.** *Bygone bidens* sp. nov. is more similar to *B. brevicaudatus* sp. nov. than to *B. operculatus*; both share several character states including the 3-segmented endopod of the maxilla (2-segmented in *B. operculatus*), the presence of a claw on the maxillary basis (only setae present in *B. operculatus*), the inner coxal seta is present in all swimming legs (present only in leg 1 in *B. operculatus*), and the second endopodal segment of leg 1 is armed with 7 setae (compared with 6 setae in *B. operculatus*).

The salient differences between *B. brevicaudatus* sp. nov. and *B. bidens* sp. nov. are 7 setae on the maxilliped in the latter (vs. 9 setae in *B. brevicaudatus* sp. nov.), 4

setae on the second exopodal segment of leg 1 (vs. 3 setae in *B. brevicaudatus* sp. nov.), and a protopodal seta in leg 5 (vs. this seta absent in *B. brevicaudatus* sp. nov.).

### Genus *Lonchidiopsis* Vanhöffen, 1917

**Diagnosis.** Body of female dorsoventrally depressed; consisting of cephalosome, short neck, large trunk and small free urosome. Trunk forming brood pouch consisting of fused third to fifth pedigerous somites. Urosome unsegmented but with traces of articulations. Caudal rami armed with 6 setae. Rostrum tipped with spinous process. Antennule 8-segmented. Female antenna 3-segmented, comprising coxa, allobasis and 1-segmented free endopod bearing terminal claw. Male antenna forming powerful chelate grasping organ. Mandible with coxal gnathobase forming broad cutting margin; basis fused with first endopodal segment, second endopodal segment with 10 setae: exopod 1-segmented, fused to basis, armed with 5 setae. Maxillule armed with 9 setae on arthrite, 1 on endite, 2 on epipodite, 3 on basis, 4 on exopod, and 5 on endopod. Maxilla 3-segmented; basis with claw plus 2 setae; endopod small, unsegmented with 5 setae. Maxilliped unsegmented, armed with 5 setae medially and 3 setae distally. Legs 1–3 with 2-segmented rami; inner coxal seta present in leg 1, present or absent in legs 2–4; basis with inner distal spine. Leg 4 with 2-segmented rami, lacking inner seta on first exopodal segment; leg 4 vestigial in some species, or absent. Leg 5 comprising lateral papilla bearing protopodal seta and exopodal segment armed with 2 setae distally.

**Type species.** *Lonchidiopsis hartmeyeri* Vanhöffen, 1917, by original designation.

**Remarks.** Unlike its two congeners *L. tripes* Stock, 1967 and *L. setosus* Jones & Montez Moreno, 1981, the type species *L. hartmeyeri* possesses a well-developed leg 4 and has more armature elements on legs 1–3.

### *Lonchidiopsis hartmeyeri* Vanhöffen, 1917

(Figs. 296–298)

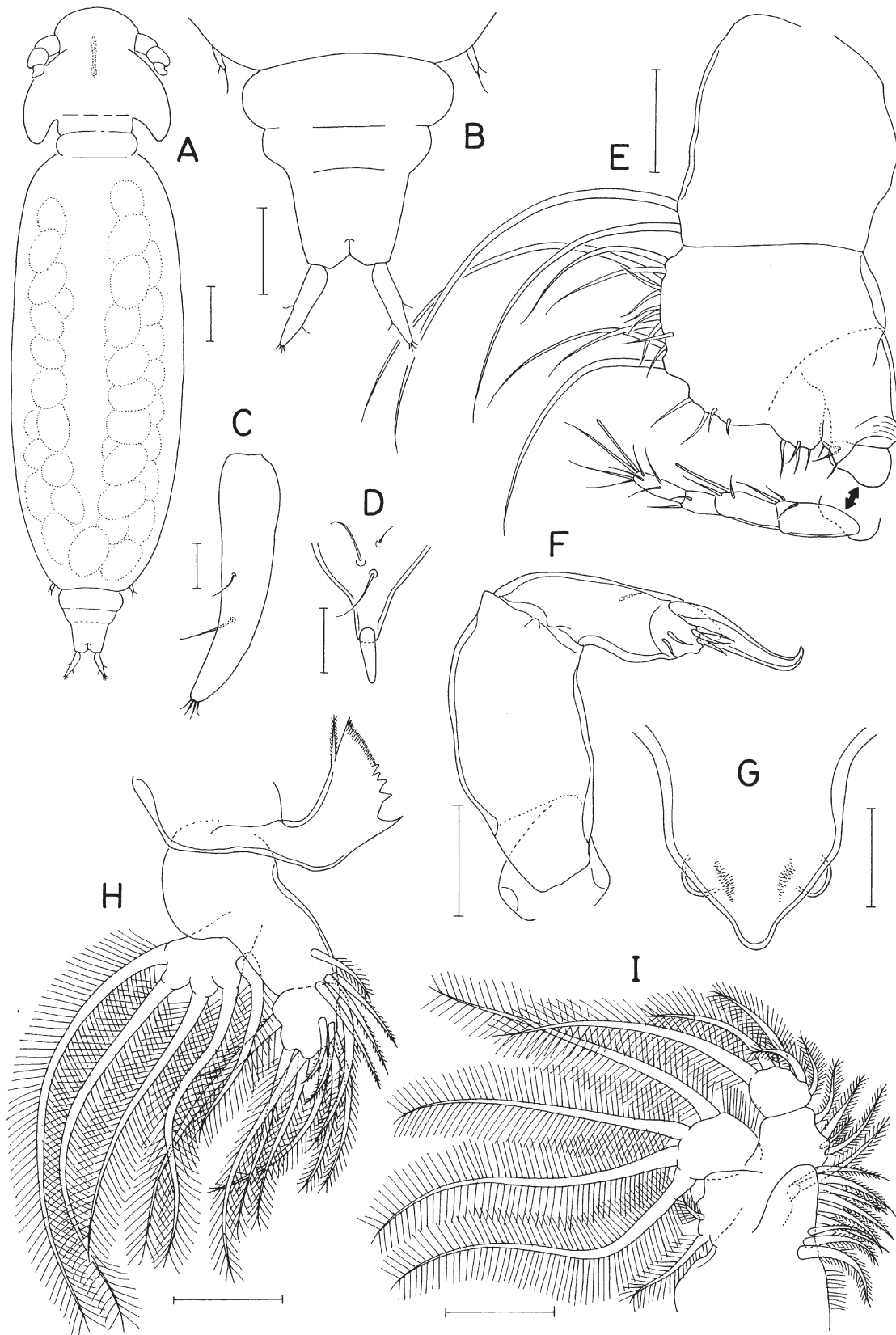
**Material examined.** 22 ♀♀, 18 ♂♂ (MNHN-IU-2018-1884) and dissected 2 ♀♀, 2 ♂♂ from *Ascidia sydneyensis* Stimpson, 1855, Guadeloupe; 2 ♀♀ (MNHN-IU-2018-1885) from *Symplegma brakenhielmi* (Michaelsen, 1904), Saint François, Guadeloupe No. 18; 3 ♀♀ (MNHN-IU-2018-1886) from *A. sydneyensis*, Porte de Case Pilote, Martinique; 14 ♀♀, 8 ♂♂ (MNHN-IU-2018-1887) from *A. sydneyensis*, Riviere Sens, Guadeloupe; 6 ♀♀, 1 ♂ (MNHN-IU-2018-1888) from *Ascidia canaliculata* Heller, 1878, Victoria harbour, Seychelles, 1995; 12 ♀♀, 3 ♂♂ (MNHN-IU-2018-1889) and 1 dissected ♀ from *A. canaliculata*, Victoria, Seychelles, 1995; 2 ♀♀ (MNHN-IU-2017-2149) from *A. sydneyensis*, MADIBENTHOS

Stn AD 208 (14°31.7'N, 61°05.3'W), depth 5–10 m, 07 September 2016; 3 ♀♀ (MNHN-IU-2017-2150) from *A. sydneyensis*, MADIBENTHOS Stn AB 187 (14°38'N, 60°51.2'W), depth 5 m.; 2 ♀♀ (MNHN-IU-2017-2151) from *A. sydneyensis*, MADIBENTHOS Stn AB 189 (14°44.1'N, 60°50.8'W), depth 16 m, 18 September 2016.

**Description of female.** Body (Fig. 296A) linear, dorsoventrally depressed; consisting of cephalosome, short neck, large trunk and small free urosome. Body length 2.50 mm. Cephalosome (Fig. 297A) 430×550 µm, divisible into narrower frontal (antennal) part, 320 µm wide, and laterally expanded posterior part bearing posterolateral extensions on each side. Neck consisting of indistinctly defined first and second pedigerous somites. Trunk forming brood pouch, variable in size, 1.59×0.64 mm in dissected specimen, consisting of fused third to fifth pedigerous somites; legs 3 and 4 positioned anteriorly on trunk, and leg 5 posteriorly. Eggs serially arranged internally along both sides of brood pouch. Urosome (Fig. 296B) 320×242 µm, tapering distally, unsegmented but with traces of 2 articulations. Caudal ramus (Fig. 296C) small, weak, easily detachable from urosome; armed with 6 small setae.

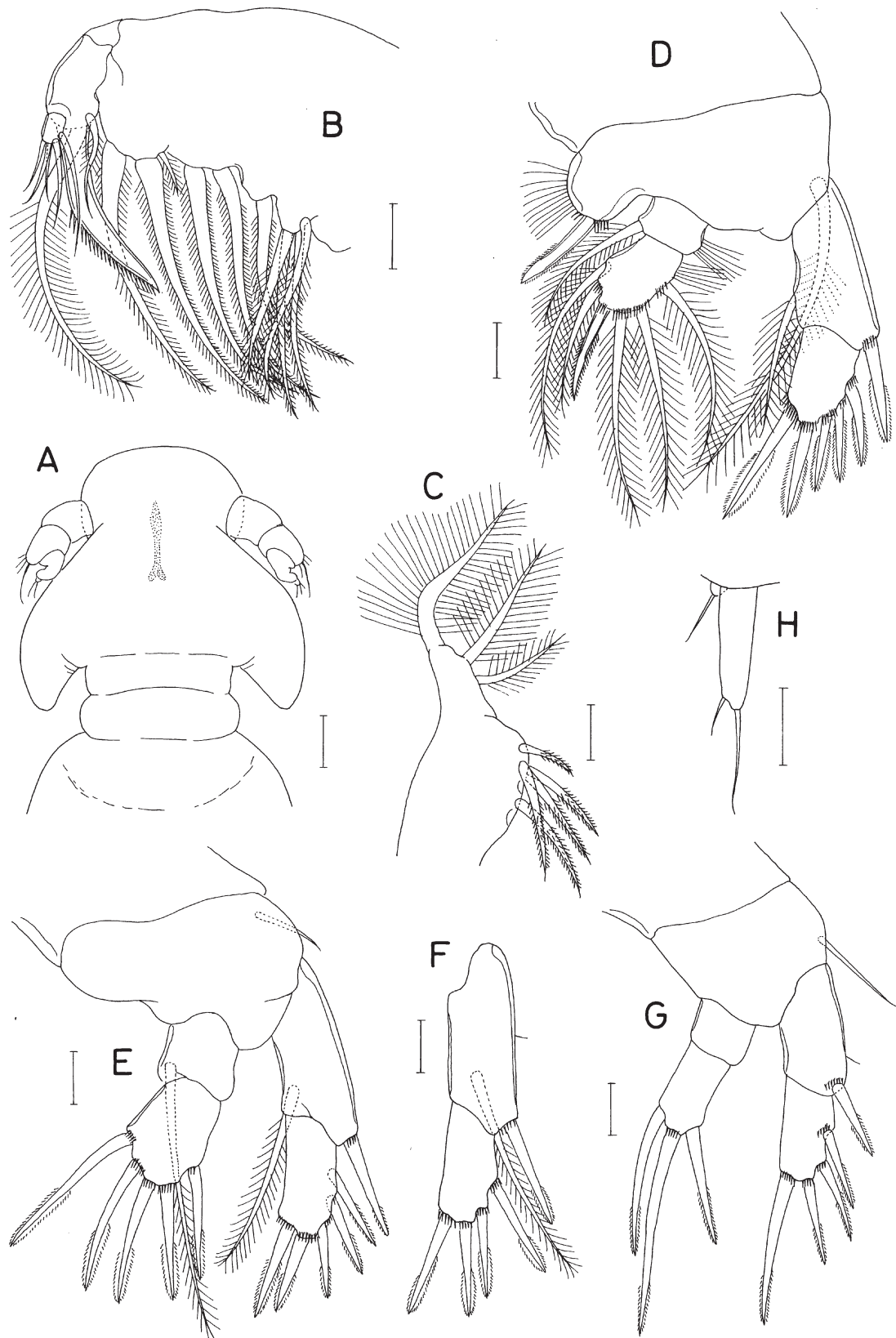
Rostrum (Fig. 296D) on frontal surface of cephalosome; small, tapering, tipped with spinous process; few setules present on ventral surface. Antennule (Fig. 296E) strongly geniculate between fourth and fifth segments; first and second segments extremely broad; third segment inserted into middle of second segment; articulations obscure between second and third, and between third and fourth segments; 4 distal segments slender; armature formula 2, 17, 6, 2, 3, 2+aesthetasc, 2, and 7+aesthetasc; all setae naked, 2 on first and 4 on second segment large, other setae small. Antenna (Fig. 296F) robust, consisting of coxa, allobasis, and 1-segmented endopod; allobasis 100×60 µm, unarmed; free endopodal segment 70×30 µm; armed with 6 small setae (arranged as 1, 2, and 3) plus terminal claw 60 µm long, only slightly shorter than segment.

Labrum (Fig. 296G) with lateral margins parallel proximally, but strongly tapering distally, paired semicircular lobes present subdistally on lateral margins, and paired patches of minute setules subdistally on ventral surface. Mandible (Fig. 296H) with 5 teeth on medial cutting margin and 1 small seta on proximal margin of coxal gnathobase: basis fused with first endopodal segment, armed with 1 seta subdistally and 3 setae distally; exopod not articulated from basis, armed with 5 setae; proximal seta shortest, second and third setae of medium length, and 2 distal setae longest; endopod 1-segmented, armed with 10 setae; 3 distal setae on basis and 2 smaller medial setae on endopod ornamented with short spinules (instead of setules). Maxillule (Fig. 296I) with 9 setae on medial margin of arthrite, 1 long seta on coxal endite, 2 unequal setae on epipodite, 4 setae (second seta small) on medial

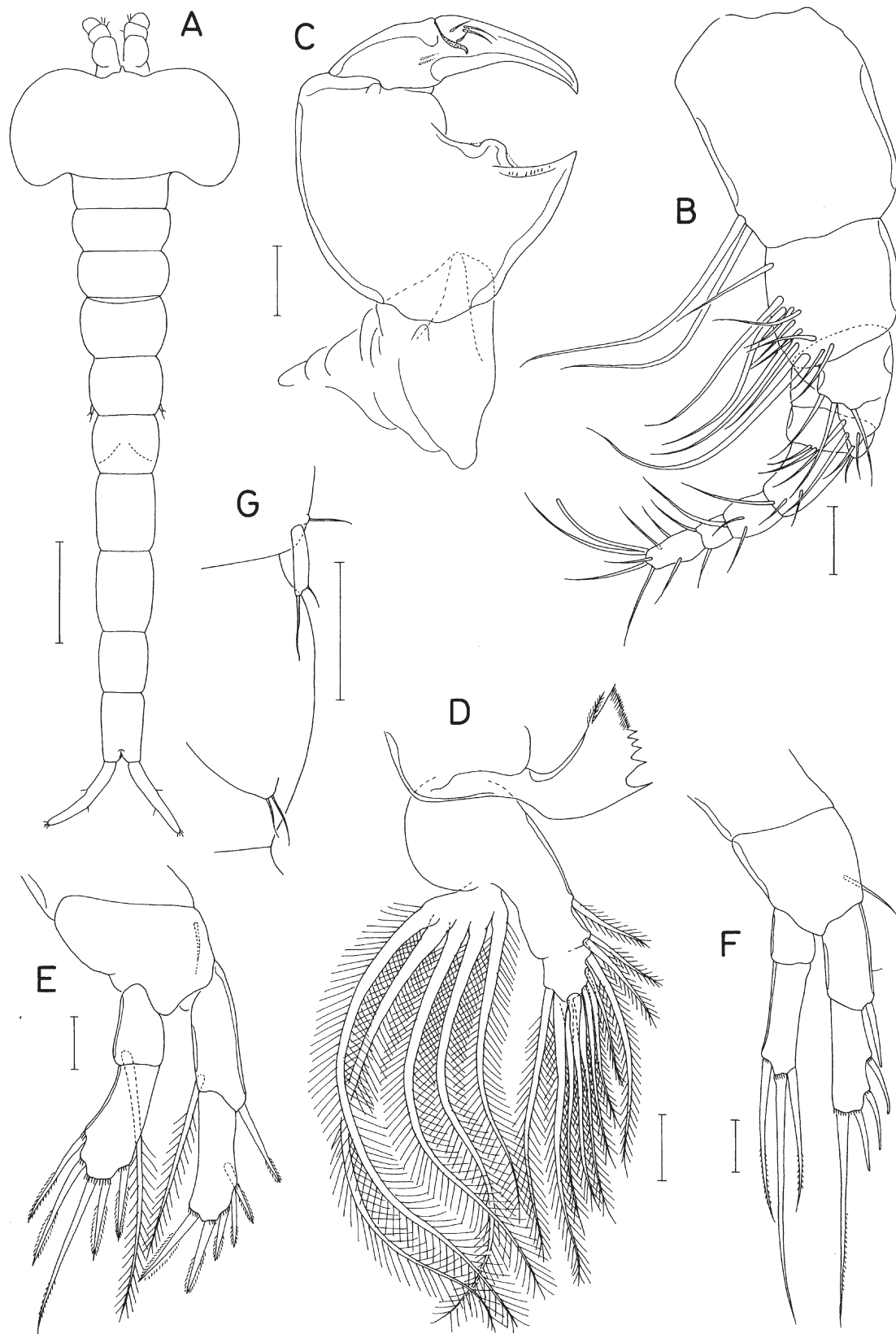


**FIGURE 296.** *Lochidiopsis hartmeyeri* Vanhöffen, 1917, female. A, habitus, dorsal; B, urosome, dorsal; C, caudal ramus, lateral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C, 0.02 mm; D, 0.01 mm; E–I, 0.05 mm.





**FIGURE 297.** *Lochidiopsis hartmeyeri* Vanhöffen, 1917, female. A, anterior part of prosome, dorsal; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, exopod of leg 3; G, leg 4; H, leg 5. Scale bars: A, 0.1 mm; B–H, 0.02 mm.



**FIGURE 298.** *Lochidiopsis hartmeyeri* Vanhöffen, 1917, male. A, habitus, dorsal; B, antennule; C, antenna; D, mandible; E, leg 2; F, leg 4; G, legs 5 and 6. Scale bars: A, 0.2 mm; B–G, 0.02 mm.

margin of basis; exopod with 4 large, subequal setae distally; endopod with 5 unequal setae (second seta curved outwards, and outermost distal seta much longer than other 4). Maxilla (Fig. 297B) 3-segmented, consisting of syncoxa, basis, and 1-segmented endopod; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites, respectively; basis with robust claw bearing spinules along convex margin plus 2 unequal setae; endopod small with 5 small, naked setae. Maxilliped (Fig. 297C) unsegmented but divisible into broader proximal and narrow distal parts; proximal part with 5 spinulose setae on medial margin, distal part with 3 pinnate setae (2 medial and 1 apical).

Legs 1–4 biramous with 2-segmented rami (Fig. 297D–G); inner coxal seta absent. Outer seta on basis large in leg 1, much smaller in legs 2–4. Inner distal spine on basis of leg 1 well-developed, spinulose. Inner margin of basis and outer margin of endopod setulose in leg 1 but naked in legs 2–4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; III, I, I	0-1; 3, I, 2
Leg 2	0-0	1-0	I-1; III, I, I	0-1; I, II, II
Leg 3	0-0	1-0	I-1; II, I, I	0-1; I, II, II
Leg 4	0-0	1-0	I-0; II, I, I	0-0; I, I, I

Leg 5 (Fig. 297H) very small, consisting of small lateral papilla tipped with seta and free exopodal segment 3 times longer than wide (30×10 µm): armed with short subdistal seta and long distal seta.

**Description of male.** Body (Fig. 298A) very different from that of female, elongate (body length 1.50 mm), cylindrical, 11-segmented, without distinct prosome-urosome boundary. Body segmentation distinct, except less distinct articulation between cephalosome and first pedigerous somite. Cephalosome 270×450 µm, expanded laterally. Remaining part of body gradually narrowing posteriorly. Genital somite with weak paired genital opercula. Four abdominal somites longer than wide, anterior somites wider than long. Caudal ramus longer than that of female, about 7.1 times longer than wide (155×22 µm).

Rostrum as tiny anterior process on cephalosome (Fig. 298A). Antennule (Fig. 298B) 8-segmented, tapering distally; first and second segments only slightly expanded; articulations between second and fourth segments obscure; armature formula 2, 13, 8, 2, 3, 3, 2, and 7+aesthetasc. Antenna (Fig. 298C) forming powerful chelate grasping organ, very different in shape from that of female; 3-segmented; coxa weak; basis expanded, with strong, tapering inner projection with pointed apex, and with blunt tubercle distal to inner projection; subchela comprising endopod with 2 minute vestigial setae subdistally, and terminal claw, only partially articulated from endopod, bearing 4 minute setae proximally: tip of claw opposing apex of inner projection on basis. Labrum

as in female. Mandible (Fig. 298D) with 1 short proximal and 4 equally long distal setae; basis with 1 subdistal plus 2 distal setae derived from incorporated exopodal segment; free endopodal segment with 9 setae. Maxillule, maxilla, and maxilliped as in female.

Leg 1 as in female. Rami of legs 2–4 more slender than those of female. Second endopodal segment of legs 2 and 3 armed with 4 slender spines and 1 setae, formula I, I+1, II (Fig. 298E). Rami of leg 4 (Fig. 298F) armed with setae, instead of spines as in female. Leg 5 (Fig. 298G) as in female. Leg 6 (Fig. 298G) represented by 2 small setae on apex of genital operculum.

**Remarks.** Ooishi & Illg (1986) redescribed this species in detail. There are a few minor differences between our specimens and their redescription, including: (1) the mandible bears 4 setae on the basis-first endopodal segment complex and 10 setae on the second endopodal segment, compared to 5 and 9 setae, respectively, in Ooishi & Illg; (2) the mandible of the male is armed with 3 setae on the basis+first endopodal segment complex and 9 setae on the second endopodal segment (Ooishi & Illg stated that the male mandible is armed as in the female); and (3) the female maxilliped is unsegmented, compared to the 2-segmented condition in Ooishi & Illg's specimens.

The type species, *L. hartmeyeri*, was previously known only from the type host *Ascidia sydneiensis* in the Pacific. The ascidians *Symplegma brakenhielmi* and *Ascidia canaliculata* reported here, are new host records. With the additional distribution records from Guadeloupe in the Caribbean to the Seychelles in the Indian Ocean, *L. hartmeyeri* turns out to be a very widely distributed species.

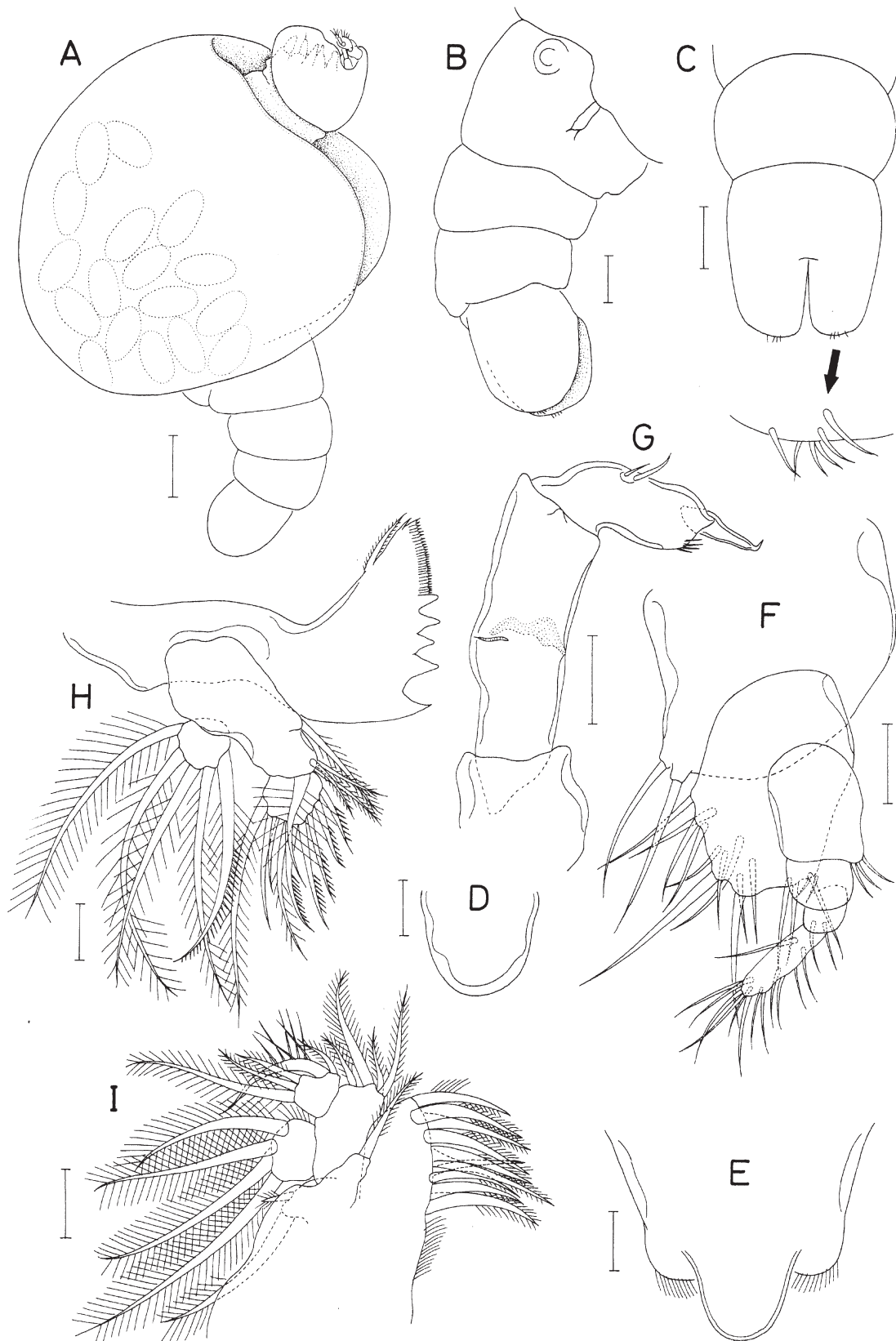
### *Lonchidiopsis replicata* sp. nov.

(Figs. 299, 300)

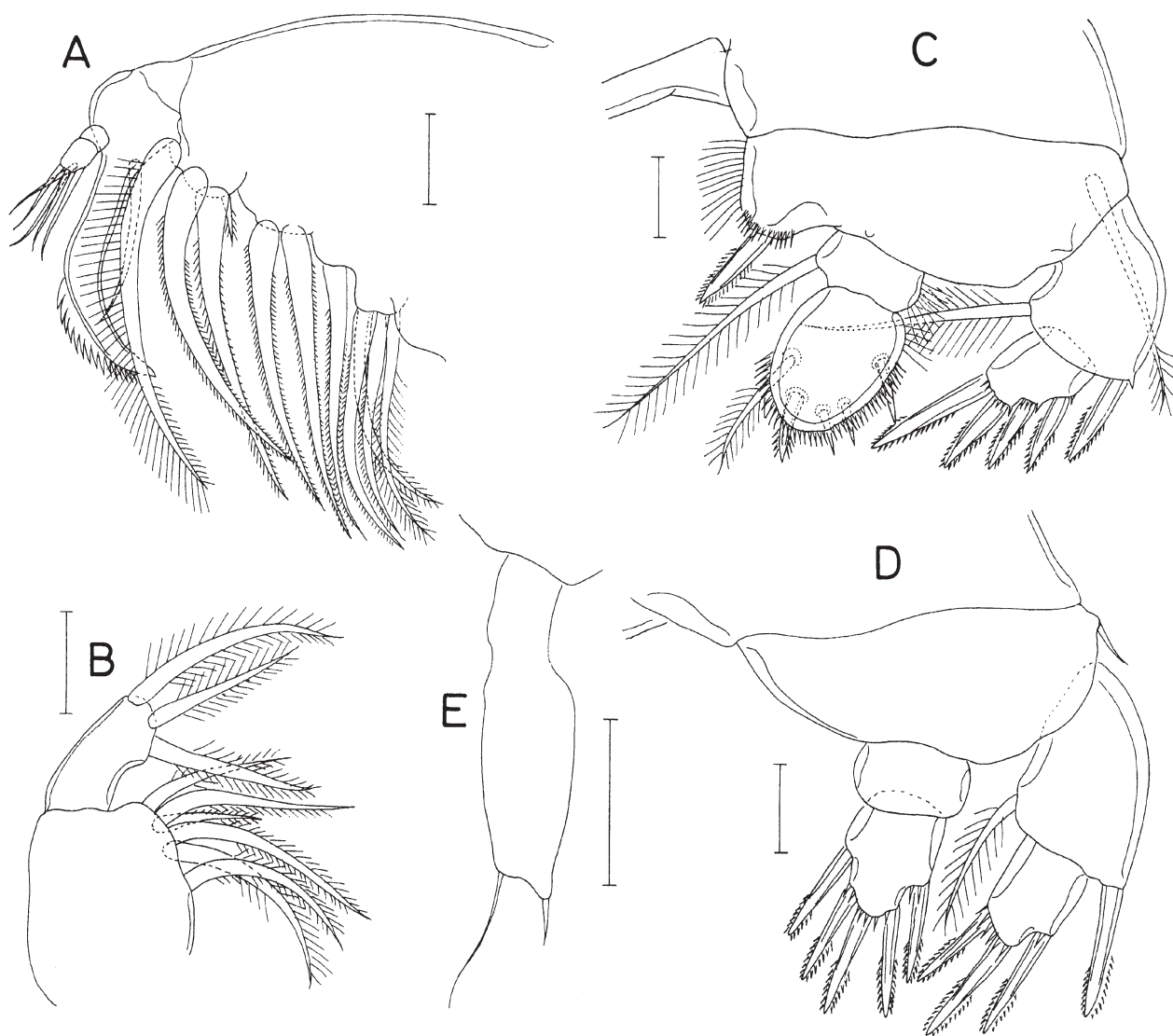
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21358) from *Plurella kottae* Monniot F. & Monniot C., 1996 (Holotype MNHN-IT-2008-6248 = MNHN P7/PLU.A/1), CRRF OCDN 2088-F, Buyong, Mactan Island, Cebu, the Philippines (10°17.19'N, 124°00.15'E), depth 27 m, 07 February 1994.

**Etymology.** The specific name is derived from the Latin *replic* (=fold back), referring to the shape of the brood pouch.

**Description of female.** Body (Fig. 299A) highly transformed, laterally compressed, consisting of cephalothorax, short neck, greatly expanded brood pouch, and 4-segmented free urosome. Body length 1.70 mm. Cephalic shield expanded ventrolaterally, concealing part of surface extending from mouthparts to third pedigerous somite in lateral view. Short neck region without appendages. Fourth pedigerous somite forming brood pouch, extremely compressed but expanded in vertical



**FIGURE 299.** *Lochidiopsis replicata* **sp. nov.**, female. A, habitus, left; B, urosome, right; C, posterior part of urosome, dorsal view showing rami fused to anal somite, with inset showing detail of caudal setae; D, rostrum; E, labrum; F, antennule; G, antenna; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D, 0.01 mm; E–I, 0.02 mm.



**FIGURE 300.** *Lochidiopsis replicata* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 5. Scale bars: A–D, 0.02 mm; E, 0.05 mm.

plane to form paired discoid lateral folds separated by deep dorsal furrow. Free urosome (Fig. 299B) 4-segmented, consisting of genital double-somite and 3-segmented abdomen, Caudal rami fused to anal somite without any trace of articulation, slightly longer than wide; armed with 6 minute setae on convex distal margin (Fig. 299C).

Rostrum (Fig. 299D) small,  $20 \times 22 \mu\text{m}$ , highly sclerotized with rounded apex. Antennule (Fig. 299F) about  $120 \mu\text{m}$  long, 6-segmented; first and second segments extremely expanded; third segment inserting into middle of second segment; armature formula 2, 14, 3, 2, 2, and 13. Antenna (Fig. 299G) 3-segmented, consisting of coxa, allobasis, and 1-segmented endopod; allobasis  $57 \times 23 \mu\text{m}$ , unarmed, with unsclerotized area near middle as trace of articulation; free endopodal segment  $32 \times 15 \mu\text{m}$ , armed

with 2 setae in middle of inner margin, and ornamented with 4 or 5 spinules on distal outer margin; terminal claw about  $19 \mu\text{m}$  long, attenuated at tip.

Labrum (Fig. 299E) with large, linguiform posteromedian lobe and setulose posterior margin. Mandible (Fig. 299H) with broad coxal gnathobase bearing 5 teeth on medial margin and 1 seta on proximal margin: basis with seta at mediodistal corner: exopod with 5 large setae, medial seta pinnate proximally but with spinules along distal part of medial margin; first endopodal segment almost fused to basis, with trace of articulation on medial side, armed with 4 setae, distalmost seta broad and pinnate, with long setules; second endopodal segment armed with 9 setae, 5 medial setae spinulose along distal half of medial margin. Maxillule (Fig. 299I) with 10 setae

on arthritis; coxa with 1 seta on endite and 2 very unequal setae on epipodite; basis with 4 setae (second and fourth setae shorter than first and third); exopod with 4 setae on distal margin; endopod with 2 medial and 3 distal setae (second medial seta broad, curved outwards, with thick setules along convex margin; outermost distal seta longest). Maxilla (Fig. 300A) 4-segmented; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites, respectively; basis with large claw bearing serrations along distal half of convex margin plus 2 unequal setae; endopod atrophied, 2-segmented, first segment unarmed, second with 5 small setae. Maxilliped (Fig. 300B) distinctly 2-segmented; first segment with 6 setae on medial margin; second segment narrow with 3 setae.

Legs 1–3 biramous with 2-segmented rami (Fig. 300C, D); inner coxal seta absent; outer seta on basis large in leg 1, but small in legs 2 and 3. Inner margin of basis and outer margin of endopod setulose in leg 1, but smooth in legs 2 and 3. Compound second endopodal segment of leg 1 ovate with spinulose margins. Leg 4 absent. Armature formula for legs 1–3 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; II, I, I	0-1; 1, 2, I+1
Legs 2 & 3	0-0	1-0	I-1; I, I, I	0-0; I, II, II

Leg 5 (Fig. 300E) represented by small free exopodal segment about 3.6 times longer than wide (101×28 µm), with narrow proximal third and broader distal two-thirds; armed with 2 unequal setae distally.

**Male.** Unknown.

**Remarks.** Despite the highly transformed body form which makes *L. replicata* **sp. nov.** instantly recognizable, its cephalic appendages and legs share various similarities with those of its three congeners. The unique features of the new species within the genus include; the caudal rami are completely fused to the anal somite (vs. the caudal rami are free in all congeneric species), the distal endopodal segment of leg 1 is armed with 1 spine and 4 setae (vs. 1 spine and 5 setae in congeners), and leg 4 is absent (vs. this leg is present in congeners, although it is rudimentary in *L. setosus* and *L. tripes*).

### Genus *Remex* Monniot C., 1983

**Diagnosis.** Body of female slightly depressed: consisting of cephalosome, short neck, expanded brood pouch and narrow urosome. Brood pouch formed by fused fourth and fifth pedigerous somites. Free urosome 5-segmented but with traces of articulations. Caudal rami whip-like. Rostrum shield-like. Antennule 7-segmented. Female antenna 3-segmented, comprising coxa, allobasis and unsegmented free endopod bearing terminal claw. Male antenna forming powerful chelate grasping organ. Mandible with coxal gnathobase forming broad cutting

margin; basis separate; endopod 2-segmented, separate from basis; first and second endopodal segments with 3 and 7 setae, respectively; exopod 1-segmented, armed with 5 setae. Maxillule armed with 8 setae on arthritis, 1 on endite and 1 on epipodite, 3 on basis, 4 on exopod and 5 on endopod. Maxilla 3-segmented; basis with claw plus 2 setae; endopod small, 1-segmented with 4 setae plus spiniform process. Maxilliped 2-segmented, armed with 5 setae on first segment and 3 setae on second. Legs 1–4 with 3-segmented exopods and 2-segmented endopods; inner coxal seta absent in all legs; basis of leg 1 with inner distal spine. Leg 4 lacking inner seta on first exopodal segment. Armature formula for legs 1–4 as follows.

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	I-1; I-0; II, I, I	0-1; 1, 2, 2
Leg 2	0-0	1-0	1-1; 1-0; 2, II, 1	0-1; II, I, I+1
Leg 3	0-0	1-0	1-0; 0-0; 1, 1, 2	0-1; 1, 2, 1
Leg 4	0-0	1-0	1-0; 0-0; 0, 3, 0	0-0; 0, 2, 0

Leg 5 comprising lateral papilla bearing protopodal seta and exopodal segment armed with 2 setae distally.

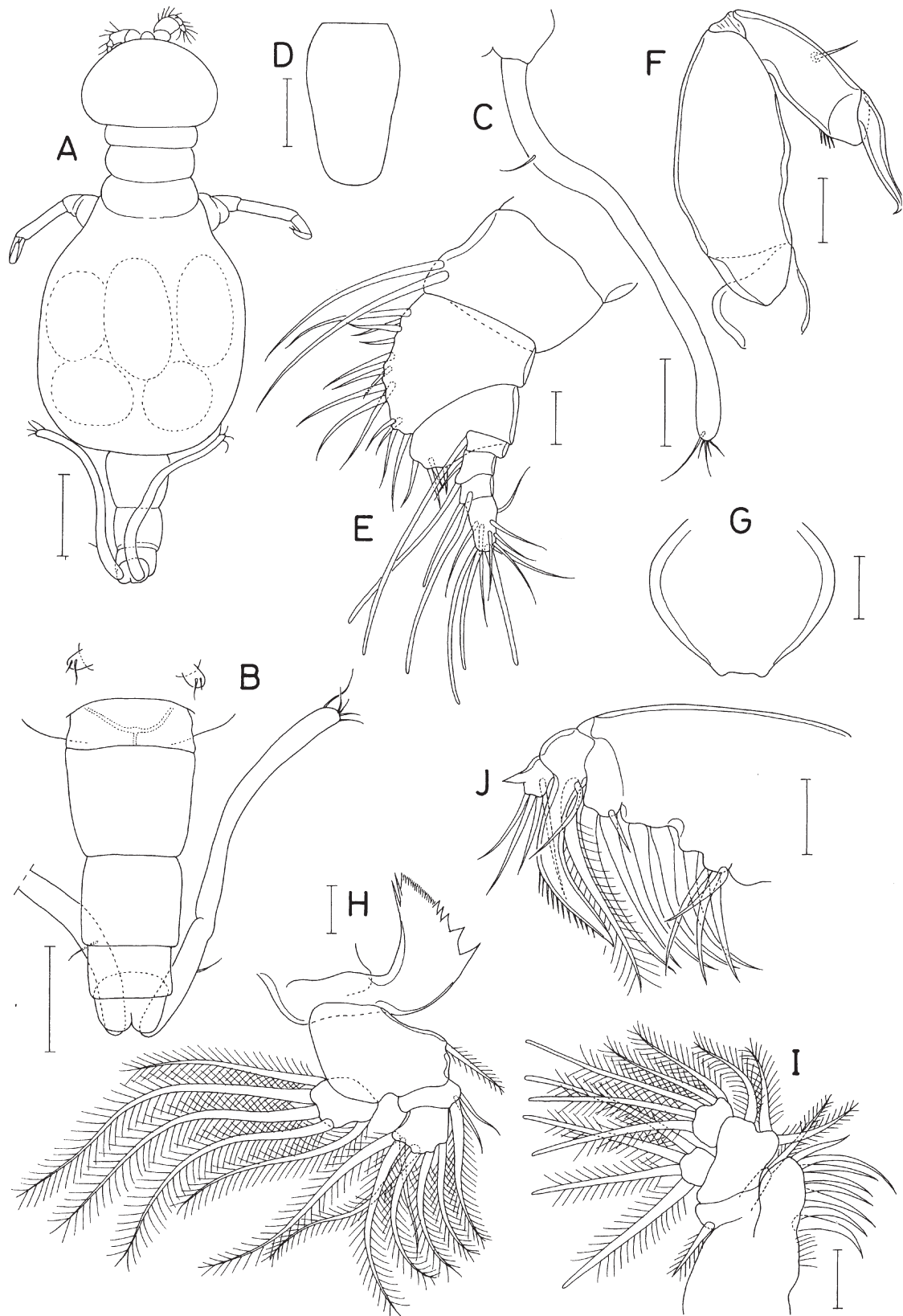
**Type species.** *Remex obesus* Monniot C., 1983, by original designation.

**Remarks.** When he established *Remex*, Monniot (1983) considered that it was related to *Lonchidiopsis*. These two genera appear to form a distinct group and may be distinguished from other related genera by shared features, such as: (1) antenna sexually dimorphic, cheliform in male; (2) basis and first endopodal segment of mandible fused; (3) endopod of maxillule armed with 5 setae; (4) maxilla with strong claw on basis and atrophied endopod; (5) maxilliped bipartite, armed with 3 setae on distal part (or segment); (6) legs 1–3 each with 2-segmented endopod; and (7) leg 5 rudimentary. Of these, three features, the sexually dimorphic antenna, the 5 setae on the maxillary endopod, and the bipartite maxilliped with 3 distal setae, are unusual and serve to characterise the group. *Remex* is not confusable with *Lonchidiopsis*, however, because it has 3-segmented exopods in legs 1–3, and displays a peculiar form of the caudal rami and leg 4.

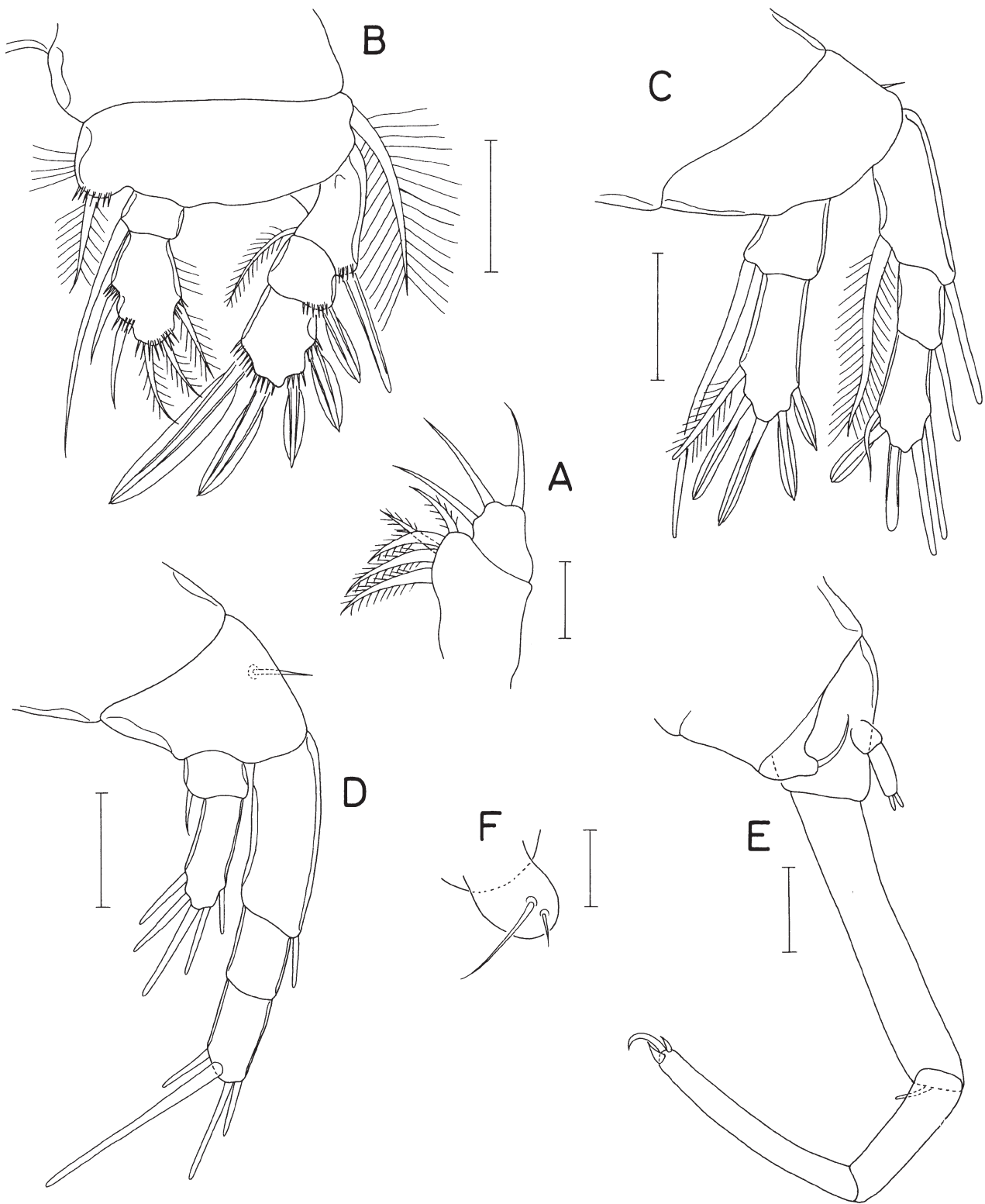
### *Remex obesus* Monniot C., 1983

(Figs. 301–303)

**Material examined.** 6 ♀♀, 4 ♂♂ (MNHN-IU-2018-1890) from *Ascidia interrupta* Heller, 1878, Riviere Sens, Gaudeloupe; 5 ♀♀ (MNHN-IU-2018-1891) from *A. interrupta*, Grande Anse, Guadeloupe; 18 ♀♀, 4 ♂♂ (MNHN-IU-2018-1892) and dissected 2 ♀♀, 1 ♂ (figured) from *A. interrupta*, Pointe des Salines, Martinique; 10 ♀♀, 7 ♂♂ (MNHN-IU-2017-2079) from *A. interrupta*, MADIBENTHOS Stn AR 063 (14°27.3'N, 60°55.5'W), depth 21–26 m, 10 September 2016; 10 ♀♀ (MNHN-IU-2017-2144) from *A. interrupta*, MADIBENTHOS

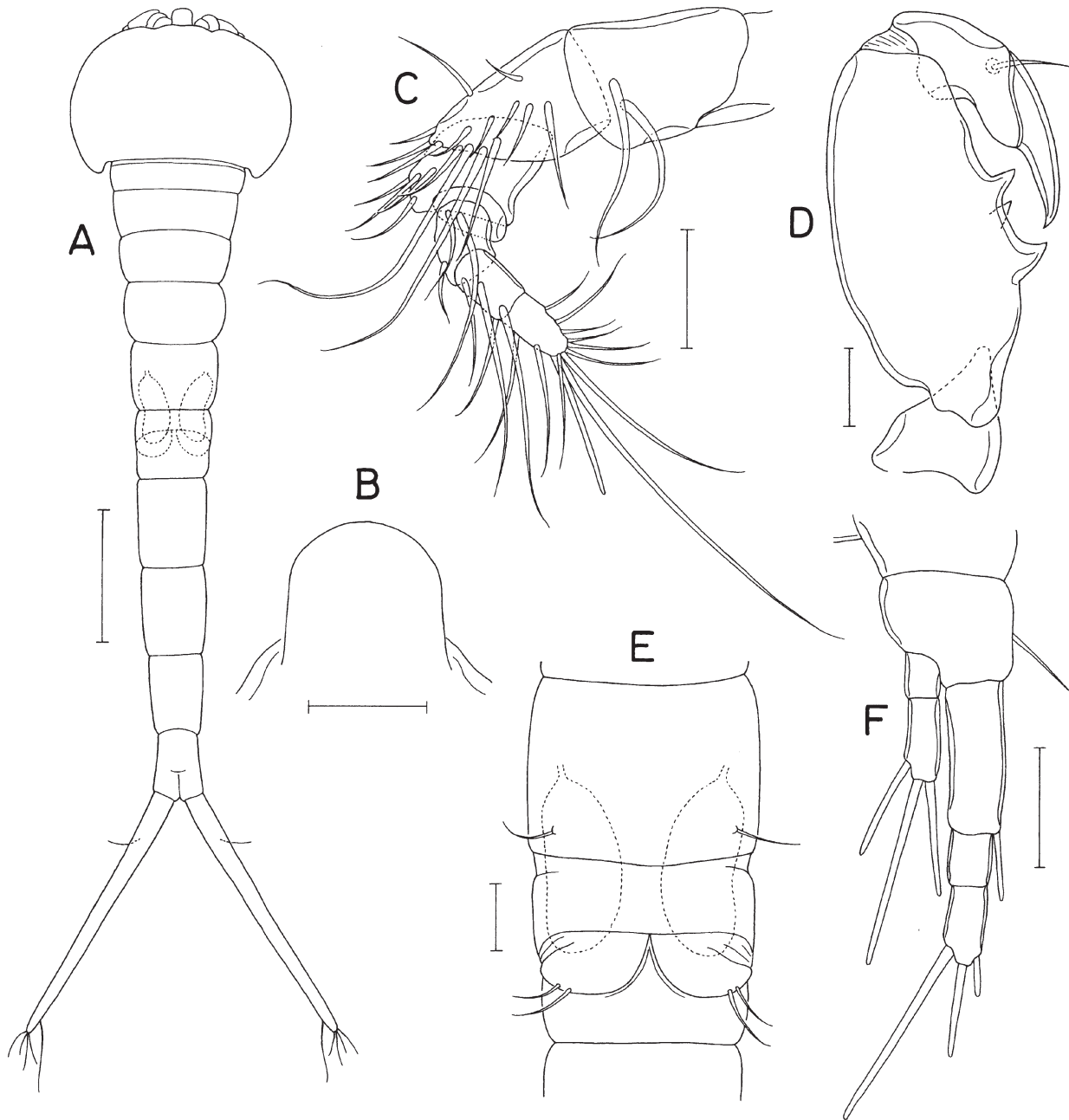


**FIGURE 301.** *Remex obesus* Monniot C., 1983, female. A, habitus, dorsal B, urosome, ventral; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.1 mm; B, C, 0.05 mm; D–J, 0.01 mm.



**FIGURE 302.** *Remex obesus* Monniot C., 1983, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: A, F, 0.01 mm; B–E, 0.02 mm.





**FIGURE 303.** *Remex obesus* Monniot C., 1983, male. A, habitus, dorsal; B, rostrum; C, antennule; D, antenna; E, fifth pedigerous and genital somites, ventral; F, leg 4. Scale bars: A, 0.1 mm; B–F, 0.02 mm.

Stn AR 051 (14°29.6'N, 61°05.5'W), depth 5–25 m, 07 September 2016; 3 ♀♀, 1 ♂ (MNHN-IU-2017-2148) from *A. interrupta*, MADIBENTHOS Stn AR 172 (14°24'N, 60°49.6'W), depth 19–24 m, 12 September 2016.

**Description of female.** Body (Fig. 301A) small, slightly depressed, consisting of cephalosome, neck region, expanded brood pouch, and narrow urosome. Body length 697 µm in dissected specimen. Cephalosome 91×158 µm, with rounded anterior and lateral margins. Neck region comprising first to third pedigerous somites. Brood pouch 303×274 µm, formed by fused fourth and

fifth pedigerous somites, bearing leg 4 anteroventrally and leg 5 posteroventrally (Fig. 301A, B). Free urosome (Fig. 301B) 5-segmented, curved dorsally: genital somite 27×74 µm; 4 abdominal somites 61×74, 53×56, 30×48, and 32×42 µm, respectively. Caudal ramus (Fig. 301B, C) elongate, about 17 times longer than wide (250×15 µm), whip-like, flexible: armed with 1 proximal and 5 distal, small setae; proximal seta positioned at 20% of ramus length.

Rostrum (Fig. 301D) shield-like, articulated at base, 1.7 times longer than wide (24×14 µm), truncated distally.

Antennule (Fig. 301E) consisting of 3 broad proximal segments and 4 narrower distal segments; armature formula indistinctly 2, 14, 4, 1 aesthetasc, 1 aesthetasc, 2+aesthetasc, and 8+3 aesthetascs. Antenna (Fig. 301F) 3-segmented, consisting of unarmed coxa and allobasis, and unsegmented free endopod bearing 1 seta in middle and several minute spinules subdistally on inner margin; terminal claw slender, about 0.7 times as long as free endopodal segment.

Labrum (Fig. 301G) small, subcircular, with narrow, truncate apex. Mandible (Fig. 301H) with 5 teeth and 2 small setae on coxal gnathobase: basis with 1 seta subdistally on medial margin: exopod wider than long, armed with 5 setae (medial and outer setae shorter than 3 distal setae): endopod clearly articulated from basis and clearly 2-segmented, armed with 3 and 7 setae on first and second segments, respectively; 2 of 3 setae on first segment naked and much smaller than distal seta. Maxillule (Fig. 301I) with 8 setae on arthrite, 1 on each coxal endite and epipodite, 3 on basis, 4 on exopod and 5 on endopod; all setae on exopod and 3 outer setae on endopod bluntly tipped. Maxilla (Fig. 301J) 3-segmented, consisting of syncoxa, basis, and 1-segmented endopod; setae on syncoxa arranged as 4, 1, 2, and 3; basis with strong claw plus 2 unequal setae; endopod small with 4 naked setae and 1 distinct, spiniform process. Maxilliped (Fig. 302A) 2-segmented; armed with 5 pinnate setae on first segment and 3 naked setae on second.

Legs 1–4 (Fig. 302B–E) with 3-segmented exopods and 2-segmented endopods; exopods distinctly longer than endopods. Inner coxal seta absent in legs 1–4. Outer seta on basis large in leg 1, vestigial in leg 2, and small in legs 3 and 4. Basis of leg 1 with inner distal seta (not spine). Exopod of leg 3 twice as long as endopod. Leg 4 with extremely unequal rami; exopod about 10 times longer than endopod; 3 exopodal segments 4:2:3 in proportional lengths; third exopodal segment tipped with 3 small setae (or spines), median seta curved, hook-like. Armature formula for legs 1–4 as in generic diagnosis. Leg 5 (Fig. 302F) represented by small exopodal lobe bearing 2 unequal setae.

**Description of male.** Body (Fig. 303A) extremely slender, gradually narrowing posteriorly, 11-segmented. Body length 773  $\mu\text{m}$ . Prosome-urosome boundary obscure. Caudal rami (Fig. 303A) divergent, slender, about 13 times longer than wide (209 $\times$ 16  $\mu\text{m}$ ) and 4.6 times longer than anal somite.

Rostrum (Fig. 303B) directed anteriorly, fused to dorsal cephalic shield, with parallel lateral margins and convex distal margin. Antennule 7-segmented (Fig. 303C); proximal 3 segments broader than distal 4 segments; shortest fourth segment obscure; armature formula 2, 14, 4, 0, 3, 4, and 11+aesthetasc. Antenna (Fig. 303D) robust, chelate; small coxa unarmed; basis broadened, with 3 dentiform processes along medial margin, proximal process opposing tip of terminal claw;

endopod unsegmented, armed with 1 seta subdistally; terminal claw clearly articulated from and as long as endopod. Labrum and maxillule similar to those of female. Mandible with 3 large setae on first endopodal segment. Maxilla with smaller dentiform process on endopod than in female. Maxilliped with indistinct articulation between segments.

Legs 1 lacking outer seta on basis. Leg 2 as in female. Leg 3 with large inner seta on first endopodal segment. Leg 4 (Fig. 303F) very different from that of female; exopod 2.2 times longer than endopod, with 4 bluntly tipped setae (1 on first and 3 on third segments, as in female); endopod with unarmed first segment, but armed with 3 setae on second segment. Leg 5 (Fig. 303E) represented by 1 seta. Leg 6 (Fig. 303E) represented by 2 setae on genital operculum.

**Remarks.** The specimens examined here were collected from the type host at the type locality. Some parts of the original description of this species are not in accord with our observations. The above redescription includes corrections and clarifications of the original description, mainly with regard to body segmentation, the segmentation and setation of the mandible and maxilla, the presence of a maxilliped, and the armature of legs 1 and 2.

### *Doroixys*-group of genera

**Remarks.** For convenience, the genus *Doroixys* Kerschner, 1879 and its allied genera are referred to here as the “*Doroixys*-group”. In addition to *Doroixys*, the group comprises *Demoixys* Illg & Dudley, 1961, *Loboixys* Ooishi, 2006, and *Mesoixys* Illg & Dudley, 1965 plus eleven new genera. This group may be characterised by the combination of the following features: (1) female body inflated, usually globular; (2) antennule at most 9-segmented; (3) mandibular endopod armed with 1 seta on the first segment (with the exception of 2 setae in *Gallincola bisetatus* **gen. et sp. nov.**) and 4 to 7 setae on the second segment; (4) maxillule bearing at most 2 setae on the basis and lacking the coxal endite (except *Prodoroixys* **gen. nov.** which retains the coxal endite); (5) inner coxal seta usually absent from swimming legs; (6) segmentation and setation of swimming legs variously reduced; and (7) leg 5 rudimentary, lacking free exopodal segment. The important character states of the genera within the *Doroixys*-group are compared in Table 10.

Species of genera in this group are mostly associated with compound ascidians, however *Borixys simplex* (Marchenkov & Boxshall, 2004) **comb. nov.** and the species of *Gallincola* **gen. nov.** and *Scoliosoma* **gen. nov.** are found in association with solitary ascidians.

The fifteen genera in the *Doroixys*-group can be distinguished using the following dichotomous key:

**TABLE 10.** Comparison of characters exhibited by genera of the *Doroixys*-group.

Genera	Mnd coxa armature	Mx1 coxal endite	Mx1 basis setae	Mx2 enp segs	Mxp setae	Segments							
						Leg 1		Leg 2		Leg 3		Leg 4	
						exp	enp	exp	enp	exp	enp	exp	enp
<i>Prodoroixys gen.nov.</i>	5-6 teeth	+	2	3	6-10	3	3	3	3	3	3	3	2-3
<i>Notoixys gen.nov.</i>	various	X	1-2	3	3-5	3	2-3	3	2-3	3	1-3	3	2-3
<i>Doroixys</i> Kerschner, 1879	5 teeth	X	1	2	4-6	3	3	3	3	3	2-3	3	2-3
<i>Pentachaetus gen.nov.</i>	5 teeth	X	1	2	6	2-3	3	3	2-3	3	2	3	2
<i>Diceratus gen.nov.</i>	1-3 teeth	X	1	2	2	3	2-3	3	3	3	3	3	3
<i>Borixys gen.nov.</i>	5 teeth	X	1	2	5	3	3	3	3	3	3	3	3
<i>Cystixys gen.nov.</i>	1 tooth	X	1	2	2	3	3	3	3	3	3	3	3
<i>Loboixys</i> Ooishi, 2006	5-6 teeth	X	1	1-2	6	2-3	2-3	3	2-3	2-3	2-3	2-3	2-3
<i>Ammonixys gen.nov.</i>	4 teeth	X	1	2	4	3	3	3	3	3	3	3	2
<i>Mesoixys</i> Illg & Dudley, 1965	styliiform	X	1	3	X	2	1	1	1	1	1	1	1
<i>Ctenixys gen.nov.</i>	pectinate	X	1	1	4-8	1-2	2	2	1	2	1, X	2	X
<i>Demoixys</i> Illg & Dudley, 1961	3-4 teeth	X	1	1-2	2-6	1	1-2	1-2	1	1	1	1, X	1, X
<i>Ademoixys gen.nov.</i>	1 hook	X	-	2	6	2	2	3	2	3	2	3	2
<i>Gallincola gen.nov.</i>	3-5 teeth	X	1	2	2-3	1-3	2-3	1-3	1-2	1-3	1-2	1-3	X-2
<i>Scoliosoma gen.nov.</i>	serrate	X	-	1-2	2	1	1	1	1	1	1	1	X

\*Abbreviations and symbols: Mnd, mandible; Mx1, maxillule; Mx2, maxilla; Mxp, maxilliped; exp, exopod; enp, endopod; segs, segments; +, present; X, absent.

- |   |   |
|---|---|
| <p>1. Endopod of maxilla 3-segmented ..... 2<br/>Endopod of maxilla 1- or 2-segmented ..... 3</p> <p>2. Maxillule with seta-tipped coxal endite .....<br/>..... <i>Prodoroixys gen. nov.</i><br/>Maxillule lacking seta-tipped coxal endite.....<br/>..... <i>Notoixys gen. nov.</i></p> <p>3. Some setae on maxillary endopod enlarged, about twice as long as maxillary segments ..... <i>Cystixys gen. nov.</i><br/>All setae on maxillary endopod at most as long as maxillary segments ..... 4</p> <p>4. Dorsal cephalic shield with 2 pairs of posterolateral horns; basis of maxillule armed with 2 setae.....<br/>..... <i>Diceratus gen. nov.</i><br/>Dorsal cephalic shield with or without paired posterolateral horns; basis of maxillule armed with 1 seta ..... 5</p> <p>5. Caudal ramus armed with 5 setae, at least 1 longer than ramus ..... <i>Pentachaetus gen. nov.</i><br/>Caudal ramus armed with 0 to 6 setae, all shorter than ramus ..... 6</p> <p>6. Maxilliped absent; mandibular gnathobase styliiform .....<br/>..... <i>Mesoixys</i> Illg &amp; Dudley<br/>Maxilliped present; mandibular gnathobase otherwise .... 7</p> <p>7. Mandibular gnathobase transformed to large hook .....<br/>..... <i>Ademoixys gen. nov.</i><br/>Mandibular gnathobase with pectinate medial margin.....<br/>..... <i>Ctenixys gen. nov.</i><br/>Mandibular gnathobase with serrate medial margin.....<br/>..... <i>Scoliosoma gen. nov.</i><br/>Mandibular gnathobase with 3 to 6 teeth on medial margin ..... 8</p> <p>8. Leg 1 exopod 3-segmented; first and second exopodal</p> | <p>segments each armed with outer and inner seta ..... 9<br/>Leg 1 exopod 1- to 3-segmented; when 3-segmented, first or second segments (or both segments) lacking outer or inner seta..... 10</p> <p>9. Dorsal cephalic shield with posterolateral horns; first and second exopodal segments of legs 3 and 4 lacking inner seta..... <i>Doroixys</i> Kerschner<br/>Dorsal cephalic shield without posterolateral horns; first and second exopodal segments of legs 3 and 4 with inner seta..... <i>Borixys gen. nov.</i></p> <p>10. Exopod of mandible completely fused with basis and represented by 2 large setae..... <i>Ammonixys gen. nov.</i><br/>Exopod of mandible defined, usually distinctly articulated from basis ..... 11</p> <p>11. Urosome short, at most as long as wide; caudal rami fused with anal somite..... <i>Demoixys</i> Illg &amp; Dudley<br/>Urosome distinctly longer than wide; caudal rami articulated from anal somite ..... 12</p> <p>12. Maxilliped armed with 2 or 3 setae; distalmost tooth of mandibular gnathobase elongate; gall-inhabiting in solitary ascidians ..... <i>Gallincola gen. nov.</i><br/>Maxilliped armed with 6 setae; distalmost tooth of mandibular gnathobase not elongate; living in compound ascidians ..... <i>Loboixys</i> Ooishi</p> |
|---|---|

**Genus *Doroixys* Kerschner, 1879**

**Diagnosis.** Female body moderately inflated. Dorsal cephalic shield bearing pair of tapering posterolateral horn-like processes. Antennule at most 9-segmented. Antenna

3- or 4-segmented, with terminal claw. Mandibular exopod armed with 5 setae; mandibular endopod 2-segmented with 1 seta on first segment and 3 to 7 setae on second. Maxillule armed with 8 to 10 setae on arthrite, 1 on basis, 4 on exopod, and 3 on endopod; coxal endite typically absent; epipodite usually with 1 seta. Endopod of maxilla 2-segmented with 1 (occasionally 0) and 3 setae on first and second segments, respectively; occasionally 1-segmented with 3 setae. Maxilliped unsegmented, armed with at most 6 setae. Legs 1–4 biramous with 2-segmented protopod; coxa lacking inner seta. Armature formula for legs 1–4 as follows (setae and spines are not differentiated):

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1(or 0)	1-1; 7 (or 6)	0-1; 0-1; 6
Leg 2	0-0	1-0	1-0 (or 1-1); 1-0; 9	0-0; 0-0; 4 to 6 (or 0-0; 5)
Leg 3	0-0	1-0	1-0; 1-0; 9	0-0; 0-0; 3 to 5 (or 0-0; 4 or 5)
Leg 4	0-0	1-0	1-0; 1-0; 8	0-0; 0 to 4 (or 0-0; 0-0; 0 to 2)

Leg 1 with distinctly 3-segmented rami; basis with or without inner distal element (spine or seta); third exopodal segment usually with 7 setal elements (occasionally 6 elements); first and second endopodal segments each bearing inner seta. Legs 2–4 lacking inner seta on first and second exopodal segments, except few species bearing inner seta on first segment only. Endopods of legs 2–4 slender; setae present only on terminal segment (endopod occasionally unarmed). Leg 5 with sclerotized, horn-like process (vestige of exopodal segment) usually bearing 1 small seta. Associated with compound ascidians.

**Type species:** *Doroixys uncinata* Kerschner, 1879, by original monotypy.

**Remarks.** The genus *Doroixys* currently comprises five nominal species, *D. bispinosa* Ooishi, 1998, *D. capillosus* Ho & Kim I.H., 2009, *D. minuta* Stock, 1970, *D. simplex* Marchenkov & Boxshall, 2004, and *D. uncinata*. As Marchenkov & Boxshall (2004) mentioned, the genus was indistinctly defined when originally established (Kerschner, 1879). Nevertheless, the original illustrations of the type species given by Kerschner (1879) display important morphological information that allows us to redefine the genus. It should be pointed out here that Kerschner's Fig. 8 (leg 2) in Plate V was erroneously labelled as leg 3 in the text and Fig. 9 (leg 4) was erroneously labelled as leg 3 in the figure legend. Based on his figures for legs 1, 2, and 4, the type species displays a limited reduction of the setation on leg 1 (on third exopodal segment). In contrast, legs 2–4 of this species reveal remarkable reductions of armature elements: the loss of the inner seta on proximal segment(s) of the exopod and

endopod. In the endopods of legs 2–4, only the terminal segment is armed with seta(e), and in some cases there are no setae at all on the endopod. A comparison between *D. uncinata* and the many new species described below in the present work reveals that the above characteristics of the legs are combined with other diagnostic features at the generic level, as follows: (1) dorsal cephalic shield and leg 5 bearing horn-like processes; (2) mandible with broadened coxal gnathobase bearing 5 teeth; (3) maxillule with 1 seta on basis, but mostly lacking coxal endite; (4) endopod of maxilla typically 2-segmented, with well-developed claw on basis; and (5) maxilliped unsegmented and armed with fewer than 7 setae (generally 5 or 6 setae). The combination of these features allows us to define the genus *Doroixys*. Known species of this genus are distributed in both tropical and warm temperate waters.

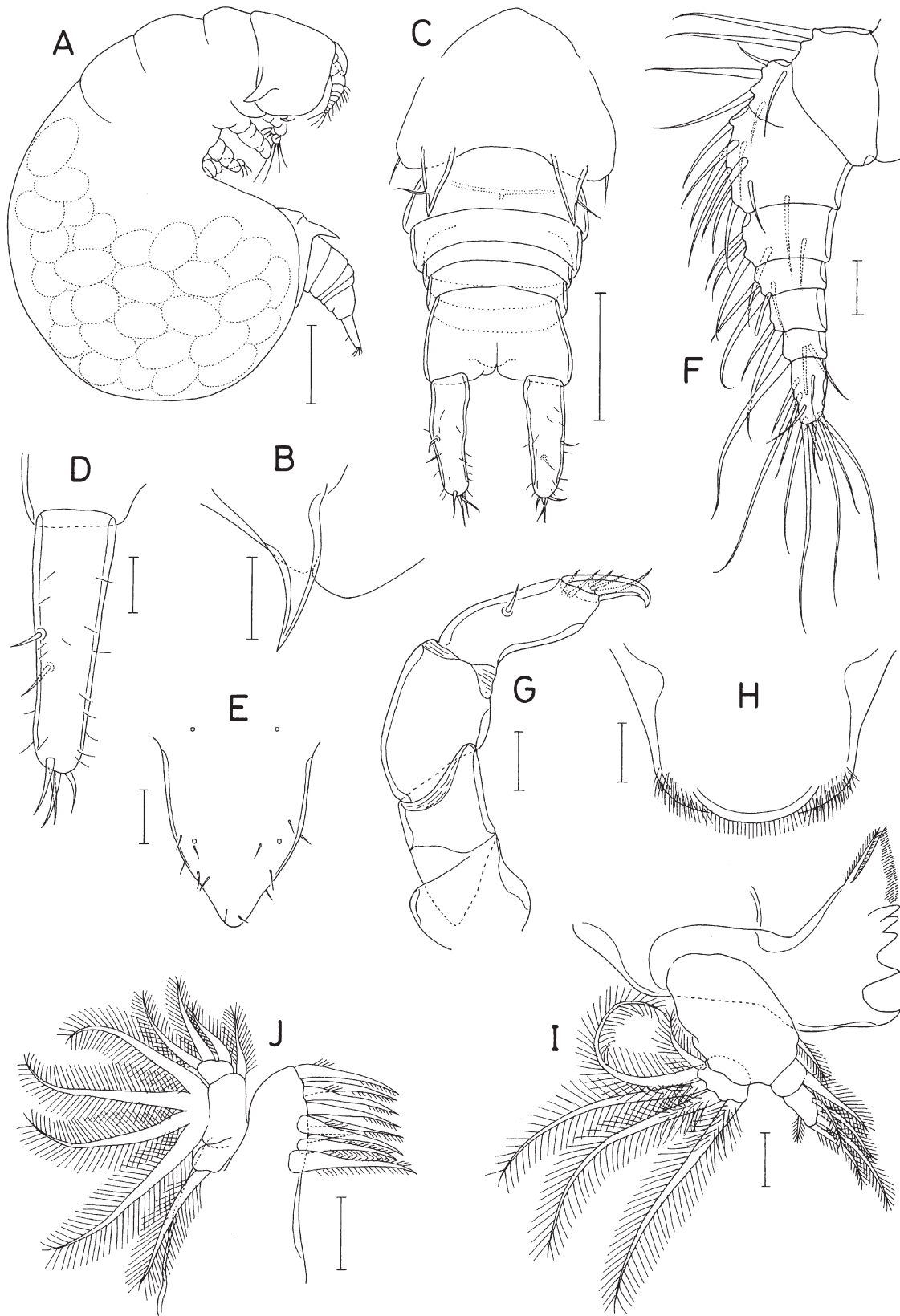
Three of the current species, *D. bispinosa*, *D. capillosus*, and *D. simplex*, do not share the characteristics outlined above in the revised diagnosis of *Doroixys* and are here removed to other genera.

#### *Doroixys uncinata* Kerschner, 1879

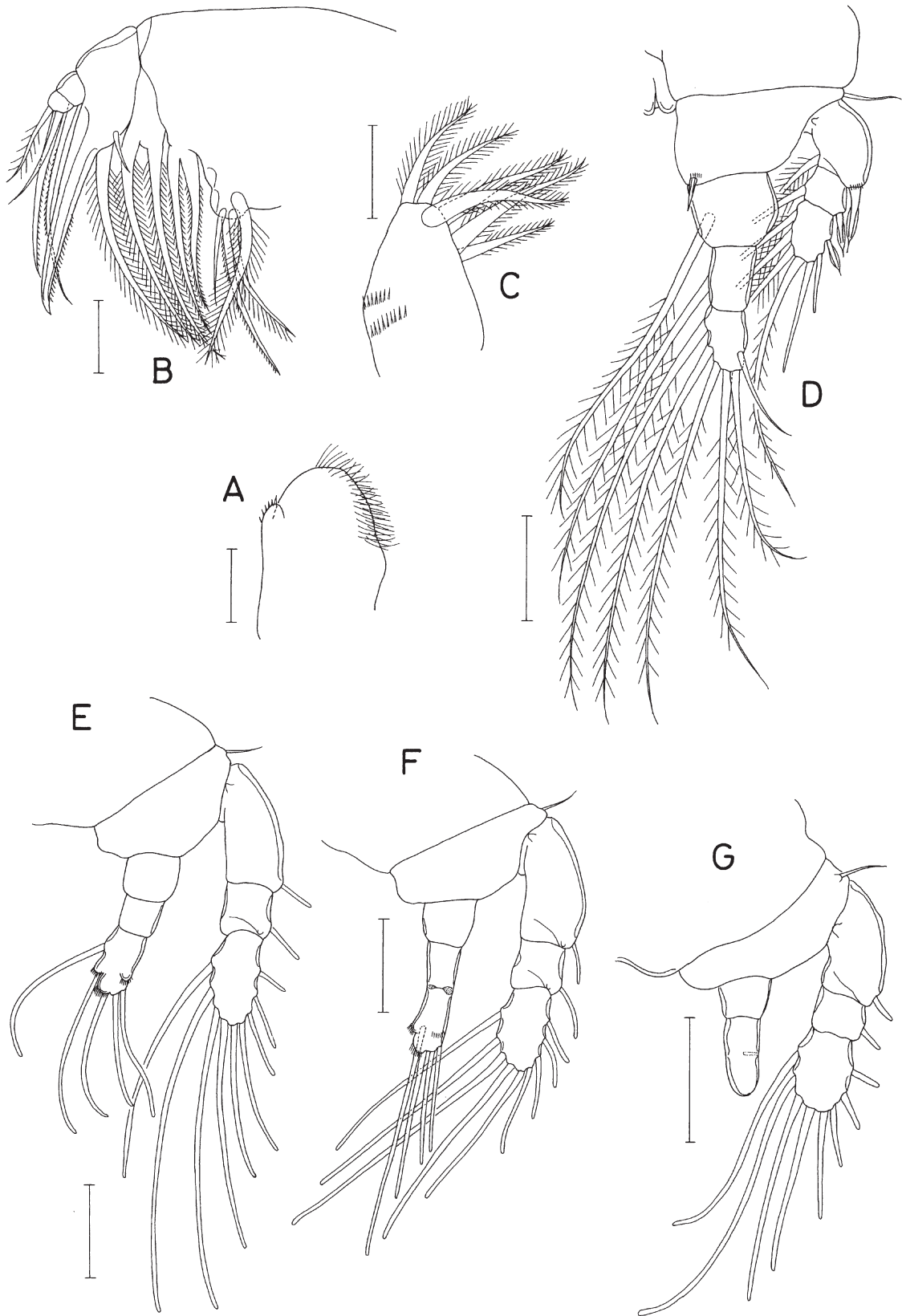
(Figs. 304, 305)

**Material examined.** 8 ♀♀ (MNHN-IU-2018-1893) and 1 dissected ♀ from *Aplidium turbinatum* (Savigny, 1816), Roscoff, Atlantic coast of France; 1 ♀ (MNHN-IU-2018-1894) from *A. turbinatum*, Roscoff; 7 ♀♀ (MNHN-IU-2018-1895) from *A. nordmanni* Milne Edwards, 1841, Greece; 5 ♀♀ (MNHN-IU-2018-1896) and 2 dissected ♀♀ from *A. proliferum* Milne Edwards, 1841, SME 473, Îles d'Hyères, Mediterranean coast of France; 4 ♀♀ (MNHN-IU-2018-1897) and 1 dissected ♀ from *Aplidium* sp., Porto Vecchio, Corsica; 7 ♀♀ (MNHN-IU-2018-1898) and 2 dissected ♀♀ from *A. nordmanni*, Porto Vecchio, Corsica; 5 ♀♀ (MNHN-IU-2018-1899) and 1 dissected ♀ from *A. elegans* (Giard, 1872), Tabarka, Tunisia; 5 ♀♀ (MNHN-IU-2018-1900) and 2 dissected ♀♀ (figured) from *A. turbinatum*, Dinard, Atlantic coast of France.

**Description of female.** Body (Fig. 304A) inflated. Body length variable, 1.41 mm in figured specimen. Cephalosome clearly defined from metasome. Dorsal cephalic shield with pair of acutely pointed, sclerotized, posterolateral horn-like processes (Fig. 304B). Metasome incompletely 4-segmented dorsally; fourth pedigerous somite forming thin-walled brood pouch, usually moderately swollen, bulbous, but sometimes strongly swollen and almost spherical as in Fig. 304A. Free urosome (Fig. 304C) stout, 5-segmented. Caudal rami widely separated from each other; ramus about 3.2 times longer than wide (Fig. 304D) and slightly longer than anal somite, with blunt apex: armed with 2 middle and 4 distal setae, and ornamented with many setules; 2 middle setae positioned at 48 and 59% of ramus length.



**FIGURE 304.** *Doroixys uncinata* Kerschner, 1879, female. A, habitus, right; B, posterolateral process of cephalic shield; C, leg 5 and urosome, ventral; D, right caudal ramus, ventral; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, 0.2 mm; B, 0.05 mm; C, 0.1 mm; D–J, 0.02 mm.



**FIGURE 305.** *Doroixys uncinata* Kerschner, 1879, female. A, paragnath; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4. Scale bars: A–C, 0.02 mm; D–G, 0.05 mm.

Rostrum (Fig. 304E) about 80×65 µm, with almost parallel lateral margins in proximal half, tapering distally towards blunt tip; distal half irregularly ornamented with more than 10 sensillae. Antennule (Fig. 304F) small, 146 µm long, 7-segmented; armature formula 2, 15, 5, 3+aesthetasc, 2, 2+aesthetasc, and 11+aesthetasc; all setae naked and relatively short. Antenna (Fig. 304G) stout, 4-segmented; proximal 3 segments unarmed; basis short, shorter than first endopodal segment; compound distal endopodal segment 2.5 times longer than wide (50×20 µm): armed with 6 setae (arranged as 1, 2, and 3) plus terminal claw 32 µm long.

Labrum (Fig. 304H) with broad, weakly convex free posterior margin ornamented with dense setules; posteromedian lobe short but broad, setulose. Mandible (Fig. 304I) with broadened coxal gnathobase bearing 5 teeth on medial margin and 1 seta proximally; basis with 1 seta on medial margin; exopod unsegmented, wider than long, armed with 5 setae, outermost seta small (about one-third as long as other 4 setae); endopod 2-segmented, armed with 1 and 5 setae on first and second segments, respectively; outer seta on second segment much smaller than other 4 setae. Paragnath (Fig. 305A) as small lobe ornamented with setules on medial margin and small spinulose lobule on outer margin. Maxillule (Fig. 304J) with 9 setae on arthrite (1 small), 1 each on epipodite and basis, 4 on exopod and 3 on endopod; endite absent. Maxilla (Fig. 305B) 4-segmented, consisting of syncoxa, basis, and 2-segmented endopod; syncoxa with 3 endites bearing 4, 2, and 2 setae on first to third endites, respectively; distal seta on first endite thin and naked; basis with strong claw ornamented with spinules on concave margin, plus 2 markedly unequal setae; endopod small bearing 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 305C) unsegmented, tapering distally, armed with 5 or occasionally 6 setae; ornamented with 2 horizontal rows of spinules on lateral surface.

Legs 1–4 (Fig. 305D–G) biramous; coxa lacking inner seta; outer seta on basis small. Legs 1–3 with 3-segmented rami. Leg 4 with 3-segmented exopod and 2-segmented endopod. Leg 1 with small inner distal spine on basis (about half as long as first segment); first endopodal segment much broader than second and third; exopod shorter than endopod; outer setae on both rami pinnate, those of endopod markedly enlarged. Legs 2–4 with exopod longer than endopod: all setae on legs 2–4 naked and blunt tipped. Second endopodal segment of leg 4 often with vestige of articulation on outer side, occasionally absent. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; I+2, 1, 3	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1, 2, 2
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1, 2, 1
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 0

Leg 5 (Fig. 304C) consisting of rounded ill-defined protopod and acute, beak-like exopod: protopod tipped with small seta; exopod not articulated from protopod, sclerotized, armed with 1 small seta subdistally on outer margin.

**Male.** Unknown.

**Remarks.** In this species the form and size of the mature female body varies according to the reproductive state of the individual, since the degree of inflation of the brood pouch depends on the number of eggs it contains and their state of development. The unarmed endopod of leg 4 is a character state shared by very few other species (described below). However, this character state combined with the presence of 5 setae on the second endopodal segment of the mandible serves to differentiate the type species, *D. uncinata*, from its congeners. *Doroixys uncinata* sensu Ooishi (1972) is treated as a new species below.

### *Doroixys ooishiae* sp. nov.

Syn. *Doroixys uncinata*: Ooishi, 1972, p. 305, text-figs. 1-3; pl. xiv, fig. 2.

**Etymology.** The name of the new species honours its discoverer, Shigeko Ooishi.

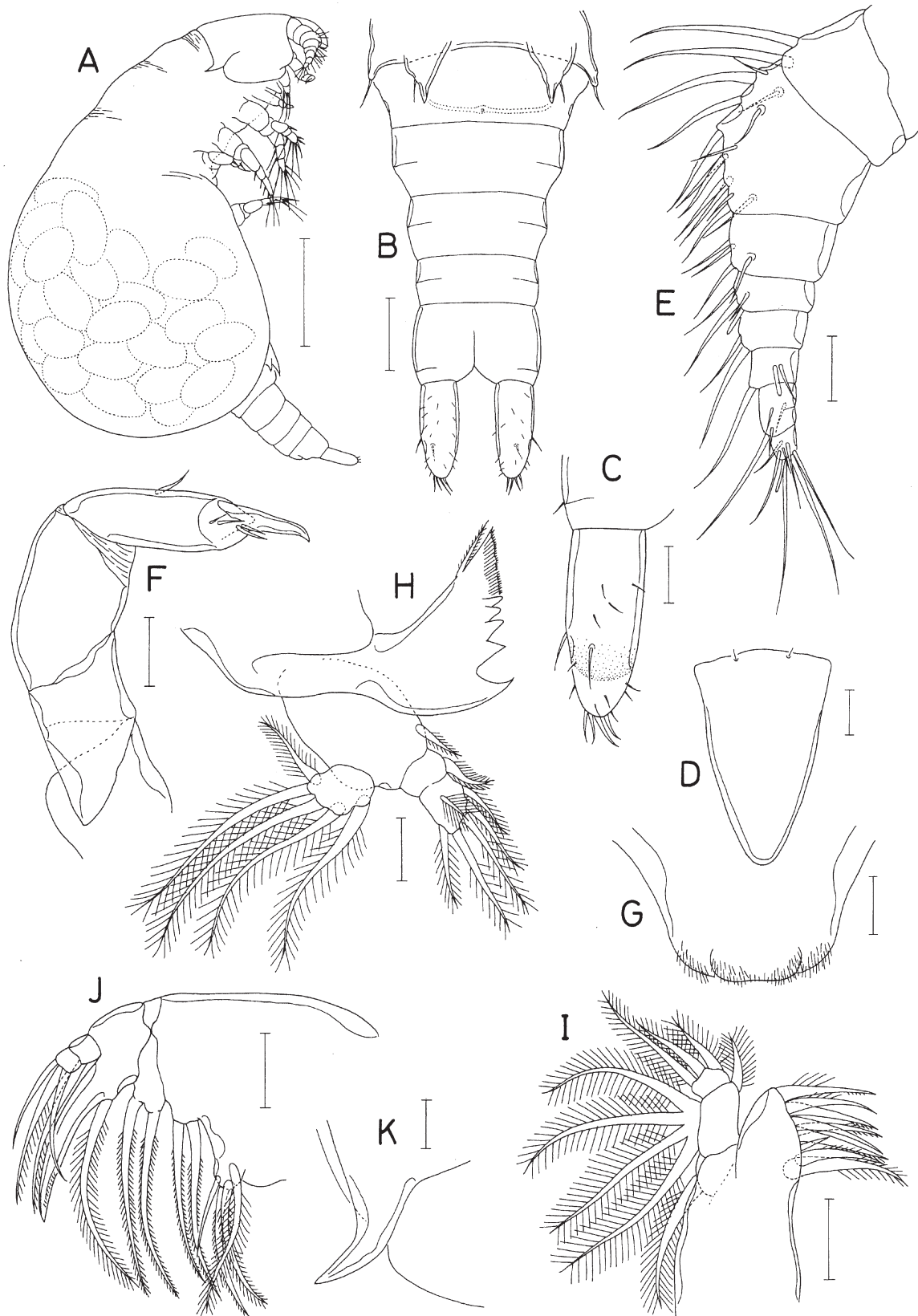
**Description:** see Ooishi (1972).

**Remarks.** The specimens described by Ooishi (1972) under the name *D. uncinata* Kerschner exhibit significant differences from the original description and from our observations of typical *D. uncinata*. These differences are: (1) the caudal ramus is shorter, 2.3 times longer than wide compared to 3.2 times in *D. uncinata*; (2) the first exopodal segment of leg 2 bears an inner seta (cf. seta absent); (3) the distal segment of the endopod of leg 4 is armed with 3 setae (cf. no setae); and (4) the protopodal process (“outer lobe” according to Ooishi) of leg 5 is produced and tapering. The material examined by Ooishi (1972) is not conspecific with *D. uncinata* and we here recognize it as a new species, *Doroixys ooishiae* sp. nov. Ooishi (1972) described the third endopodal segment of leg 1 as bearing 7 setae (formula 1, 2, 4), such an armature formula is extremely unusual for the family Notodelphyidae. This armature condition is considered an abnormality and requires confirmation.

### *Doroixys manadoensis* sp. nov.

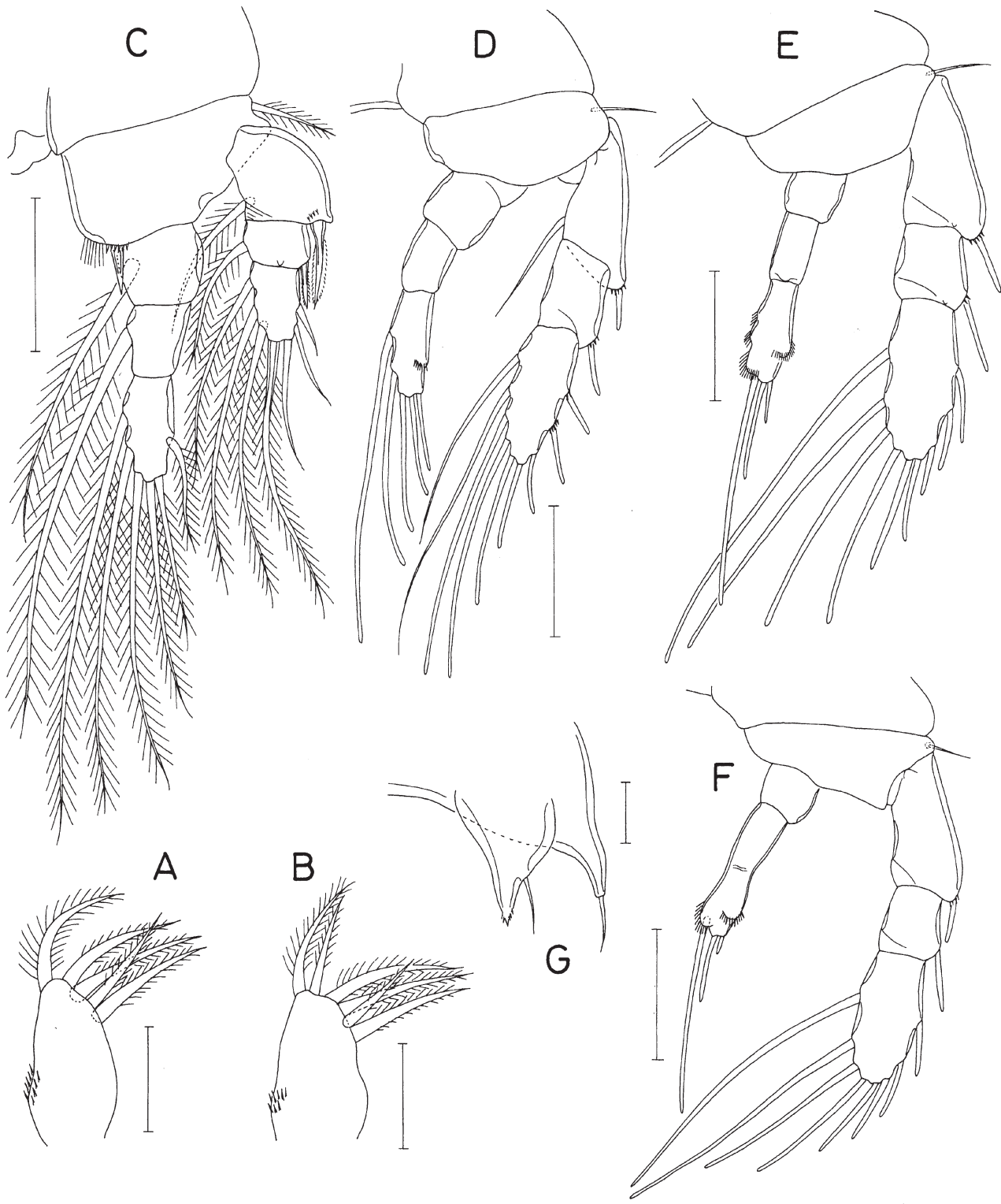
(Figs. 306, 307)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21359), paratypes (4 intact ♀♀, MNHN-IU-2014-21360), and dissected paratypes (2 ♀♀, figured) from *Aplidium lineatum* Monniot F. & Monniot C., 1996 (type MNHN-IT-2008-469 = MNHN A1/APL.B/311), CRRF OCDN



**FIGURE 306.** *Doroixys mandoensis* sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla; K, posterolateral process of cephalic shield. Scale bars: A, 0.5 mm; B, 0.05 mm; C–K, 0.02 mm.





**FIGURE 307.** *Doroixys manadoensis* sp. nov., female. A, B, maxillipeds; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, B, G, 0.02 mm; C–F, 0.05 mm.

1447-I, Manado 25, northern tip of Sulawesi, Manado, Indonesia (11°45.10'N, 124°58.87'E), depth 33 m.

**Etymology.** The specific name refers to the type locality of the new species.

**Description of female.** Body (Fig. 306A) stout, 1.39 mm long; prosome 1.09 mm long. Dorsal cephalic shield bearing paired hook-like, tapering processes (Fig. 306K) at posterolateral corners. Metasome unsegmented, but with dorsal folds in integument, indistinctly delimiting first and second pedigerous somites; third and fourth pedigerous somites fused, without trace of suture between them. Region of fourth pedigerous somite expanded forming almost spherical brood pouch. Free urosome (Fig. 306B) 5-segmented; genital and 4 abdominal somites 55×152, 48×120, 45×98, 34×86, and 54×90 µm, respectively. Caudal ramus (Fig. 306C) about 2.4 times longer than wide (68×28 µm), distal 20% of ramus pale and thin-walled, rounded distally: armed with 6 small setae and ornamented with scattered setules; outer and dorsal setae positioned at 56 and 63% of ramus length, respectively.

Rostrum (Fig. 306D) 95×61 µm, tapering towards blunt apex. Antennule (Fig. 306E) 144 µm long, 8-segmented but with articulation between 2 terminal segments incomplete; armature formula 2, 14, 4, 3+aesthetasc, 2, 2+aesthetasc, 4, and 7+aesthetasc; all setae naked and aesthetascs short. Antenna (Fig. 306F) stout, 4-segmented; proximal 3 segments unarmed; basis shorter than first endopodal segment; compound distal endopodal segment 3 times longer than wide (51×17 µm) and about as long as first endopodal segment: armed with 5 small setae (arranged as 1, 2, and 2) plus terminal claw about half as long as distal endopodal segment.

Labrum with setulose free posterior margin and broad, setulose posteromedian lobe. Mandible (Fig. 306H) similar to that of *D. uncinata*, but second endopodal segment bearing 1 small, pinnate seta in mid-dorsal surface and outer subdistal seta relatively larger than that of *D. uncinata*. Maxillule (Fig. 306I) similar to that of *D. uncinata*, but 2 medial setae on endopod distinctly shorter than outer seta. Maxilla (Fig. 306J) 4-segmented; syncoxa with 4, 2, and 2 setae on first to third endites, respectively; basis with strong claw plus 1 seta; endopod small with 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 307A, B) unsegmented, armed with 5 or 6 setae and ornamented with patch of spinules on outer surface.

Legs 1–3 (Fig. 307C–E) with 3-segmented rami. Leg 4 (Fig. 307F) with 3-segmented exopod and 2-segmented endopod: compound distal endopodal segment of leg 4 about 3 times longer than first endopodal segment and retaining vestige of articulation in middle. Inner coxal seta absent in all swimming legs. Outer seta on basis pinnate in leg 1, but naked in legs 2–4. Inner distal spine on basis of leg 1 small, 15 µm long. Setae on leg 1 pinnate, except 3 naked setae on third exopodal segment (1 distal and 2 outer setae). All setae on legs 2–4 naked and most bluntly

tipped. Three setae on tip of endopod of legs 3 and 4 very unequal in length, outermost seta shortest. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 2, 2, 3	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 1
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 0, 2, 1

Leg 5 (Fig. 307G) consisting of elongate, digitiform outer protopodal process tipped with 1 seta and tapering exopod not articulated from protopod, armed with 1 seta on outer margin and with several microspinules distally.

**Male.** Unknown.

**Remarks.** This species appears most closely related to *D. ooishiae* sp. nov. because only these two species have an inner seta on the first exopodal segment of leg 2. The most salient differences between these two species are in the number of setae on the second endopodal segment of the mandible (6 in *D. manadoensis* sp. nov. vs. 5 in *D. ooishiae* sp. nov.), in the armature of the third endopodal segment of leg 3 (armed with 3 setae in *D. manadoensis* sp. nov. vs. 4 setae in *D. ooishiae* sp. nov.), and in the form of the rostrum (gradually narrowing distally in *D. manadoensis* sp. nov. compared to abruptly narrowing in distal half in *D. ooishiae* sp. nov.)

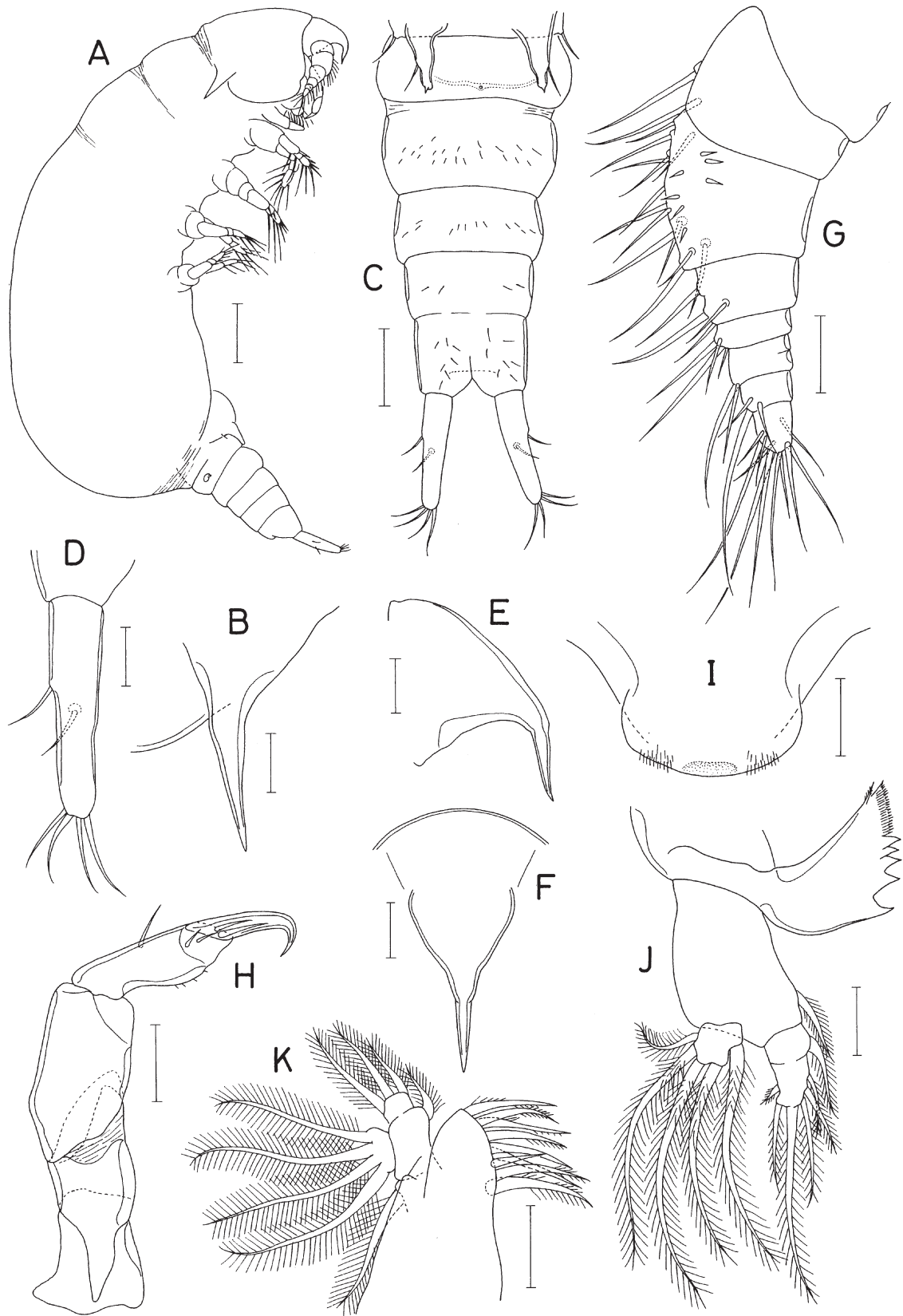
#### *Doroixys acutirostris* sp. nov.

(Figs. 308, 309)

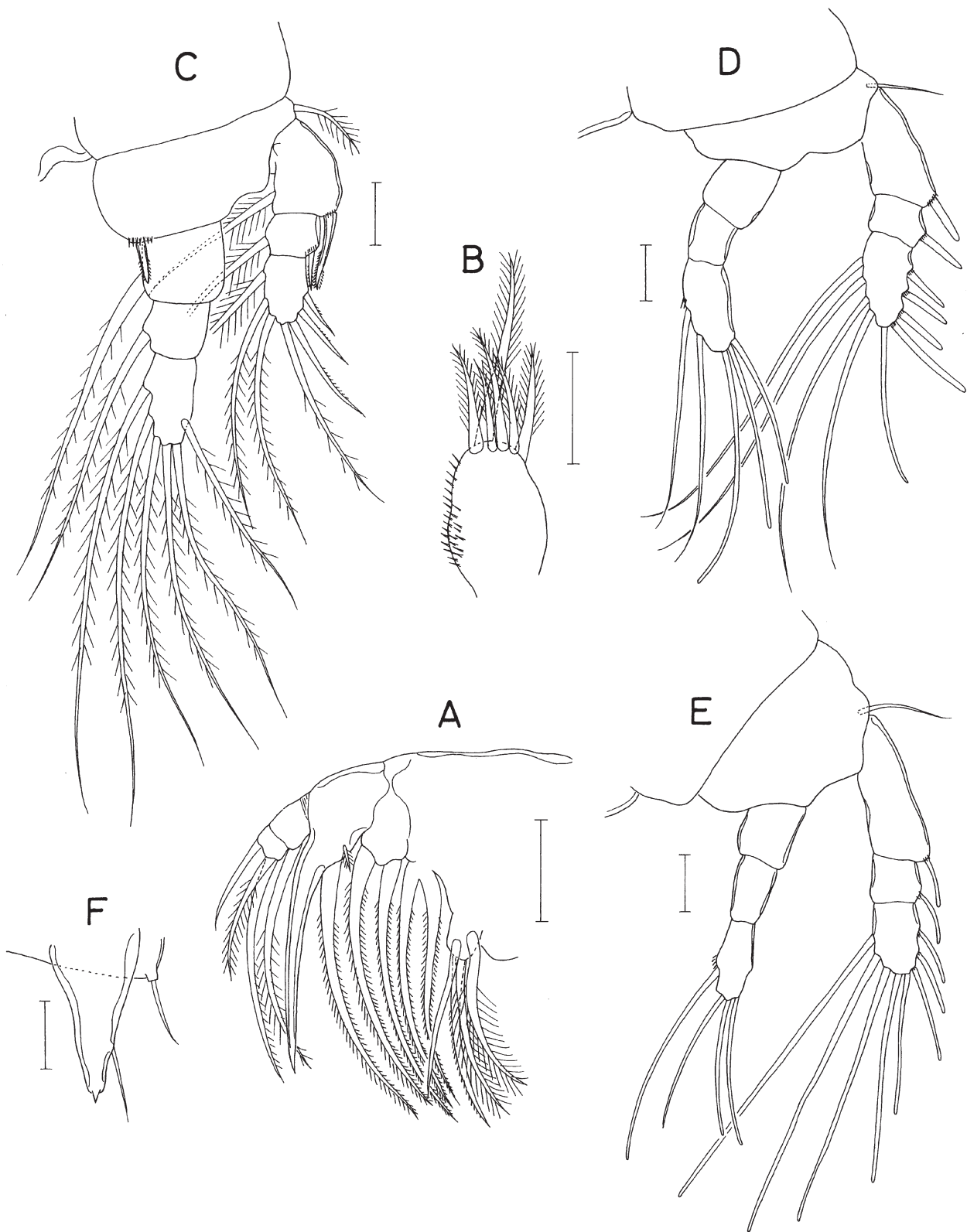
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21361) and 1 paratype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21362) from *Cystodytes* sp. (MNHN-IT-2008-2621 = MNHN A3/CYS/135), CRRF OCDN 5119-X, the Philippines (09°31.02'N, 123°40.83'E), depth 10 m, 15 April 1997.

**Etymology.** The specific name is a combination of Latin words *acut* (= sharp) and *rostr* (= a beak), alluding to the acutely pointed rostrum.

**Description of female.** Body (Fig. 308A) narrow, 1.27 mm long. Prosome 0.91 mm long. Dorsal cephalic shield bearing pair of slender, spiniform horn-like processes (Fig. 308B) posterolaterally. Metasome with 2 dorsal and lateral constrictions delimiting first, second, and fused third plus fourth pedigerous somites; region of fourth pedigerous somite longer than wide. Free urosome (Fig. 308C) gradually narrowing posteriorly, 5-segmented: genital and 4 abdominal somites 44×127, 57×115, 42×97, 40×84, and 52×74 µm, respectively. Abdominal somites ornamented with many scattered surface setules. Caudal ramus (Fig. 308D) about 4.0 times longer than wide (75×19 µm): armed with 6 naked setae, 2 middle and 4 distal; 2 middle setae positioned at 40 and 53% of ramus length; setae small but at least as long as width of ramus at base.



**FIGURE 308.** *Doroixys acutirostris* sp. nov., female. A, habitus, right; B, posterolateral process of cephalic shield; C, leg 5 and urosome, ventral; D, right caudal ramus, ventral; E, rostrum, lateral; F, rostrum, ventral; G, antennule; H, antenna; I, labrum; J, mandible; K, maxillule. Scale bars: A, 0.1 mm; B, D–K, 0.02 mm; C, 0.05 mm.



**FIGURE 309.** *Doroixys acutirostris* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

Rostrum (Fig. 308E, F) well-developed, hook-like in lateral view (Fig. 308A, E), strongly tapering towards beak-like tip (Fig. 308F). Antennule (Fig. 308G) stout, 117 µm long, 7-segmented; armature formula 2, 13, 4, 4, 2, 3, and 12; second segment ornamented with several sensillae; all setae naked; aesthetascs apparently absent. Antenna (Fig. 308H) 4-segmented; proximal 3 segments unarmed; basis shorter than first endopodal segment; compound distal endopodal segment 2.7 times longer than wide (38×14 µm), ornamented with few minute spinules on outer margin; armed with 5 small setae (arranged as 1, 2, and 2) plus strongly curved, hook-like terminal claw, as long as second endopodal segment.

Labrum (Fig. 308I) lacking defined posteromedian lobe, ornamented with fine setules on both sides of posterior margin; dense area of cuticle present posteromedially. Mandible (Fig. 308J) bearing 5 teeth on broad coxal gnathobase, 1 seta on basis, 5 setae on exopod, and 1 and 6 setae on first and second endopodal segments, respectively; outer seta on exopod about one-third as long as other 4 setae; articulation between endopodal segments incomplete; outer seta on second endopodal segment small; largest mediobasal seta on second endopodal segment about twice as long as second longest seta on segment. Maxillule (Fig. 308K) armed with 9 setae on arthrite, 1 on epipodite; 1 on basis; 4 on exopod and 3 on endopod; coxal endite absent. Maxilla (Fig. 309A) 4-segmented; syncoxa with 4, 2, and 2 setae on first to third endites, respectively; basis with slender, naked claw plus 2 setae (1 large and 1 minute); endopod 2-segmented with 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 309B) lobate, armed distally with 1 longer and 5 short setae, ornamented with spinules on outer surface.

Legs 1–4 with 3-segmented rami (Fig. 309C–E). Leg 3 same as leg 2 in armature. Inner coxal seta absent in all swimming legs. Inner distal spine on basis of leg 1 small, 13 µm long. All setae on legs 2–4 naked, most bluntly tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; 2, 2, 3	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 3
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 0-0; 0, 2, 2

Leg 5 (Fig. 309F) consisting of obscure protopod bearing 1 seta at outer distal corner and tapering, sclerotized process representing exopod, bearing 1 seta on outer margin and 1 pointed dentiform process at tip.

**Male.** Unknown.

**Remarks.** In *Doroixys acutirostris* sp. nov. the endopods of legs 2 and 3 are 3-segmented and both are armed with 5 setae on the third segment, and the endopod of leg 4 is 3-segmented and armed with 4 setae on the third segment. This characteristic armature combination serves to differentiate the new species from all of its

congeners. The possession of the beak-like rostrum and the distal position of all setae on the maxilliped seem to be additional diagnostic (autapomorphic) features.

***Doroixys parvicaudata* sp. nov.**

(Figs. 310, 311)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21363), intact paratypes (3 ♀♀, MNHN-IU-2014-21364), and dissected paratype (♀, figured) from *Polyclinum macrophyllum* Michaelsen, 1919, Mont Dore, New Caledonia, NC 46, Monniot coll., 19 March 1987.

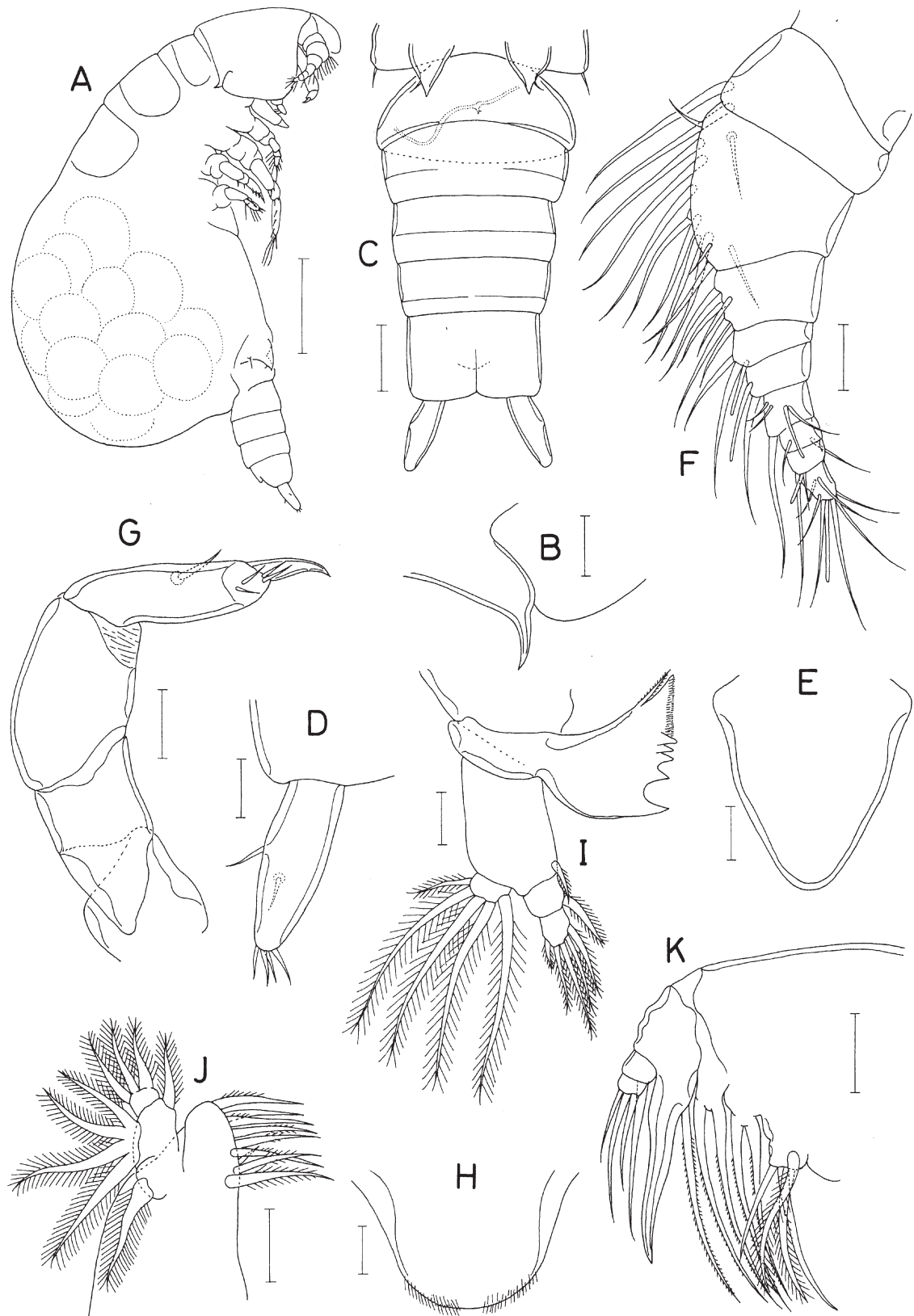
**Additional material.** 1 ♀ (dissected) from *P. macrophyllum*, Îlot Maître Mont Dore, NC 16, New Caledonia, depth 5 m, 12 September 1985.

**Etymology.** The specific name is derived from Latin *parv* (=small) and *cauda* (=tail) and refers to the relatively small caudal rami.

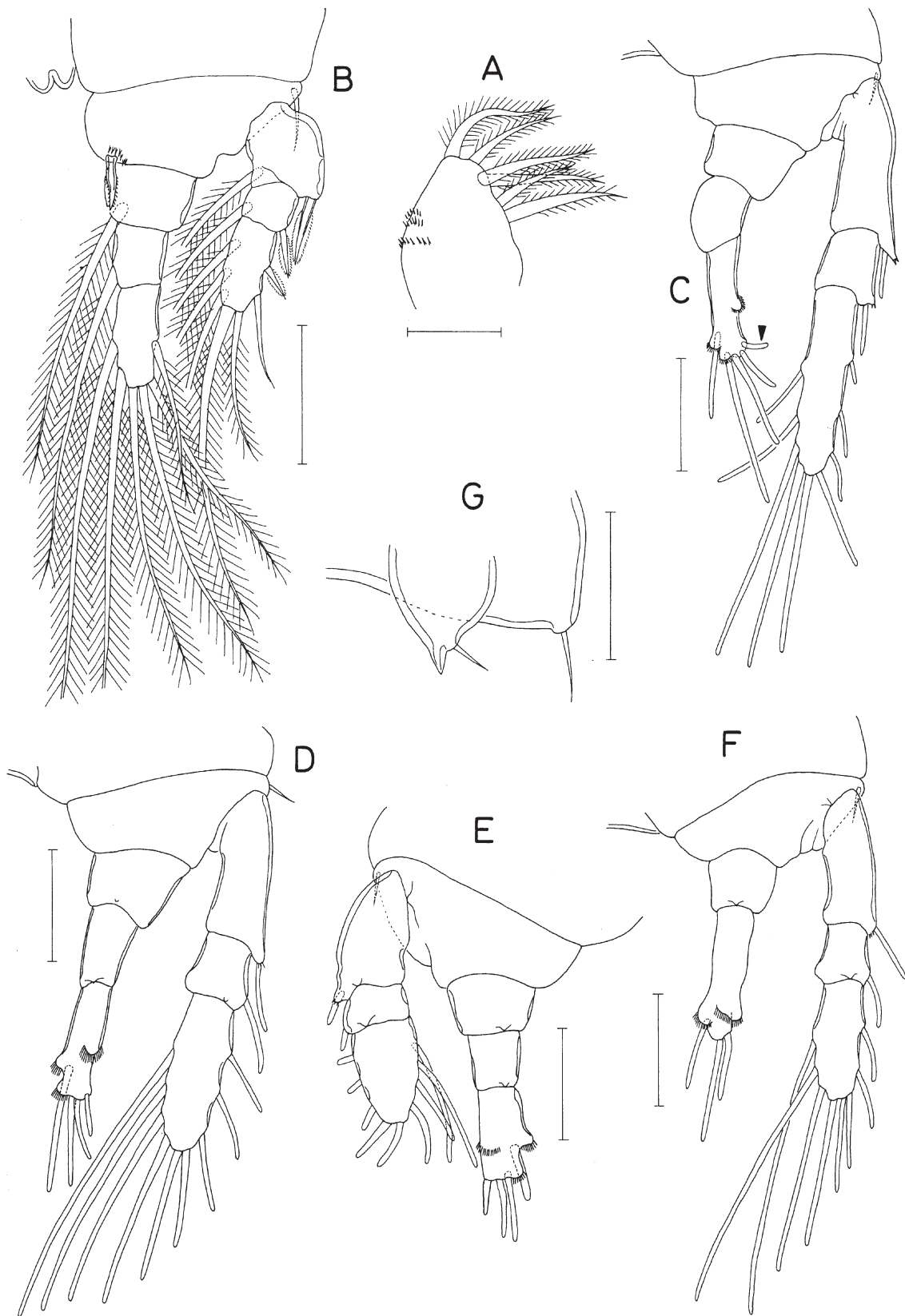
**Description of female.** Body (Fig. 310A) stout, 1.32 mm long. Prosome bulbous, 1.00 mm long: dorsal cephalic shield bearing pair of small, narrow claw-like processes (Fig. 310B) posterolaterally. Metasome unsegmented, broadening posteriorly, with 3 vestigial tergites dorsally marking first to third pedigerous somites; fourth pedigerous somite swollen, forming brood pouch, with straight ventral margin and rounded dorsal and posterior margins. Free urosome (Fig. 310C) small, 5-segmented: all urosomites much wider than long: genital somite narrowing anteriorly, 55×156 µm; 4 abdominal somites 58×145, 47×127, 44×118, and 65×95 µm, respectively. Anal somite rectangular, lacking posteromedian incision. Caudal rami (Fig. 310C) small, fusiform, widely separated from each other; each ramus (Fig. 310D) about 2.5 times longer than wide (59×22 µm) and shorter than anal somite: armed with 1 outer, 1 dorsal and 4 distal setae; all setae shorter than width at base of ramus; outer and dorsal setae positioned at 43 and 58% of ramus length, respectively.

Rostrum (Fig. 310E) well-developed, 86×77 µm, tapering towards rounded apex. Antennule (Fig. 310F) 147 µm long, 9-segmented; armature formula 2, 12, 5, 2+aesthetasc, 1+aesthetasc, 4+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked; aesthetascs small and setiform. Antenna (Fig. 310G) 4-segmented; proximal 3 segments unarmed; basis shorter than first endopodal segment; compound distal endopodal segment about 3.1 times longer than wide (52×17 µm) and as long as first endopodal segment: armed with 5 setae (arranged as 1, 2, and 2) plus small terminal claw, about 0.4 times as long as segment.

Labrum (Fig. 310H) simple, setulose along evenly convex posterior margin. Mandible (Fig. 310I) with 5 teeth and 1 seta on coxal gnathobase; setae on palp relatively short, 1 on basis, 5 on exopod, 1 and 5 on first and second endopodal segments, respectively; outer seta on exopod small, one-third as long as other 4 exopodal



**FIGURE 310.** *Doroixys parvicaudata* sp. nov., female. A, habitus, right; B, posterolateral process of cephalic shield; C, leg 5 and urosome, ventral; D, right caudal ramus, ventral; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule; K, maxilla. Scale bars: A, 0.2 mm; B, D–K, 0.02 mm; C, 0.05 mm.



**FIGURE 311.** *Doroixys parvicaudata* sp. nov., female. A, maxilliped; B, leg 1; C, left leg 2 (seta marked by arrowhead absent in some specimens); D, left leg 3; E, right leg 3; F, left leg 4; G, leg 5. Scale bars: 0.05 mm

setae. Maxillule (Fig. 310J) armed with 9 setae on arthrite, 1 on epipodite, 1 on basis, 4 on exopod and 3 on endopod; 3 setae on endopod equal in length. Maxilla (Fig. 310K) 4-segmented; syncoxa with 4, 2, and 2 setae on first to third endites, respectively; basis with strong, naked claw plus 1 seta; endopod with 1 and 3 naked setae on first and second segments, respectively. Maxilliped (Fig. 8A) as tapering lobe armed with 6 setae (4 medial and 2 apical) and ornamented with 3 rows of spinules on outer surface.

Legs 1–3 (Fig. 311B–E) with 3-segmented rami. Leg 4 (Fig. 311F) with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent in all swimming legs. Inner distal spine on basis of first leg 20 µm long. Setae on leg 1 pinnate except outer seta on third exopodal segment. Third exopodal segment of legs 2–4 (except that of right leg 3) more than twice as long as wide. All setae on legs 2–4 naked and bluntly tipped. First endopodal segment of legs 2 and 3 broadened. Second endopodal segment of leg 2 with convex inner margin and shorter, straight outer margin. Outer seta (indicated by arrowhead in Fig. 311C) on third endopodal segment of leg 2 present or absent. Left and right leg 3 asymmetrical: right leg 3 stouter with shorter setae than in left leg 3 (cf. Fig. 311D and 311E). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; I+1, 2, 3	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1 (or 0), 2, 2
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1, 2, 1
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 0, 2, 1

Leg 5 (Fig. 311G) consisting of outer and inner lobes located posteroventrally on brood pouch; outer protopodal lobe tipped with 1 seta; inner exopodal lobe not articulated at base, terminating in dentiform process, with convex outer and inner margins, and armed with 1 seta subdistally on outer margin

**Male.** Unknown.

**Remarks.** The endopods of legs 3 and 4 are 3- and 2-segmented, respectively, and are armed with 4 and 3 setae on the terminal segment, respectively. This leg segmentation and armature of *D. parvicaudata* **sp. nov.** is shared with *D. ooishiae* **sp. nov.** but these two species can be readily distinguished by the presence of an inner seta on the first exopodal segment of leg 2 in *D. ooishiae* **sp. nov.** (vs. absent in *D. parvicaudata* **sp. nov.**). There are additional differences: in *D. ooishiae* **sp. nov.** the outer protopodal lobe of leg 5 is extended, the third exopodal segment of legs 2–4 is only slightly longer than wide, and the body, antennule, antenna, and swimming legs are all setulose, as illustrated by Ooishi (1972). These surfaces are not setulose in *D. parvicaudata* **sp. nov.**

***Doroixys atlantica* sp. nov.**

(Figs. 312, 313)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21365), paratypes (2 intact ♀♀, MNHN-IU-2014-21366), and dissected paratypes (2 ♀♀, figured) from *Morchellium argus* (Milne Edwards, 1841), Brest, France, date unknown.

**Additional material.** 4 ♀♀ (MNHN-IU-2018-1901) and 2 dissected ♀♀ from *M. argus*, Dinard, France; 3 ♀♀ (MNHN-IU-2018-1902) from *M. argus*, Dinard; 2 ♀♀ (MNHN-IU-201801903) from *M. argus*, Tatihou, France; 1 ♀ (MNHN-IU-2018-1904) and 1 dissected ♀ from unknown host.

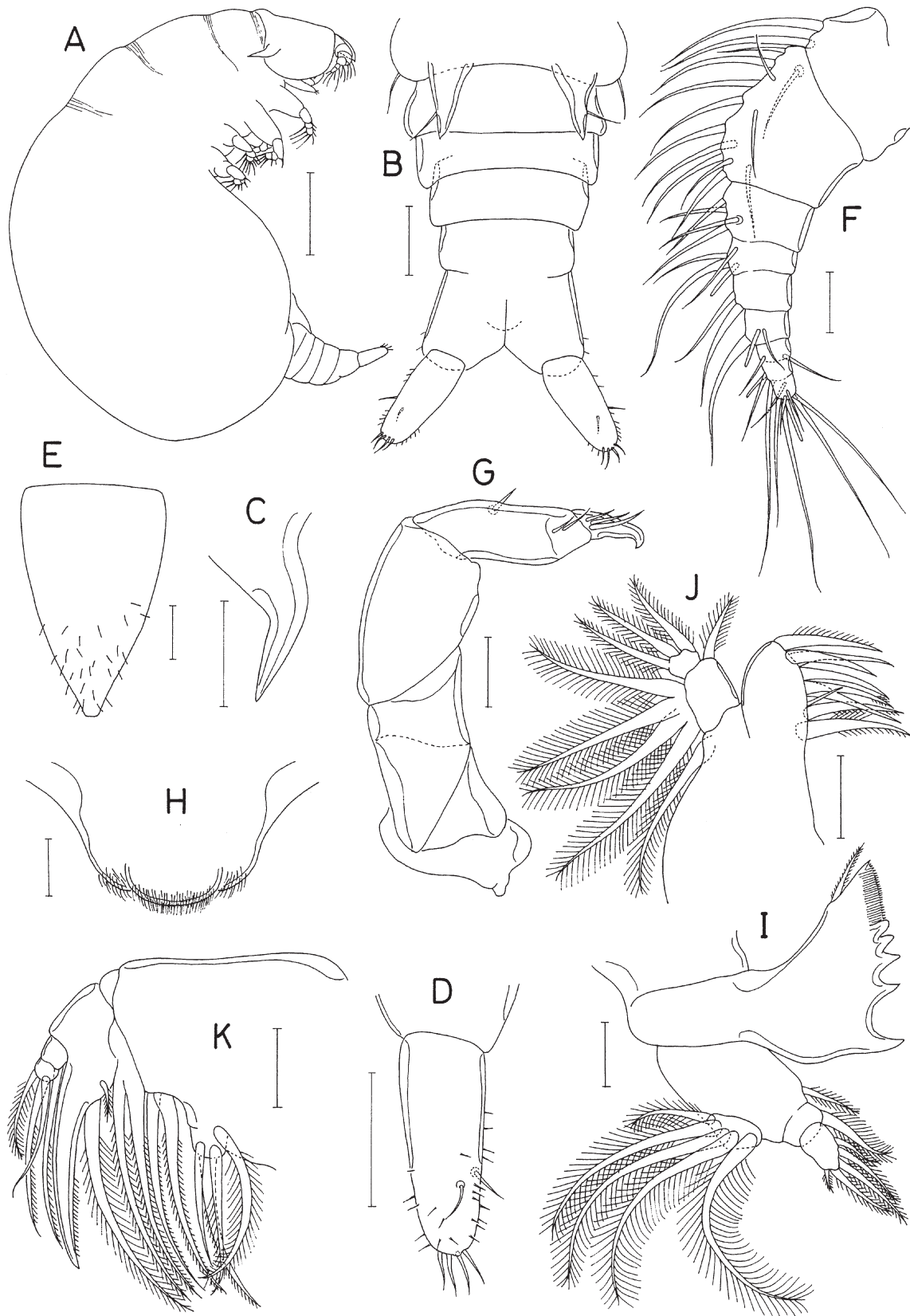
**Etymology.** The Atlantic Ocean, the distributional range of the ascidian host *Morchellium argus* is taken for the specific name of the new species.

**Description of female.** Body (Fig. 312A) curved ventrally. Body length of dissected largest specimen 1.86 mm; prosome 1.51 mm long. Dorsal cephalic shield bearing prominent, claw-like processes (Fig. 312C) at posterolateral corners. Metasome unsegmented, but 4 pedigerous somite boundaries indicated by 3 transverse wrinkles on dorsal surface; fourth pedigerous somite globular, forming brood pouch. Free urosome (Fig. 312B) stout, 5-segmented: genital and 4 abdominal somites 42×146, 38×133, 46×115, 31×100, and 71×117 µm, respectively. Articulation between third abdominal and anal somites incomplete. Anal somite broadening distally, with broad posteromedian incision. Caudal rami widely divergent; each ramus (Fig. 312D) about 2.5 times longer than wide (79×32 µm), gradually narrowing distally, setulose, with rounded distal margin: armed with 6 setae (1 outer, 1 dorsal, and 4 distal), all setae small, less than half width of ramus at base; outer and dorsal setae positioned at 62 and 68% of ramus length, respectively.

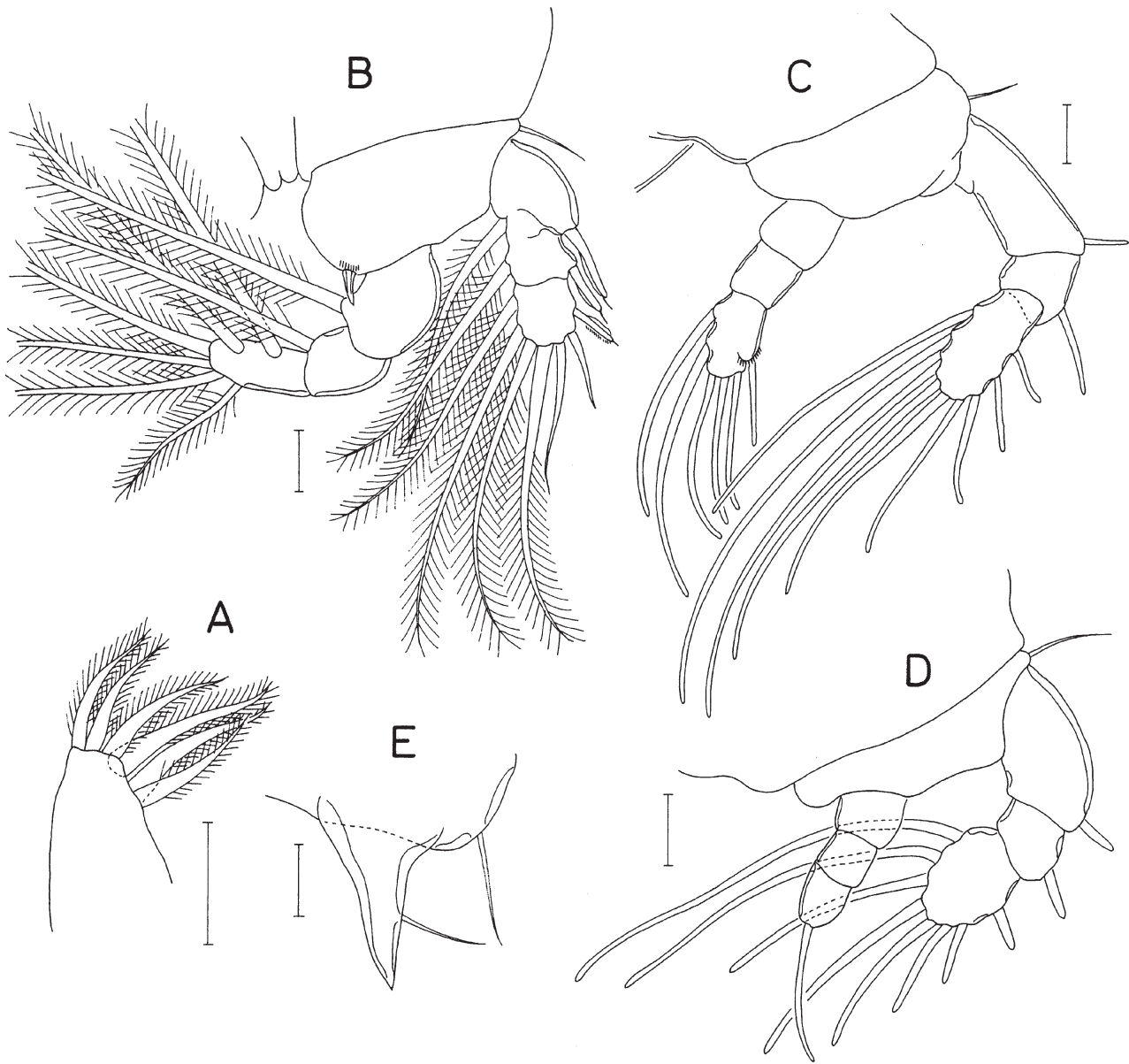
Rostrum (Fig. 312E) longer than wide (82×52 µm), with slightly convex lateral margins; tapering towards truncate apex; setulose along distal third. Antennule (Fig. 312F) 133 µm long, 9-segmented; 3 distal segments obscurely defined by indistinct articulations; armature formula 2, 13, 4, 3+aesthetasc, 2, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked; aesthetascs small. Antenna (Fig. 312G) stout, 4-segmented; proximal 3 segments unarmed; compound distal endopodal segment 2.5 times longer than wide (42×17 µm) and as long as first endopodal segment: armed with 6 setae (arranged as 1, 2, and 3) plus stout terminal claw, about half as long as segment.

Labrum (Fig. 312H) densely setulose posteriorly; posteromedian lobe broad and densely setulose. Mandible (Fig. 312I) with broad coxal gnathobase bearing 5 teeth and 1 proximal seta; basis with 1 seta on medial margin; exopod short, armed with 5 setae, outermost seta smallest, about one-third as long as adjacent seta; endopod 2-segmented with 1 and 5 setae on first and second segments,





**FIGURE 312.** *Doroixys atlantica* sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, posterolateral process of cephalic shield; D, right caudal ramus, dorsal; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule; K, maxilla. Scale bars: A, 0.2 mm; B–D, 0.05 mm; E–K, 0.02 mm.



**FIGURE 313.** *Doroixys atlantica* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Scale bars: 0.02 mm.

respectively; outer subdistal seta on second endopodal segment much smaller than other 4 setae. Maxillule (Fig. 312J) armed as usual: 9 setae on arthrite, 1 on epipodite, 1 on basis, 4 on exopod and 3 on endopod; endopodal setae equal in length. Maxilla (Fig. 312K) 4-segmented; syncoxa with 4, 2, and 2 setae on first to third endites, respectively; basis with 2 unequal setae plus strong claw bearing spinules along distal half of concave margin; endopod small, 2-segmented with 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 313A) as unsegmented lobe bearing 6 setae.

Legs 1–4 with 3-segmented rami (Figs. 313B–D); articulation between first and second exopodal segments of leg 1 obscure; endopod of leg 1 strongly directed

medially; exopod of legs 2–4 curved medially. Inner coxal seta absent in legs 1–4. Inner distal spine of basis of leg 1 small, 11  $\mu$ m long.. Armature of endopods of legs 2–4 variable: formula 1, 2, 3 or 0, 2, 3 in leg 2; 1, 2, 2 or 0, 2, 2 in leg 3; and 0, 1, 0 or 0, 2, 0 in leg 4. All setae on legs 2–4 naked and bluntly tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; I+1, 2, 3	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1 (or 0), 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1 (or 0), 2, 2

Leg 4 0-0 1-0 1-0; 1-0; 2, 1, 5 0-0; 0-0; 0, 1  
(or 2), 0

Leg 5 (Fig. 313E) represented by 1 seta on outer protopodal lobe and tapering, sclerotized, claw-like exopodal process bearing 1 seta slightly distal to middle of outer margin.

**Male.** Unknown.

**Remarks.** The endopod of leg 4 of *Doroixys atlantica* sp. nov. is 3-segmented and the third endopodal segment is armed with 1 or 2 setae only. These two unique features allow the new species to be differentiated from all of its currently known congeners.

***Doroixys amicta* sp. nov.**

(Figs. 314, 315)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21367) and dissected paratype (♀, figured) from membranous cysts of *Leptoclinides* sp. (MNHN-IT-2008-4855 = MNHN A2/LEP/108), CRCHO 555, Baluan, Papua New Guinea (02°32.27'S, 147°17.97'E), depth 15 m, P. Colin coll., 23 June 2003.

**Etymology.** The specific name is derived from the Latin words *amict* (=wrapped up), referring to the finding of the new species in the membranous cyst.

**Description of female.** Body (Fig. 314A) inflated, strongly curved ventrally: body length 860 µm. Dorsal cephalic shield expanded ventrolaterally, produced into paired posterolateral processes (Fig. 314D) each with acutely pointed tip and 2 semicircular tubercles on outer margin; ornamented with numerous minute sensillae (or setules) on surface. Metasome consisting of 4 pedigerous somites; fourth pedigerous somite spherical, forming brood pouch. Free urosome (Fig. 314B) 5-segmented, curved ventrally. Caudal ramus (Fig. 314C) indistinctly articulated from anal somite, 3.0 times longer than wide (54×18 µm) and about 1.2 times longer than anal somite, narrowing distally; and ornamented with numerous setules on all surfaces: armed with 6 setae (outer lateral, dorsal, and 4 distal), outer lateral and dorsal setae attenuated, positioned at 46 and 61% of ramus length, respectively; 4 distal setae bluntly tipped.

Rostrum (Fig. 314E) longer than wide (52×48 µm), tapering towards blunt apex; ornamented with numerous setules. Antennule (Fig. 314F) broad, 102 µm long, 7-segmented; armature formula 2, 11, 3, 3+aesthetasc, 3+aesthetasc, 1, and 11+aesthetasc; all setae naked; aesthetascs short, rod-shaped. Antenna (Fig. 314G) 4-segmented; proximal 3 segments (coxa, basis, and first endopodal segment) unarmed; compound distal endopodal segment narrowest, about 3.4 times longer than wide (37×11 µm); armed with 3 setae plus small terminal claw, 12 µm long, about one-third as long as segment.

Labrum (Fig. 314H) with smooth, convex, posterior

margin and broad, densely setulose posteromedian lobe. Mandible (Fig. 314I) bearing 5 sharply pointed teeth and 1 thin seta on coxal gnathobase; basis with 1 seta distally on medial margin and setules on outer margin; exopod short, armed with 5 unequal setae becoming gradually shortened from medial to outermost; endopod with 1 and 4 setae on first and second segments, respectively; seta on first segment broad; 2 median distal setae on second segment subequal and longer than other 2 setae. Maxillule (Fig. 314J) armed with 8 setae on arthrite; coxal endite present, tipped with 1 small seta; epipodite with 1 seta; basis with 1 seta on medial margin; exopod with 4 equal setae; endopod with 3 or 2 setae. Maxilla (Fig. 315A) consisting of syncoxa, basis, and 2-segmented endopod; syncoxa with 4, 2, and 2 setae on first to third endites, respectively; basis with narrow claw plus 1 seta; endopod with 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 315B) unsegmented with 4 setae distally.

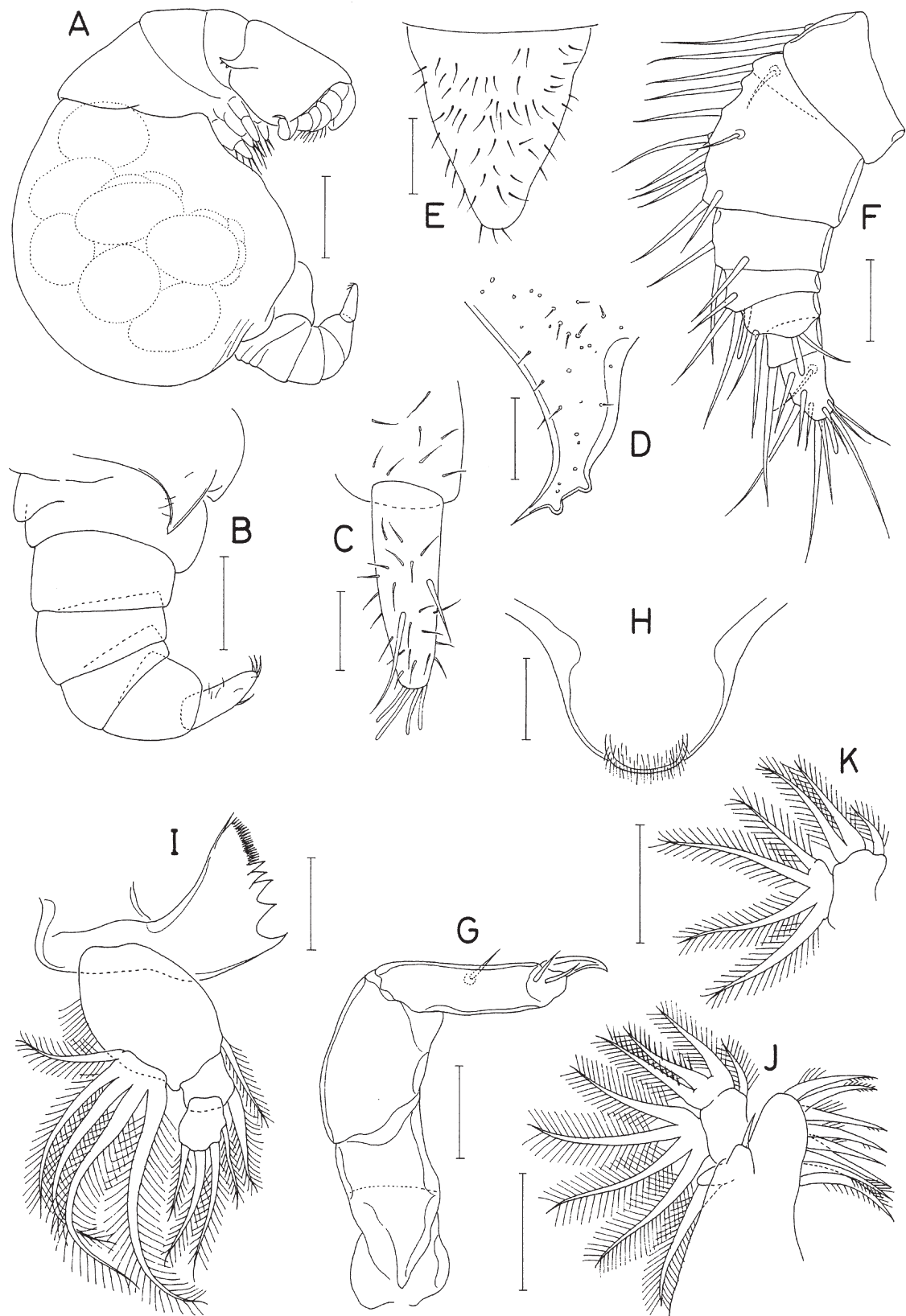
Legs 1 and 2 (Fig. 315C, D) with 3-segmented rami. Legs 3 and 4 (Fig. 315E, F) with 3-segmented exopods and 2-segmented endopods. Inner coxal seta absent in all swimming legs. Inner distal spine of basis of leg 1 very short, 6 µm long. First exopodal segment of swimming legs ornamented with setules on outer margin, 4, 4, 5, and 2 in legs 1–4, respectively. Third exopodal segment of leg 1 armed with 1 spine and 5 setae. Compound distal endopodal segment of leg 3 retaining trace of articulation. Setae on rami of legs 2–4 generally bluntly tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; I, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1, 2, 2
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0, 3, 1
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 0, 3, 0

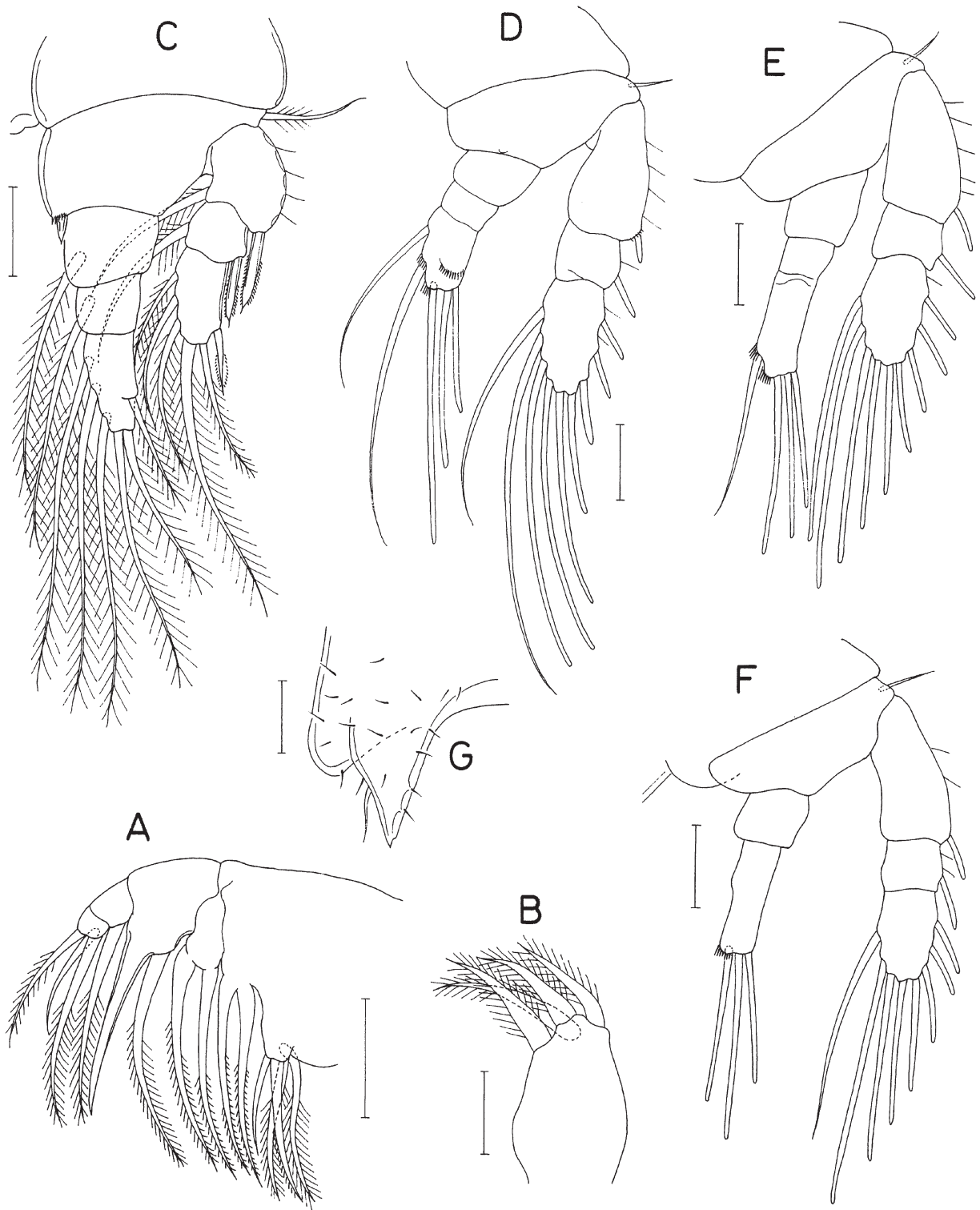
Leg 5 (Fig. 315G) consisting of unarmed, blunt outer protopodal lobe and tapering, pointed exopodal process bearing 1 seta on its outer margin; both protopodal lobe and exopodal process ornamented with setules.

**Male.** Unknown.

**Remarks.** *Doroixys amicta* sp. nov. displays three outstanding features: the maxillule has a coxal endite tipped with a small seta, the maxilliped is armed with only 4 setae, and the third exopodal segment of leg 1 is armed with only 6 (not 7) armature elements. These character states are unique within the genus and allow the new species to be distinguished from all congeners. The absence of an armature element on the protopodal lobe of leg 5 and the discovery of the copepod specimens inside membranous cysts in the host also are unusual features in *Doroixys*.



**FIGURE 314.** *Doroixys amicta* sp. nov., female. A, habitus, right; B, leg 5 and urosome, right; C, right caudal ramus, dorsal; D, posterolateral process of cephalic shield; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule; K, palp of maxillule. Scale bars: A, 0.1 mm; B, 0.05 mm; C–K, 0.02 mm.



**FIGURE 315.** *Doroixys amicta* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A, C–G, 0.02 mm; B, 0.01 mm.

***Doroixys gryphina* sp. nov.**

(Figs. 316, 317)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21368) from *Eudistoma reginum* Kott, 1990 (MNHN-IT-2008-4187 = MNHN A3/EUD/75), CRRF OCDN 1434-S, Manado, north Sulawesi, Indonesia, depth 60 m, 21 May 1993; 1 paratype ♀ (dissected) from *E. reginum*, CRRF same locality data, Indonesia.

**Etymology.** The specific name is derived from the Greek *gryp* (=hook-nosed), referring to the hook-shaped rostrum.

**Description of female.** Body (Fig. 316A) curved ventrally, 1.39 mm long. Dorsal cephalic shield expanded ventrolaterally; paired posterolateral horn-like processes prominent, bearing 2 nodule-like tubercles subdistally (Fig. 316B). Metasome unsegmented, but with 3 weak constrictions on dorsal and lateral surfaces; third and fourth pedigerous somites containing eggs and nauplii inside. Fourth pedigerous somite expanded, but shorter than anterior part of metasome. Free urosome (Fig. 316C) tapering posteriorly: genital and 4 abdominal somites 65×182, 45×169, 36×136, 47×122, and 64×102 µm, respectively. Anal somite and caudal rami ornamented with minute spinule-like setules on all surfaces. Caudal ramus (Fig. 316D) tapering distally, thin-walled in distal half, 3.0 times longer than wide (96×32 µm): armed with 6 setae; outer lateral and dorsal setae positioned at 49 and 53% of ramus length, respectively; all caudal setae shorter than width of ramus at base.

Rostrum longer than wide (120×75 µm), tapering to pointed apex in ventral view (Fig. 316F), hook-like in lateral view (Fig. 316E). Antennule (Fig. 316G) 157 µm long, 8-segmented; articulation incomplete between 2 distal segments; armature formula 2, 14, 4, 3+aesthetasc, 2, 2+aesthetasc, 2, and 7+2 aesthetascs; all setae naked; aesthetascs short. Antenna (Fig. 316H) 4-segmented; coxa and basis unarmed; first endopodal segment with 1 small seta subdistally; compound distal endopodal segment 2.9 times longer than wide (47×16 µm): armed with 5 setae (arranged as 1, 2, and 2) plus slender terminal claw, about 0.6 times as long as segment.

Labrum lost during dissection. Mandible (Fig. 316I) with broadened coxal gnathobase bearing 5 teeth and 1 seta; basis with 1 seta on medial margin; exopod with 5 setae (4 medial setae subequal in length and outermost seta about half as long as other 4); first endopodal segment with 1 broad seta; second endopodal segment with 4 setae (middle 2 longer than medial and outer setae). Maxillule (Fig. 316J) with 9 setae on arthrite, 1 on each epipodite and basis, 4 on exopod, and 3 on endopod; 3 setae on endopod becoming longer from medial to outer; coxal endite absent. Maxilla (Fig. 317A) 4-segmented; syncoxa with 4, 3, and 2 setae on first to third endites, respectively; basis with slender, smooth claw plus 1 seta; endopod with 1 and 3 setae on first and second segments, respectively.

Maxilliped (Fig. 316K) unsegmented, tapering distally, armed with 6 setae and ornamented with spinules along outer margin.

Legs 1–4 (Figs. 317B–E) with 3-segmented rami; inner seta absent on coxa. Leg 1 lacking inner distal spine on basis. All setae on legs 2–4 naked and bluntly tipped. Endopod slightly shorter than exopod in legs 2 and 3, endopod of leg 4 less than half length of exopod. Third endopodal segment of leg 4 unarmed, bearing only 2 small setules (or setal vestiges) distally. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-1; I-1; I+1, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1, 2, 2
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 3, 1
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 0-0; 0

Leg 5 (Fig. 317F) represented by 1 ventrodistal seta on surface of somite and tapering, sclerotized exopodal process lacking seta but bearing tubercle subdistally on outer margin, and ornamented with scattered setules.

**Male.** Unknown.

**Remarks.** This new species is characterised by the lack of an inner distal element on the basis of leg 1 and by the absence of a seta on the inner (exopodal) process of leg 5. The combined setation patterns of the third endopodal segments of legs 2 to 4 (5, 4, and 0, respectively) is also an important diagnostic feature of the new species.

***Doroixys nodulosa* sp. nov.**

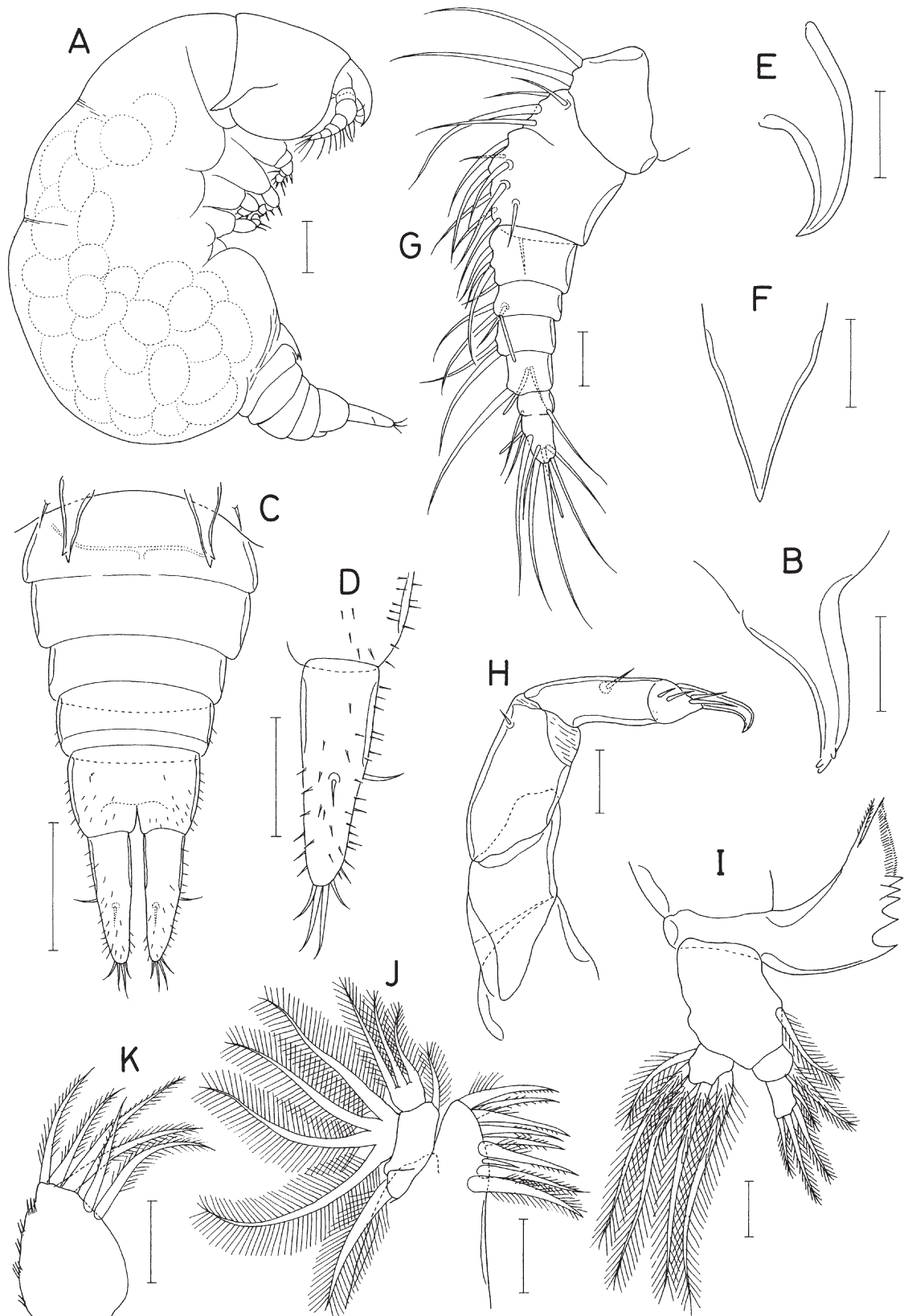
(Figs. 318, 319)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21369), paratypes (3 intact ♀♀, MNHN-IU-2014-21370), and dissected paratype (♀, figured) from *Leptoclinides oscitans* Monniot F. & Monniot C., 1996 (MNHN-IT-2008-4814 = MNHN A2/LEP/67), CRRF OCDN 4379-T, Palau, Ngemelis, Bailechesengel Island, (07°06.22'N, 134°15.06'E), depth 20 m, 26 November 1996.

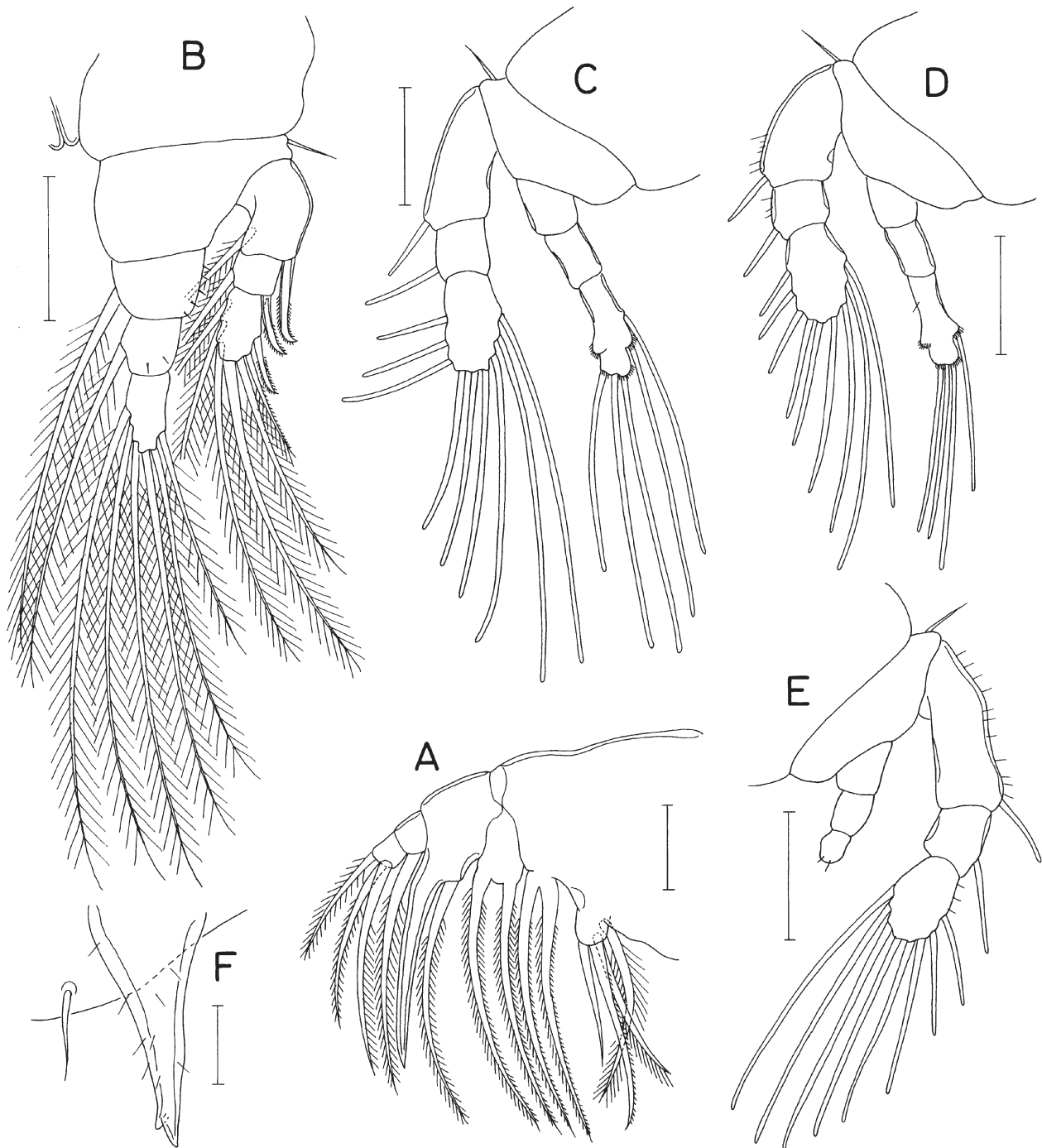
**Additional material.** 2 ♀♀ (MNHN-IU-2018-1905) from *L. oscitans*, CRRF OCDN 3434-R, Davao Philippines; 1 ♀ (dissected) from *L. oscitans*, Indonesia, collected by Ireland, 01 May 1996.

**Etymology.** The specific name refers to the presence of nodule-like tubercles on the posterolateral processes of the cephalic shield.

**Description of female.** Body (Fig. 318A) moderately inflated, 1.00 mm long. Prosoma straight, 740 µm long, gradually broadening distally; dorsal cephalic shield with paired, sclerotized horn-like processes posterolaterally, each with 2 small tubercles distally (Fig. 318B). Free urosome (Fig. 318C) 5-segmented, articulations indistinct: genital and 4 abdominal somites 47×103, 40×102, 37×79, 31×75, and 45×70 µm, respectively. Lateral margins of



**FIGURE 316.** *Doroixys gryphina* sp. nov., female. A, habitus, right; B, posterolateral process of cephalic shield; C, leg 5 and urosome, ventral; D, right caudal ramus, dorsal; E, rostrum, right; F, rostrum, ventral; G, antennule; H, antenna; I, mandible; J, maxillule; K, maxilliped. Scale bars: A, 0.1 mm; B, D–F, 0.05 mm; C, 0.1 mm; G–K, 0.02 mm.

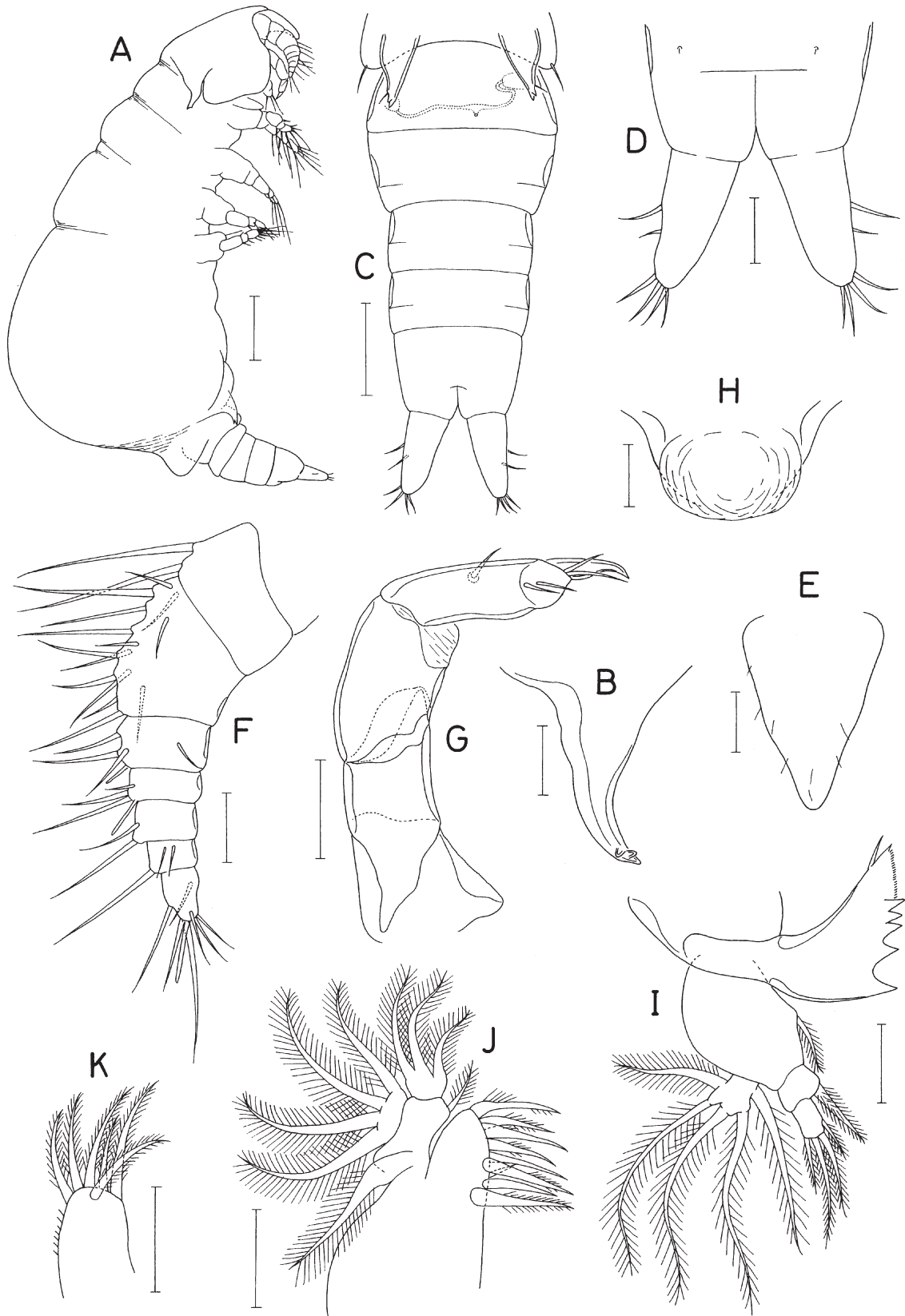


**FIGURE 317.** *Doroixys gryphina* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: A, F, 0.02 mm; B–E, 0.05 mm.

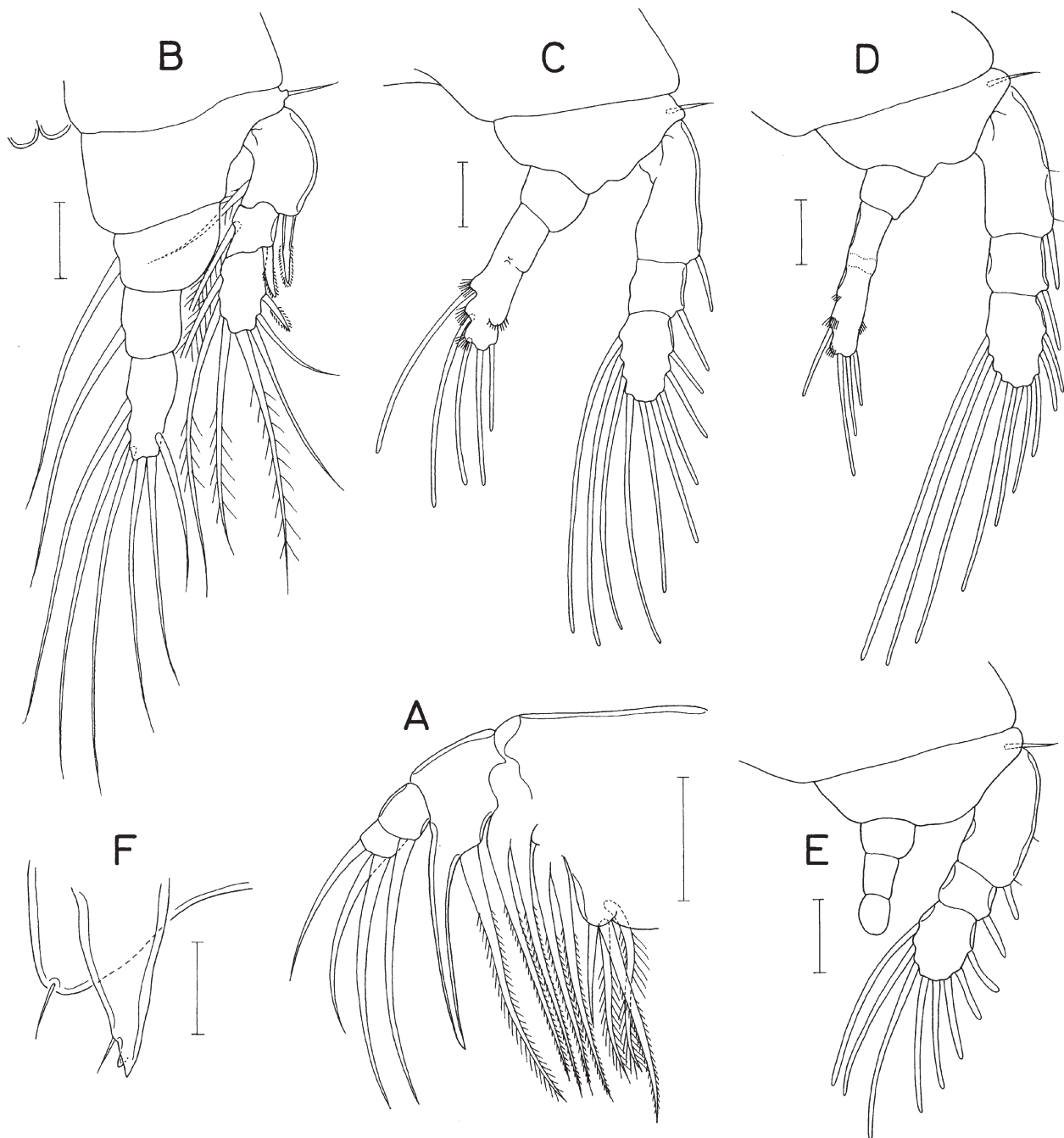
genital and first abdominal somites convex when viewed together. Anal operculum not developed. Caudal rami (Fig. 318D) stout, divergent, incompletely articulated from anal somite; ramus 2.0 times longer than wide ( $42 \times 21 \mu\text{m}$ ), tapering, slightly shorter than anal somite: armed with 6 setae (2 outer and 4 distal); 2 outer setae located at 42 and 62% of ramus length; second outer seta shorter than other 5 setae.

Rostrum 1.35 times longer than wide, tapering to blunt apex (Fig. 318E), ornamented with few setules. Antennule (Fig. 318F) 117  $\mu\text{m}$  long, 7-segmented; armature formula 2, 14, 4+aesthetasc, 3+aesthetasc, 2, 3, and 7+aesthetasc; all setae naked; aesthetascs small. Antenna (Fig. 318G) 4-segmented; proximal 3 segments unarmed; basis shorter than first endopodal segment; compound distal endopodal segment about 2.8 times longer than wide ( $33 \times 12 \mu\text{m}$ ):





**FIGURE 318.** *Doroixys nodulosa* sp. nov., female. A, habitus, right; B, posterolateral process of cephalic shield; C, leg 5 and urosome, ventral; D, caudal rami, dorsal; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule; K, maxilliped. Scale bars: A, 0.1 mm; B, D–K, 0.02 mm; C, 0.05 mm.



**FIGURE 319.** *Doroixys nodulosa* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

armed with 5 setae (arranged as 1, 2, and 2) plus small terminal claw, about half as long as segment.

Labrum (Fig. 318H) unornamented; posterior part bullate and soft. Mandible (Fig. 318I) with 5 teeth and 1 seta on coxal gnathobase, as usual: basis with 1 seta near middle of medial margin; exopod with 5 setae (3 mid-distal setae subequal in length and longer than medial seta; outermost seta about half as long as longer middle setae); endopod with 1 broad seta on first segment and 4

setae (shorter medial and outer, and 2 longer distal) on second. Maxillule (Fig. 318J) with 9 setae on arthrite, 1 each on epipodite and basis, 4 on exopod and 3 on endopod; 2 outer distal setae on endopod equal in length, both longer than medial seta. Maxilla (Fig. 319A) 4-segmented, armed with 8 setae on syncoxa (4, 2, and 2 on first to third endites, respectively), smooth claw plus 1 seta on basis, and 1 and 3 naked setae on first and second endopodal segments, respectively. Maxilliped (Fig. 318K)

unsegmented, armed with 6 distal setae, and ornamented with fine spinules along outer margin.

Leg 1 (Fig. 319B) and leg 4 (Fig. 319E) with 3-segmented rami; first endopodal segment of leg 1 broad. Legs 2 and 3 (Fig. 319C, D) with 3-segmented exopods and 2-segmented endopods; distal endopodal segment of legs 2 and 3 each bearing trace of articulation in middle. Inner coxal seta absent in all swimming legs. Inner distal element absent on basis of leg 1. Inner setae on exopod of leg 1 pinnate, but all other setae on swimming legs naked. All setae on legs 2–4 bluntly tipped. Inner setae on third exopodal segment of right legs 2 and 3 shorter than those of left legs 2 and 3. Endopod of leg 4 half as long as exopod; third endopodal segment unarmed or armed with 1 distal seta. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-1; I+1, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 1, 2, 2
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 1, 2, 1
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 0-0; 1 (or 0)

Leg 5 (Fig. 319F) represented by blunt posteroventral lobe on surface of somite, tipped with 1 thin seta, plus tapering inner process (representing exopod) bearing 1 small seta and 1 tubercle on subdistal outer margin.

**Male.** Unknown.

**Remarks.** *Doroixys nodulosa* sp. nov. resembles *D. gryphina* sp. nov. more closely than other congeners: both these new species share the absence of an inner distal spine on the basis of leg 1, the possession of 2 distal tubercles on the posterolateral horn-like processes of the dorsal cephalic shield, a single subdistal tubercle on the exopodal process of leg 5, and similar setation on the endopods of legs 2–4. They were also found in the same geographical region, Indonesia. However, they are not conspecific and can be differentiated by the caudal ramus, which is 2.0 times longer than wide in *D. nodulosa* sp. nov. compared with 3.0 times longer in *D. gryphina* sp. nov., the rostrum has an acutely pointed tip in *D. nodulosa* sp. nov. whereas it is bluntly tipped in *D. gryphina* sp. nov., and there are other minor differences in the length and pinnation of the setae on the mandibular exopod, the maxilla, and leg 1.

***Doroixys fijiensis* sp. nov.**  
(Figs. 320, 321)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21371) and paratype ♀ (dissected, MNHN-IU-2014-21372) from *Eucoelium mariae* (Michaelsen, 1924) (MNHN-IT-2008-6923 = MNHN P3/POL.B/04), CRRF-OCDN 4237-P, Fiji (18°18,08'S, 178°01,05'E), depth 12 m, 29 October 1996.

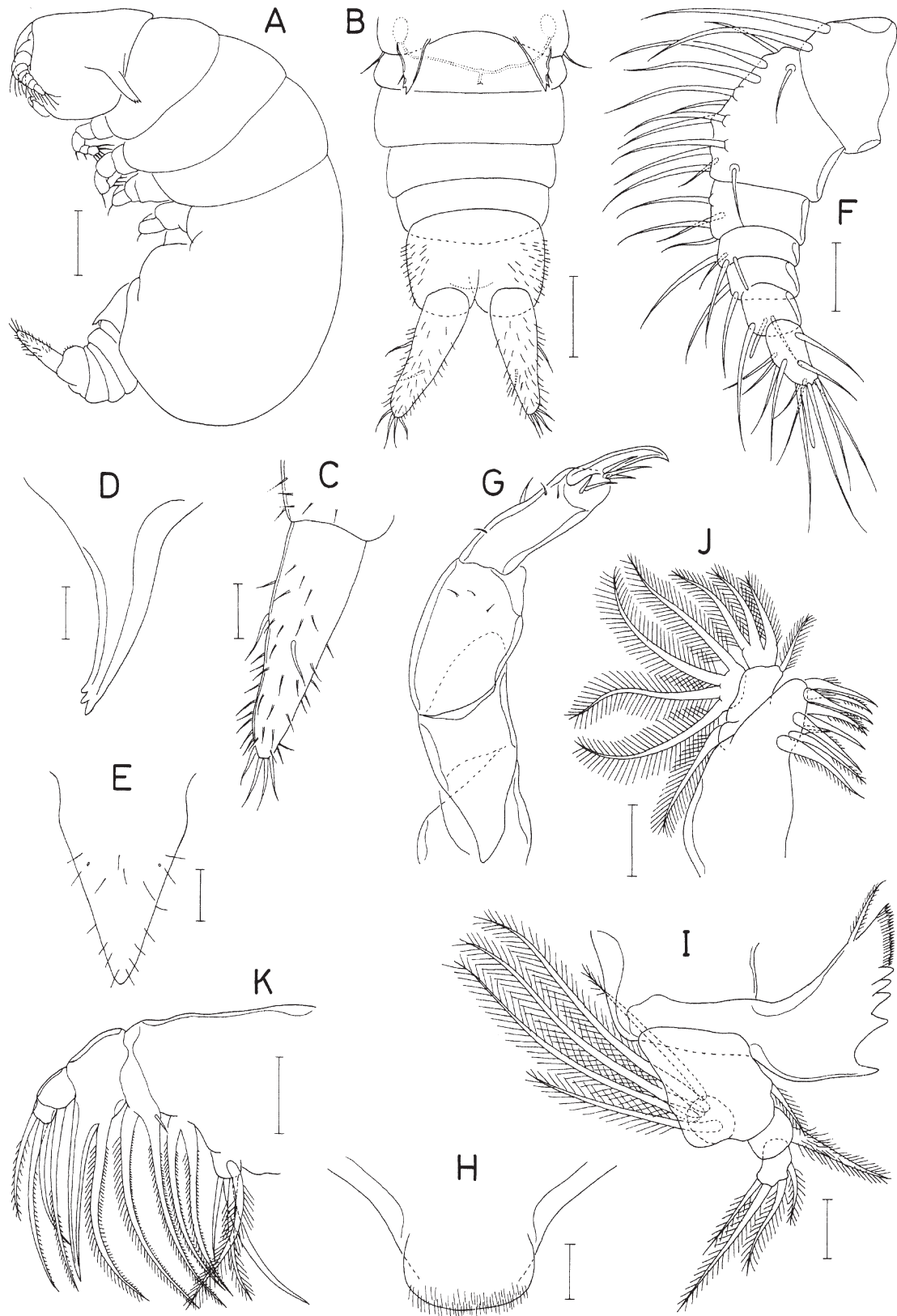
**Etymology.** The specific name of the new species is derived from its type locality, Fiji.

**Description of female.** Body (Fig. 320A) curved ventrally, 1.07 mm long. Prosome 836 µm long, consisting of cephalosome and distinctly 4-segmented metasome. Dorsal cephalic shield with prominent paired horn-like process (Fig. 320D) posterolaterally, each bearing 2 small tubercles distally. Fourth pedigerous somite slightly longer than anterior part of metasome. Free urosome (Fig. 320B) 5-segmented. Anal somite and caudal rami ornamented with numerous setules on all surfaces. Caudal rami divergent, evenly tapering; ramus (Fig. 320C) about 3.1 times longer than wide (89×29 µm) and 1.6 times longer than anal somite: armed with 6 setae (outer lateral, dorsal, and 4 distal); outer lateral and dorsal setae positioned at 43 and 51% of ramus length; all caudal setae naked and shorter than width of ramus at base.

Rostrum (Fig. 320E) 82×50 µm, bearing scattered setules; lateral margins parallel proximally, and evenly tapering over distal four-fifths. Antennule (Fig. 320F) 110 µm long, 7-segmented; armature formula 2, 13, 4, 3+aesthetasc, 2, 2+aesthetasc, and 12+aesthetasc; setae moderately long, all naked. Antenna (Fig. 320G) consisting of coxa, basis, and 2-segmented endopod; proximal 3 segments unarmed; endopodal segments with few setules; compound distal endopodal segment about 2.9 times longer than wide (40×14 µm): armed with 6 small setae (grouped as 1, 2, and 3) plus terminal claw, more than half length of distal endopodal segment.

Labrum (Fig. 320H) simple, densely setulose posteriorly. Mandible (Fig. 320I) with 5 teeth and 1 seta on coxal gnathobase; basis with 1 seta on medial margin: exopod with 5 setae (innermost and outermost subequal in length and both about 0.6 times as long as 3 larger middle setae): endopod 2-segmented; first segment with 1 broad seta on medial margin; second with 4 setae, outer distal seta longest (1.5 times longer than mediobasal seta). Maxillule (Fig. 320J) lacking coxal endite and armed as usual: 9 seta on arthrite, 1 on epipodite, 1 on basis, 4 on exopod, and 3 on endopod. Maxilla (Fig. 320K) 4-segmented; syncoxa with 4, 2, and 3 setae (including minute proximal seta) on first to third endites, respectively; basis with smooth claw plus 1 seta; endopod with 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 321A) unsegmented, tapering distally, armed with 6 setae and ornamented with spinules along outer margin,

Legs 1–4 with 3-segmented rami (Fig. 321B–D); inner seta absent on coxa of all legs. Leg 1 lacking inner distal spine on basis. First endopodal segment of leg 1 broad. Legs 2 and 3 with same armature formula. All setae on legs 2–4 naked and bluntly tipped. Distal seta on third endopodal segment short in left leg 4 (as in Fig. 321D) but longer in right leg 4. Armature formula for legs 1–4 as follows:



**FIGURE 320.** *Doroixys fijiensis* sp. nov., female. A, habitus, left; B, leg 5 and urosome, ventral; C, left caudal ramus, dorsal; D, posterolateral process of cephalic shield; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule; K, maxilla. Scale bars: A, 0.1 mm; B, 0.05 mm; C–K, 0.02 mm.

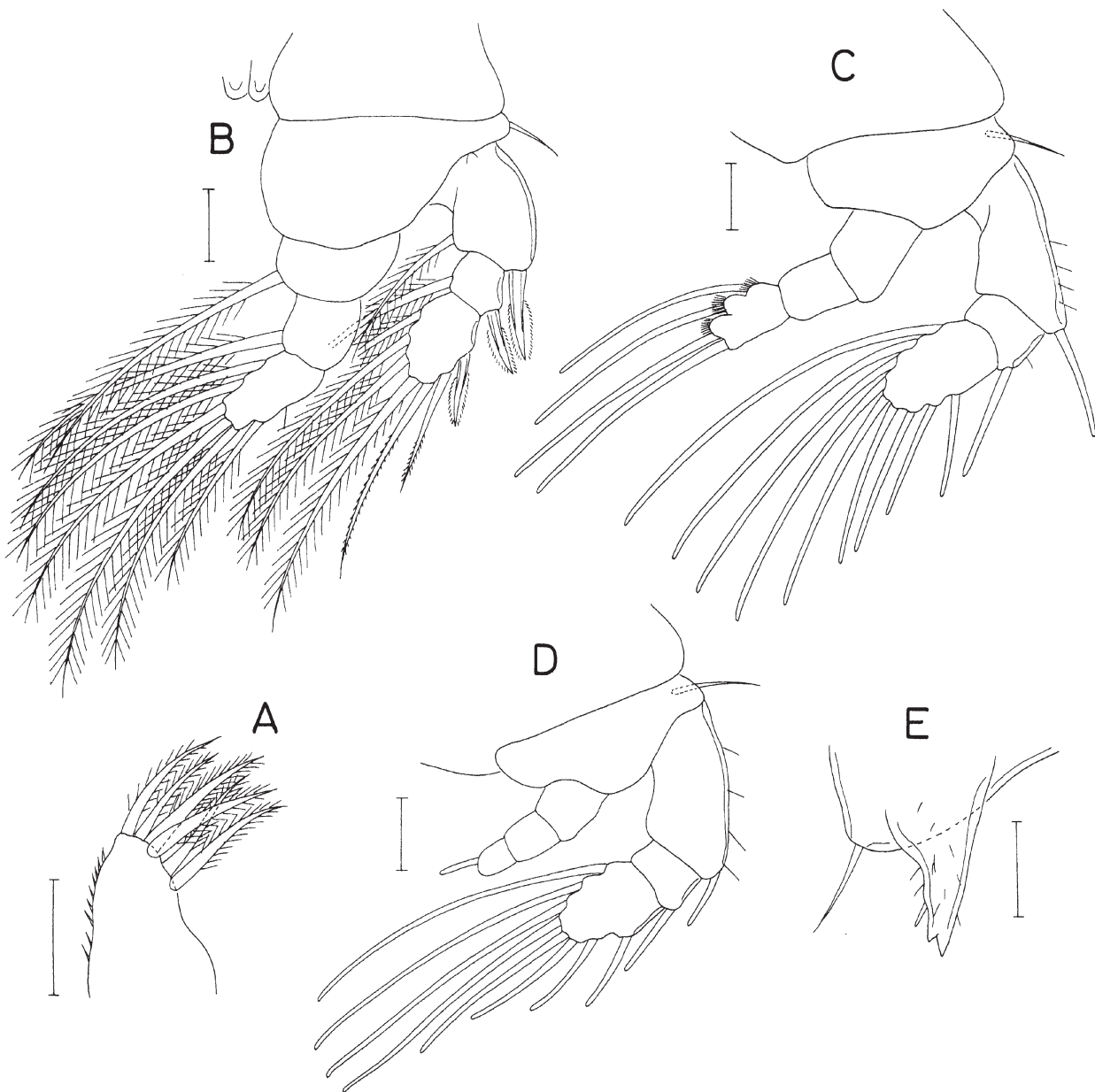


FIGURE 321. *Doroixys fijiensis* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Scale bars: 0.02 mm.

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	I-1; I-1; I+1, 1, 4	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 2
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 0-0; 1

Leg 5 (Figs. 320B, 321E) represented by blunt posteroventral lobe on somite tipped with protopodal seta and tapering inner process (representing exopod) bearing 1 small seta and 1 tubercle on subdistal outer margin, ornamented with several setules scattered on ventral surface.

**Male.** Unknown.

**Remarks.** The lack of an inner distal spine on the

basis of leg 1 is shared between only three species, *D. fijiensis* sp. nov., *D. gryphina* sp. nov. and *D. nodulosa* sp. nov. Both *D. fijiensis* sp. nov. and *D. gryphina* sp. nov. have caudal rami with a length/width ratio of about 3.0 or 3.1:1, a setulose anal somite and caudal rami, and distinctly 3-segmented endopods in legs 2 and 3. In contrast, in *D. nodulosa* sp. nov. the caudal rami are only 2.0 times longer than wide, the anal somite and caudal rami are not setulose, and the endopods of legs 2 and 3 are only 2-segmented. Marked differences between *D. fijiensis* sp. nov. and *D. gryphina* sp. nov. include the distal endopodal segments of legs 2 and 4 which are armed with 4 and 1 setae, respectively, in *D. fijiensis* sp. nov. (compared to

5 and 0 setae, respectively, in *D. gryphina* sp. nov.), and the medial and outermost setae on the mandibular exopod are 0.6 times as long as the 3 middle setae whereas in *D. gryphina* sp. nov. the medial seta is not shorter than 3 middle setae and the outermost seta is about half as long as the other 4 setae.

***Doroixys obesa* sp. nov.**  
(Figs. 322, 323)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21373) from *Polyclinum isipingense* Sluiter, 1898 (MNHN-IT-2008-XXX = MNHN A1/POL.B/108), ATIMO VATAE TR07, Madagascar (25°01'N, 47°00'E), depth 12-16 m, MNHN coll., 01 May 2010.

**Etymology.** The specific name refers to the obese body form of the female.

**Description of female.** Body (Fig. 322A) stout, ventrally curved; body length 1.01 mm. Prosome 808 µm long: dorsal cephalic shield expanded ventrolaterally, with small, paired, dorsally curved horn-like processes (Fig. 322D) posterolaterally. Free urosome (Fig. 19B) 5-segmented. Caudal ramus (Fig. 322C) about 3.2 times longer than wide (89×28 µm) and about twice as long as anal somite, with almost parallel lateral margins and rounded distal margin, ornamented with many scattered setules: armed with 6 setae (outer lateral, dorsal, and 4 distal) outer lateral and dorsal setae positioned in same plane at 60% length of ramus; all caudal setae small, less than half width of ramus at base.

Rostrum (Fig. 322E) large, 95×53 µm, proximal third with parallel lateral margins, distal two-thirds tapering towards blunt apex. Antennule (Fig. 322F) stout, strongly tapering, 9-segmented, but articulation between seventh and eighth segments incomplete; armature formula 2, 13, 5, 2+aesthetasc, 2, 3, 2, 2, and 7; all setae naked. Antenna (Fig. 322G) stout, 3-segmented, comprising unarmed coxa and basis and unsegmented endopod; endopod about 2.5 times longer than wide (42×17 µm) and about 0.8 times as long as basis: armed with 1 middle and 2 distal setae plus terminal claw, half as long as endopod.

Labrum (Fig. 322H) simple, with narrow setulose posterior margin. Mandible (Fig. 322I) with broadened coxal gnathobase bearing 5 teeth and 1 seta; basis with 1 seta: exopod 2-segmented; first segment armed with 2 equal, large setae; second segment with 2 equal, distal setae and 1 small outer seta (about half as long as larger setae): endopod with 1 and 5 setae on first and second segments, respectively; all setae short, subequal in length. Maxillule (Fig. 322J) armed with 9 setae on arthrite, 2 unequal setae on epipodite, 1 on basis, 4 on exopod, and 3 on endopod; coxal endite absent. Maxilla (Fig. 323A) 4-segmented; syncoxa bearing 4, 2, and 2 setae on first to third endites, respectively; basis with smooth claw plus 1

seta; endopod small, lacking seta on first segment, with 3 setae on second segment. Maxilliped (Fig. 323B) lobate, armed with 6 subequal setae.

Legs 1–3 (Fig. 323C–E) with 3-segmented rami. Leg 4 (Fig. 323F) with 3-segmented exopod and 2-segmented endopod; second endopodal segment of leg 4 elongate, about 4.2 times longer than wide (54×13 µm), 3.5 times longer than first endopodal segment. Inner coxal seta absent on all swimming legs. Inner distal spine of basis of leg 1 small, 12 µm long. Second exopodal segment of leg 1 bearing outer seta (instead of spine). All setae on swimming legs naked, except feebly pinnate (or spinulose) setae on third exopodal segment of leg 3. Leg 4 asymmetrical: outer setae on exopod of left leg 4 slender (as on leg 3), but setae on right leg 4 broad and spiniform (Fig. 323F). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; 1-1; 3, 1, 3	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 1
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 1, 2, 0

Leg 5 (Fig. 322B) represented by 2 tapering, pointed posteroventral processes on surface of somite; outer process smaller; inner exopodal process larger, armed with 1 small seta on outer margin.

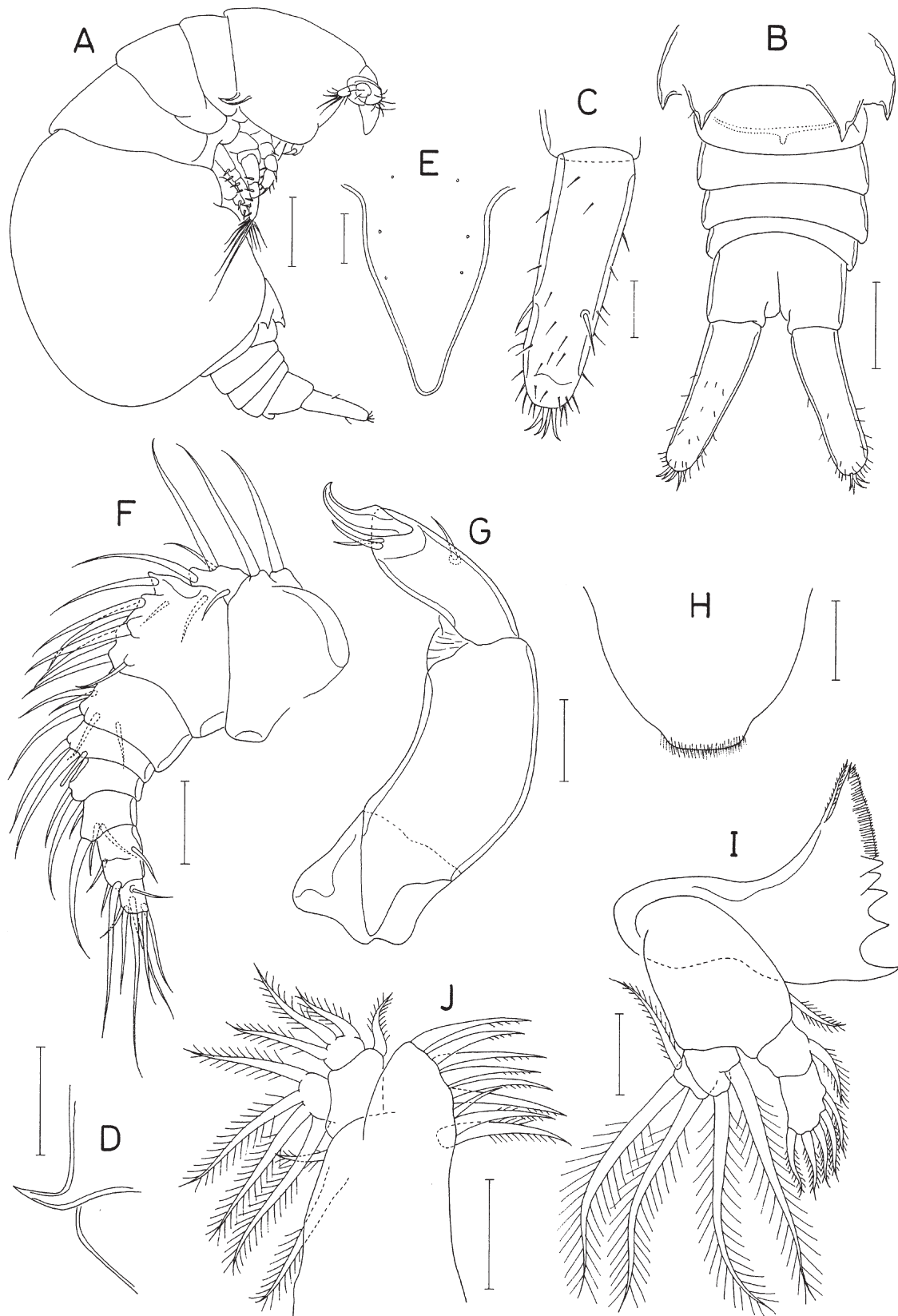
**Male.** Unknown.

**Remarks.** This is the first species of *Doroixys* to be characterised by the possession of a 3-segmented antenna, comprising coxa, basis, and an unsegmented endopod, although additional new species sharing the same kind of 3-segmented antenna are described below. *Doroixys obesa* sp. nov. is unique within the genus in the absence of a seta on the first endopodal segment of the maxilla. Other unusual features include the endopod of the mandible is armed with 6 equal, short setae (1 on first and 5 on second segment, respectively) rather than setae of dissimilar lengths, and the maxillule bears 2 setae on the epipodite rather than the typical single seta. These features are sufficient to distinguish the new species from its congeners.

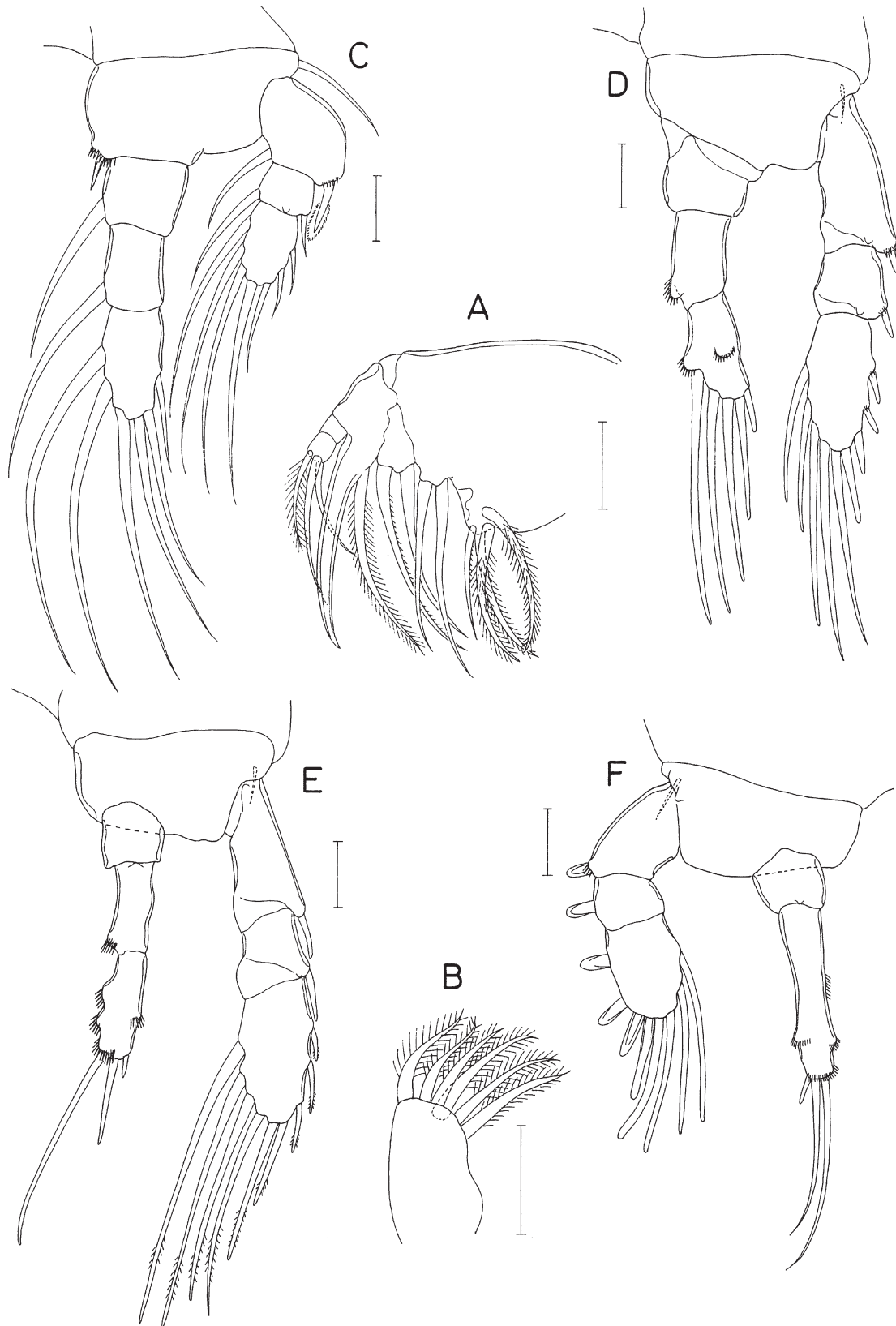
***Doroixys pilosa* sp. nov.**  
(Figs. 324, 325)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21374), paratype (intact ♀, MNHN0IU-2014-21375), and dissected paratype (♀, figured) from *Eudistoma gilboviride* (Sluiter, 1909) (MNHN-IT-2008-4052 = MNHN A3/EUD/88), CRRF OCDN 0678-U, Rasch Passage, Papua New Guinea (05°09.27'S, 145°49.82'E), depth 3 m, 04 November 1993.

**Etymology.** The specific name is from the Latin

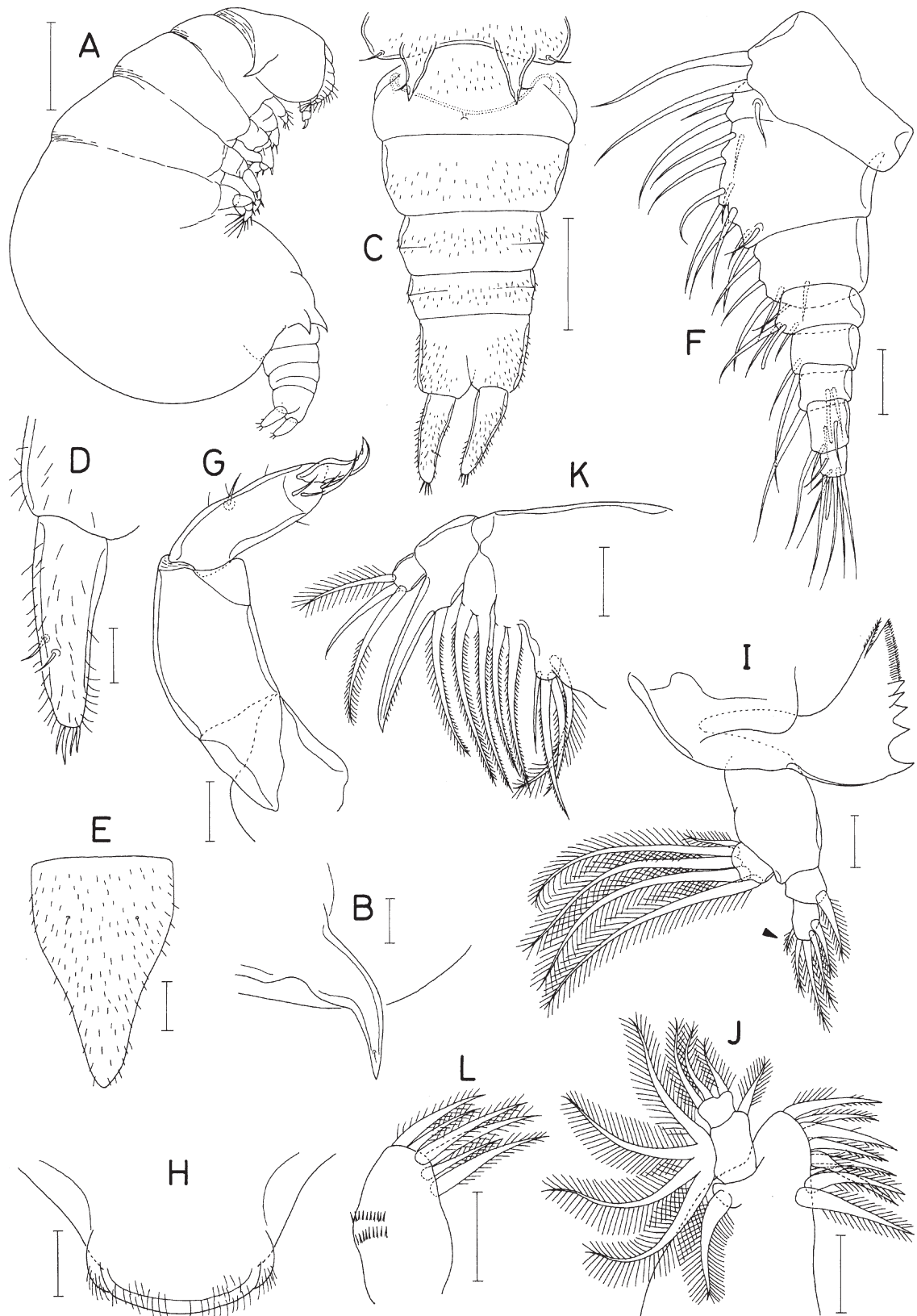


**FIGURE 322.** *Doroixys obesa* sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, left caudal ramus, dorsal; D, posterolateral process of cephalic shield; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, 0.1 mm; B, D, 0.05 mm; C, E–J, 0.02 mm.

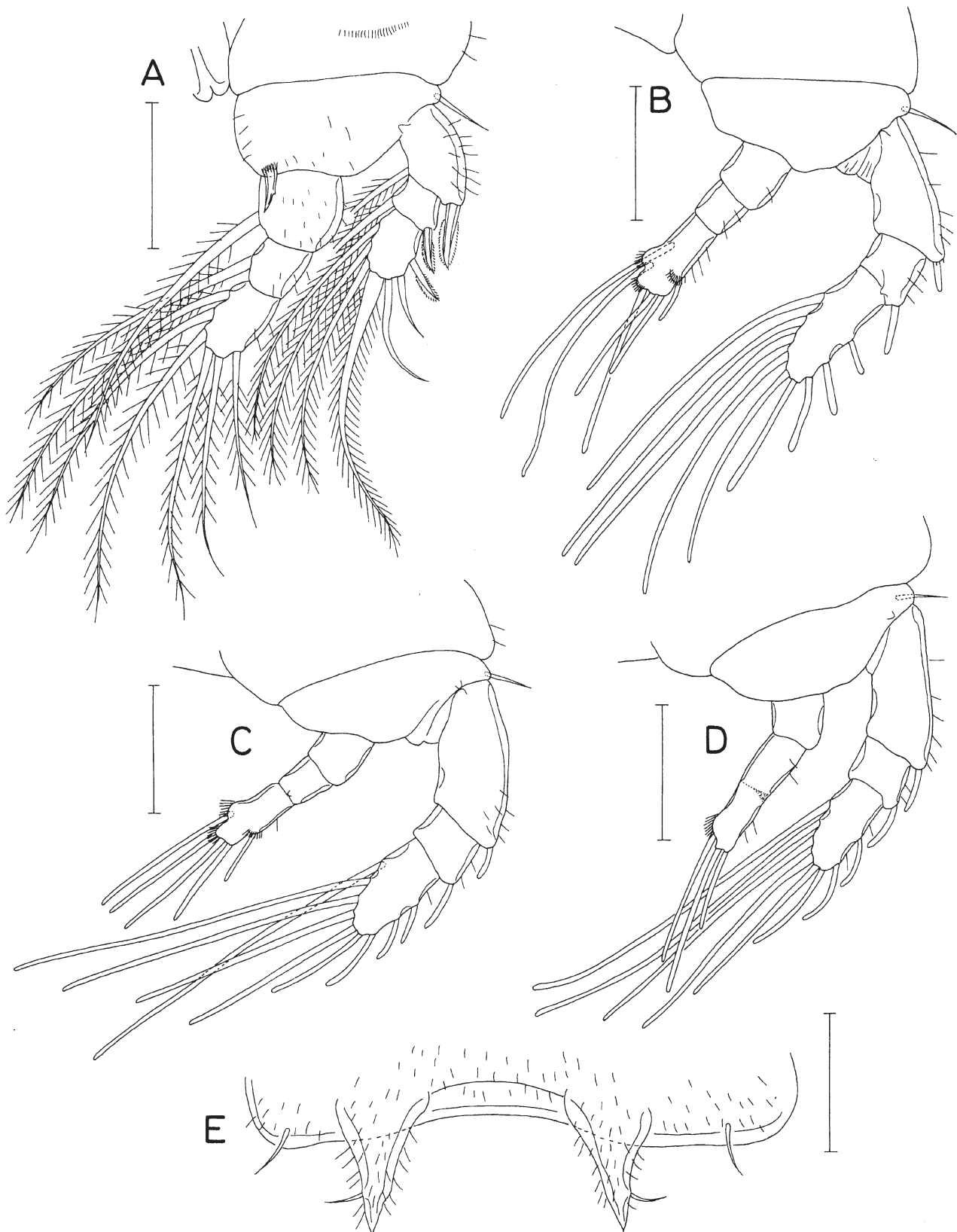


**FIGURE 323.** *Doroixys obesa* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4. Scale bars: 0.02 mm.





**FIGURE 324.** *Doroixys pilosa* sp. nov., female. A, habitus, right; B, cephalic horn; C, leg 5 and urosome, ventral; D, left caudal ramus, dorsal; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bars: A, 0.2 mm; B, D–L, 0.02 mm; C, 0.1 mm.



**FIGURE 325.** *Doroixys pilosa* **sp. nov.**, female. A, leg 1; B, leg 2; C, leg 3; D, leg 4; E, left and right legs 5. Scale bars: 0.05 mm.

*pilos* (=hairy) and refers to the dense ornamentation of minute setules covering the body.

**Description of female.** Body (Fig. 324A) stout, bearing numerous minute setules on external surface (ornamentation not shown in Fig. 324A): body length 1.39 mm. Prosome 1.05 mm long: dorsal cephalic shield bearing prominent, paired dorsally-curved, horn-like processes posterolaterally (Fig. 324B). Metasome incompletely 4-segmented; fourth pedigerous somite swollen, forming brood pouch. Free urosome (Fig. 324C) 5-segmented, gradually narrowing posteriorly, covered with minute setules: genital and 4 abdominal somites 64×173, 64×156, 49×122, 36×105, and 64×91 µm, respectively. Caudal ramus (Fig. 324D) tapering, 2.85 times longer than wide (77×27 µm): armed with 6 setae; outer lateral and dorsal setae positioned at 59 and 66% of ramus length, respectively; all setae small, at most half as long as width of ramus at base.

Rostrum (Fig. 324E) setulose, longer than wide (98×60 µm), with parallel lateral margins in proximal third, but tapering steeply in distal two-thirds towards angular apex. Antennule (Fig. 324F) 147 µm long, strongly tapering, 8-segmented, but articulation incomplete between last 2 segments: armature formula 2, 14, 6, 3+aesthetasc, 2, 2+aesthetasc, 4, and 7+aesthetasc; all setae naked. Antenna (Fig. 324G) 3-segmented, consisting of unarmed coxa and basis and unsegmented endopod; endopod as long as basis and about 2.6 times longer than wide (50×19 µm), ornamented with few setules: armed with 5 small setae (arranged as 1, 2, and 2) plus terminal claw slightly less than half length of endopod.

Labrum (Fig. 324H) bearing broad, convex, setulose posterior margin. Mandible (Fig. 324I) with broad coxal gnathobase bearing 5 teeth and 1 seta: basis unarmed, lacking medial seta: exopod short, armed with 4 large subequal setae and 1 small outer seta (about 25% as long as larger setae): endopod 2-segmented; first segment with 1 broad seta mediolaterally; second segment with 5 or 4 setae, smallest outer seta (indicated by arrowhead) present or absent. Maxillule (Fig. 324J) armed with 9 setae on arthrite, 1 on epipodite, 1 on basis, 4 on exopod and 3 on endopod; coxal endite absent. Maxilla (Fig. 324K) 3-segmented with 1-segmented endopod: armed with 4, 2, and 2 setae on first to third endites of syncoxa, respectively, claw plus 1 seta on basis, and 3 setae on endopod; claw on basis ornamented with minute spinules along distal third of concave margin. Maxilliped (Fig. 324L) unsegmented, armed with 6 setae, and ornamented with 2 transverse rows of spinules on outer surface.

Legs 1–3 (Fig. 325A–C) with 3-segmented rami. Leg 4 (Fig. 325D) with 3-segmented exopod and 2-segmented endopod; compound distal endopodal segment of leg 4 bearing trace of articulation in middle. Inner coxal seta absent in all legs. Inner distal spine on basis of leg 1 small, 15 µm long. Distal seta on third exopodal segment of leg 1 broadened. All setae on rami of legs 2–4 bluntly tipped.

Outer seta on third endopodal segment of legs 2 and 3 present or absent. Inner seta on second exopodal segment of leg 4 also present or absent.

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; I+1, 2, 3	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 1, 2, 3 (or 0, 2, 3)
Leg 3	0-0	1-0	1-0; 1-0 (or 1-1); 3, 1, 5	0-0; 0-0; 1, 2, 2 (or 0, 2, 2)
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 1, 2, 0

Leg 5 (Fig. 325E) represented by outer protopodal seta on ventrolateral margin of somite plus tapering, pointed inner exopodal process bearing 1 seta subdistally on outer margin.

**Male.** Unknown.

**Remarks.** The setation of the swimming legs and the mandibular endopod are unreliable for characterising *Doroixys pilosa* **sp. nov.** due to the variability exhibited between specimens. Instead, this new species exhibits a remarkable autapomorphic feature, the single-segmented endopod of the maxilla. The combination of this feature with the lack of a seta on the mandibular basis and the relative lengths of the setae on the mandibular exopod (small outermost seta and 4 other equally large setae) allows this new species to be separated from all of its congeneric species.

***Doroixys bifurcata* sp. nov.**

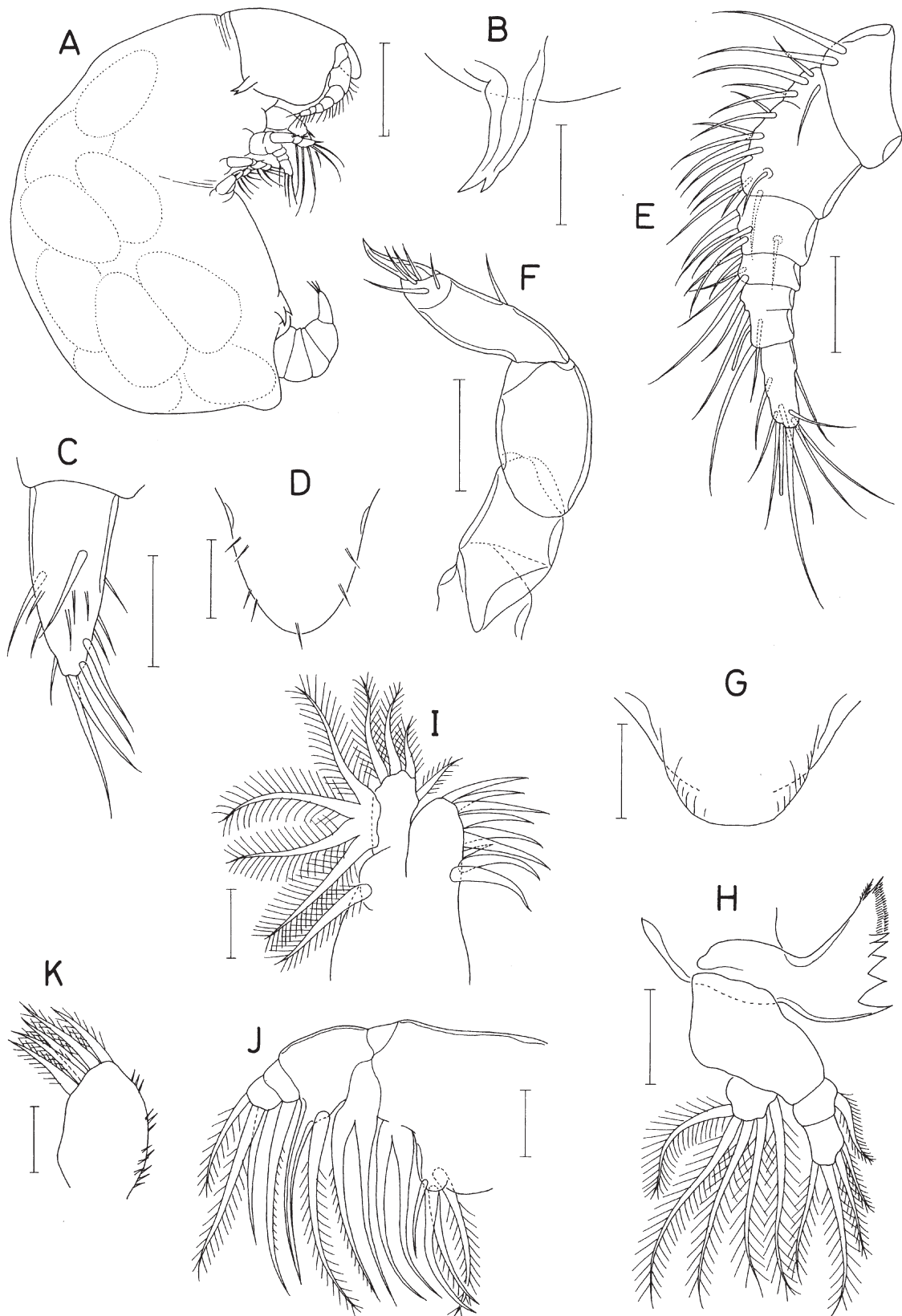
(Figs. 326, 327)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21376), paratypes (2 intact ♀♀, MNHN-IU-2014-21377). and dissected paratypes (2 ♀♀, figured) from *Didemnum psammatoedes* (Sluiter, 1895), Pt. Lambi, Guadeloupe, depth 1–3 m, Monniot coll., 16 December 1980.

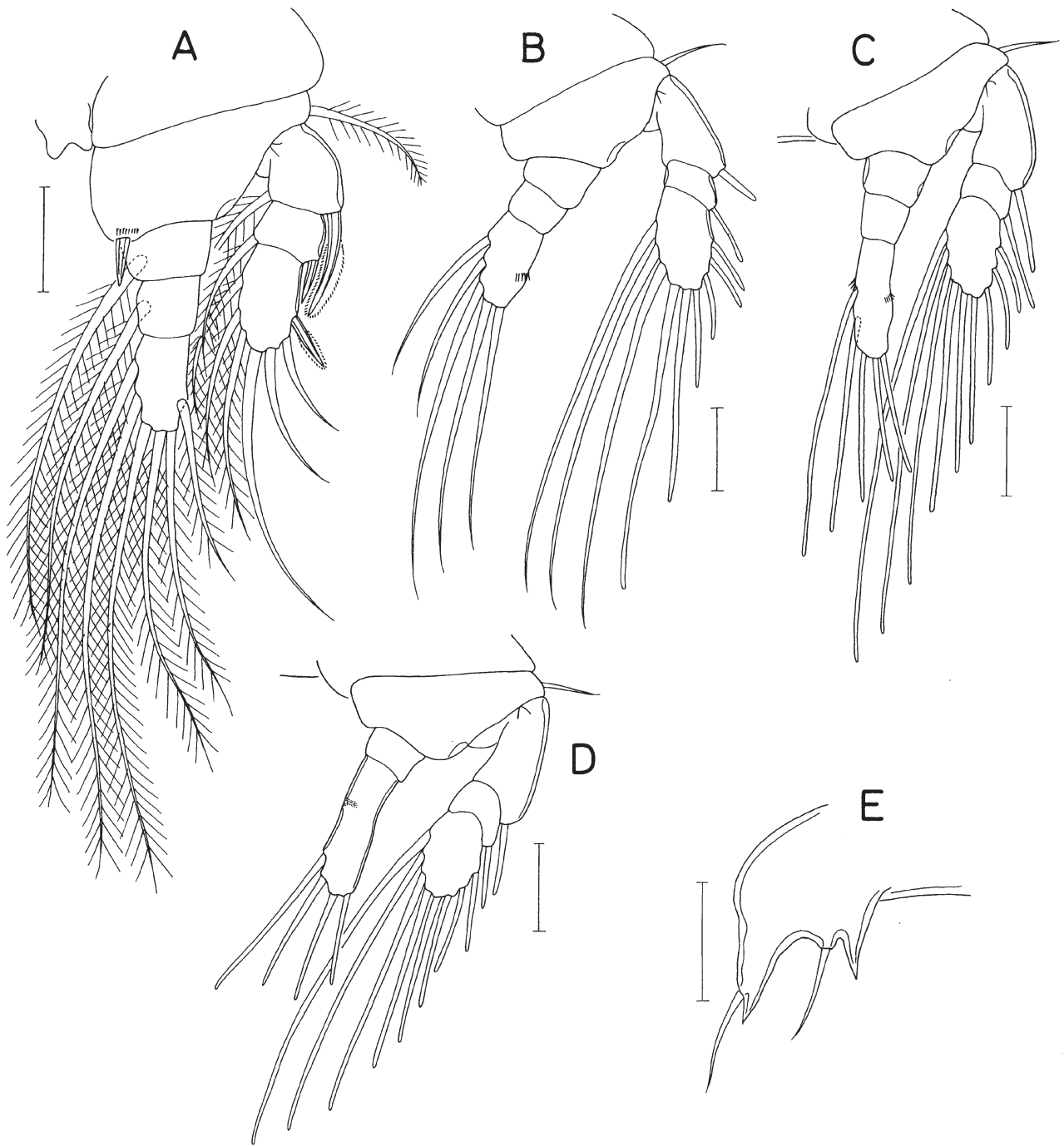
**Etymology.** The specific name refers to the distally bifurcate cephalic horn-like processes.

**Description of female.** Body (Fig. 326A) small, stout, curved ventrally; body length 700 µm. Prosome 546 µm long; dorsal cephalic shield bearing paired posterolateral horn-like processes (Fig. 326B); these processes highly sclerotized and bifurcate at tip. Metasome unsegmented, with posterior 60% more expanded than anterior 40% and with rounded protuberance on posterior margin. Eggs visible within entire metasome. Free urosome 5-segmented, small, recurved ventrally. Caudal ramus (Fig. 326C) about 2.2 times longer than wide (35×16 µm), tapering, slightly longer than anal somite, and ornamented with setules: armed with 6 setae, all setae naked and shorter than ramus but longer than width of ramus at base; 2 proximal setae positioned at 37 and 47% of ramus length.

Rostrum (Fig. 326D) as long as wide, gradually



**FIGURE 326.** *Doroixys bifurcata* sp. nov. A, habitus, right; B, cephalic horn; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B–H, 0.02 mm; I–K, 0.01 mm.



**FIGURE 327.** *Doroixys bifurcata* sp. nov. A, leg 1; B, leg 2; C, leg 3; D, leg 4; E, leg 5. Scale bars: 0.02 mm.

narrowing distally towards rounded apex; ornamented with several setules. Antennule (Fig. 326E) 90  $\mu$ m long, 6-segmented but fifth segment subdivided by incomplete suture line on posterior side; armature formula 2, 17, 6, 4, 4+aesthetasc, and 9+aesthetasc; all setae naked. Antenna (Fig. 326F) 4-segmented; proximal 3 segments (coxa, basis, and first endopodal segment) unarmed; narrower second endopodal segment  $29 \times 10 \mu$ m, slightly longer than first; armed with 6 setae (arranged as 1, 2, and 3) plus small terminal claw, less than half length of segment.

Labrum (Fig. 326G) simple, unornamented, with soft, thin-walled, posterior part. Mandible (Fig. 326H) bearing 5 acute teeth and 1 small seta on coxal gnathobase: basis unarmed; exopod with 4 subequal medial and distal setae plus short outer seta about 0.65 times length of other 4; endopod 2-segmented, armed with 1 broad seta on first segment and 4 unequal setae on second segment; relative lengths of latter setae 5:8:11:9 from medial to outer. Maxillule (Fig. 326I) with 9 setae on arthrite, 1 on epipodite, and 4 on exopod; basis and endopod fused,

without any trace of articulation, bearing total of 4 setae. Maxilla (Fig. 326J) 4-segmented, armed with 4, 2, and 2 setae on first to third endites of syncoxa, slender claw plus 1 seta on basis, and 1 and 3 setae on first and second endopodal segments, respectively. Maxilliped (Fig. 326K) small, unsegmented, armed with 5 setae and ornamented with spinules on outer surface.

Legs 1–3 (Fig. 327A–C) with 3-segmented rami. Leg 4 (Fig. 327D) with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent in legs 1–4. Outer seta on basis pinnate in leg 1, but naked in legs 2–4. Inner distal spine on basis of leg 1 small, 9 µm long. Outer spine on first exopodal segment of leg 1 enlarged, extending beyond distal tip of outer spine on second exopodal segment. All setae on legs 2–4 naked and most bluntly tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	1-1; 1-1, 2, 3	0-1; 0-1; 1, 2, 3
Legs 2 & 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 3
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 0, 2, 2

Leg 5 (Fig. 327E) represented by 2 pointed processes and 2 naked setae; larger outer process bearing protopodal seta subdistally on outer margin, other seta positioned laterally at base of exopodal process.

**Male.** Unknown.

**Remarks.** The endopod of leg 4 of *Doroixys bifurcata* **sp. nov.** is 2-segmented and armed with 4 setae on the compound distal segment. This pattern of segmentation and setation of the leg 4 endopod is shared only with *D. minuta*. The maxilliped armature of 5 setae is known only in *D. bifurcata* **sp. nov.**, *D. minuta*, and *D. manadoensis* **sp. nov.**, although the number of setae on this limb may be either 5 or 6 in the latter species. However, *D. minuta* differs from *D. bifurcata* **sp. nov.** because the former has a 3-segmented antenna and is armed with only 3 setae on the second endopodal segment of the mandible, as described and illustrated by Stock (1970), whereas in *D. bifurcata* **sp. nov.** the antenna is 4-segmented and the mandible carries 4 setae on the second endopodal segment. It can be distinguished from *D. manadoensis* **sp. nov.** which has 6 setae on the second endopodal segment of the mandible (rather than 4) and an inner seta on the first exopodal segment of leg 2 which is missing in *D. bifurcata* **sp. nov.**

In *Doroixys*, leg 5 consists of a protopod which is incorporated into the somite and a tapering, sclerotized inner process representing the transformed exopod. The rudimentary protopod (outer lobe) is either fully incorporated and appears as a bluntly rounded angle (which may or may not carry the outer protopodal seta), or projects as a digitiform process tipped with a seta. Leg 5 of *D. bifurcata* **sp. nov.** deviates from this general form in having an outer protopodal lobe which forms a pointed process similar to the exopodal process, and bears a seta

on its outer margin. The characteristic form of leg 5 is an additional distinguishing feature of *D. bifurcata* **sp. nov.**

### *Pentachaetus* gen. nov.

**Diagnosis.** Body form as in *Doroixys*. Dorsal cephalic shield bearing paired horn-like processes posterolaterally. Fifth pedigerous somite fused with fourth. Free urosome 5-segmented. Caudal ramus bearing 5 well-developed setae (2 proximal and 3 distal). Rostrum well-developed. Antennule 6-segmented; first segment armed with 2 setae. Antenna 3-segmented, comprising coxa, basis, and unsegmented endopod; terminal claw small. Labrum weak, flexible. Mandible similar to that of *Doroixys*; exopod armed with 5 setae; endopod 2-segmented with 1 seta on first segment and 4 setae on second. Maxillule as in *Doroixys*, lacking coxal endite. Maxilla 4-segmented, bearing 4 setae on first endite of syncoxa, claw plus 2 setae on basis, and 2-segmented endopod armed with 1 and 3 setae on first and second segments, respectively. Maxilliped unsegmented with 6 setae. Leg 1 with 2- or 3-segmented exopod and 3-segmented endopod; second exopodal segment (or original second exopodal segment) lacking outer element. Leg 2 with 3-segmented rami. Legs 3 and 4 with 3-segmented exopods and 2-segmented endopods. Inner coxal seta absent in legs 1–4. First and second exopodal segments of legs 2–4 lacking inner seta. Legs 2–4 with setal armature only on terminal endopodal segments. Leg 5 represented by 2 processes and 2 setae.

**Etymology.** The generic name is derived from the Greek *penta* (=five) and *chaet* (=a bristle) and refers to the presence of five setae on the caudal ramus. Gender masculine.

**Type species.** *Pentachaetus spinatus* gen. et sp. nov. by original designation.

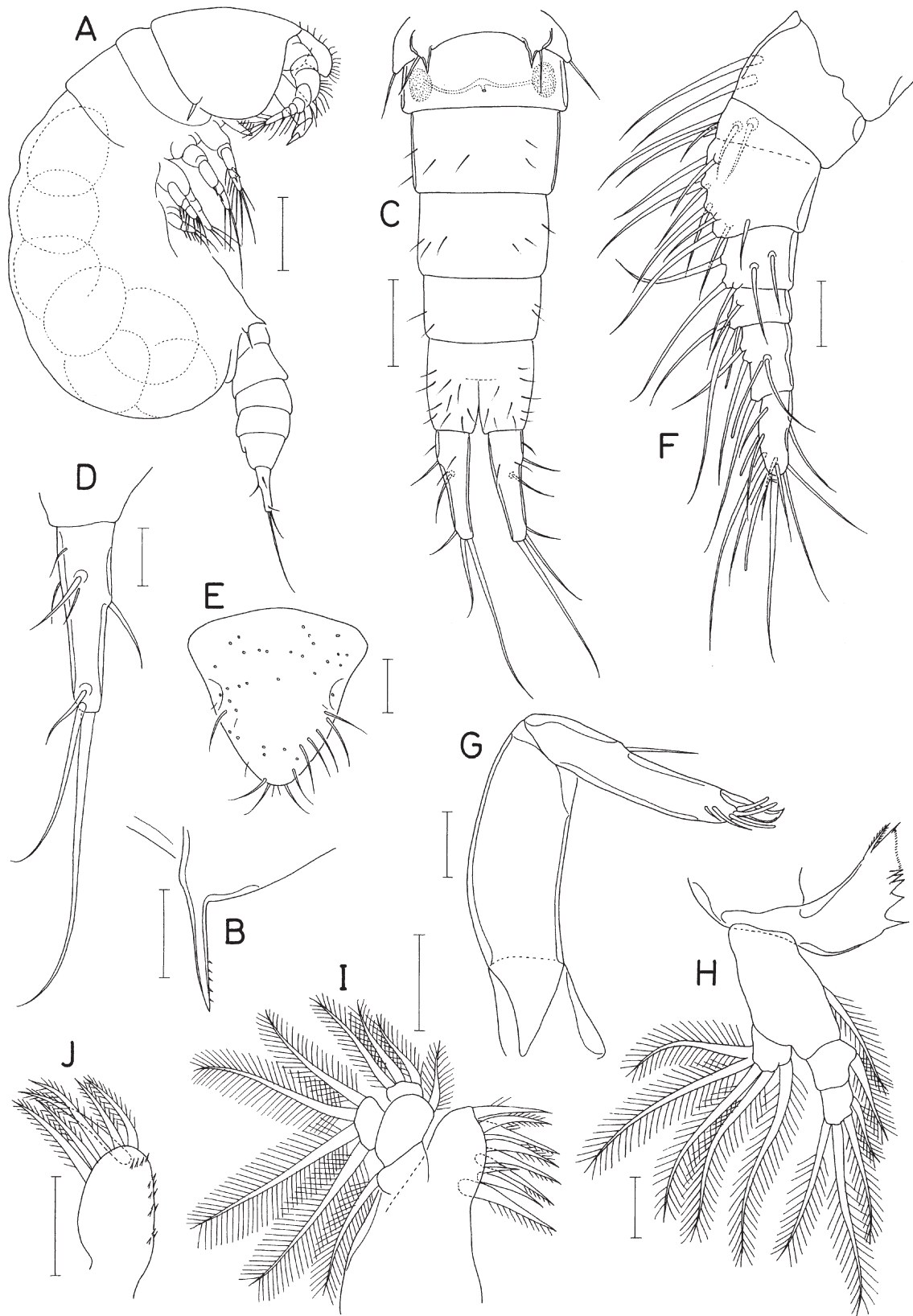
**Other included species.** *Pentachaetus palauensis* gen. et sp. nov. and *P. longisetatus* gen. et sp. nov.

**Remarks.** The three species placed in this new genus constitute a homogeneous group and can be separated from the closely related genus, *Doroixys*, by two prominent features: firstly, the caudal ramus is armed with 5 (not 6) well-developed setae, and secondly, the second exopodal segment (or original second exopodal segment) of leg 1 lacks an outer setal element.

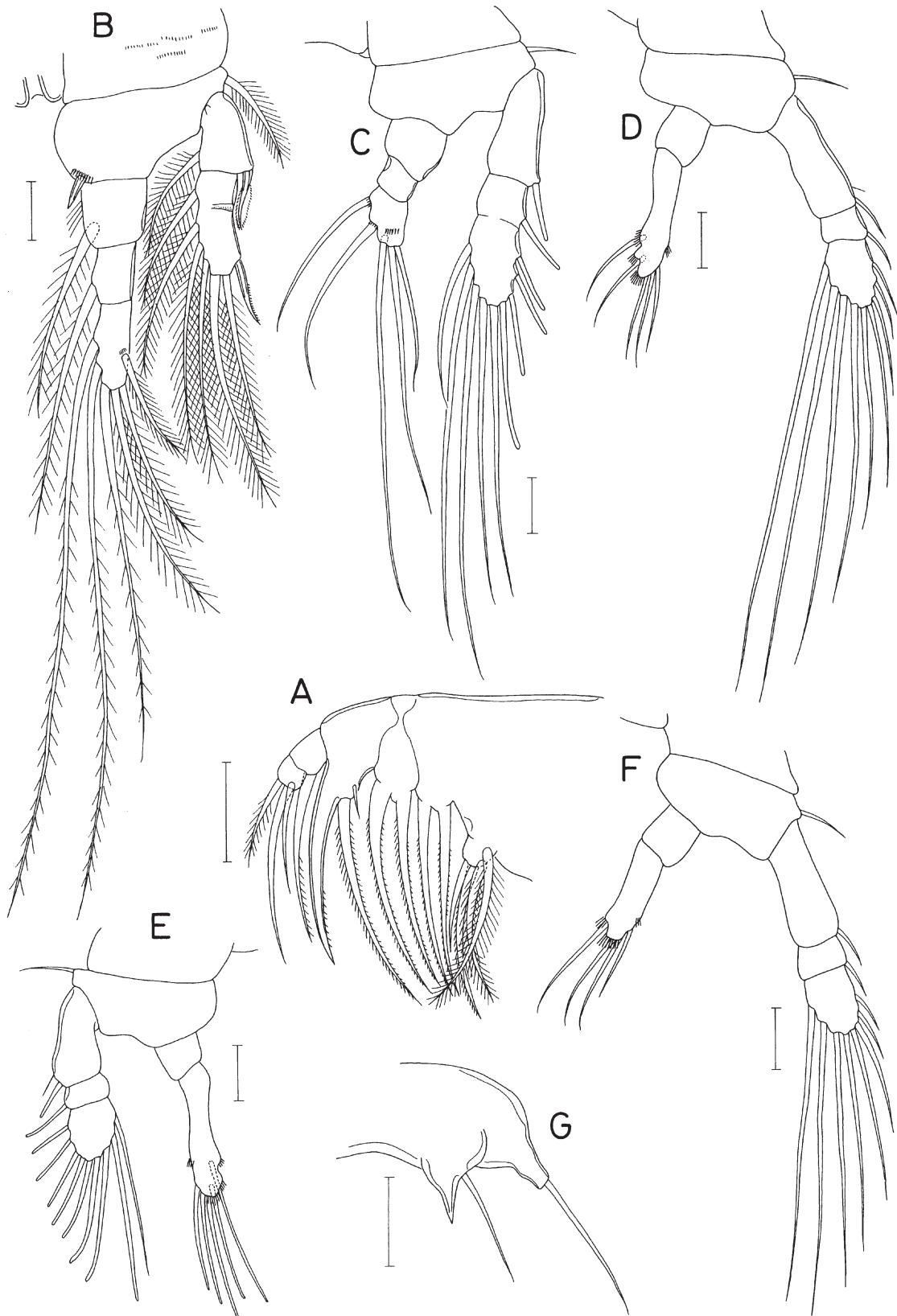
### *Pentachaetus spinatus* gen. et sp. nov. (Figs. 328, 329)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21378) and dissected paratype (♀, MNHN-IU-2014-21379) from unidentified immature host of family Didemnidae, Canal Woodin, Grande Terre New Caledonia, depth 32 m, Monniot coll., 12 March 1987.

**Etymology.** The specific name refers to the possession



**FIGURE 328.** *Pentachaetus spinatus* gen. et sp. nov., female. A, habitus, right; B, posterolateral process of cephalic shield; C, leg 5 and urosome; D, left caudal ramus, lateral; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilliped. Scale bars: A, 0.1 mm; B, D–J, 0.02 mm; C, 0.05 mm.



**FIGURE 329.** *Pentachaetus spinatus* gen. et sp. nov., female. A, maxilla; B, leg 1; C, left leg 2; D, left leg 3; E, right leg 3; F, left leg 4; G, leg 5. Scale bars: 0.02 mm.



of the paired spiniform posterolateral processes on the dorsal cephalic shield.

**Description of female.** Body (Fig. 328A) slightly expanded; body length 0.99 mm. Prosome curved ventrally: cephalosome well-defined from metasome; dorsal cephalic shield extended ventrolaterally and bearing paired posteroventral process; processes thin, straight, thorn-like, 25 µm long, ornamented with 4 or 5 fine spinules distally on dorsal margin (Fig. 328B). Metasome with 2 incomplete articulations dividing first to third pedigerous somites; third and fourth pedigerous somites fused, both containing large eggs inside. Free urosome (Fig. 328C) cylindrical, gradually narrowing posteriorly: genital somite 42×97 µm, 4 abdominal somites sparsely ornamented with setules on all surfaces, 47×86, 48×75, 36×67, and 54×62 µm, respectively. Anal somite with narrow posteromedian incision. Caudal ramus (Fig. 328D) tapering, about 3.3 times longer than wide (65×20 µm), and ornamented with few setules; armed with 5 setae (outer lateral, dorsal, and 3 distal), all setae naked and longer than width of ramus at base, largest seta 105 µm long, 1.6 times longer than ramus, second longest adjacent seta 60 µm long; outer lateral and dorsal seta positioned at 27 and 43% of ramus length, respectively.

Rostrum (Fig. 328E) subtriangular, 69×70 µm, setulose, with blunt apex. Antennule (Fig. 328F) relatively slender, 147 µm long, 6-segmented; armature formula 2, 15, 5, 3+aesthetasc, 4+aesthetasc, and 10+2 aesthetascs; all setae naked; aesthetascs setiform (thin and short). Antenna (Fig. 328G) 3-segmented, comprising coxa, basis and unsegmented endopod; coxa and basis unarmed; endopod about 4.1 times longer than wide (62×15 µm) and as long as basis: armed with 6 setae arranged as 1, 2, and 3; proximalmost seta longer than width of endopod; 3 distal setae bluntly tipped, all shorter than claw; terminal claw small, about 20 µm long, one-quarter as long as endopod.

Labrum soft, hardly discernible. Mandible (Fig. 328H) with relatively narrow coxal gnathobase bearing 5 acute teeth and 1 small seta: basis with 1 seta on medial margin: exopod with 5 setae, outermost only 0.6 times as long as other 4 setae: endopod 2-segmented; first segment with 1 proximally broadened seta; second segment with 4

unequal setae (proportional lengths of setae 1, 2, 3, and 2.2 from inner to outer). Maxillule (Fig. 328I) with 9 setae on arthrite, 1 on each epipodite and basis, 4 on exopod and 3 on endopod (endopodal setae unequal in length, medial seta shortest and outer longest). Maxilla (Fig. 329A) 4-segmented, armed with 4, 2, and 2 setae on first to third endites on syncoxa, claw plus 2 very unequal setae on basis, and 1 and 3 setae on first and second endopodal segments, respectively; claw on basis ornamented with several minute spinules distally on concave margin. Maxilliped (Fig. 328J) unsegmented, lobate, armed with 6 setae and ornamented with spinules on outer surface.

Legs 1–4 (Fig. 329B–F) lacking inner coxal seta. Outer seta on basis pinnate in leg 1, but naked in legs 2–4. Leg 1 bearing small inner distal spine on basis, 12 µm long; exopod 2-segmented, with vestige of articulation on compound distal segment; 2 inner proximal setae on third endopodal segment markedly elongate, about 3 times longer than ramus. All setae on legs 2–4 naked. Leg 2 with 3-segmented rami. Legs 3 and 4 with 3-segmented exopods and 2-segmented endopods; both legs slightly asymmetrical in length and in shape of setae on left and right sides; outer setae on exopod and all setae on endopod attenuated in left leg but bluntly tipped in right leg, and inner setae on third exopodal segment long in left leg but shorter in right leg (cf. Fig. 329D and E). Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I, 1, 5	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 1, 2, 2
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 1, 2, 1

Leg 5 (Fig. 329G) consisting of protopodal lobe bearing digitiform outer distal process tipped with 1 seta, plus pointed inner (exopodal) process tapering distally from broad base and bearing 1 seta on outer margin.

**Male.** Unknown.

**Remarks.** Unlike its two congeners described below, *Pentachaetus spinatus* **gen. et sp. nov.** has thin, spiniform, horn-like processes posterolaterally on the dorsal cephalic shield. It also has a triangular rostrum which is as long

**TABLE 11.** Differences between the new species of *Pentatachaetus* **gen. nov.**

Characters	<i>P. spinatus</i> <b>gen. et sp. nov.</b>	<i>P. palauensis</i> <b>gen. et sp. nov.</b>	<i>P. longisetatus</i> <b>gen. et sp. nov.</b>
Cephalic horns	thin	tapering	tapering
Longest caudal seta	1.62 times longer than caudal ramus	1.70 times longer than caudal ramus	2.24 times longer than caudal ramus
Rostrum	setulose, as long as wide	smooth, semicircular	smooth, longer than wide
Outer (5 <sup>th</sup> ) seta on Mnd exp	0.6 times longer than 4 <sup>th</sup> seta	as long as 4 <sup>th</sup> seta	0.4 times longer than 4 <sup>th</sup> seta
Seta on Mnd enp1	slightly broadened	tipped with digitiform process	expanded proximally
Exopod of leg 1	2-segmented	3-segmented	indistinctly 3-segmented
Outer spine exp1 of leg 1	serrate, shorter than segment	naked, longer than segment	serrate, longer than segment
Setae on enp3 of leg 1	pinnate	naked	pinnate
Leg 3 setation of enp2	5 setae	5 setae	4 setae

as wide, the outer seta on the exopod of the mandible is 0.6 times as long as other 4 exopodal setae, and the inner exopodal process of leg 5 is broadened at its base. These and other differences between the species of *Pentachaetus* **gen. nov.** are summarised in Table 11.

***Pentachaetus palauensis* gen. et sp. nov.**

(Figs. 330, 331)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21380) and dissected paratype (♀, figured) from *Lissoclinum* sp., marine lake, Ngeruktabel I., Palau (07°17.87'N, 134°26.82'E), 09 August 2005.

**Etymology.** The name of the type locality, Palau Island, provides the specific name for the new species.

**Description of female.** Body (Fig. 330A) small and stout; body length 745 µm. Prosome 600 µm long, expanding gradually posteriorly; dorsal cephalic shield bearing paired pointed horn-like process (Fig. 330C) posterolaterally. Metasome bearing 3 faint dorsal constrictions; fourth pedigerous somite expanded, longer than anterior part of prosome. Fifth pedigerous somite not discernible, fused with fourth. Free urosome (Fig. 330B) 5-segmented: genital and four abdominal somites 45×90, 34×79, 38×63, 28×55, and 34×51 µm, respectively. Caudal rami widely separated at base; each ramus (Fig. 330D) about 3.1 times longer than wide (46×15 µm) and about 1.4 times longer than anal somite, narrowing distally: armed with 5 setae; largest seta 78 µm long, 1.7 times longer than ramus; 2 proximal setae located at 33 and 50% of ramus length.

Rostrum (Fig. 330E) semicircular, wider than long. Antennule (Fig. 330F) tapering, 110 µm long, 6-segmented; armature formula 2, 8, 2, 2, 3, and 8+aesthetasc; all setae naked. Antenna (Fig. 330G) slender, 3-segmented; coxa and basis unarmed; endopod (third segment) 4.9 times longer than wide (49×10 µm) and as long as basis; armed with 4 setae plus small terminal claw, about 0.3 times as long as endopod.

Labrum weak, flexible. Mandible (Fig. 330H) with 5 teeth and 2 small setae on coxal gnathobase: basis with 1 seta on medial margin; exopod with 5 large setae of equal length; endopod 2-segmented; first segment bearing digitiform process medially tipped with 1 seta; second segment with 4 setae (distal 2 equal in length, both longer than 2 on medial margin). Maxillule (Fig. 330I) with 9 setae on arthrite, 1 on each epipodite and basis, 4 on exopod, and 3 on endopod; coxal endite absent. Maxilla (Fig. 330J) 4-segmented, armed with 4, 2, and 2 setae on first to third endites of syncoxa, respectively, smooth claw plus 2 unequal setae on basis, and 1 and 3 setae on first and second endopodal segments, respectively. Maxilliped (Fig. 331A) lobate, armed with 6 setae and ornamented with spinules on outer margin.

Legs 1 and 2 (Fig. 331B, C) with 3-segmented rami.

Legs 3 and 4 (Fig. 331D, E) with 3-segmented exopods and 2-segmented endopods; second endopodal segment of legs 3 and 4 elongate, more than 4 times longer than wide. Inner coxal seta absent in legs 1–4. Outer seta on basis moderately large and pinnate in leg 1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 small, 8 µm long. Outer spine on first exopodal segment of leg 1 smooth, elongate, 23 µm long, extending beyond base of first outer element of third exopodal segment. Second exopodal segment of leg 1 lacking outer element. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; 0-1; 1, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 3, 2
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0, 3, 2
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 1, 2, 1

Leg 5 (Fig. 331F) represented by elongate outer protopodal process tipped with seta, and inner, claw-like smaller process (representing exopod); exopodal seta positioned between outer and inner processes.

**Male.** Unknown.

**Remarks.** The combination of a semicircular rostrum (which is wider than long), the relatively long outer seta on the mandibular exopod (which is almost as long as the other 4 exopodal setae), the completely 3-segmented exopod of leg 1, and the large, unornamented outer spine on the first exopodal segment of leg 1 serves to differentiate *P. palauensis* **gen. et sp. nov.** from its congeners (see Table 11).

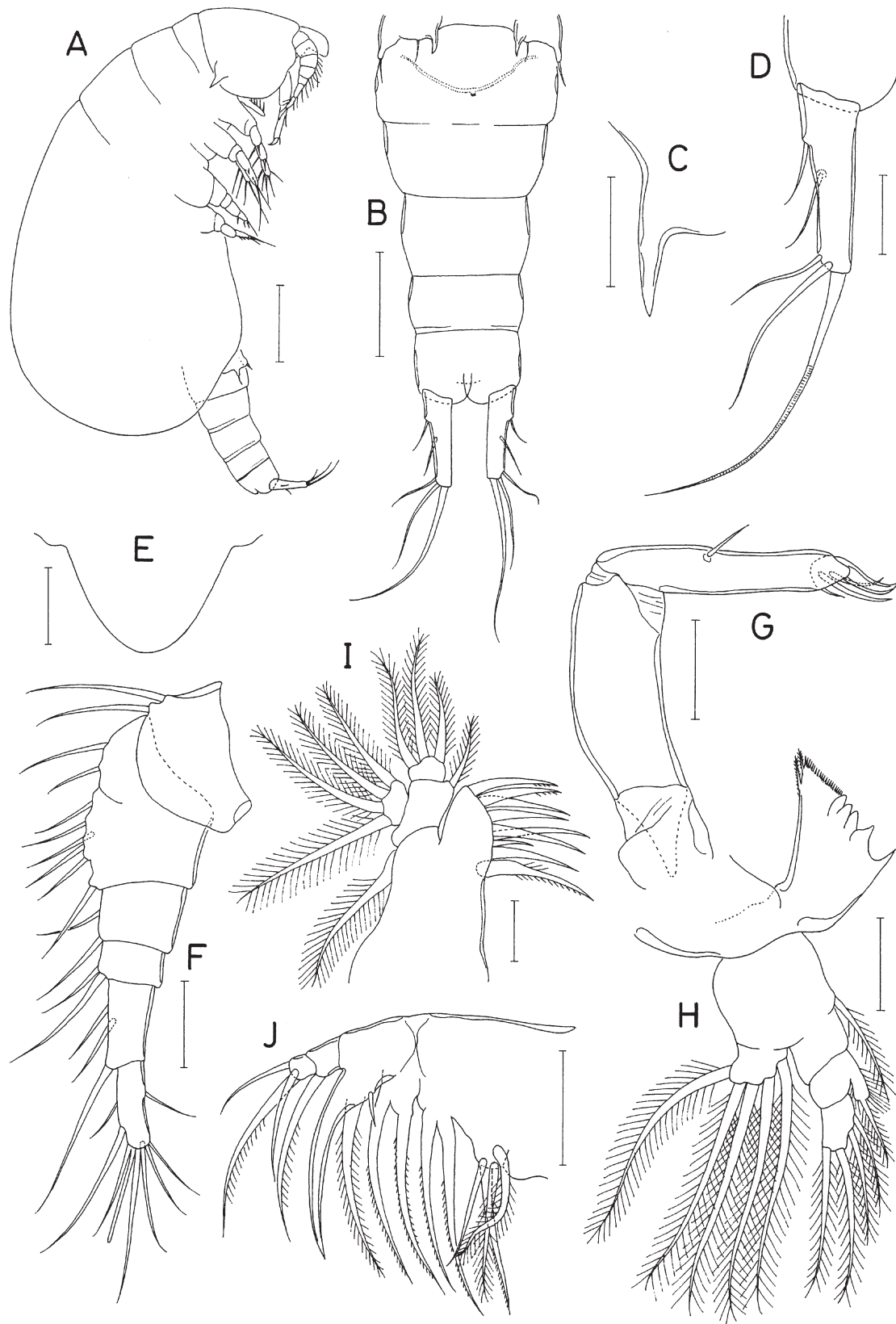
***Pentachaetus longisetatus* gen. et sp. nov.**

(Figs. 332, 333)

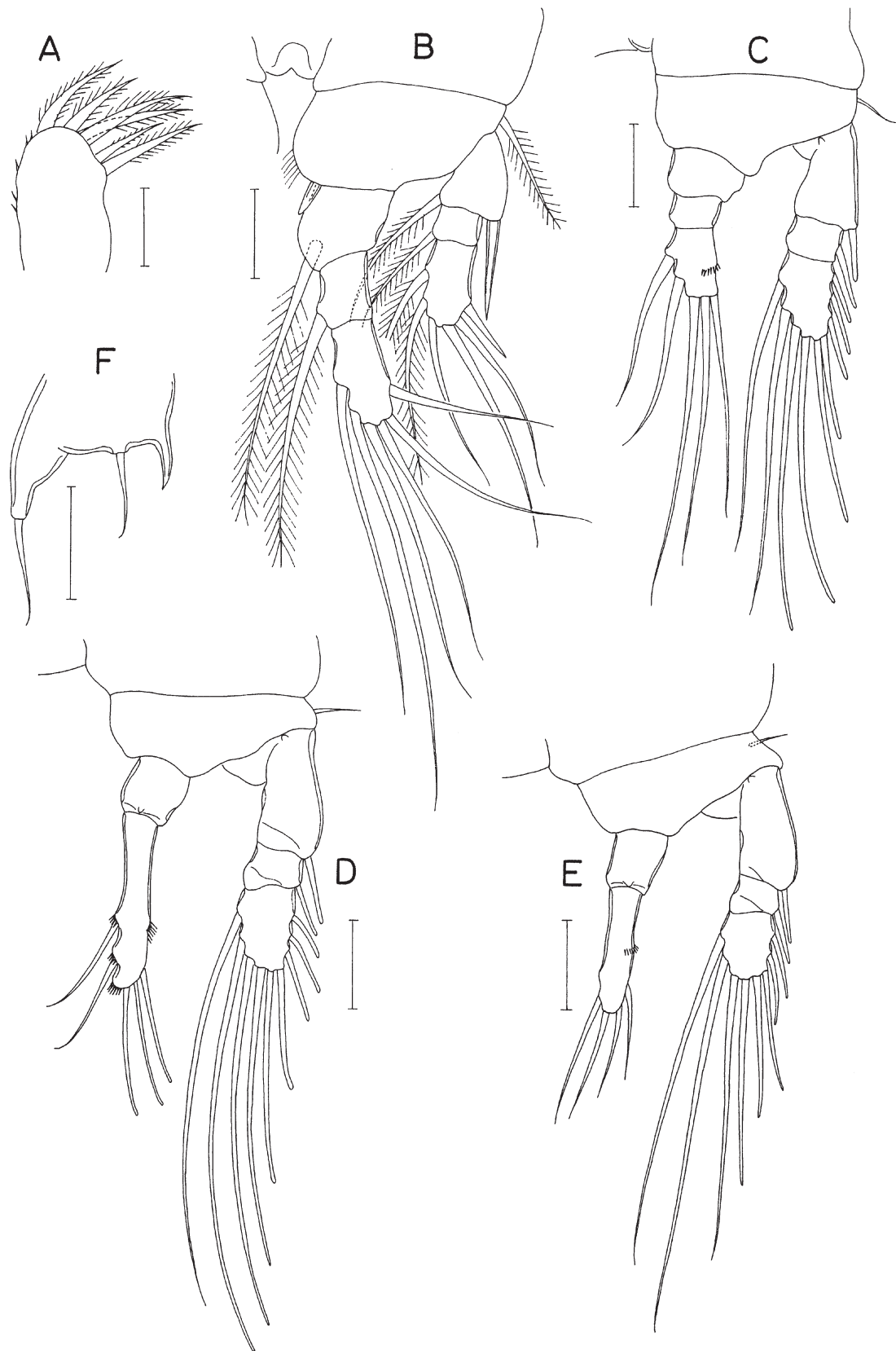
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21381), paratype (intact ♀, MNHN-IU-2014-21382), and dissected paratype (♀, figured) from *Leptoclinides* sp. (MNHN-IT-2008-4861 = MNHN A2/LEP/111), CRRF CRCHO 561, on reef slope, Baluan, Papua New Guinea (02°32,27'S, 147°17.97'E), depth 24 m, L. Martin coll., 22 June 2003.

**Etymology.** The specific name refers to the long terminal seta on the caudal ramus, which is distinctly longer than that of its congeners.

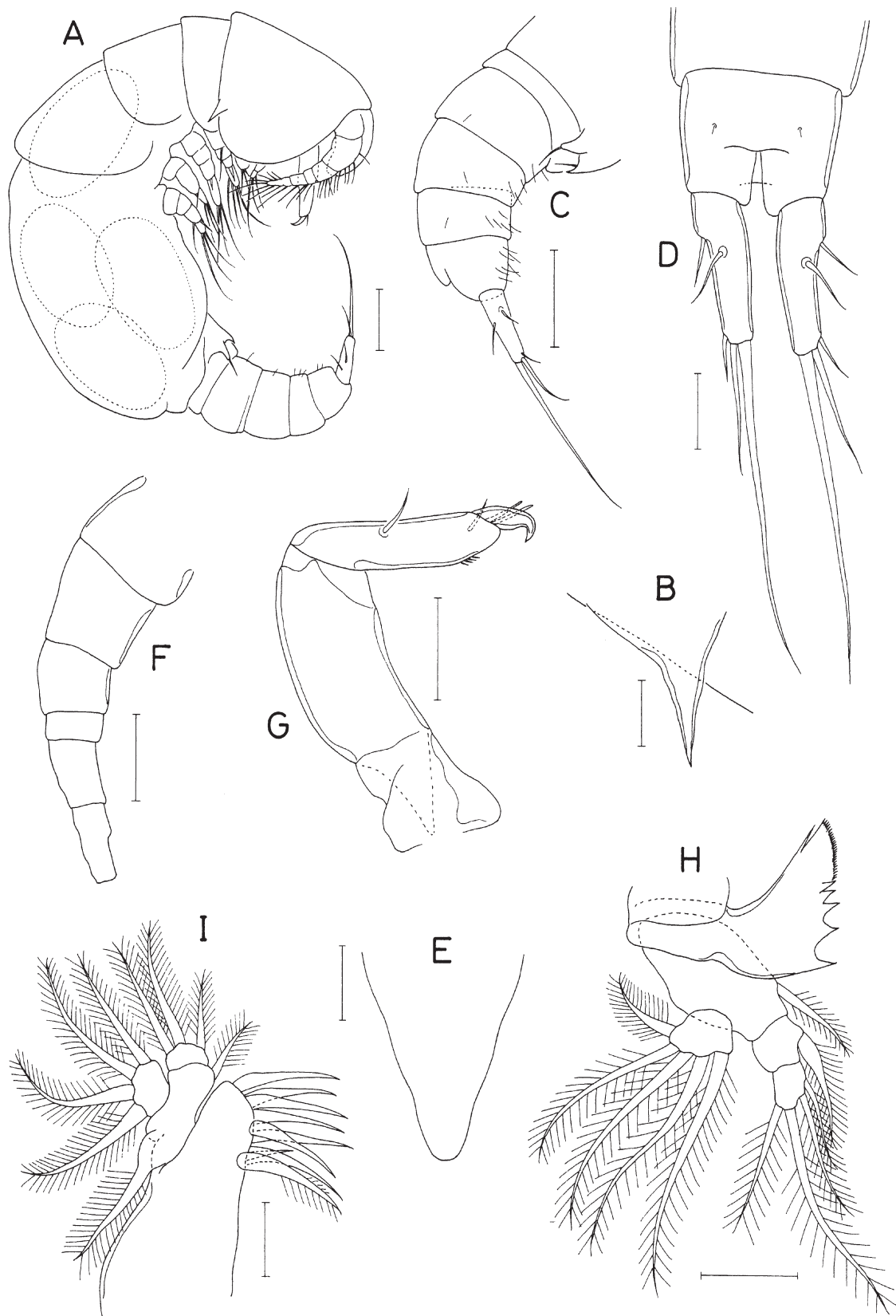
**Description of female.** Body (Fig. 332A) small, strongly curved ventrally; body length 638 µm. Prosome comprising cephalosome and 4 metasomites; dorsal cephalic shield large, bearing tapering, acutely pointed horn-like processes posterolaterally on each side (Fig. 332B). Fourth pedigerous somite not expanded; fifth pedigerous somite not defined. Free urosome (Fig. 332C) 5-segmented, curved ventrally, setulose on dorsal surface. Anal somite (Fig. 332D) 37×43 µm. Caudal ramus (Fig. 332D) about 3.2 times longer than wide (41×13 µm) and



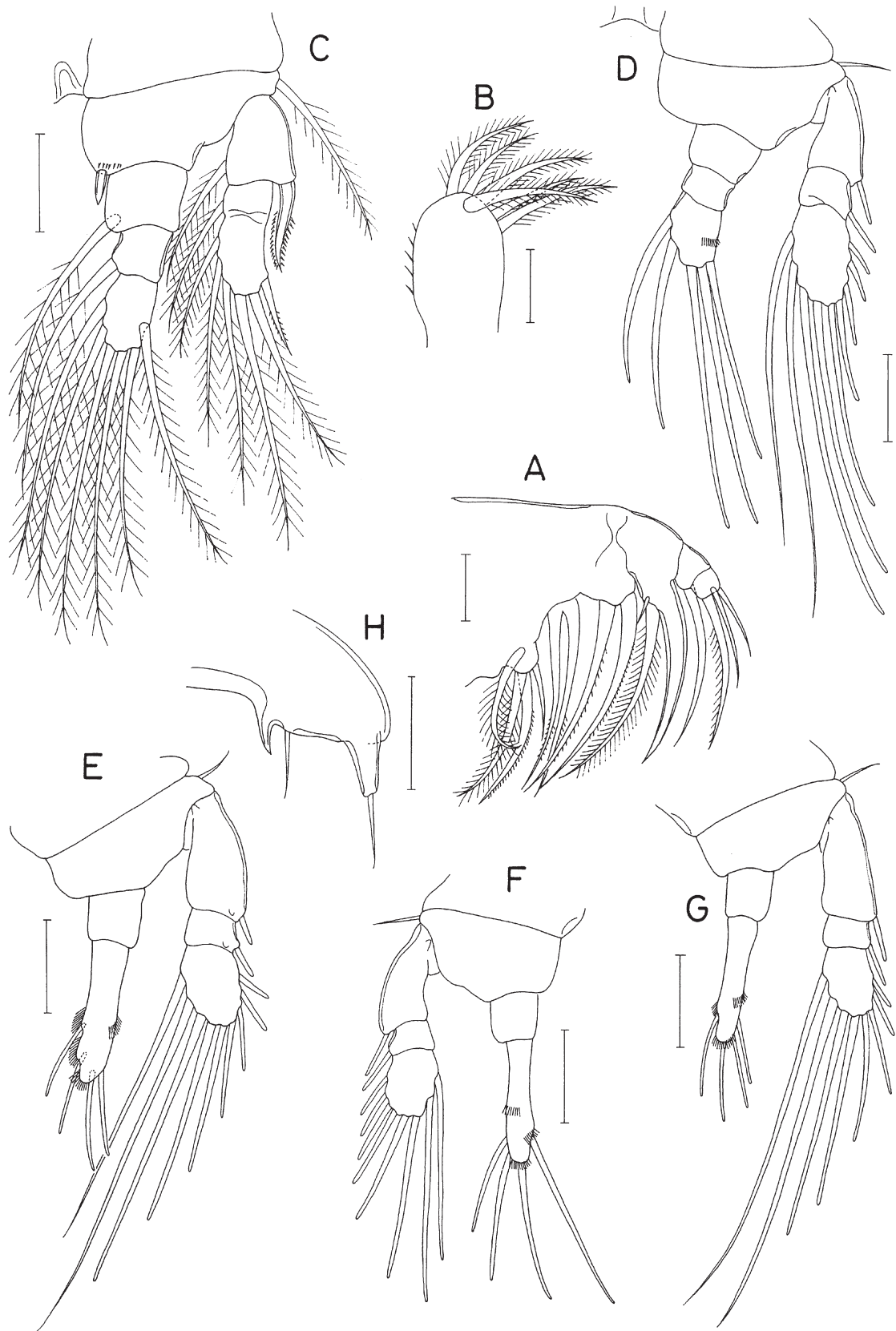
**FIGURE 330.** *Pentachaetus palauensis* gen. et sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, cephalic horn; D, left caudal ramus, dorsal; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.1 mm; B, 0.05 mm; C–H, J, 0.02 mm; I, 0.01 mm.



**FIGURE 331.** *Pentachaetus palauensis* **gen. et sp. nov.**, female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: A, 0.1 mm; B–F, 0.02 mm.



**FIGURE 332.** *Pentachaetus longisetatus* gen. et sp. nov., female. A, habitus, right; B, cephalic horn; C, leg 5 and urosome, right; D, anal somite and caudal rami, dorsal; E, rostrum; F, antennule, with setation omitted; G, antenna; H, mandible; I, maxillule. Scale bars: A, C, 0.05 mm; B, I, 0.01 mm; D–H, 0.02 mm; I, 0.01 mm.



**FIGURE 333.** *Pentachaetus longisetatus* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, right leg 4; G, left leg 4; H, leg 5. Scale bars: A, B, 0.01 mm; C–H, 0.02 mm.

slightly longer than anal somite: armed with 5 naked setae; longest distal seta 92 µm long, 2.5 times longer than second longest adjacent seta; 2 proximal setae positioned at 31 and 41% of ramus length.

Rostrum (Fig. 332E) about 1.3 times longer than wide, tapering towards blunt apex. Antennule (Fig. 332F) about 95 µm long, 6-segmented; setation indeterminable due to damage. Antenna (Fig. 332G) 3-segmented; coxa and basis unarmed; endopod 3.2 times longer than wide (32×10 µm) and as long as basis: armed with 4 setae (grouped as 1, 1, and 2) and several spinules subdistally on outer margin; terminal claw small, strongly curved.

Labrum soft, not dissected. Mandible (Fig. 332H) with broad coxal gnathobase bearing 5 pointed teeth and 1 small seta: basis with 1 seta on medial margin: exopod with 5 setae, distal 4 becoming shorter from medial to outer; outermost seta about 0.4 times as long as adjacent outer distal seta: endopod with 1 and 4 setae on first and second segments, respectively; seta on first segment markedly expanded proximally; proportional lengths of 4 setae on second segment 8:11:20:11 from medial to outer. Maxillule (Fig. 332I), maxilla (Fig. 333A), and maxilliped (Fig. 333B) armed as in *P. palauensis* **gen. et sp. nov.**

Legs 1 and 2 (Fig. 333C, D) with 3-segmented rami, but articulation incomplete between second and third exopodal segments of leg 1. Legs 3 and 4 (Fig. 333E-F) with 3-segmented exopods and 2-segmented endopods; second endopodal segment of legs 3 and 4 elongate, about 4 times longer than wide. Inner coxal seta absent in legs 1–4. Outer seta on basis large and pinnate in leg 1, but small and naked in legs 2–4. Inner distal spine on basis of leg 1 small, 7 µm long. Outer spine on first exopodal segment of leg 1 serrate, 15 µm long. Legs 2–4 slightly asymmetrical between left and right sides: setae on third exopodal segment of left leg longer than those of right leg, but setae on second endopodal segment of left leg shorter than those of left leg (cf. Fig. 333E and G). Armature formula for legs 1–4 as in *P. palauensis* **gen. et sp. nov.** except second endopodal segment of leg 3 armed with 4 setae (formula 1, 1, 2).

Leg 5 (Fig. 333H) similar to that of *P. palauensis* **gen. et sp. nov.**, but seta between outer and inner processes positioned closer to inner (exopodal) process.

**Male.** Unknown.

**Remarks.** In *P. longisetatus* **gen. et sp. nov.** the posterolateral horn-like processes on the dorsal cephalic shield taper towards an acutely pointed tip, the rostrum is elongate, the outermost seta on the mandibular exopod is short (only 0.4 times as long as the adjacent outer distal seta), and the endopod of leg 3 is armed with 4 setae. These features differentiate *P. longisetatus* **gen. et sp. nov.** from its two congeners (see Table 11).

### *Diceratus* **gen. nov.**

**Diagnosis.** Body form as in *Doroixys*. Dorsal cephalic shield bearing 2 pairs of horn-like processes posterolaterally. Free urosome 5-segmented. Rostrum well-developed. Antennule 7- or 8-segmented. Antenna 3-segmented, consisting of coxa, basis, and unsegmented endopod bearing terminal claw. Mandible with enlarged distal tooth and 1 or 2 subsidiary teeth on coxal gnathobase; basis with 1 seta on medial margin; exopod with 5 setae; endopod with 1 and 7 setae on first and second segments, respectively. Maxillule with 5 or 6 setae on arthrite, 1 on epipodite, 2 on basis, 4 on exopod and 3 on endopod; coxal endite absent. Maxilla 4-segmented, armed with 3, 2, and 2 setae on first to third syncoxal endites, respectively, strong claw plus 2 setae on basis, and with 1 and 3 setae on first and second endopodal segments, respectively. Maxilliped unsegmented with 2 setae. Legs 1–4 biramous. Inner coxal seta absent in legs 1–4. Leg 1 with inner distal seta on basis; endopod 2- or 3-segmented; exopod with 2, 2, and 7 armature elements on first to third segments, respectively. Legs 2–4 with 3-segmented rami; first and second segments of exopods and endopods lacking inner setae. Leg 5 consisting of digitiform outer protopodal process tipped with 1 seta, and claw-like inner exopodal process bearing 1 seta on outer margin.

**Etymology.** The generic name is derived from the Greek *di* (=double) and *cerat* (=horn), referring to the presence of the double posterolateral processes on the dorsal cephalic shield.

**Type species.** *Diceratus unidentatus* **gen. et sp. nov.** by original designation.

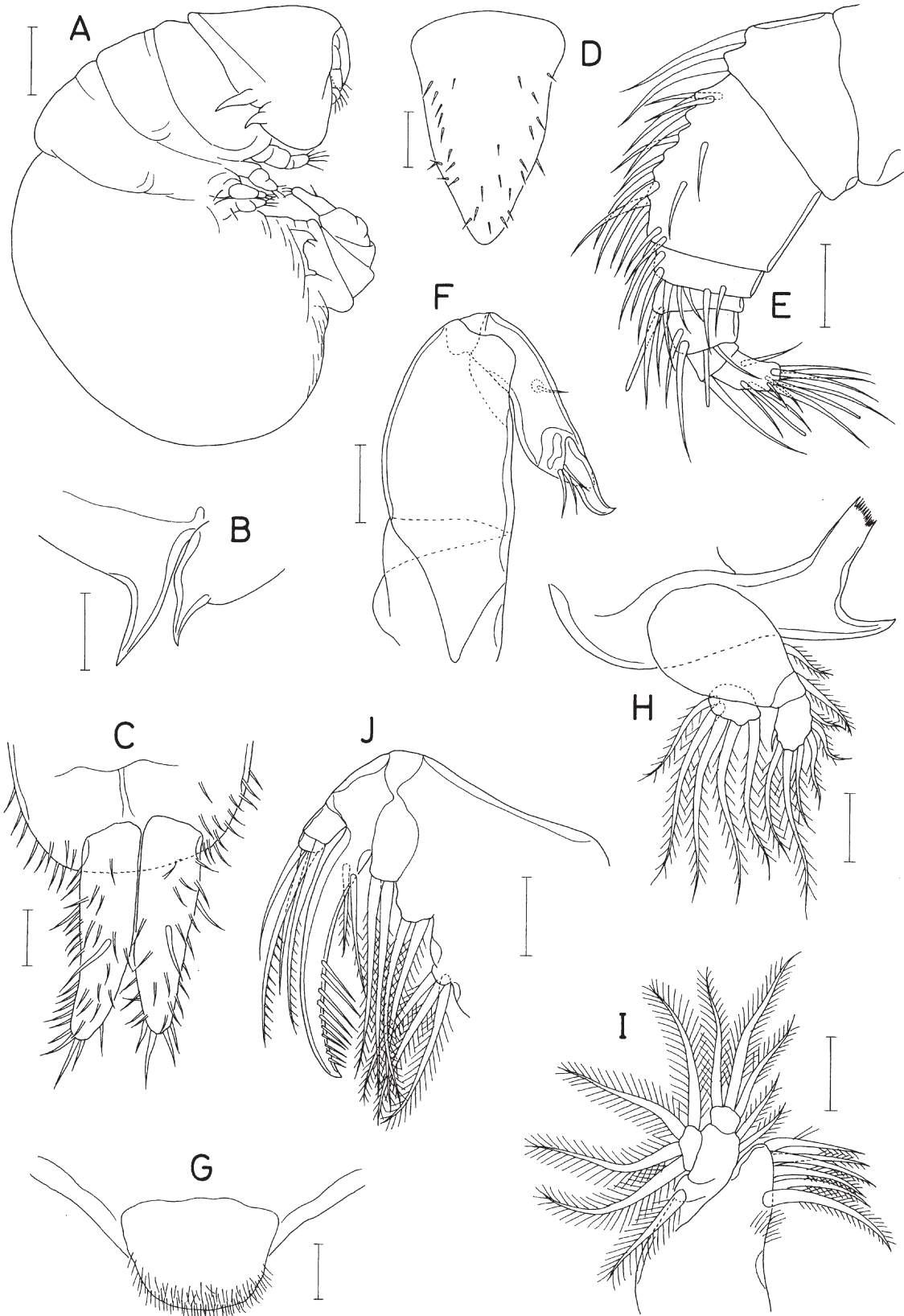
**Other included species.** *Diceratus bispinosus* (Ooishi, 1998) **comb. nov.** (originally described as *Doroixys bispinosa* Ooishi, 1998)

**Remarks.** Ooishi (1998) originally placed *Diceratus bispinosus* (Ooishi, 1998) **comb. nov.** in the genus *Doroixys*. Detailed comparison of this species with the newly discovered *Diceratus unidentatus* **gen. et sp. nov.** reveals that they share numerous distinctive features which justify their placement in an independent new genus. The shared features of these two species include the presence of two pairs of cephalic processes, the enlarged distal tooth on the coxal gnathobase of the mandible, the presence of 2 setae on the basis of the maxillule, and the presence of only 2 setae on the maxilliped.

### *Diceratus unidentatus* **gen. et sp. nov.**

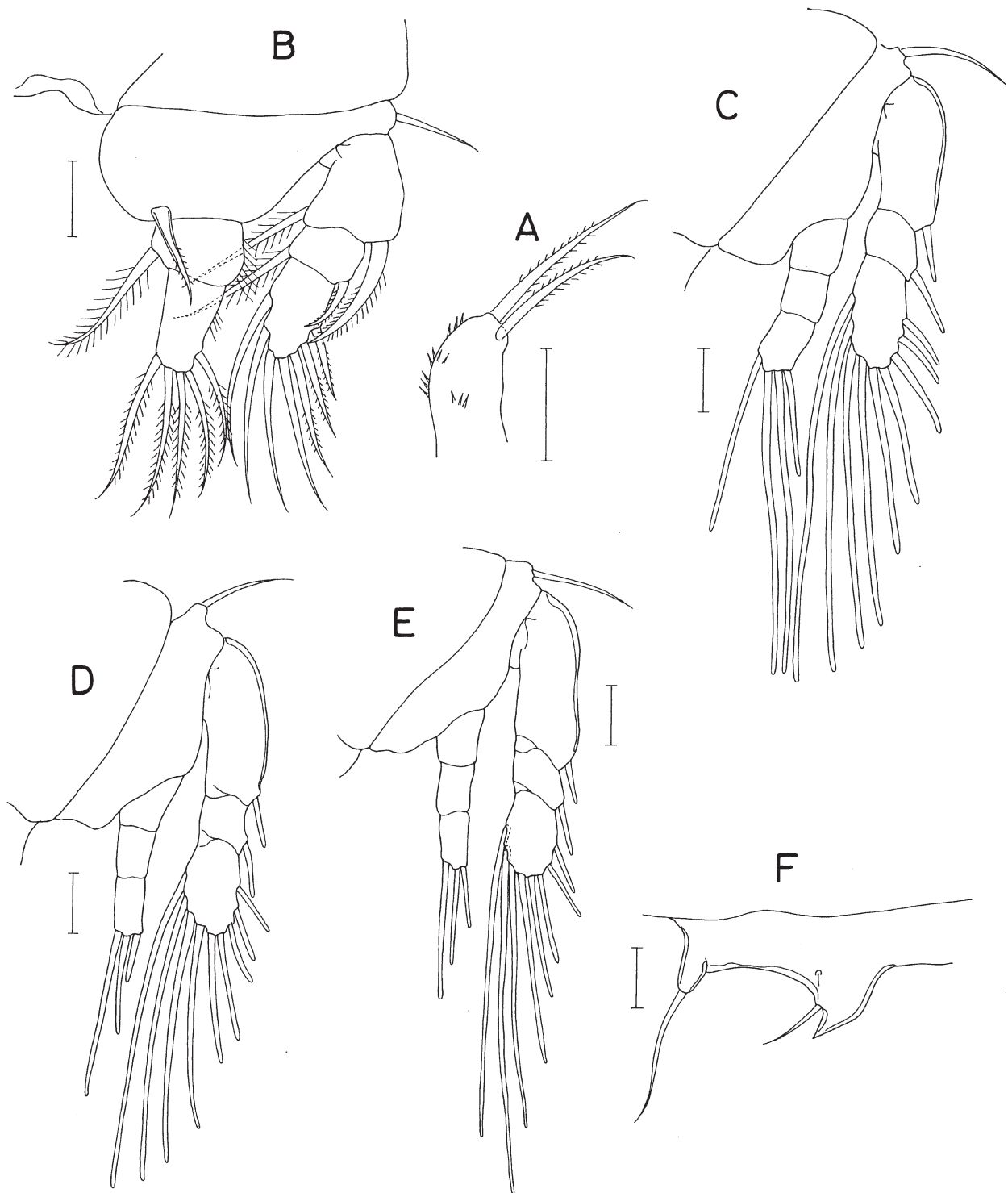
(Figs. 334, 335)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21383) and dissected paratype (♀, figured) from *Eudistoma hepaticum* (Van Name, 1921) (MNHN-IT-2008-4067 = MNHN A3/EUD/18), west of Îlet a Cochons, Guadeloupe, depth 1–5 m, 01 January 1981.



**FIGURE 334.** *Diceratus unidentatus* gen. et sp. nov., female. A, habitus, right; B, cephalic horns; C, caudal rami, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.1 mm; B, 0.05 mm; C–I, 0.02 mm.





**FIGURE 335.** *Diceratus unidentatus* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4; F, leg 5. Scale bars: 0.02 mm.

**Etymology.** The specific name is a combination of the Latin *uni* (=one) and *dentat* (=toothed), referring to the single tooth on the coxal gnathobase of the mandible.

**Description of female.** Body (Fig. 334A) stout, strongly curved ventrally; body length 1.12 mm. Dorsal cephalic shield expanded ventrolaterally, with 2 pairs of

horn-like processes posterolaterally (Fig. 334B); ventral process smaller than dorsal. Metasome 4-segmented: fourth pedigerous somite inflated, as long as anterior part of prosome. Free urosome recurved ventrally, 5-segmented. Anal somite and caudal rami densely covered with ornamentation of thick setules. Caudal rami (Fig.

334C) originating close to each other, elongate, about 3.5 times longer than wide (80×23 μm): armed with 6 setae, but setae hardly discernible from setules; 2 proximal setae positioned at 36 and 50% of ramus length.

Rostrum (Fig. 334D) large, longer than wide (86×55 μm), gently tapering in proximal two-thirds and steeply tapering in distal third towards blunt apex, ornamented with many surface setules (or spinules). Antennule (Fig. 334E) strongly tapering, 7-segmented; armature formula 2, 16, 7, 3+aesthetasc, 3+aesthetasc, 1, and 10+2 aesthetascs; setae naked, crowded, and relatively short. Antenna (Fig. 334F) stout, 3-segmented; coxa and basis unarmed; endopod 41×15 μm, 0.67 times as long as basis, armed with 1 seta in middle and 3 setae distally plus weakly curved terminal claw, less than half length of endopod.

Labrum (Fig. 334G) strongly tapering, with soft, setulose distal part. Mandible (Fig. 334H) with coxal gnathobase forked into strong distal tooth widely separated from narrow proximal branch provided with pectinate distal margin: basis with 1 seta on medial margin: exopod with 4 or 5 setae (outermost seta present or absent, if present, only half as long as other 4 setae): endopod with 1 and 7 setae on first and second segments, respectively; setae on second segment unequal, outer margin seta very small, spinule-like, distalmost seta (fifth seta) much longer than others. Maxillule (Fig. 334I) with 6 setae on arthrite, 1 on epipodite, 2 on basis, 4 on exopod and 3 (middle seta longest) on endopod; coxal endite absent. Maxilla (Fig. 334J) 4-segmented; syncoxa with 3, 2, and 2 setae on first to third endites, respectively; basis with 2 small setae and large claw ornamented with large spinules along distal half of concave margin; endopod small with 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 335A) small, unsegmented, armed with 2 setae distally, ornamented with spinules mainly on outer surface.

Leg 1 (Fig. 335B) with 3-segmented exopod and 2-segmented endopod; second endopodal segment armed with only 5 setae; inner and distal setae on third exopodal segment naked, all other setae on both rami feebly pinnate. Legs 2–4 (Fig. 335C–E) with 3-segmented rami; endopods shorter than exopods. Inner coxal seta absent in legs 1–4. Outer seta on basis of legs 1–4 naked and uniformly sized. Basis of leg 1 with broad inner distal seta. Outer spine on first exopodal segment of leg 1 arched, large, 36 μm long, extending to base of second outer armature element of third segment. All setae on rami of legs 2–4 naked and bluntly tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	1-1; 1-1; 3, 1, 3	0-1; 1, 2, 2
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 2
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 0-0; 0, 2, 1
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 0-0; 0, 2, 1

Leg 5 (Fig. 335F) positioned posteroventrally on somite, represented by outer digitiform protopodal process tipped with seta and inner, pointed exopodal process bearing small seta on outer margin.

**Male.** Unknown.

**Remarks.** The differences between the type species *Diceratus unidentatus* **gen. et sp. nov.** and *D. bispinosus* (Ooishi, 1998) **comb. nov.** include: (1) the apex of the rostrum is blunt in the type species (vs. acutely pointed in *D. bispinosus*); (2) the caudal ramus is elongate, about 3.5 times longer than wide in *Diceratus unidentatus* **gen. et sp. nov.** (vs. at most 3.0 times longer than wide in *D. bispinosus*, measured from the original illustration); (3) the coxal gnathobase of the mandible bears only 1 major tooth (vs. 1 major and 1 or 2 subsidiary teeth in *D. bispinosus*); (4) the maxillular arthrite bears 6 setae (vs. 4 or 5 setae in *D. bispinosus*); (5) the endopod of leg 1 is 2-segmented (vs. 3-segmented in *D. bispinosus*); and (6) the third endopodal segment of leg 2 is armed with 4 setae (vs. 3 setae in *D. bispinosus*).

### *Prodoroiixys* **gen. nov.**

**Diagnosis.** Body form as in *Doroiixys*, stout, moderately inflated. Dorsal cephalic shield with or without posterolateral horn-like processes. Metasome unsegmented or indistinctly segmented; fifth pedigerous somite fused with fourth. Free urosome 5-segmented. Caudal ramus with 6 setae. Rostrum well-developed. Antennule 9-segmented; first segment armed with 2 setae. Antenna 4-segmented with 2-segmented endopod. Mandible with broadened medial margin of coxal gnathobase bearing 5 or 6 teeth; exopod with 5 setae; endopod with 1 seta on first segment and 5 to 7 setae on second. Maxillule with 9 or 10 setae on arthrite, 1 each on coxal endite and epipodite, 2 on basis, 4 on exopod and 3 on endopod. Maxilla 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with claw plus 2 setae; endopod 3-segmented with 1, 1, and 3 (or 4) setae on first to third segments, respectively. Maxilliped unsegmented, armed with more than 6 setae. Legs 1–3 with 3-segmented rami. Leg 4 with 3-segmented exopod and 2- or 3-segmented endopod. Leg 1 basis with inner distal spine. First and second segments of exopod and endopod of legs 1 and 2 with inner setae. First endopodal segment of leg 3 also with inner seta. Leg 5 rudimentary.

**Type species.** *Prodoroiixys antarctica* **gen. et sp. nov.** by original designation.

**Other included species.** *Prodoroiixys bathybia* **gen. et sp. nov.**

**Etymology.** The name of the new genus is derived from *pro* (“before” in Greek) and the generic name *Doroiixys*, and alludes to the relatively primitive character states exhibited by the new genus in comparison with *Doroiixys*. Gender feminine.

**Remarks.** The new genus is readily separated from *Doroixys* and *Loboixys* by the more plesiomorphic state of the armature of the oral appendages. It has 2 setae on the basis of the maxillule (only 1 in *Doroixys* and *Loboixys*), a 3-segmented endopod on the maxilla (2-segmented in *Doroixys* and 1- or 2-segmented in *Loboixys*), and an inner seta on the first and second segments of the 3-segmented exopods of legs 1 and 2 (seta missing from at least some of these segments). The new genus is similar to *Notoixys* **gen. nov.** (see below) in the degree of complexity of the armature of oral appendages, but can be distinguished from the latter genus by the broad cutting margin of the mandibular coxa (vs. narrow in *Notoixys* **gen. nov.**), by the presence of a seta-tipped coxal endite of the maxillule (vs. lacking in *Notoixys* **gen. nov.**), and only 2 setae on the maxilliped (vs. 3 or more in *Notoixys* **gen. nov.**).

***Prodroixys antarctica* gen. et sp. nov.**

(Figs. 336, 337)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21384), paratypes (5 intact ♀♀, MNHN-IU-2014-21385), and dissected paratypes (2 ♀♀, figured) from *Synoicum salivum* Monniot F. & Gaill, 1978 (MNHN-IT-2008-8621 = MNHN A1/SYN/28), Kerguelen Islands, MD04 DR106 (49°00'18"S, 67°30'42"E), "Marion Dufresne", depth 206 m, Boury-Esnault coll., 01 March 1975.

**Additional material.** 13 ♀♀ (MNHN-IU-2018-1906) and 1 dissected ♀ from *Synoicum* sp., Kerguelen Islands, MD 04 DR 106; 17 ♀♀ (MNHN-IU-2018-1907) from *Aplidium* sp., Kerguelen Islands, MD 03 Pr 61; 14 ♀♀ (MNHN-IU-2018-1908) from *Synoicum* sp., Kerguelen Islands. MD 04 DR 106.

**Etymology.** The specific name of the new species refers to its distribution in the Antarctic.

**Description of female.** Body (Fig. 336A) similar to typical *Doroixys*, 1.09 mm long. Prosome 0.89 mm long, relatively narrow; dorsal cephalic shield distinctly defined, with acutely pointed posterolateral horn-like process on each side. Metasome unsegmented, distinctly longer than wide, gradually broadening posteriorly; fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 336B) 5-segmented: genital somite distinctly longer and wider than abdominal somites. Surface of abdominal somites densely ornamented with setules. Caudal ramus (Fig. 336C) about 2.3 times longer than wide (68×30 µm) and as long as anal somite; ornamented with numerous setules: armed with 6 setae, 2 proximal setae positioned at 46% and 60% of ramus length; 4 distal setae blunt at tip; all caudal setae shorter than ramus width.

Rostrum (Fig. 336D) 100×74 µm, tapering, setulose distally, slightly constricted at proximal third; apex rounded. Antennule (Fig. 336E) 154 µm long, 9-segmented; third segment with traces of 2 articulations; armature formula 2, 17, 5, 3+aesthetasc, 3, 2+aesthetasc, 2,

2+aesthetasc, and 7+aesthetasc; setae crowded, all naked. Antenna (Fig. 336F) 4-segmented; proximal 3 segments short and unarmed, terminal (second endopodal) segment longest, 2.5 times longer than wide (45×18 µm); armed with 10 setae (arranged as 1, 1, 3, 2, and 3) plus terminal claw less than half length of segment.

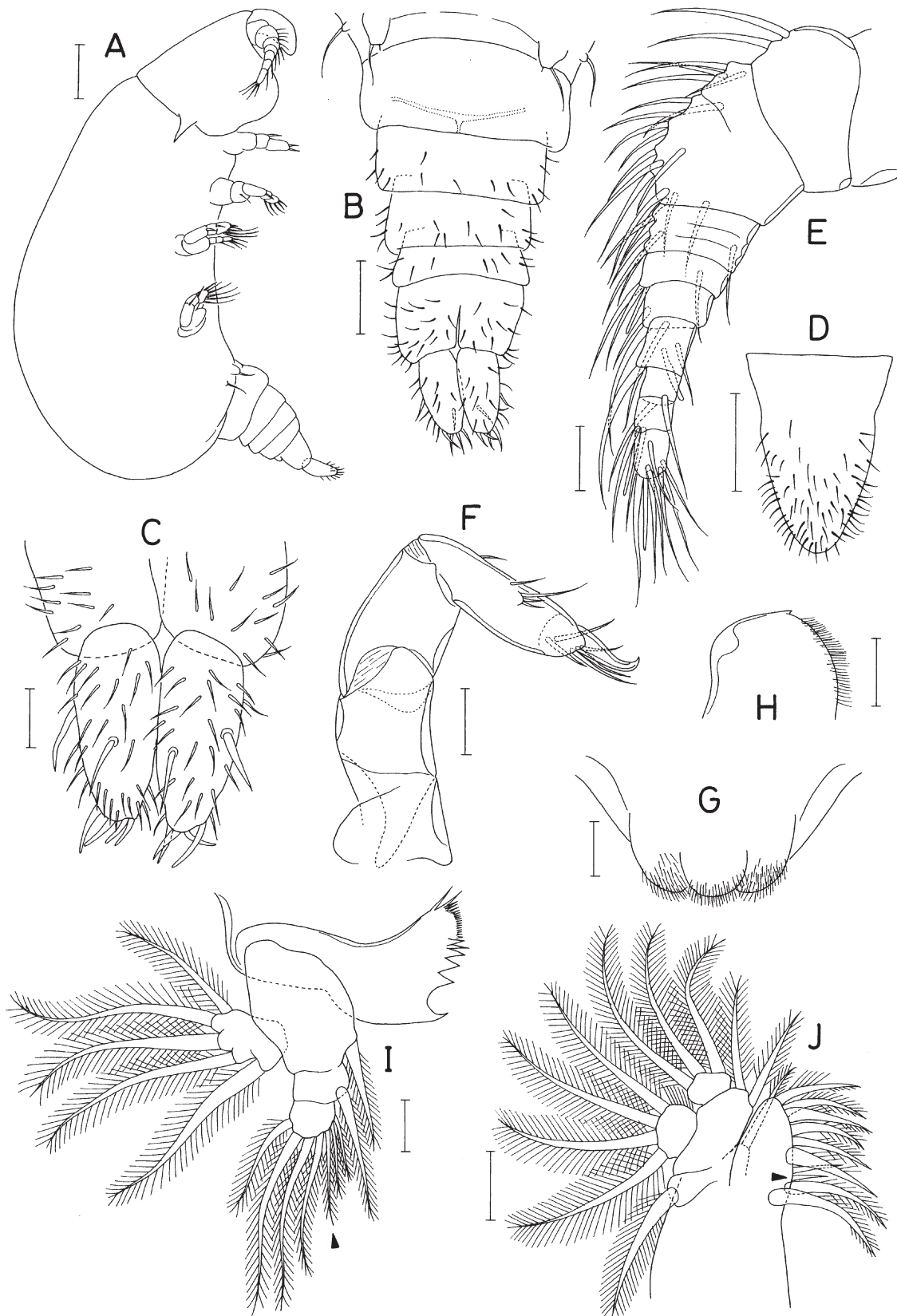
Labrum (Fig. 336G) with densely setulose posterior margin and posteromedial lobe. Mandible (Fig. 336I) with 6 acute teeth and 2 small setae on coxal gnathobase: basis with 1 seta medially; exopod with 5 setae, shortest outer seta about 0.6 times as long as adjacent distal seta; endopod 2-segmented; first segment with 1 seta; second segment with 6 or 7 setae, third medial seta (indicated by arrowhead in Fig. 336I) present or absent. Paragnath (Fig. 336H) lobate, bearing small tooth apically and setules on medial surface. Maxillule (Fig. 336J) armed with 9 or 10 setae on arthrite (small seta indicated by arrowhead present or absent), 1 each on coxal endite and epipodite, 2 on basis, 4 on exopod and 3 on endopod; setae on exopod and endopod subequal in length. Maxilla (Fig. 337A) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with slender claw plus 2 unequal setae; endopod with 1, 1, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 337B, C) unsegmented elongate lobe, bearing 6 to 9 setae (3 to 6 medial and 2 or 3 apical).

Legs 1–3 (Fig. 337D–F) with 3-segmented rami. Leg 4 (Fig. 337G) with 3-segmented exopod and 2-segmented endopod. Endopods shorter than exopods; endopods of legs 3 and 4 small, less than half length of exopod. Inner coxal seta present only on leg 1. Inner distal spine on basis of leg 1 bilaterally serrate, 20 µm long. All setae on rami of legs 2–4 bluntly tipped. First and second exopodal segments of legs 3 and 4 lacking inner seta. Second endopodal segment of leg 3 and first endopodal segment of leg 4 lacking inner seta. Number of inner setae on second endopodal segment of leg 2 variable, 1 or 2 (usually 1, indicated by arrowhead in Fig. 337E). Number of setae on second endopodal segment of leg 4 (Fig. 337G, H) also variable, 2 to 4 (usually 3). Armature formula for legs 1–4 as follows:

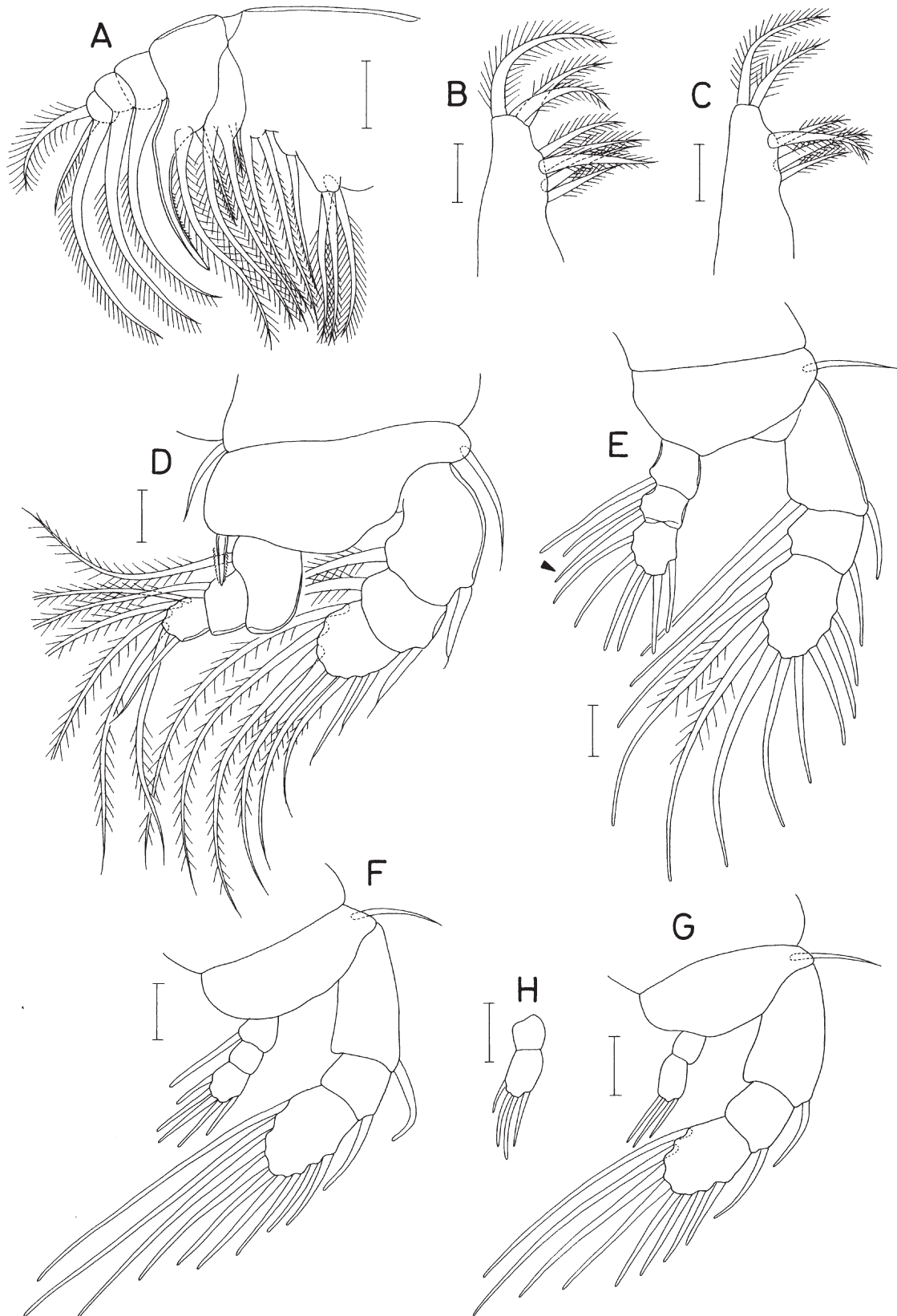
	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	1-1; 1-1; 3, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-1 (or 0-2); 1, 2, 3
Leg 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-1; 0-0; 1, 2, 2
Leg 4	0-0	1-0	1-0; 1-0; 3, 1, 4	0-0; 1, 2, 0 (or 1, 2, 1 or 0, 2, 0)

Leg 5 (Fig. 336B) located posteroventrally on somite and represented by outer protopodal papilla tipped with 1 seta and inner exopodal lobe tipped with 1 seta and 1 minute setule.

**Male.** Unknown.



**FIGURE 336.** *Prodoxixys antarctica* gen. et sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, caudal rami, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, paragnath; I, mandible (marked seta absent in some specimens); J, maxillule (marked seta absent in some specimens). Scale bars: A, 0.1 mm; B, D, 0.05 mm; C, E–J, 0.02 mm.



**FIGURE 337.** *Prodoroiyxys antarctica* gen. et sp. nov., female. A, maxilla; B, C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4; H, endopod of leg 4. Scale bars: 0.02 mm.

**Remarks.** The armature of the second endopodal segment of the mandible, the arthrite of the maxillule, the maxilliped, and the endopods of legs 2 and 4 of the new species are variable, and are not robust taxonomic characters.

***Prodroixys bathybia* gen. et sp. nov.**

(Figs. 338, 339)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21386) from unknown host, BIOGAS 4 DS63, Atlantic, Golfe de Gascogne, “Jean Charcot” (47°33’N, 08°35’W), depth 2126 m, IFREMER coll., 26 February 1974.

**Etymology.** The specific name is derived from the Greek words *bath* (=deep) and *bio* (=life), referring to the discovery of the new species in the deep sea (2126 m).

**Description of female.** Body (Fig. 338A) small, not swollen; body length 875 µm. Prosome 675 µm long: dorsal cephalic shield large, lacking posterolateral processes, but with posterolateral corners produced, nipple-shaped. First to fourth pedigerous somites discernible by 3 dorsal constrictions on metasome; fourth pedigerous somite containing large eggs inside. Fifth pedigerous somite not defined. Free urosome (Fig. 338B) 5-segmented: genital and 4 abdominal somites 34×120, 47×119, 37×108, 28×94, and 51×81 µm, respectively. Caudal rami directed posteriorly, gently narrowing distally; each ramus (Fig. 338C) about 4.2 times longer than wide (83×20 µm), and ornamented with thin setules mainly on outer surface: armed with 6 setae (outer lateral, dorsal, and 4 subdistal), outer distal and dorsal setae positioned at 36 and 45% of ramus length; all setae naked and shorter than width of ramus at base.

Rostrum (Fig. 338D) large, 70×44 µm, tapering evenly towards blunt apex. Antennule (Fig. 338E) 130 µm long, 9-segmented; armature formula 2, 13, 6, 5, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc. Antenna (Fig. 338F) stout, 4-segmented; proximal 3 segments unarmed; terminal segment about 2.5 times longer than wide (37×15 µm) and as long as first endopodal segment: armed with 8 setae (arranged as 1, 2, 2, and 3) plus terminal claw more than half length of segment.

Labrum (Fig. 338G) with setulose posterior margin and posteromedial lobe. Mandible (Fig. 338H) with broadened coxal gnathobase bearing 5 teeth and 1 small seta: basis with 1 seta on medial margin: exopod with 5 large, equal setae: endopod with 1 and 5 setae on first and second segments, respectively. Paragnath (Fig. 338I) as small lobe bearing 1 denticle apically and setules on medial margin. Maxillule (Fig. 338J) armed with 9 setae on arthrite, 1 each on coxal endite and epipodite, 2 on basis, 4 on exopod, and 3 on endopod. Maxilla (Fig. 338K) 5-segmented; syncoxa with 3, 1, 2, and 3 setae on first to fourth endites, respectively; basis with smooth claw plus 2 setae; endopod with 1, 1,

and 4 naked setae on first to third segments, respectively. Maxilliped (Fig. 339A) unsegmented, armed with 10 setae (8 medial and 2 apical).

Legs 1–4 biramous with distinctly 3-segmented rami (Fig. 339B–D). Inner coxal seta absent in legs 1–4. Exopodal segments of legs 1–3 bearing outer spines, but exopod of leg 4 with bluntly tipped setae. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	I-1; I-1; III, 1, 4	0-1; 0-1; 1, 2, 2
Legs 2 & 3	0-0	1-0	I-1; I-1; III, I, 5	0-1; 0-1; 1, 2, 2
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-1; 0, 2, 2

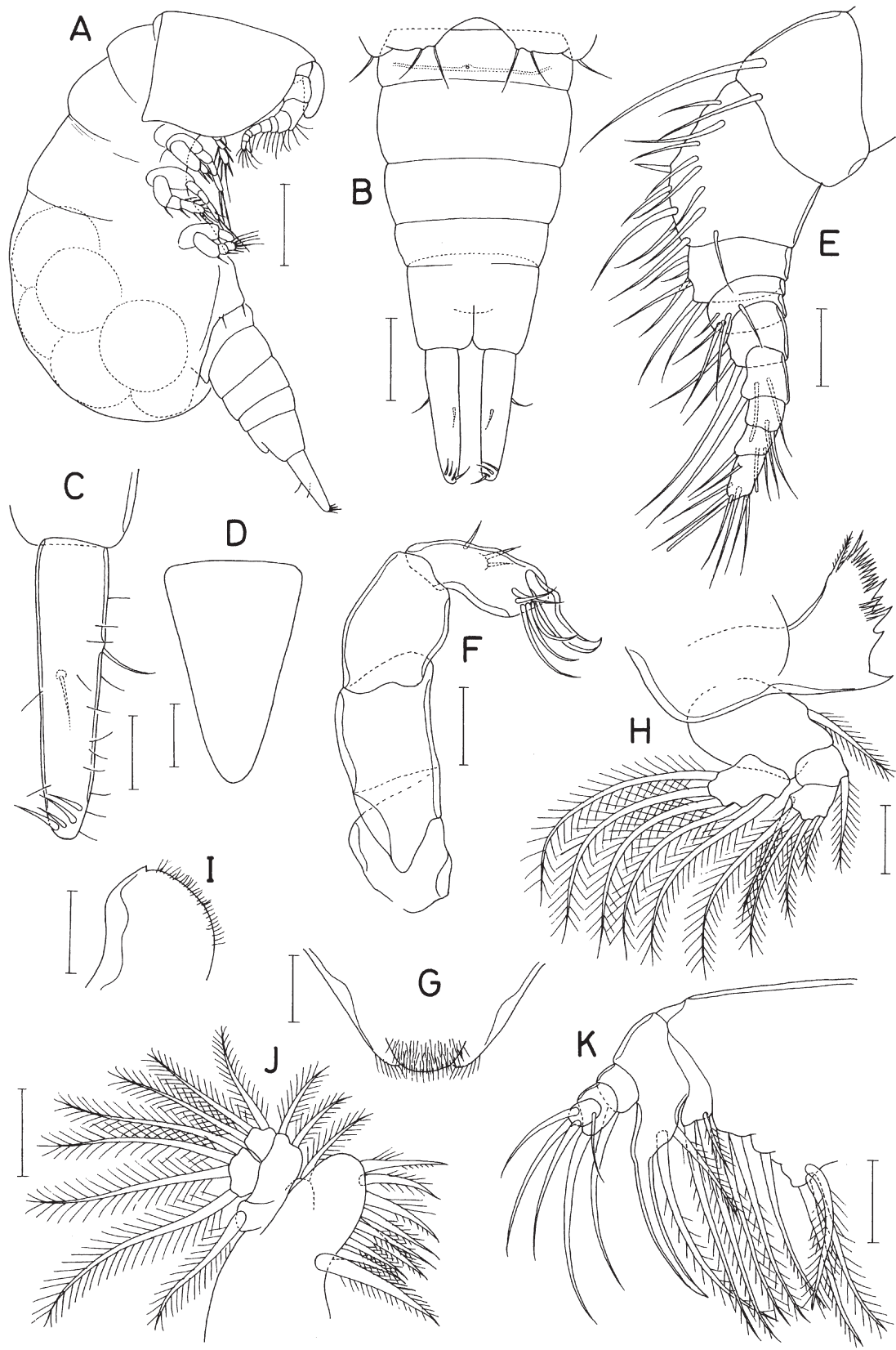
Leg 5 (Fig. 338B) represented by 2 indistinct lobes of posteroventral margin of somite; inner exopodal lobe tipped with 2 setae and outer protopodal lobe with 1 seta.

**Male.** Unknown.

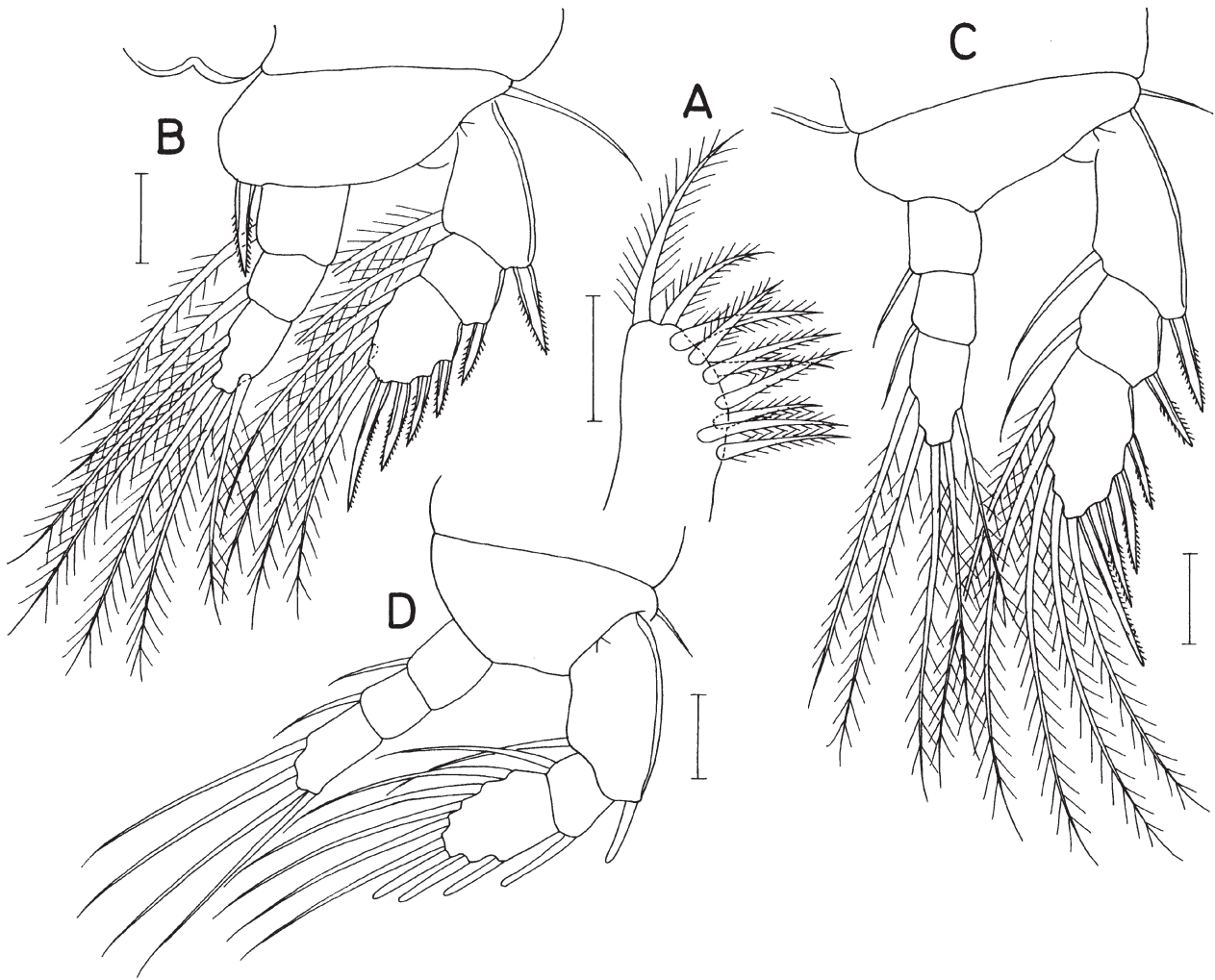
**Remarks.** The major differences between *Prodroixys bathybia* gen. et sp. nov. and *P. antarctica* gen. et sp. nov. are the more slender caudal rami in the former, the presence of 5 setae on the second endopodal segment of the mandible (cf. 6 or 7 in the type species), 4 setae on the third endopodal segment of the maxilla (cf. 3 in the type species), 10 setae on the maxilliped (cf. 6 to 9 setae in the type species), the absence of an inner coxal seta on leg 1 (cf. present in the type species), and the different armature states of the posterior swimming legs.

***Notoixys* gen. nov.**

**Diagnosis.** Body inflated, usually with unsegmented, globular metasome. Dorsal cephalic shield expanded ventrolaterally, with paired horn-like processes posterolaterally. Fifth pedigerous somite completely fused with fourth. Free urosome 5-segmented. Caudal setae small or absent. Rostrum well-developed. Antennule 7- to 10-segmented. Antenna 4-segmented with 2-segmented endopod bearing small terminal claw. Mandible with coxal gnathobase bearing narrow medial cutting margin; armed with 1 seta on basis, 5 setae on exopod, 1 seta on first endopodal segment, and 4 to 7 setae on second. Maxillule armed with 5 or 6 setae on arthrite, 1 seta on epipodite, 1 or 2 setae on basis, 4 setae on exopod, and 3 setae on endopod; coxal endite absent. Maxilla 5-segmented with 3-segmented endopod; syncoxa bearing 4 endites; basis with 3 setae (or 2 setae plus claw). Maxilliped as unsegmented lobe bearing 3 to 5 setae. Legs 1–4 biramous; segmentation of rami frequently incompletely expressed. Inner coxal seta present at least in leg 1. Leg 1 with inner distal element on basis; exopod 3-segmented, with inner seta on first and second segments, and 7 or 8 setae on third segment. Leg 2 exopod 3-segmented, with inner seta on first and second segments. Exopods of legs



**FIGURE 338.** *Prodoiroixys bathybia* gen. et sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule; K, maxilla. Scale bars: A, 0.1 mm; B, 0.05 mm; C–K, 0.02 mm.



**FIGURE 339.** *Prodoroiixys bathybia* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 4. Scale bars: 0.02 mm.

3 and 4 usually with inner seta on first or second, or both segments. Endopods of legs 2–4 usually with inner seta on first or second, or both segments. Leg 5 rudimentary or absent.

**Type species.** *Notoixys heardensis* gen. et sp. nov. by original designation.

**Other included species.** *Notoixys hirsuta* gen. et sp. nov., *N. ovata* gen. et sp. nov. and *Notoixys planiceps* gen. et sp. nov.

**Etymology.** The generic name is derived from the combination of *noto* (=“south” in Greek) and *-ixys*, the ending of several existing genera of the Notodelphyidae. The name alludes to the zoogeographic distribution of the new genus in the Antarctic or Southern Ocean.

**Remarks.** *Notoixys* gen. nov. can be distinguished from *Loboixys* and *Doroixys* by the more complex state of the armature on the oral appendages and swimming legs. Unlike the latter two genera, *Notoixys* gen. nov. has a 3-segmented endopod in the maxilla (cf. 2-segmented in *Doroixys* and 1- or 2-segmented in *Loboixys*), and a narrow

cutting edge on the coxal gnathobase in the mandible (vs. broad medial margin in *Doroixys* and *Loboixys*). It also differs from *Loboixys* in having an inner seta on the first and second exopodal segments of legs 1 and 2, whereas setae on these segments are lacking in *Loboixys*. It also differs from *Doroixys* in having an inner seta on the proximal segment(s) of endopods of legs 2–4 (vs. lacking in *Doroixys*) and it lacks a tapering (exopodal) process on leg 5 which is present in *Doroixys*.

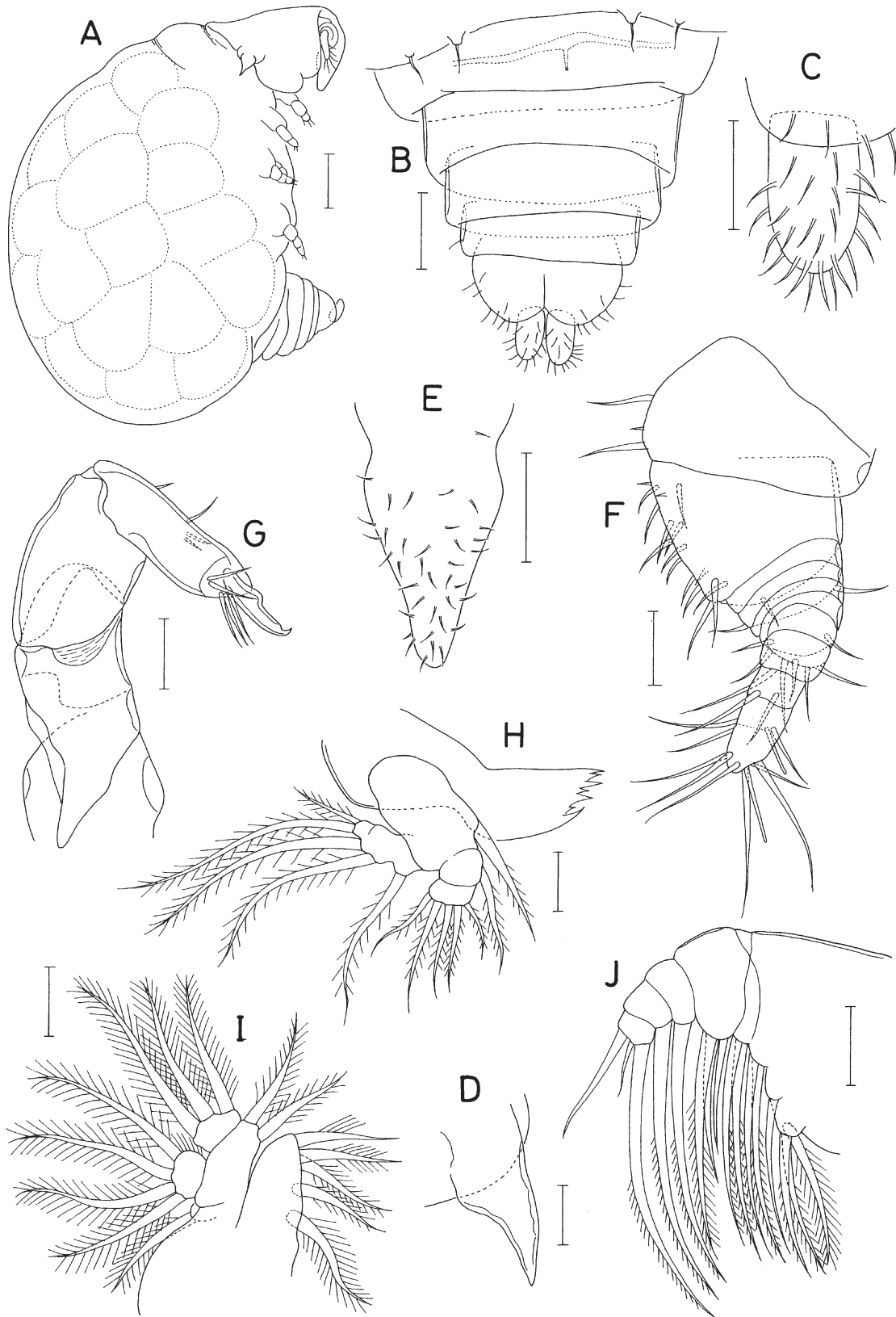
The four species of *Notoixys* gen. nov. described in the present work live in association with compound ascidians of the genus *Aplidium* in the Antarctic Ocean.

***Notoixys heardensis* gen. et sp. nov.**

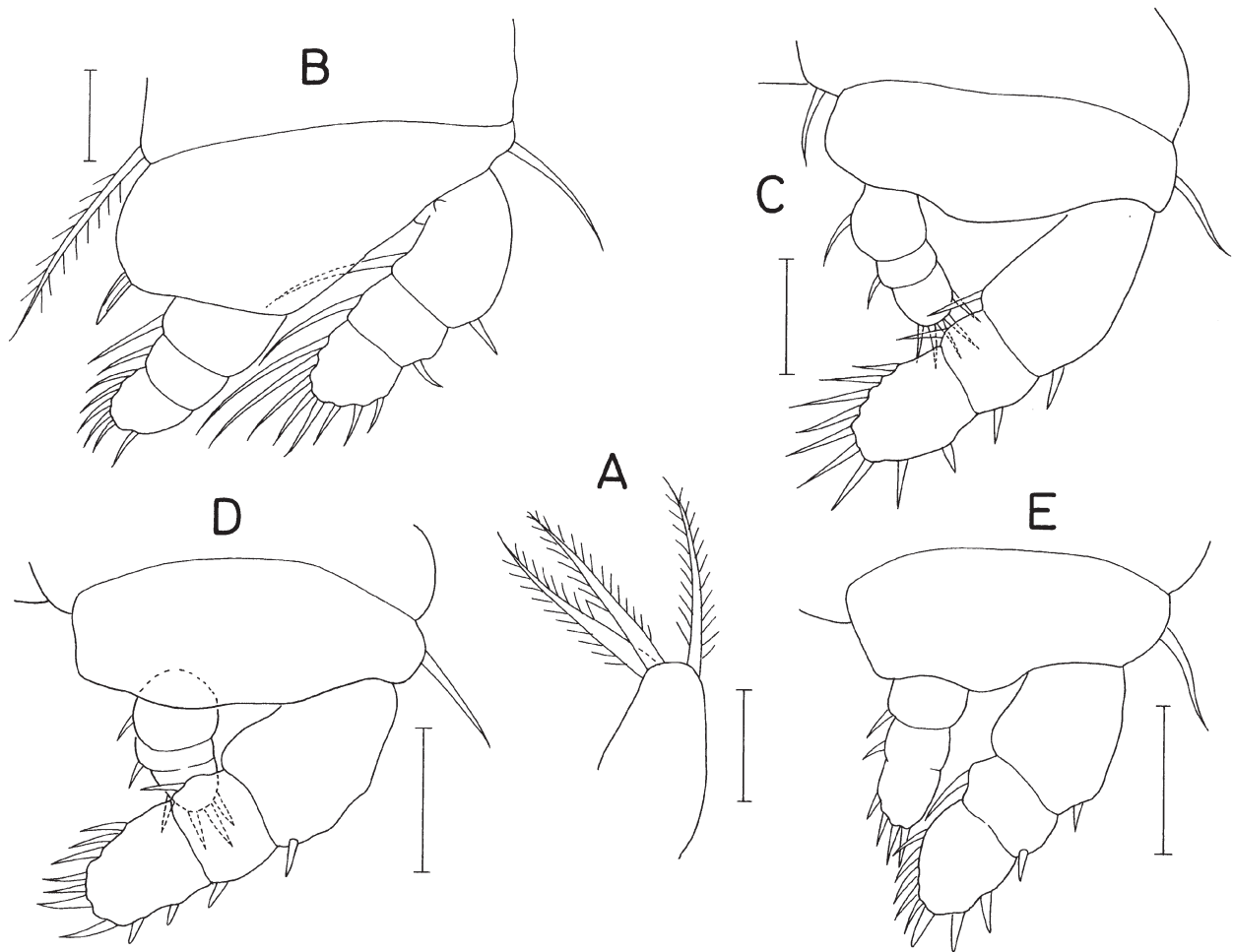
(Figs. 340, 341)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21387), paratypes (3 intact ♀♀, MNHN-IU-2014-21388), and dissected paratypes (2 ♀♀, figured) from branchial





**FIGURE 340.** *Notoixys heardensis* gen. et sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, right caudal ramus, dorsal; D, cephalic horn; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.2 mm; B, C, E, 0.05 mm; D, F–J, 0.02 mm.



**FIGURE 341.** *Notoixys heardensis* gen. et sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: 0.02 mm.

chamber of *Aplidium acropodium* Monniot F. & Gaill, 1978 (MNHN-IT-2008-155 = MNHN A1/APL.B/111), Heard Island, Antarctic Ocean, "Marion Dufresne", 52°59.4'S, 73°38'E, depth 90 m, 08 April 1974, MNHN coll.

**Etymology.** The new species is named after the type locality, Heard Island in the Antarctic.

**Description of female.** Body (Fig. 340A) swollen, 1.80 mm long. Prosome 1.72 mm long; dorsal cephalic shield expanded ventrolaterally, well-defined from metasome, bearing paired, tapering horn-like processes (Fig. 340D) posterolaterally. Metasome globular, unsegmented, with thin exoskeleton; fifth pedigerous somite completely fused with fourth. Free urosome (Fig. 340B) stout, tapering, 5-segmented. Anal somite and caudal rami setulose. Caudal ramus (Fig. 340C) about 1.7 times longer than wide (74×44 μm), with rounded distal margin; caudal setae not discernible from setules.

Rostrum (Fig. 340E) large, elongate, twice as long as wide, constricted at proximal 20%, widest at proximal third, tapering in distal two-thirds towards blunt apex;

surface ornamented with setules. Antennule (Fig. 340F) indistinctly 10-segmented; proximal 2 segments much broader than following segments; terminal segment subdivided by indistinct articulation on one surface; first and second segments armed with 3 and 17 setae, respectively; armature uncertain for remaining segments. Antenna (Fig. 340G) 4-segmented, with 2-segmented endopod; coxa, basis, and first endopodal segment unarmed; compound distal endopodal segment about 2.8 times longer than wide (47×17 μm): armed with 9 small setae (arranged as 1, 1, 2, 2, and 3) plus slender terminal claw, half as long as segment.

Labrum not examined. Mandible (Fig. 340H) with narrow medial margin on coxal gnathobase, bearing 7 teeth of irregular sizes: basis with large medial seta; exopod with 5 setae, outer distal seta much smaller than other 4 (about one-third as long as adjacent seta); endopod incompletely articulated from basis, armed with 1 and 5 setae on first and second segments, respectively. Maxillule (Fig. 340I) with 5 setae on arthrite, 1 on epipodite, 2 on

basis, 4 on exopod and 3 on endopod; coxal endite absent. Maxilla (Fig. 340J) 5-segmented; syncoxa with 3, 1, 2, and 2 setae on first to fourth endites, respectively; basis with 3 unequal setae; endopod with 1, 1, and 3 setae on first to third segments, respectively; setae on third segment very unequal in size. Maxilliped (Fig. 341A) as small lobe bearing 3 equal setae distally.

Legs 1–3 (Fig. 341B–D) with 3-segmented rami. Legs 3 and 4 smaller than legs 1 and 2. Leg 4 (Fig. 341E) with 3-segmented exopod and 2-segmented endopod; second endopodal segment subdivided by lateral constriction. Endopods shorter than exopods in legs 1–4. Inner coxal seta present in legs 1 and 2, absent in legs 3 and 4. Inner distal spine on basis of leg 1 small, smooth, 13 µm long. First exopodal segments of legs 3 and 4 lacking inner seta. All setae on legs 1–4 short and naked, except large pinnate inner coxal seta of leg 1. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	1-1; 1-1; 3, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-1	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-1; 1, 2, 2
Leg 3	0-0	1-0	1-0; 1-1; 3, 1, 5	0-1; 0-1; 1, 2, 1
Leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-1; 0, 2, 3

Leg 5 (Fig. 340B) represented by 2 posteroventral papillae on somite, each papilla tipped with 1 small seta.

**Male.** Unknown.

**Remarks.** The salient character states of the type species *Notoixys heardensis* **gen. et sp. nov.** are the possession of 5 setae on the second endopodal segment of the mandible and 5 on the maxillular arthrite whereas its congeners have 6 setae in both positions. The setation of legs 2–4 of *N. heardensis* **gen. et sp. nov.** is quite different from all other congeners. The type species has an inner coxal seta on both legs 1 and 2, which is shared only with *N. ovata* **gen. et sp. nov.** (see below).

***Notoixys hirsuta* gen. et sp. nov.**

(Figs. 342, 343)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21389), paratypes (6 intact ♀♀, MNHN-IU-2014-21390), and dissected paratypes (2 ♀♀, figured) from *Aplidium imbutum* Monniot C. & Monniot F., 1983, South Orkney Islands, Cruise 876, Antarctic, “Islas Orcadas”, (60°27.8’S, 46°23.1’W), depth 93–102 m, trawl, 16 February 1976.

**Etymology.** The specific name refers to the hirsute body of the new species.

**Description of female.** Body (Fig. 342A) swollen, 1.20 mm long. Prosome 0.91 mm long; dorsal cephalic shield expanded ventrolaterally, surface densely setulose along ventral border, with paired acutely-pointed posterolateral horn-like processes (Fig. 342B). Metasome almost spherical, without trace of articulation, slightly

longer than wide. Free urosome (Fig. 342C) 5-segmented; genital somite much wider than long; 4 abdominal somites setulose on ventral surface, 124×160, 67×127, 44×104, and 58×96 µm, respectively. Caudal ramus (Fig. 342D) small, setulose, slightly tapering distally, about 2.0 times longer than wide (43×21 µm); caudal setae not discernible from setules.

Rostrum (Fig. 342E) about 1.2 times longer than wide, densely covered with setules, tapering to blunt apex. Antennule (Fig. 342F) narrow, 147 µm long, indistinctly 7-segmented; second to fourth segments each bearing 1 or 2 incomplete subdivisions on posterior surface; armature formula 2, 14, 8, 3+aesthetasc, 1, 4, and 5+aesthetasc. Antenna (Fig. 342G) 4-segmented; proximal 3 segments unarmed; terminal segment about 3.4 times longer than wide (57×17 µm) and distinctly longer than first: armed with 9 setae (arranged as 1, 3, 2, and 3) plus small terminal claw, about 0.3 times as long as segment.

Labrum (Fig. 342H) with large posteromedian protuberance bearing setules along posterior margin. Mandible (Fig. 342J) with narrow coxal gnathobase bearing 6 unequal teeth on medial margin: basis with 1 seta on medial margin: exopod with 5 setae; outer distal seta short, about half as long as adjacent seta: endopod with 1 and 6 setae on first and second segments, respectively. Maxillule (Fig. 342I) armed with 6 setae on arthrite, 1 on epipodite, 2 on basis, 4 on exopod and 3 on endopod; setae on endopod longer than those on exopod; arthrite ornamented with patch of setules on proximal medial margin. Maxilla (Fig. 343A) 5-segmented; syncoxa armed with 3, 1, 1, and 1 setae on first to fourth endites, respectively; basis with 3 setae; first to third endopodal segments with 1, 1, and 3 setae respectively. Maxilliped (Fig. 343B) unsegmented, narrowing distally, armed with 3 setae distally.

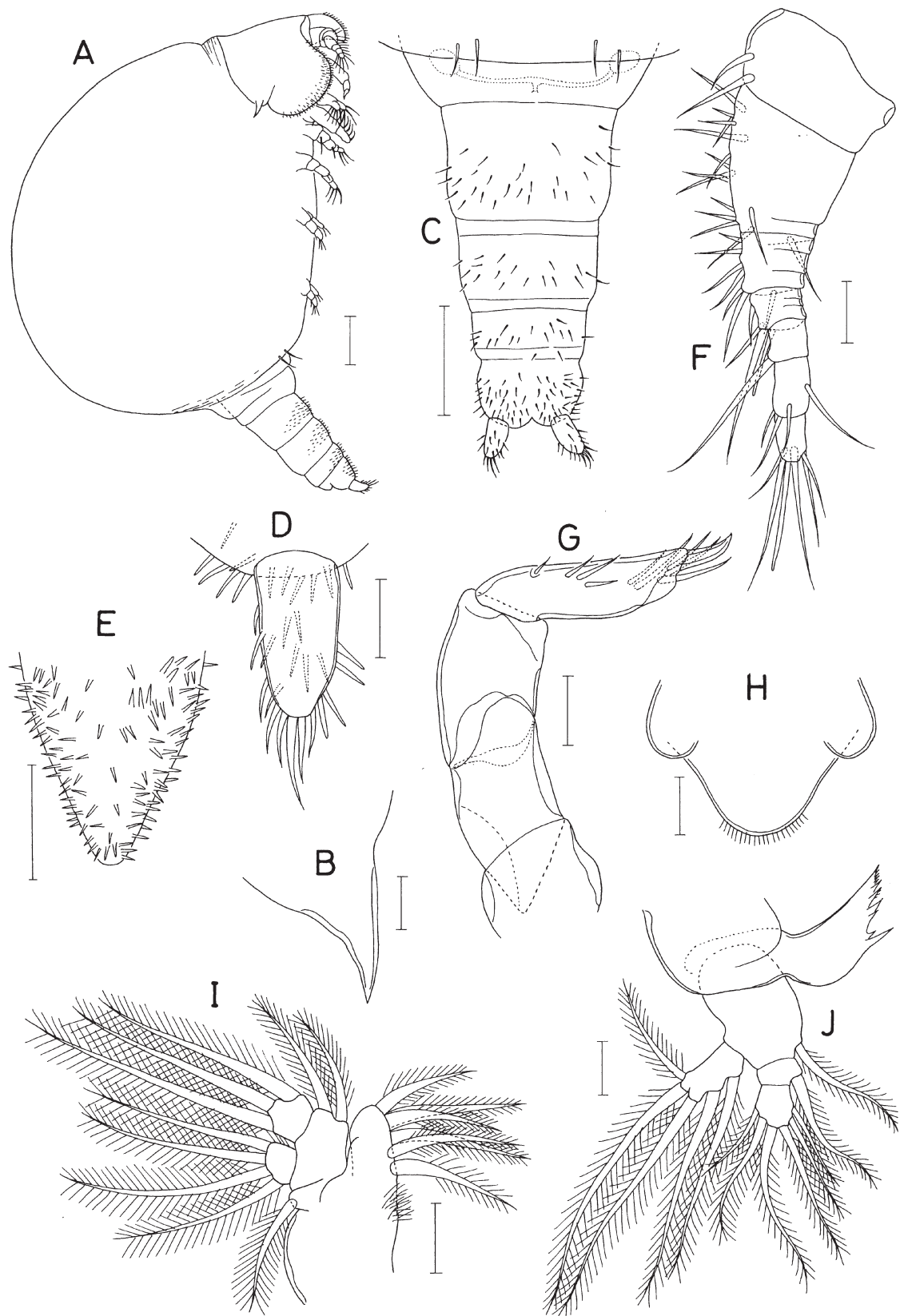
Legs 1–4 (Fig. 343C–F) biramous; all setae on legs short and naked except pinnate inner coxal seta and outer seta on basis of leg 1. Leg 1 endopod distinctly 2-segmented; but segmentation of other rami of legs 1–4 obscure. Inner coxal seta present only in leg 1. Inner distal seta on basis of leg 1 smooth, 19 µm long. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	1-1; 1-1; 3, 1, 4	0-1; 1, 2, 4
Leg 2	0-0	1-0	1-1; 4, 1, 6	0-1; 1, 2, 5
Leg 3	0-0	1-0	1-1; 4, 1, 6	1, 2, 6
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 1, 2, 4

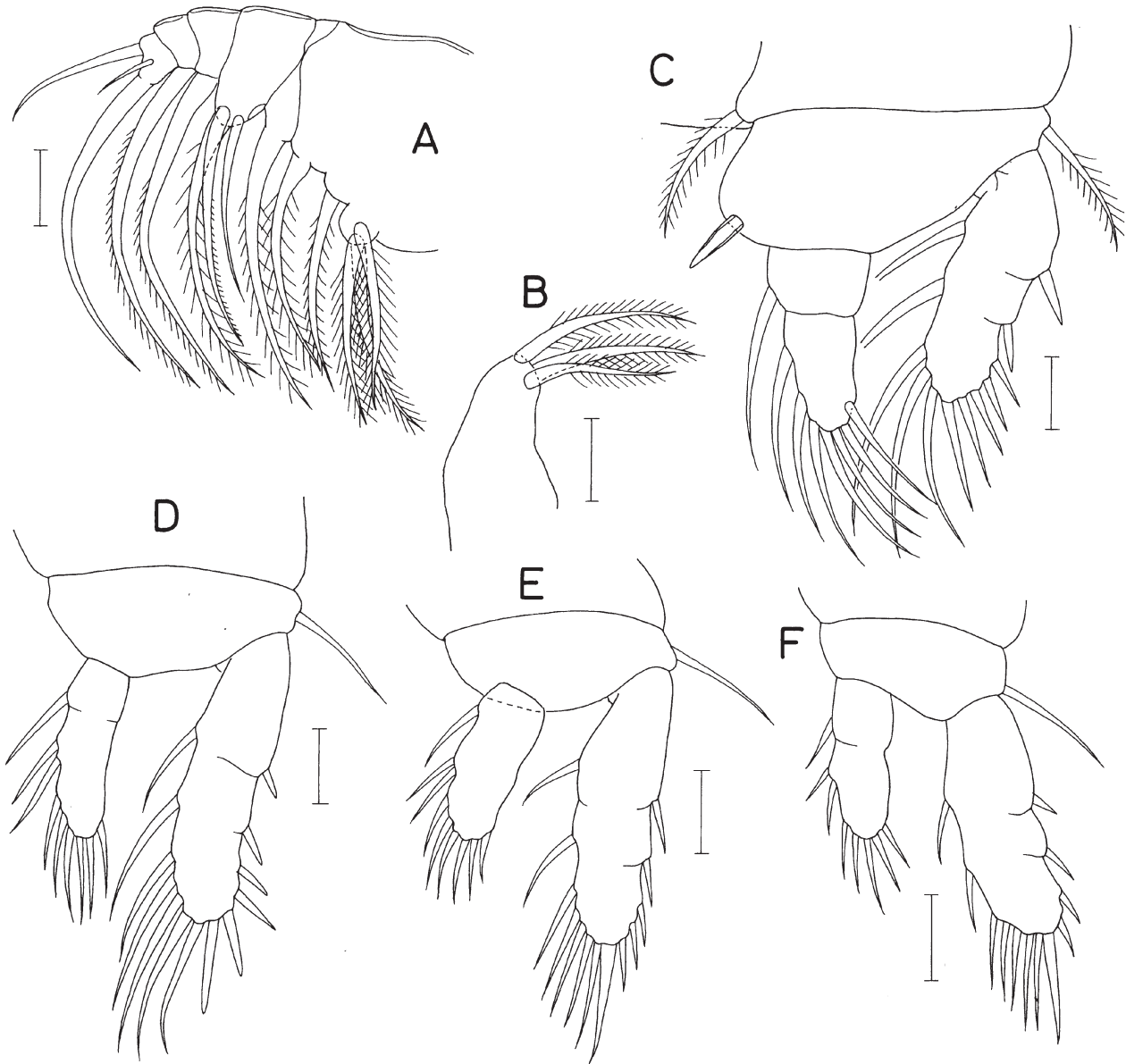
Leg 5 (Fig. 342B) represented by 2 small setae on posteroventral margin of somite, near base of free urosome.

**Male.** Unknown.

**Remarks.** *Notoixys hirsuta* **gen. et sp. nov.** possesses a seta-tipped coxal endite on the maxillule and has 3 setae on the third endopodal segment of the maxilla. Within



**FIGURE 342.** *Notoixys hirsuta* n gen. et sp. nov., female. A. habitus, right; B, cephalic horn; C, leg 5 and urosome, ventral; D, right caudal ramus, dorsal; E, rostrum; F, antennule; G, antenna; H, labrum; I, maxillule; J, mandible. Scale bars: A, C, 0.1 mm; B, D, F–J, 0.02 mm; E, 0.05 mm.



**FIGURE 343.** *Notoixys hirsuta* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4. Scale bars: 0.02 mm.

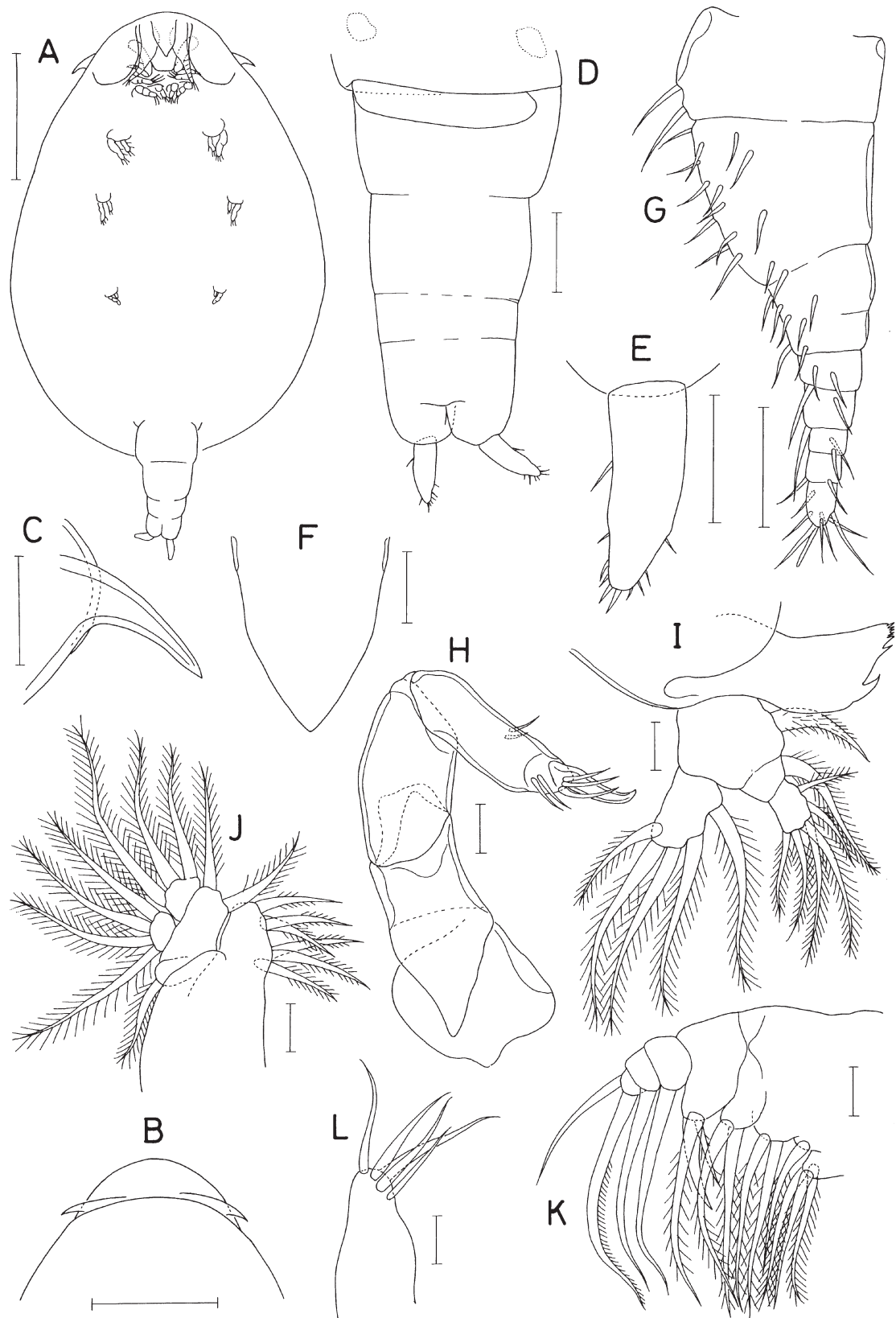
the genus, both features are shared only with the type species, *N. heardensis* gen. et sp. nov. However, they can be distinguished by the number of setae on the second endopodal segment of the mandible (6 in *D. hirsuta* gen. et sp. nov. compared to 5 in *N. heardensis* gen. et sp. nov.). The rami of legs 2–4 are also different: the exopods of legs 3 and 4 are armed with totals of 13 and 12 setae, respectively in *N. hirsuta* gen. et sp. nov., and the endopods are armed with 9 and 8 setae, respectively. In contrast, in all three congeners the numbers of these setae are lower, for example, with a maximum of 12 and 11, respectively, on the exopods of legs 3 and 4, and 6 setae on each endopod, as found in *N. heardensis* gen. et sp. nov.

*Notoixys hirsuta* gen. et sp. nov. has an inner coxal seta only on leg 1, as in *N. planiceps* gen. et sp. nov. (see below). However, unlike the latter species, *N. hirsuta* gen. et sp. nov. possesses more teeth on the medial margin of the mandibular coxal gnathobase, 2 setae (vs. 1 in *N. planiceps* gen. et sp. nov.) on the basis of the maxillule, and has obscurely segmented rami on the posterior swimming legs, although there are more setae on these rami.

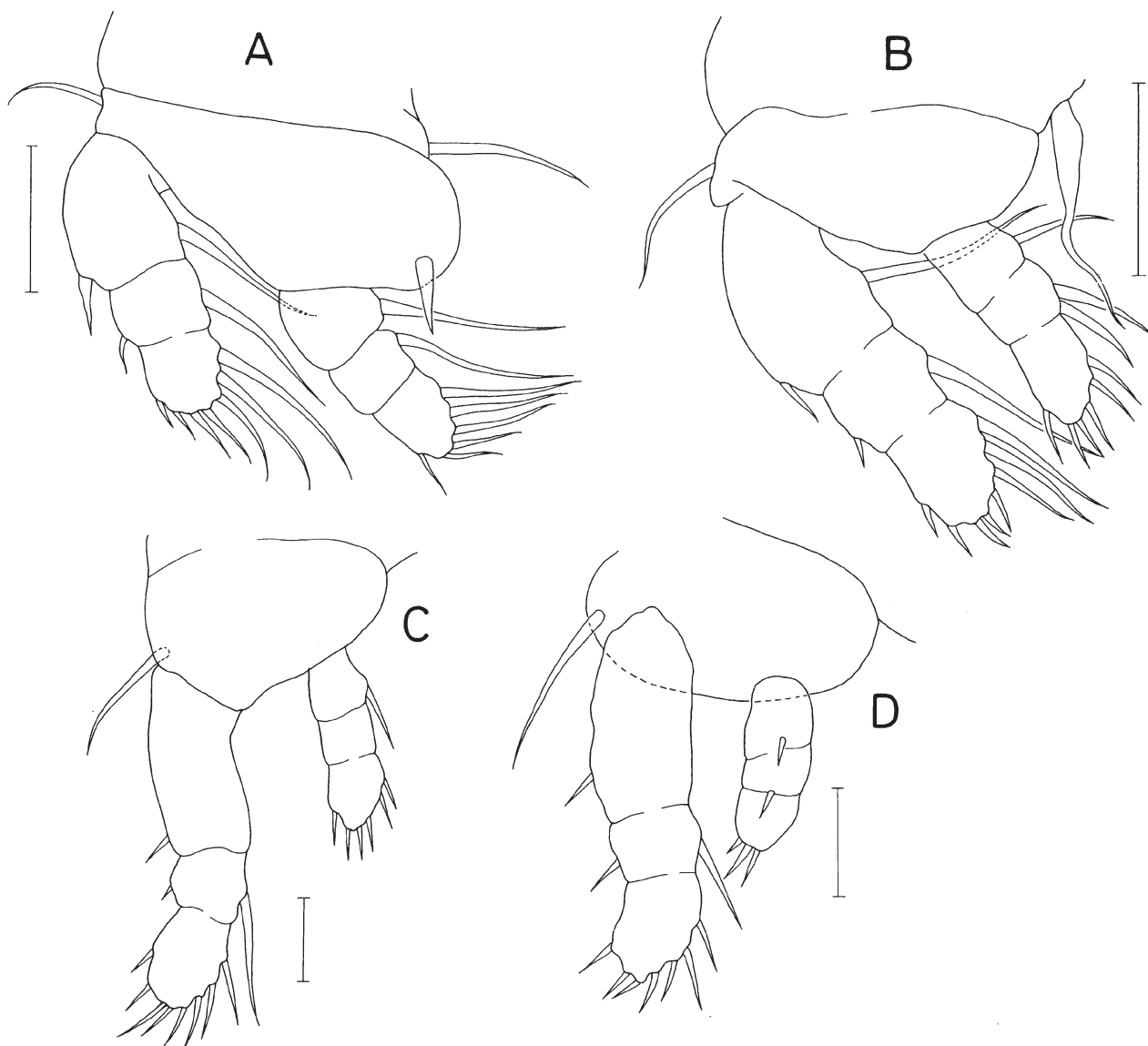
***Notoixys ovata* gen. et sp. nov.**

(Figs. 344, 345)

**Type material.** Holotype ♀ (dissected and mounted on



**FIGURE 344.** *Notoixys ovata* gen. et sp. nov., female. A, habitus, ventral; B, cephalic region, dorsal; C, cephalic horn; D, urosome, dorsal; E, left caudal ramus, dorsal; F, rostrum; G, antennule; H, antenna; I, mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bars: A, B, 0.5 mm; C, E–G, 0.05 mm; D, 0.1 mm; H–L, 0.02 mm.



**FIGURE 345.** *Notoixys ovata* gen. et sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: A, B, 0.05 mm; C, D, 0.02 mm.

a slide, MNHN-IU-2014-21391) from *Aplidium millari* Monniot C. & Monniot F., 1994 (Type MNHN-IT-2008-556 = MNHN A1/APL.B/295), EPOS 3 Stn 235, Weddell Sea, Antarctic Ocean (75°09.1'S, 27°34.7'W), depth 407 m, 31 January 1989.

**Etymology.** The name is derived from the Latin *ovata* (=egg-shaped), referring to the ovate prosome of the new species.

**Description of female.** Body (Fig. 344A) straight, slightly depressed, 2.11 mm long. Prosome inflated, oval, 1.76 mm long: greatest width of prosome 1.25 mm, at posterior third. Cephalosome (Fig. 344B) short, defined from metasome; dorsal cephalic shield with paired lateral horn-like processes (Fig. 344C). Metasome lacking any trace of articulation. Free urosome (Fig. 344D) small,

indistinctly 5-segmented; articulations between somites obscure, represented by weak constrictions and faint suture lines. Genital somite short, characteristically bearing short, broad hood-like flap of cuticle along posterodorsal margin (Fig. 344B). Caudal ramus (Fig. 344E) small, shorter than anal somite and about 2.7 times longer than wide (82×31 μm), tapering in distal third, ornamented with several setules; caudal setae not distinguishable from setules.

Rostrum (Fig. 344F) well-developed, longer than wide, slightly tapering proximally and strongly tapering distally towards angular apex. Antennule (Fig. 344G) tapering, 225 μm long, indistinctly 8-segmented; armature formula 2, 15, 7, 3, 2, 2, 2, and 7+aesthetasc; third segment subdivided; all setae small, setule-like.

Antenna (Fig. 344H) 4-segmented; proximal 3 segments unarmed; terminal segment (second endopodal segment) 2.7 times longer than wide (68×25 µm) and longer than first endopodal segment: armed with 7 setae (arranged as 2, 2, and 3) plus terminal claw half as long as segment.

Labrum weak, easily damaged during dissection. Mandible (Fig. 344I) with 3 small teeth and short pectinate margin on coxal gnathobase: basis with broad seta on medial margin: exopod with 4 equally large setae and 1 short outer seta half as long as others: endopod with 1 and 6 setae on first and second segments, respectively. Maxillule (Fig. 344J) armed with 6 setae on arthrite, 1 on epipodite, 2 on basis, 4 on exopod and 3 on endopod; setae on endopod longer than those on exopod; coxal endite absent. Maxilla (Fig. 344K) 5-segmented; syncoxa with 3, 1, 2, and 2 setae on first to fourth endites, respectively; basis with short claw plus 2 unequal setae; endopod with 1, 1, and 2 setae on first to third segments, respectively. Maxilliped (Fig. 344L) as unsegmented, elongate lobe bearing 5 naked setae distally.

Legs 1–4 (Fig. 345A–D) with incompletely 3-segmented rami. Protopod obscurely segmented in legs 3 and 4. Endopods slightly shorter than exopods in legs 1 and 2, but distinctly shorter, half as long as exopod, in legs 3 and 4. Inner coxal seta present in legs 1 and 2, absent in legs 3 and 4. Setae on rami small, markedly smaller in legs 3 and 4. First exopodal segments of legs 3 and 4 lacking inner seta. Second endopodal segment of leg 2 bearing 2 inner setae. Second endopodal segment of leg 3 lacking inner seta. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	1-1; 1-1; 7	0-1; 0-1; 6
Leg 2	0-1	1-0	1-1; 1-1; 8	0-1; 0-2; 6
Leg 3	0-0	1-0	1-0; 1-1; 8	0-1; 0-0; 6
Leg 4	0-0	1-0	1-0; 1-1; 7	0-1; 0-1; 3
Leg 5	absent.			

**Male.** Unknown.

**Remarks.** *Notoixys ovata* gen. et sp. nov. can readily be differentiated from its congeners by the following features: the ovoid, slightly depressed body shape, the presence of the posterodorsal hood-like flap on the genital somite, the presence of only 2 setae on the third endopodal segment of the maxilla, the absence of leg 5, and the characteristic setation of legs 1–4.

The new species is superficially similar in body shape to *Mesoixys otaria* Illg & Dudley, 1965, but the genus *Mesoixys* may distinguished from *Notoixys* gen. nov. (and other genera) by the styliform coxal gnathobase on the mandible and by the lack of the maxilliped.

***Notoixys planiceps* gen. et sp. nov.**

(Figs. 346, 347)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21392), paratypes (3 intact ♀♀, MNHN-IU-2014-21393), and dissected paratypes (2 ♀♀, figured) from *Aplidium cyaneum* Monniot C. & Monniot F., 1983 (MNHN-IT-2008-295 = MNHN A1/APL.B/129), Cruise Eltanin 32, Stn 2127, Antarctic Peninsula (71°23'S, 171°36'E), depth 515–521 m, SOSC coll., 13 February 1968.

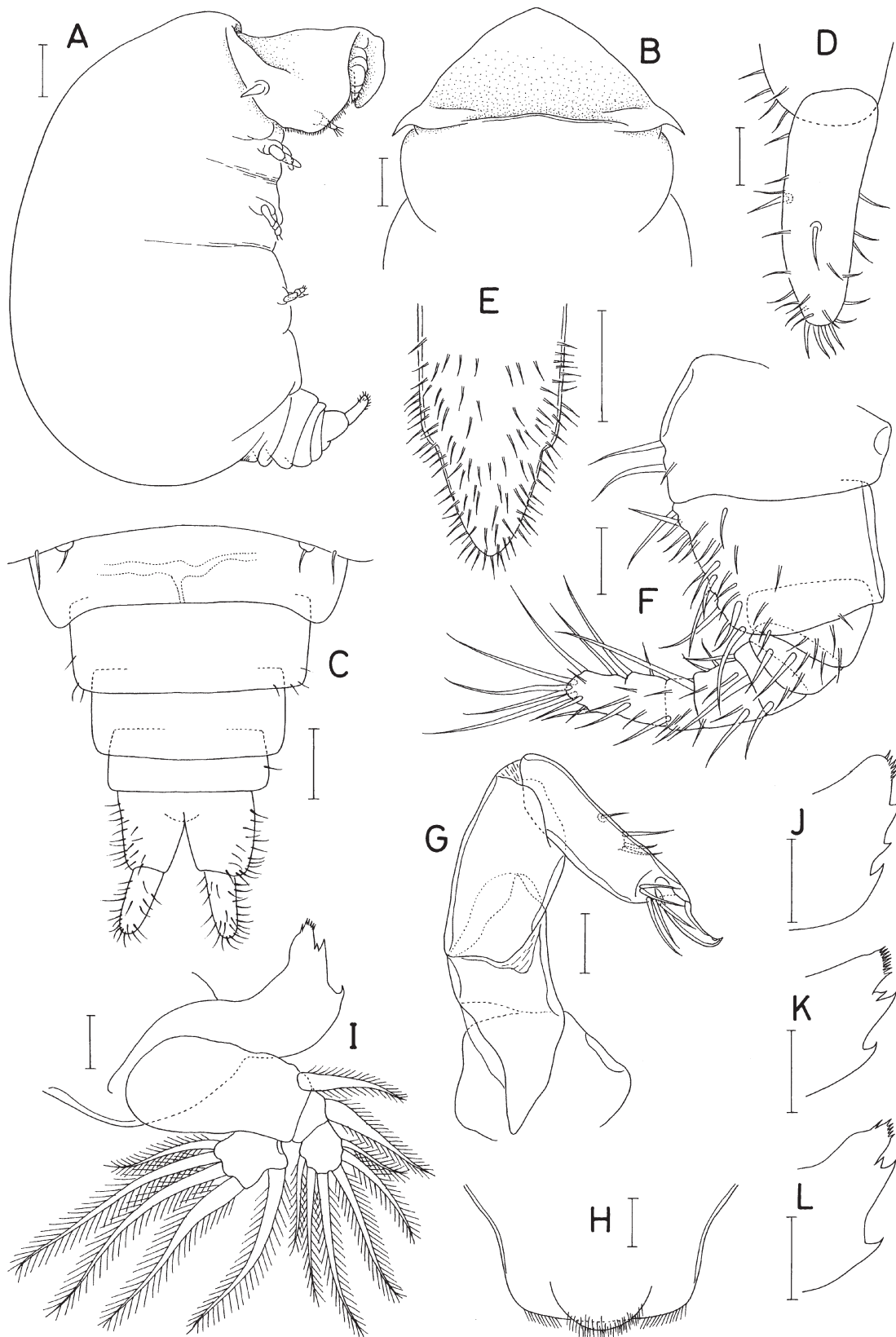
**Etymology.** The specific name of the new species is derived from the combination of the Latin *plan* (=flat) and *ceps* (=head), alluding to the flattened cephalosome.

**Description of female.** Body (Fig. 346A) robust, 1.37 mm long. Prosome 1.14 mm long: dorsal cephalic shield dorsoventrally flattened (Fig. 346A), expanded ventrally, tapering anteriorly in dorsal view towards angular anterior apex, and with paired horn-like processes posterolaterally (Fig. 346B). Metasome swollen, unsegmented, 1.7 times longer than dorsoventral depth, with arched dorsal margin and straight ventral margin. Free urosome (Fig. 346C) small, recurved ventrally, tapering posteriorly, distinctly 5-segmented: genital and 4 abdominal somites 55×230, 64×175, 60×141, 44×116, and 56×96 µm, respectively. Anal somite and caudal rami covered with setules; anal somite with deep posteromedian incision. Caudal ramus (Fig. 346D) about 2.9 times longer than wide (82×28 µm) and shorter than anal somite: armed with 6 setae (outer lateral, dorsal, and 4 distal); outer distal and dorsal setae positioned at 48 and 60% of ramus length, respectively; all caudal setae small, less than half width of ramus.

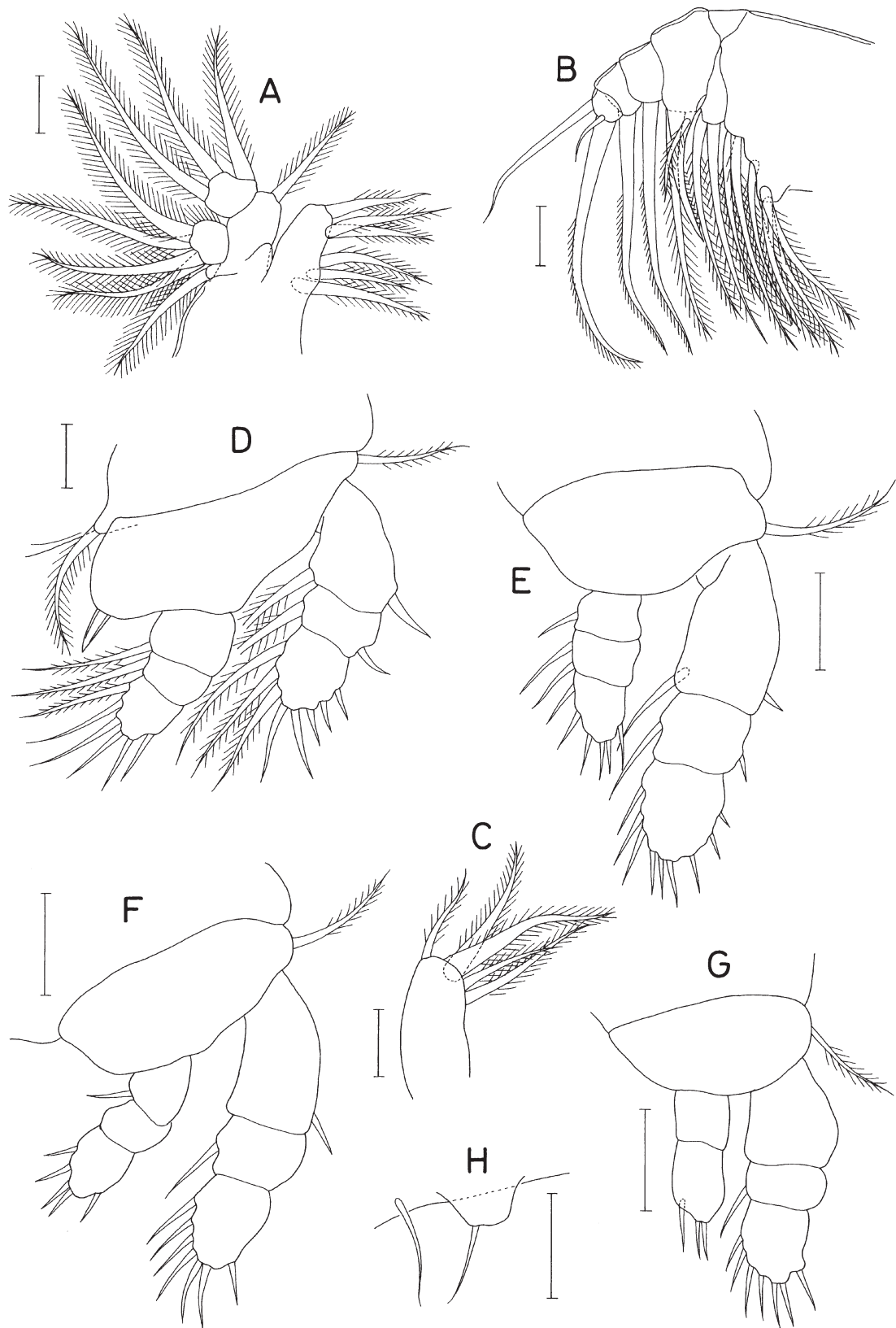
Rostrum (Fig. 346E) large, elongate, densely covered with setules, proximal half with parallel margins, distal half tapering. Antennule (Fig. 346F) 7-segmented, but terminal segment bearing traces of 2 articulations; first and second segments much broader than other segments; setal armature not discernible due to similarity with setules. Antenna (Fig. 346G) 4-segmented; proximal 3 segments unarmed; terminal segment (second endopodal segment) 3.1 times longer than wide (62×20 µm) and slightly longer than first endopodal segment: armed with 9 small setae (arranged as 1, 1, 2, 2, and 3) plus small terminal claw, less than half length of segment.

Labrum (Fig. 346H) with broad, setulose, almost straight posterior margin and large, semicircular, setulose posteromedian lobe. Mandible (Fig. 346I) with medial margin of coxal gnathobase bearing 3 teeth and short pectinate area; sizes and gaps between teeth variable (Fig. 346J–L): basis with 1 seta medially: exopod with 4 equally large medial setae and 1 small outer seta (0.4 times as long as medial setae): endopod with 1 broad seta on first segment and 6 setae on second. Maxillule (Fig. 347A) with 6 setae on arthrite, 1 each on epipodite and basis, 4 on exopod and 3 on endopod. Maxilla (Fig. 347B) 5-segmented; syncoxa with 3, 1, 2, and 2 setae on





**FIGURE 346.** *Notoixys planiceps* gen. et sp. nov., female. A, habitus, right; B, cephalosome, dorsal; C, urosome, ventral; D, left caudal ramus, dorsal; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J–L, coxal gnathobase of mandible. Scale bars: A, B, 0.1 mm; C, E, 0.05 mm; D, F–L, 0.02 mm.



**FIGURE 347.** *Notoixys planiceps* gen. et sp. nov., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4; H, leg 5. Scale bars: 0.02 mm.

first to fourth endites, respectively; basis with 3 setae; first to third endopodal segments with 1, 1, and 3 setae, respectively; 3 setae on third endopodal segment very unequal. Maxilliped (Fig. 347C) as unsegmented small lobe bearing 5 setae (1 broadened).

Legs 1–3 (Fig. 347D–F) with 3-segmented rami. Leg 4 (Fig. 347G) with 3-segmented exopod and 2-segmented endopod. Inner coxal seta present only in leg 1. Outer seta on basis of legs 1–4 large and pinnate. Inner distal spine on basis of leg 1 smooth, 15 µm long. Outer seta absent on second exopodal segment of leg 3 and first and second exopodal segments of leg 4. Inner seta absent on first exopodal segment of legs 3 and 4, on second endopodal segment of leg 3, and on first endopodal segment of leg 4. Setae on rami of legs 2–4 short and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-I	1-1; 1-1; 3, 1, 4	0-1; 0-1; 1, 2, 3
Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1; 0-2; 1, 2, 3
Leg 3	0-0	1-0	1-0; 0-1; 1, 1, 5	0-1; 0-0; 1, 2, 2
Leg 4	0-0	1-0	0-0; 0-1; 1, 1, 5	0-0; 0, 2, 1

Leg 5 (Fig. 347H) positioned on posteroventral margin of somite; consisting of outer seta and inner truncate exopodal lobe tipped with 1 seta.

**Male.** Unknown.

**Remarks.** *Notoixys planiceps* **gen. et sp. nov.** can be easily distinguished from its congeners by its characteristic, strongly depressed cephalosome, by the possession of a single seta on the basis of the maxillule and by the presence of 2 setae on the third endopodal segment of the maxilla. The setation of the posterior swimming legs is also reduced relative to its congeners.

It is remarkable that *Notoixys planiceps* **gen. et sp. nov.** and *N. ovata* **gen. et sp. nov.** have a very similar form of the coxal gnathobase on the mandible despite the different body form of the adult females and the marked differences in the armature of the mouthparts and swimming legs.

### ***Borixys* gen. nov.**

**Diagnosis.** Body inflated. Dorsal cephalic shield lacking posterolateral horn-like processes. Free urosome 5-segmented. Caudal rami setulose; caudal setae obscure. Rostrum well-developed. Antennule 7-segmented, tapering. Antenna 4-segmented, consisting of coxa, basis, and 2-segmented endopod with small terminal claw. Mandible with large coxal gnathobase bearing 5 teeth; palp armed with 1 seta on basis, 5 on exopod, 1 on first endopodal segment and 7 on second. Maxillule with 9 setae on arthrite, 1 each on epipodite and basis, 4 on exopod and 3 on endopod. Maxilla 4-segmented with 4, 1, and 2 setae on first to third endites of syncoxa,

strong claw plus 2 setae on basis, 1 and 3 setae on first and second endopodal segments, respectively. Maxilliped as unsegmented lobe bearing several setae. Legs 1–4 biramous with 2-segmented protopods and 3-segmented rami. Leg 5 represented by outer protopodal seta and inner lobe bearing exopodal seta.

**Type and only species.** *Borixys simplex* (Marchenkov & Boxshall, 2004) **comb. nov.** (originally as *Doroixys simplex*), by original designation.

**Etymology.** The name is derived from the Greek *boreios* (=northern) and refers to the known distribution of the type species in the North Pacific. Gender feminine.

**Remarks.** There were only three species in the genus *Doroixys* at the time Marchenkov & Boxshall (2004) described *D. simplex*. The addition of multiple new species to this genus in the present work allows generic boundaries to be re-assessed and we consider that it is necessary to place *D. simplex* in a separate genus. We establish *Borixys* **gen. nov.** to accommodate *D. simplex* as type species, and the new genus can be differentiated from *Doroixys* by the absence of the paired horn-like processes on the posterolateral corners of the dorsal cephalic shield, by the reduction of leg 5 to single protopodal and exopodal setae each carried on a small, ill-defined lobe, and by the presence of the inner seta on the first and second exopodal segments of legs 2–4. The new genus differs from *Prodoixys* **gen. nov.** by the lack of the coxal endite on the maxillule (cf. present and armed with a single seta in the latter), by the presence of a single seta on the maxillular basis (cf. 2 setae in *Prodoixys* **gen. nov.**), and by the 2-segmented endopod of the maxilla (cf. 3-segmented in *Prodoixys* **gen. nov.**). The new genus differs from *Notoixys* **gen. nov.** by the presence of 5 teeth on the broad coxal gnathobase of the mandible (cf. a narrow coxal gnathobase in *Notoixys* **gen. nov.**), by the 2-segmented endopod of the maxilla (cf. 3-segmented in *Notoixys* **gen. nov.**), and by the absence of the horn-like processes on the dorsal cephalic shield. Finally, the new genus differs from *Loboixys* by the 4-segmented antenna (cf. 3-segmented in *Loboixys*), by the possession of 5 setae on the maxilliped (cf. 6 setae in *Loboixys*), and by the possession of the inner seta on the first and second exopodal segments of legs 2–4 (cf. inner seta absent in legs 2–4 in *Loboixys*).

*Borixys simplex* displays a unique feature in this cluster of genera in retaining an inner coxal seta on leg 4. None of these other genera has an inner coxal seta on leg 4 but we don't yet know whether this character state is significant at the generic level.

### ***Cystixys* gen. nov.**

**Diagnosis.** Body highly transformed, globular. Dorsal cephalic shield bearing paired lateral horn-like processes. Metasome unsegmented, entire metasome forming brood

pouch. Free urosome 5-segmented. Caudal rami small, setose; caudal setae indistinct. Rostrum distinct. Antennule 7-segmented. Antenna 4-segmented, with 2-segmented endopod and small terminal claw. Labrum weak. Mandible with narrow coxal gnathobase bearing 1 distal tooth and proximal pectinate region; palp armed with 1 seta on basis, 5 on exopod, and 1 and 4 on first and second endopodal segments, respectively. Maxillule armed with 3 setae on arthrite, 1 each on coxal epipodite and basis, 4 on exopod and 3 on endopod; coxal endite absent. Maxilla 4-segmented, 3 endites on syncoxa; basis with slender claw plus 1 seta; endopod small, 2-segmented with 1 and 3 setae on first and second segments, respectively; seta on first segment and 1 seta on second segment enlarged (much longer than entire maxillary segments). Maxilliped unsegmented, armed with few setae. Legs 1–4 with 3-segmented rami; inner coxal seta absent; first and second segments of both rami usually bearing inner seta. Leg 1 basis bearing inner distal spine. Leg 5 located ventrally on surface of somite and represented by outer protopodal seta and inner (exopodal) process bearing outer margin seta. Living in gall formed on branchial tissue of ascidian host.

**Type and only species.** *Cystixys globosa* **gen. et sp. nov.** by original designation.

**Etymology.** The generic name comes from the Greek *cyst* (= bladder) and *ixys*, the ending of several generic names in the family Notodelphyidae: it refers to the mode of life of the type species, living inside a cyst within a gall. Gender feminine.

**Remarks.** There are two significant autapomorphic features characterising the new genus. Firstly, the shape of the mandibular coxal gnathobase is characteristic with the cutting edge consisting of a single distal tooth and a pectinate proximal region. The second feature is the presence of 2 extremely large setae on the endopod of the maxilla: these setae are longer than the limb itself.

The armature of the mouthparts is markedly reduced in *Cystixys* **gen. nov.** In particular, there are only 3 setae on the arthrite of the maxillule and only 2 setae on the maxilliped. In contrast, the armature of swimming legs is relatively well conserved, retaining the inner seta on the first and second segments of all swimming legs.

***Cystixys globosa* gen. et sp. nov.**

(Fig. 348–350)

**Type material.** Holotype (intact ♀, MNHN-IU-2009-2469), paratypes (2 intact ♀♀, MNHN-IU-2014-21394), and dissected paratypes (2 ♀♀, figured), each from membranous cyst in globular gall in *Eudistoma illotum* (Sluiter, 1898) (MNHN-IT-2008-XXXX = MNHN A3 EUD 353), south of Madagascar (25°02.8'S, 46°59.3'E), depth 22 m, MNHN coll., 01 May 2010.

**Etymology.** The name alludes to the globose body of the new species.

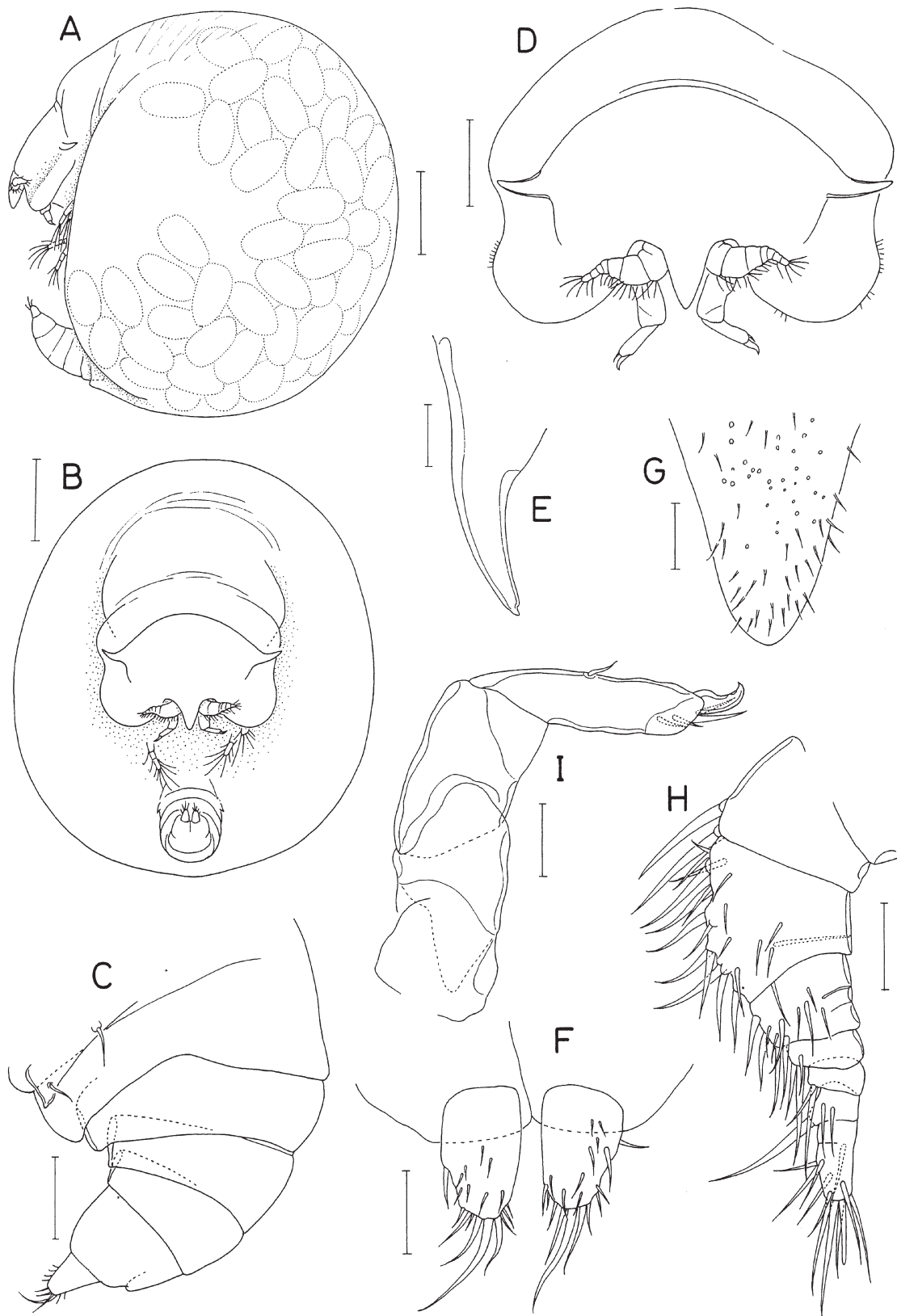
**Description of female.** Body (Fig. 348A, B) inflated, almost spherical, slightly longer than wide, 1.01 mm in greatest diameter. Cephalosome and urosome facing each other on ventral side of brood pouch. Dorsal cephalic shield (Fig. 348D) with paired horn-like processes laterally (Fig. 348D, E). Metasome unsegmented, entire metasome forming brood pouch. Free urosome (Fig. 348C) curved ventrally, stout, 5-segmented. Caudal rami (Fig. 348F) small, shorter than anal somite, about 1.6 times longer than wide (31×20 µm), setulose: armed with 6 setae, but setae difficult to distinguish from setules.

Rostrum (Fig. 348D, G) evenly tapering, longer than wide, ornamented with numerous setules. Antennule (Fig. 348H) 108 µm long, 7-segmented; second and third segments with traces of 1 and 3 sutures on posterior side, respectively, and terminal segment with trace of suture on anterior side; armature formula 2, 22, 11, 3, 2, 3, and 11+aesthetasc. Antenna (Fig. 348I) 4-segmented; proximal 3 segments stout, unarmed; terminal segment (second endopodal segment) about 3.1 times longer than wide (52×17 µm) and longer than first endopodal segment; armed with 5 setae (arranged as 1, 2, and 2) plus small terminal claw, less than third of length of segment.

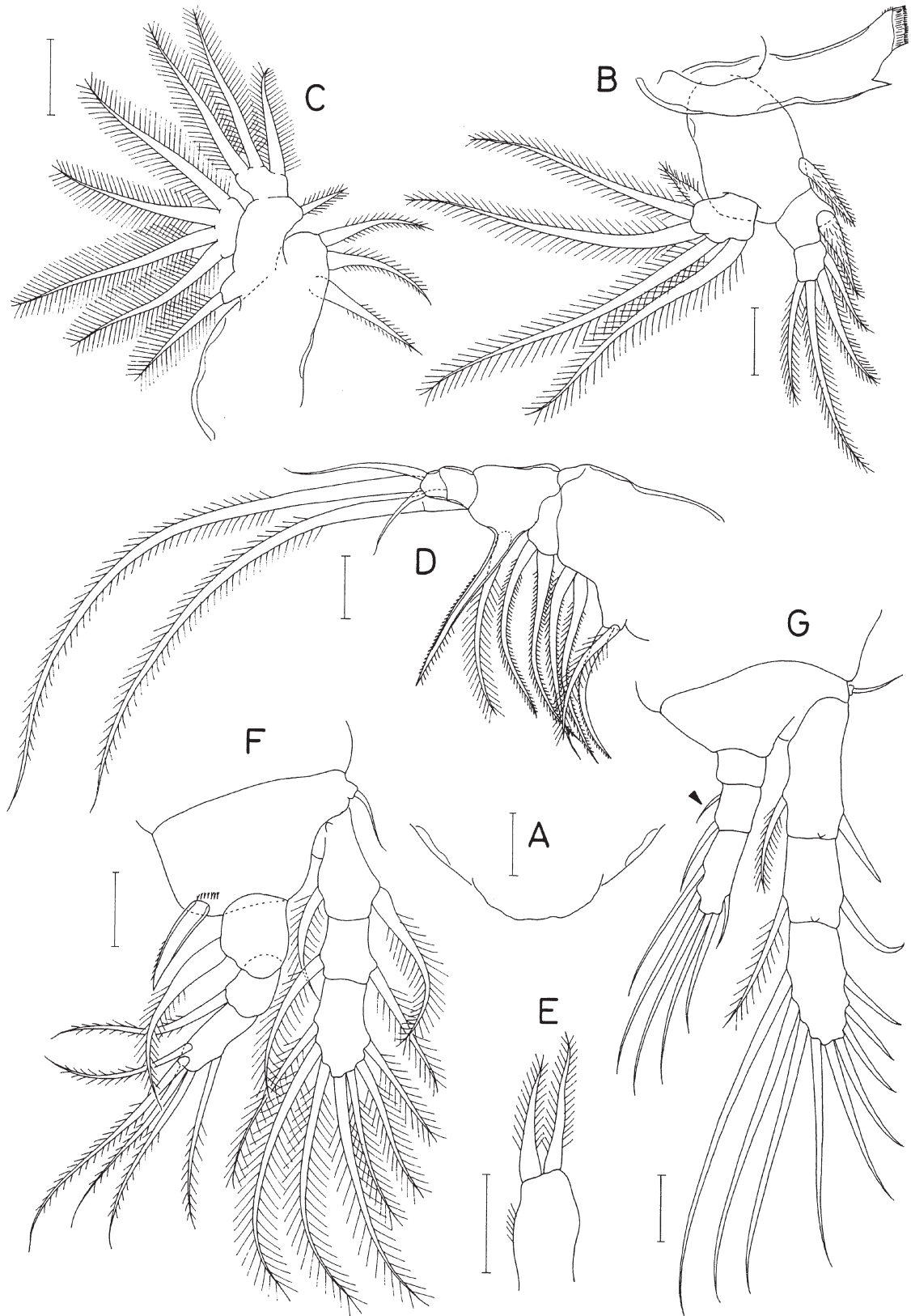
Labrum (Fig. 349A) short, unornamented, tapering towards thin, soft distal part. Mandible (Fig. 349B) with narrow coxal gnathobase bearing 1 distal tooth and proximal pectinate region on medial (cutting) margin: basis with 1 medial seta; exopod with 4 large medial and 1 small outer seta (less than third length of adjacent seta): endopod with 1 and 4 setae on first and second segments, respectively; seta on first segment markedly broadened; proportional lengths of setae on second segment 7:10:17:10 from medial to outer. Maxillule (Fig. 349C) armed with 3 setae on arthrite, 1 each on epipodite and basis, 4 on exopod and 3 (1 short medial and 2 longer distal) on endopod. Maxilla (Fig. 349D) 4-segmented; syncoxa with 2 setae on each of first to third endites; basis with 2 setae, one spiniform, spinulose; endopod small, with 1 and 3 setae on first and second segments, respectively; seta on first endopodal segment and 1 seta on second extremely large (about twice as long as entire maxilla). Maxilliped (Fig. 349E) small, unsegmented, armed with 2 setae distally; ornamented with few setules on outer margin.

Legs 1–4 (Figs. 349F, G, 350A, B) with 3-segmented rami; coxa short or absent; intercoxal sclerite and inner coxal seta absent. Inner distal spine on basis of leg 1 large, 28 µm long. Inner seta on first endopodal segment broad. Endopods of legs 2–4 small, about half as long as exopods. Second endopodal segment of leg 2 and first and second endopodal segments of leg 3 with variable setation; setae indicated by arrowheads in Fig. 349G and 350A may be present or absent. Armature formula for legs 1–4 as follows:

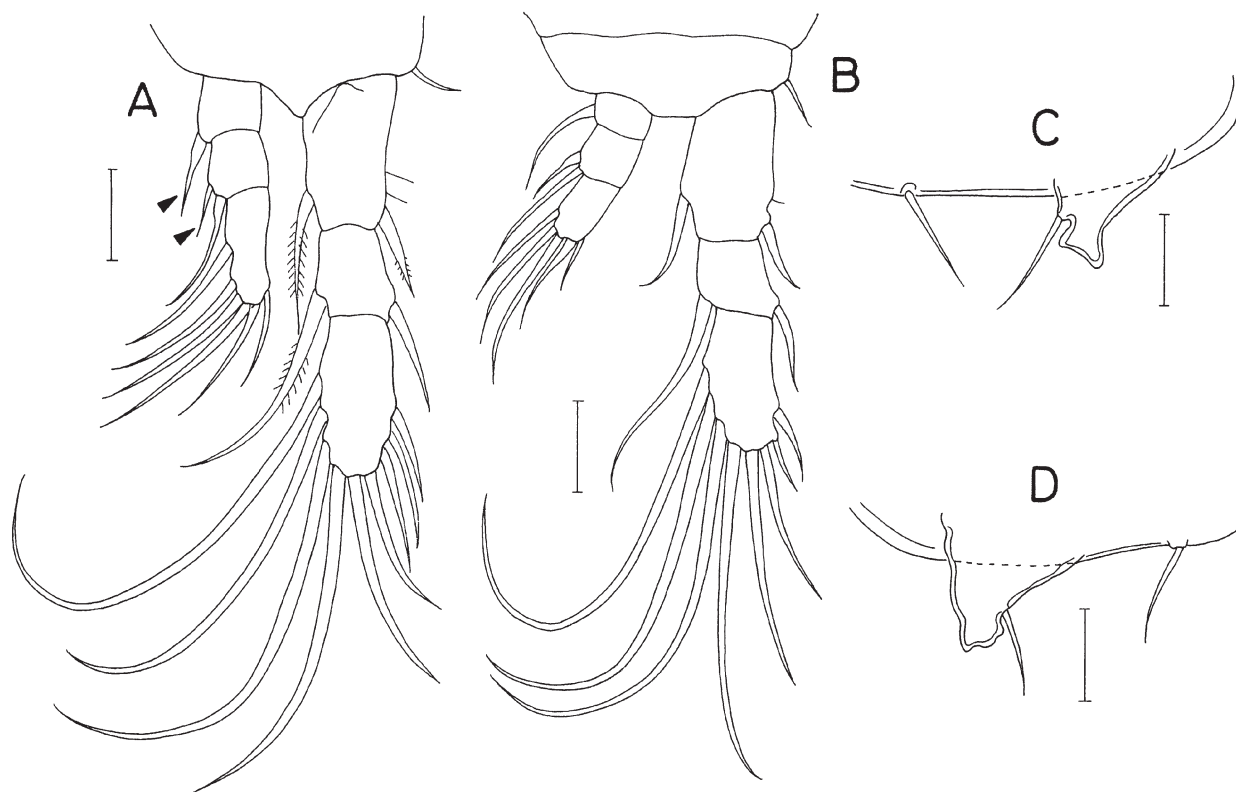
	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	1-1; 1-1; 3, 1, 3	0-1; 0-1; 1, 2, 2



**FIGURE 348.** *Cystixys globosa* **gen. et sp. nov.**, female. A, habitus, left; B, habitus, ventral; C, urosome, left; D, cephalic shield, frontal; E, cephalic horn; F, caudal rami, dorsal; G, rostrum; H, antennule; I, antenna. Scale bars: A, B, 0.2 mm; C, 0.05 mm; D, 0.1 mm; E–I, 0.02 mm.



**FIGURE 349.** *Cystixys globosa* gen. et sp. nov., female. A, labrum; B, mandible; C, maxillule; D, maxilla; E, maxilliped; F, leg 1 (marked seta absent in some specimens); G, leg 2. Scale bars: 0.02 mm.



**FIGURE 350.** *Cystixys globosa* gen. et sp. nov., female. A, leg 3 (marked seta absent in some specimens); B, leg 4; C, right leg 5, ventral; D, left leg 5, ventral. Scale bars: 0.02 mm.

Leg 2	0-0	1-0	1-1; 1-1; 3, 1, 5	0-0; 0-1 (or 0-2); 1, 2, 3
Leg 3	0-0	1-0	1-1; 1-1; 3, 1, 5	0-1 (or 0-0); 0-1 (or 0-2); 1, 2, 3
Leg 4	0-0	1-0	1-1; 1-1; 2, 1, 5	0-1; 0-2; 1, 2, 2

Leg 5 (Fig. 350C, D) positioned on posteroventral margin of somite and represented by outer propodal seta and irregular inner (exopodal) process bearing 1 seta on outer margin.

**Male.** Unknown.

**Remarks.** The specimens of this species were each enclosed within a membranous cyst and each cyst was located within a gall formed in the branchial tissue of the host.

### Genus *Loboixys* Ooishi, 2006

**Diagnosis.** Body inflated, typically globular. Dorsal cephalic shield with horn-like processes present or absent. Brood pouch comprising second to fourth pedigerous somites, or fourth pedigerous somite alone. Free urosome typically 5-segmented, occasionally 4-segmented. Caudal ramus small, armed with up to 5 setae; caudal setae small, when present. Rostrum present. Antennule at most 7-segmented, occasionally unsegmented.

Antenna 3-segmented, consisting of short coxa, basis, and unsegmented endopod bearing small terminal claw. Labrum weak. Mandible bearing 5 or 6 teeth on coxal gnathobase; palp armed with 1 seta on basis, 5 on exopod, and 1 and 4 on first and second endopodal segments, respectively. Maxillule with 6 to 10 setae on arthrite, 1 on basis, 4 on exopod and 3 on endopod; coxal endite absent; epipodite (and its seta) present or absent. Maxilla 3- or 4-segmented, consisting of syncoxa, basis, and 1- or 2-segmented endopod; syncoxa with 3 endites; endopod with 4 setae in total (2 thick). Maxilliped as unsegmented lobe armed with 6 setae. Legs 1–4 each consisting of 2-segmented propod and 2- or 3-segmented rami; segmentation of rami usually obscure. Inner coxal seta absent in legs 1–4. Second exopodal segment (or original second exopodal segment when not expressed) of leg 1 lacking outer element. First exopodal segment of legs 2–4 lacking inner seta. Proximal endopodal segment(s) of legs 2–4 with or without inner seta. Leg 5 rudimentary, bilobed or absent.

**Type species.** *Loboixys ryukyuensis* Ooishi, 2006 by original designation.

**Other included species.** *Loboixys sibogae* sp. nov., *L. pilosa* sp. nov., *L. palauensis* sp. nov., *L. similis* sp. nov., *L. tetramera* sp. nov., and *L. capillosus* (Ho & Kim 2006) **comb. nov.** (originally described as *Doroixys capillosus*).

**Remarks.** Within the genus *Loboixys* we now recognize that there is a trend towards the segmentation of the rami of the swimming legs becoming obscured, and the leg setation tending to be reduced in all swimming legs. These trends stand in contrast to the characteristics of *Prodoroxys* **gen. nov.**, *Notoixys* **gen. nov.**, *Borixys* **gen. nov.**, and *Cystixys* **gen. nov.**, in each of which both rami of leg 1 are clearly 3-segmented and the first and second exopodal segments of leg 1 each bear outer and inner setal elements. In these new genera, the reduction of leg setation occurs mainly in the more posterior swimming legs. The second exopodal segment (or original second exopodal segment in a 2-segmented exopod) of *Loboixys* characteristically lacks an outer element, as in *Pentachaetus* **gen. nov.** However, the latter genus is distinguishable from *Loboixys* by its possession of 5 large caudal setae and *Doroixys*-like leg setation.

Additional diagnostic features of *Loboixys* also appear to include: (1) the lack of an inner seta on the first exopodal segment of legs 2–4; (2) the horn-like processes on the dorsal cephalic shield are very small or absent; (3) the caudal ramus is short and the caudal setae are reduced in number and size, as in *Notoixys* **gen. nov.**; (4) the endopod of the mandibular palp is armed with 1 and 4 setae on the first and second segments, respectively; (5) the endopod of the maxilla is armed with a total of 4 setae; and (6) the maxilliped is armed with 6 setae. All known species of the *Loboixys* are associated with compound ascidians in the tropical Pacific.

***Loboixys sibogae* sp. nov.**  
(Figs. 351, 352)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21395), paratypes (9 intact ♀♀, MNHN-IU-2014-21396), and dissected paratypes (3 ♀♀, figured) from *Diplosoma* sp., south coast of Timor, Siboga Stn 296 (10°14'S, 124°5.5' E), depth 8–36 m, 24–26 January 1900.

**Etymology.** This species is named after the “Siboga Expedition” during which the type specimens were collected.

**Description of female.** Body (Fig. 351A) of ovigerous adult extremely swollen. Smaller young adult (Fig. 351B) stout, but not as swollen. Body surface densely ornamented with minute setules. Prosome of ovigerous adult 1.57 mm long; dorsal cephalic shield bearing acutely pointed, paired horn-like processes posterolaterally (Fig. 351C). Metasome with 2 or 3 dorsal constrictions, marking original articulations between somites; fourth pedigerous somite (or fused third and fourth pedigerous somites) greatly expanded, almost spherical, forming brood pouch. Free urosome (Fig. 351D) small, inserted into ventral surface of prosome, 5-segmented, but posterior articulations indistinct. Genital somite 49×193 µm; abdominal somites covered with minute setules, 36×167, 58×149, 33×138, and 73×135 µm,

respectively. Caudal ramus (Fig. 351E) strongly tapering, about 1.8 times longer than wide (71×40 µm) and as long as anal somite, densely covered with setules; narrowed distal part pale and with thin cuticle: caudal setae not discernible from setules.

Rostrum (Fig. 351F) as long as wide, densely setulose, weak, flexible, with rounded distal margin. Antennule (Fig. 351G) strongly tapering, incompletely 7-segmented, 160 µm long; setae not discernible from setules. Antenna (Fig. 351H) 3-segmented, consisting of coxa, basis, and unsegmented endopod; endopodal segment 2.9 times longer than wide (55×19 µm) and 0.7 times as long as basis: armed with 6 setae (grouped as 1, 2, and 3) plus small terminal claw, one-third as long as endopod.

Labrum (Fig. 351I) with broad convex posterior margin; posterior region soft, flexible, densely setulose. Mandible (Fig. 351J) with 5 acute teeth and 1 small seta on coxal gnathobase: basis with 1 medial seta: exopod with 5 setae, outer setae slightly shorter than others: endopod with 1 and 4 setae on first and second segments, respectively; proportional lengths of setae on second segment 3:4:6:5 from inner to outer. Maxillule (Fig. 351K) with 7 setae on arthrite, 1 each on epipodite and basis, 4 on exopod and 3 on endopod; coxal endite absent; 3 setae on endopod unequal (medial seta shortest and outer seta longest). Maxilla (Fig. 352A) 4-segmented; syncoxa with 4, 2, and 2 setae on first to third endites, respectively; basis with thick seta plus 1 small seta; endopod 2-segmented with thick seta on first segment and 1 thick and 2 shorter, thin setae on second. Maxilliped (Fig. 352B) as unsegmented lobe bearing 5 or 6 (commonly 6) setae mediolaterally and ornamented with fine spinules on distal and outer surfaces.

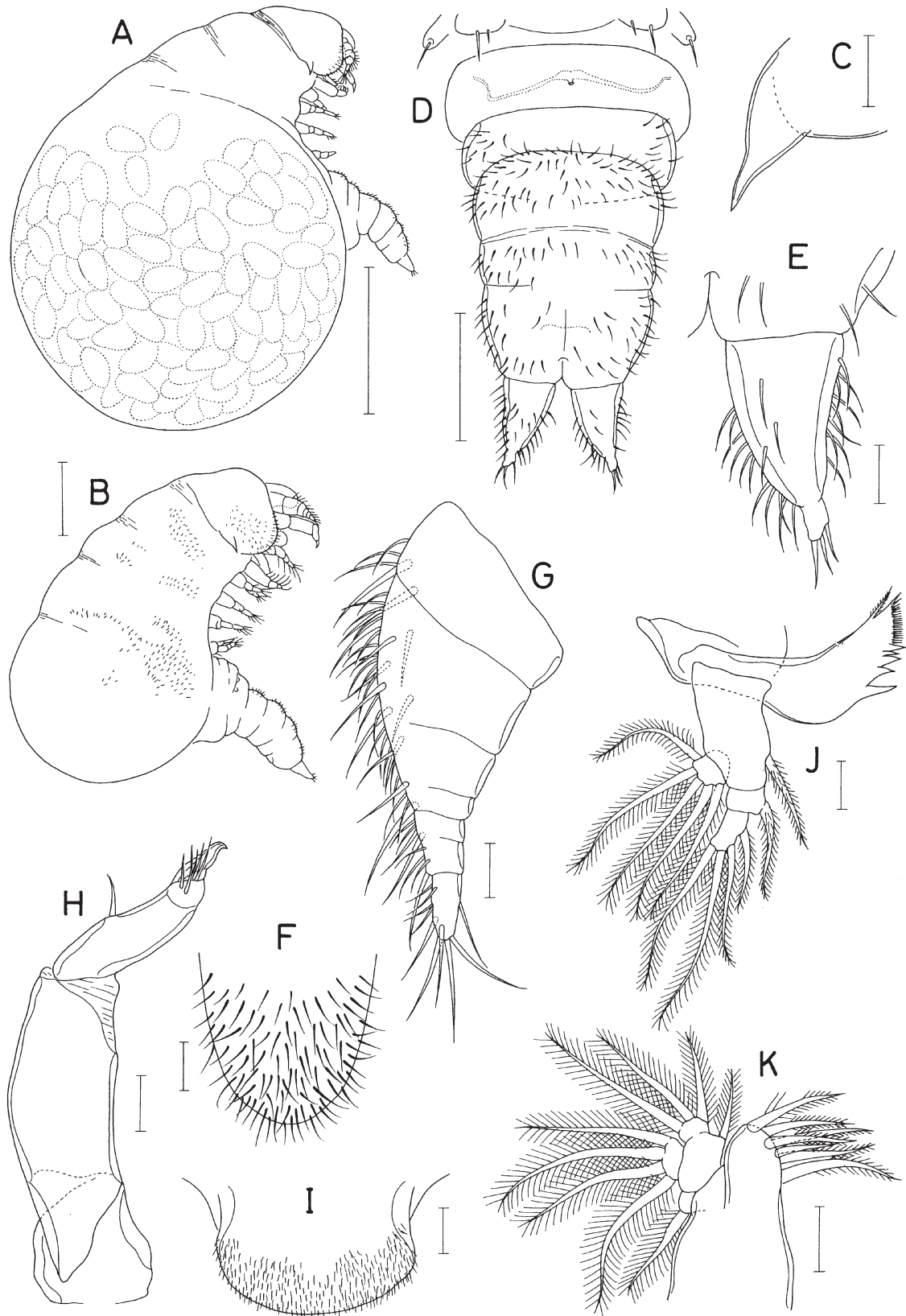
Leg 1 (Fig. 352C) with incompletely 3-segmented rami; inner distal spine on basis 15 µm long, bilaterally serrate; both rami ornamented with slender setules; second exopodal segment lacking outer element. Inner coxal seta absent in legs 1–4. Legs 2–4 with 3-segmented exopods and 2-segmented endopods (Fig. 352D, E); second endopodal segment of legs 2 and 3 with vestige of articulation: first exopodal segment lacking inner seta. Second exopodal segment bearing minute inner seta in legs 2 and 3, but lacking in leg 4. Legs 2 and 3 with same armature formula. Proximal 2 inner setae on endopod of legs 2 and 3 minute. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	1-1; 0-1; 2, 1, 3	0-1; 0-1; 1, 2, 2
Legs 2 & 3	0-0	1-0	1-0; 1-1; 3, 1, 5	0-1; 1, 2, 4
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 1, 2, 2

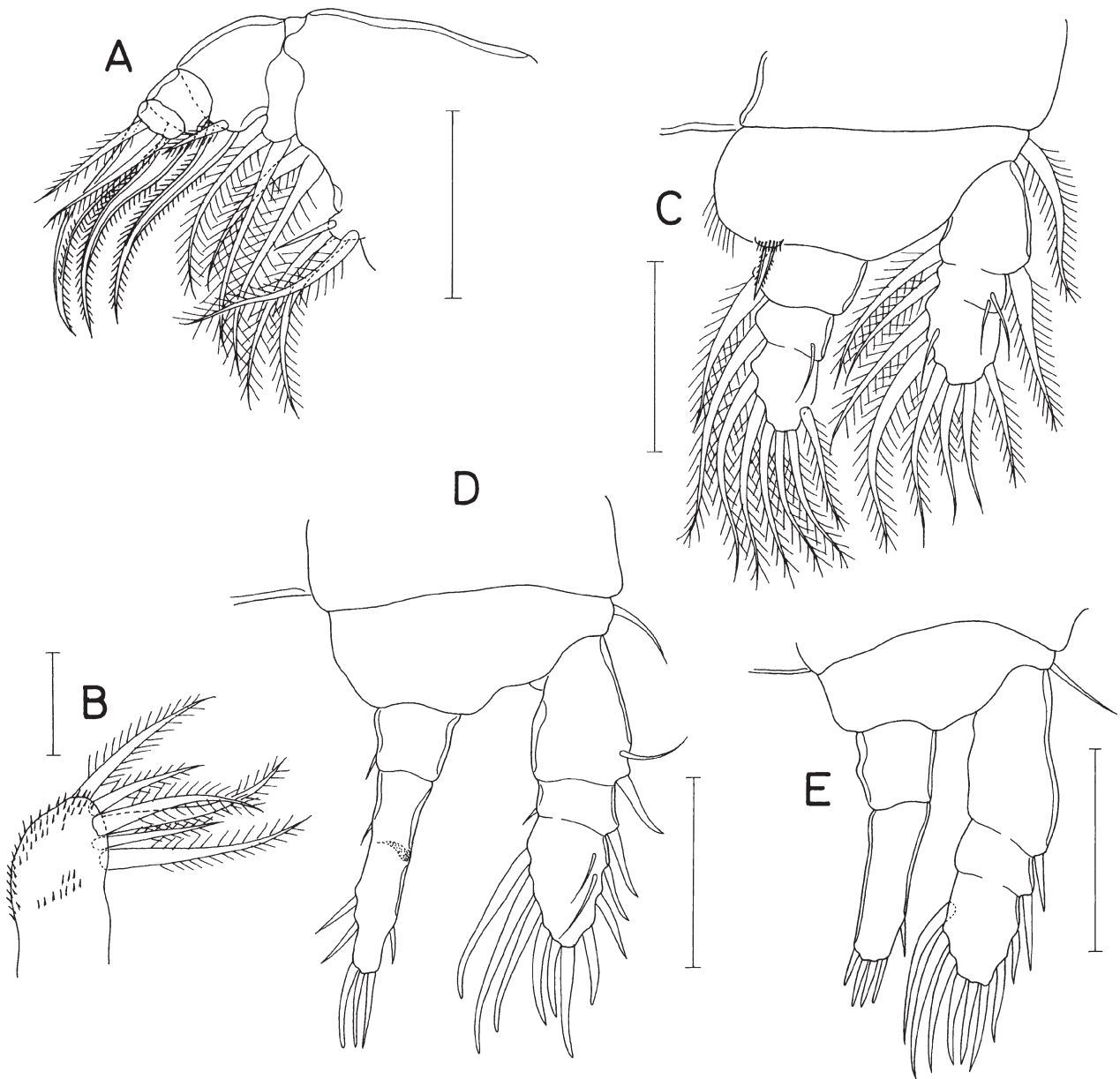
Leg 5 (Fig. 351D) represented by 2 small lobes positioned posteroventrally on somite; outer lobe tipped with small protopodal seta, and inner (exopodal) lobe tipped with 2 small setae.

**Male.** Unknown.





**FIGURE 351.** *Loboixys sibogae* sp. nov., female. A, habitus, right; B, habitus of young adult, right; C, cephalic horn; D, leg 5 and urosome, ventral; E, right caudal ramus, dorsal; F, rostrum; G, antennule; H, antenna; I, labrum; J, mandible; K, maxillule. Scale bars: A, 0.5 mm; B, 0.2 mm; C, E–K, 0.02 mm; D, 0.1 mm.



**FIGURE 352.** *Loboixys sibogae* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4. Scale bars: A, C–E, 0.05 mm; B, 0.02 mm.

**Remarks.** *Loboixys sibogae* sp. nov. differs from the type species *L. ryukyuensis*, in the setation of the first exopodal and endopodal segments of leg 1, each of which bears an inner seta (cf. absent in *L. ryukyuensis*), the caudal rami are distinct (fused to anal somite in *L. ryukyuensis*), the first endopodal segment of leg 4 is unarmed (cf. bears an inner seta in *L. ryukyuensis*), and leg 5 is bilobed (leg 5 consists of 1 inner seta and an apparently bipartite outer lobe in *L. ryukyuensis*).

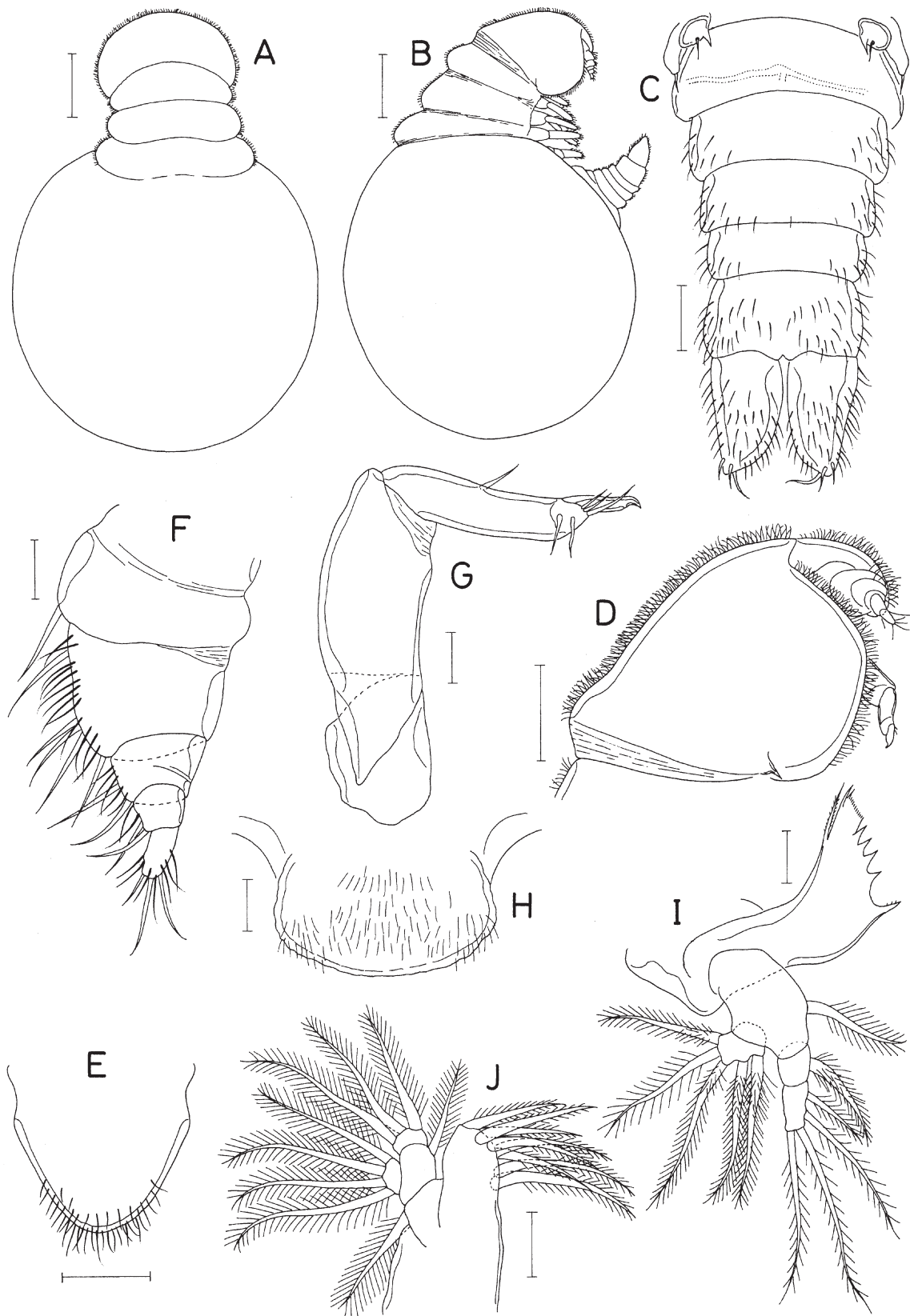
The third exopodal segment of leg 4 of *L. ryukyuensis* is armed with 9 setae (formula 3, 1, 5), such a setation pattern is extremely unusual for a member of the Notodelphyidae.

***Loboixys pilosa* sp. nov.**  
(Fig. 353, 354)

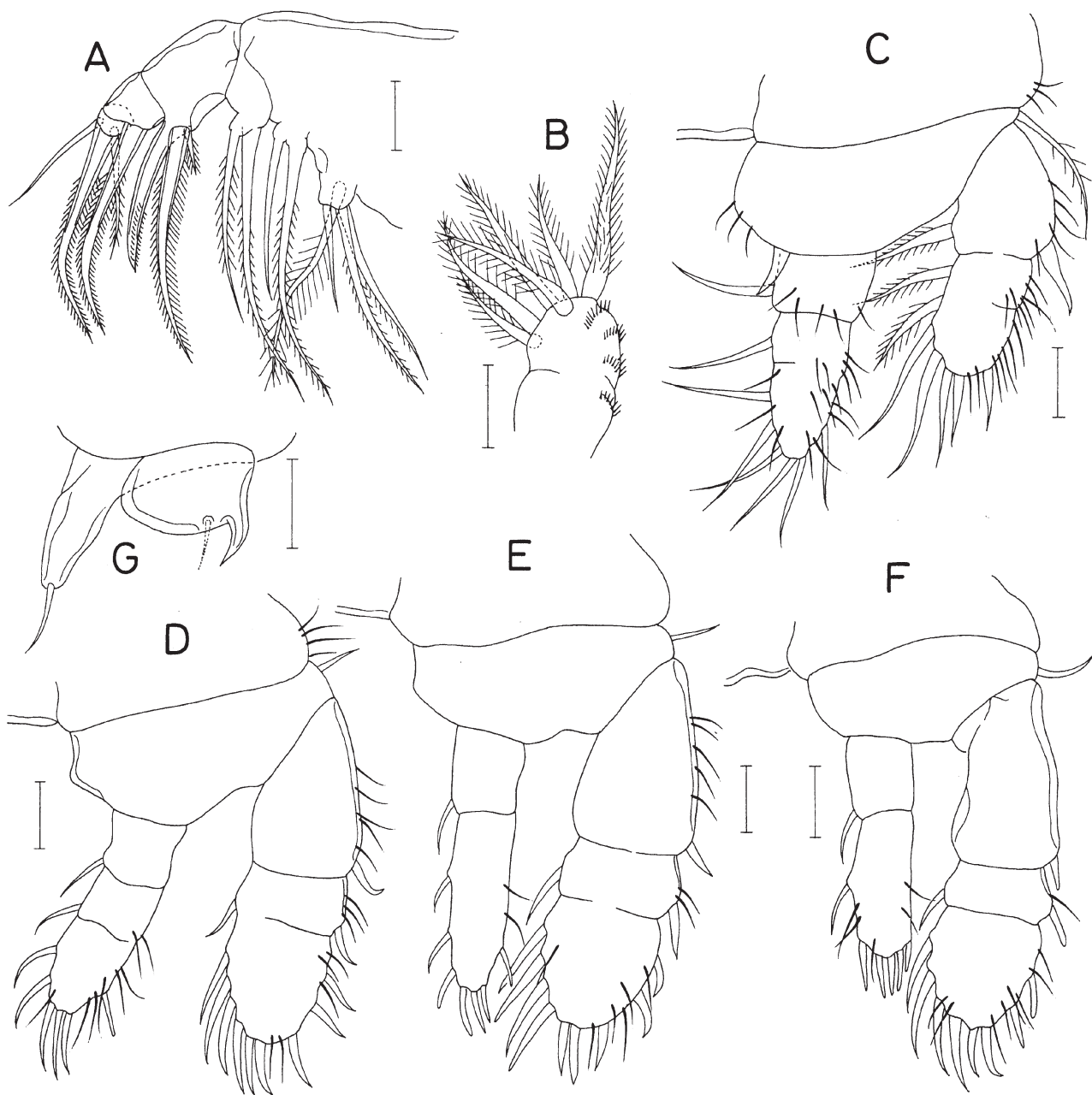
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21397), paratypes (2 intact ♀♀, MNHN-IU-2014-21398), and dissected paratypes (2 ♀♀, figured) from *Diplosoma multifidum* (Sluiter, 1909), Récif Néokumbi, New Caledonia, depth 40 m, Monniot coll., 10 March 1987.

**Additional material.** 6 ♀♀ (MNHN-IU-2018-1909) embedded in tissues of *D. multifidum*, Îlot Atire, NC 63, New Caledonia, 1987; 1 ♀ (MNHN-IU-2018-1910) from *D. multifidum*, NC 30, New Caledonia, 09 March 1987.

**Etymology.** The name is derived from the Latin *pilosus*



**FIGURE 353.** *Loboixys pilosa* sp. nov., female. A, habitus, dorsal; B, habitus, right; C, leg 5 and urosome, ventral; D, cephalosome, right; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, maxillule. Scale bars: A, B, 0.2 mm; C, E, 0.05 mm; D, 0.1 mm; F–J, 0.02 mm.



**FIGURE 354.** *Loboixys pilosa* sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: 0.02 mm.

(=hairy) and refers to the hairy body surface of the new species.

**Description of female.** Body (Fig. 353A, B) very similar in form to *Loboixys sibogae* sp. nov., 1.39 mm long. Prosome 5-segmented: dorsal cephalic shield bearing paired minute horn-like processes posterolaterally (Fig. 353D); surface of dorsal cephalic shield and anterior 3 pedigerous somites covered with numerous fine setules. Fourth pedigerous somite forming almost spherical brood pouch, about 970  $\mu$ m long, longer than anterior part of

prosome. Free urosome (Fig. 353C) inserted into anterior ventral surface of brood pouch, 5-segmented: genital somite 58 $\times$ 182  $\mu$ m; 4 abdominal somites covered with fine setules, 56 $\times$ 156, 51 $\times$ 138, 38 $\times$ 125, and 62 $\times$ 124  $\mu$ m, respectively. Caudal rami broad, about 1.7 times longer than wide (93 $\times$ 56  $\mu$ m) and 1.5 times longer than anal somite, covered with fine setules, tapering with straight lateral margin and continuously curved inner and distal margins: armed only with 3 small distal setae.

Rostrum (Fig. 353E) as long as wide, nearly

semicircular, with slight lateral constriction proximally; setulose in distal third. Antennule (Fig. 353F) strongly tapering, setulose, about 120 µm long, 5-segmented; first and second segments much wider than distal segments; armature formula 1, 5, 2, 2, and 3; setae indistinguishable from setules. Antenna (Fig. 353G) 3-segmented; coxa and basis unarmed; slender endopod 4.1 times longer than wide (73×18 µm), slightly shorter than basis: armed with 6 setae (grouped as 1, 2, and 3) plus small terminal claw, about one-third as long as endopod.

Labrum (Fig. 353H) broadly inflated distally, setulose and soft. Mandible (Fig. 353I) with medially broadened coxal gnathobase bearing 5 acute teeth and 1 seta: basis with 1 seta on medial margin: exopod with 5 subequal setae; endopod with 1 seta on first segment and 4 setae on second. Maxillule (Fig. 353J) with 8 setae on arthrite, 1 each on epipodite and basis, 4 on exopod and 3 on endopod; coxal endite absent. Maxilla (Fig. 354A) 4-segmented; syncoxa with 4, 2, and 2 on first to third endites, respectively; basis with small claw plus 2 unequal setae; endopod with 1 and 3 setae on first and second segments, respectively; seta on first endopodal segment and one seta on second thick. Maxilliped (Fig. 354B) unsegmented, but constricted in middle, armed with 6 setae and ornamented with 4 rows of setules.

Legs 1–4 (Fig. 354C–F) biramous with 2-segmented protopods. Inner coxal seta absent in all legs. Leg 1 with inner distal seta on basis. Exopod 2-segmented in leg 1 and incompletely 3-segmented in legs 2–4. Endopod 3-segmented in leg 2 and 2-segmented in legs 1, 3, and 4. Both rami of legs 1–4 ornamented with setules in addition to setae. Setae on all swimming legs short. First exopodal segment of legs 2–4 lacking inner seta. Outer seta on basis and 3 inner setae on exopod of leg 1 weakly pinnate; all other setae on legs 1–4 naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-I	1-1; 1, 1, 5	0-1; 1, 2, 4
Leg 2	0-0	1-0	1-0; 1-1; 3, 1, 5	0-1; 0-1; 1, 2, 3
Leg 3	0-0	1-0	1-0; 1-1; 3, 1, 5	0-1; 1, 2, 4
Leg 4	0-0	1-0	1-0; 1-1; 2, 1, 5	0-1; 1, 2, 3

Leg 5 (Fig. 354G) bilobed; outer (protopodal) lobe digitiform, and tipped with 1 seta; inner (exopodal) lobe broad, bearing 1 small seta distally and acutely pointed, hook-like process mediolaterally.

**Male.** Unknown.

**Remarks.** Leg 5 of *Loboixys pilosa* **sp. nov.** consists of an elongate outer lobe bearing the protopodal seta and an inner lobe representing the exopod, which carries a hook-like distal process. This form of leg 5 is the most distinctive feature of *L. pilosa* **sp. nov.**, because it is unique within the genus. Other diagnostic features of the new species include: the presence of a claw plus 2 setae on the basis of the maxilla, and the endopods of legs 2

and 3 are armed with 8 setae each (compared to at most 7 setae as in *L. ryukyuensis* and *L. sibogae* **sp. nov.**).

Within the genus only two species, *L. pilosa* **sp. nov.** and *L. capillosus* (Ho & Kim, 2009) **comb. nov.** have a claw on the basis of the maxilla, but these two species can be easily separated because *L. capillosus* has a different form of leg 5 and has fewer setae on the rami of legs 2–4.

***Loboixys palauensis* sp. nov.**

(Fig. 355, 356)

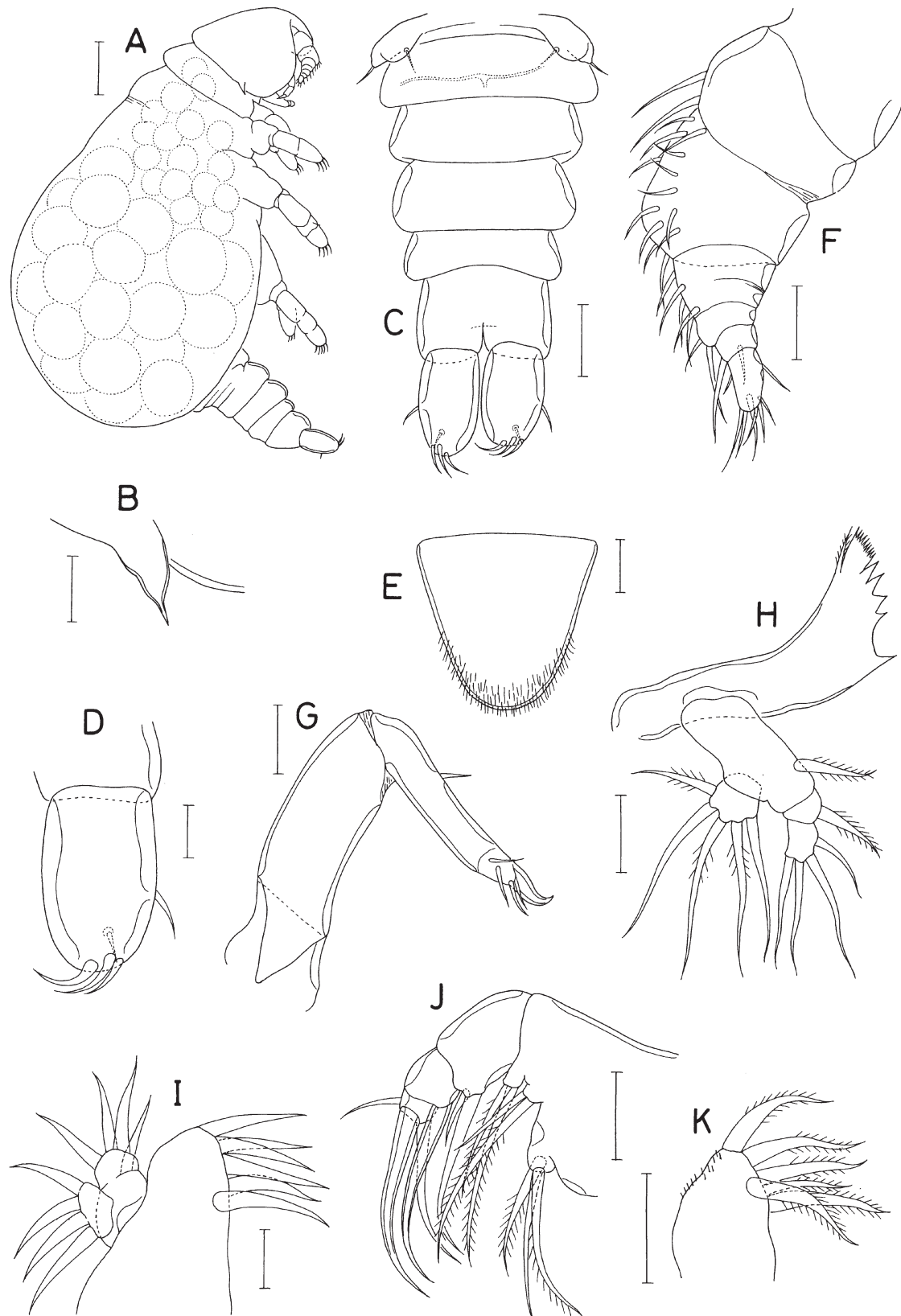
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21399), paratypes (4 intact ♀♀, MNHN-IU-2014-21400), and dissected paratype (♀, figured) from *Diplosoma multifidum* (Sluiter, 1909), Palau, Lewin coll., 19 October 1985.

**Etymology.** The specific name is derived from the type locality Palau Island.

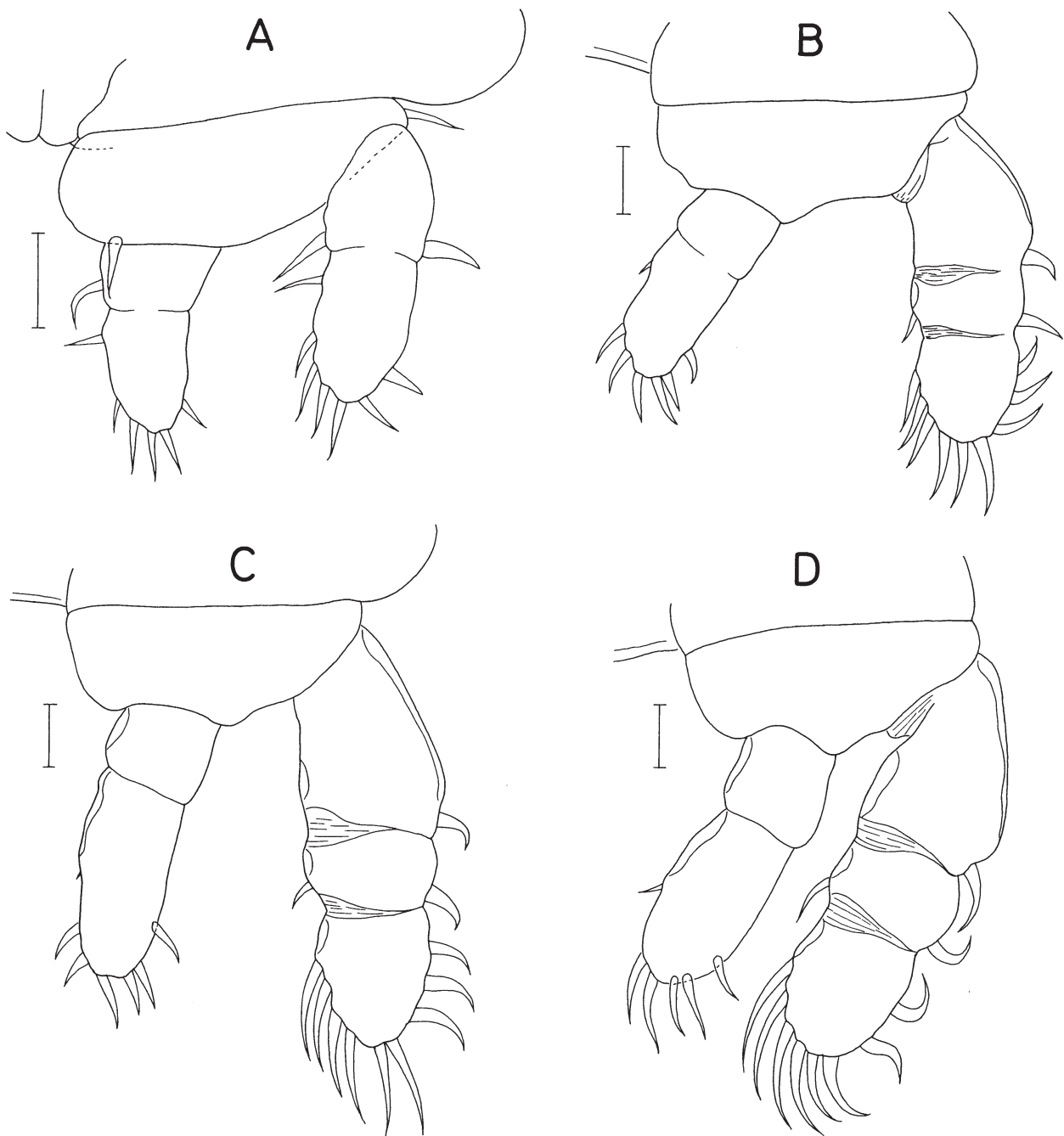
**Description of female.** Body (Fig. 355A) moderately inflated. Body length variable, 1.09 mm in dissected specimen. Prosome bulbous; dorsal cephalic shield bearing small, horn-like process, with slender tip, posterolaterally on each side (Fig. 355B). Metasome 1.5 times longer than wide, gradually broadening posteriorly, articulated between first and second pedigerous somites. Fifth pedigerous somite completely fused with the fourth. Free urosome (Fig. 355C) 5-segmented: genital and 4 abdominal somites 38×152, 41×136, 48×130, 32×111, and 56×95 µm, respectively. Caudal ramus (Fig. 355D) robust, sub-oval, 1.6 times longer than wide (72×45 µm) and slightly longer than anal somite; armed with 5 short setae (outer lateral, subdistal dorsal, and 3 distal); all setae naked and less than half width of ramus at base; outer lateral seta positioned at 56% of ramus length.

Rostrum (Fig. 355E) as long as wide (68×70 µm), tapering, setulose in distal third, with broadly rounded apex. Antennule (Fig. 355F) stout, 106 µm long, 6-segmented; first and second segments broad; third segment subdivided by trace of articulation posteriorly; armature formula 2, 13, 5, 2, 2, and 8; all setae short and naked. Antenna (Fig. 355G) slender, 3-segmented; coxa and basis unarmed; endopod slender, 4.7 times longer than wide (56×12 µm), subequal in length to basis: armed with 5 small setae (arranged as 1, 2, and 2) plus small terminal claw, about 0.3 times as long as endopod.

Labrum missing. Mandible (Fig. 355H) with coxal gnathobase bearing 5 pointed teeth and 1 small seta on broadened medial margin: basis with 1 seta on medial margin; exopod with 5 setae, outer seta half length of outer distal seta: endopod with 1 and 4 setae on first and second segments, respectively. Maxillule (Fig. 355I) with 6 setae on arthrite, 1 on basis, 4 on exopod and 3 on endopod; articulation between basis and endopod indistinct; coxal endite and epipodite absent; all setae naked. Maxilla (Fig.



**FIGURE 355.** *Loboixys palauensis* sp. nov., female. A, habitus, right; B, cephalic horn; C, leg 5 and urosome, ventral; D, left caudal ramus, ventral; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, D–H, J, K, 0.02 mm; C, 0.05 mm; I, 0.01 mm.



**FIGURE 356.** *Loboixys palauensis* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

355J) 4-segmented; syncoxa with 3, 2, and 2 setae on first to third endites, respectively; basis with 2 unequal setae only; first endopodal segment with 1 thick, spiniform seta; second endopodal segment with 3 unequal setae (1 thick and spiniform). Maxilliped (Fig. 355K) as unsegmented lobe armed with 6 setae and ornamented with minute spinules on outer distal surface.

Legs 1–4 (Fig. 356A–D) biramous with 2-segmented protopods. Rami of leg 1 incompletely 2-segmented. Legs 2–4 each with 3-segmented exopod and 2-segmented

endopod. Inner coxal seta absent in legs 1–4. Outer seta on basis present in leg 1, but absent in legs 2–4. Basis of leg 1 with inner distal seta. First exopodal segments and first endopodal segments of legs 2–4 lacking inner seta. All setae on legs 1–4 short and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	1-1; 1, 1, 5	0-1; 1, 2, 3
Leg 2	0-0	0-0	1-0; 1-1; 3, 1, 5	0-0; 0-1; 1, 2, 4

Leg 3	0-0	0-0	1-0; 1-1; 3, 1, 5	0-0; 1, 2, 4
Leg 4	0-0	0-0	1-0; 1-1; 2, 1, 5	0-0; 1, 2, 3

Leg 5 (Fig. 355C) bilobed; both lobes tipped with 1 small seta.

**Male.** Unknown.

**Remarks.** In the genus *Loboixys* the caudal rami exhibit various states of setal loss, with the complete loss of caudal setae in *L. ryukyuensis*, *L. capillosus* (Ho & Kim, 2009) **comb. nov.**, and *L. sibogae* **sp. nov.** In contrast, *L. palauensis* **sp. nov.** carries 5 caudal setae, the largest number currently known within the genus. This characteristic setation allows the new species to be distinguished from its congeners.

The numbers of setae on the exopods of legs 1–4 of *L. palauensis* **sp. nov.** are 9, 12, 12, and 11, respectively. In *Loboixys* this combination of leg setation is shared only with *L. pilosa* **sp. nov.** However, the setation of the endopods of legs 1–4 is different between the two species (see Table 12). In addition, the lack of a claw on the basis of the maxilla, the absence of a seta representing the coxal epipodite on the maxillule, and the simple, bilobed state of leg 5 are also diagnostic features of *L. palauensis* **sp. nov.**, serving to differentiate it from *L. pilosa* **sp. nov.**

#### *Loboixys similis* **sp. nov.**

(Fig. 357, 358)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21401), paratypes (5 intact ♀♀, MNHN-IU-2014-21402), and dissected paratypes (2 ♀♀, figured) from *Diplosoma multifidum* (Sluiter, 1909), CRRF OCDN 4382-W, Kotor, Palau Islands (07°19.60'N, 134°30.84'E), depth 1 m, 27 November 1996.

**Etymology.** The name is derived from the Latin *simil* (=similar), referring to the similarity of the new species to *L. pilosa* **sp. nov.** and *L. palauensis* **sp. nov.**

**Description of female.** Body (Fig. 357A) swollen, surface covered with setules. Prosome 1.21 mm long; dorsal cephalic shield lacking posterolateral horn-like processes. Metasome indistinctly 4-segmented by 3 constrictions dorsally and laterally; fourth pedigerous somite greatly expanded, forming spherical brood pouch, about 810 µm in diameter. Free urosome (Fig. 357B) inserted into ventral surface of brood pouch; 5-segmented: genital and 4 abdominal somites 30×139, 58×133, 53×121, 44×108, and 53×110 µm, respectively. Caudal ramus (Fig. 357B) broad, 1.24 times longer than wide (57×46 µm) and as long as anal somite, tapering, with rounded distal margin; armed with 2 or 3 small setae.

Rostrum (Fig. 357C) slightly longer than wide (100×91 µm); wider in proximal quarter, narrower and tapering in distal three-quarters; surface covered with setules. Antennule (Fig. 357D) short, strongly tapering, 97

µm long, 7-segmented; armature formula uncertain due to similarity between setae and setules. Antenna (Fig. 357E) 3-segmented; coxa and basis unarmed; unsegmented endopod slender, 4.3 times longer than wide (65×15 µm), as long as basis; armed with 5 small setae (arranged as 1, 2, and 2) plus small terminal claw, about 0.3 times as long as basis.

Labrum (Fig. 357F) weak, with smooth, convex posterior margin and paired, setulose lobes posterolaterally. Mandible (Fig. 357G) with 5 acute teeth and 1 seta on coxal gnathobase: basis with 1 seta on medial margin; exopod with 5 setae (outermost distal seta longer than other 4); endopod with 1 and 4 setae on first and second segments, respectively; 2 longer distal setae on second segment naked, other setae pinnate. Maxillule (Fig. 357H) with basis and endopod fused; precoxal arthrite armed with 6 setae; coxal endite and epipodite lacking; fused basis and endopod armed with 1 medial and 3 distal setae; exopod with 4 setae. Maxilla (Fig. 357I) 4-segmented; syncoxa with 3, 2, and 2 setae on first to third endites, respectively; basis with 1 thick seta and 1 small seta; endopod with 1 thick seta on first segment and 1 thick and 2 thin setae on second. Maxilliped (Fig. 357J) as unsegmented lobe bearing 6 setae and outer distal ornamentation of minute spinules.

Legs 1–4 (Fig. 358A–D) biramous with incompletely 2-segmented protopods; inner coxal seta absent. Leg 1 basis with inner distal seta. Endopods 2-segmented in legs 1–4; exopods obscurely segmented, with trace of articulation in leg 1, and traces of 2 articulations in legs 2–4. Protopods and rami of legs 1–4 ornamented with setules; all setae short and naked. Armature formula of legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	1-0; 2, 1, 4	0-1; 0, 2, 4
Legs 2 & 3	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 1, 2, 3
Leg 4	0-0	1-0	1-0; 1-0; 2, 1, 5	0-0; 1, 2, 2

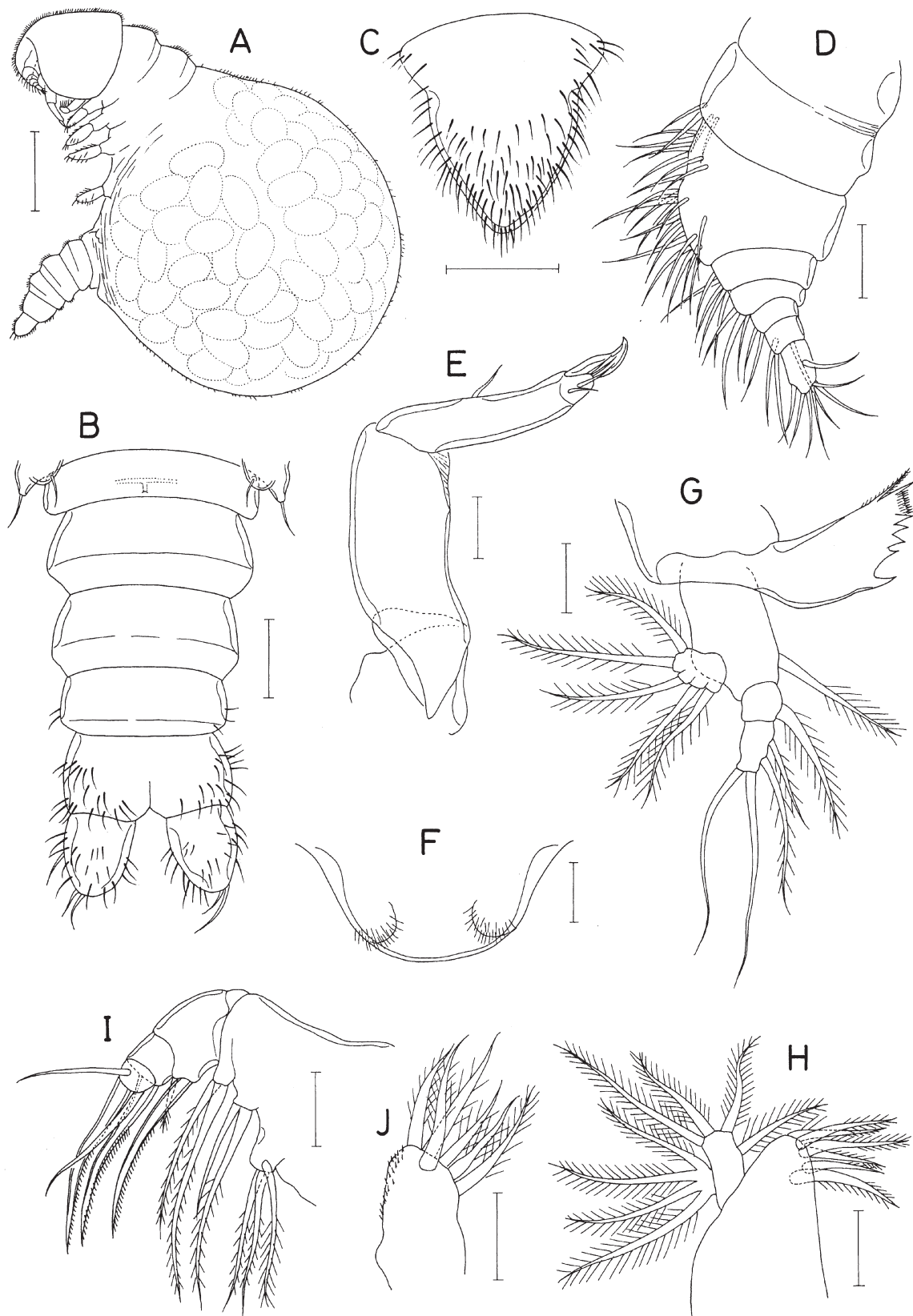
Leg 5 (Fig. 357B) rudimentary, bilobed; outer lobe tapering; each lobe tipped with small seta.

**Male.** Unknown.

**Remarks.** *Loboixys similis* **sp. nov.** is similar to *L. palauensis* **sp. nov.** in the possession of 6 setae on the arthrite of the maxillule, in the absence of a coxal epipodite on the same appendage, and in the possession of 2-segmented endopods in legs 1–4. However, in *L. similis* **sp. nov.** the caudal ramus is shorter (1.24 times longer than wide, compared to 1.6 times in *L. palauensis* **sp. nov.**) and has fewer setae, the setae on the maxillule are pinnate (cf. naked in *L. palauensis* **sp. nov.**), and there are fewer setae on legs 1–4 in *L. similis* **sp. nov.** than in *L. palauensis* **sp. nov.**

*Loboixys similis* **sp. nov.**, *L. pilosa* **sp. nov.** and *L. palauensis* **sp. nov.** were all found living in association with the same ascidian host *Diplosoma multifidum* in the





**FIGURE 357.** *Loboixys similis* sp. nov., female. A, habitus, left; B, leg 5 and urosome, ventral; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Scale bars: A, 0.2 mm; B, C, 0.05 mm; D–J, 0.02 mm.

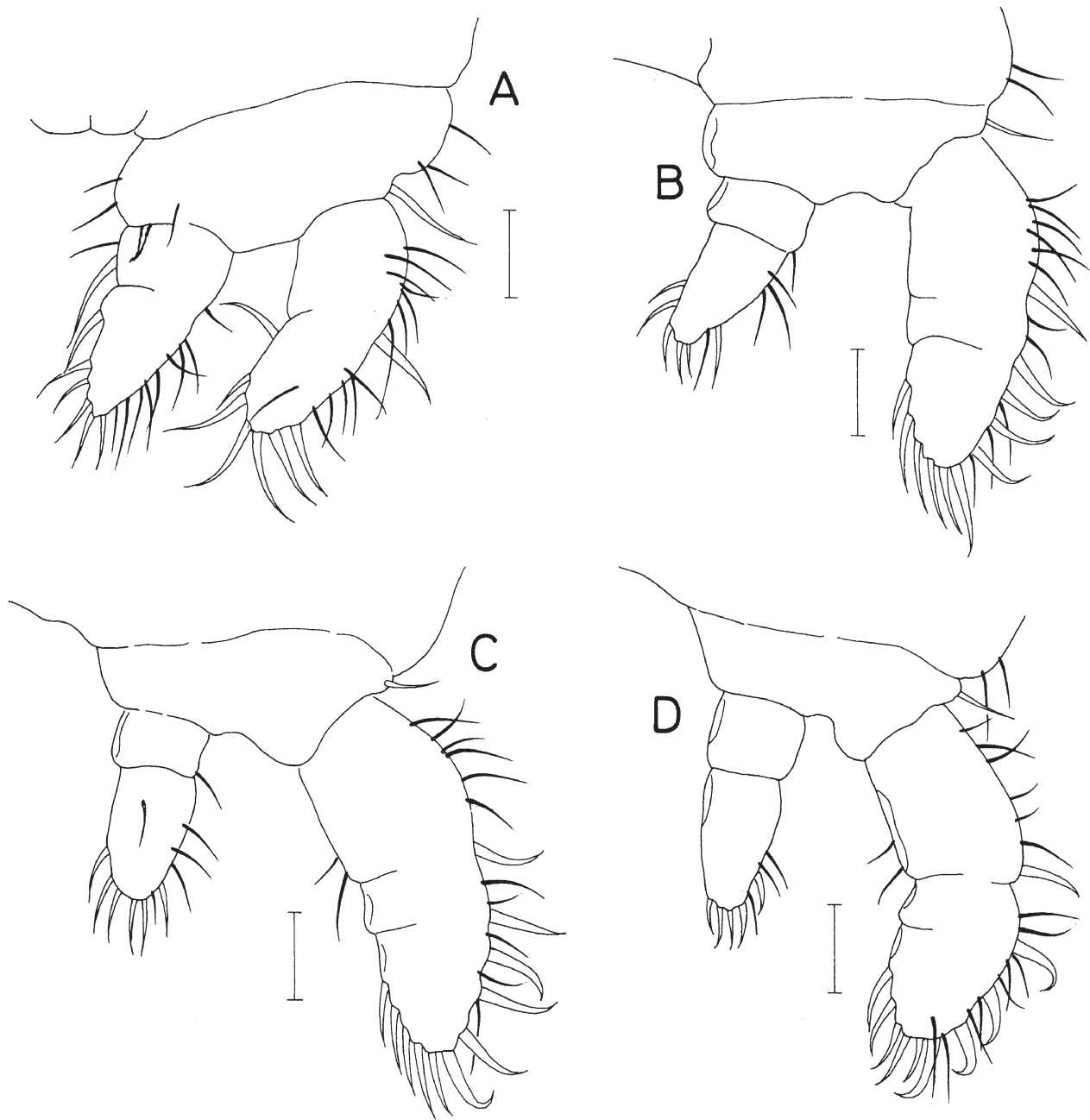


FIGURE 358. *Loboixys similis* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

TABLE 12. Differences between the three species of *Loboixys* associated with the ascidian *Diplosoma multifidum* (Sluiter, 1909)

Characters	<i>L. pilosa</i> sp. nov.	<i>L. palauensis</i> sp. nov	<i>L. similis</i> sp. nov
Caudal setae	3	5	2 or 3
Number of antennule segments	5	6	7
Setae on maxillular arthrite	8	6	6
Coxal epipodite on maxillule	present	absent	absent
Setation of 1st endite of maxillary syncoxa	4 setae	3 setae	3 setae
Armature of maxillary basis	1 claw + 2 setae	2 setae	2 setae
Setation of exopods of legs 1-4	9, 12, 12, 11	9, 12, 12, 11	8, 11, 11, 10
Setation of endopods of legs 1-4	8, 8, 8, 7	7, 7, 6, 6	7, 6, 6, 5
Hook-like process on inner lobe of leg 5	present	absent	absent

tropical Pacific. Their detailed differences are summarised in Table 12.

***Loboixys tetramera* sp. nov.**

(Figs. 359, 360)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21403) from *Trididemnum cyclops* Michaelsen, 1921, New Caledonia, Récif Néokumbi ext, Stn NC30, depth 20–30m, Monniot coll., 09 March 1987.

**Etymology.** The name is derived from the Greek *tetr* (=four) and *mero* (=part), alluding to the four-segmented urosome of the new species.

**Description of female.** Body (Fig. 359A, B) highly transformed, globular, about 2.0 mm long along body axis. Body surface smooth. Prosome curved ventrally; dorsal cephalic shield lacking posterolateral horn-like processes. Metasome 4-segmented; fourth pedigerous somite nearly spherical, 1.15 mm in diameter, consisting of narrower dorsal and broad ventral zones indented ventrally. Free urosome (Fig. 359C) small, tapering, inserted into indented ventral surface of brood pouch, 4-segmented, consisting of genital and 3 abdominal somites measuring 68×330, 68×227, 50×197, and 105×175 µm, respectively. Caudal ramus (Fig. 359C) narrowing distally, about 2.3 times longer than wide (100×47 µm) and slightly shorter than anal somite: armed with 4 small setae only (1 outer lateral and 3 distal).

Rostrum (Fig. 359D) bulbous, ornamented with long setules along distal margin. Antennule (Fig. 359D) small, tapering, abruptly narrowing in distal third, 85 µm long, unsegmented and apparently unarmed, but ornamented with many setules. Antenna (Fig. 359E) 3-segmented; coxa and basis unarmed; unsegmented endopod about 3.7 times longer than wide (63×17 µm) and about 0.8 times as long as basis: armed with 5 small setae (arranged as 1, 2, and 2) plus small terminal claw, about 0.35 times as long as endopod.

Labrum (Fig. 359F) with broad, straight posterior margin covered with fine setules. Mandible (Fig. 359G) with 6 acute teeth, including smaller distalmost tooth, and 1 small seta on coxal gnathobase; palp armed with 1 seta on basis, 5 equal setae on exopod, and 5 setae on endopod (1 on first and 4 on second segment). Maxillule (Fig. 359H) armed with 6 setae on arthrite, 1 on basis, 4 on exopod and 3 on endopod; coxa lacking endite and epipodite. Maxilla (Fig. 360A) 4-segmented, strongly flexed between syncoxa and basis; syncoxa with 4 (including 1 minute seta), 2, and 2 setae on first to third endites, respectively; basis with 2 small setae; first endopodal segment with 1 thick seta, second segment with 1 thick, spiniform seta and 2 small setae. Maxilliped (Fig. 359I) as unsegmented lobe bearing 6 setae and scattered fine spinules.

Legs 1–4 (Fig. 360B–E) biramous: protopod 2-segmented in legs 1–3, unsegmented and obscurely

defined at base in leg 4. Inner coxal seta absent in legs 1–4. Endopods of these legs 2-segmented, shorter than exopods. Exopods of legs 1–3 incompletely segmented. Leg 4 with distinctly 2-segmented rami; endopod much reduced in size. All setae naked and short. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	1-0; 1, 1, 3	0-1; 1, 2, 2
Leg 2	0-0	1-0	1-0; 1-0; 3, 1, 5	0-0; 1, 2, 1
Leg 3	0-0	1-0	1-0; 3, 1, 5	0-0; 1, 2, 1
Leg 4	0-0	1-0	1-0; 2, 1, 5	0-0; 0, 2, 1
Leg 5	absent (Fig. 359C).			

**Male.** Unknown.

**Remarks.** *Loboixys tetramera* sp. nov. is unique within the genus in having a 4-segmented urosome and in lacking leg 5. Additional diagnostic features include: the antennule is small, unsegmented, and ornamented only with setules, without identifiable setae, the coxal gnathobase of the mandible is armed with 6 teeth, and the swimming legs are armed with the fewest setae of any species within the genus, i.e., the endopods of legs 1–4 carry 6, 4, 4, and 3 setae, respectively. These features allow us to differentiate *L. tetramera* sp. nov. from its congeners.

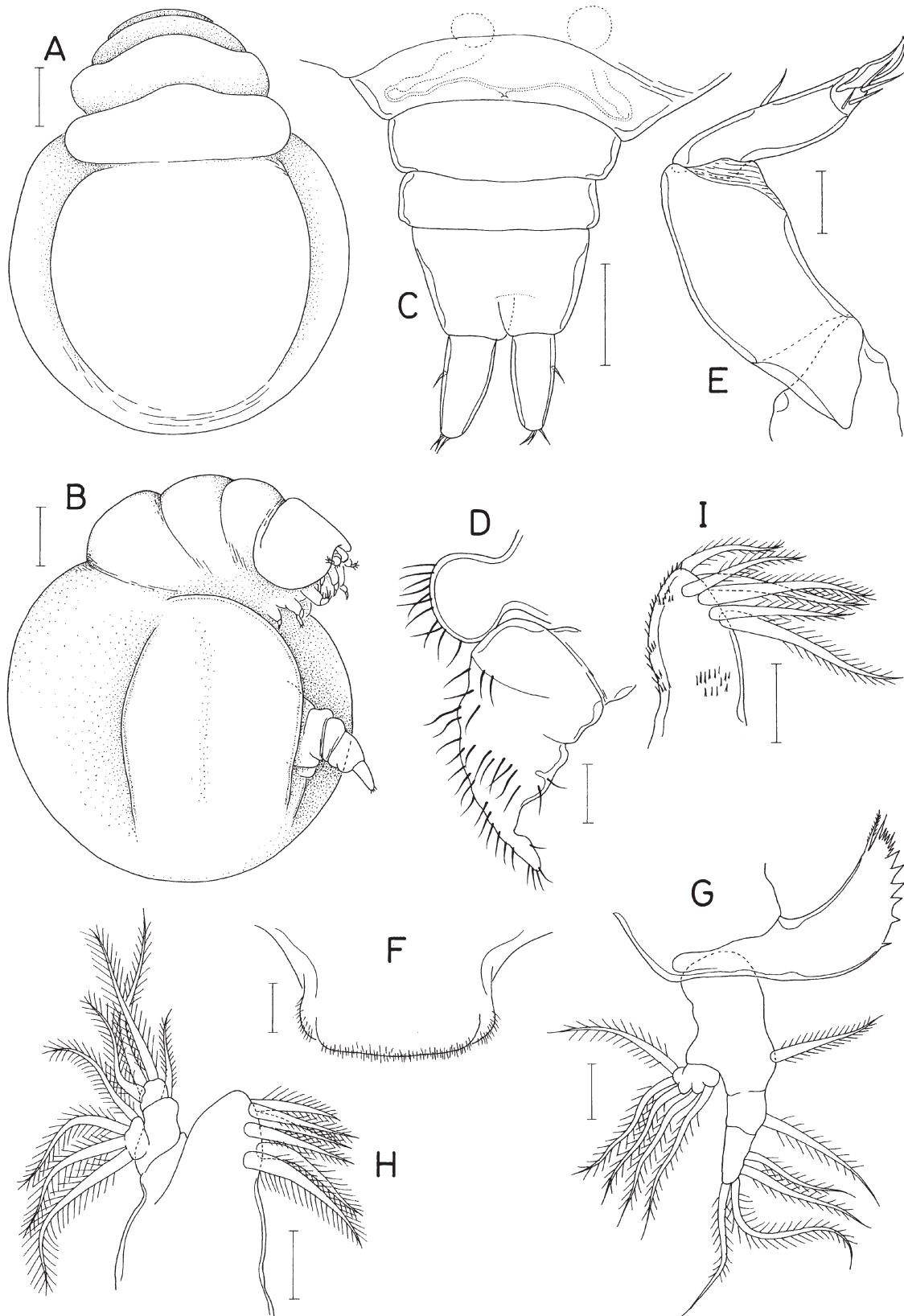
***Ammonixys* gen. nov.**

**Diagnosis.** Body globular with swollen, almost spherical, fourth pedigerous somite. Free urosome 5-segmented. Caudal setae obscure. Rostrum well-developed. Antennule small, 6-segmented. Antenna 4-segmented with small terminal claw. Mandible with 4 teeth on coxal gnathobase; exopod fused with basis, represented by 2 setae; endopod 2-segmented with 1 and 4 setae on first and second segments, respectively. Maxillule with 6 setae on arthrite, 1 each on coxal epipodite and basis, 4 on exopod and 3 on endopod; coxal endite absent. Maxilla 4-segmented; syncoxa with 2 endites; basis with claw plus 1 seta; endopod 2-segmented. Maxilliped as unsegmented lobe bearing 4 setae. Legs 1–3 with 3-segmented rami. Leg 4 with 3-segmented exopod and 2-segmented endopod. Inner coxal seta absent in legs 1–4. Leg 1 lacking inner distal element on basis. First and second exopodal segments of legs 1–4 lacking inner seta. First and second endopodal segments of legs 1–3 lacking inner seta. Leg 5 represented by lobe and tapering, sclerotized process located ventrodistally on somite.

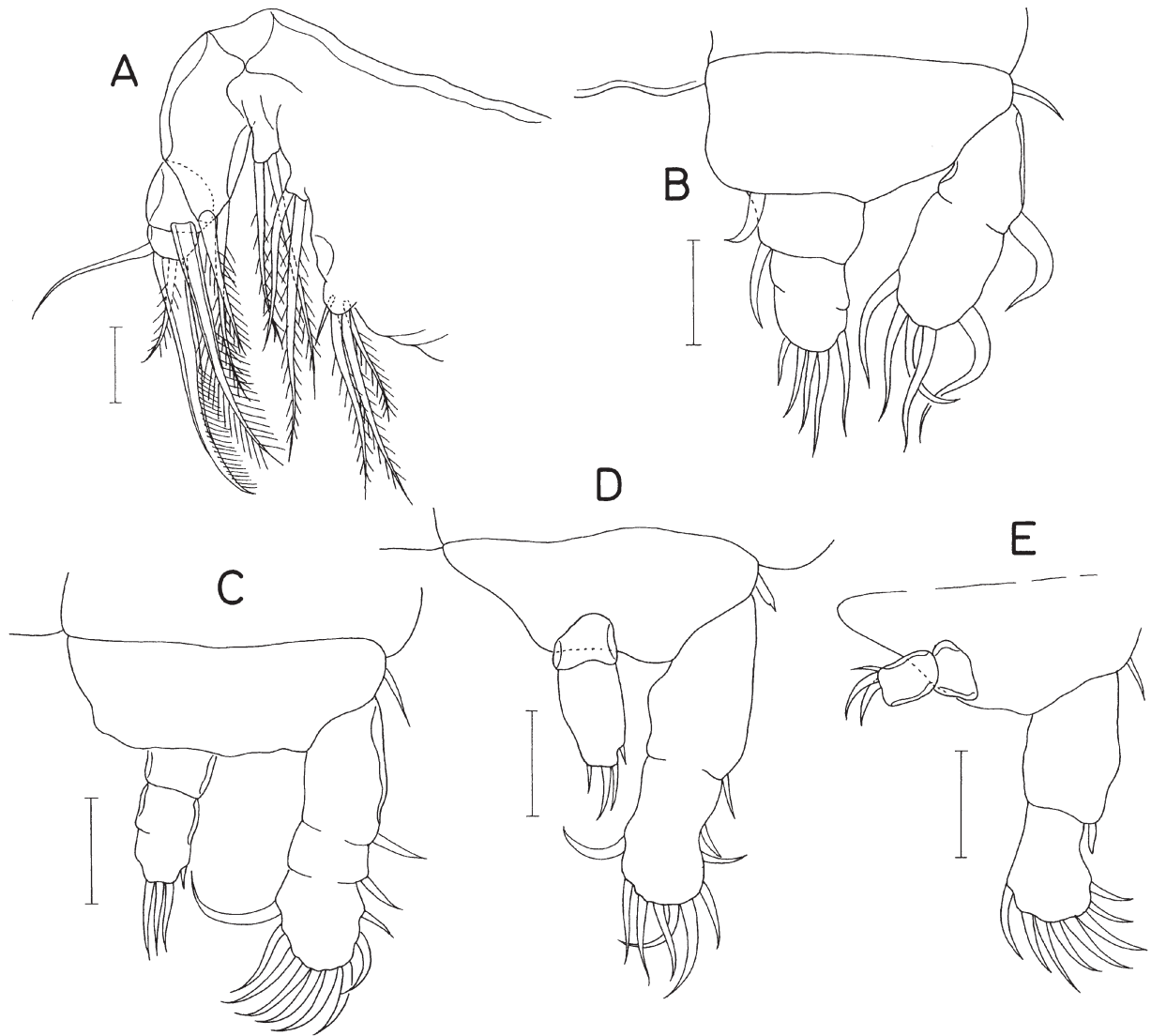
**Type species.** *Ammonixys quadridens* gen. et sp. nov. by original designation.

**Etymology.** The name is derived from the Greek *ammon* (=African) and *ixys*, referring to the discovery of the new genus in Africa.

**Remarks.** *Ammonixys* gen. nov. resembles *Doroixys* in the absence of the inner seta on the proximal endopodal



**FIGURE 359.** *Loboixys tetramera* sp. nov., female. A, habitus, dorsal; B, habitus, right; C, urosome, ventral; D, rostrum and antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilliped. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D–I, 0.02 mm.



**FIGURE 360.** *Loboixys tetramera* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: 0.02 mm.

segment(s) of legs 2–4, but the new genus exhibits a striking derived feature separating it from *Doroixys* and other genera, namely, the loss of a distinct mandibular exopod. The exopod is represented only by a pair of setae originating on the surface of the fused basis plus exopod. The setation of leg 1 is also distinctive because the first and second exopodal and endopodal segments of leg 1 all lack an inner seta, and the basis of leg 1 is unarmed. This setation of leg 1 differs from that expressed by the four new genera described above, *Progoroixys* gen. nov., *Notoixys* gen. nov., *Borixys* gen. nov., and *Cystixys* gen. nov. Although the loss of inner setae from the exopod of leg 1 occurs in *Loboixys*, the latter genus usually retains the inner setae on the endopod of leg 1. Unlike in *Ammonixys* gen. nov., the seven known species of *Loboixys* each have a 3-segmented antenna and carry 6 setae on the maxilliped. This constitutes an additional

significant difference between *Loboixys* and *Ammonixys* gen. nov., which has a 4-segmented antenna and carries only 4 setae on the maxilliped.

***Ammonixys quadridens* gen. et sp. nov.**  
(Figs. 361, 362)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21404) from *Polyclinum isipingense* Sluiter, 1898 (MNHN-IT-2008-XXX = MNHN A1/POL.B/108), ATIMO VATAE TR07, Madagascar (25°01'S, 47°00'E), depth 12–16 m, MNHN coll., 01 May 2010.

**Etymology.** The specific name is from the Latin *quadr* (=four) and *dens* (=tooth), referring to the presence of four teeth on the coxal gnathobase of the mandible.

**Description of female.** Body (Fig. 361A, B) globular, greatly swollen: body length 1.12 mm from frontal margin of cephalosome to posterior margin of fourth pedigerous somite. Prosome with smooth surface; lateral margins of dorsal cephalic shield expanded ventrally, completely concealing mouthparts in lateral view. Metasome 4-segmented; first and second articulations complete, third articulation incomplete; first to third pedigerous somites much wider than long, Fourth pedigerous somite greatly expanded, spherical, 785×774 µm. Free urosome (Fig. 361C) small, stout, 5-segmented, inserted into ventral surface of brood pouch (Fig. 361B). All urosomites much wider than long; 4 abdominal somites sparsely ornamented with minute spinules. Caudal ramus (Fig. 361C) small, lobate, slightly longer than wide, not articulated from anal somite, bearing minute setules; caudal setae apparently absent.

Rostrum (Fig. 361E) distinct, slightly longer than wide (84×72 µm), tapering to narrow apex. Antennule (Fig. 361F) arched posteriorly, 117 µm long, 6-segmented; third and fourth segments articulated from each other only on one surface; first segment with 2 setae; setation of other segments obscure due to similarity with setules; third, fifth and terminal segments each bearing 1 small aesthetasc. Antenna (Fig. 361G) stout, 4-segmented; coxa, basis, and first endopodal segment unarmed; basis shorter than first endopodal segment; narrower second endopodal segment about 2.3 times longer than wide (41×18 µm) and as long as first segment: armed with 3 small setae plus small terminal claw, about one-third as long as second endopodal segment.

Labrum (Fig. 361H) simple, unornamented, with short, broad posteromedian lobe. Mandible (Fig. 361I) with coxal gnathobase bearing 4 teeth on distal half of medial margin and pectinate proximal half of medial margin: palp consisting of basis and 2-segmented endopod; basis with 1 seta mediodistally; exopod completely fused with basis, represented by outer lobe of basis and pair of large setae at base of lobe; endopod 2-segmented, incompletely articulated from basis, with 1 broad seta on first segment and 4 setae on second. Maxillule (Fig. 362A) armed with 6 setae on arthrite, 1 on coxal epipodite, 1 on basis, 4 on exopod and 3 on endopod; coxal endite absent. Maxilla (Fig. 362B) 4-segmented; syncoxa bearing 2 endites, with 3 setae on first endite and 2 on second; basis with strong claw plus 1 seta; small endopod with 1 seta on first segment and 3 setae on second. Maxilliped (Fig. 362C) as small lobe bearing 4 setae.

Legs 1–4 (Fig. 362D–G) biramous with 3-segmented exopods; endopods 3-segmented in legs 1–3, but 2-segmented in leg 4. Protopod 2-segmented in leg 1, but unsegmented in legs 2–4. Inner coxal seta absent in legs 1–4. Leg 1 lacking inner distal element on basis. Outer seta on basis present only in leg 3. Endopod of leg 1 strongly curved inwards. First exopodal segment of legs 3 and 4 and second exopodal segment of legs 2 and 4

each bearing spiniform outer distal process. Outer setae on third exopodal segment of legs 2–4 vestigial. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	0-0; 0-0	1-0; 1-0; 1, 1, 4	0-0; 0-0; 4
Leg 2	0-0	1-0; 0-0; 3, 1, 5	0-0; 0-0; 0, 2, 2
Leg 3	1-0	0-0; 0-0; 1, 0, 4	0-0; 0-0; 0, 2, 2
Leg 4	0-0	0-0; 0-0; 1, 1, 4	0-0; 0, 2, 1

Leg 5 (Fig. 361C) consisting of outer lobe tipped with 1 small seta and inner, tapering, sclerotized process; left and right inner processes interconnected.

**Male.** Unknown.

**Remarks.** It is noteworthy that *Ammonixys quadridens* **gen. et sp. nov.** was extracted along with *Doroixys obesa* **sp. nov.** and two other species of copepods (*Scolecodes* sp. and *Haplostoma* sp.), all from the same ascidian host.

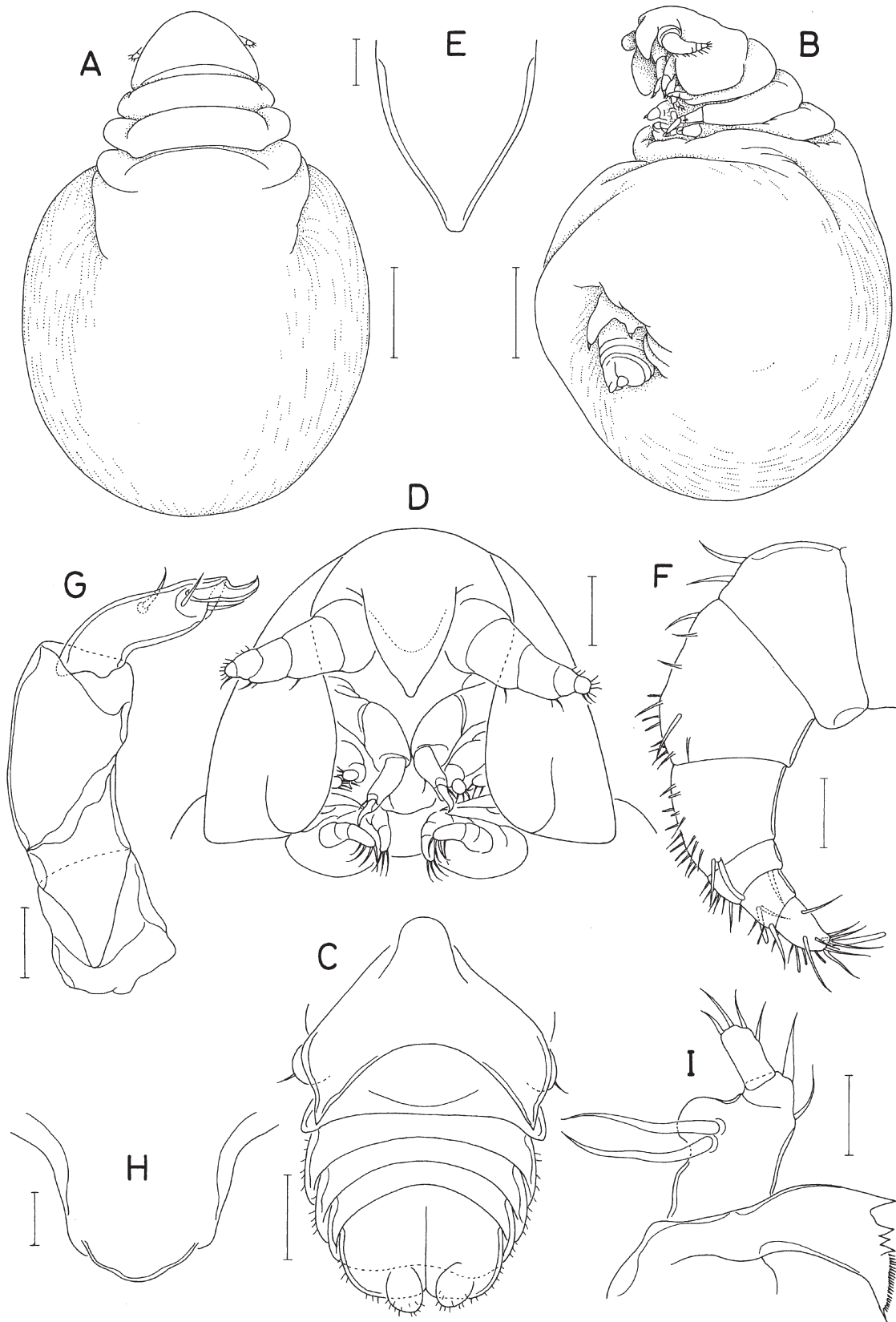
### *Ctenixys* **gen. nov.**

**Diagnosis.** Body inflated. Dorsal cephalic shield well defined from metasome, with or without paired posterolateral horn-like processes. Metasome unsegmented, longer than wide, gradually broadening posteriorly. Free urosome 5-segmented. Caudal ramus small; caudal setae obscure or absent. Rostrum present. Antennule 6- or 7-segmented; setae small, not discernible from setules. Labrum weak. Mandible consisting of coxa with straight, pectinate medial margin, and palp comprising basis bearing 1 seta, exopod bearing 5 setae, and 2-segmented endopod bearing 1 and 4 setae on first and second segments, respectively. Maxillule with 3 or 4 setae on arthrite, 1 on coxal epipodite; coxal endite absent; exopod and endopod fused with basis, with 7 or 8 setae (3 or 4 on exopodal region, 3 on endopodal region, and 1 on basis region). Maxilla 3-segmented; syncoxa with 3 endites; basis with strong claw only; endopod unsegmented, armed with 3 setae. Maxilliped as small lobe bearing 4 to 8 setae. Swimming legs with reduced segmentation and setation; inner coxal seta absent. Leg 1 with 1- or 2-segmented rami; inner distal seta of basis present or absent. Legs 2–4 each with indistinctly 2-segmented exopod; endopod absent or represented by small knob. Leg 5 vestigial or represented by 2 small lobes.

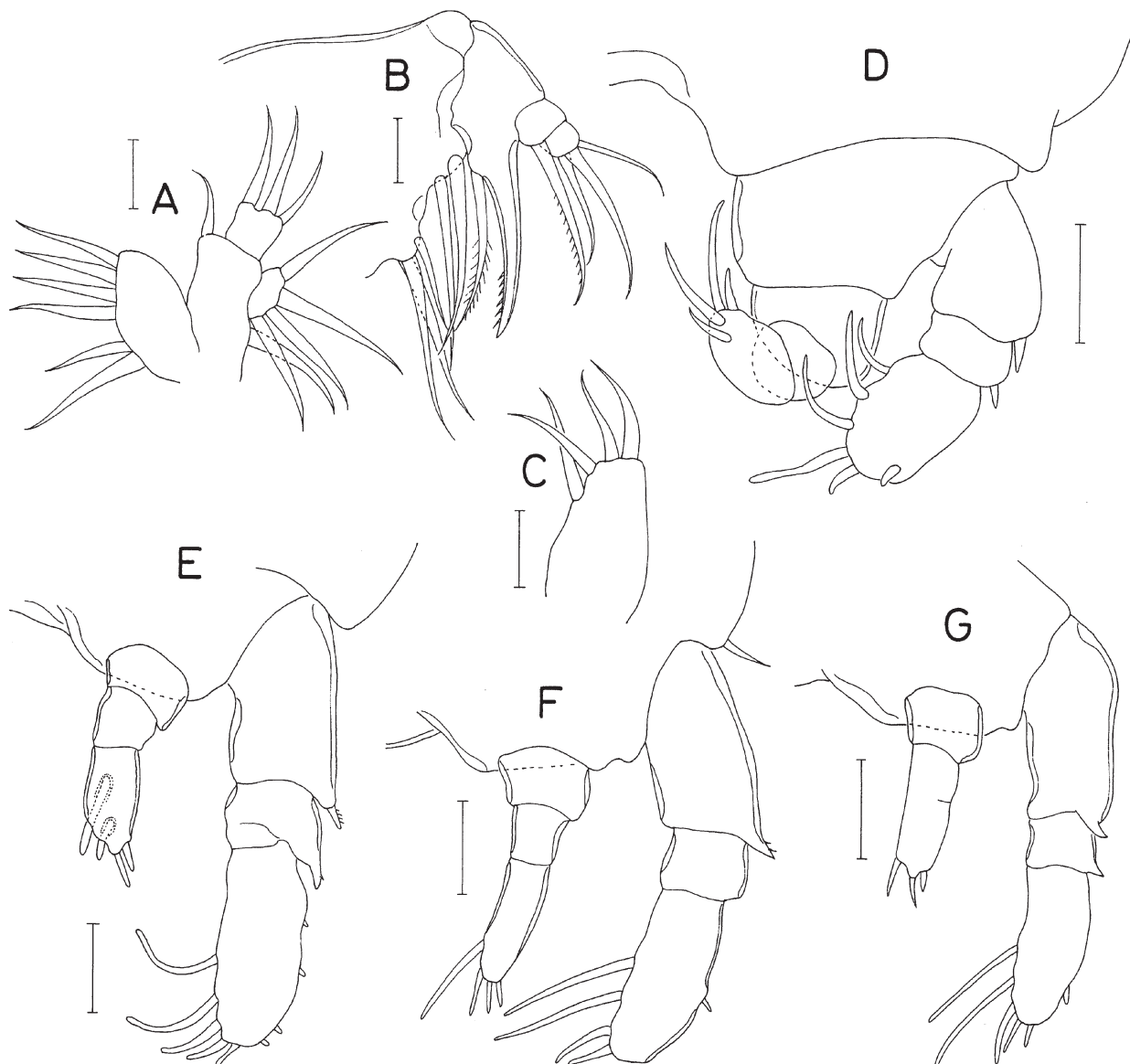
**Type species.** *Ctenixys pusilla* **gen. et sp. nov.** by original designation.

**Other included species.** *Ctenixys abdominalis* (Stock, 1967) **comb. nov.** (originally as *Demoixys abdominalis*) and *C. affinis* (Stock & Humes, 1970) **comb. nov.** (originally as *Demoixys affinis*).

**Etymology.** The generic name is the combination of the Greek *cten* (=comb) and *ixys*, the ending of many generic names in the family Notodelphyidae. It alludes to



**FIGURE 361.** *Ammonixys quadridens* gen. et sp. nov., female. A, habitus, dorsal; B, habitus, ventrolateral; C, leg 5 and urosome, ventral; D, anterior part of prosome, ventral; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible. Scale bars: A, B, 0.2 mm; C, D, 0.05 mm; E–I, 0.02 mm.



**FIGURE 362.** *Ammonixys quadridens* gen. et sp. nov., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4. Scale bars: A–C, 0.01 mm; D–G, 0.02 mm.

the comb-like medial margin on the coxal gnathobase of the mandible.

**Remarks.** *Demoixys abdominalis* Stock, 1967 and *D. affinis* Stock & Humes, 1970 are here transferred into *Ctenixys* gen. nov. The significant synapomorphy shared by all species of the new genus is the pectinate medial margin of the coxal gnathobase of the mandible. This form of coxal gnathobase, which lacks defined teeth on the medial margin, is distinctly different from that of *Demoixys* which bears between 3 and 5 teeth.

***Ctenixys pusilla* gen. et sp. nov.**

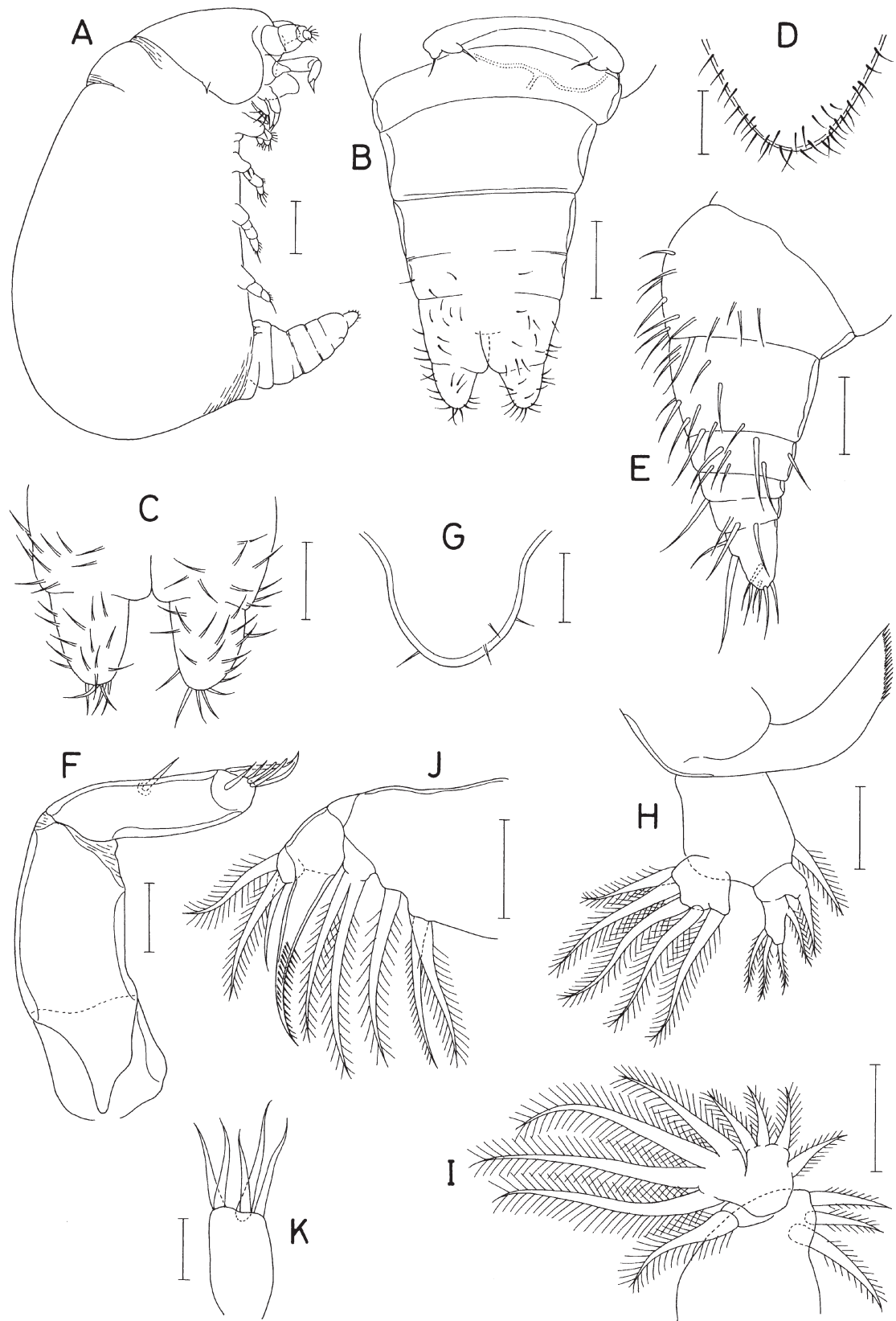
(Figs. 363, 364)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21405), paratypes (7 intact ♀♀, MNHN-IU-2014-21406), and dissected paratypes (2 ♀♀, figured) from *Diplosoma listerianum* (Milne Edwards, 1841) (MNHN-IT-2008-3541=MNHNA2/DIP.A/69), Îlot Canard, New Caledonia, depth 9 m, Monniot coll., 12 September 1985.

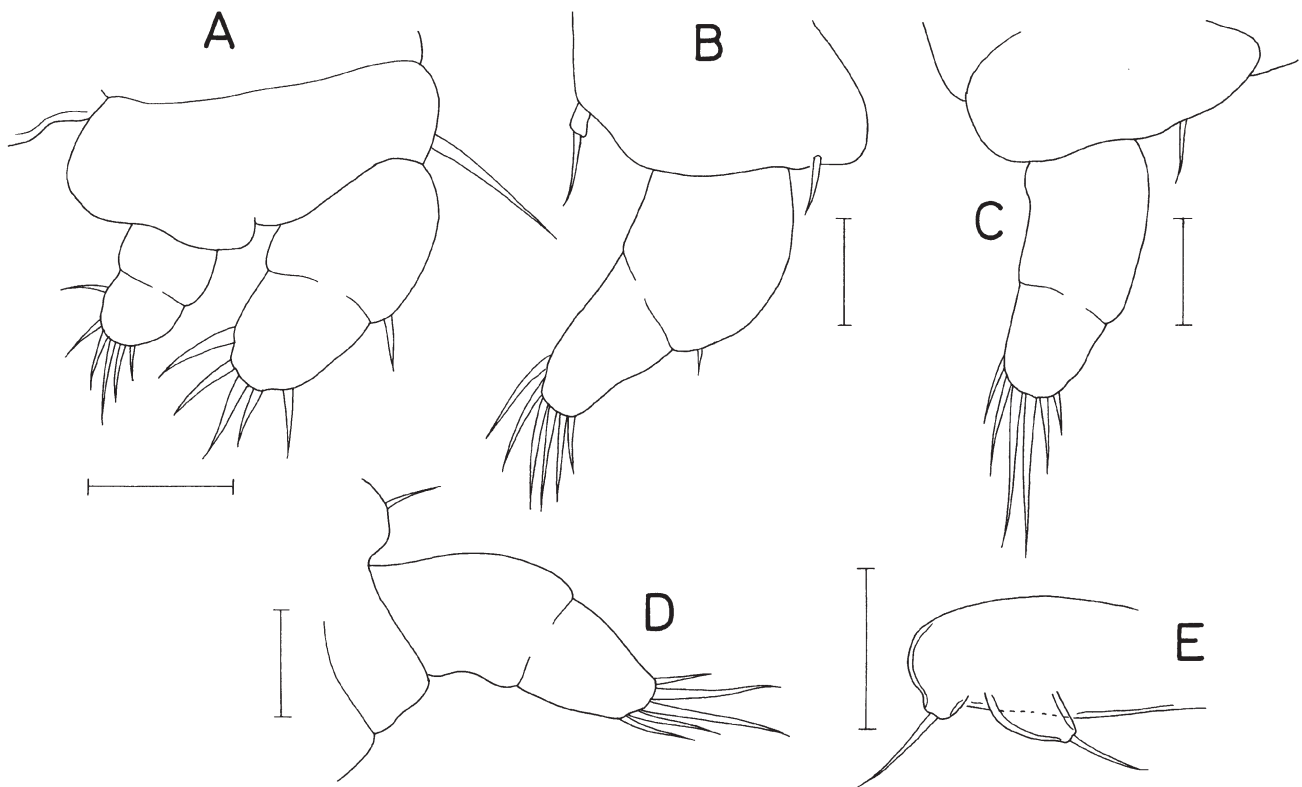
**Etymology.** The specific name is derived from the Latin *pusill* (=very small), referring to its small body.

**Description of female.** Body (Fig. 363A) stout, inflated; body length 1.06 mm. Prosome 882 µm long; dorsal cephalic shield well-defined, with very small horn-





**FIGURE 363.** *Ctenixys pusilla* gen. et sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, caudal rami, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, 0.05 mm; C–J, 0.02 mm; K, 0.01 mm.



**FIGURE 364.** *Ctenixys pusilla* gen. et sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4; E, leg 5. Scale bars: 0.02 mm.

like process posterolaterally on each side. Metasome gradually broadening posteriorly towards rounded margin, unsegmented but with dorsal constriction between pedigerous regions of legs 1 and 2. Free urosome (Fig. 363B) directed ventrally, perpendicular to prosomal axis, evenly tapering, 5-segmented; articulations between last 3 segments incomplete; surface of anal somite and caudal rami ornamented with setules. Caudal rami (Fig. 363C) short, obscurely defined from anal somite, slightly longer than wide ( $24 \times 21 \mu\text{m}$ ) and about half as long as anal somite, with rounded distal margin; caudal setae indistinguishable from setules.

Rostrum (Fig. 363D) semicircular, 1.5 times wider than long, setulose. Antennule (Fig. 363E)  $100 \mu\text{m}$  long, setulose, broad, tapering, indistinctly 6-segmented; 2 distal articulations obscure; setae indistinguishable from setules. Antenna (Fig. 363F) 3-segmented; coxa and basis unarmed; unsegmented endopod about 3.4 times longer than wide ( $55 \times 16 \mu\text{m}$ ) and as long as basis: armed with 5 setae (grouped as 1, 1, and 3) plus small terminal claw, about one-third as long as endopod.

Labrum (Fig. 363G) semicircular, with few setules. Mandible (Fig. 363H) with elongate coxal gnathobase terminating in narrow, pectinate medial margin; basis with 1 seta medially; exopod with 4 longer medial setae

and 1 short outer seta; first endopodal segment projecting medially and armed with 1 seta; second segment narrow, with 4 small setae. Maxillule (Fig. 363I) with 3 setae on arthrite and 1 seta on coxal epipodite; coxal endite absent; exopod and endopod both fused with basis but discernible from each other by marginal notches; regions representing basis, exopod and endopod armed with 1, 4, and 3 setae, respectively. Maxilla (Fig. 363J) 3-segmented, comprising syncoxa, basis, and unsegmented endopod; syncoxa bearing 2, 1, and 2 setae on first to third endites, respectively; basis armed only with strong claw bearing 2 rows of spinules distally; endopod small with 3 setae, smallest seta naked, all other setae on maxilla pinnate. Maxilliped (Fig. 363K) small, as unsegmented lobe armed distally with 4 or 5 (5 is common) naked setae.

Legs 1–4 (Fig. 364A–D) reduced in segmentation and setation; inner coxal seta absent. Leg 1 with incompletely 2-segmented rami; basis with large outer seta, but lacking inner distal element. Legs 2–4 with protopod (fused coxa and basis) bearing outer seta and incompletely 2-segmented exopod. Leg 2 endopod rudimentary, knob-like, tipped with 1 seta. Legs 3 and 4 lacking trace of endopod. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	1-0	1-0; 5	0-0; 5
Leg 2	1-0	1-0; 6	1
Leg 3	1-0	0-0; 6	absent
Leg 4	1-0	0-0; 5	absent

Leg 5 (Fig. 364E) represented by 2 unequal posteroventral lobes (smaller outer and larger inner) on somite, each tipped with 1 seta.

**Male.** Unknown.

**Remarks.** *Ctenixys pusilla* **gen. et sp. nov.** differs from its congeners in the absence of an inner distal element on the basis of leg 1, in the absence of an endopod on leg 3 (cf. present in both other species), in the possession of fewer setae on the maxilliped (4 or 5, compared with 6 in *C. abdominalis* and 8 in *C. affinis*), and in the different setation of legs 1 and 2.

### Genus *Demoixys* Illg & Dudley, 1961

**Diagnosis.** Body globular or stout. Dorsal cephalic shield with or without horn-like posterolateral processes. Free urosome small, 2- to 5-segmented. Caudal ramus small, poorly defined from anal somite; caudal setae at most 5 in number or apparently absent. Rostrum distinct. Antennule small, unsegmented or at most 6-segmented. Antenna 3- or 4-segmented, with small terminal claw. Mandible bearing 3 to 6 teeth on coxal gnathobase; armed with 1 seta on basis, 2 to 5 on exopod, and at most 6 on 1- or 2-segmented endopod. Maxillule as in *Doroixys* or much reduced to bilobed appendage; coxal epipodite usually present, but coxal endite absent. Maxilla 3- or 4-segmented; syncoxa with 3 endites at most; basis with large claw; endopod 1- or 2-segmented, armed with total of 4 setae at most. Maxilliped as small lobe bearing 2 to 6 setae. Legs 1–4 variously reduced, weak, consisting of indistinctly 2-segmented rami, or further reduced to 2 small lobes or rudimentary knob. Leg 5 absent, or represented by outer lobe and tapering inner process, or represented by lobe.

**Type species:** *Demoixys chattoni* Illg & Dudley, 1961, by original designation.

**Remarks.** The genus *Demoixys* was poorly defined in the original report of Illg & Dudley (1961) who differentiated between it and other notodelphyids by its weakly segmented, inflated body, its reduced antennular segmentation, and the highly modified mouthparts and legs. It can be distinguished from *Mesoixys* by the form of the mandible (which has a styliiform coxal gnathobase in *Mesoixys*), and by the 5-segmented maxilla (Humes & Stock, 1970). It can be distinguished from both *Lobodelphys* and *Paralobodelphys* Gotto, 1981, because both of these genera lack a coxal gnathobase on the mandible.

### *Demoixys depressa* sp. nov.

(Figs. 365, 366)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21407), paratypes (2 intact ♀♀, MNHN-IU-2014-21408), and dissected paratypes (2 ♀♀, figured) from *Diplosoma versicolor* Monniot F., 1994 (MNHN-IT-2008-3648 = MNHN A2/DIP/147), CRRF CRCHO 139, Caminguin I., the Philippines (09°12.89'N, 124°38.03'E), 18 April 1997.

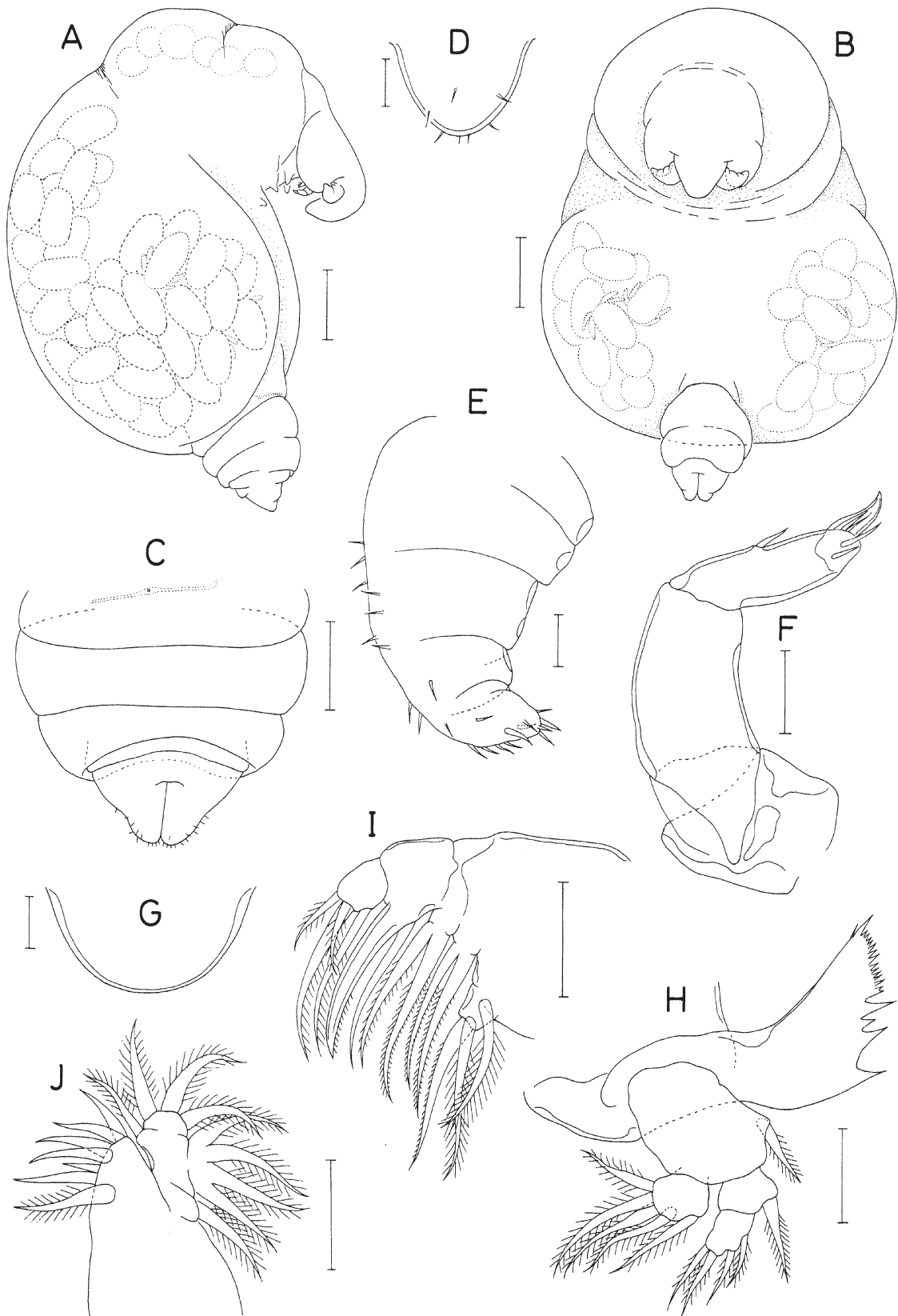
**Etymology.** The specific name alludes to the dorsoventrally depressed body of the new species.

**Description of female.** Body (Fig. 365A, B) swollen, 1.94 mm long. Prosome curved ventrally, depressed, markedly broader posteriorly, 1.03 mm wide, and 0.79 mm dorsoventral depth. Cephalosome directed posteriorly; dorsal cephalic shield distinct, small in relation to metasome, lacking posterolateral processes. Metasome unsegmented, with 2 dorsal constrictions anteriorly; posterolateral part more expanded than anterior and middle regions; entire metasome forming brood pouch. Free urosome (Fig. 365C) short, slightly wider than long, 5-segmented, but genital somite fused with metasome. Caudal rami fused with anal somite, without trace of articulation, strongly tapering, nearly as long as wide, setulose but lacking setae.

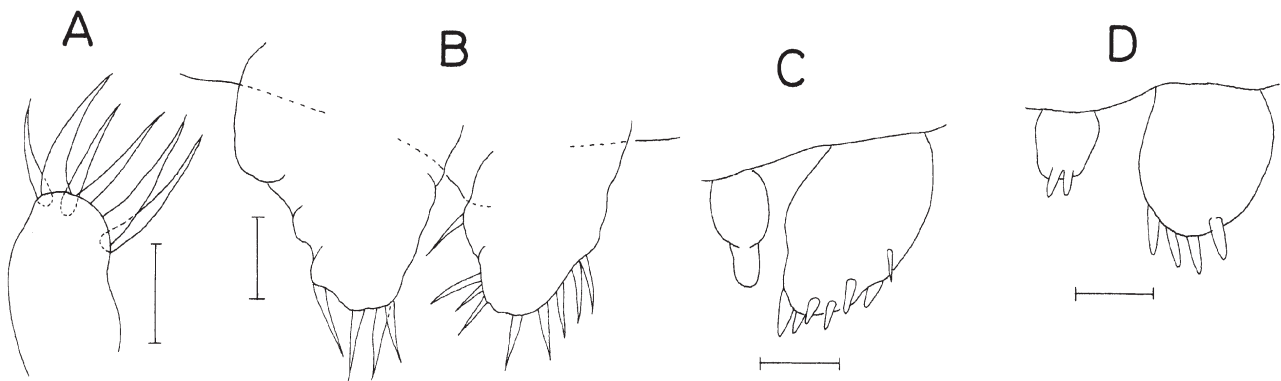
Rostrum (Fig. 365D) large, slightly wider than long, semicircular, with scattered setules. Antennule (Fig. 365E) short, broad, 90 µm long, 1.5 times longer than wide, incompletely 5-segmented; articulations expressed only on posterior surface of appendage; few setae indistinguishable from scattered setules. Antenna (Fig. 365F) 3-segmented, consisting of coxa, basis, and unsegmented endopod; coxa and basis unarmed; endopod about 2.7 times longer than wide (41×15 µm); armed with 5 setae (arranged as 1, 2, and 2) plus short terminal claw, about one-third as long as endopod.

Labrum (Fig. 365G) semicircular, much wider than long, unornamented. Mandible (Fig. 365H) with broad coxal gnathobase bearing 4 teeth; proximal second tooth smaller: basis with 1 seta medially; exopod with 5 setae; proportional lengths of setae 12:13:15:16:10 from inner to outer; endopod with 1 broad seta on first segment and 4 (2 medial and 2 distal) subequal setae on second. Maxillule (Fig. 365J) with 7 setae on arthrite, 1 on each epipodite and basis, 4 on exopod, and 3 on endopod; endopod incompletely defined from basis; coxal endite absent. Maxilla (Fig. 365I) 3-segmented; syncoxa with 3, 2, and 2 setae on first to third endites, respectively; basis with claw plus 1 seta; endopod unsegmented with 4 setae. Maxilliped (Fig. 366A) as small lobe armed with 6 naked setae.

Legs 1–3 (Fig. 366B–D) rudimentary, each represented by 2 unsegmented lobes; coxa and basis not defined. Leg 1 with 9 setae on exopodal lobe and 4 on endopodal lobe. Leg 2 with 7 setae on exopodal lobe and



**FIGURE 365.** *Demoixys depressa* sp. nov., female. A, habitus, right; B, habitus, ventral; C, urosome, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxilla; J, maxillule. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D–J, 0.02 mm.



**FIGURE 366.** *Demoixys depressa* sp. nov., female. A, maxilliped; B, leg 1; C, leg 2; D, leg 3. Scale bars: 0.01 mm.

unarmed endopod. Leg 3 with 4 setae on exopodal lobe and 2 setae on endopodal lobe. Setae on legs 1–3 small or rudimentary. Legs 4 and 5 absent.

**Male.** Unknown.

**Remarks.** *Demoixys depressa* sp. nov. may be distinguished from its congeners by the absence of legs 4 and 5. The dorsoventrally depressed body and the possession of 4 setae on the unsegmented endopod of the maxilla are also distinguishing character states of the new species.

***Demoixys compressa* sp. nov.**

(Figs. 367, 368)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2009-5229) from *Didemnum* sp., (MNHN-IT-2018-10), ATIMO VATAE TA21, Banc Tozer, Madagascar (25°12'38"S, 44°8'36"E), depth 13–27 m, MNHN coll., 21 May 2010.

**Etymology.** The specific name alludes to the compressed body of the female of the new species.

**Description of female.** Body (Fig. 367A) greatly expanded dorsally, slightly compressed, almost circular in lateral view, 1.54 mm in greatest diameter. Cephalosome small, discernible but incompletely defined from metasome. Metasome unsegmented, entire brood pouch containing developing eggs. Free urosome (Fig. 367B) broad, depressed, setulose, obscurely 3-segmented, strongly tapering posteriorly, wider than long, comprising genital and 2 expressed abdominal somites. Caudal ramus (Fig. 367C) not articulated from anal somite, irregular in form, about twice as long as wide, flexed in middle, with broad proximal part and narrow distal part: armed with 5 setae and ornamented with several setules.

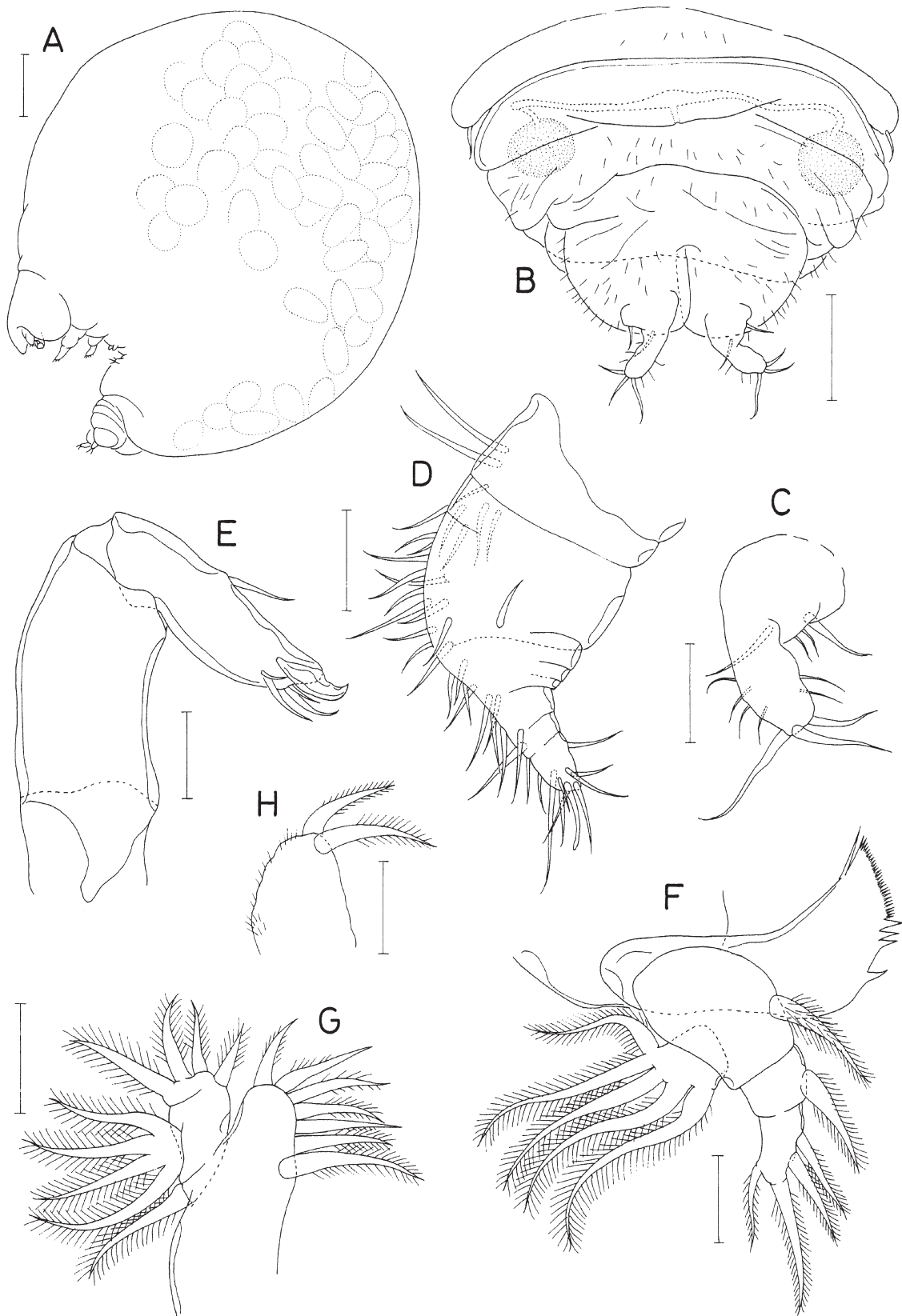
Rostrum longer than wide, tapering towards blunt apex. Antennule (Fig. 367D) 82 µm long, obscurely 6-

segmented, proximal two-thirds (first to third segments) broad and abruptly narrowing to distal third (fourth to sixth segments); armature formula 3, 18, 6, 3, 2, and 9+aesthetasc; all setae small and naked. Antenna (Fig. 367E) stout, 3-segmented; coxa and basis unarmed; unsegmented endopod about 3.1 times longer than wide (55×18 µm) and about as long as basis: armed with 5 setae (grouped as 1, 2, and 2) plus short terminal claw, about quarter length of endopod.

Labrum missing. Mandible (Fig. 367F) comprising coxa and palp: medial margin of coxal gnathobase with 4 distal teeth and pectinate region proximally; proximal margin of gnathobase with 1 seta: basis with 1 broad seta on medial margin; exopod with 5 setae (4 large mediobasal setae and 1 short outer seta); endopod with 1 broad seta on first segment, 4 setae on second. Maxillule (Fig. 367G) with 7 setae on arthrite, 1 each on epipodite and basis, 4 on exopod, and 3 on endopod; endopod obscurely defined from basis; coxal endite absent. Maxilla (Fig. 368A) 4-segmented, comprising syncoxa, basis, and 2-segmented endopod; syncoxa with 4, 2, and 2 setae on first to third endites, respectively; basis with strong claw plus 2 unequal setae; first and second endopodal segments with 1 and 3 setae, respectively. Maxilliped (Fig. 367H) as unsegmented lobe bearing 2 setae distally and scattered setules on outer surface.

Legs 1–4 lacking inner coxal seta, ornamented with scattered setules on rami. Leg 1 (Fig. 368B) consisting of coxa, basis, and incompletely 2-segmented rami; inner distal spine on basis small, setiform. Legs 2–4 (Fig. 368C–E) degenerated; coxa and basis not defined. Rami of leg 2 and exopod of leg 3 obscurely 2-segmented. Exopod of leg 4 1-segmented. Endopods of legs 3 and 4 lobate and unarmed. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	0-0; 1-I	1-1; 8 (or 9)	0-1; 5
Leg 2	1-0	1-0; 5	0-0; 0



**FIGURE 367.** *Demoixys compressa* **sp. nov.**, female. A, habitus, left; B, leg 5 and urosome, ventral; C, left caudal ramus, ventral; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilliped. Scale bars: A, 0.2 mm; B, 0.05 mm; C–H, 0.02 mm.

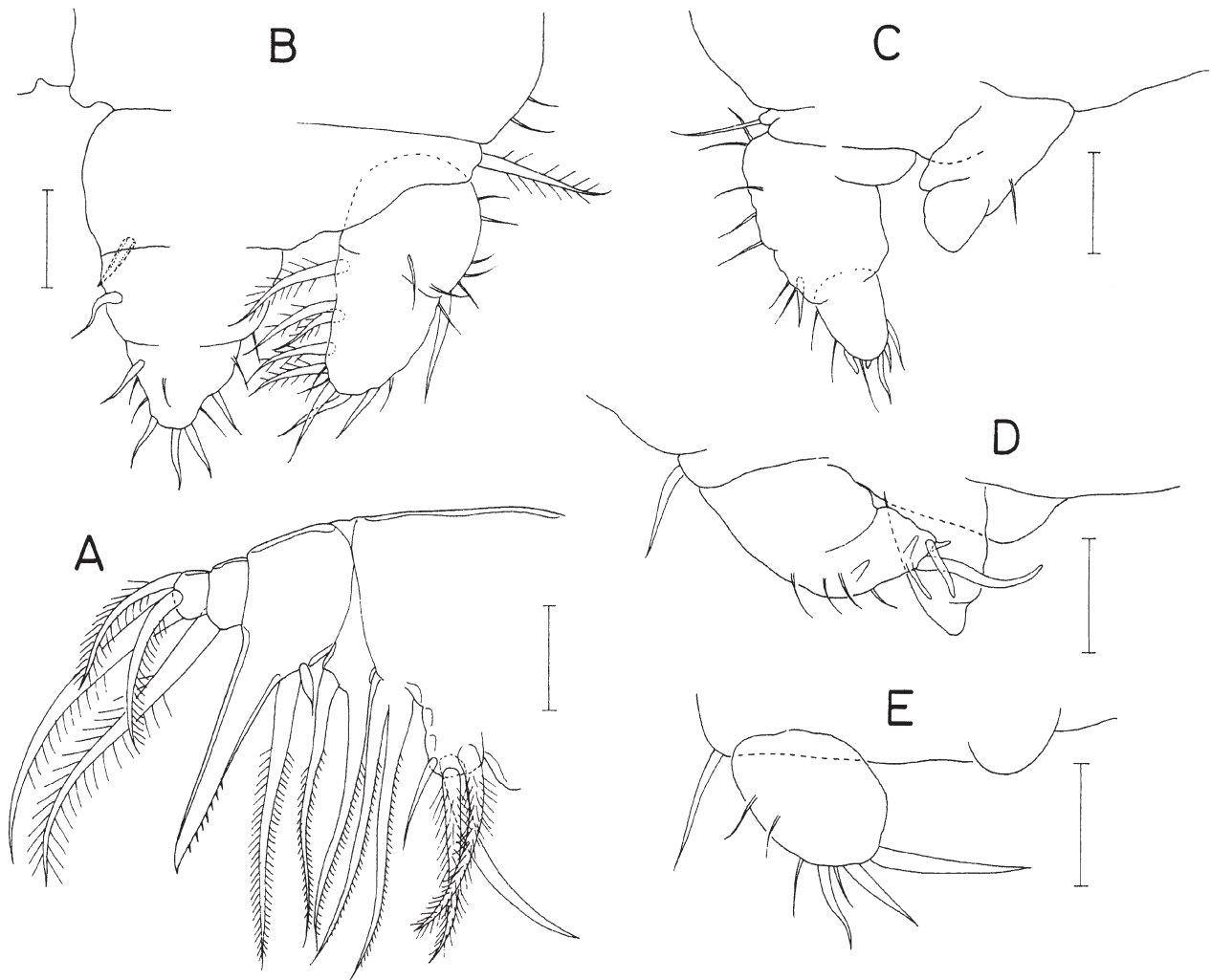


FIGURE 368. *Demoixys compressa* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: 0.02 mm.

Leg 3	1-0	0-0; 6	0
Leg 4	1-0	3	0

Leg 5 represented by posteroventral lobes on somite (Fig. 367B) tipped 1 small seta.

**Male.** Unknown.

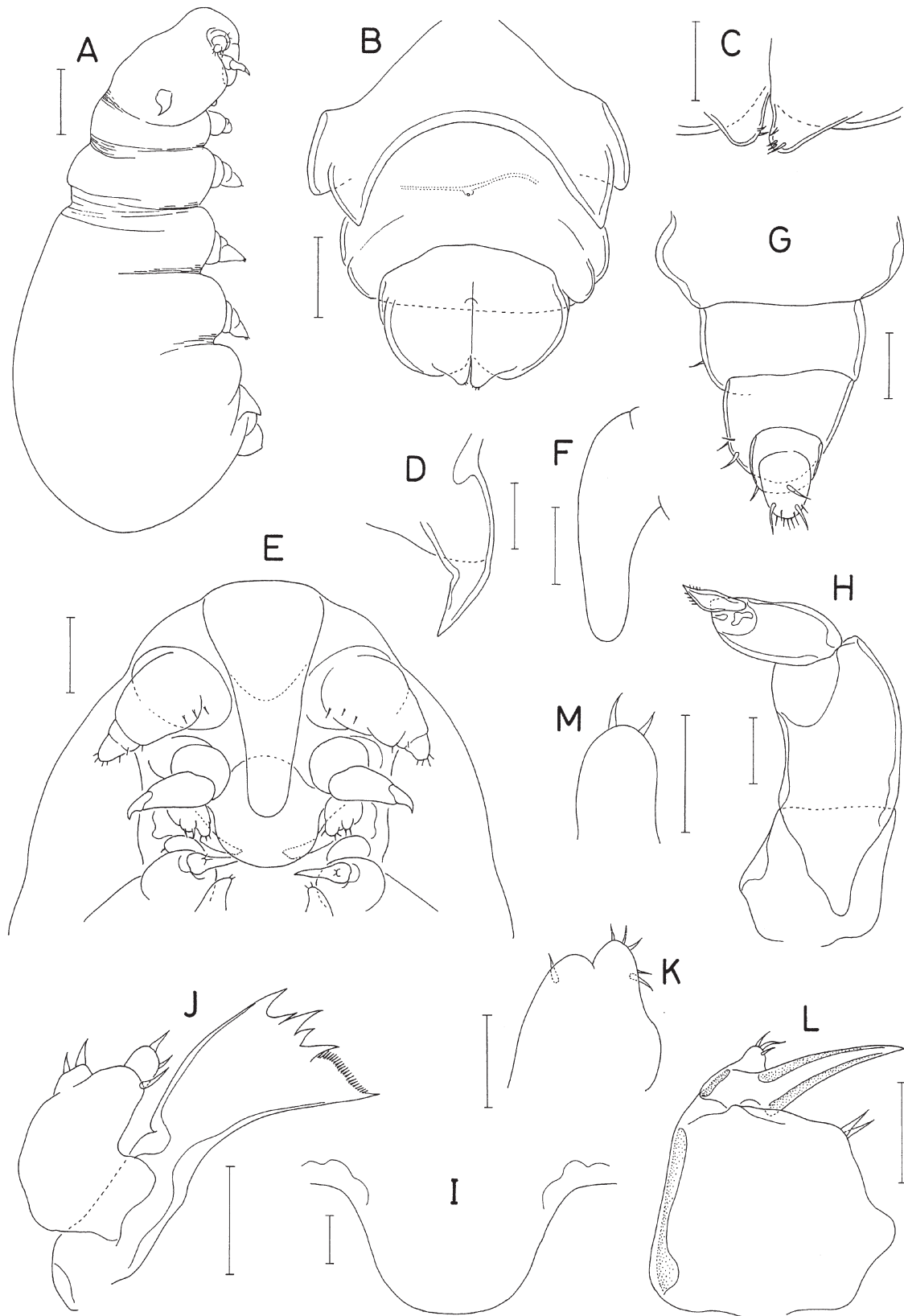
**Remarks.** *Demoixys compressa* sp. nov. seems to be closer to *D. depressa* sp. nov. than to its other congeners, because these two species share the possession of a 3-segmented antenna, 4 teeth on the coxal gnathobase of the mandible, 7 setae on the arthrite of the maxillule, and 9 setae on the exopod of leg 1. However, *D. compressa* sp. nov. exhibits some distinct differences from *D. depressa* sp. nov., for example: (1) the caudal ramus is armed with 5 setae (cf. apparently unarmed in *D. depressa* sp. nov.); (2) the endopod of the maxilla is 2-segmented (cf. unsegmented in *D. depressa* sp. nov.); (3) the maxilliped is armed with 2 setae as in the type species, *D. chattoni*

and *D. dialepta* Illg & Dudley, 1961 (cf. 6 setae in *D. depressa* sp. nov.); (4) leg 1 bears an outer seta and an inner distal seta on the basis (cf. both of these setae are absent in *D. depressa* sp. nov.), and (5) leg 4 is present (cf. absent in *D. depressa* sp. nov.)

***Demoixys cornuta* sp. nov.**  
(Figs. 369, 370)

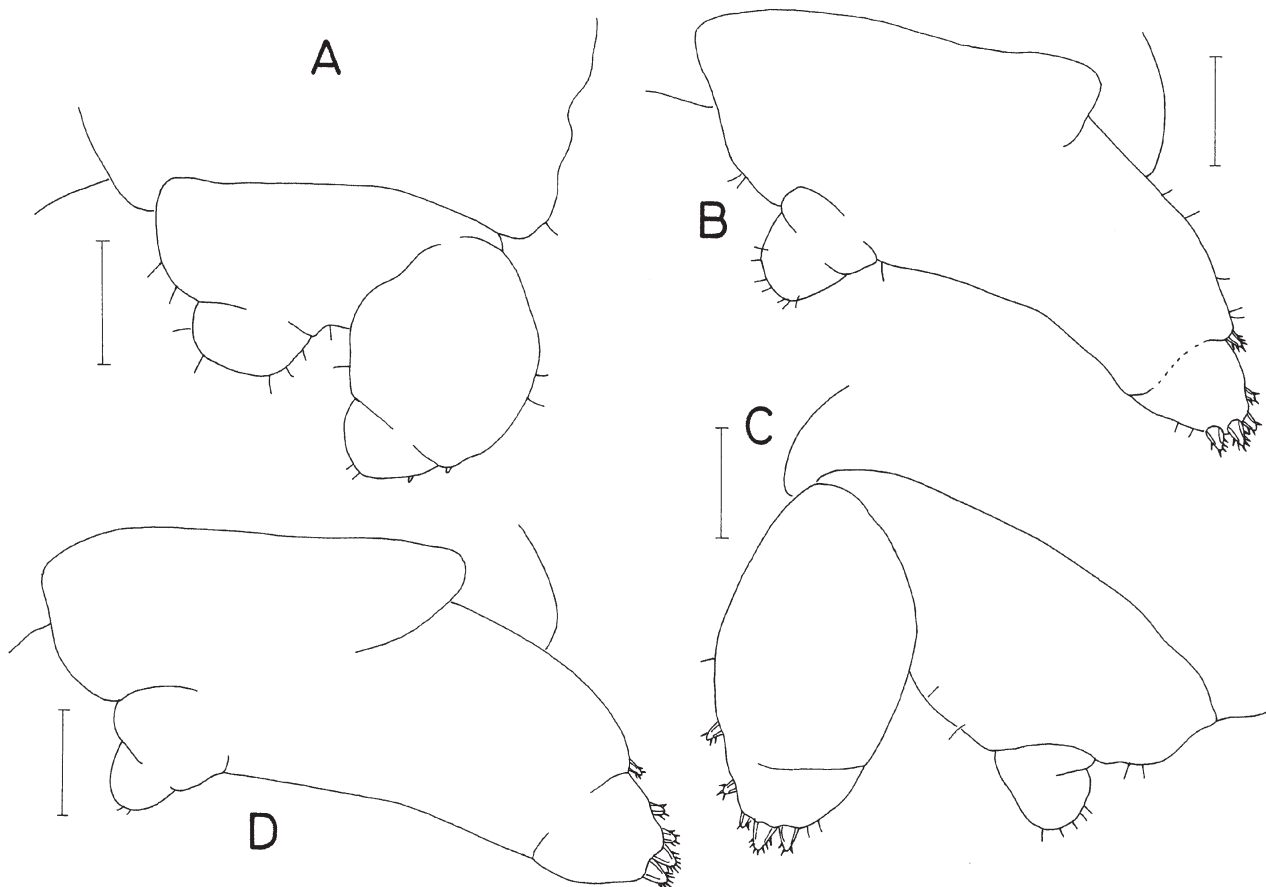
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21409), paratypes (2 intact ♀♀, MNHN-IU-2014-21410), and dissected paratypes (3 ♀♀, figured) from *Pseudodistoma arborescens* Millar, 1967 (MNHN-IT-2018-11 = MNHN A1/PSE/80), ATIMO VATAE TA28, Banc Tozer, Madagascar (25°12'S, 44°08'E), depth 20-22 m, MNHN coll., 25 May 2010.

**Etymology.** The specific name is derived from the



**FIGURE 369.** *Demoixys cornuta* sp. nov., female. A, habitus, right; B, leg 5 and urosome, ventral; C, caudal rami, ventral; D, cephalic horn; E, anterior part of prosome, ventral; F, rostrum, left; G, antennule; H, antenna; I, labrum; J, mandible; K, maxillule; L, maxilla; M, maxilliped. Scale bars: A, 0.2 mm; B, E, F, 0.05 mm; C, D, G–M, 0.02 mm.





**FIGURE 370.** *Demoixys cornuta* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

Latin *cornut* (=horned), referring to the possession by the new species of the posterolateral horn-like processes on the dorsal cephalic shield.

**Description of female.** Body (Fig. 369A) stout, inflated; body length 1.65 mm. Cephalosome indistinctly defined from metasome, dorsal cephalic shield with paired posterolateral horn-like processes; each process (Fig. 369D) sclerotized, bent dorsally in middle and with pointed tip. Metasome gradually broadening posteriorly, longer than wide, unsegmented, but with 2 constrictions delimiting first to third pedigerous somites. Free urosome (Fig. 369B) small, slightly shorter than wide, 2-segmented, consisting of genital complex and unsegmented abdomen. Genital complex subdivided by lateral constriction. Caudal rami (Fig. 369C) rudimentary, lobate, fused with abdomen; armed with few minute setal vestiges distally.

Rostrum (Fig. 369F) large, elongate, extending to middle of labrum (Fig. 369E). Antennule (Fig. 369G) small, strongly tapering, 5-segmented; first to fifth segments armed with 0, 1, 2, 1, and 3 minute setae, respectively; terminal segment with several setules in addition to setae. Antenna (Fig. 369H) 3-segmented,

consisting of coxa, basis, and unsegmented endopod; coxa and basis unarmed; endopod distinctly narrower and shorter than basis and 2.1 times longer than wide ( $38 \times 18 \mu\text{m}$ ); armed with 1 small seta distally plus small terminal claw bearing minute spinules distally.

Labrum (Fig. 369I) as simple, smooth and convex plate. Mandible (Fig. 369J) consisting of coxa and palp: coxal gnathobase with broad medial margin bearing 5 teeth distally and with pectinate proximal part (second and fourth teeth smaller than other 3); proximal corner of gnathobase acutely pointed: palp reduced, consisting of basis and small 1-segmented rami; basis with 1 small seta at mediobasal corner; exopod wider than long, incompletely articulated from basis, armed with 2 short setae distally; endopod as long as wide, with 2 small distal setae. Maxillule (Fig. 369K) extremely simplified and indistinctly bilobed, lobes with 1 seta and 5 setae (3 distal and 2 outer). Maxilla (Fig. 369L) 3-segmented; syncoxa bearing 2 small setae; basis with large, highly sclerotized claw only; endopod small, knob-like with 3 small setae. Maxilliped (Fig. 369M) lobate, bearing 2 small setae distally.

Legs 1–4 (Fig. 370A–D) biramous, with 2-segmented

protopods; ornamented with few scattered setules; rami incompletely 2-segmented, except unsegmented endopod of leg 1, and obscurely articulated from basis. Endopods much smaller than exopods. Leg 1 exopod with 2 minute, papilliform rudiments of spines, one on outer distal corner on first exopodal segment and another on outer margin of second segment. Exopods of legs 2–4 armed with 5 small, spinulose spines, one on first segment and 4 on second. Coxa, basis, and endopod of all swimming legs unarmed.

Leg 5 (Fig. 369B) present on posteroventral surface of somite near base of urosome; represented by short, outer angular process and tapering, pointed inner process; both processes unarmed.

**Male.** Unknown.

**Remarks.** Based on the reduction in segmentation of the swimming leg rami and the general simplification of the mouthparts, combined with the retention of a well-developed, dentate coxal gnathobase on the mandible, this species is placed in the genus *Demoixys*. The new species can be readily distinguished from its congeners by its possession of a pair of posterolateral cephalic horns and by the extremely simplified mouthparts with, for example, the maxillule reduced to a bilobed vestige bearing a few setae.

#### *Ademoixys* gen. nov.

**Diagnosis.** Body linear, fusiform. Cephalosome clearly defined. First and second pedigerous somite indistinctly defined; fused third and fourth pedigerous somites oval. Free urosome indistinctly 4-segmented. Caudal ramus armed with 6 small setae. Rostrum as small anteroventral lobe on frontal margin of dorsal cephalic shield. Antennule small, unsegmented. Antenna 3-segmented with small terminal claw. Mandible consisting of coxa extending medially as large hook, and palp consisting of basis and 1-segmented rami, armed with 1 seta on basis, 4 on exopod and 5 on endopod. Maxillule simplified, represented by lobe bearing several setae. Maxilla 4-segmented with 2-segmented endopod; lacking defined claw on basis. Maxilliped as lobe bearing setae distally. Legs 1–4 biramous, each with 2-segmented protopod. All swimming legs unarmed, except inner distal spine on basis of leg 1. Legs 2–4 with 3-segmented exopods and 2-segmented endopods. Leg 5 represented by tapering posteroventral process on somite.

**Type and only species.** *Ademoixys fusiforma* (Ooishi, 1972) **comb. nov.** (originally as *Demoixys fusiforma*), by original designation

**Etymology.** From “a” (Greek prefix meaning “not”) and the generic name *Demoixys*, referring to the differences between the new genus and *Demoixys*. Gender feminine.

**Remarks.** Ooishi (1972) described *D. fusiforma* based on material found living in association with

the ascidian *Distaplia dubia* (Oka, 1927) in Japanese waters. This copepod differs fundamentally from known species of *Demoixys*, so the new genus, *Ademoixys* **gen. nov.**, is established to accommodate it as type species. The significant features defining the new genus are the transformation of the coxal gnathobase of the mandible into a powerful hook, the fusiform body, and the distinct but unarmed rami of the swimming legs.

#### *Gallincola* gen. nov.

**Diagnosis.** Body curved ventrally. Prosome tapering anteriorly, unsegmented or indistinctly segmented, with swollen fourth pedigerous somite. Free urosome slender, consisting of genital somite and 3-segmented abdomen. Caudal rami unarmed and with rounded distal margin. Rostrum with evenly convex distal margin. Antennule unsegmented or weakly segmented; setae small or absent. Antenna 4-segmented, with few setae only on second endopodal segment; terminal claw small. Labrum weak. Mandible with broad coxal gnathobase bearing strong, pronounced distalmost tooth; basis with 1 seta; exopod with 5 setae; endopod 2-segmented, with 1 or 2 setae on first segment and 5 setae on second. Maxillule with 9 setae on well-developed arthrite, 1 seta each on epipodite and basis, 4 on exopod, and 3 on endopod; coxal endite absent. Maxilla consisting of syncoxa, basis and 2-segmented endopod; syncoxa bearing 3, 1, and 2 setae on first to third endites, respectively; basis with claw plus 1 seta; endopod with total of 4 setae. Maxilliped unsegmented lobe with 2 or 3 setae. Legs 1–4 biramous with unsegmented or incompletely 2-segmented protopods; rami widely separated from each other; exopods 1- to 3-segmented; endopods much smaller than exopods, 1- to 3-segmented, or absent in more posterior legs. Number and size of setae on legs reduced. Leg 5 absent. Female living within discoid membranous gall on branchial tissue of host.

**Type species.** *Gallincola bisetatus* **gen. et sp. nov.** by original designation.

**Other included species.** *Gallincola major* **gen. et sp. nov.**

**Etymology.** The name is derived from the Latin *gall* (=a gall nut) and *incola* (an inhabitant), referring to the mode of life of the type species living inside a gall formed within the host. Gender masculine.

**Remarks.** We consider the genus *Demoixys* to be most closely related to *Gallincola* **gen. nov.** The new genus can be distinguished from the former by the form of its urosome, which is elongate (more than 3 times longer than wide) compared with the short (at most as long as wide) urosome in *Demoixys*. Another difference is the pronounced distalmost tooth on the mandibular gnathobase, which is not prominent in *Demoixys*. In addition, the maxillular arthrite is armed with 9 setae in the new genus compared with 7 setae at most in *Demoixys*

species, and the endopod of the maxillule is distinctly articulated from the basis, while it is fused or confluent with the basis in *Demoixys*.

We also note that the known hosts of the type species of *Gallincola* **gen. nov.** are solitary ascidians, whereas the known hosts of *Demoixys* species are compound ascidians.

***Gallincola bisetatus* gen. et sp. nov.**

(Figs. 371, 372)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21411) from a discoid gall formed on the branchial tissue of the ascidian *Pyura gangelion* (Savigny, 1816) (MNHN-IT-2008-7540 = MNHN S2/PUY/143), KARUBAR DW31, Iles Kai, N/O “Baruna Jaya 1”, Indonesia (05°40’S, 132°51’E), depth 288–289 m, Bouchet, Kastoro & Métivier coll., 26 October 1991.

**Etymology.** The specific name is derived from the Latin *bi* (=two) and *set* (=seta), alluding to the presence of two setae on the first endopodal segment of the mandible.

**Description of female.** Body (Fig. 371A) with thin, soft epidermis; body length 2.22 mm. Prosome distinctly tapering anteriorly; dorsal cephalic shield expanded ventrally, lacking posterolateral processes. Cephalosome and first pedigerous somite incompletely articulated from each other and from remaining part of prosome (Fig. 371B); second to fourth pedigerous somites not articulated. Region of fourth pedigerous somite swollen forming almost spherical brood pouch. Fifth pedigerous somite not defined. Free urosome (Fig. 371C) 4-segmented, slender, consisting of genital somite and 3-segmented abdomen. Genital somite short, not articulated from brood pouch; 3 abdominal somites 140×170, 126×140, and 210×120 µm, respectively. Last abdominal somite longer than others, probably formed by fusion of original third abdominal and anal somites, with deep posteromedian (anal) incision, and ornamented with numerous surface setules. Caudal rami (Fig. 68D) directed posterolaterally, about 2.4 times longer than wide (63×26 µm) with rounded apex, distinctly articulated at base, covered with numerous setules; lacking setae.

Rostrum (Fig. 371E) with evenly convex distal margin, setulose, and not articulated at base. Antennule (Fig. 371F) broad, gradually narrowing distally and slightly curved posteriorly, about 170 µm long, and 7-segmented; articulations between third and terminal segments incomplete; armature formula 3, 5, 3, 1, 2, 2, and 12; setae small; second to terminal segments ornamented with setules on anterior surface. Antenna (Fig. 371G) moderately slender, 4-segmented; coxa, basis and first endopodal segment unarmed, almost equal in length; second endopodal segment about 3.6 times longer than wide (69×19 µm) and as long as first: armed with 4 small setae (2 inserted into base of terminal claw) and several

setules; terminal claw small, about one-third as long as second endopodal segment.

Labrum (Fig. 372A) with smooth, convex posterior margin and patches of fine spinules posterolaterally. Mandible (Fig. 371H) with broad coxal gnathobase; medial margin of gnathobase with 1 elongate distal tooth, 5 unequal, smaller teeth in middle, proximal pectinate region, and 2 small setae on proximal corner: palp consisting of basis bearing 1 small seta at mediobasal corner, 4 large setae and 1 small seta on exopod (small outer seta one-third as long as larger setae), 2 unequal setae on first endopodal segment, and 5 setae on second; all setae pinnate. Maxillule (Fig. 371I) with 9 setae (including 1 small naked seta) on large, pronounced arthrite, 1 each on epipodite and basis, 4 on exopod and 3 on endopod; coxal endite absent; exopod and endopod small; exopod not articulated from basis; all setae on rami pinnate. Maxilla (Fig. 372B) consisting of syncoxa, basis, and 2-segmented endopod; syncoxa with 3, 1, and 2 setae on first to third endites, respectively; basis with smooth claw plus 1 seta; endopod small with 1 and 3 setae on first and second segments, respectively. Maxilliped (Fig. 372C) unsegmented, tapering apically, armed with 2 or 3 setae (outer subdistal seta indicated by arrowhead in Fig. 372C may be present or absent) and ornamented with setules on all surfaces.

Legs 1–4 (Fig. 372D–H) small, biramous; protopod unsegmented or indistinctly 2-segmented; coxa lacking inner seta. Basis of legs 1–4 with outer seta. Basis of leg 1 with inner distal seta. Exopods 3-segmented, densely setulose in leg 1, but with few setules in legs 2–4. Endopods much smaller than exopods, 3-segmented in leg 1, and 2-segmented in legs 2–4. Endopods of legs 3 and 4 vestigial. All setae on legs small and naked. Armature formula for legs 1–4 as follows.

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	1-1; 1-1; 6	0-1; 0-1; 5
Leg 2	0-0	1-0	1-0; 1-0; 8	0-0; 3 or 4
Leg 3	0-0	1-0	1-0; 1-0; 8	0-0; 1
Leg 4	0-0	1-0	1-0; 1-0; 5	0-0; 0
Leg 5	absent.			

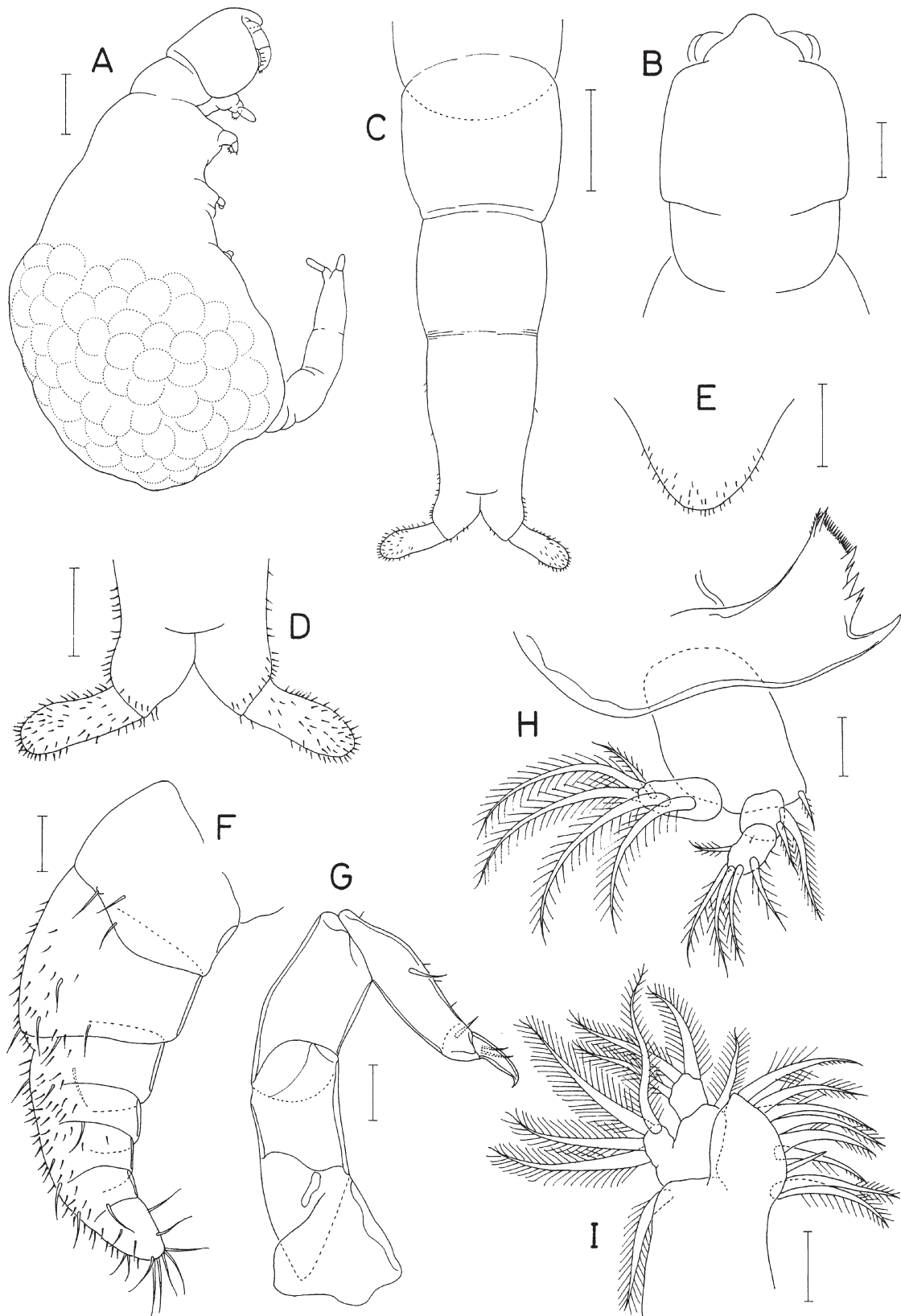
**Male.** Unknown.

**Remarks.** The gall from which the copepod specimen was removed was discoid and formed from membranous host tissue on the surface of the branchial wall.

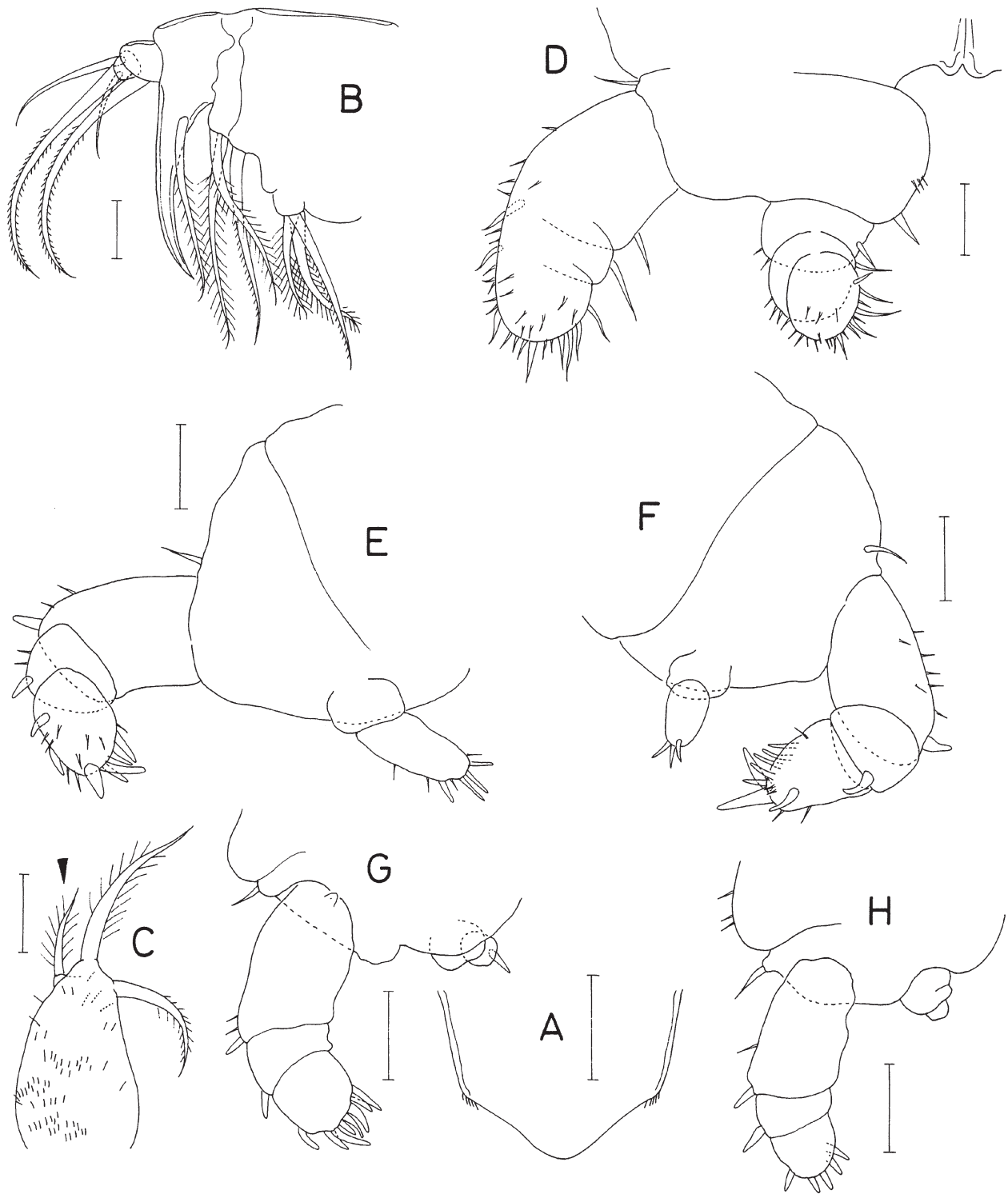
***Gallincola major* gen. et sp. nov.**

(Figs. 373, 374)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21412) from a gall on the branchial tissue of *Microcosmus madagascariensis* Michaelsen, 1918, the Philippines, 07 June 1905.



**FIGURE 371.** *Gallincola bisetatus* **gen. et sp. nov.**, female. A, habitus, right; B, cephalosome and first pedigerous somite, dorsal; C, urosome, dorsal; D, caudal rami, dorsal; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D, E, 0.05 mm; F–I, 0.02 mm.



**FIGURE 372.** *Gallincola bisetatus* **gen. et sp. nov.**, female. A, labrum, B, maxilla; C, maxilliped (marked seta absent in some specimens); D, leg 1; E, F, leg 2; G, leg 3; H, leg 4. Scale bars: A, 0.05 mm; B–H, 0.02 mm.

**Etymology.** The specific name refers to the larger body size of the new species compared to the type species.

**Description of female.** Body (Fig. 373A) similar to that of *G. bisetatus* **gen. et sp. nov.** Body length 2.90 mm. Prosome 1.95 mm long, tapering anteriorly, unsegmented,

but with 3 lateral constrictions defining cephalosome, first and second pedigerous somites and fused third and fourth pedigerous somites. Cephalosome and first pedigerous somite (Fig. 373B) much narrower than second pedigerous somite; fused third and fourth pedigerous somites swollen,

nearly spherical, forming brood pouch. Free urosome (Fig. 373C) slender, 4-segmented: genital somite short; 3 abdominal somites 336×250, 273×205, and 295×159 µm, respectively. Last abdominal somite constricted at about 40% of length, marking trace of original articulation between third abdominal and anal somites; with deep posteromedial anal incision; ornamented with setules on lateral surfaces. Caudal ramus (Fig. 373D) club-shaped, blunt, about 4.0 times longer than wide (121×30 µm), with narrow proximal part, covered with fine setules.

Rostrum (Fig. 373E) wider than long, with rounded posterior margin. Antennule (Fig. 373E) slender, 230 µm long, unarmed and unsegmented, but with traces of several articulations on posterior surface; anterior surface covered with fine setules. Antenna (Fig. 373F) 4-segmented; proximal 3 segments unarmed; last segment (second endopodal segment) about 3.9 times longer than wide (59×15 µm), ornamented with several fine setules; armed with 5 small setae (arranged as 1, 2, and 2) plus small, strongly curved terminal claw.

Labrum missing. Mandible (Fig. 373G) with coxal gnathobase moderately broad; medial margin with 1 large distal, spiniform tooth, 2 small teeth in middle, and short proximal pectinate region: palp biramous with 1 broad, sparsely pinnate seta at mediobasal corner of basis; exopod with 5 naked setae (2 outer setae about half as long as 3 medial setae); endopod incompletely 2-segmented, with 1 broad, sparsely pinnate seta on first segment and 5 naked setae, including small outer seta, on second. Maxillule (Fig. 373H) with distally produced arthrite bearing 9 setae; coxa with 1 seta on epipodite, endite absent; basis with 1 naked seta on medial margin; exopod and endopod distinctly articulated from basis, exopod with 4 pinnate setae, endopod with 3 naked setae; middle seta distinctly longer than other 2. Maxilla (Fig. 373I) 4-segmented; syncoxa with 3, 1, and 2 large setae on first to third endites, respectively; basis with strong claw plus 1 large seta; endopod with 1 large seta on first segment and 2 small setae on second. Maxilliped unsegmented, elongate, armed with 2 broad, pinnate setae distally, ornamented with scattered patches of fine setules.

Leg 1-4 (Fig. 374A-D) small. Legs 1-3 biramous, with widely separated rami; exopods curved and unsegmented; endopod incompletely 2-segmented in leg 1, but unsegmented, lobate in legs 2 and 3. Leg 4 represented by elongate lobe (exopod). Protopod 2-segmented in legs 1 and 2, but unsegmented in leg 3. Rami of leg 1 and exopod of leg 2 ornamented with numerous setules. Legs lacking inner coxal and outer basal setae. Leg 1 bearing inner distal seta on basis. Setation of rami: 2, 8, 8, and 6 (or 5) on exopods of legs 1-4, respectively; 1 on second endopodal segment of leg 1, 5 or 6 on endopod of leg 2, and 1 or 2 on endopod of leg 3. Leg 5 absent.

**Male.** Unknown.

**Remarks.** *Gallincola major* **gen. et sp. nov.** can be

easily distinguished from *G. bisetatus* **gen. et sp. nov.** by the following character states: (1) the caudal ramus is longer, about 4.0 times longer than wide, compared to about 2.4 times longer than wide in *G. bisetatus* **gen. et sp. nov.**; (2) the antennule is slender and unsegmented, compared to the broad and 7-segmented antennule in *G. bisetatus* **gen. et sp. nov.**; (3) the mandibular coxal gnathobase bears 1 large and 2 small teeth, compared to 1 large and 5 small teeth in *G. bisetatus* **gen. et sp. nov.**; (4) the first endopodal segment of the mandible is armed with 2 setae, compared to only a single seta in *G. bisetatus* **gen. et sp. nov.**; (5) the setae on the basis and endopod of the maxillule are naked, whereas these setae are pinnate in *G. bisetatus* **gen. et sp. nov.**; (6) the first and second endopodal segments of the maxilla are armed with 1 and 3 setae, respectively, compared to 2 setae on each segment in *G. bisetatus* **gen. et sp. nov.**; and finally, (7) the exopods of legs 1-4 are unsegmented, compared to 3-segmented in *G. bisetatus* **gen. et sp. nov.**

### ***Scoliosoma* gen. nov.**

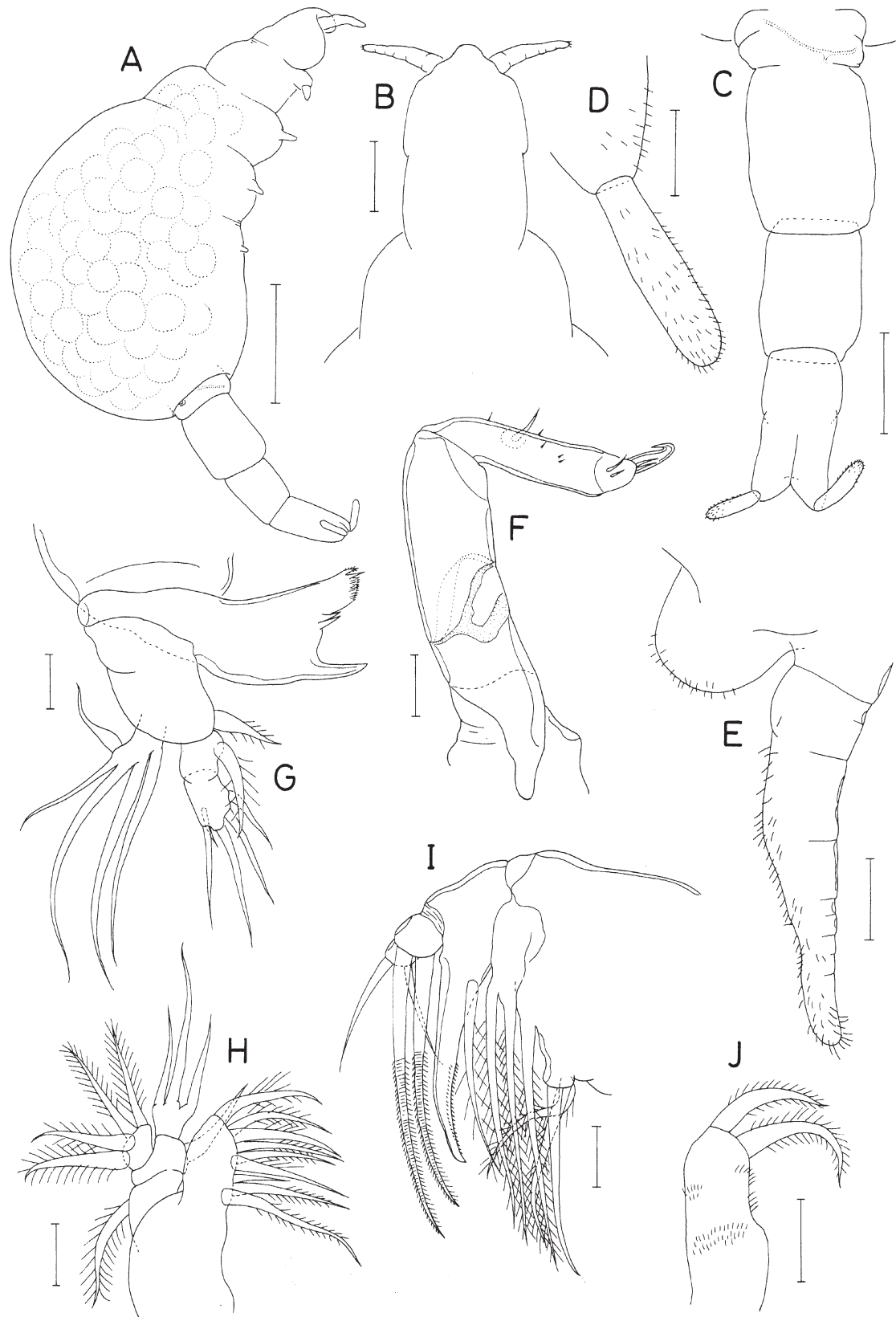
**Diagnosis.** Female body strongly curved ventrally. Prosoma divided only by constrictions. Brood pouch formed by fused swollen third and fourth pedigerous somites. Urosome rather long, apparently 6-segmented although first urosomite (fifth pedigerous somite) almost completely fused to prosoma. Genital somite free. Caudal ramus small, armed with 3 small setae. Rostrum short. Antennule broad, leaf-like, unsegmented or obscurely segmented, armed with few small setae. Antenna 4-segmented with small terminal claw. Labrum short and broad. Mandible consisting of coxa and palp; coxal gnathobase broad, bearing large, spiniform mediobasal tooth and serrate medial margin; palp consisting of basis, exopod and endopod, but rami may be fused with basis; basis with 1 seta mediobasally; exopod with 4 setae; endopod unsegmented with 5 setae, or 2-segmented with 1 and 4 setae on first and second segments, respectively. Maxillule comprising precoxal arthrite armed with 5 setae and lobate palp bearing 5 setae. Maxilla consisting of syncoxa, basis, and 1- or 2-segmented endopod; basis with robust claw only. Maxilliped represented by small lobe bearing 2 setae distally. Legs 1-4 rudimentary. Legs 1-3 bilobed; lobes not articulated at base and armed with minute setae. Leg 4 as small lobe. Leg 5 absent.

**Type species.** *Scoliosoma haplomerosum* **gen. et sp. nov.** by original designation.

**Other included species.** *Scoliosoma dimerosum* **gen. et sp. nov.**

**Etymology.** The generic name is from the Greek *scoli* (=curved, crooked) and *soma* (=body), referring the curved body of the adult female in species of the new genus. Gender neuter.

**Remarks.** *Scoliosomagen. nov.* resembles *Gallincola*



**FIGURE 373.** *Gallincola major* gen. et sp. nov., female. A, habitus, right; B, anterior part of prosome, dorsal; C, urosome, ventral; D, right caudal ramus, dorsal; E, rostrum and antennule; F, antenna; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Scale bars. A, 0.5 mm; B, C, 0.2 mm; D, E, 0.05 mm; F–J, 0.02 mm.

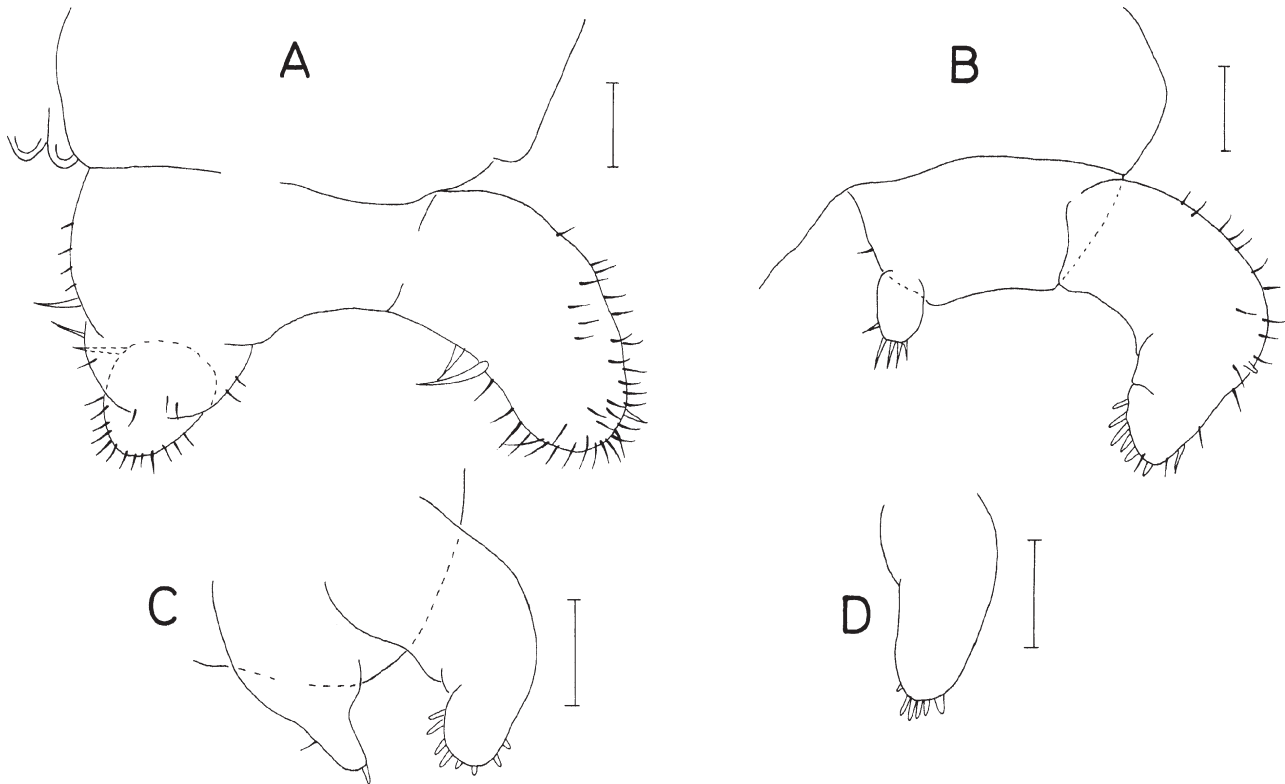


FIGURE 374. *Gallincola major* gen. et sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

**gen. nov.:** they have a similar body form and both have a strong distal tooth on the mandibular gnathobase. Interestingly, both live in galls in solitary ascidians. However, the cephalic appendages of *Scoliosoma* gen. nov. are much more simplified than in *Gallincola* gen. nov. The mandibular exopod is armed with 5 setae in *Gallincola* gen. nov. but with 4 setae in *Scoliosoma* gen. nov. The maxillule of *Gallincola* gen. nov. bears as many as 9 setae on the arthrite and has a biramous palp but this appendage in *Scoliosoma* gen. nov. bears a total of only 5 setae on the arthrite and has a rudimentary, lobate palp. Other notable differences include: in *Scoliosoma* gen. nov. the urosome is 5-segmented compared to 4-segmented in *Gallincola* gen. nov., the antennule is broad, leaf-like compared to elongate in *Gallincola* gen. nov., and the maxillary syncoxa has only 2 endites compared with 3 endites in *Gallincola* gen. nov.

***Scoliosoma haplomerusum* gen. et sp. nov.**

(Figs. 375, 376)

**Type material.** Holotype (♀, urosome partially damaged, MNHN-IU-2014-21413), paratypes (1 damaged ♀ with maxillae dissected and 5 intact copepodids, MNHN-IU-2014-21414), and dissected paratypes (1 damaged ♀ and 1 copepodid, figured) from galls on the surface of brachial

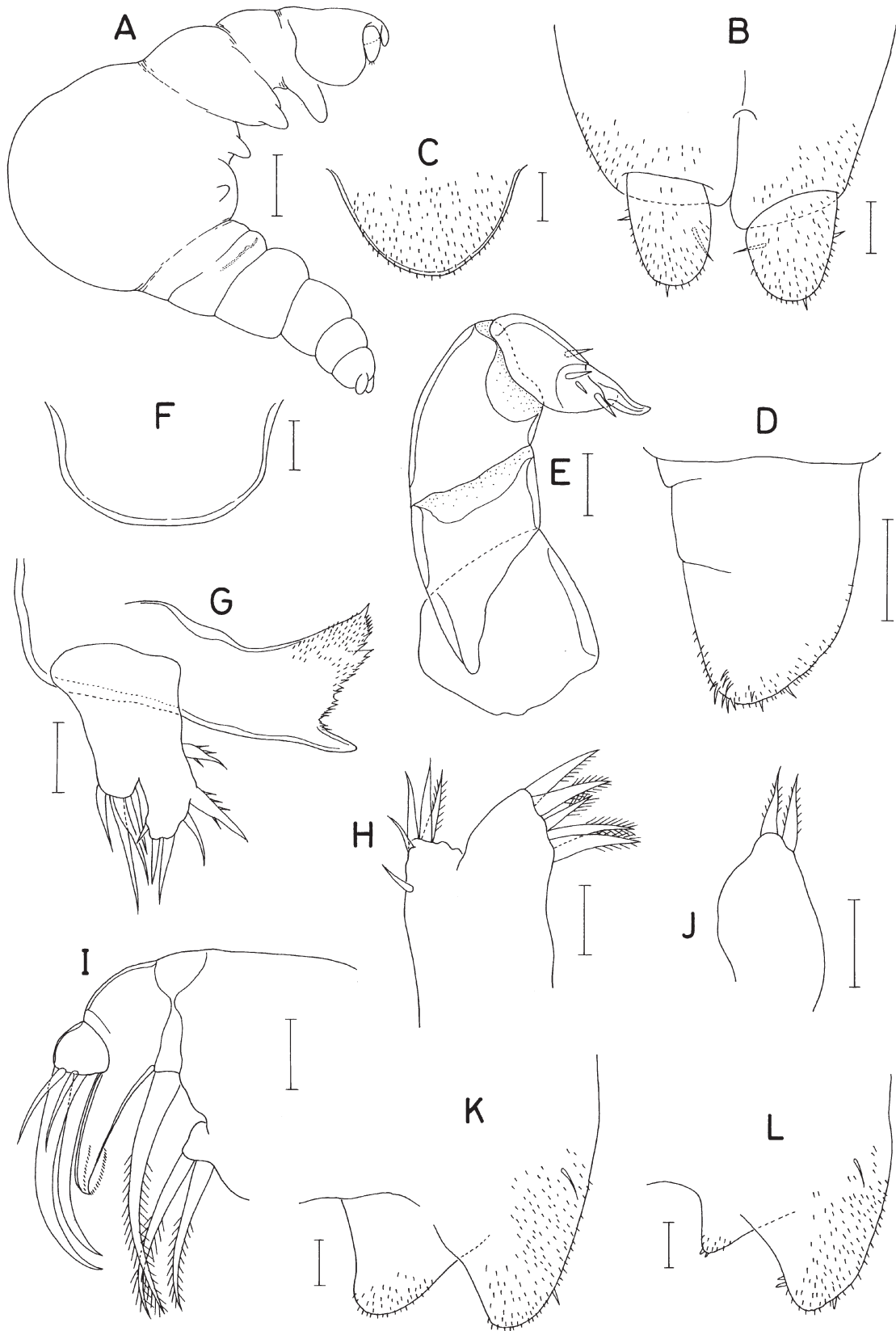
wall of *Polycarpa cryptocarpa* Sluiter, 1885 (MNHN-IT-2008-6441 = MNHN S1 POL.B 454); 6 copepodids from fibrillar networks on outer surface of one of galls, CRRF OCDN 7521-K, near Port Vila, Vanuatu (17°45.41' S, 168°16.90' E), depth 12 m, 16 November 2000.

**Etymology.** The specific name is derived from the Greek *haplo* (=single) and *mer* (=a part), referring to the unsegmented endopod of the maxilla in the new species.

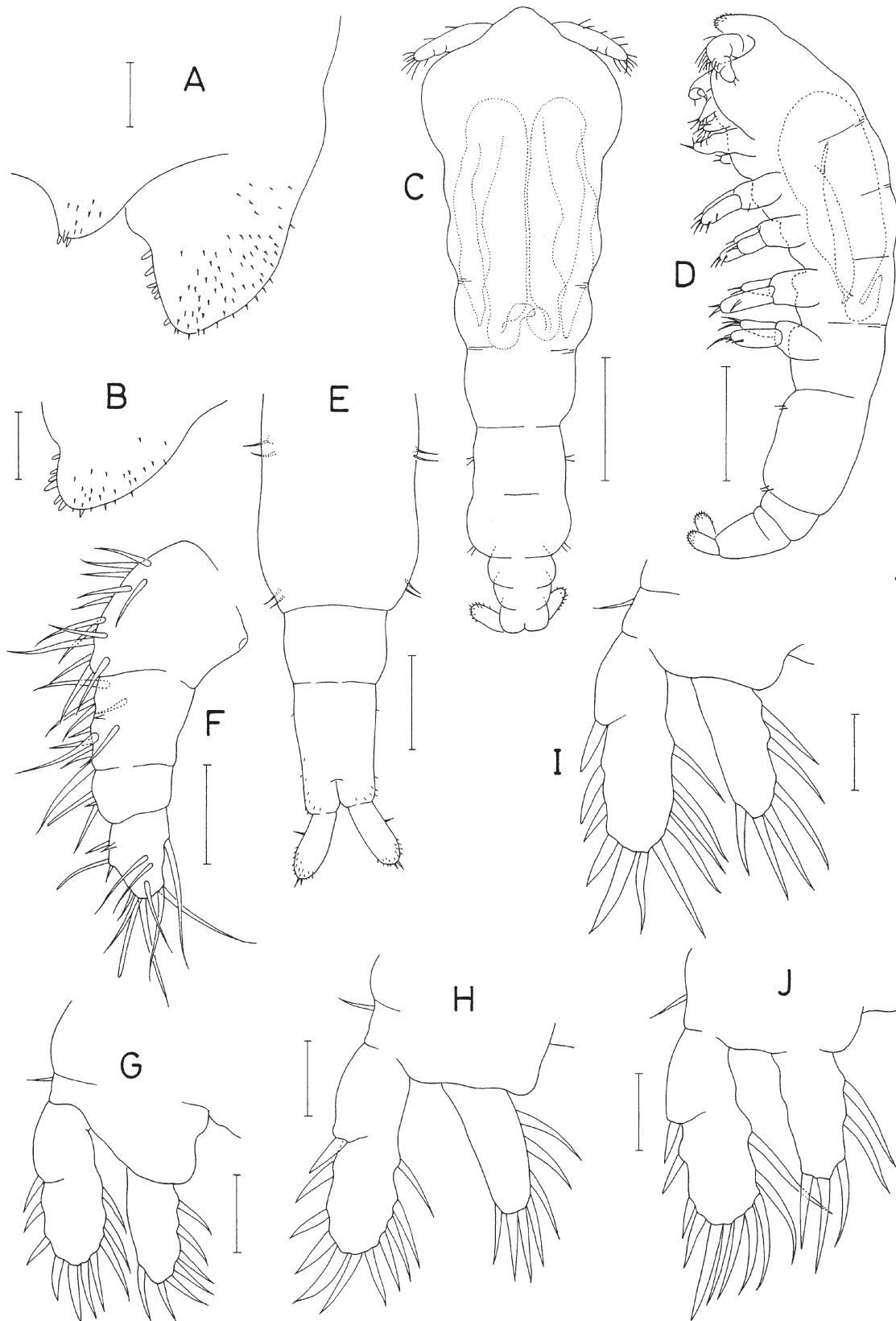
**Description of female.** Body (Fig. 375A) strongly curved ventrally, with weak exoskeleton; body length 2.12 mm. Prosome tapering anteriorly, divisible by 3 constrictions into cephalosome, first and second pedigerous somites; lateral margins of dorsal cephalic shield extended ventrally and concealing entire mouthparts in lateral view. Brood pouch formed by fused third and fourth pedigerous somites. Urosome slightly shorter than prosome, 6-segmented but first urosomite not articulated from prosome. Genital somite (second urosomite) short. Posterior part of anal somite ornamented with minute spinules. Caudal rami (Fig. 375B) small, 1.27 times longer than wide (42×33 μm), rounded distally, covered with minute spinules; armed with 3 small setae (outer lateral, medioventral, and distal).

Rostrum (Fig. 375C) semicircular, rounded apically, wider than long, and covered with minute spinules. Antennule (Fig. 375D) short and broad, leaf-like,





**FIGURE 375.** *Scoliosoma haplmerosum* gen. et sp. nov., female. A, habitus, right; B, caudal rami, dorsal; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla; J, maxilliped; K, leg 1; L, leg 2. Scale bars: A, 0.2 mm; B, C, E–L, 0.02 mm; D, 0.05 mm.



**FIGURE 376.** *Scoliosoma haplomerusum* gen. et sp. nov., female: A, leg 3; B, leg 4. Copepodid V female: C, habitus, dorsal; D, habitus, left; E, urosome, dorsal; F, antennule; G, leg 1; H, leg 2; I, leg 3; J, leg 4. Scale bars: A, B, F–J, 0.02 mm; C, D, 0.1 mm; E, 0.05 mm.

122×102 µm, unsegmented but with trace of articulation on posterior side; armed with several small setae plus minute surface spinules distally. Antenna (Fig. 375E) stout, 4-segmented; coxa and basis unarmed, each much wider than long; first endopodal segment also unarmed, as long as wide, its outer margin much shorter than inner margin; second endopodal segment about twice as long as wide; armed with 4 small setae plus small terminal claw, about half as long as segment.

Labrum (Fig. 375F) short and broad, unornamented, with convex posterior margin. Mandible (Fig. 375G) with broad coxal gnathobase bearing along medial margin, strong distal tooth, uneven serrate middle region, and pointed proximal corner: palp (fused basis, exopod and endopod) bilobed distally; short outer lobe (exopod) with 4 naked setae; longer inner lobe (distal part of basis + unsegmented endopod) with 6 setae, proximal seta (representing medial seta on basis), second proximal seta (originally medial seta of first endopodal segment), and 4 setae from original second endopodal segment; first 2 proximal setae bearing few spinules on margins, other setae naked. Maxillule (Fig. 375H) not articulated, distally bilobed; outer lobe (palp, comprising fused basis, exopod and endopod) bearing 1 outer proximal and 4 distal setae, 1 distal seta weakly pinnate; inner lobe (precoxal arthrite) larger than outer lobe, armed with 5 pinnate setae on medial margin. Maxilla (Fig. 375I) 3-segmented; syncoxa with 2 endites bearing 2 setae on first endite and 1 large seta on second; basis with robust claw ornamented with serrate membrane in distal third; unsegmented endopod with 2 large and 2 small setae, all naked. Maxilliped (Fig. 375J) as distally narrowing lobe bearing 2 weakly pinnate setae on apex.

Legs 1–4 (Figs. 375K, L, 376A, B) rudimentary, lacking defined protopod. Legs 1–3 bilobed, unsegmented; both rami covered with minute spinules. Inner lobe (endopod) as large as outer lobe (exopod) in leg 1, but much smaller than outer lobe in legs 2 and 3. Leg 4 represented by single lobe (exopod). Legs 1 and 2 with 1 outer proximal seta on outer lobe; this seta absent in legs 3 and 4. Other setae 1, 3, 5, and 7 on exopods of legs 1–4, respectively, and 0, 2, and 3 on endopods of legs 1–3, respectively; all setae rudimentary. Leg 5 absent.

**Male.** Unknown.

**Description of Copepodid V female.** Body (Fig. 376C, D) not swollen, slightly curved ventrally, poorly segmented, much smaller than adult (body length of figured specimen 533 µm). Cephalic region widest. Prosome-urosome division obscure. Fifth pedigerous and genital somites (Fig. 376E) not articulated from one another. Abdomen 2-segmented in dorsal view, but second abdominal somite with additional suture line on ventral surface. Caudal rami 2.3 times longer than wide (37×16 µm); armed with 3 small setae. Antennule (Fig. 376F) much narrower than in adult, 4-segmented; armature formula 13, 11, 3, and 14; setae distinct. Antenna, labrum,

mandible, maxillule, maxilla, and maxilliped as in adult female. Legs 1–4 (Fig. 376G–J) biramous, each with unsegmented or partially segmented protopod, and well-defined exopod and endopod; exopods incompletely 2-segmented, and endopods unsegmented; setae distinct and naked. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	1-0; 3, 1, 5	1, 2, 4
Leg 2	0-0	1-0	1-0; 4, 1, 5	1, 2, 4
Leg 3	0-0	1-0	1-0; 4, 1, 5	1, 2, 3
Leg 4	0-0	1-0	1-0; 4, 1, 5	0, 2, 3

Legs 5 and 6 each represented by pair of small setae.

**Remarks.** The galls inhabited by the adult females were flattened and about 1.2 mm in diameter, with irregular margins. Each gall contained a single female and one was found with its anal somite protruding out of the gall. Six copepodids discovered were among fibrillary network on the external surface of one of the galls.

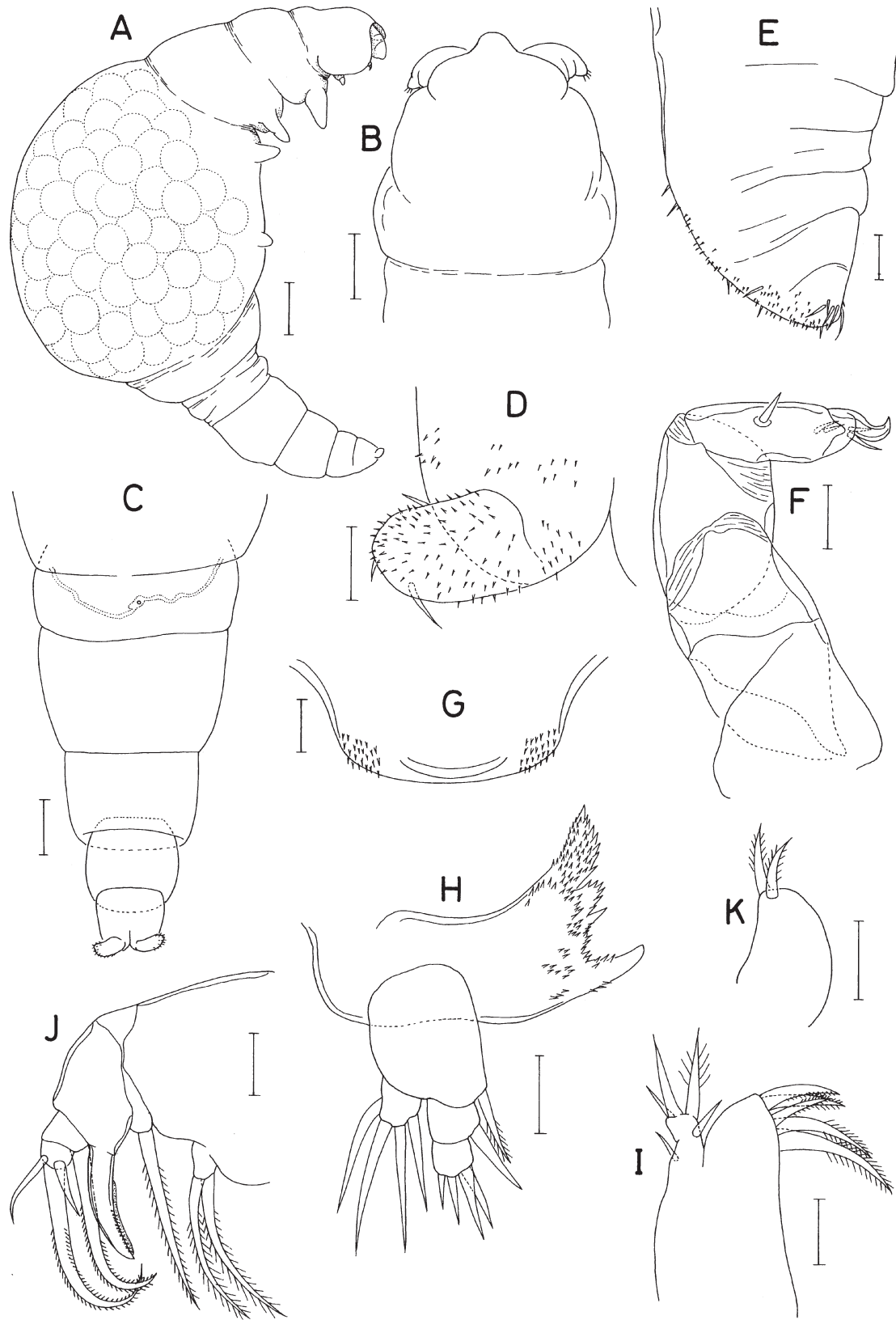
*Polycarpa cryptocarpa*, the ascidian host of *Scoliosoma haplomerosum* **gen. et sp. nov.**, is known to harbour several other species of ascidicolous copepods. One of them, *Sphaerothylacus polycarpae* Sluiter, 1884, is remarkable as it was first recognized as a cirripede by its original describer (Sluiter, 1884), but Grygier (1993) later concluded that it was a copepod. The absence of frontolateral horns in the nauplii of *S. polycarpae* illustrated by Sluiter (1884) indicates that his species cannot be classified as a cirripede, but the presence of transverse sculpturing appearing to represent articulations on the hind body of the nauplii is unusual for copepods. *Sphaerothylacus polycarpae* is not confusable with *Scoliosoma haplomerosum* **gen. et sp. nov.**, because it is an almost spherical parasite with a root-like holdfast and a pore on the opposite side of the body from the holdfast.

Another remarkably transformed copepod associate of *P. cryptocarpa* is *Paralobodelphys setipoda* Gotto, 1981, which was described as a new genus and species from the Great Barrier Reef, Australia. The specimens were “contained in a circular area” (Gotto, 1881), suggesting that the species is a gall-inhabitant as is *S. haplomerosum* **gen. et sp. nov.** Although this species has a body similar to that of *S. haplomerosum* **gen. et sp. nov.**, its cephalic appendages and legs are quite different from those of *S. haplomerosum* **gen. et sp. nov.** For example, the mandible lacks a coxal gnathobase, the maxilla is only 2-segmented, and the legs have elongate rami in *P. setipoda*.

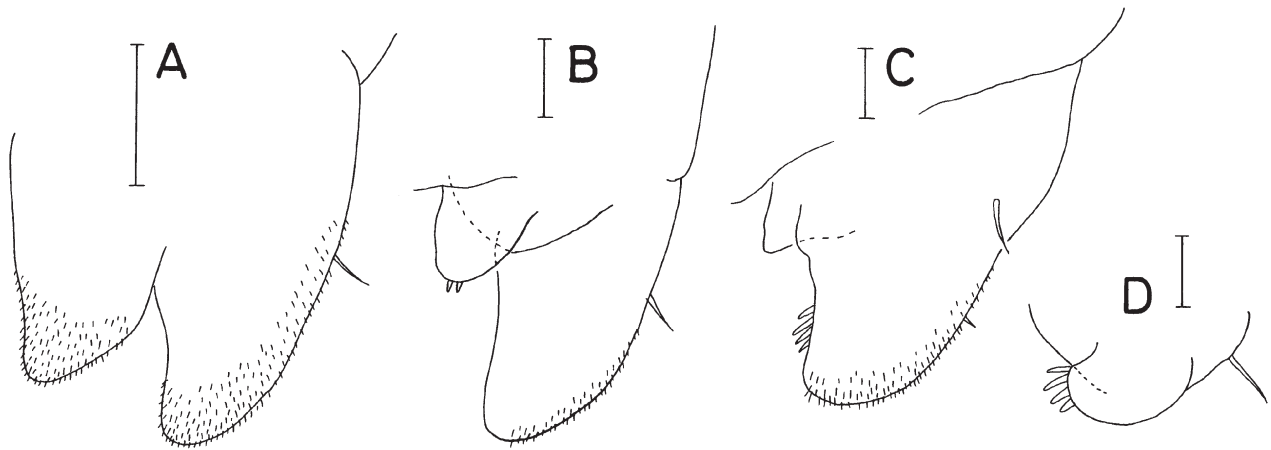
***Scoliosoma dimerosum* gen. et sp. nov.**

(Figs. 377, 378)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21415) from a flat gall on the branchial wall of the ascidian *Polycarpa rima* Monniot



**FIGURE 377.** *Scoliosoma dimerosum* gen. et sp. nov., female: A, habitus, right; B, cephalosoma, dorsal; C, urosome, ventral; D, right caudal ramus, ventral; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D–K, 0.02 mm.



**FIGURE 378.** *Scoliosoma dimerosum* gen. et sp. nov., female: A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: A, 0.05 mm; B–D, 0.02 mm.

F. & Monniot C., 1996 (Holotype MNHN-IT-2008-6761 = MNHN S1/POL.B/318), CRRF OCDN A3, Eastern Fields Atoll, Coral Sea, Papua New Guinea, depth 30 m, 22 October 1993.

**Etymology.** The specific name is derived from the Greek *di* (=two) and *mer* (=a part), referring to the two-segmented endopod of the maxilla in the new species.

**Description of female.** Body (Fig. 377A) curved ventrally; body length 2.65 mm. Prosome tapering anteriorly, divided by 3 constrictions into cephalosome, first and second pedigerous somites, and fused third and fourth pedigerous somites; cephalosome (Fig. 377B) 364×382 µm, with weak lateral constriction near middle; dorsal cephalic shield extended ventrally. Fused third and fourth pedigerous somites forming swollen, globular brood pouch. Urosome (Fig. 377C) 6-segmented, tapering posteriorly; first urosomite not articulated from brood pouch. Genital somite (second urosomite) 160×377 µm; 4 abdominal somites 227×340, 168×245, 154×168, and 105×123 µm, respectively. Caudal ramus (Fig. 377D) small, 42×28 µm, incompletely articulated from anal somite, covered with minute spinules; armed with 3 small setae.

Rostrum short and semicircular as in *D. haplomerosum* gen. et sp. nov. Antennule (Fig. 377E) broad, leaf-like, about 1.3 times longer than wide, with several incomplete suture lines (or wrinkles) along posterior surface, armed with 11 small setae (grouped as 2, 3, and distal 6), and with minute spinules on anterior surface. Antenna (Fig. 377F) stout, 4-segmented; proximal 3 segments unarmed; terminal (second endopodal) segment 50×18 µm; armed with 5 small setae (grouped as 1, 2, and 2) plus small, strongly curved terminal claw, about one-third as long as terminal segment.

Labrum (Fig. 377G) short and broad, with patches of minute spinules posterolaterally. Mandible (Fig. 377H)

with broad coxal gnathobase bearing numerous surface spinules; medial margin of gnathobase with pronounced distal tooth, 1 spiniform tooth and 1 serrate projection near middle, and serrate proximal part: palp consisting of well-defined basis, exopod, and 2-segmented endopod; basis with weakly pinnate seta at mediolateral corner; exopod with 4 naked setae; first and second endopodal segments with 1 and 4 naked setae, respectively. Maxillule (Fig. 377I) bilobed distally; inner lobe (precoxal arthrite) with 5 pinnate setae on margin; smaller outer lobe (palp) bearing total of 5 setae, inner distal seta weakly pinnate, other 4 naked. Maxilla (Fig. 377J) 4-segmented; syncoxa with 2 endites and 2 and 1 setae on first and second endites, respectively; basis with strong claw fringed with narrow membrane along concave margin; endopod small with 1 seta on first segment and 3 setae (1 large and 2 small) on second. Maxilliped (Fig. 377K) as small lobe bearing 2 pinnate setae apically.

Legs 1–4 (Fig. 378A–D) rudimentary, lacking defined protopods. Legs 1–3 represented by lobate, blunt rami. Leg 4 as single small lobe (exopod). Both rami subequal in leg 1, but endopodal lobe markedly smaller than exopodal lobe in legs 2 and 3. Exopod of legs 1–4 with 1 small seta proximally on outer margin. Additional minute setae present: 2 distally on endopod of leg 2, and 4 each on inner margin of exopod of legs 3 and 4. Both rami of leg 1 and exopod of legs 2 and 3 ornamented with minute spinules. Leg 5 absent.

**Male.** Unknown.

**Remarks.** *Scoliosoma dimerosum* gen. et sp. nov. closely resembles the type species *S. haplomerosum* gen. et sp. nov. They share a similar body form, short caudal rami bearing 3 setae, broad, leaf-like antennules, an almost identically reduced maxillule, and very similar swimming legs. Nevertheless, there are significant differences between them, including; the rami of the mandibular palp are not

demarcated in *S. haplomerusum* **gen. et sp. nov.**, unlike *D. dimerosum* **gen. et sp. nov.** in which the palp is clearly divided into the basis, exopod, and 2-segmented endopod, and the maxillary endopod is unsegmented in the type species but 2-segmented in *S. dimerosum* **gen. et sp. nov.**

### *Contoura* **gen. nov.**

**Diagnosis.** Body inflated. Urosome greatly reduced, indistinctly 1- or 2-segmented. Caudal rami rudimentary, not articulated from abdomen, lacking setae. Rostrum well-developed. Antennule short and broad, unsegmented or partially segmented; setae vestigial. Antenna 3-segmented, consisting of coxa, basis, and unsegmented endopod with small terminal claw. Labrum broad. Mandible consisting of coxa and palp; coxa with broad gnathobase with uneven, serrate medial margin; palp unsegmented, unilobate with vestigial exopod or lacking trace of exopod, armed with few rudimentary setae. Maxillule consisting of precoxa and palp; precoxa bearing 3 large, spiniform processes on arthrite; palp distally bilobed with large subdistal seta on medial margin and vestigial or transformed setae on distal lobes. Maxilla 4-segmented, comprising syncoxa, basis, and 2-segmented endopod; syncoxa with 1 or 2 small setae; basis with large, robust claw plus 1 seta; endopod with 3 or 4 small setae. Maxilliped as small lobe tipped with 1 or 2 setae. Leg 1 as unsegmented and unarmed plate, obscurely bilobed distally, or bearing lobe distally. Leg 2 absent or represented by small lobe. Legs 3 and 4 absent. Leg 5 represented by pair of conical, sclerotized processes.

**Type species.** *Contoura globosa* **gen. et sp. nov.** by original designation.

**Other included species.** *Contoura elliptica* **gen. et sp. nov.**

**Etymology.** The generic name is a combination of Greek *cont* (=short) and *ur* (=tail) and alludes to the short urosome of the new genus. Gender feminine.

**Remarks.** Two species are included in the new genus *Contoura*. Although they have remarkably different body form in the adult female, their cephalic appendages are highly derived and astonishingly similar. The most outstanding feature of the new genus is the presence of 3 large, spiniform teeth on the precoxal arthrite of the maxillule. The rudimentary urosome, the leaf-like antennule, the enlarged claw on the basis of the maxilla, the rudimentary leg 1, and the transformed leg 5 consisting of paired conical processes are all additional derived features of the new genus. Both species of *Contoura* **gen. nov.** are distributed in the western Atlantic.

### *Contoura globosa* **gen. et sp. nov.**

(Figs. 379, 380)

**Type material.** Holotype (intact ♀, MNHN-IU-2009-

5056), paratypes (10 intact ♀♀, MNHN-IU-2014-21416), and dissected paratypes (2 ♀♀, figured) from *Aplidium antillense* (Gravier, 1955) (MNHN-IT-2008-170 = MNHN A1/APL.B/166), St. François, S Grande Terre, Guadeloupe, Monniot coll., 25 December 1980.

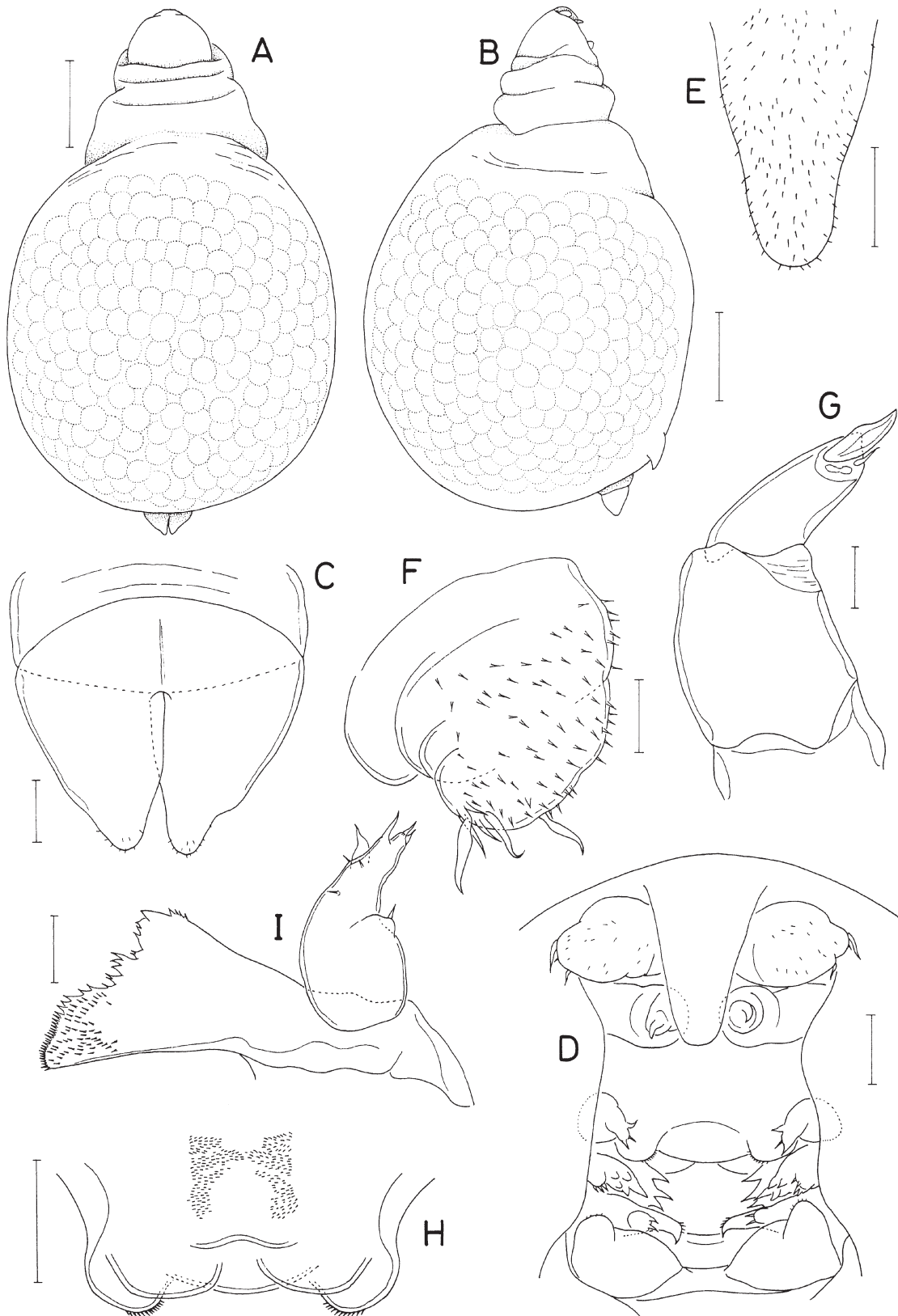
**Additional material.** 12 ♀♀ (MNHN-IU-2018-1911) from *A. antillense*, St. François, Guadeloupe.

**Etymology.** The specific name is derived from the Latin *glob* (=a ball), referring the spherical body of the adult female of the new species.

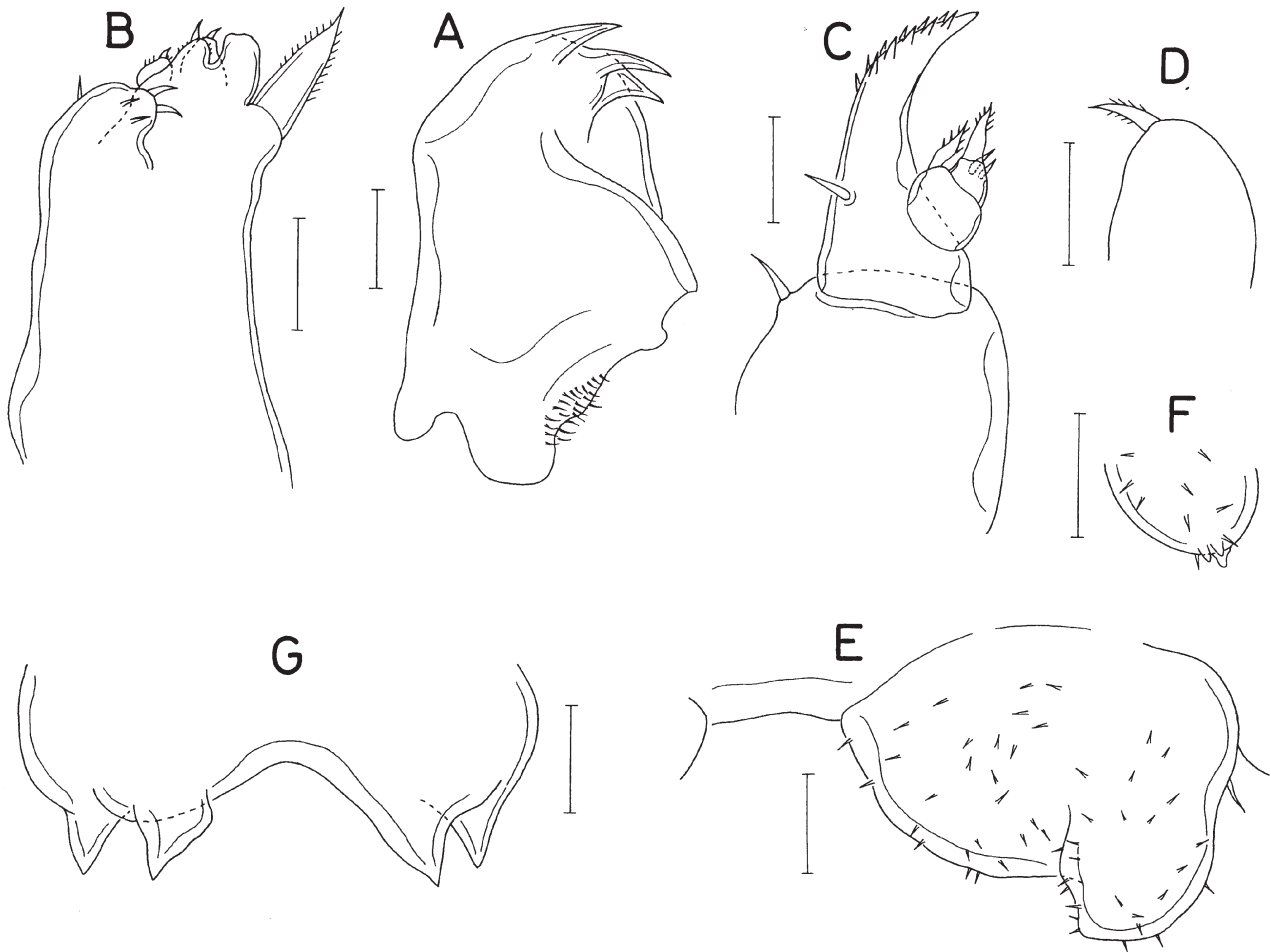
**Description of female.** Body (Fig. 379A, B) swollen with almost spherical brood pouch; body length 3.03 mm in dissected specimen. Prosome obscurely divided by 4 constrictions or wrinkles demarcating cephalosome and metasome; cephalosome small, narrower than anterior pedigerous somites. Fourth pedigerous somite (brood pouch) extremely expanded, spherical, 2.02×1.89 mm. Urosome (Fig. 379C) rudimentary, very small, 2-segmented: first urosomite short, not articulated from prosome, with traces of 2 or 3 suture lines on surface; second urosomite narrowing posteriorly. Caudal rami completely fused to anal somite, wider than long and narrowing distally, unarmed but ornamented with minute setules on surfaces.

Rostrum (Fig. 379D, E) large, 135×85 µm, tapering, bluntly tipped, with minute spinules on ventral surface. Antennule (Fig. 379F) 71×83 µm, short and broad, leaf-like, with 3 partial sutures (or constrictions) along posterior surface, armed distally with 5 or 6 small setae, ornamented with minute spinules on all surfaces. Antenna (Fig. 379G) stout, 3-segmented; coxa very short; basis 66×54 µm, unarmed; unsegmented endopod much narrower than proximal segments, 50×31 µm; armed with 1 small seta distally plus small terminal claw.

Labrum (Fig. 379H) broad, bilobate at each posterolateral corner, outer posterolateral lobe fringed with fine spinules along distal margin; ornamented with patch of minute spinules in mid ventral surface. Mandible (Fig. 379I) with coxal gnathobase broadening out towards oblique medial margin; margin serrate, with protruded proximal, pectinate part: palp reduced and unsegmented, with small, outer knob (vestige of exopod) in middle, bearing 1 or 2 minute setae; distal half (endopodal region) narrowing, bearing 2 small subdistal setae on medial margin, 2 or 3 minute setae apically; with few small spinules on medial surface. Maxillule consisting of precoxa and palp: precoxa (Fig. 380A) with patch of minute setules proximally and bearing 3 strong, spiniform teeth on mediodistal arthrite: palp (Fig. 380B) distally bilobed; outer lobe (exopod) with 2 small setae apically and 3 small spinules subdistally; inner lobe (basis+endopod) broad, with 1 large seta subdistally on medial margin and 4 tubercles apically, 3 outer tubercles each tipped with 1 small seta. Maxilla (Fig. 380C) 4-segmented, consisting of syncoxa, basis, and 2-segmented endopod; syncoxa with 1 seta medially; basis drawn out



**FIGURE 379.** *Contoura globosa* gen. et sp. nov., female. A, habitus, dorsal; B, habitus, right; C, urosome, ventral; D, cephalic region, ventral; E, rostrum; F, antennule; G, antenna; H, labrum, dorsal; I, mandible. Scale bars: A, B, 0.5 mm; C–E, H, 0.05 mm; F, G, I, 0.02 mm.



**FIGURE 380.** *Contoura globosa* gen. et sp. nov., female. A, precoxa of maxillule; B, palp of maxillule; C, maxilla; D, maxilliped; E, leg 1; F, leg 2; G, leg 5 pair. Scale bars: A–F, 0.02 mm; G, 0.05 mm.

to massive, curved claw bearing 1 seta proximally and 2 rows of denticles along distal part of convex proximal margin; endopod small, with broad seta on first segment and 1 broad and 2 small setae on second. Maxilliped (Fig. 380D) represented by small lobe tipped with 1 seta

Leg 1 (Fig. 380E) as broad plate bearing blunt outer distal lobe (exopod) and ornamented with minute spinules scattered on ventral surface. Leg 2 (Fig. 380F) as small lobe tipped with 3 minute, nipple-like processes (rudimentary setae) and ornamented with several minute spinules. Legs 3 and 4 absent. Leg 5 (Fig. 380G) represented by pair of conical, highly sclerotized processes.

**Male.** Unknown.

**Remarks.** The host of the new species, *Aplidium antillense*, is distributed in the western Atlantic from Georgia (United States of America) in the north to Brazil in the south (Sanamyan & Gleason, 2009; Da Rocha *et al.*, 2012).

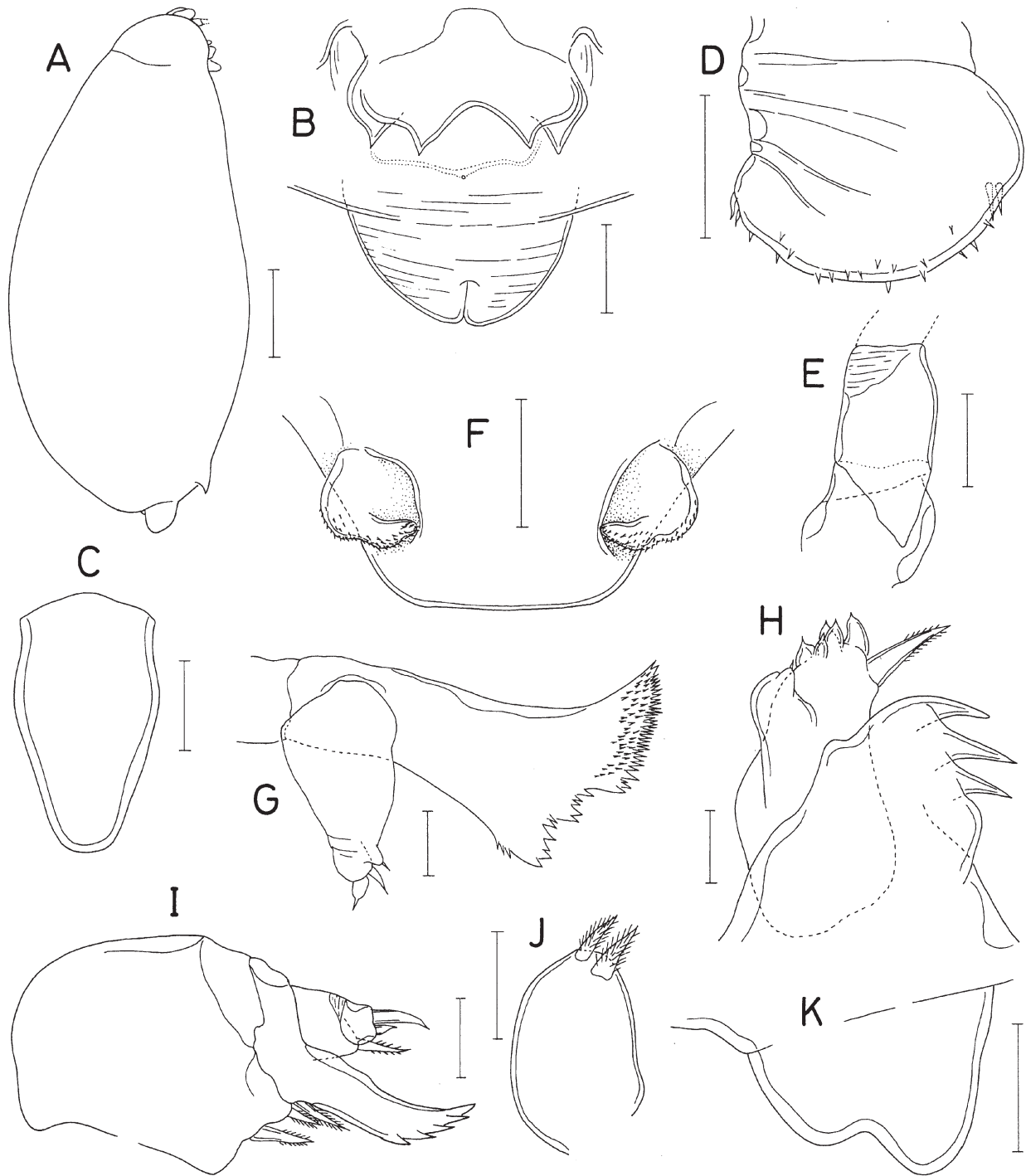
***Contoura elliptica* gen. et sp. nov.**  
(Fig. 381)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21417) from a colonial ascidian of *Aplidium* sp., Porto Belo, Santa Catarina, Brazil, da Rocha coll., 02 March 1987.

**Etymology.** The specific name refers to the elliptical shaped body of the adult female of the new species.

**Description of female.** Body (Fig. 381A) fusiform, with rudimentary free urosome; body length 2.98 mm. Cephalosome weakly defined from anterior part of prosome by indistinct dorsal suture line; greatest dorsoventral depth of prosome 1.38 mm near posterior third. Prosome-urosome boundary not defined, with fifth pedigerous and genital somites incorporated into swollen prosome. Free urosome (Fig. 381B) extremely reduced, wider than long, unsegmented, and distally incised. Leg 5 and gonopore positioned ventrodistally on prosome-urosome complex (Fig. 381B). Caudal rami and caudal setae absent.





**FIGURE 381.** *Contoura elliptica* gen. et sp. nov., female. A, habitus, right; B, posterior part of body, ventral; C, rostrum; D, antennule; E, proximal part of antenna; F, labrum; G, mandible; H, maxillule; I, maxilla; J, maxilliped; K, leg 1. Scale bars: A, 0.5 mm; B, 0.1 mm; C–F, K, 0.05 mm; G–J, 0.02 mm.

Rostrum (Fig. 381C) longer than wide ( $147 \times 83 \mu\text{m}$ ), widest at 40% of length, tapering distally towards blunt apex. Antennule (Fig. 381D) lobate, wider than long ( $78 \times 95$ ), subcircular, bearing 3 or 4 wrinkles on posterior surface; armed with 2 small setae proximally on anterior margin and 2 setae at apex; ornamented with minute

setules (or spinules) along anterior surface. Antenna (Fig. 381E) narrow, probably 3-segmented; coxa and basis unarmed; endopod missing in holotype.

Labrum (Fig. 381F) broad with large paired ventrolateral tubercles; tubercles digitiform distally and curved medially; ornamented with spinules; posterior

margin straight and smooth. Mandible (Fig. 381G) consisting of coxa and reduced palp: coxal gnathobase similar to that of *C. globosa* **gen. et sp. nov.**, with serrate medial margin: palp tapering, unsegmented, bearing 3 small setae (or tubercles) mediolaterally. Maxillule (Fig. 381H) similar to that of *C. globosa* **gen. et sp. nov.**, with 3 large spiniform teeth on precoxal arthrite; outer lobe of palp tipped with 1 minute setule; inner lobe with 1 large seta mediolaterally and 5 apically pointed tubercles. Maxilla (Fig. 381I) 4-segmented; syncoxa with 2 small setae medially; basis with 1 seta and drawn out to large claw bearing 4 teeth distally on convex proximal margin; endopod with 1 small seta on first segment and 2 very unequal setae on second. Maxilliped (Fig. 381J) as small lobe tipped with 2 equal, plumose setae.

Leg 1 (Fig. 381K) plate-like, unarmed and unornamented, distally bilobed, with weak inner lobe (endopod). Legs 2–4 absent. Leg 5 (Fig. 381B) represented by 2 pairs of conical, sclerotized processes.

**Male.** Unknown.

**Remarks.** *Contoura elliptica* **gen. et sp. nov.** is easily distinguished from its only congener, the type species *C. globosa* **gen. et sp. nov.**, by the markedly different body form of the female. Other differences include, the unsegmented urosome (vs. 2-segmented urosome in *C. globosa* **gen. et sp. nov.**), the labrum is specialized and bears paired ventrolateral tubercles (vs. these tubercles lacking in *C. globosa* **gen. et sp. nov.**), the syncoxa of the maxilla bears a single seta (vs. 2 setae), and the maxilliped is armed with 2 setae (vs. 1 seta).

### *Unimeria* **gen. nov.**

**Diagnosis.** Body inflated. Prosome unsegmented, gradually broadening posteriorly. Urosome small, wider than long, unsegmented, and directed perpendicular to prosomal axis. Caudal ramus small, not articulated from abdomen, armed with 6 setae. Rostrum present. Antennule incompletely 2-segmented. Antenna 3-segmented, consisting of short coxa, basis and unsegmented endopod with small terminal claw. Labrum simple. Mandible with pectinate medial margin on coxal gnathobase; palp biramous; exopod incompletely articulated from basis, bearing 4 setae; first endopodal segment fused with basis, with 2 setae on medial margin; second endopodal segment incompletely articulated from first, armed with 4 setae. Maxillule as lobe bearing 10 setae. Maxilla incompletely 3-segmented with 4, 1, and 2 setae on first to third segments, respectively. Maxilliped absent. Legs 1–4 biramous, unsegmented with elongate, digitiform rami; setae small and naked. Leg 5 absent.

**Type and only species.** *Unimeria longipedata* **gen. et sp. nov.** by original designation.

**Etymology.** The generic name is derived from the Greek *uni* (=one) and *mer* (=a part) and refers to the

unsegmented body of the type species. Gender feminine.

**Remarks.** The type species could not be assigned to any known notodelphyid genera because it exhibits a unique combination of highly derived and plesiomorphic character states. The derived states include: the urosome is small and unsegmented, the medial margin of mandibular coxa is pectinate, the maxillule is very reduced (represented by a lobe bearing setae), the maxilliped is absent, the swimming legs are unsegmented but retain elongate rami, and leg 5 is absent. However, the presence of 6 caudal setae and the setation of the mandibular palp are both relatively plesiomorphic features. *Unimeria* **gen. nov.** is established to accommodate *U. longipedata* **gen. et sp. nov.**

### *Unimeria longipedata* **gen. et sp. nov.**

(Fig. 382)

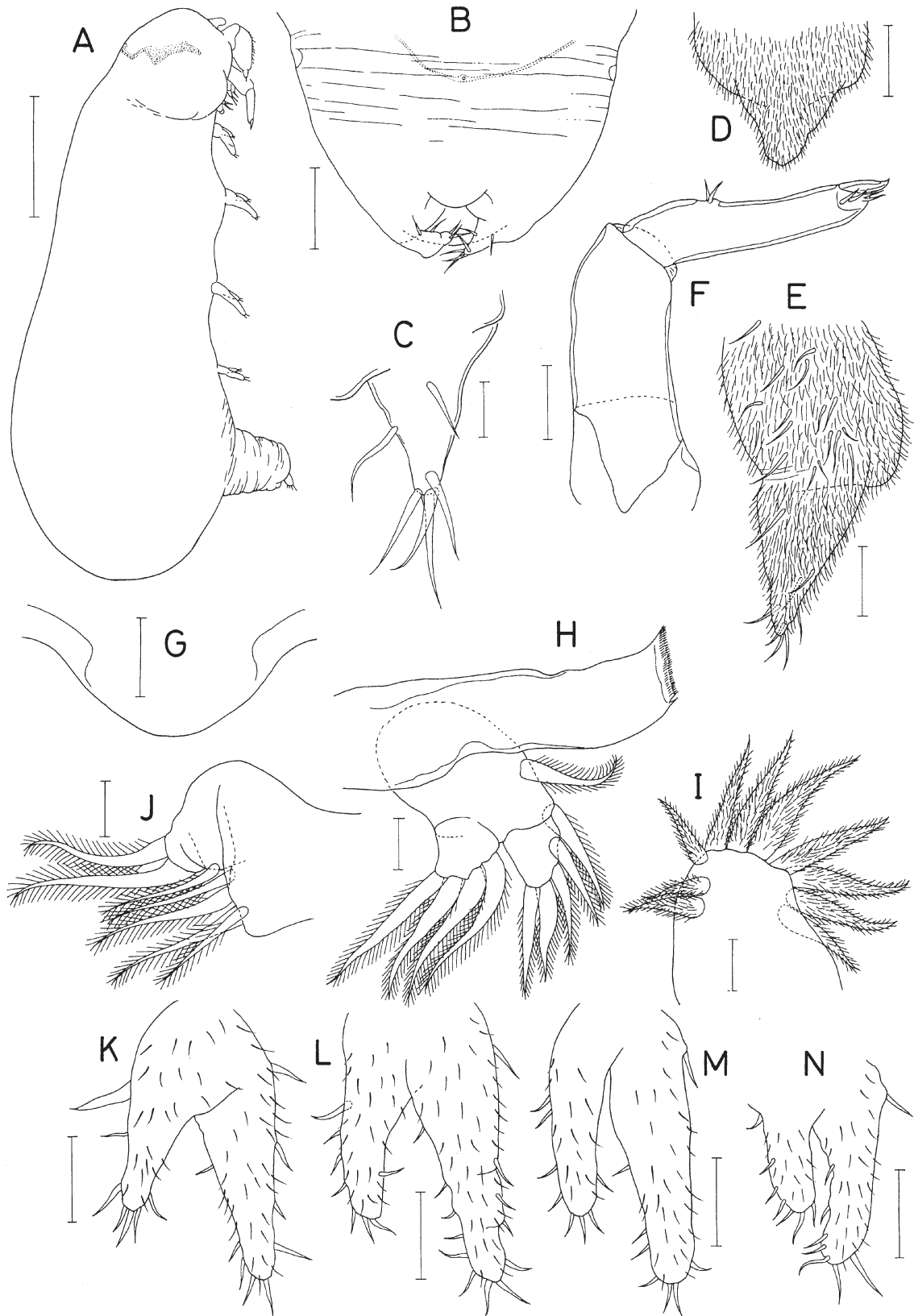
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21418) from the colonial ascidian *Leptoclinides apertus* Monniot F., 1989 (MNHN-IT-2008-4767 = MNHN A2/LEP/20), Rocher à la Voile, Noumea, NC45, New Caledonia, depth 9–10 m, Monniot coll., 19 March 1987.

**Etymology.** The specific name refers to the long, digitiform rami of legs 1–4.

**Description of female.** Body (Fig. 382A) unsegmented; body length (prosome length) 2.43 mm. Prosome undivided, elongate, gradually broadening posteriorly, with rounded posterior margin; dorsoventral depth of posterior part 936 µm. Cephalosome obscurely defined by slight lateral constriction. Free urosome (Fig. 382B) short, unsegmented, wider than long, directed perpendicular to prosome, not articulated from prosome, inserted into posteroventral surface of brood pouch. Caudal ramus (Fig. 382C) not articulated from urosome, strongly tapering, slightly longer than wide (63×52 µm); armed with 6 naked setae.

Rostrum (Fig. 382D) weak, flexible, broad proximally, narrow and tapering distally; densely covered with setules. Antennule (Fig. 382E) also densely ornamented with setules, incompletely 2-segmented; broader first segment armed with 17 small setae, narrower, tapering second segment with 8 setae. Antenna (Fig. 382F) 3-segmented; coxa and basis unarmed; unsegmented endopod narrow, 3.6 times longer than wide (160×44 µm) and longer than basis; armed with 6 small setae (2 at proximal 40% on inner margin, 2 subdistal, and 2 distal) plus very small terminal claw, 0.25 times as long as endopodal segment.

Labrum (Fig. 382G) broad, unornamented, with convex posterior margin. Mandible (Fig. 382H) with coxal gnathobase slightly narrowing medially; medial margin nearly straight, pectinate, with 1 minute tooth distally: palp consisting of basis (basis+first endopodal segment) armed with 2 setae; exopod and endopod each



**FIGURE 382.** *Unimeria longipedata* gen. et sp. nov., female. A, habitus, right; B, urosome, dorsal; C, caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla; K, leg 1; L, leg 2; M, leg 3; N, leg 4. Scale bars: A, 0.5 mm; B, 0.1 mm; C, H–J, 0.02 mm; D–G, K–N, 0.05 mm.

with 4 setae. Maxillule (Fig. 382I) as single lobe bearing 10 densely plumose setae (medial 3 shorter than others). Maxilla (Fig. 382J) strongly curved, incompletely 3-segmented; armed with 4, 1, and 2 setae on first to third segments, respectively. Maxilliped absent.

Legs 1–4 (Fig. 382K–N) biramous, unsegmented with elongate digitiform rami covered with setules; rami lacking any trace of articulation; endopods shorter than exopods. Exopods of legs 1–4 armed with 9, 13, 8, and 8 setae, respectively, 1 seta (originally outer seta of basis) positioned on proximal outer margin. Endopods of legs 1–4 armed with 7, 8, 8, and 6 setae, respectively. All setae small and naked, except original inner distal seta on basis on proximal inner margin of leg 1 endopod broadened. Leg 4 smaller than anterior legs. Leg 5 absent.

**Male.** Unknown.

**Remarks.** The new species shares the same species of host with *Adrodelphys tectifera* **gen. et sp. nov.** (described below) from the same locality.

### *Mecodelphys* **gen. nov.**

**Diagnosis.** Body *Doropygus*-like. Prosomal somites divided only by weak constrictions; third and fourth pedigerous somites fused, forming inflated brood pouch. Free urosome clearly 5-segmented, inserted into ventral side of brood pouch. Caudal ramus armed with small setae. Rostrum well-developed. Antennule incompletely segmented with reduced setation. Antenna 3-segmented with small terminal claw. Labrum distinct. Mandible consisting of biramous palp only; exopod and endopod fused to basis, lobate, unsegmented, each armed with 4 setae. Maxillule, maxilla and maxilliped each represented by single lobe bearing 1 to few setae. Legs 1–4 biramous with extremely long, unsegmented rami; setation reduced. Leg 5 represented by 2 processes each bearing 1 seta.

**Type and only species.** *Mecodelphys edentatus* **gen. et sp. nov.** by original designation.

**Etymology.** The generic name is derived from the Greek *meco* (=long) and *-delphys* (a common ending for genera in the family) and refers to the elongate swimming legs of the new genus. Gender masculine.

**Remarks.** The body of *Mecodelphys* **gen. nov.** is similar to that of *Doroixys*, but its mouthparts and legs are entirely different from those of *Doroixys* and the other genera in the *Doroixys*-group. Although the characteristically elongate and unsegmented rami of legs 1–4 of *Mecodelphys* **gen. nov.** are shared by *Unimeria* **gen. nov.**, they display several other important morphological differences. In *Mecodelphys* **gen. nov.** the urosome is distinctly 5-segmented whereas it is unsegmented in *Unimeria* **gen. nov.** The mandible of *Mecodelphys* **gen. nov.** lacks the coxal gnathobase and its exopod and endopod are both fused to the basis whereas the mandible of *Unimeria* **gen. nov.** has a pectinate coxal gnathobase

and has a free exopod and endopod. The maxilliped is present in *Mecodelphys* **gen. nov.** but absent in *Unimeria* **gen. nov.**, and leg 5 is present in *Mecodelphys* **gen. nov.** but absent in *Unimeria* **gen. nov.**

### *Mecodelphys edentatus* **gen. et sp. nov.**

(Figs. 383, 384)

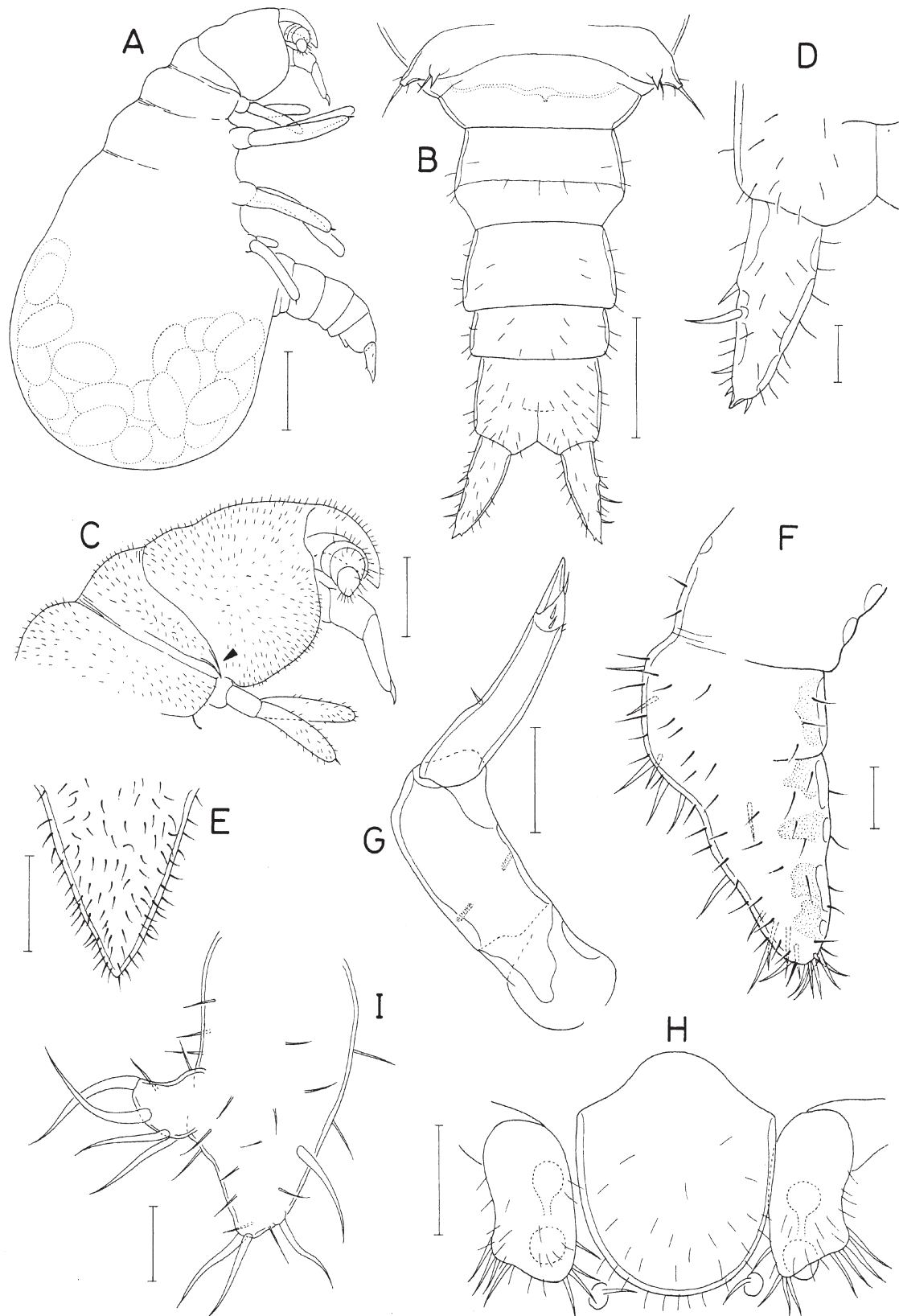
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21419), paratypes (6 intact ♀♀, MNHN-IU-2014-21420), and dissected paratypes (2 ♀♀, figured) from the colonial ascidian *Lissoclinum taratara* Monniot C. & Monniot F., 1987 (MNHN-IT-2008-4990 = MNHN A2/LIS/162), CRRF CRCHO 297, Cape Rodney Pass, Papua New Guinea (10°15.66'S, 148°22.27'E), depth 31 m, 11 June 1998.

**Etymology.** The name is from the Latin *e* (=without) and *dentat* (=toothed), alluding to the absence of a coxal gnathobase in the new species.

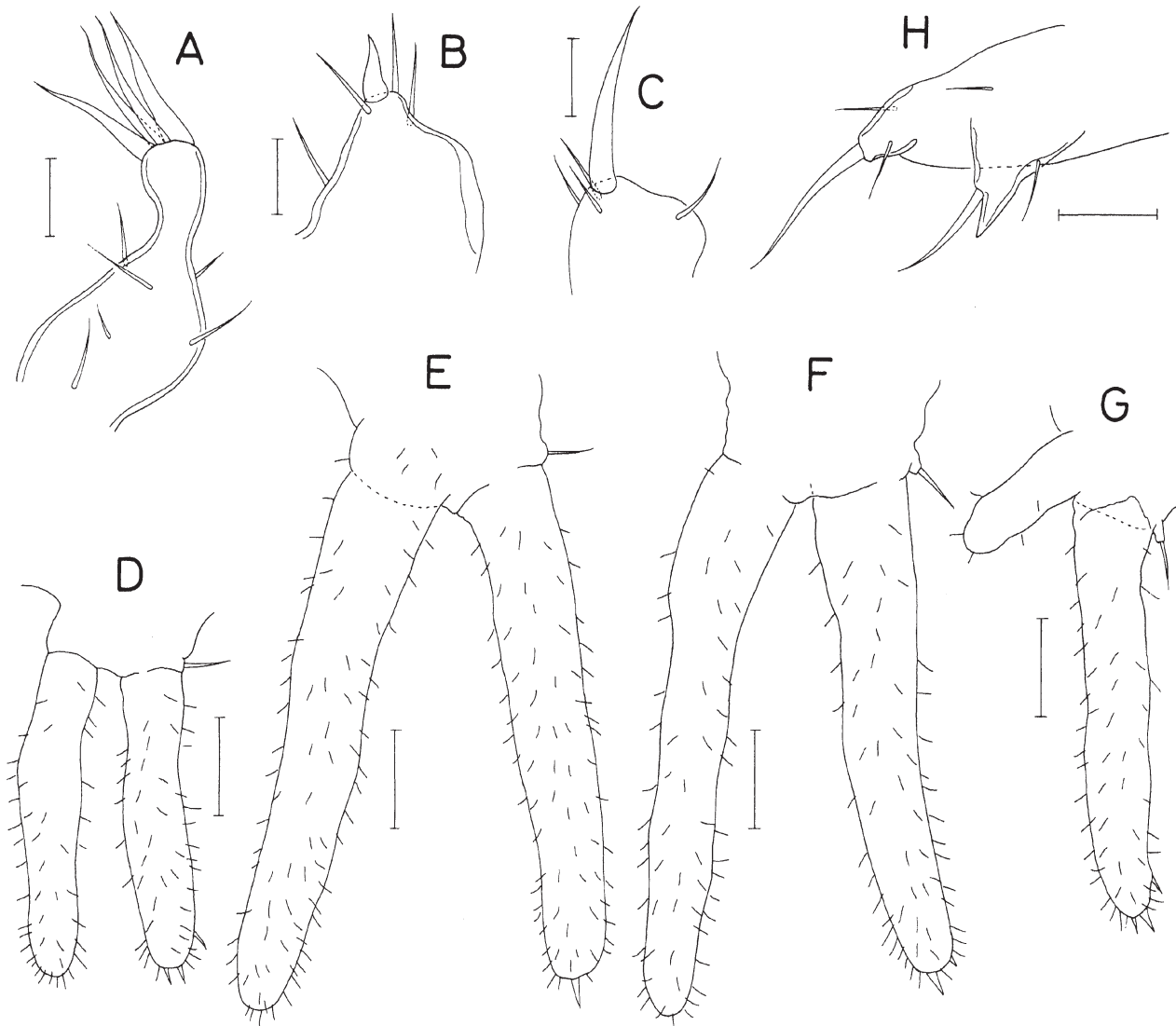
**Description of female.** Body (Fig. 383A) *Doropygus*-like in form, surface ornamented with numerous, minute setules. Prosome divisible by weak constrictions into cephalosome, first and second pedigerous somites, and fused third and fourth pedigerous somites; dorsal cephalic shield expanded ventrolaterally, bearing pair of small, acutely pointed, spiniform processes posterolaterally (Fig. 383C). Fused third and fourth pedigerous somites swollen, forming brood pouch. Free urosome (Fig. 383B) 5-segmented: genital somite short, only partially articulated from brood pouch; 4 abdominal somites setulose, 85×144, 69×131, 38×118, and 80×107 µm, respectively. Caudal ramus (Fig. 383D) tapering, covered with setules, about 2.7 times longer than wide (75×28 µm), slightly shorter than anal somite, tipped with short, spiniform process: armed with 5 small setae (2 outer lateral, 1 outer subdistal, and 2 small distal).

Rostrum (Fig. 383E) rather large, 100×89 µm, evenly tapering towards pointed apex, surface covered with setules. Antennule (Fig. 383F) stout, 148 µm long, covered with setules, unsegmented but with 2 partial articulations on posterior surface; armed with about 17 small setae. Antenna (Fig. 383G) slender and 3-segmented; coxa short and unarmed; second segment (fused basis and first endopodal segment) also unarmed, with vestige of articulation near middle; third segment (second endopodal segment) about 4.2 times longer than wide (101×24 µm); armed with 4 tiny setae (1 proximal, 2 subdistal, and 1 distal) plus small terminal claw, about 0.2 times as long as segment.

Labrum (Fig. 383H) large with rounded posterior margin. Mandible consisting only of palp, without coxal gnathobase; palp unsegmented with lobate rami; inner lobe broad and blunt; each lobe armed with 4 naked setae. Maxillule (Fig. 384A), maxilla (Fig. 384B), and maxilliped (Fig. 384C) each represented by lobe. Maxillule



**FIGURE 383.** *Mecodelphys edentatus* gen. et sp. nov., female. A, habitus, right; B, urosome, ventral; C, anterior part of prosome, right side showing posterolateral process on dorsal cephalic shield (arrowhead); D, left caudal ramus, dorsal; E, rostrum; F, antennule; G, antenna; H, labrum and mouthparts; I, mandible. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D, F, I, 0.02 mm; E, G, H, 0.05 mm.



**FIGURE 384.** *Mecodelphys edentatus* gen. et sp. nov., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4; H, left leg 5, ventral. Scale bars: A–C, 0.01 mm; D–G, 0.05 mm; H, 0.02 mm.

narrowing distally, with subdistal constriction, armed with 4 equal setae on apex. Maxilla tipped with 1 short seta, and maxilliped with 1 longer seta. All mouthparts ornamented with scattered setules.

Legs 1–4 (Fig. 384D–G) biramous, with unsegmented protopods armed with small outer seta; both rami elongate, digitiform, fused with or incompletely articulated with protopod, covered with setules. Leg 1 distinctly smaller than posterior swimming legs. Endopods slightly longer than exopods in legs 1–3, but less than one-third as long as exopod in leg 4. Lengths of rami: 153, 258, 251, and 207  $\mu\text{m}$ , respectively, for exopods of legs 1–4; and 167, 275, 285, and 64  $\mu\text{m}$ , respectively, for endopods of leg 1–4. Endopods unarmed, but exopods of legs 1–4 armed with few, small setae distally, 2 or 3, 1, 2, and 3, respectively.

Leg 5 (Fig. 384H) represented by 2 ventral processes

on each side of somite; outer protopodal process tipped with 1 seta; inner exopodal process conical, pointed apically, bearing 1 seta on its outer margin.

**Male.** Unknown.

**Remarks.** The caudal ramus of *M. edentatus* gen. et sp. nov. bears 5 small setae and a claw-like distal process. It can be inferred that the latter process is derived from the fusion of a seta to the ramus.

### Genus *Campopera* Schellenberg, 1922

**Diagnosis.** Body caterpillar-like; with prosome cylindrical, unsegmented or divided only by constrictions between somites. Urosome narrower than prosome, 4-segmented, consisting of genital complex (fused fifth pedigerous

somite and genital double-somite) and 3-segmented abdomen. Caudal rami small; caudal setae obscure or absent. Rostrum well-developed. Antennule broad, 1- or 2-segmented. Antenna 4-segmented, consisting of coxa, basis, and 2-segmented endopod bearing terminal claw. Mandible consisting of coxa and palp; coxa with broad gnathobase bearing teeth on medial margin; palp biramous with 1 seta on basis, 5 setae on exopod; endopod free or fused with basis. Maxillule with 8 or 9 setae on arthrite, 1 on coxal endite, 2 on epipodite; exopod and endopod not articulated from basis, armed with 4 setae each on exopod and on basis-endopod complex. Maxilla 3-segmented, consisting of syncoxa, basis, and unsegmented endopod; syncoxa with 2 or 3 endites; basis with large claw plus 1 or 2 setae; endopod atrophied, bearing 2 to 4 setae. Maxilliped lobate with several setae. Legs 1–4 biramous; protopods unsegmented or indistinctly 2-segmented; rami fused with or indistinctly articulated from protopod and unarmed or armed only with minute, papilliform setae. Leg 1 exopod 2-segmented; endopod of leg 1 and all rami of legs 2–4 unsegmented or only with traces of articulations. Leg 5 absent.

**Type species.** *Campopera michaelsoni* Schellenberg, 1922 by original designation.

**Remarks.** Schellenberg (1922) described the type species, *C. michaelsoni*, as an associate of the ascidian *Paramolgula gigantea* (Cunningham, 1871) collected in the Falkland Islands. In the original description he provided figures of the habitus, rostrum, antennule, and leg 1. Two of the new species described in the present work are immediately identifiable as belonging to *Campopera*, due to their characteristic caterpillar-like body form. The presence of a large claw on the basis of the maxilla, which Schellenberg (1922) mentioned as a diagnostic feature of the genus *Campopera*, is confirmed in two new species described below.

### *Campopera magellanica* sp. nov.

(Figs. 385, 386)

**Type material.** Holotype (copepodid V ♀, MNHN-IU-2014-21421), paratypes (8 intact copepodids, probably stages III and IV ♀♀, MNHN-IU-2014-21422), dissected paratypes (1 ♀ and 1 copepodid V ♀, figured) from *Paramolgula gregaria* (Lesson, 1830), Magellan Strait, date unknown.

**Etymology.** The new species is named after its type locality, the Strait of Magellan.

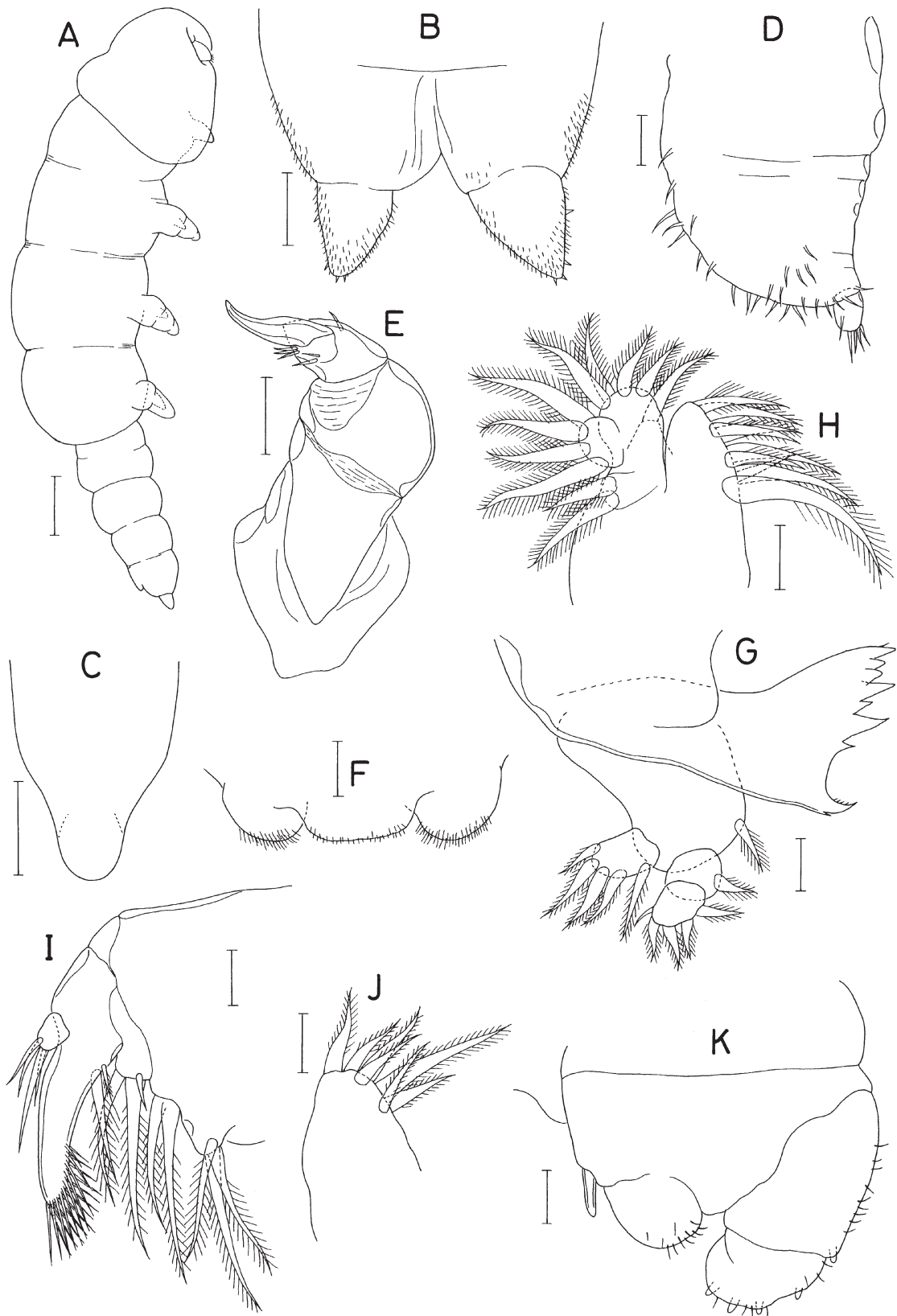
**Description of female.** Body (Fig. 385A) cylindrical, caterpillar-like, slightly curved ventrally. Body length 3.14 mm, with prosome occupying about 70% of body length. Cephalosome well-defined from metasome; dorsal cephalic shield with expanded ventrolateral margins. Metasome about 2.5 times longer than wide; 4 pedigerous somites defined only by constrictions. Urosome distinctly

narrower than prosome, 4-segmented, consisting of genital complex incorporating fifth pedigerous somite and 3 free abdominal somites. Genital complex subdivided by lateral constriction; genital apertures not discernible. Articulation between last 2 abdominal somites indistinct. Anal somite with distinct posteromedian incision and ornamented with fine setules on lateral surfaces. Caudal ramus (Fig. 385B) small, conical, incompletely articulated from anal somite, 1.07 times longer than wide (72×67 µm), ornamented with numerous fine setules on all surfaces: armed with 4 small, papilliform setae (outer lateral, outer subdistal, and 2 distal).

Rostrum (Fig. 385C) distinct, longer than wide; lateral margins parallel in proximal half, but abruptly tapering distally towards blunt apex. Antennule (Fig. 385D) 2-segmented; consisting of broad, leaf-like proximal segment and small, nipple-shaped distal segment; proximal segment with traces of articulations; both segments bearing minute setae. Antenna (Fig. 385E) stout, 4-segmented; coxa, basis, and first endopodal segment unarmed, each wider than long; distal endopodal segment distinctly narrower than proximal segments, slightly longer than wide (53×44 µm); bearing 6 small setae plus terminal claw, slightly longer than segment.

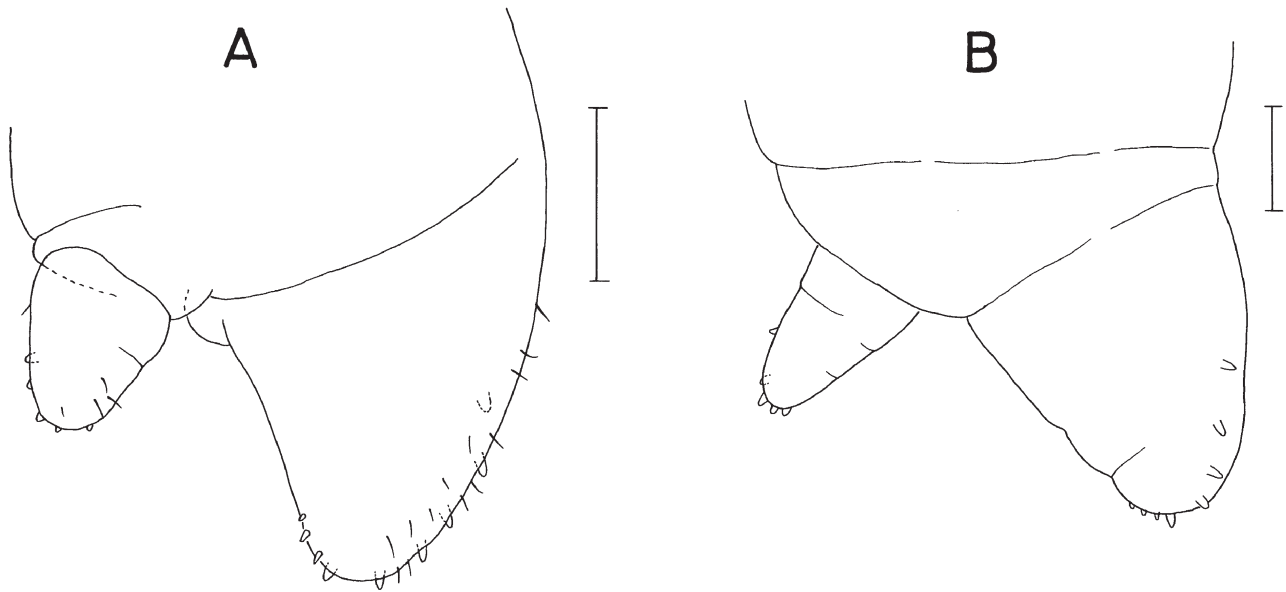
Labrum (Fig. 385F) short and broad, distally trilobate, ornamented with fine setules on lobes. Mandible (Fig. 385G) consisting of coxa and palp: coxa with broad gnathobase bearing 4 large and 4 small teeth on medial margin; distalmost tooth with minute subsidiary tooth on distal margin: palp consisting of basis, exopod and 2-segmented endopod; armed with 1 seta on basis, 5 setae on exopod, and 1 and 5 setae on first and second endopodal segments, respectively; all setae small and pinnate, except minute, naked outermost seta on second endopodal segment. Maxillule (Fig. 385H) with 9 setae on arthrite, 1 on coxal endite, 2 on epipodite, 4 on exopod, and 4 on fused basis and endopod; exopod incompletely articulated at base; setae densely pinnate except 1 small naked seta on arthrite. Maxilla (Fig. 385I) 3-segmented; syncoxa with 3, 2 and 3 setae on first to third endites, respectively; basis bearing 2 setae proximally and drawn out into large, robust claw with blunt tip ornamented with 2 rows of thick, stiff setules along distal third of concave margin; endopod small, unsegmented, bearing 4 small, naked setae. Maxilliped (Fig. 385J) unsegmented, lobate, armed with 7 pinnate setae.

Leg 1 (Fig. 385K) biramous with 2-segmented protopod; coxa unarmed; basis lacking outer seta but with inner distal spine; both rami setulose; exopod broad, 2-segmented, bearing 5 small, papilliform setae, 1 on outer distal corner of first segment and 4 on outer and distal margins of second segment; endopod short, lobate, incompletely articulated from basis. Legs 2–4 biramous (Fig. 386A, B); protopods indistinctly 2-segmented and unarmed. Exopods larger than endopods; both rami tapering, unsegmented, sparsely setulose, with partial trace



**FIGURE 385.** *Campopera magellanica* sp. nov., female. A, habitus, right; B, caudal rami, dorsal; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla; J, maxilliped; K, leg 1. Scale bars: A, 0.2 mm; B, E, 0.05 mm; C, 0.1 mm; D, F–K, 0.02 mm.





**FIGURE 386.** *Campopera magellanica* sp. nov., female. A, leg 2; B, leg 4. Scale bars: 0.05 mm.

of articulation and small papilliform setae; 9 papilliform setae on exopod and 6 on endopod of legs 2 and 3, 8 on exopod and 5 on endopod of leg 4. Legs 5 and 6 absent.

**Description of Copepodid V female.** Body hardly distinguishable from that of adult female. Body length 2.11 mm. Body segmentation more distinct than in adult. Caudal ramus armed and ornamented as in adult. Antennule, antenna, mandible, maxilla, and legs 2–4 as in female. Maxillular arthrite bearing 8 setae. Maxilliped with 5 setae. Leg 1 with unsegmented exopod. Leg 5 absent as in adult.

**Male.** Unknown.

**Remarks.** *Campopera magellanica* sp. nov. and the type species *C. michaelsoni* are very alike in the form of the body, antennule and leg 1, but there are significant differences between the two species, as follows: (1) the caudal ramus of *C. magellanica* sp. nov. is strongly tapering, but is bluntly rounded distally in *C. michaelsoni*, as figured in the original description (Schellenberg, 1922); (2) the distal half of the rostrum of *C. magellanica* sp. nov. is tapering, but the lateral margins of the rostrum of *C. michaelsoni* appear to be parallel in the figure of Schellenberg (1922); (3) the mandibular exopod of *C. magellanica* sp. nov. is armed with 5 setae, compared to 4 subequal setae as described by Schellenberg (1922); (4) the maxilla of *C. magellanica* sp. nov. bears 3 setae on the first endite of syncoxa and 4 setae on the endopod, in contrast to 2 and 3 setae, respectively, in *C. michaelsoni* (Schellenberg, 1922); (5) the endopod of leg 1 of *C. magellanica* sp. nov. is unarmed, but several small papilliform spines were illustrated and described in *C. michaelsoni*; and (6) leg 5 is absent in *C. magellanica* sp. nov. whereas it is present in *C. michaelsoni*, according

to Schellenberg (1922). These differences are sufficient to support the establishment of the new species.

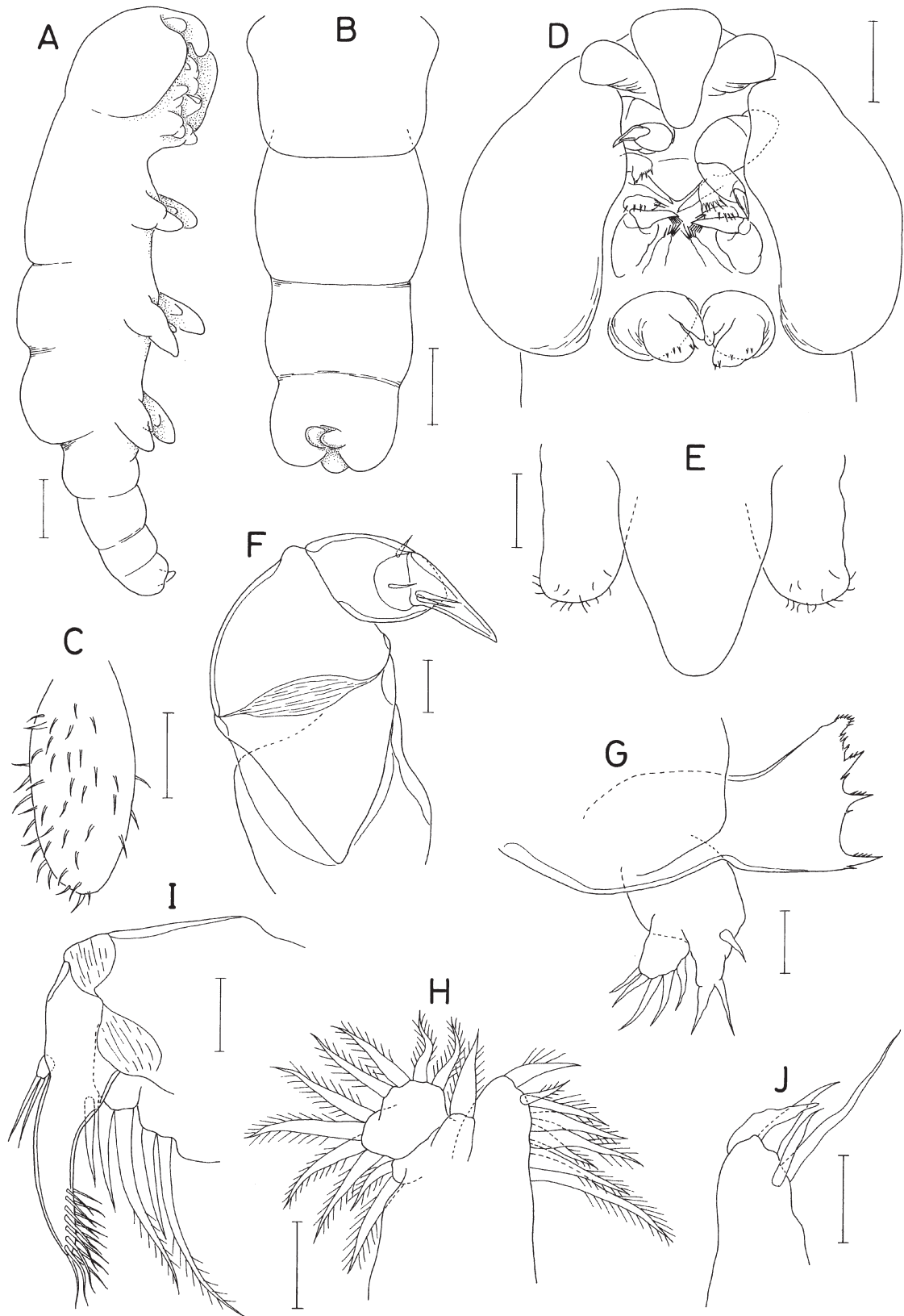
***Campopera caribbensis* sp. nov.**  
(Figs. 387, 388)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21423) and dissected paratype (♀, figured) from *Botryllus planus* (Van Name, 1902) (MNHN-IT-2008-1729 = MNHN S1/BOT.B/21), W. Îlet a Cochons, Guadeloupe Stn 13, depth 5–10 m, Monniot coll., 23 December 1980.

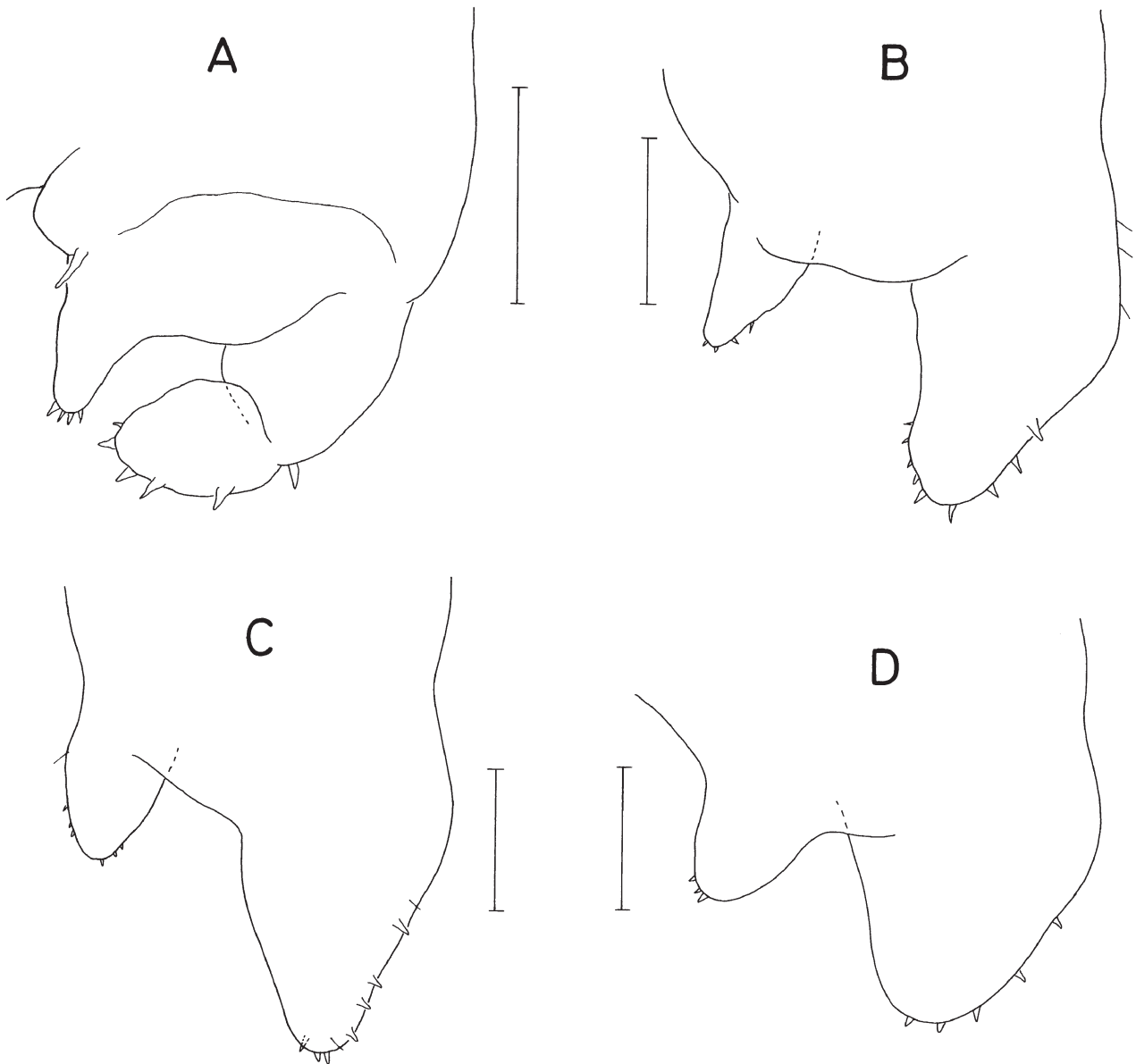
**Etymology.** The name of the new species is derived from the Caribbean.

**Description of female.** Body (Fig. 387A) resembling that of *C. magellanica* sp. nov., but segmentation of prosome more obscure. Body length 2.05 mm. Cephalosome indistinctly defined from metasome. Urosome 4-segmented (Fig. 387B), distinctly narrower and shorter than prosome; first urosomite (genital complex) not articulated from prosome; genital apertures not discernible. Three free abdominal somites indistinctly articulated. Caudal ramus (Fig. 387C) small, lobate, about twice as long as wide (55×25 µm), fusiform, not articulated from anal somite, ornamented with many setules: caudal setae absent.

Rostrum (Fig. 387D, E) large, smooth, tapering in distal two-thirds towards rounded apex. Antennule (Fig. 387E) lobate, unsegmented, shorter than rostrum, blunt tipped, sparsely ornamented with minute setules over distal surface; setae apparently absent. Antenna (Fig. 387F) robust, 4-segmented; coxa, basis, and first endopodal segment unarmed, each much wider than long;



**FIGURE 387.** *Campopera caribbensis* sp. nov., female. A, habitus, right; B, urosome, ventral; C, caudal ramus; D, cephalic region, ventral; E, rostrum and antennules; F, antenna; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Scale bars: A, 0.2 mm; B, D, 0.1 mm; C, F–J, 0.02 mm; E, 0.05 mm.



**FIGURE 388.** *Campopera caribbensis* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.05 mm.

distal endopodal segment about 1.4 times longer than wide ( $45 \times 33 \mu\text{m}$ ): armed with 4 small setae, 2 inserted into basal part of terminal claw; terminal claw strong, straight, as long as segment.

Labrum convex posteriorly. Mandible (Fig. 387G) with broad coxal gnathobase bearing 3 major teeth and several minute denticles on medial margin, and bluntly produced, spinulose proximal corner; 3 major teeth each bearing 3 or 4 spinules on proximal margin; distalmost tooth with 1 minute denticle at base of distal margin: palp consisting of obscurely defined exopod bearing 5 short, naked setae and basis-endopod complex bearing 3 small, naked setae, one originating from basis region and remaining 2 more distally. Maxillule (Fig. 387H) bearing 8 setae on arthrite, 1 broad seta on coxal endite,

2 on epipodite; exopod and endopod fused with basis, bearing 4 setae each on exopodal region and endopod-basis complex; all setae pinnate. Maxilla (Fig. 387I) 3-segmented; syncoxa bearing 2 endites, each tipped with 2 setae; basis with 1 seta plus massive claw bearing 2 rows of thick setules distally; endopod 1-segmented, rudimentary, tipped with 2 thin setae. Maxilliped (Fig. 387J) lobate, armed with 4 unequal, naked setae (2 subdistal and 2 distal).

Legs 1–4 (Fig. 388A–D) biramous; both rami fused with protopod in all legs. Leg 1 with protopod retaining trace of articulation and bearing inner distal seta on basis region. Exopods of legs 1–4 larger than endopods. Exopod of leg 1 incompletely 2-segmented, but endopod and both rami of other legs unsegmented, lobate. Minute

setae present: 6, 10, 7, and 5 on exopods of legs 1–4, respectively, and 4, 4 (or 5), 6, and 3 (or 4) on endopods of legs 1–4, respectively. Legs 5 and 6 absent.

**Male.** Unknown.

**Remarks.** *Campopera caribbensis* **sp. nov.** differs from its two congeners in having an unsegmented antennule compared to the 2-segmented limb present in both *C. michaelsoni* and *C. magellanica* **sp. nov.** In addition, the maxillary syncoxa has 2 endites in the new species in contrast to 3 endites in both of its congeners, and the maxillary endopod has only 2 setae, in contrast to 3 setae in *C. michaelsoni* and 4 setae in *C. magellanica* **sp. nov.**

### ***Tubipedia* gen. nov.**

**Diagnosis.** Body caterpillar-like, dorsoventrally depressed with defined cephalosome, metasome, and free urosome. Cephalosome small. Metasome unsegmented, incorporating fifth pedigerous somite. Free urosome 5-segmented, comprising genital somite and 4-segmented abdomen. Caudal ramus with 5 setae. Rostrum present. Antennule 5-segmented with distinct setae. Antenna 4-segmented, consisting of coxa, basis, and 2-segmented endopod; first endopodal segment with 1 seta; terminal claw small. Mandible consisting of coxa and palp; medial margin of coxal gnathobase bearing 4 teeth only; palp comprising unarmed basis, exopod bearing 4 setae, and endopod bearing 4 setae on first segment and 6 setae on second. Maxillule bilobed, armed with 5 setae on inner lobe (precoxal arthrite) and 6 setae on outer lobe (palp formed by fusion of basis, exopod and endopod). Maxilla short and broad, indistinctly 5-segmented, armed with 3, 2, 1, 1, and 2 setae on first to fifth segments, respectively. Maxilliped lobate, bearing 8 setae apically. Legs 1–4 biramous, each with unsegmented protopod; endopods rudimentary, markedly smaller than exopods, and tipped with 1 or 2 setae. Leg 1 with 2-segmented rami. Legs 2–4 each with 3-segmented exopod and lobate endopod; exopods tipped with tube-like structure. Leg 5 rudimentary, represented by small setae. Leg 6 absent.

**Type and only species.** *Tubipedia anisocladia* **gen. et sp. nov.** by original designation.

**Etymology.** The generic name is from the Latin *tub* (=a tube) and *ped* (=a foot), referring to the presence of a small tube on the exopods of legs 2–4. Gender feminine.

**Remarks.** The new genus shares a similar body form with *Prophioseides* Chatton & Brément, 1911 and *Campodelphys* **gen. nov.** (see below), but is readily distinguishable by the possession of a 4-segmented antenna bearing a seta on the first endopodal segment, and by the presence of 4 setae on the first endopodal segment of the mandibular palp. The presence of the tube-like structure on the apex of the exopod of legs 2–4 is an autapomorphy which serves to separate *Tubipedia* **gen. nov.** from all other genera in the Notodelphyidae.

***Tubipedia anisocladia* gen. et sp. nov.**  
(Figs. 389, 390)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21424) from an unknown host, AURACEA 1995 Stn P15, near the lighthouse, Ibo Island, Mozambique, depth 0–20 m, Monniot coll., 14 November 1995.

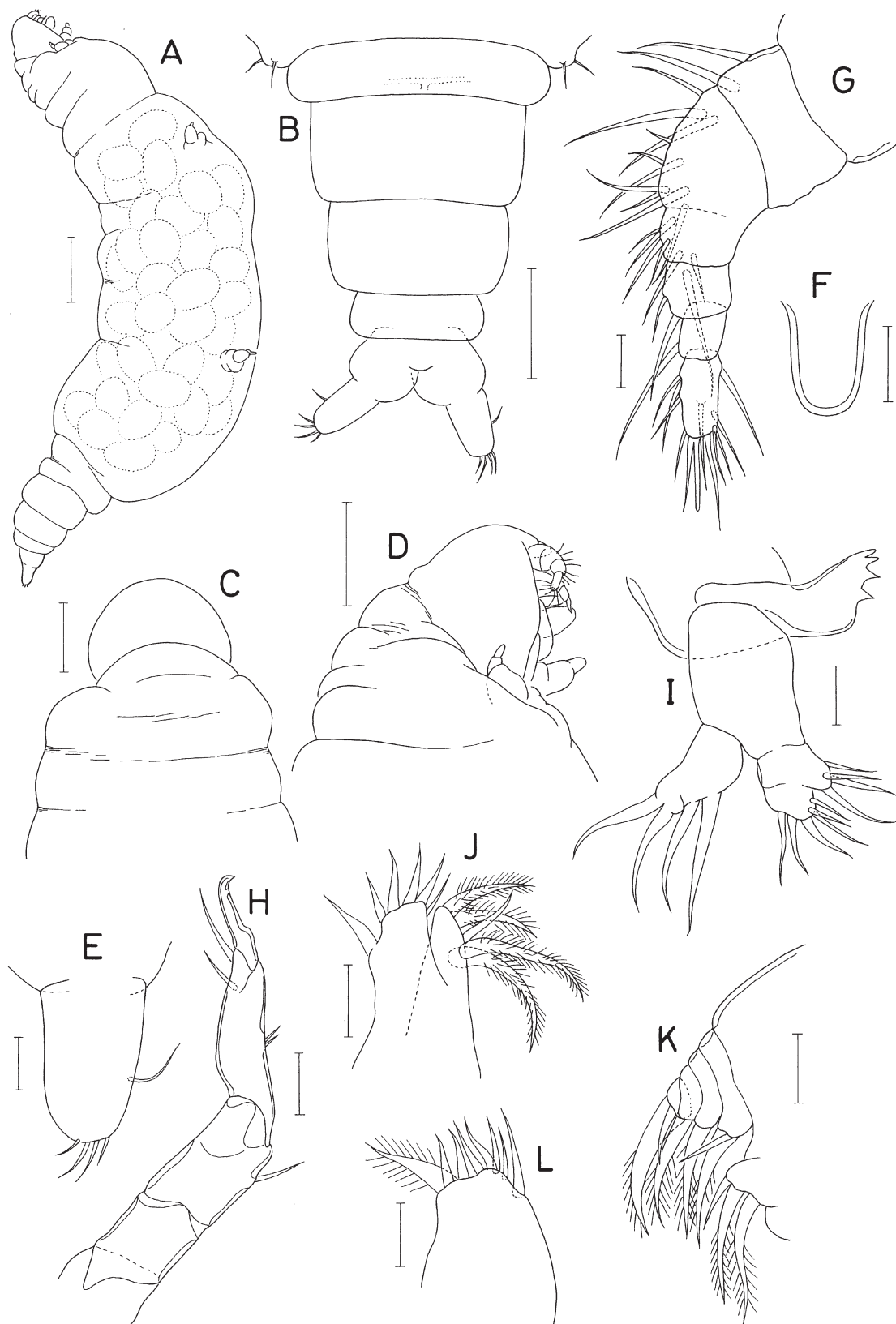
**Etymology.** The name of the new species is derived from the Greek *anis* (=unequal) and *clad* (=a branch), alluding to the extremely unequal sizes of the exopods and endopods of swimming legs.

**Description of female.** Body (Fig. 389A) elongate, length 2.03 mm. Prosoma curved dorsally, dorsoventrally depressed, gradually broadening posteriorly in dorsal and ventral view, unsegmented, but with several transverse wrinkles present dorsally. Cephalosome (Fig. 389C) small, free margins rounded in dorsal view. Legs 1 and 2 positioned anteriorly on metasome (Fig. 389D). Leg 3 positioned distant from leg 2, and leg 4 widely separated from leg 3 (Fig. 389A). Fused third and fourth pedigerous somites forming brood pouch. Free urosome (Fig. 389B) small, occupying 20% of body length, 5-segmented, distinctly narrowing posteriorly. Genital somite short but broadest. Caudal ramus (Fig. 389E) 1.5 times longer than wide (60×40 µm), rounded distally; armed with 5 small setae (1 lateral and 4 distal).

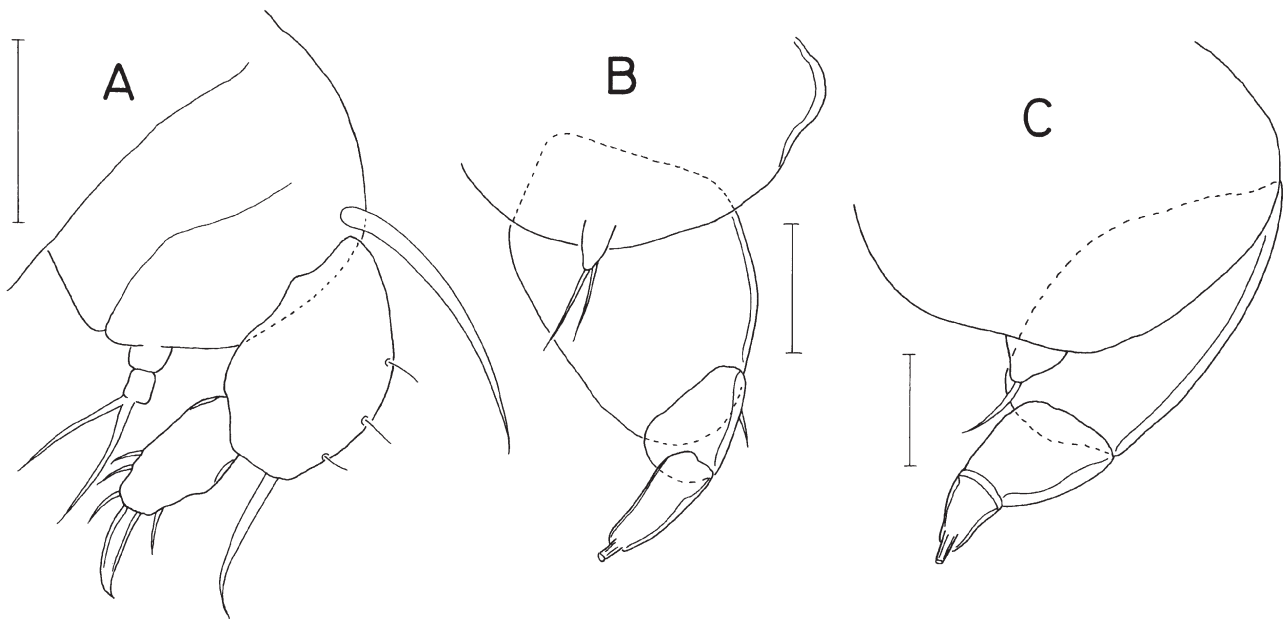
Rostrum (Fig. 389F) small, longer than wide, with nearly parallel lateral margins and rounded distal margin. Antennule (Fig. 389G) small, 77 µm long, 5-segmented; second segment subdivided by incomplete suture on one surface; armature formula 2, 16, 3, 1, and 11+aesthetasc; all setae naked. Antenna (Fig. 389H) slender, 4-segmented, consisting of coxa, basis, and 2-segmented endopod; coxa and basis unarmed; first endopodal segment longer than basis and armed with 1 seta on inner margin; distal endopodal segment slightly longer than first, 3.4 times longer than wide (27×8 µm); armed with 4 setae (2 minute setae at middle of inner margin, 1 subdistal, and 1 distal) plus slender terminal claw, 0.6 times as long as segment.

Labrum missing. Mandible (Fig. 389I) coxa with 4 teeth on medial margin of gnathobase, proximal 2 blunt and positioned close to each other: palp consisting of basis, exopod and 2-segmented endopod; basis lacking seta; exopod with 4 setae (proximalmost slightly longer than other 3); endopod incompletely articulated from basis and incompletely 2-segmented with 4 setae on first segment and 6 setae on second; medial margin of first endopodal segment projecting. Maxillule (Fig. 389J) bilobed; medial lobe (precoxal arthrite) with 1 naked and 4 plumose setae; outer lobe (palp) broader with 6 naked setae. Maxilla (Fig. 389K) short, broad, indistinctly 5-segmented; armed with 3, 2, 1, 1, and 2 setae on first to fifth segments, respectively. Maxilliped (Fig. 389L) lobate, bearing 7 naked setae and 1 broad, pinnate seta.

Legs 1–4 biramous (Fig. 390A–C), with endopods



**FIGURE 389.** *Tubipedia anisocladia* gen. et sp. nov., female. A, habitus, right; B, urosome, dorsal; C, anterior part of prosome, dorsal; D, same, right; E, right caudal ramus, dorsal; F, rostrum; G, antennule; H, antenna; I, mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bars: A, 0.2 mm; B–D, 0.1 mm; E, 0.02 mm; F–L, 0.01 mm.



**FIGURE 390.** *Tubipedia anisocladia* gen. et sp. nov., female. A, leg 1; B, leg 2; C, leg 4. Scale bars: 0.02 mm.

markedly smaller than exopods; protopod of leg 1 incompletely 2-segmented, but those of legs 2–4 unsegmented; first exopodal segment of all legs inflated. Leg 1 with large outer seta on basis; both rami 2-segmented. Legs 2–4 with 3-segmented exopods and 1-segmented endopods. Third exopodal segment of legs 2–4 tipped with small tube at tip. Leg 3 not differing from leg 2. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	1-0	1-0; 1, I, 3	0-0; 2
Legs 2 & 3	0-0	1-0; 0-0; 0	2
Leg 4	0-0	0-0; 0-0; 0	1

Leg 5 (Fig. 389B) represented by 2 small setae at posteroventral corners of prosome. Leg 6 absent.

**Male.** Unknown.

**Remarks.** *Tubipedia anisocladia* gen. et sp. nov. was collected together with *Procampodelphys nodosus* gen. et sp. nov. (see below) from the same host at the same locality.

### ***Procampodelphys* gen. nov.**

**Diagnosis.** Body caterpillar-like, consisting of cephalosome, cylindrical metasome, and small urosome. Cephalosome indistinctly defined from trunk. Metasome unsegmented or bearing constriction or wrinkle between first pedigerous somite and remaining part of metasome. Free urosome small, 3-segmented. Caudal rami small, armed with small caudal setae. Rostrum well-developed. Antennule short, 1- or 2-segmented. Antenna 3-segmented

with unsegmented endopod bearing small terminal claw. Labrum simple. Mandible consisting of coxa with pectinate gnathobase and biramous palp, armed with 1 seta on basis, 4 setae on exopod, 5 setae on endopod. Maxillule consisting of precoxa and lobate palp; armed with 3 or 4 setae on precoxal arthrite and 5 or 6 setae on palp. Maxilla 2- or 3-segmented; armed with 2 setae on first segment and 4 setae on distal segments. Maxilliped unsegmented with 5 to 7 setae. Leg 1 biramous with unsegmented protopod; rami fused with, or incompletely articulated from, protopod. Legs 2–4 present or absent; if present, legs 2 and 3 similar to leg 1, and leg 4 biramous or uniramous. Rami of these legs unarmed or armed with small setae. Leg 5 absent or represented by small seta. Leg 6 absent.

**Type species.** *Procampodelphys bidentatus* gen. et sp. nov. by original designation.

**Other included species.** *Procampodelphys nodosus* gen. et sp. nov., *P. unipedatus* gen. et sp. nov., *P. diplosomae* (Illg & Dudley, 1961) comb. nov. (originally *Prophioseides diplosomae*), and *P. biramus* (Stock, 1967) comb. nov. (originally *Prophioseides biramus*).

**Etymology.** The generic name *Procampodelphys* is a combination of the Greek prefix *pro* (=before) and *Campodelphys*, a new genus established below in this work. It refers to the plesiomorphic condition of the cephalic appendages exhibited by species of *Procampodelphys* relative to those of *Campodelphys* gen. nov. Gender masculine.

**Remarks.** *Procampodelphys* gen. nov. resembles *Pholeterides* Illg, 1958 and *Prophioseides*. These three genera have in common a caterpillar-like body and rudimentary legs in the adult female. The genus

*Pholeterides* currently consists of the type species, *P. furtiva* Illg, 1958 from the Northeastern Pacific (Illg, 1958) and *P. pilosa* Kim & Moon, 2011 from the Northwestern Pacific (Kim & Moon, 2011). In both these species the mandible lacks a coxal gnathobase and is represented by a lobe bearing few setae or a spiniform process, the maxillule also is lobate and armed with 3 or 4 setae, and there are only three pairs of mouthparts, so that either the maxillae or maxillipeds are absent. Thus, by virtue of its more complex and relatively plesiomorphic mouthparts *Procampodelphys* **gen. nov.** is readily distinguishable from *Pholeterides*.

At present the genus *Prophioseides* comprises six nominal species, *P. abdominalis* (Chatton & Brément, 1911), *P. delamarei* Illg & Dudley, 1961, *P. ampullacea* Ooishi, 1972, *P. biramus* Stock, 1967, *P. diplosomae* Illg & Dudley, 1961, and *P. brevis* Stock, 1967. However, these six species do not exhibit a consistent evolutionary trend in terms of the morphology of the mandible. When it was originally established, Chatton & Brément (1911) illustrated the mandible of the type species *P. abdominalis* as having a denticulate medial margin of the coxal gnathobase, although the teeth are feeble. *Prophioseides delamarei* and *P. ampullacea* share a denticulate coxal gnathobase with the type species and are recognized here as members of *Prophioseides*. We note here that in the redescription of *P. abdominalis* by Illg & Dudley (1961) the mandible was depicted with a simple, styliform coxal gnathobase, but we consider that this apparent difference in the form of the mandible can be explained by a difference in viewing angle and we regard the original illustration (Chatton & Brément, 1911) as correct. Unlike the type species of *Prophioseides*, *P. biramus* and *P. diplosomae* both have a pectinate medial margin bearing numerous fine spinules on the coxal gnathobase of the mandible. In consideration of this major difference in morphology, these two species are placed in *Procampodelphys* **gen. nov.**

The remaining species, *Prophioseides brevis*, is treated as the type species of a new genus (*Janius* **gen. nov.**) proposed below.

Key to species of *Procampodelphys* **gen. nov.** based on adult females.

1. Palp (outer lobe) of maxillule armed with 6 setae; maxilliped with 5 setae; legs 2–4 absent .....  
..... *P. unipedatus* **gen. et sp. nov.**  
Palp of maxillule armed with 5 or 7 setae; maxilliped with 6 or 7 setae; at least legs 2 and 3 present..... 2
2. Palp of maxillule armed with 7 setae; maxilla with more than 6 setae; leg 4 absent.....  
..... *P. diplosomae* (Illg & Dudley, 1961) **comb. nov.**  
Palp of maxillule armed with 5 setae; maxilla with 6 setae; leg 4 present..... 3
3. Arthritis (inner lobe) of maxillule armed with 3 setae;

- maxilliped with 7 setae..... *P. nodosus* **gen. et sp. nov.**  
Arthritis of maxillule armed with 4 setae; maxilliped with 6 setae ..... 4
4. First pedigerous somite with dorsal tubercle; antennule unsegmented; leg 4 biramous .....  
..... *P. biramus* (Stock, 1967) **comb. nov.**  
First pedigerous somite without dorsal tubercle; antennule 2-segmented; leg 4 represented by a lobe.....  
..... *P. bidentatus* **gen. et sp. nov.**

***Procampodelphys bidentatus* gen. et sp. nov.**

(Figs. 391, 392)

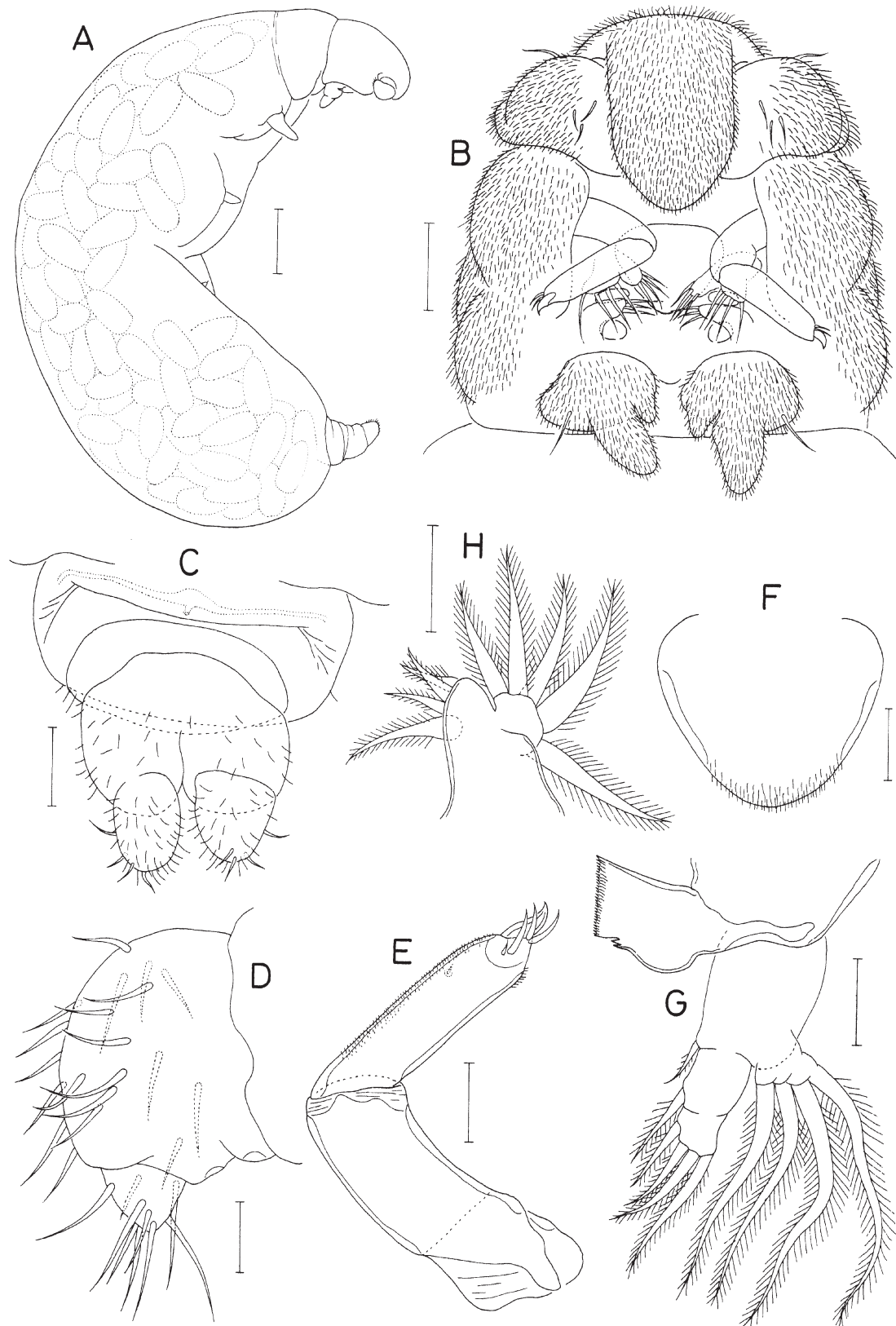
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21425), paratype (intact ♀, MNHN-IU-2014-21426), and dissected paratype (♀, figured) from *Lissoclinum taratara* Monniot F. & Monniot C., 1987 (MNHN-IT-2008-4990 = MNHN A2/LIS/162), Cape Rodney Pass, Papua New Guinea (10°15.66'S, 148°22.27'E), depth 31 m, 11 June 1998.

**Etymology.** The specific name is from the Latin *bi* (=two) and *dentat* (=toothed), and refers to the presence of the two small denticles on the distal margin of the mandibular gnathobase.

**Description of female.** Body (Fig. 391A) caterpillar-like, cylindrical, curved ventrally, with surface densely covered with fine setules (omitted in Fig. 391A). Body length 2.47 mm; body width 0.64 mm across posterior part of prosome. Prosome gradually broadening posteriorly; cephalosome (Fig. 391B) small, weakly defined from metasome. Metasome (trunk) unsegmented, but with constriction between first pedigerous somite and remaining part of metasome; second to fourth pedigerous somites forming brood pouch. Free urosome (Fig. 391C) small, slightly wider than long (200×210 µm), occupying only 8% of body length, and 3-segmented. First urosomite (genital double-somite) much wider than abdomen, with transverse suture line (or wrinkle) on ventral surface. Free abdomen 2-segmented; anal somite setulose. Caudal rami (Fig. 391C) short, setulose, about 60×50 µm; armed with 4 small setae (1 lateral and 3 distal).

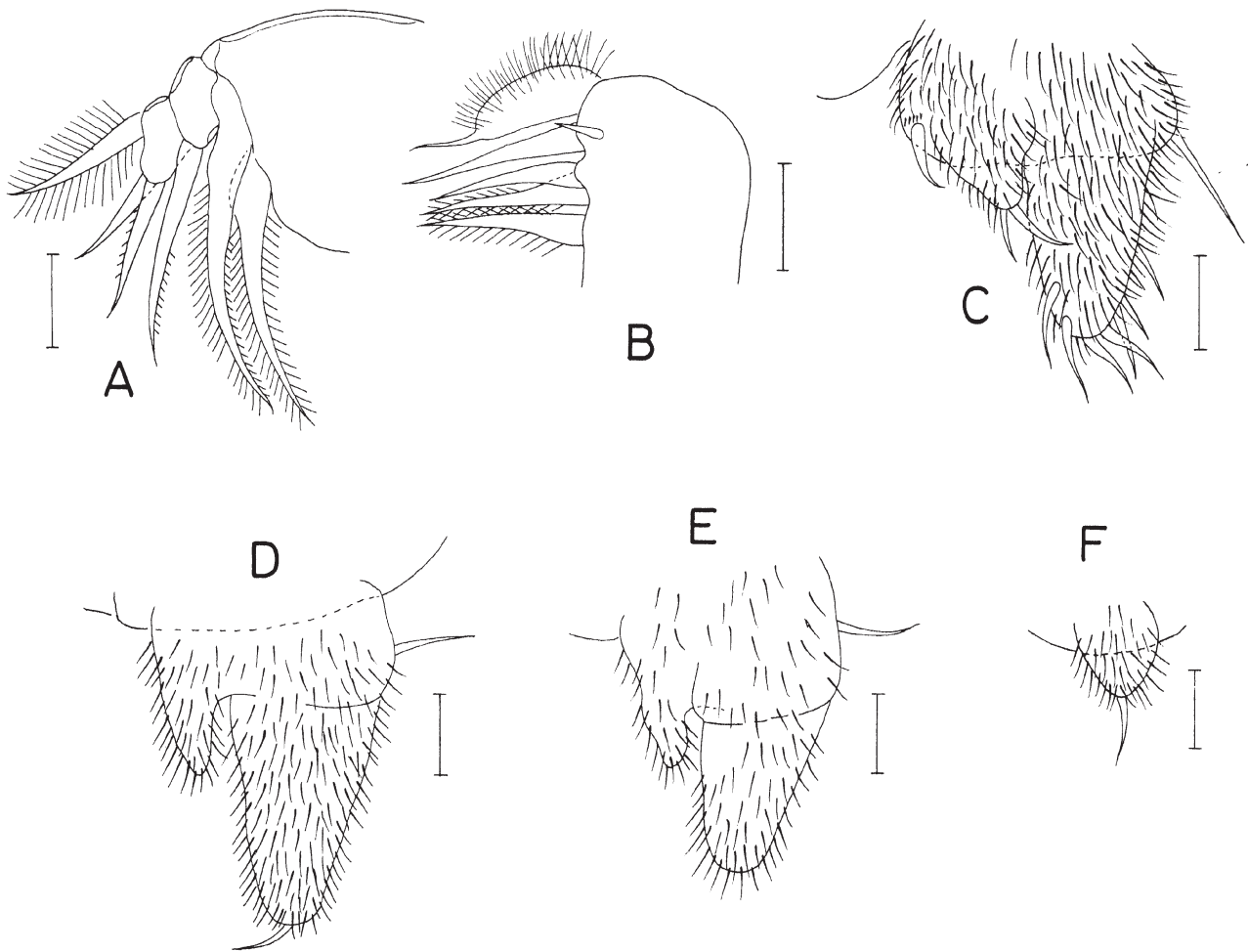
Rostrum (Fig. 391B) large, shield-like, with parallel lateral margins and convex distal margin, surface densely covered with fine setules. Antennule (Fig. 391D) small, 84 µm long, curved, about as long as wide, 2-segmented, second segment much smaller than first: armed with 20 and 9 setae on first and second segments, respectively, and ornamented with numerous setules (not shown in Fig. 391D). Antenna (Fig. 391E) 3-segmented; coxa and basis unarmed; unsegmented endopod about 3.8 times longer than wide (61×16 µm), slightly longer than basis, and ornamented with minute spinules along inner surface: armed with 2 subdistal and 2 distal setae plus small terminal claw, about quarter of length of endopod.

Labrum (Fig. 391F) slightly wider than long,



**FIGURE 391.** *Procampodelphys bidentatus* gen. et sp. nov., female. A, habitus (showing nauplii within brood chamber), right; B, cephalosome and leg 1, ventral; C, urosome, ventral; D, antennule (setules omitted); E, antenna; F, labrum; G, mandible; H, maxillule. Scale bars: A, 0.2 mm; B, C, G, 0.05 mm; D–F, H, 0.02 mm.





**FIGURE 392.** *Procampodelphys bidentatus* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4. Scale bars: A, B, 0.1 mm; C–F, 0.02 mm.

narrowing distally, with rounded, setulose distal margin. Mandible (Fig. 391G) consisting of coxa and palp: coxal gnathobase with linear, pectinate medial margin, and 2 small denticles on convex distal margin; palp armed with 1 small seta on basis, 4 large setae on exopod, and 1 and 4 setae, respectively on first and second endopodal segments; articulations incomplete or obscure between basis and rami and between endopodal segments. Maxillule (Fig. 391H) consisting of precoxa and lobate, unsegmented palp; arthrite of precoxa extending beyond palp and armed with 4 setae; palp with 5 large setae. Maxilla (Fig. 392A) distinctly 3-segmented, consisting of syncoxa, basis, and unsegmented endopod; armed with 2 setae on syncoxa, 1 seta on basis, and 3 setae on endopod. Maxilliped (Fig. 392B) as unsegmented lobe armed with 5 large setae and 1 small seta on medial margin; distalmost seta markedly swollen, densely setulose on distal surface, with slender flagella-like, distal part; 2 proximal setae pinnate, 3 middle setae naked.

Legs 1–3 (Fig. 392C–E) bilobed, densely covered with setules, consisting of protopodal region, larger

outer lobe (exopod), and smaller inner lobe (endopod); protopodal region with 1 seta on outer margin; protopodal region of leg 1 also with inner seta (originally inner distal seta on basis). Endopodal lobe of leg 1 tipped with 2 setae; endopodal lobe of legs 2 and 3 lacking setae. Outer lobe with 7 setae in leg 1, 1 seta distally in leg 2, but lacking setae in leg 3. Leg 4 (Fig. 392F) represented by small lobe tipped with 1 seta. Legs 5 and 6 absent.

**Male.** Unknown.

**Remarks.** *Procampodelphys bidentatus* gen. et sp. nov. resembles *P. biramus* (Stock, 1967) **comb. nov.:** they share an identical form of mandibular gnathobase and have very similar caudal rami. In addition, both species have identical setation patterns on the maxillule, maxilla, and maxilliped. These two species can be distinguished by the presence in *P. biramus* of a dorsal tubercle on the first pedigerous somite, by the longer 4-segmented urosome, by the unsegmented antennule, the obscurely segmented maxilla, and the biramus condition of leg 4. In contrast, *P. bidentatus* gen. et sp. nov. lacks a dorsal tubercle on the first pedigerous somite, has a

short 3-segmented urosome, a 2-segmented antennule, a distinctly 3-segmented maxilla, and a unilobate leg 4. The new species was collected off Papua New Guinea whereas *P. biramus* was originally recorded as an associate of the ascidian *Didemnum candidum* Savigny, 1816 in the Red Sea (Stock, 1967).

***Procampodelphys nodosus* gen. et sp. nov.**  
(Figs. 393, 394)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21427) from an unidentified ascidian, near the lighthouse, Ibo Island, Mozambique, depth 0–20 m, AURACEA 1995 Stn P15, Monniot coll., 14 November 1995.

**Etymology.** The specific name is from the Greek *nod* (=toothless) and alludes to the lack of teeth on the distal margin of the mandibular coxa.

**Description of female.** Body (Fig. 393A) caterpillar-like, weakly curved ventrally, surface densely covered with fine setules (setules omitted in Fig. 393A). Body length 2.36 mm; width 567 µm. Cephalosome (Fig. 393B) indistinctly defined from metasome. Metasome cylindrical, with weak constriction between first pedigerous somite and remaining part of metasome. Free urosome (Fig. 393C) indistinctly 3-segmented in ventral view, but with additional suture line in dorsal view; ornamented with scattered setules on all surfaces; first urosomite with copulatory pore on ventral surface. Caudal rami (Fig. 393D) about 1.3 times longer than wide (59×44 µm), not articulated from anal somite; armed with 6 small setae and scattered setules.

Rostrum (Fig. 393E) linguiform with rounded distal margin, about 70×50 µm, densely covered with setules. Antennule (Fig. 393F) small, about 90 µm long, unsegmented, curved, strongly tapering, covered with setules and armed with 16 setae. Antenna (Fig. 393G) 3-segmented; coxa and basis unarmed; unsegmented endopod as long as basis, 2.3 times longer than wide (44×19 µm); ornamented with large patch of minute spinules distally on inner surface and several spinules distally on outer margin; armed with 7 small setae arranged as 2, 2, and 3 (2 of distal setae spinulose along inner margin), plus small terminal claw, about one-third as long as endopod.

Labrum missing. Mandible (Fig. 393H) consisting of coxa and palp: coxal gnathobase with linear, pectinate medial margin and convex distal margin: palp armed with 1 seta on basis, 4 large setae on exopod, and 1 and 4 setae on first and second endopodal segments, respectively; articulation incomplete between basis and endopod. Maxillule (Fig. 393I) unsegmented and bilobed; inner lobe (precoxal arthrite) extending beyond outer lobe and armed with 3 setae (proximal seta larger than 2 distal setae); outer lobe armed with 5 setae, proximalmost seta swollen at base and second proximal seta longest.

Maxilla (Fig. 393J) distinctly 3-segmented; syncoxa with 2 large pinnate setae; basis with 1 naked seta; endopod with 1 pinnate and 2 naked setae. Maxilliped (Fig. 393K) unsegmented, armed with 7 setae on medial margin; distalmost seta swollen, plumose, bluntly tipped; spinules present near base of distalmost seta; proximal 6 setae subequal in length, proximal 2 pinnate, other 4 setae naked.

Legs 1–4 (Fig. 393L, 394A–C) bilobed with unsegmented protopods; rami setulose and obscurely defined from protopod; endopods smaller than exopods. Outer seta on protopods well-developed, naked in leg 1, but pinnate in legs 2–4. Endopod of leg 4 rudimentary. Protopod of leg 1 with inner proximal seta (original inner coxal seta) and inner distal seta (original inner distal seta of basis). Protopod of leg 1 with short spinule row along inner margin. Exopods of legs 1–4 armed with 7, 6, 5, and 4 setae, respectively. Endopods of legs 1–4 armed with 6, 8, 6, and 4 setae, respectively. Leg 4 with 1 seta on protopod medial to endopod. Leg 5 represented by 1 minute seta (Fig. 393A, C) on ventrodistal surface of metasome.

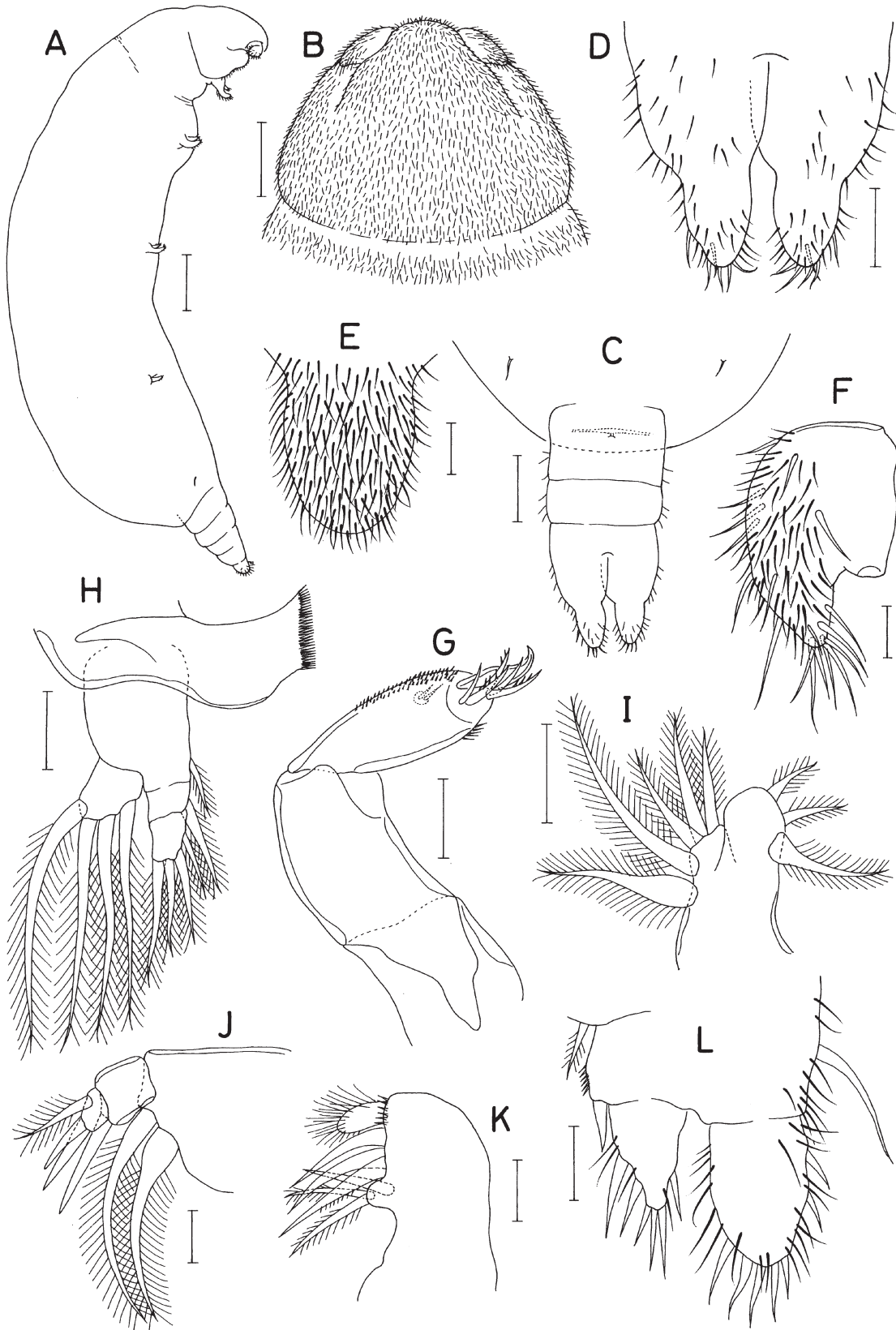
**Male.** Unknown.

**Remarks.** The diagnostic features of *Procampodelphys nodosus* gen. et sp. nov. include: the antennule is unsegmented, the distal margin of the gnathobase of the mandibular coxa is smooth (lacking denticles), the precoxal arthrite of the maxillule bears 3 setae, and the maxilliped is armed with 7 setae of which the distalmost is bluntly tipped. These features serve to differentiate the new species from the type species *P. bidentatus* gen. et sp. nov., which is characterised by a 2-segmented antennule, by the presence of 2 denticles on the distal margin of the coxal gnathobase of the mandible, 4 setae on the precoxal arthrite, and 6 setae on the maxilliped (with the distalmost seta terminating in a thin flagellate section).

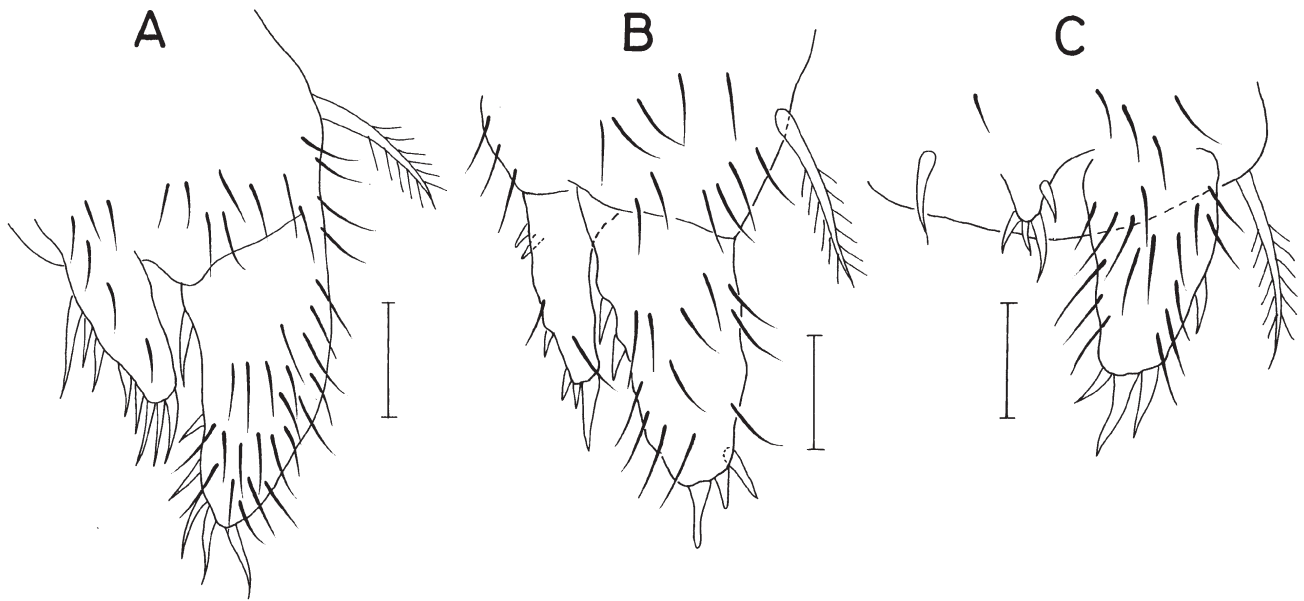
A remarkable and fine-scale synapomorphy between *P. nodosus* gen. et sp. nov., *P. bidentatus* gen. et sp. nov., and *P. biramus* is the peculiar maxilliped in which all setae are inserted on the medial margin of the lobate appendage and the base of the distalmost seta is inflated and plumose distally. The retention of the inner coxal seta on leg 1 is an extraordinarily plesiomorphic state for such a highly transformed parasite. The isolated seta present medial to the endopod on the incorporated protopod of leg 4 may represent the original inner coxal seta of leg 4.

***Procampodelphys unipedatus* gen. et sp. nov.**  
(Fig. 395)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21384) from *Lissoclinum bilobatum* Millar, 1955 (MNHN-IT-2008-4921 = MNHN A2/LIS/153), Port Elizabeth, South Africa, intertidal, Monniot coll., 01 February 1996.



**FIGURE 393.** *Procampodelphys nodosus* gen. et sp. nov., female. A, habitus, right; B, cephalosome, dorsal; C, urosome, ventral; D, caudal rami, ventral; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla; K, maxilliped; L, leg 1. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D, 0.05 mm; E–I, L, 0.02 mm.



**FIGURE 394.** *Procampodelphys nodosus* gen. et sp. nov., female. A, leg 2; B, leg 3; C, leg 4. Scale bars: 0.02 mm.

**Etymology.** The specific name is derived from the Latin *uni* (=one) and *pedat* (=having feet), and refers to the presence of only one pair of legs.

**Description of female.** Body (Fig. 395A) caterpillar-like, strongly curved ventrally, surface densely covered with fine setules: consisting of unsegmented prosome and small free urosome. Body length 2.45 mm; greatest width of prosome 545  $\mu$ m across posterior part. Cephalosome (Fig. 395B) as long as wide, defined from metasomal region by weak constriction. Rostral region produced anteriorly. Free urosome (Fig. 395C) short, 160  $\mu$ m long, consisting of genital somite and 2 abdominal somites. Genital somite bearing copulatory pore on ventral surface. Caudal rami (Fig. 395C) fused with anal somite, as long as wide, ornamented with setules mainly distally; armed with 1 small, bifurcate seta distally.

Rostrum as prominence on frontal margin of cephalosome (Fig. 395B). Antennule (Fig. 395D) attenuated, about 120  $\mu$ m long, unsegmented with several partial suture line along posterior side; densely covered with setules, setae small, similar in form to setules. Antenna (Fig. 395E) slender, 3-segmented; coxa and basis unarmed; unsegmented endopod 2.9 times longer than wide (58 $\times$ 20  $\mu$ m); armed with 4 small setae (1 on proximal inner margin, 1 subdistal, and 2 distal) plus very small terminal claw, about 20% length of endopod.

Labrum (Fig. 395F) short and broad, with rounded, setulose posterior margin. Mandible (Fig. 395G) consisting of coxa with extended gnathobase bearing pectinate medial margin and markedly convex distal margin, and biramous palp armed with 4 setae on exopod and 1 seta on basis; endopod only partially demarcated

from basis, with 2 setae on first segment and 3 setae on second. Maxillule (Fig. 395H) consisting of precoxa and unsegmented, lobate palp; with 3 setae on medial margin of precoxal arthrite and 6 setae on palp; all setae broad and pinnate. Maxilla (Fig. 395I) 2-segmented; first segment with 2 setae; second segment subdivided by partial suture line, armed with 2 smaller medial and 2 larger distal setae; all setae pinnate. Maxilliped (Fig. 395J) lobate, bearing 5 subequal, naked setae distally.

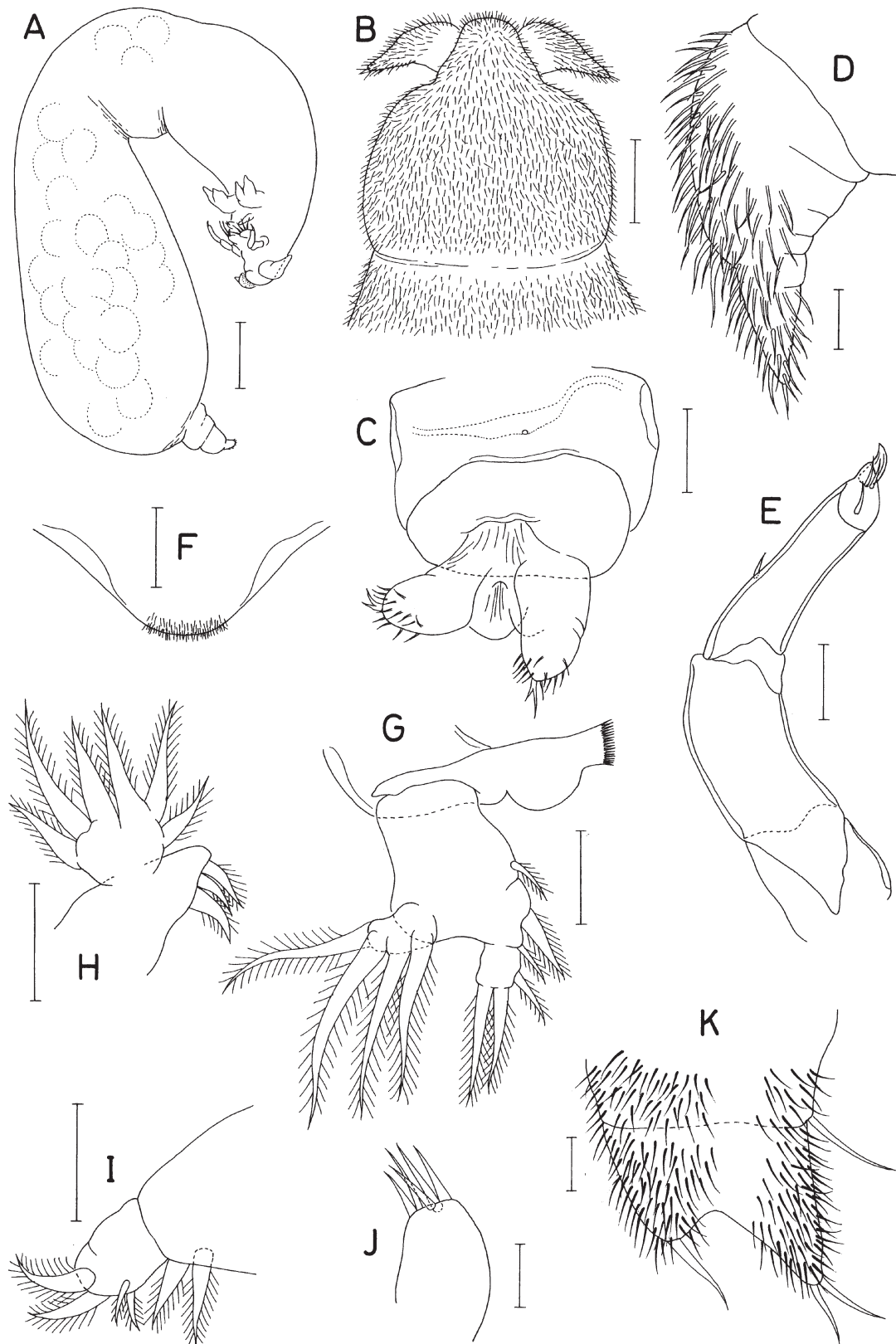
Leg 1 (Fig. 395K) densely covered with setules, obscurely 2-segmented; first segment (protopod) with outer distal seta; second segment bilobed, with 2 setae distally on longer outer lobe (exopod) and 1 seta distally on shorter inner lobe. Legs 2–5 absent.

**Male.** Unknown.

**Remarks.** The new species is distinguishable from its four congeneric species by its 2-segmented maxilla (3-segmented in congeners), by the possession of 5 setae on the maxilliped (6 or 7 setae in congeners), and by the absence of legs 2–4 (legs 2 and 3, at least, are present in congeners).

#### ***Janius* gen. nov.**

**Diagnosis.** Body maggot-like, cylindrical. Prosome consisting of clearly defined cephalosome and unsegmented metasome with very reduced, unsegmented, free urosome inserted into ventral surface of prosome. Caudal rami broadly elliptical, ornamented with setules; setal armature uncertain. Antennule lobate, tapering; surface densely covered with setules. Antenna consisting



**FIGURE 395.** *Procampodelphys unipedatus* gen. et sp. nov., female. A, habitus, right; B, cephalosome, dorsal; C, urosome, ventral; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule; I, maxilla; J, maxilliped; K, leg 1. Scale bars: A, 0.2 mm; B, 0.1 mm; C, 0.05 mm; D–I, K, 0.02 mm; J, 0.01 mm.

of coxa, basis, and unsegmented endopod bearing small terminal claw. Mandible with broad coxal gnathobase bearing pectinate medial margin; palp with elongate basis bearing 1 seta; exopod rudimentary, represented by small, unarmed swelling; endopod obscurely defined from basis, 2-segmented, armed with 1 and 4 setae on first and second segments, respectively. Maxillule unsegmented, armed with 4 mediobasal and 5 outer subbasal setae. Maxilla 3-segmented; armed with 2 setae on syncoxa, 1 seta on basis, and 2 setae on unsegmented endopod. Maxilliped unsegmented with 4 setae. Leg 1 biramous, positioned just posterior to oral area, directed anteriorly; exopod 1-segmented; endopod obscurely 2-segmented. Leg 2 rudimentary, represented by 2 setae. Legs 3-5 absent.

**Type species.** *Janius brevis* (Stock, 1967) **comb. nov.** (originally as *Prophioseides brevis* Stock) by original designation.

**Etymology.** The generic name honours the late Prof. Jan H. Stock who discovered the type species of the new genus. Gender masculine.

**Remarks.** The mandible of *Prophioseides brevis* Stock, 1967 is very unusual for the genus *Prophioseides*, because the exopod is reduced to a semicircular, unarmed swelling. Stock (1967) described this species on the basis of a single specimen and did not determine whether the reduction of the mandibular exopod was a normal condition or a deformity resulting from injury or damage. However, Stock (1967) mentioned that the left and right mandibles are of the same form, from which we infer that this is the normal structure of mandible for this species. Stock (1967) mentioned other differences between *P. brevis* from its congeners: the body is shorter and thicker, the abdomen is inserted ventrally, the caudal rami are broadly elliptical, and the species is associated with the solitary ascidian *Phallusia nigra* Savigny, 1816 in the Red Sea, in contrast to the association of all other congeneric species with the compound ascidians.

*Prophioseides brevis* cannot be accommodated in *Prophioseides* without an unacceptable broadening of the generic diagnosis, and therefore a new genus, *Janius* **gen. nov.**, is established here to accommodate this species, as *Janius brevis* (Stock, 1967) **comb. nov.**

### ***Campodelphys* gen. nov.**

**Diagnosis.** Body caterpillar-like, elongate, cylindrical. Prosome unsegmented or with constrictions between somites: cephalosome lacking defined dorsal shield, bearing paired ventral tubercles posterolaterally. First to third pedigerous somites short: fourth pedigerous somite expanded posteriorly, incorporating fifth pedigerous somite. Free urosome much smaller than prosome, 5-segmented, comprising genital somite and four free abdominal somites. Caudal ramus short, armed with 6 setae. Rostrum distinct. Antennule stout, obscurely

segmented. Antenna 3-segmented, consisting of coxa, basis, and unsegmented endopod bearing terminal claw. Labrum not specialized. Mandible consisting of coxa and biramous palp; coxal gnathobase with pectinate medial margin; exopod with 4 setae; endopod with 1 seta on first segment and 3 or 4 setae on second. Maxillule and maxilla each represented by lobe bearing setae. Maxilliped 1- or 2-segmented, bearing 1 or 2 setae distally or subdistally. Legs 1-4 biramous, located anteriorly on prosome, separated by regular gaps; legs broad with short rami; protopods unsegmented or incompletely 2-segmented; exopods 2-segmented; endopods 1- or 2-segmented. Setae on rami short, usually bluntly tipped. Inner distal seta on basis of leg 1 present or absent. Leg 5 absent or represented by 1 or 2 small setae.

**Type species.** *Campodelphys hirsutus* **gen. et sp. nov.** by original designation.

**Other included species.** *Campodelphys bullatus* **gen. et sp. nov.**, *C. stocki* **gen. et sp. nov.**, *C. ancylocephalus* **gen. et sp. nov.**, and *C. seticoxus* **gen. et sp. nov.**, described below.

**Etymology.** The name is derived from the Greek *camp* (=caterpillar) and *-delphys*, referring to the typically caterpillar-like body form of the genus. Gender masculine.

**Remarks.** *Campodelphys* **gen. nov.** resembles both *Procampodelphys* **gen. nov.** and *Prophioseides* in the body form of the adult female. *Prophioseides* can be excluded from further detailed comparisons with the new genus because it has a denticulate coxal gnathobase on the mandible, whereas the new genus has a pectinate medial margin on the gnathobase

In *Campodelphys* **gen. nov.** the swimming legs each have a 2-segmented exopod and a 1- or 2-segmented endopod, and both rami are broad and armed with thick, spiniform setae. In *Procampodelphys* **gen. nov.** the swimming legs are much reduced and narrow, with the unsegmented, lobate rami bearing fewer setae. In contrast to the relatively complex condition of the swimming legs, the mouthparts of *Campodelphys* **gen. nov.** are much more reduced, with both the maxillule and maxilla represented by setose lobes and the maxilliped is armed only with 1 or 2 setae. These differences serve to clearly differentiate between members of these two genera. In the form of the swimming legs, *Campodelphys* **gen. nov.** more closely resembles *Scolecodes* Illg, 1958 than any other genus, although these two genera can be easily distinguished by a range of other characters. The five species of *Campodelphys* **gen. nov.** described below may be distinguished by the following key.

Key to species of *Campodelphys* **gen. nov.** based on adult females.

1. Legs 2-4 with 2-segmented endopods ..... 2

- Legs 2–4 with 1-segmented endopods ..... 3
2. Anal somite lacking spinulose ventral lobes; second endopodal segment of mandible armed with 3 setae; maxilla with 4 setae ..... *C. hirsutus* **gen. et sp. nov.**  
Anal somite with spinulose ventral lobes; second endopodal segment of mandible with 4 setae; maxilla with 6 setae ....  
..... *C. bullatus* **gen. et sp. nov.**
3. Maxillule with 6 setae; maxilliped with 1 seta; endopod of leg 2 with 6 setae; leg 5 represented by 1 small seta.....  
..... *C. ancylocephalus* **gen. et sp. nov.**  
Maxillule with 7 setae; maxilliped with 2 setae; endopod of leg 2 with 8 setae; leg 5 represented by 2 small setae ..... 4
4. Maxilla armed with 7 setae; leg 1 with 2-segmented endopod; coxa of leg 4 lacking inner seta .....  
..... *C. stocki* **gen. et sp. nov.**  
Maxilla armed with 6 setae; leg 1 with 1-segmented endopod; coxa of leg 4 with inner seta.....  
..... *C. seticoxus* **gen. et sp. nov.**

***Campodelphys hirsutus* gen. et sp. nov.**

(Figs. 396, 397)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21429), paratype (intact ♀, MNHN-IU-2014-21430), and dissected paratypes (2 ♀♀, figured) from *Apliodiopsis tubiferus* Monniot C., Monniot F., Griffiths & Schleyer, 2001, ATIMO VATAE TA12, Rocher de l’Albatros, south coast of Madagascar (25°28’S, 44°58’E), depth 10–12 m, MNHN coll., 18 May 2010.

**Etymology.** The specific name refers to the hirsute body (from Latin *hirsut* meaning “hairy”).

**Description of female.** Body (Fig. 396A) caterpillar-like, elongate, cylindrical; body surface densely covered with fine setules. Body length 1.18 mm; maximum body width 0.20 mm; length to width ratio about 6.0. Prosome 5-segmented with weak articulations between somites; anterior part of prosome from rostrum to level of insertion of leg 4 occupying about half of total prosome length. Cephalosome (Fig. 396B) with paired, bluntly rounded tubercles posterolaterally on ventral surface (Fig. 396E). Free urosome (Fig. 396C) small, curved ventrally, 5-segmented, consisting of genital somite and 4 abdominal somites. Caudal rami (Fig. 396D) small, nearly as long as anal somite, narrowing distally, about 1.5 times longer than wide (31×21 µm), incompletely articulated from anal somite: caudal setae hardly discernible from setules, but 4 distal setae distinguishable from setular ornamentation.

Rostrum (Fig. 396F) large, longer than wide, with parallel lateral margins and rounded distal margin; densely covered with setules. Antennule (Fig. 396G) short and broad, as long as wide, incompletely 3-segmented; most setae not distinguishable from setules, but 3 setae on first segment distinct. Antenna (Fig. 396H) stout, consisting of unarmed coxa and basis, and unsegmented endopod bearing terminal claw; basis broadened proximally, with

protruding proximal outer margin; endopod twice as long as wide (30×15 µm): armed with 3 small setae distally plus terminal claw, about 0.7 times as long as endopod.

Labrum (Fig. 396I) setulose, linguiform, longer than wide, gradually narrowing towards rounded distal margin. Mandible (Fig. 396J) consisting of coxa and palp: coxal gnathobase simple, with slightly concave, pectinate medial margin: palp clearly segmented; basis unarmed; exopod with 4 setae and endopod with 1 and 3 setae on first and segments, respectively; all setae naked. Maxillule (Fig. 396K) lobate, armed with 1 large subdistal seta and 5 small distal setae. Maxilla (Fig. 396L) lobate, bearing 4 setae (proximalmost seta larger than distal 3). Maxilliped (Fig. 396M) small, incompletely 2-segmented; armed with 1 seta on second segment.

Legs 1–4 (Fig. 397A–D) broad and short, each with narrow intercoxal plate: all legs consisting of unsegmented protopod and 2-segmented rami; both rami stout, subequal in length. Legs separated from one another along metasome by equal gaps. Protopods unarmed, lacking seta, but usually ornamented with scattered setules on ventral surface. First exopodal segment of legs 1–4 bearing robust, dentiform outgrowth at outer distal corner. All setae on rami bluntly tipped, club-shaped, outer setae short, medial setae longer. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	0-0	1-0; 6	0-1; 6
Leg 2	0-0	1-0; 10	0-1; 7
Leg 3	0-0	1-0; 9	0-1; 8
Leg 4	0-0	1-0; 10	0-1; 7
Leg 5	absent.		

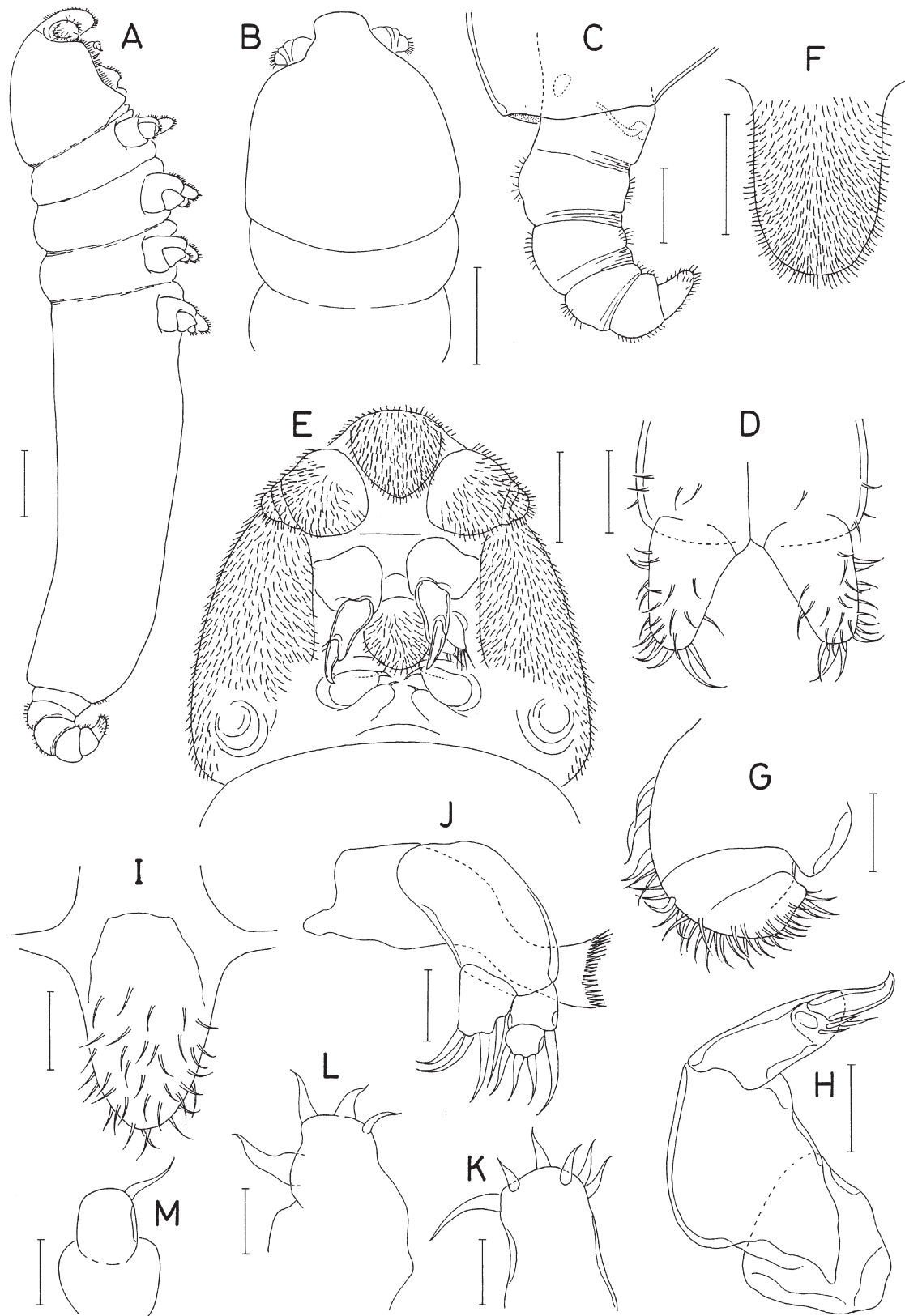
**Male.** Unknown.

**Remarks.** Five outstanding features serve to differentiate *Campodelphys hirsutus* **gen. et sp. nov.** from its congeners described below: (1) the prosome is segmented (although the segmentation is weak it contrasts with the unsegmented condition in the congeneric species); (2) the mandibular basis is unarmed (cf. 1 seta present on the basis); (3) the second endopodal segment of the mandible is armed with 3 setae (cf. 4 setae in congeners); (4) the maxilla is armed with 4 setae (cf. 6 or 7 setae in congeners); and (5) the basis of leg 1 lacks an inner distal seta (this seta is present in its congeners).

***Campodelphys bullatus* gen. et sp. nov.**

(Figs. 398, 399)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21431) from *Aplidium lobatum* Savigny, 1816 (MNHN-IT-2008-490 = MNHN A1/APL. B/499), Djibouti, Red Sea, depth 3 m, Monniot coll., 1995.



**FIGURE 396.** *Campodelphys hirsutus* sp. nov., female. A, habitus, right; B, anterior part of prosome, dorsal; C, urosome, right; D, caudal rami, dorsal; E, cephalosome, ventral; F, rostrum; G, antennule; H, antenna; I, labrum; J, mandible; K, maxillule; L, maxilla; M, maxilliped. Scale bars: A, B, 0.1 mm; C, E, F, 0.05 mm; D, G–I, 0.02 mm; J–M, 0.01 mm.



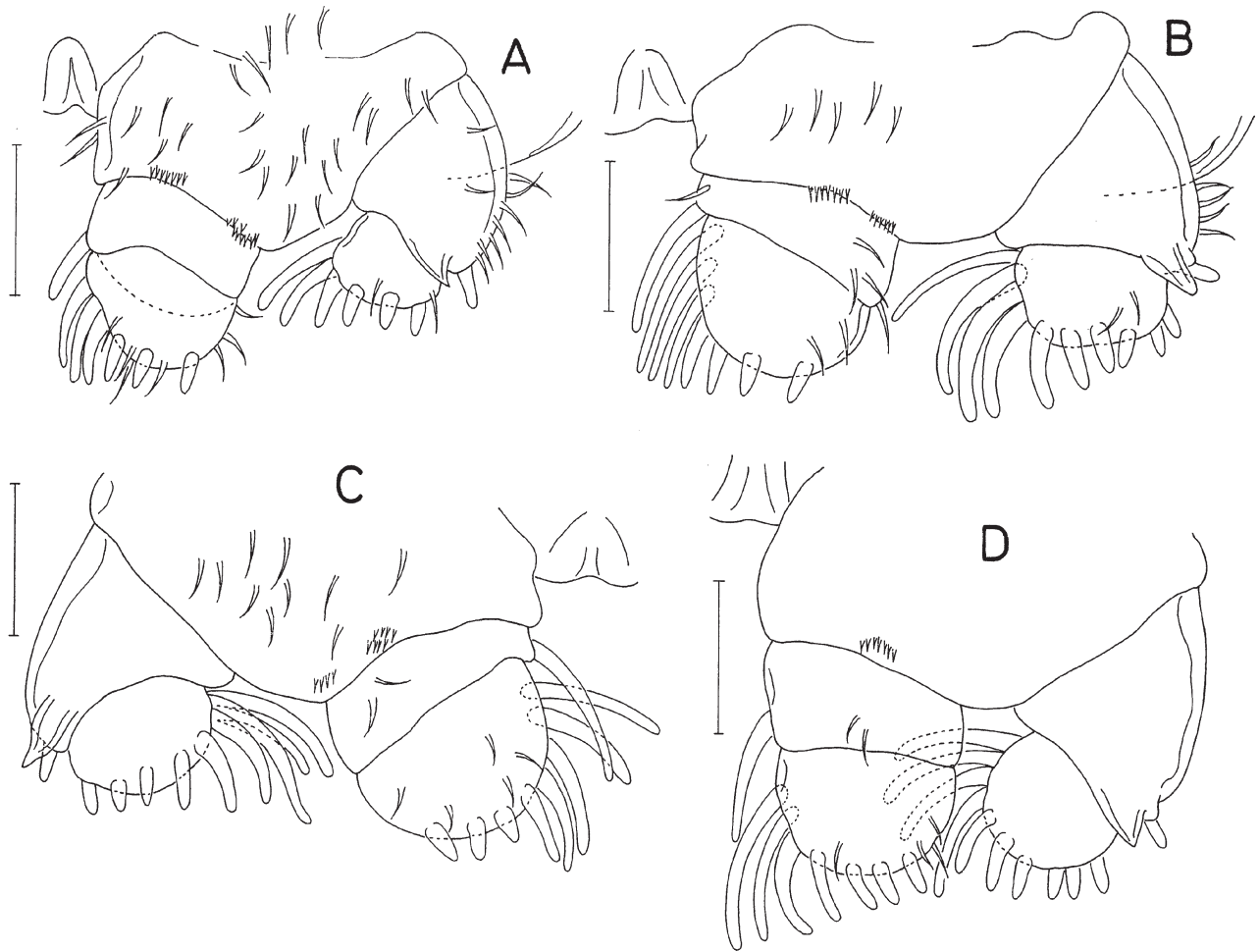


FIGURE 397. *Campodelphys hirsutus* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.01 mm.

**Etymology.** The specific name refers to the presence of the paired bullae on the ventral surface of the anal somite.

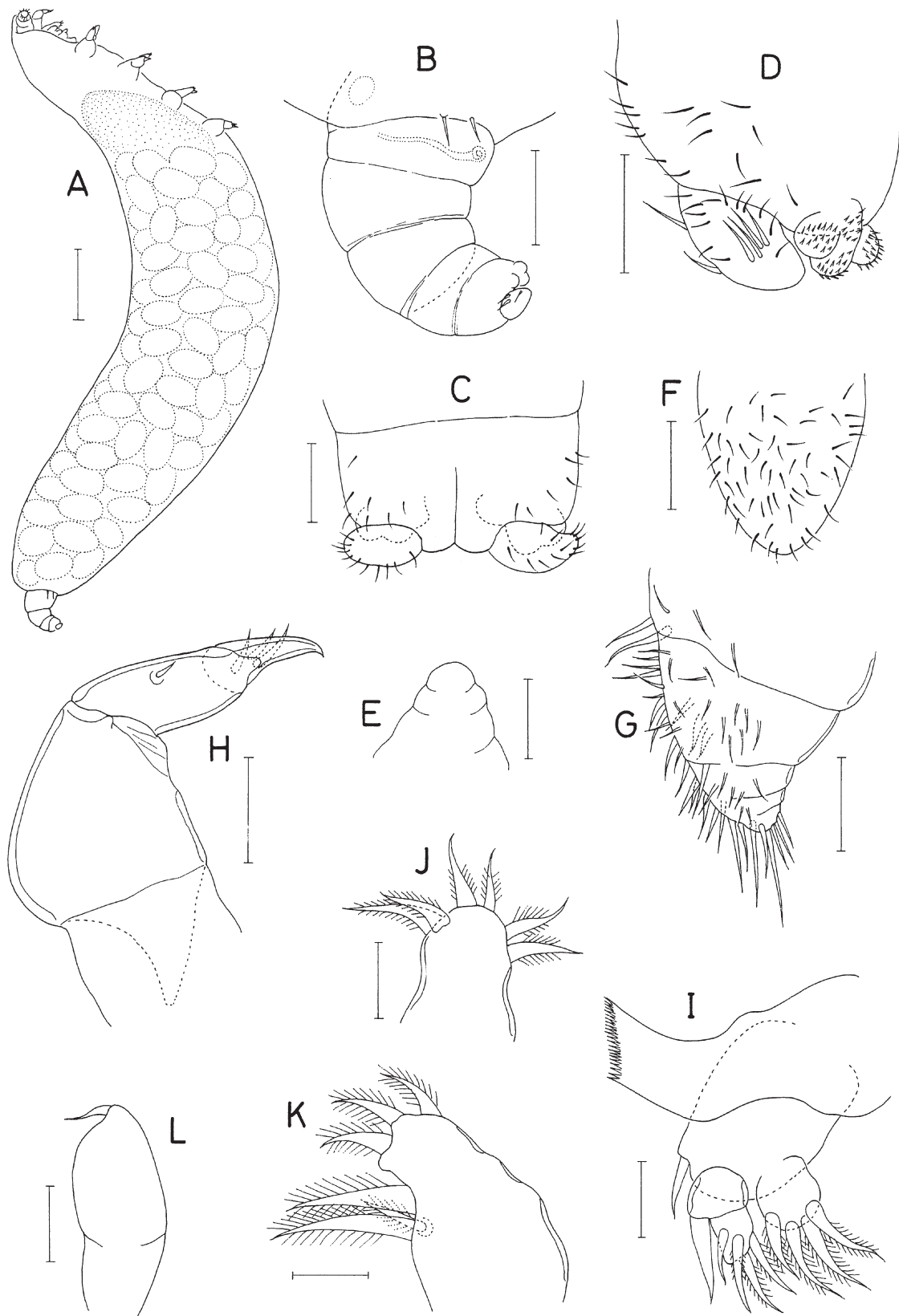
**Description of female.** Body (Fig. 398A) elongate, cylindrical, curved dorsally: body length 2.06 mm. Prosome unsegmented, narrowing anteriorly and posteriorly from maximum width in mid-region (415  $\mu$ m wide); cephalosome not demarcated from metasomal region, bearing paired tubercles (Fig. 398E) on ventral surface located lateral to oral region. Anterior region of prosome, from rostrum to leg 4, occupying about 30% of prosome length; region posterior to insertion of leg 4 forming brood pouch. Free urosome (Fig. 398B) small, consisting of genital somite and 4 abdominal somites, 137  $\mu$ m long, curved ventrally. Anal somite (Fig. 398C) with paired trilobate swellings (bullae) on ventral surface (Fig. 398D), surface of bullae ornamented with spinules, anal somite with scattered setules. Caudal ramus (Fig. 398C, D) small, 18 $\times$ 14  $\mu$ m, much shorter than anal somite, directed laterally: armed with 6 naked setae and ornamented with scattered setules.

Rostrum (Fig. 398F) 43 $\times$ 39  $\mu$ m, tapering towards rounded distal margin, surface covered with setules.

Antennule (Fig. 398G) short (about 52  $\mu$ m long), strongly tapering, incompletely 5-segmented; first segment with 2 setae; setae on other segments not distinguishable from setules. Antenna (Fig. 398H) stout, 3-segmented with short coxa; basis as long as wide, unarmed, broadened proximally; unsegmented endopod about 1.8 times longer than wide (25 $\times$ 14  $\mu$ ); armed with 4 setae (1 in middle, 1 subdistal, and 2 distal) plus terminal claw 0.7 times as long as endopod.

Labrum missing. Mandible (Fig. 398I) with coxal gnathobase bearing pectinate medial margin; palp consisting of well-defined basis, exopod and endopod; armed with 1 seta on basis, 4 pinnate setae on exopod, 1 broad, naked seta on first endopodal segment and 4 setae on second. Maxillule (Fig. 398J) represented by lobe bearing 6 subequal, pinnate setae. Maxilla (Fig. 398K) unsegmented, armed with 6 setae (3 medial and 3 on distal margin). Maxilliped (Fig. 398L) small, obscurely 2-segmented, armed with 1 small seta on tip of second segment.

Legs 1–4 (Fig. 399A–D) broad, biramous, setulose, with 2-segmented rami and unsegmented or indistinctly



**FIGURE 398.** *Campodelphys bullatus* sp. nov., female. A, habitus, right; B, urosome, right; C, anal somite and caudal rami, dorsal; D, distal part of anal somite, right; E, ventral tubercle of cephalosome; F, rostrum; G, antennule; H, antenna; I, mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bars: A, 0.2 mm; B, 0.05 mm; C–H, 0.02 mm; I–L, 0.01 mm.

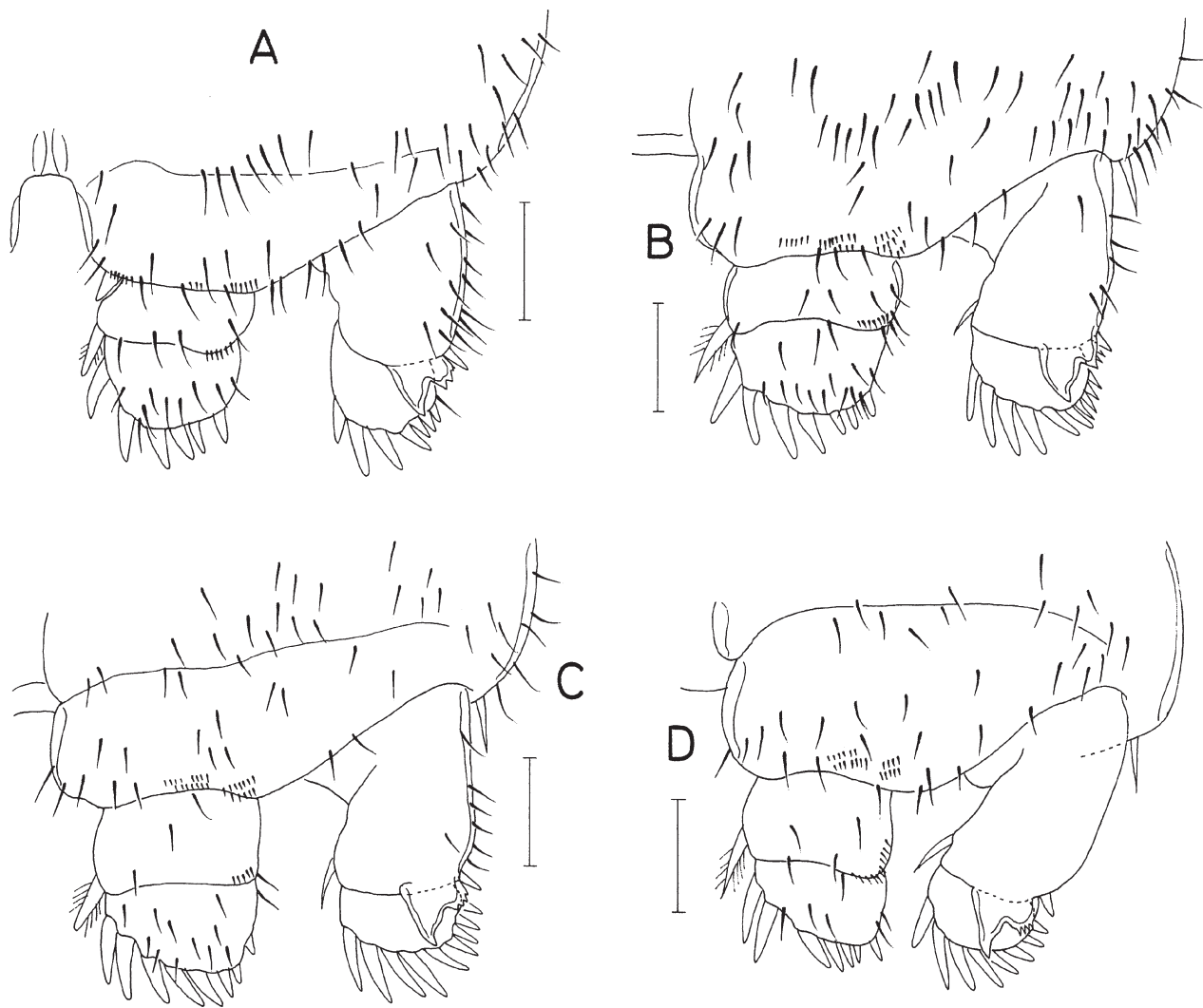


FIGURE 399. *Campodelphys bullatus* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

2-segmented protopod; coxa lacking inner seta. Outer seta on basis lacking in leg 1, but present in legs 2–4. Basis of leg 1 bearing small inner distal seta. First exopodal segment of legs 1–4 bearing broad, bifurcate process at outer distal corner (outer branch of each process shorter and tipped with 1 to 4 small denticles). All setae on legs 1–4 short. Inner seta on first endopodal segment of legs 1–4 weakly pinnate; all other setae naked and usually blunt. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	0-1	1-0; 7	0-1; 6
Leg 2	1-0	1-1; 10	0-1; 7
Leg 3	1-0	1-1; 9	0-1; 8
Leg 4	1-0	1-1; 8	0-1; 7

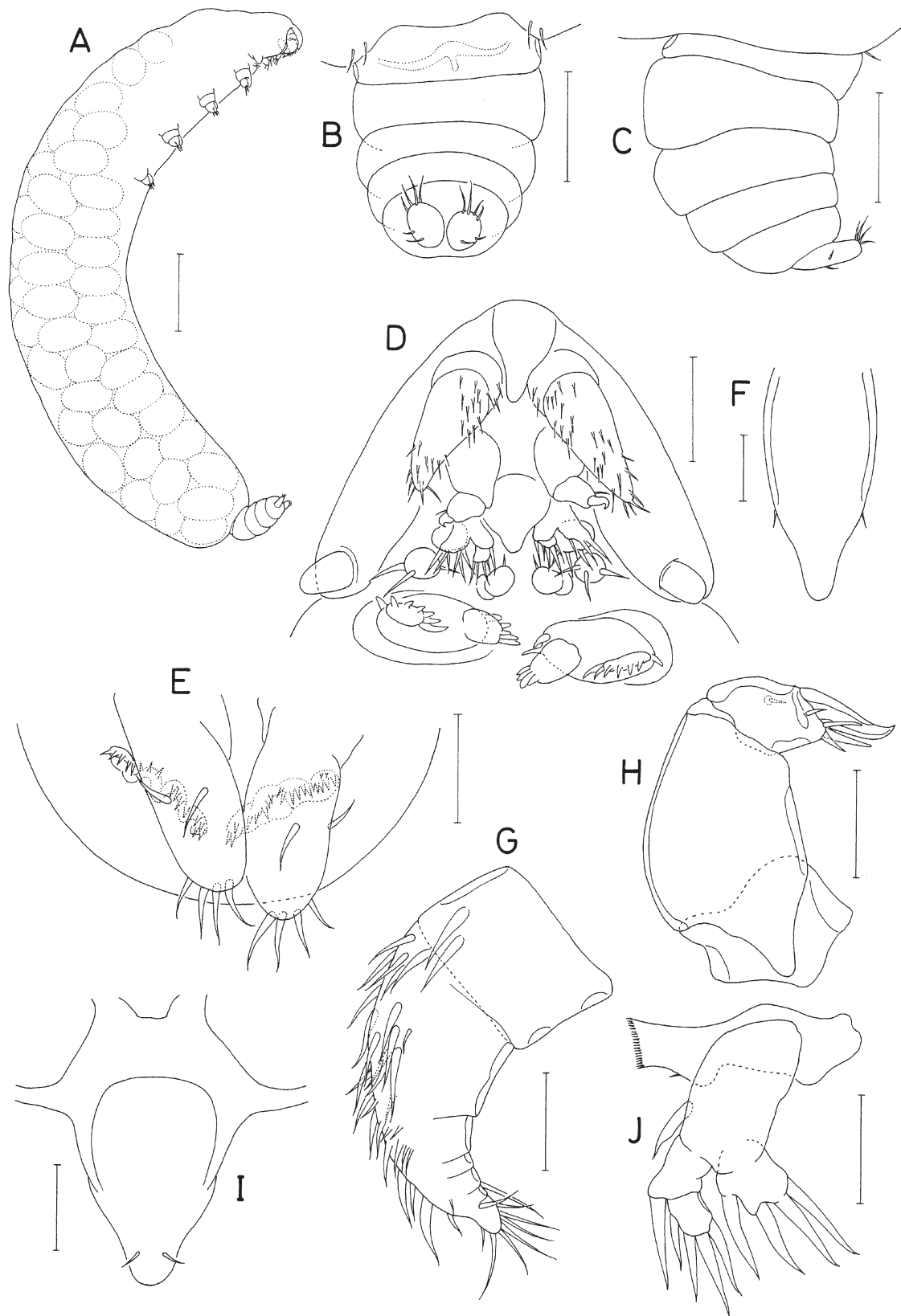
Leg 5 (Fig. 398B) represented by 2 small setae on posteroventral margin of prosome, near base of free urosome.

**Male.** Unknown.

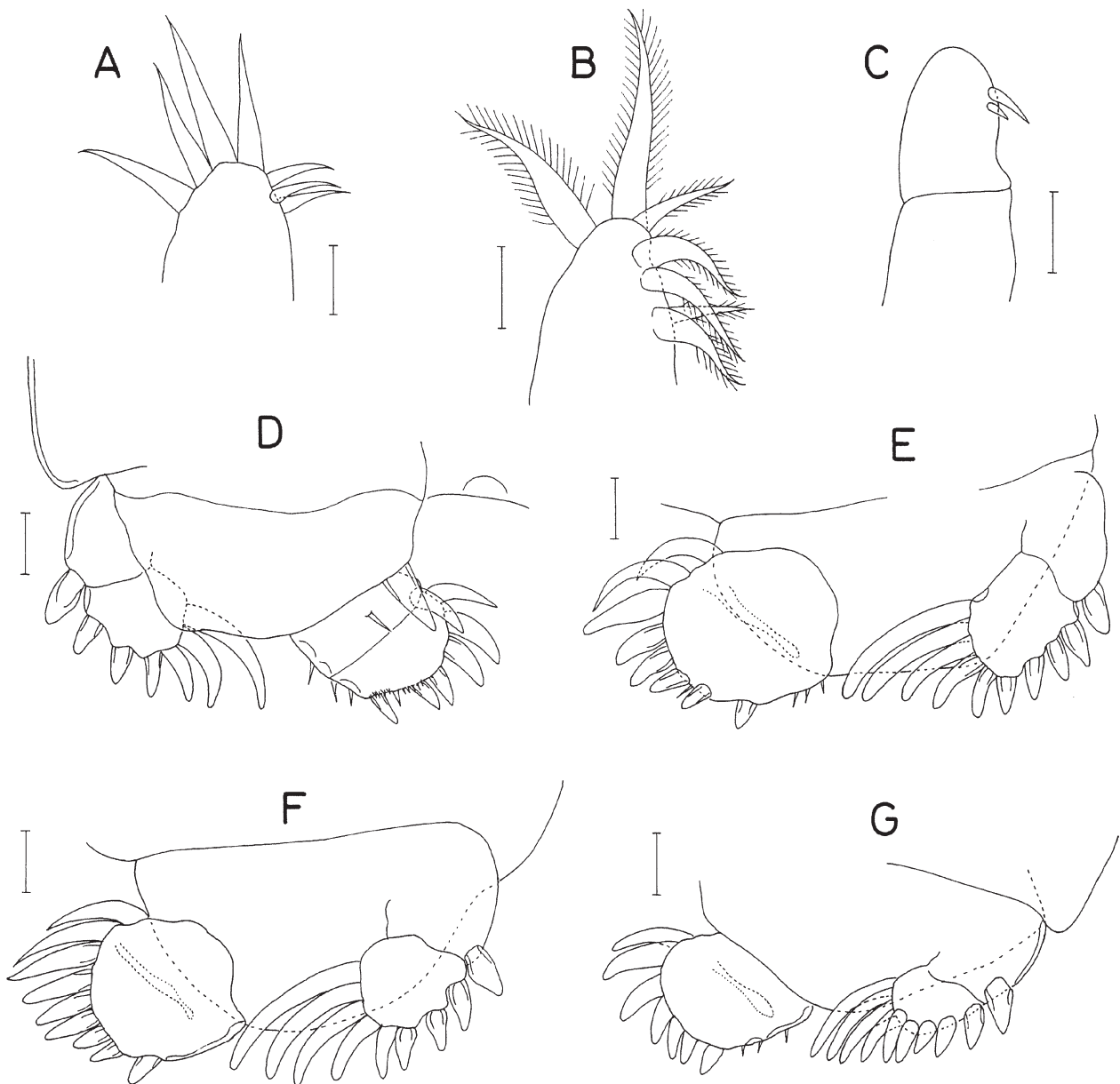
**Remarks.** *Campodelphys bullatus* gen. et sp. nov. shares some features with the type species *C. hirsutus* gen. et sp. nov. These are the only two species which possess 2-segmented endopods in all swimming legs. In the other three new species described below, the endopods of the swimming legs are typically 1-segmented, with the exception of the 2-segmented endopod of leg 1 only of *C. stocki* gen. et sp. nov. *Campodelphys bullatus* gen. et sp. nov. is readily distinguishable from the type species, *C. hirsutus* gen. et sp. nov., because it does not share any of the five outstanding features listed in the remarks section of the type species.

***Campodelphys stocki* gen. et sp. nov.**  
(Figs. 400, 401)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-



**FIGURE 400.** *Campodelphys stocki* sp. nov., female. A, habitus, right; B, urosome, ventral; C, urosome, right; D, cephalosome and leg 1, ventral; E, caudal rami; F, rostrum; G, antennule; H, antenna; I, labrum; J, mandible. Scale bars: A, 0.2 mm; B–E, 0.05 mm; E–J, 0.02 mm.



**FIGURE 401.** *Campodelphys stocki* sp. nov., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 3; G, leg 4. Scale bars: 0.01 mm.

21432), paratype (intact ♀, MNHN-IU-2014-21433), and dissected paratype (♀, figured) from *Eudistoma vulgare* Monniot F., 1988 (MNHN-IT-2008-4307 = MNHN A3/EUD/58), Grand récif Sud New Caledonia, “Vauban”, (22°36.3’S, 167°14.2’E), depth 20-60m, B. Richer de Forges-IRD coll., 24 January 1985.

**Etymology.** The new species is named in honour of the late Prof. Jan H. Stock for his many contributions to the taxonomy of ascidicolous copepods.

**Description of female.** Body (Fig. 400A) elongate, cylindrical, arched ventrally: body length 1.78 mm. Prosome unsegmented and evenly cylindrical (width 320 µm) along most of length; cephalosome tapering

anteriorly, not articulated from metasome, narrower than metasome, with prominent posteroventral tubercle on each side (Fig. 400D). Anterior region from rostrum to level of leg 4 occupying about one-third of prosome length. Free urosome (Fig. 400B, C) small, 122 µm long, 5 urosomites each markedly wider than long. Anal somite ornamented with 2 oblique rows of spinules on ventral surface near bases of caudal rami (Fig. 400E). Caudal ramus small, about 2.4 times longer than wide (38×16 µm), obscurely defined from anal somite: armed with 6 equal, naked setae (2 in middle and 4 distal).

Rostrum (Fig. 400F) elongate, about twice as long as wide, with slightly convex lateral margins bearing pair

of setules distally; distal third narrowing towards apex. Antennule (Fig. 400G) small, 82 µm long, tapering, and curved posteriorly; segmentation obscure with 6 partial sutures along posterior surface; setae grouped as 2, 21, 6, and 13. Antenna (Fig. 400H) very stout, 3-segmented; coxa short; basis slightly longer than wide, unarmed; unsegmented endopod as long as wide: armed with 5 small setae (1 middle, 1 subdistal, and 3 distal) plus terminal claw, slightly longer than endopod.

Labrum (Fig. 400I) extending posteriorly, tapering, as long as wide, with 2 large setules subdistally. Mandible (Fig. 400J): coxal gnathobase with pectinate medial margin plus 1 small spinule on distal margin; palp armed with 1 seta on basis, 4 setae on exopod, and 1 and 4 setae on first and second endopodal segments, respectively; both rami incompletely articulated from basis; all setae naked. Maxillule (Fig. 401A) lobate, bearing 7 naked setae (3 mediodistal setae smaller than remaining 4). Maxilla (Fig. 401B) lobate, armed with 7 pinnate setae (4 medial and 3 distal). Maxilliped (Fig. 401C) small, 2-segmented, bearing 2 small setae on medial margin of second segment.

Legs 1–4 (Fig. 401D–G) short and broad; protopods indistinctly 2-segmented; exopods 2-segmented, obscurely defined from basis; endopod 2-segmented in leg 1, unsegmented in legs 2–4, although retaining vestige of articulation. Basis of leg 1 bearing broad, spiniform inner distal seta. Coxa and basis unarmed in legs 2–4. Setae on rami short, broad, naked, usually blunt tipped. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	0-1	1-0; 6	0-1; 6
Leg 2	0-0	0-0	1-0; 9	8
Leg 3	0-0	0-0	1-0; 8	9
Leg 4	0-0	0-0	1-0; 9	7

Leg 5 (Fig. 400B) represented by 2 small posteroventral setae at rear of prosome near base of free urosome.

**Male.** Unknown.

**Remarks.** In *Campodelphys stocki* **gen. et sp. nov.** the endopod is 2-segmented in leg 1, but 1-segmented in legs 2–4. This leg segmentation pattern is unique and serves to differentiate the new species from all of its congeners. The 2-segmented maxilliped bearing two setae on the second segment and the presence of 7 setae on both the maxillule and maxilla also are characteristic features of the new species, as this combination does not occur in any other species.

***Campodelphys ancylcephalus* gen. et sp. nov.**  
(Figs. 402, 403)

**Type material.** Holotype (intact ♀, MNHN-IU-2013-19281) paratypes (2 intact ♀♀, MNHN-IU-2014-21434),

and dissected paratype (♀, figured) from a colonial ascidian, *Cystodytes* sp. (MNHN-IT-2008-2635 = MNHN A3/CYS/135), Gam Island, Raja Ampat, Danau Nine Gam marine lake, West Papua, Indonesia (00°26.970'S, 130°29.149'E), depth 0.5–2m, L.J. Bell & L.E. Martin coll., 04 November 2007.

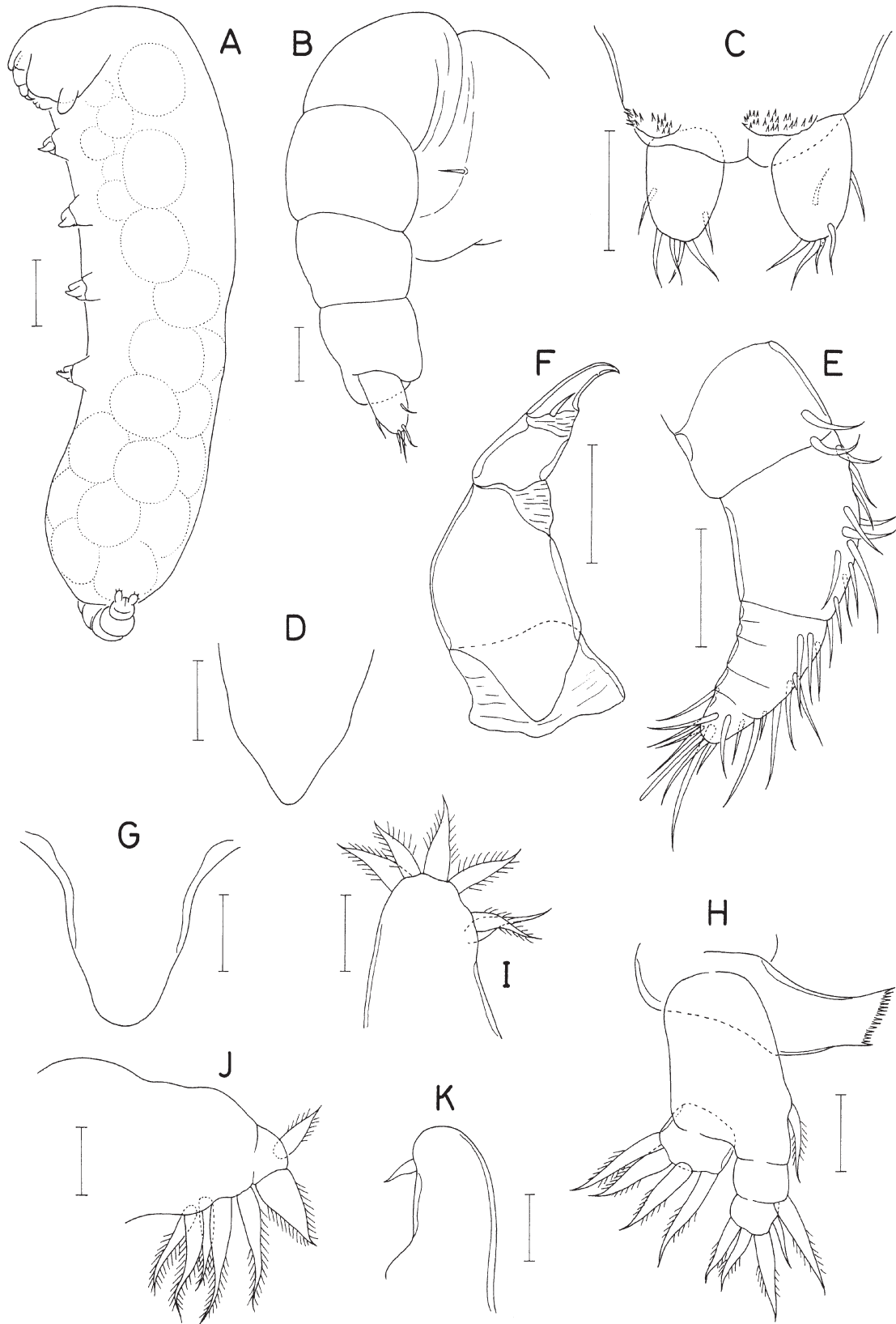
**Etymology.** The specific name is the combination of Greek *ancyl* (=crooked) and *cephal* (=head), referring to the ventrally deflected cephalic region of the new species.

**Description of female.** Body (Fig. 402A) enclosed by thin membrane; cylindrical and 1.12 mm long. Prosome 0.92 mm long, slightly narrowed in mid-section and with maximum width (250 µm) at level of leg 1, unsegmented; cephalosome not defined from metasome, directed ventrally, bearing posteroventral tubercle on each side (Fig. 402A). Anterior region of prosome from rostrum to insertion of leg 4 occupying 65% of prosome length; legs 1–4 separated from one another by equal intervals along body. Free urosome (Fig. 402B) curved, 5-segmented. Anal somite ornamented with paired patches of spinules ventrally (Fig. 402C). Caudal ramus (Fig. 402C) small, about 1.6 times longer than wide (23×14 µm): armed with 6 naked setae (1 outer lateral, 1 dorsal, and 4 distal).

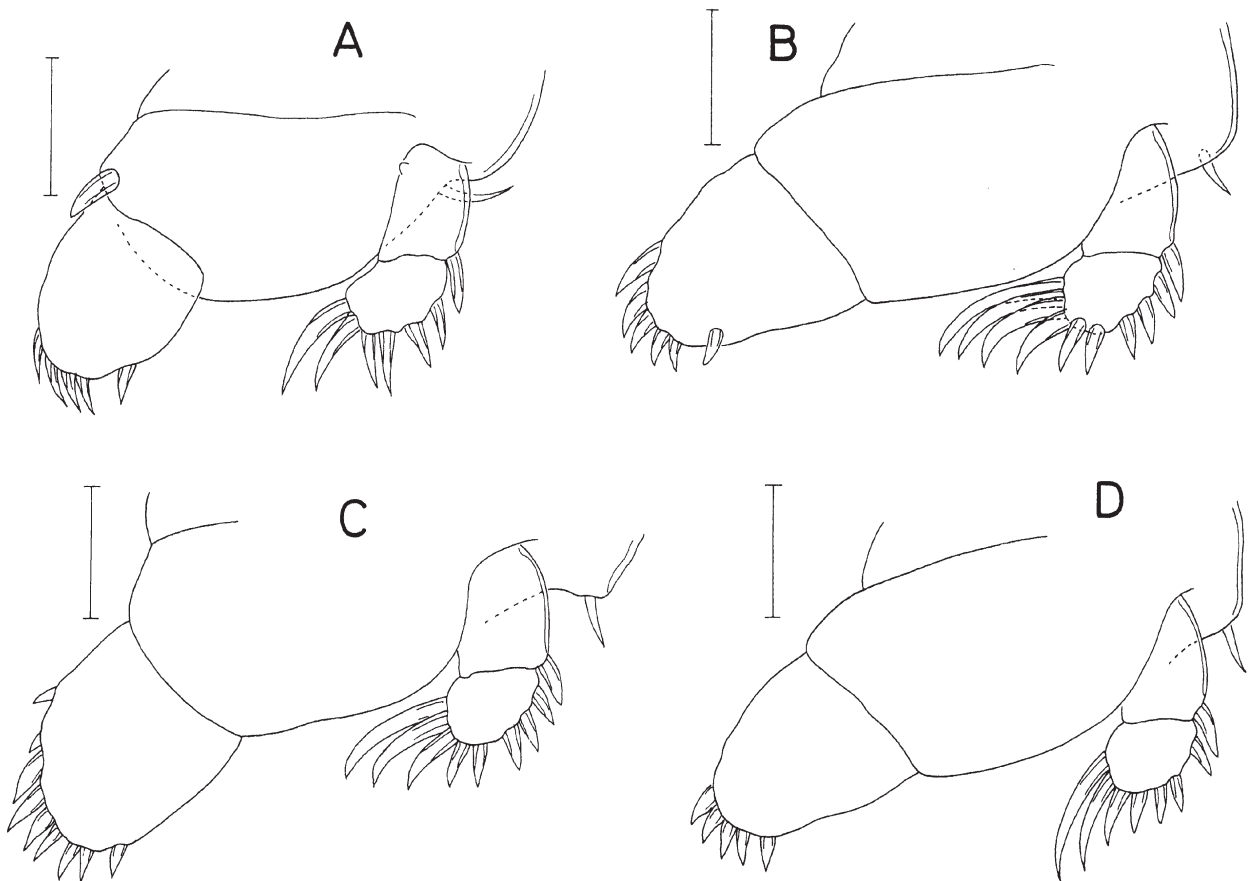
Rostrum (Fig. 402D) as long as wide, weakly tapering proximally, abruptly tapering in distal 40% towards blunt apex. Antennule (Fig. 402F) small, 71 µm long, curved posteriorly, with 2 distinct articulations proximally and several partial sutures on posterior surface more distally; armed with 2 setae on first segment, 12 on second, and 17+aesthetasc on distal region. Antenna (Fig. 402F) stout, tapering distally, 3-segmented; coxa and basis unarmed; unsegmented endopod slightly longer than wide: armed with 1 seta distally plus terminal claw, slightly longer than endopod.

Labrum (Fig. 402G) large, tapering, extended distally, unornamented. Mandible (Fig. 402H) with coxal gnathobase bearing pectinate medial margin; palp armed with 1 seta on basis, 4 setae on exopod, and 1 and 4 setae on first and second endopodal segments, respectively; small medial seta on second endopodal segment narrow and naked, all other setae on rami broad and weakly pinnate. Maxillule (Fig. 402I) lobate, bearing 6 setae (2 medial and 4 distal). Maxilla (Fig. 402J) indistinctly 2-segmented and armed with 5 setae on first segment and 2 setae on small second segment (medial seta markedly broadened). Maxilliped (Fig. 402K) unsegmented, bearing 1 small seta subdistally on medial margin.

Legs 1–4 (Fig. 403A–D) biramous, broad, each with partially 2-segmented protopod, 2-segmented exopod, and unsegmented endopod; endopods much broader than exopods and directed mediodistally. Coxa of legs 1–4 unarmed, but basis bearing outer seta. Basis of leg 1 bearing spiniform inner distal seta. All setae on rami of legs small and spiniform. Armature formula for legs 1–4 as follows:



**FIGURE 402.** *Campodelphys ancylcephalus* **sp. nov.**, female. A, habitus, left; B, urosome, lateral; C, caudal rami, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B–G, 0.02 mm; H–K, 0.01 mm.



**FIGURE 403.** *Campodelphys ancylocephalus* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	1-0; 6	5
Leg 2	0-0	1-0	1-0; 9	6
Leg 3	0-0	1-0	1-0; 8	9
Leg 4	0-0	1-0	1-0; 7	5

Leg 5 (Fig. 402B) represented by 1 minute seta.

**Male.** Unknown.

**Remarks.** In *Campodelphys ancylocephalus* gen. et sp. nov. all swimming legs have an unsegmented endopod, unlike the three congeneric species described above. The numbers of setae on the endopods of legs 1, 2, and 4 (5, 6, and 5, respectively) are smaller than those of its congeners. The presence of 6 setae on the maxillule and 7 setae on the maxilla are additional diagnostic features of the new species.

***Campodelphys seticoxus* gen. et sp. nov.**

(Figs. 404, 405)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21435) from *Eudistoma*

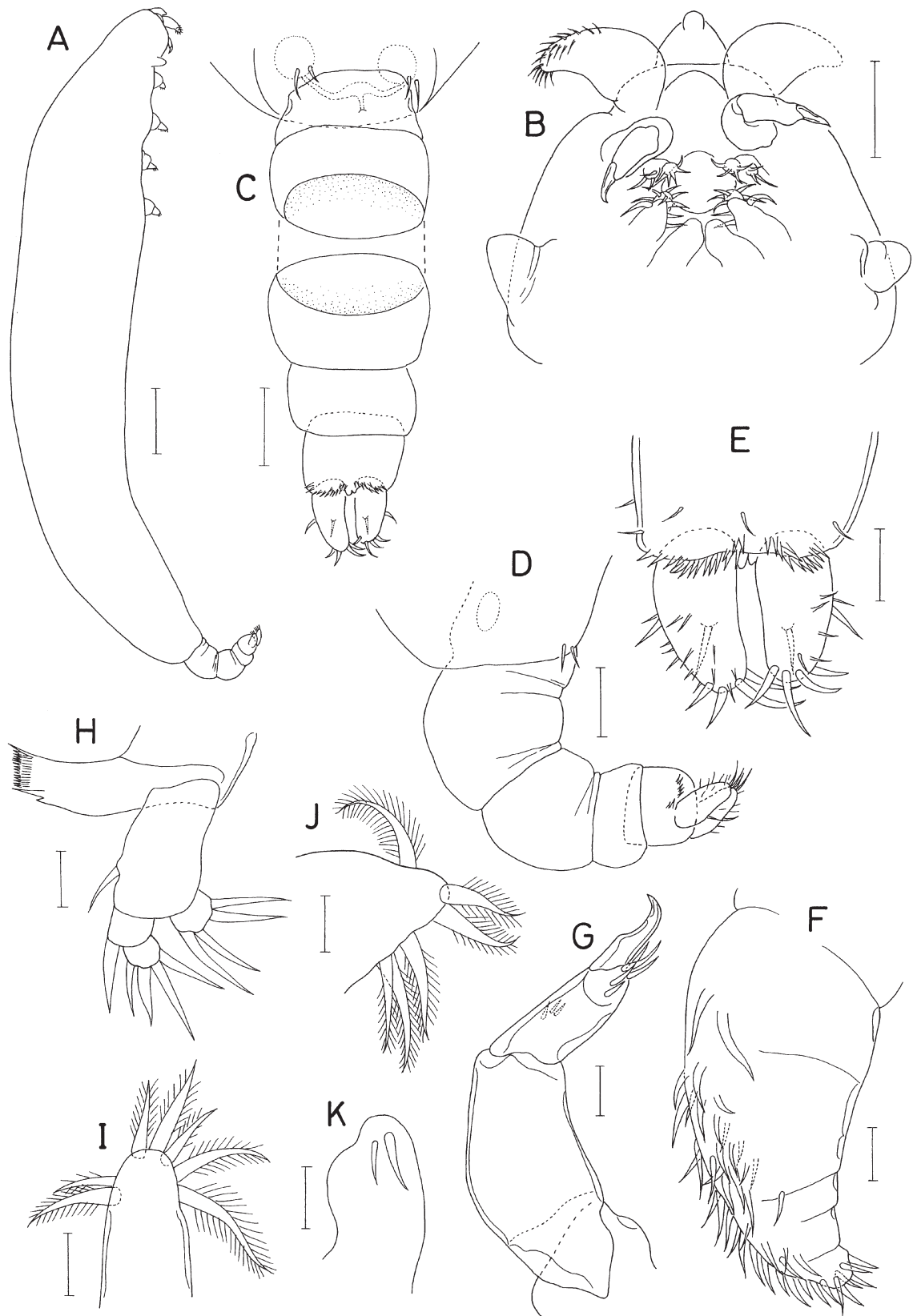
*reginum* Kott, 1991 (MNHN-IT-2008-4187 = MNHN A3/EUD/75), CRRF OCDN 1434-S, Manado, north Sulawesi, Indonesia, depth 60 m, 21 May 1993.

**Etymology.** The specific name refers to the presence of the inner seta on the coxa of leg 4.

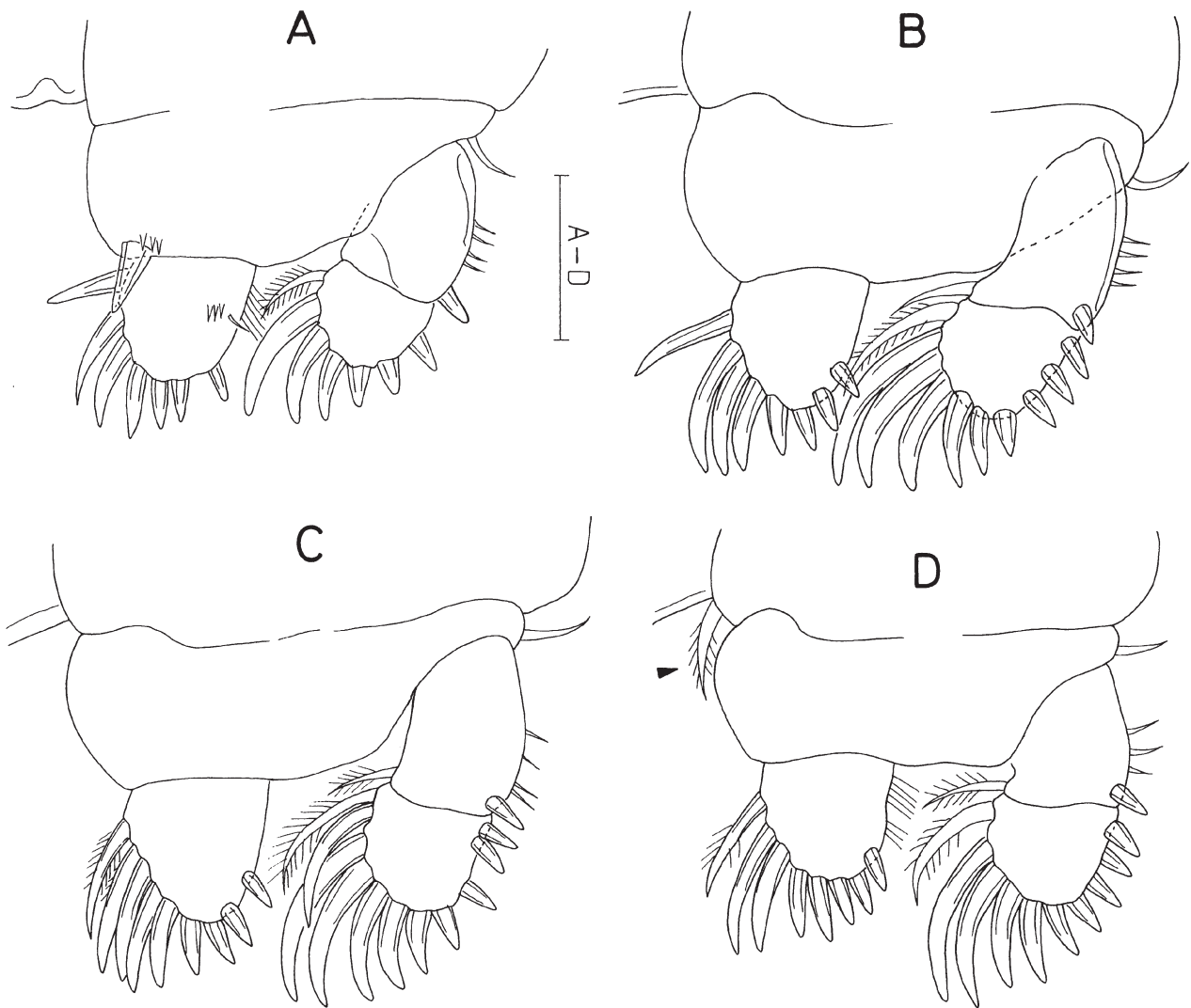
**Description of female.** Body (Fig. 404A) slender, cylindrical, slightly curved ventrally; body length 2.10 mm. Prosome unsegmented; anterior fifth tapering anteriorly and posterior third tapering posteriorly; anterior region from rostrum to level of leg 4 occupying about one-third of length of prosome. Cephalosome (Fig. 404B) defined from metasome by weak lateral constriction, bearing prominent paired tubercles posterolaterally on ventral surface. Free urosome (Fig. 404C, D) 5-segmented, strongly curved ventrally. Genital somite narrower than anterior abdominal somites. Anal somite ornamented with row of spinules along posteroventral margin (Fig. 404E). Caudal ramus (Fig. 404E) as long as anal somite and twice as long as wide (45×22 µm): armed with 6 naked setae (1 outer lateral, 1 dorsal, and 4 distal) and ornamented with scattered stiff setules.

Rostrum (Fig. 404B) directed anteroventrally, tipped with narrow tubercle. Antennule (Fig. 404F) short and





**FIGURE 404.** *Campodelphys seticoxus* sp. nov., female. A, habitus, right; B, cephalosome, ventral; C, urosome, ventral; D, urosome, right; E, caudal rami, ventral; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.2 mm; B–D, 0.05 mm; E, 0.02 mm; F–K, 0.01 mm.



**FIGURE 405.** *Campodelphys seticoxus* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

broad, 75  $\mu$ m long, divisible into 5 segments by 4 partial articulations on posterior surface; first segment bearing 2 setae, setation of other segments not discernible due to dense packing of setae. Antenna (Fig. 404G) 3-segmented, consisting of coxa, basis, and unsegmented endopod; basis about 1.7 times longer than wide, unarmed; endopod about 2.3 times longer than wide (27 $\times$ 12  $\mu$ m); armed with 8 small setae (arranged as 3, 2, and 3), plus terminal claw as long as endopod.

Labrum missing. Mandible (Fig. 404H) with narrow coxal gnathobase; medial margin of gnathobase pectinate, with 2 denticles distally (distal denticle much smaller than subdistal); palp armed with 1 seta on basis, 4 on exopod, and 1 and 4 on first and second endopodal segments, respectively; all setae naked. Maxillule (Fig. 404I) as digitiform lobe bearing 7 pinnate setae (2 medial, 3 distal, and 2 outer). Maxilla (Fig. 404J) as tapering lobe bearing 6 pinnate setae (3 medial, 2 distal, and 1 outer).

Maxilliped (Fig. 404K) unsegmented with 2 small, proximally-directed setae subapically.

Legs 1–4 (Fig. 405A–D) biramous, each with incompletely 2-segmented protopod, 2-segmented exopod, and unsegmented endopod. Coxa of leg 4 characteristically with inner seta (indicated by arrowhead in Fig. 405D). Basis of legs 1–4 with outer seta. Basis of leg 1 with spiniform inner distal seta. First exopodal segment of legs 1–4 with 3 or 4 thick setules on outer margin. Setae on rami spiniform and usually blunt, but 2 proximal setae on exopods of legs 2–4 pinnate and attenuate. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	1-0; 7	6 (or 7)
Leg 2	0-0	1-0	1-1; 10	8
Leg 3	0-0	1-0	1-1; 11	9
Leg 4	0-1	1-0	1-1; 10	8

Leg 5 (Fig. 404C, D) represented by 2 small setae on posteroventral surface of prosome.

**Male.** Unknown.

**Remarks.** *Campodelphys seticoxus* **gen. et sp. nov.** resembles *C. ancylcephalus* **gen. et sp. nov.** in having unsegmented endopods in all swimming legs and an inner distal seta on the basis of leg 1. However, they differ in the numbers of setae on the maxillule, maxilla, maxilliped, and swimming legs. It is noteworthy that the presence of the inner seta on the coxa of leg 4 of *C. seticoxus* **gen. et sp. nov.** is a unique feature within the genus.

## Genus *Scolecodes* Illg, 1958

**Diagnosis.** Body vermiform, elongate, cylindrical, usually curved or coiled, consisting of prosome incorporating all pedigerous somites and small abdomen. Cephalosome expanded laterally, but fused with or obscurely defined from metasome. Swimming legs confined to anterior part of prosome, separated from one another by regular intervals. Fourth pedigerous somite much longer than remaining part of body, forming brood pouch incorporating fifth pedigerous somite. Genital openings located posteriorly on prosome. Abdomen 1-segmented, small, incompletely articulated from prosome. Caudal rami distinct, armed with 6 small setae. Rostrum as anterior prominence on cephalosome. Antennule unsegmented, consisting of extremely expanded, globular proximal part and narrow distal part; armed with several setae on both parts. Antenna 2- or 3-segmented; terminal segment (endopod) terminating in claw, with few setae. Labrum obscure, not covering mouthparts. Mandible and maxillule lobate, bearing several setae. Maxilla unsegmented or incompletely 2-segmented, with 3 or 4 setae. Maxilliped absent. Legs 1–4 broad, biramous, each with 1- or 2-segmented protopod. Basis with outer seta in all legs; basis of leg 1 lacking inner distal element. Exopods 1- or 2-segmented; endopods unsegmented. Setae on rami mostly short, broad, spiniform, with nipple-like tip. Leg 4 with or without inner coxal seta. Leg 5 absent.

**Type species.** *Scolecodes huntsmani* (Henderson, 1930) by original designation.

**Remarks.** Illg (1958) established the genus *Scolecodes* to accommodate *Scolecimorpha huntsmani* Henderson, 1931 and redescribed this species on the basis of newly collected specimens associated with *Styela gibbsii* Stimpson, 1864, the type host, and *Pyura hauster* (Stimpson, 1864) from Washington, near the type locality in British Columbia, Canada. Dudley (1966) recorded *Boltenia villosa* (Stimpson, 1864) as an additional host of this copepod, also from Washington State. Illg (1970b) recorded the discovery of this species associated with *Cnemidocarpa fertilis* (Hartmeyer, 1906) and *C. finmarkiensis* (Kiaer, 1893) in Japanese waters.

The genus *Scolecodes* appears to be related to

*Campodelphys* **gen. nov.**, especially in leg form. However, compared to *Campodelphys* **gen. nov.**, in *Scolecodes* the body is more elongate, the prosome is expanded to include all the pedigerous somites plus the genital somite, and the free abdomen is unsegmented. In addition, the maxilliped is absent in *Scolecodes* but present in *Campodelphys* **gen. nov.**

## *Scolecodes pugetensis* **sp. nov.**

(Figs. 406, 407)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21436), paratypes (8 intact ♀♀, MNHN-IU-2014-21437), and dissected paratypes (3 ♀♀, figured) in thin membranous cysts in a solitary ascidian, *Pyura* sp., Puget Sound, Washington, USA.

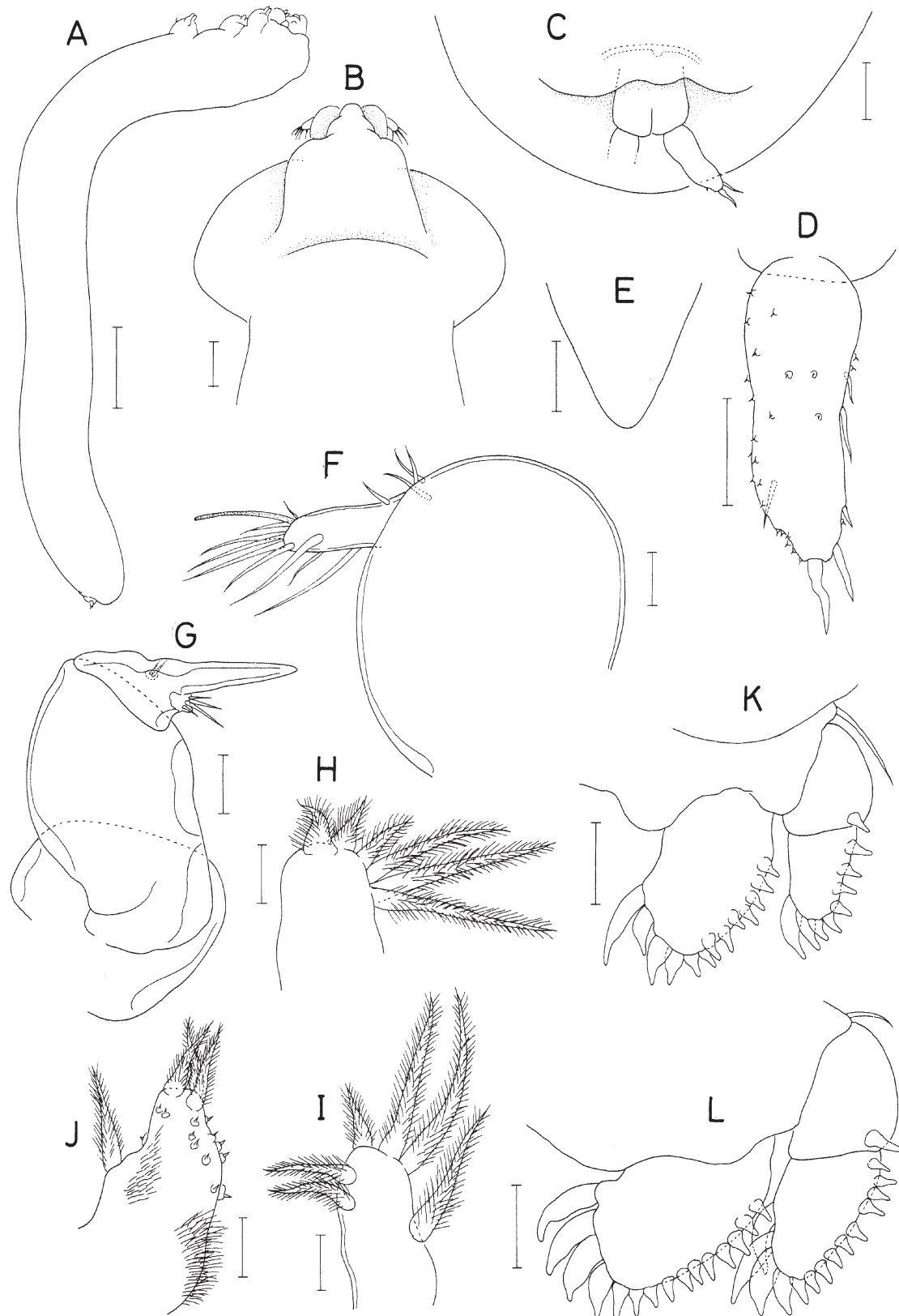
**Etymology.** The name of the new species refers to its type locality.

**Description of female.** Body (Fig. 406A) elongate, cylindrical, straight or curved, consisting of prosome and unsegmented free abdomen. Body length variable, 9.25 mm in relatively small, figured specimen; body width 0.93 mm. Prosome unsegmented: cephalosome not articulated from remaining part of prosome, but discernible by lateral expansions (Fig. 406B); antennal and rostral region narrow. All legs inserted in pedigerous region confined to anterior part of prosome. Genital openings present in posterior region of prosome. Abdomen (Fig. 406C) unsegmented, as long as wide, positioned posteroventrally on prosome. Caudal rami (Fig. 406D) 2.6 times longer than wide (140×54 µm), narrowing in middle and ornamented with numerous papillae scattered over surface: armed with 6 setae (2 outer lateral, 2 subdistal, and 2 distal).

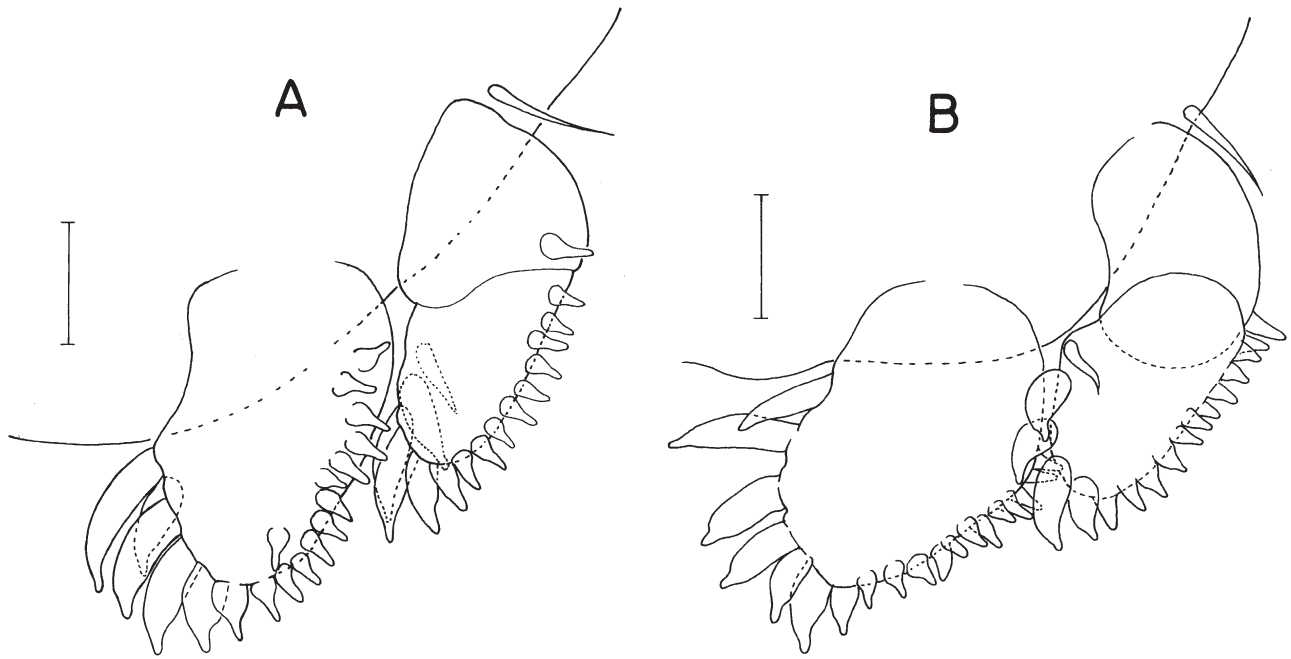
Rostrum (Fig. 406E) evenly tapering, as long as wide. Antennule (Fig. 406F) unsegmented but clearly divisible into 2 parts; proximal part extremely swollen, globular, armed with 3 small setae distally; distal part narrow, digitiform, armed with 11 setae and 1 aesthetasc. Antenna (Fig. 406G) 3-segmented; coxa and basis broad and unarmed; unsegmented endopod bearing 2 inner and 3 or 4 outer, minute setae, plus straight terminal claw.

Labrum hardly observable. Mouthparts consisting of mandible, maxillule, and maxilla, all represented by unsegmented lobes bearing plumose setae. Mandible (Fig. 406H) with 3 long medial and 2 to 4 (3 is common) shorter apical setae. Maxillule (Fig. 406I) with 3 long and 3 short setae (2 medial, 3 apical, and 1 outer). Maxilla (Fig. 406J) consisting of broader proximal half and narrower distal half (interpretable as 2-segmented condition depending on viewing angle), armed with 1 seta proximally and 3 setae on apex; ornamented 2 patches of setules and more than 10 papillae. Maxilliped absent.

Legs 1–4 (Figs. 406K, L, 407A, B) biramous, each with incompletely 2-segmented protopod, 2-segmented exopod, and unsegmented endopod. Protopods of legs 1–



**FIGURE 406.** *Scolecodes pugetensis* sp. nov., female. A, habitus, right; B, cephalosome, dorsal; C, posterior end of prosome and urosome, ventral; D, left caudal ramus, ventral; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla; K, leg 1; L, leg 2. Scale bars: A, 1 mm; B, C, 0.1 mm; D, E, K, L, 0.05 mm; F–J, 0.02 mm.



**FIGURE 407.** *Scolecodes pugetensis* sp. nov., female. A, leg 3; B, leg 4. Scale bars: 0.05 mm.

4 each with outer seta derived from basis; other armature elements absent. All setae on rami short and broad, with nipple-like tip. Number of setae variable between individuals and between left and right legs in single individual. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	1-0	1-0; 8 to 9	11 to 14
Leg 2	1-0	1-0; 11 to 17	15 to 21
Leg 3	1-0	1-0; 15 to 16	15 to 19
Leg 4	1-0	1-0; 15 to 17	15 to 19
Leg 5	absent.		

**Male.** Unknown.

**Remarks.** *Scolecodes pugetensis* sp. nov. is similar to the type species, *S. huntsmani* and both species can inhabit solitary ascidians of the same genus (*Pyura*) in the same zoogeographic region. The number of setae on the swimming legs observed by Illg (1958, 1970b) falls within the range of variability exhibited in our material. The mandible, maxillule, and maxilla of female *S. huntsmani* illustrated by Dudley (1966) are not significantly different from these limbs in our specimens. Despite these similarities and the variability observed, these two species are not conspecific because the exopods of legs 1–4 are 2-segmented in *S. pugetensis* sp. nov., but only 1-segmented in adults of *S. huntsmani* as described by Illg (1958) and illustrated by Illg (1970b). Dudley (1966) also recorded 1-segmented rami in legs 1–4 of the female copepodid V of *S. huntsmani*. The segmentation does not

appear to exhibit variability and we therefore establish a new species to accommodate the form with 2-segmented exopods in legs 1–4.

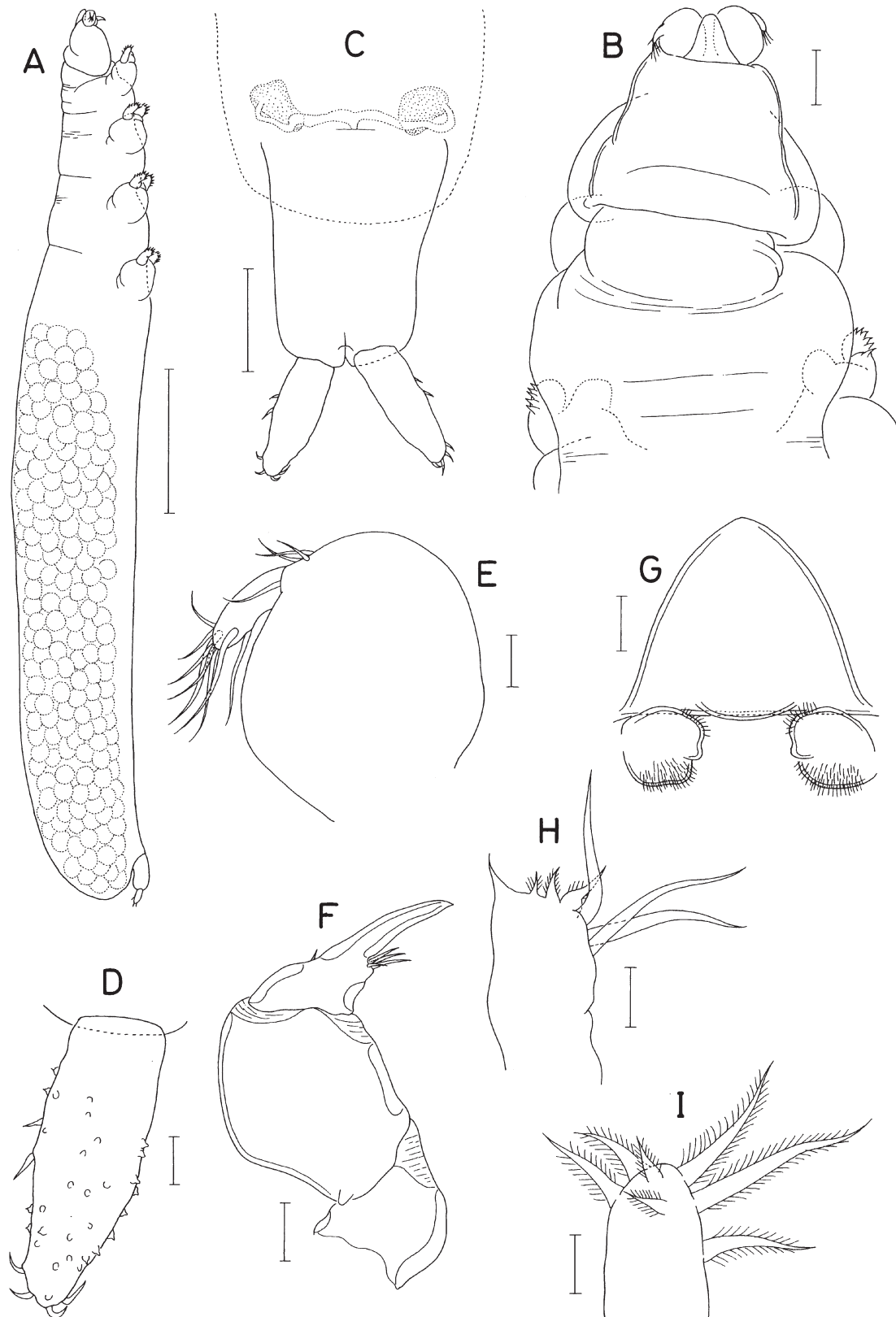
***Scolecodes rectus* sp. nov.**

(Figs. 408, 409)

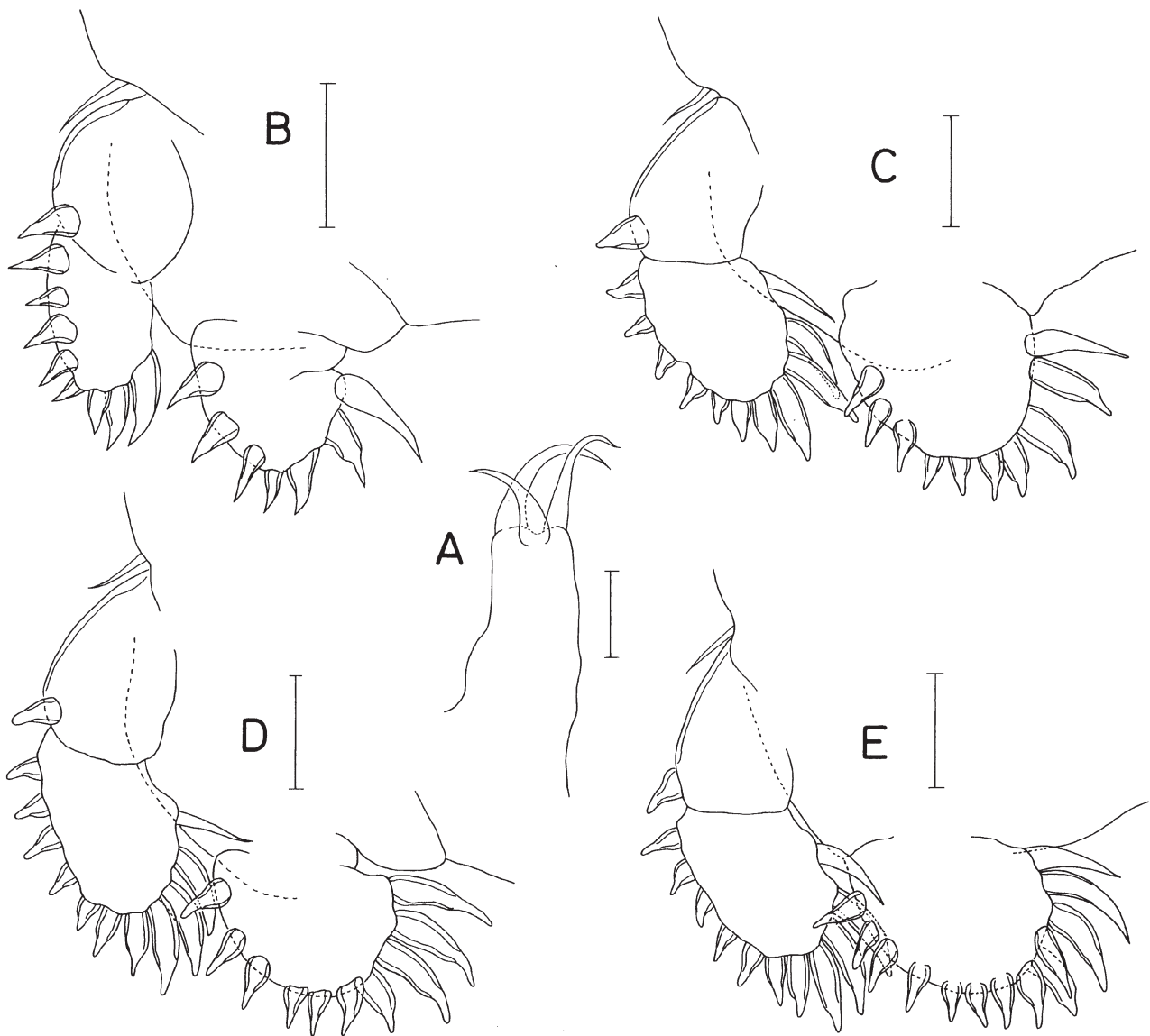
**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21438) from *Boltenia hirta* Monniot C. & Monniot F., 1977 (Type MNHN-IT-2008-1485 = MNHN S2/BOL.A/7), SW of Heard Island (55°49.5'S, 69°35.7'E), depth 4200–4225 m, MNHN coll., 11 April 1974.

**Etymology.** The name is derived from the Latin *rect* (=straight), alluding to the linear body of the female of the new species.

**Description of female.** Body (Fig. 408A) elongate, cylindrical, straight, consisting of prosome and small unsegmented abdomen: body length 6.21 mm; maximum body width 0.86 mm in middle of prosome. Cephalosome (Fig. 408B) small, articulated from metasome, narrowing anteriorly. Metasome with 4 original pedigerous somites defined by incomplete dorsal sutures. Anterior part of body from rostrum to level of leg 4 occupying about 30% of total body length; legs 1–4 separated by equal intervals. Fourth pedigerous somite expanded posteriorly, incorporating fifth pedigerous somite and forming brood pouch. Copulatory pore positioned on posteroventral surface of incorporated genital somite. Abdomen (Fig. 408C) small, unsegmented,



**FIGURE 408.** *Scolecodes rectus* sp. nov., female. A, habitus, right; B, anterior part of prosome, dorsal; C, urosome, ventral; D, right caudal ramus, ventral; E, antennule; F, antenna; G, labrum and paragnaths; H, mandible; I, maxillule. Scale bars: A, 1 mm; B, C, 0.1 mm; D–I, 0.02 mm.



**FIGURE 409.** *Scolecodes rectus* sp. nov., female. A, maxilla; B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: A, 0.02 mm; B–E, 0.05 mm.

longer than wide ( $216 \times 180 \mu\text{m}$ ), not articulated from prosome, inserted into posteroventral surface of prosome. Caudal rami (Fig. 408D) about 2.8 times longer than wide ( $125 \times 45 \mu\text{m}$ ), tapering in distal half, ornamented with scattered papillae: armed with 6 small setae (2 outer lateral plus 4 distal and subdistal).

Rostrum (Fig. 408B) directed anteriorly, tapering. Antennule (Fig. 408C) unsegmented, consisting of greatly expanded, globular proximal part and narrow, digitiform distal part; armed with 4 setae on proximal part and about 8 setae on distal part. Antenna (Fig. 408F) 3-segmented, consisting of short coxa, broad basis, and unsegmented endopod; basis slightly longer than wide; endopod tapering, terminating in claw and bearing 1 outer and 4 inner small setae at base of claw.

Labrum (Fig. 408G) simple, with slightly produced

mid-region of free posterior margin. Mandible with coxa represented by setulose lobe (Fig. 408G); palp forming rectangular lobe (Fig. 408H) bearing 3 large naked setae distally on medial margin and 3 small pinnate setae plus 1 pointed, setiform process on distal margin. Maxillule (Fig. 408I) lobate, bearing 7 pinnate setae (3 large setae on medial margin and 4 smaller, apical or subapical setae). Maxilla (Fig. 408A) lobate, unsegmented, armed distally with 3 naked setae. Maxilliped absent.

Legs 1–4 (Fig. 409B–E) biramous, each consisting of unsegmented protopod, 2-segmented exopod and 1-segmented endopod. Protopods armed with outer seta (derived from basis) only. Both rami obscurely defined from protopod; all setae naked, most spiniform, short but thick, with nipple-like tip. Armature formula for legs 1–4 as follows:

	Protopod	Exopod	Endopod
Leg 1	1-0	1-0; 8	7 or 8
Leg 2	1-0	1-0; 11	10 or 11
Leg 3	1-0	1-0; 11	10
Leg 4	1-0	1-0; 11 or 12	10 or 13
Leg 5	absent.		

**Male.** Unknown.

**Remarks.** *Scolecodes rectus* **sp. nov.** shares the possession of 2-segmented exopods on legs 1–4 only with *S. pugetensis* **sp. nov.** This character state distinguishes the new species from the type species, *S. huntsmani*. It differs from *S. pugetensis* **sp. nov.** as follows: the abdomen is longer than wide (vs. as long as wide in *S. pugetensis* **sp. nov.**), the mandible carries a setiform apical process in addition to 6 setae (vs. no setiform process in *S. pugetensis* **sp. nov.**), the maxillule is armed with 7 setae (vs. 6 setae in *S. pugetensis* **sp. nov.**), the maxilla is armed with 3 setae (vs. 4 setae in *S. pugetensis* **sp. nov.**), and the rami of legs 1–4 are armed with fewer setae.

### *Scolecodes helicinus* **sp. nov.**

(Figs. 410–414)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21439), paratypes (7 intact ♀♀, MNHN-IU-2014-21440), and dissected paratypes (4 ♀♀, figured) in thin membranous cysts in the colonial ascidian *Polyclinum isipingense* Sluiter, 1898 (MNHN-IT-2008-XXX = MNHN A1/POL.B/108), ATIMO VATAE TR07, Madagascar (25°01'S, 47°00'E), depth 12–16 m, MNHN coll., 01 May 2010.

**Additional material.** 18 ♀♀ (MNHN-IU-2018-1912) and 2 dissected ♀♀ from *Eudistoma* sp., New Caledonia (18°28'15"S, 163°04'40"E), depth 12–15 m; 4 ♀♀ (MNHN-IU-2018-1913) from *Eudistoma* sp., Mabul, Malaysia (04°14.51'N, 118°37.32'E), 16 January 2004; 1 ♀ (MNHN-IU-2018-1914) and 1 dissected ♀ from *Eudistoma* sp., Tulear, southwestern coast of Madagascar.

**Etymology.** The name is derived from the Greek *helic* (=a coil) and refers to the coiled body of the female of the new species.

**Description of female.** Body (Fig. 410A) extremely elongate, cylindrical, coiled in various ways after fixation, consisting of unsegmented prosome and small unsegmented abdomen. Body length variable, 7.23 mm in figured largest specimen; body width 0.31 mm. Anterior part of body from rostrum to level of leg 4 occupying 14% of total body length. Cephalosome about 200×280 µm, expanded laterally, with narrow antennal region (144 µm wide) and tapering rostral region (62 µm wide); pair of blunt digitiform processes (indicated by arrowhead in Fig. 410D) present on ventral surface lateral to oral region. Genital area positioned dorsally near posterior

end of prosome (Fig. 410C). Abdomen (Fig. 410C) unsegmented, wider than long (64×90 µm), divided from prosome by faint suture line, not fused with prosome on ventral surface. Caudal rami (Fig. 410C) about 2.2 times longer than wide (58×27 µm), slightly broadened in middle: armed with 6 small setae (1 outer lateral, 1 dorsal, and 4 distal).

Rostrum (Fig. 410B) tapering, directed anteriorly, usually with pair of small papillae apically (Fig. 410D). Antennule (Fig. 410E) unsegmented, divisible into globular proximal part and narrow, digitiform distal part; armed with about 4 setae on proximal part and 9 setae on distal part (setation hardly observable and apparently variable). Antenna (Fig. 410F) incompletely 3-segmented; coxa and basis obscurely demarcated, both unarmed; unsegmented endopod bearing 2 setae and drawn out into elongate, weakly curved claw.

Labrum small, hardly dissectable. Mandible (Fig. 410G) unsegmented, consisting of narrow stalk and expanded distal part, armed with 3 pinnate setae on medial margin and 1 or 2 small setae apically; ornamented with several minute setules. Paragnath (Fig. 410H) as densely setulose lobe. Maxillule (Fig. 410I) lobate, bearing 7 plumose setae and with setulose medial margin. Maxilla (Fig. 410J) incompletely 2-segmented, tapering, armed with 1 and 3 small, naked setae on first and second segments, respectively. Maxilliped absent.

Legs 1–4 (Fig. 411A–D) short and broad, each consisting of 2-segmented protopod and unsegmented rami; rami of all legs broader than long. Inner coxal seta absent in legs 1–3, but present in leg 4. Small outer seta present on basis of legs 1–4. All setae on rami broad, with narrow, rounded tip. Armature formula for legs 1–4 as follows:

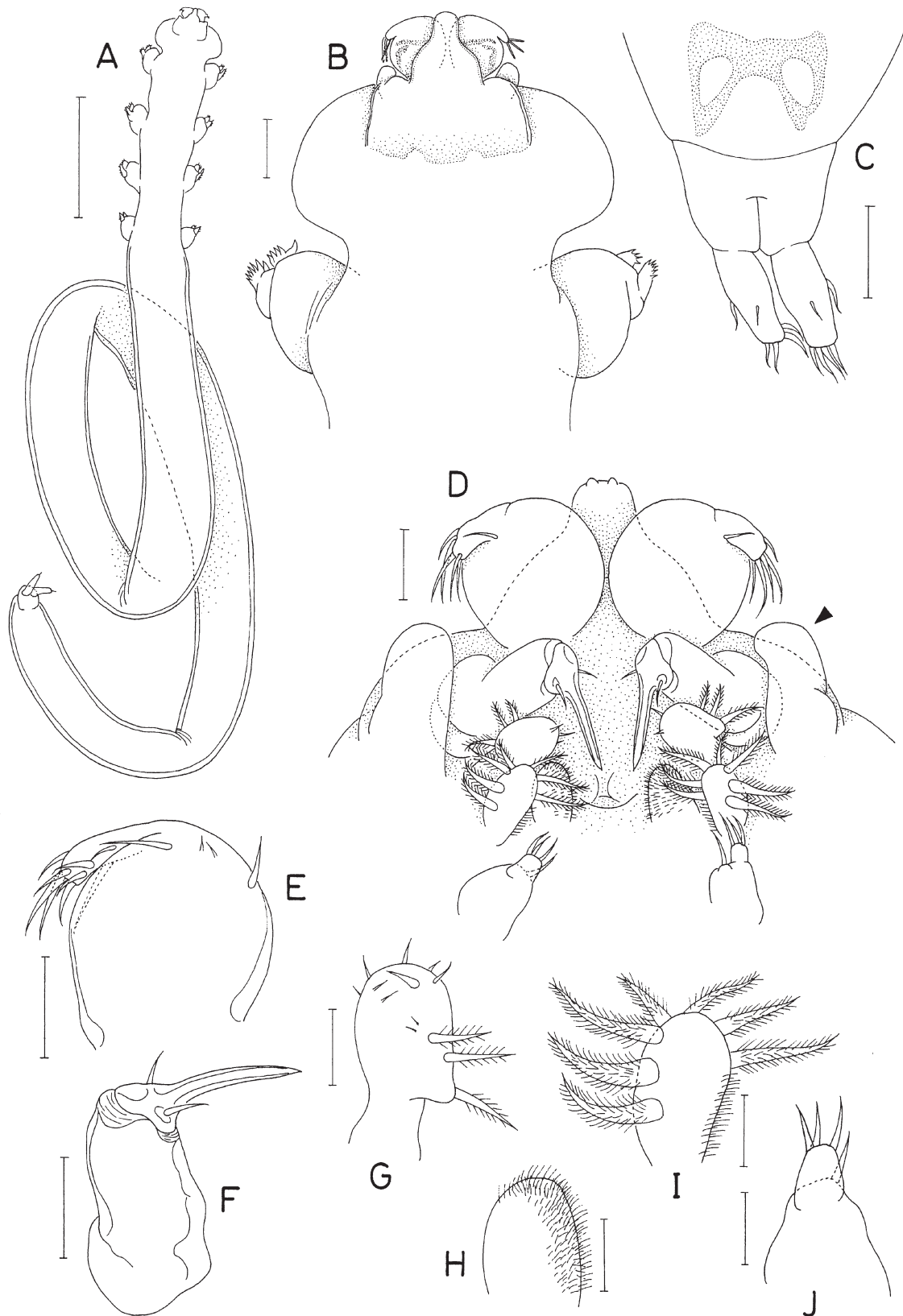
	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	8	6
Leg 2	0-0	1-0	11	8 or 9
Leg 3	0-0	1-0	12 or 13	9
Leg 4	0-1	1-0	11 to 13	8
Leg 5	absent.			

### **Brief description of female associated with *Eudistoma* sp. in New Caledonia**

Body (Fig. 412A, B) similar in form to that of type material, but smaller. Body lengths of 2 dissected specimens 4.26 and 4.68 mm; widths 0.18 and 0.17 mm, respectively. Cephalosome 205 µm wide, and antennal region 146 µm wide. Caudal ramus (Fig. 412C) about 2.6 times longer than wide (55×21 µm).

Rostrum, antennule, and antenna (Fig. 412E) as in type material. Mandible similar to that of type material, but with 7 more distinct, pinnate setae, without setules. Maxillule and maxilla (Fig. 412G) as in type material.





**FIGURE 410.** *Scolecodes helacinus* sp. nov., female. A, habitus, dorsal; B, anterior part of prosome, dorsal; C, posterior end of body, dorsal; D, cephalic region, ventral view showing blunt lateral processes (arrowhead); E, antennule; F, antenna; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scale bars: A, 0.5 mm; B, C, 0.05 mm; D–F, 0.02 mm; G–J, 0.01 mm.

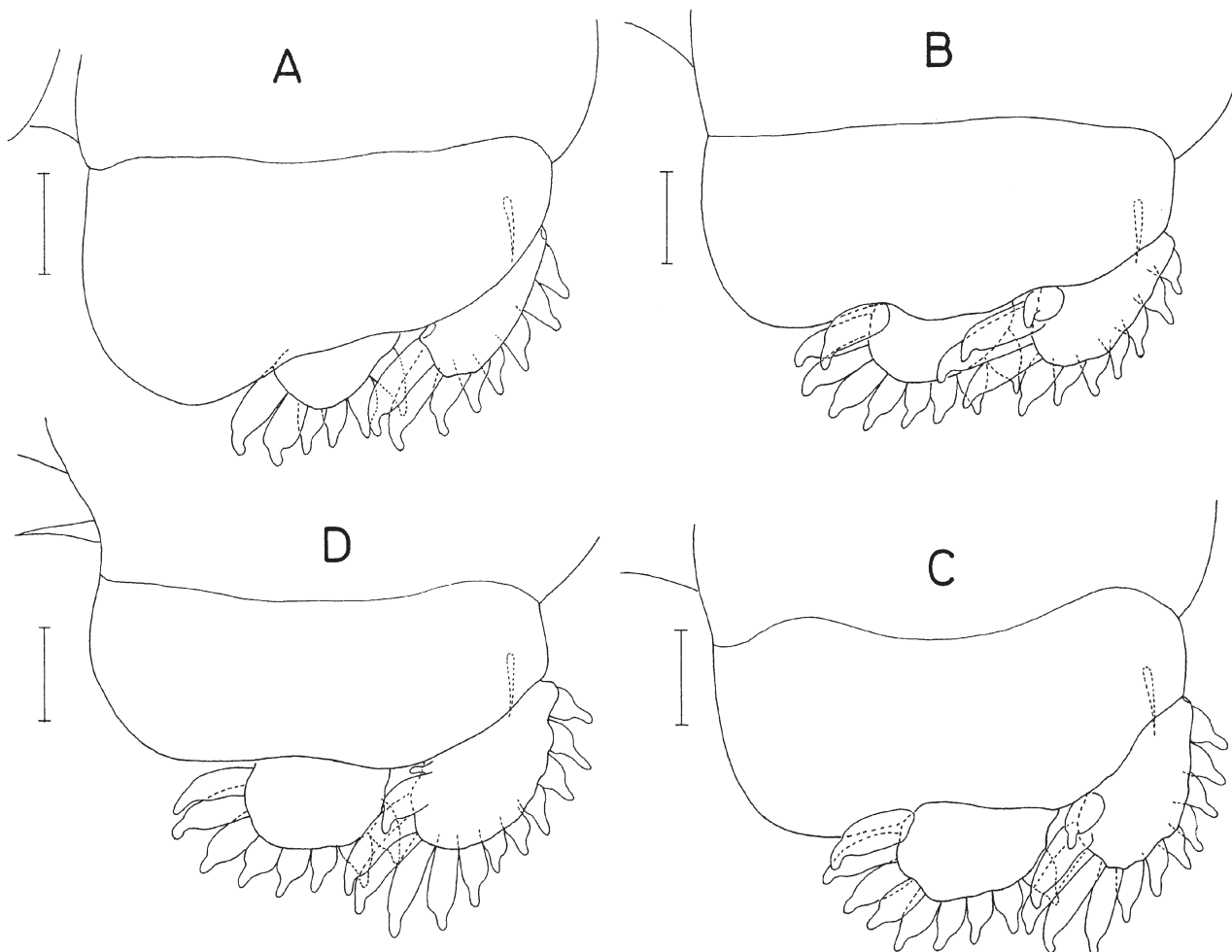


FIGURE 411. *Scolecodes helycinus* sp. nov., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: 0.02 mm.

Legs 1–4 as in type material in form, with armature formula as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	8	6 or 7
Leg 2	0-0	1-0	12 or 13	8 or 9
Leg 3	0-0	1-0	11 to 13	9
Leg 4	0-1	1-0	11 or 12	8 or 9
Leg 5	absent.			

**Brief description of female associated with *Eudistoma* sp. in Madagascar.**

Body (Fig. 413A, B) contracted into tight spiral: body length 5.1 mm in large dissected specimen. Cephalosome (Fig. 413C) 300 µm wide, and antennal region 171 µm. Abdomen (Fig. 413E) unsegmented, 70×89 µm. Caudal rami (Fig. 413E) 2.04 times longer than wide (67×33 µm), almost fully fused with abdomen.

Rostrum and antennule (Fig. 413D) as in type

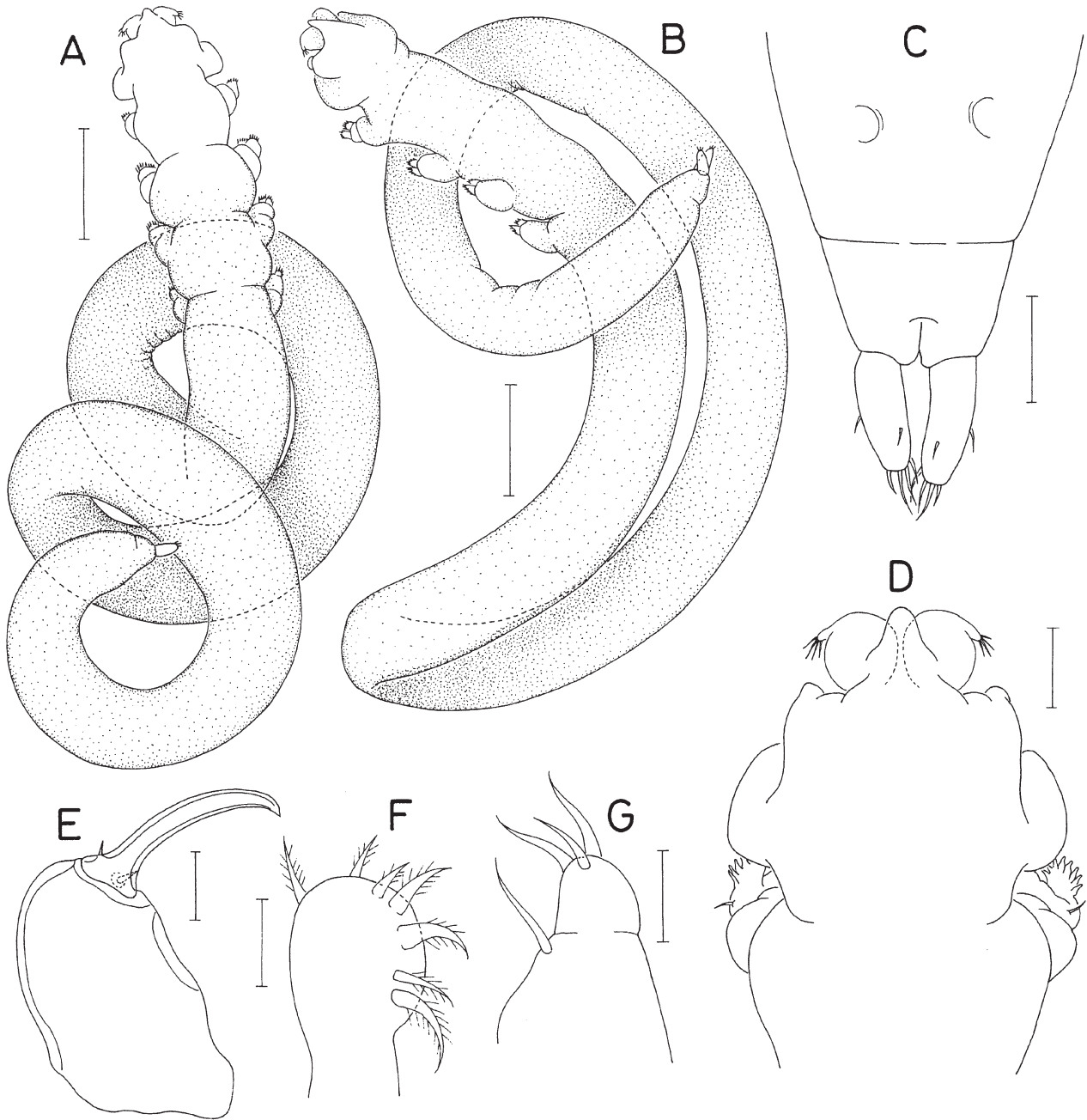
material, with scattered minute papillae. Antenna (Fig. 413F) with 6 minute setal vestiges (2 inner and 4 outer) on endopod (terminal segment). Mandible (Fig. 413A) with 6 small naked setae and 3 patches of minute spinules. Maxillule (Fig. 414B) with 7 plumose setae and patches of setules. Maxilla (Fig. 414C) armed with 1 plumose medial seta and 3 apical setae; ornamented with several patches of setules.

Legs 1–4 (Fig. 414D–G) each with unsegmented protopod, but coxa and basis recognizable by constriction. Outer seta on basis larger than in type material and plumose. Armature formula of legs 1–4 not significantly different from type material, as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-0	8	6
Legs 2 & 3	0-0	1-0	12 or 13	9
Leg 4	0-1	1-0	11 or 12	8

**Male.** Unknown.

**Remarks.** The type material of this new species was

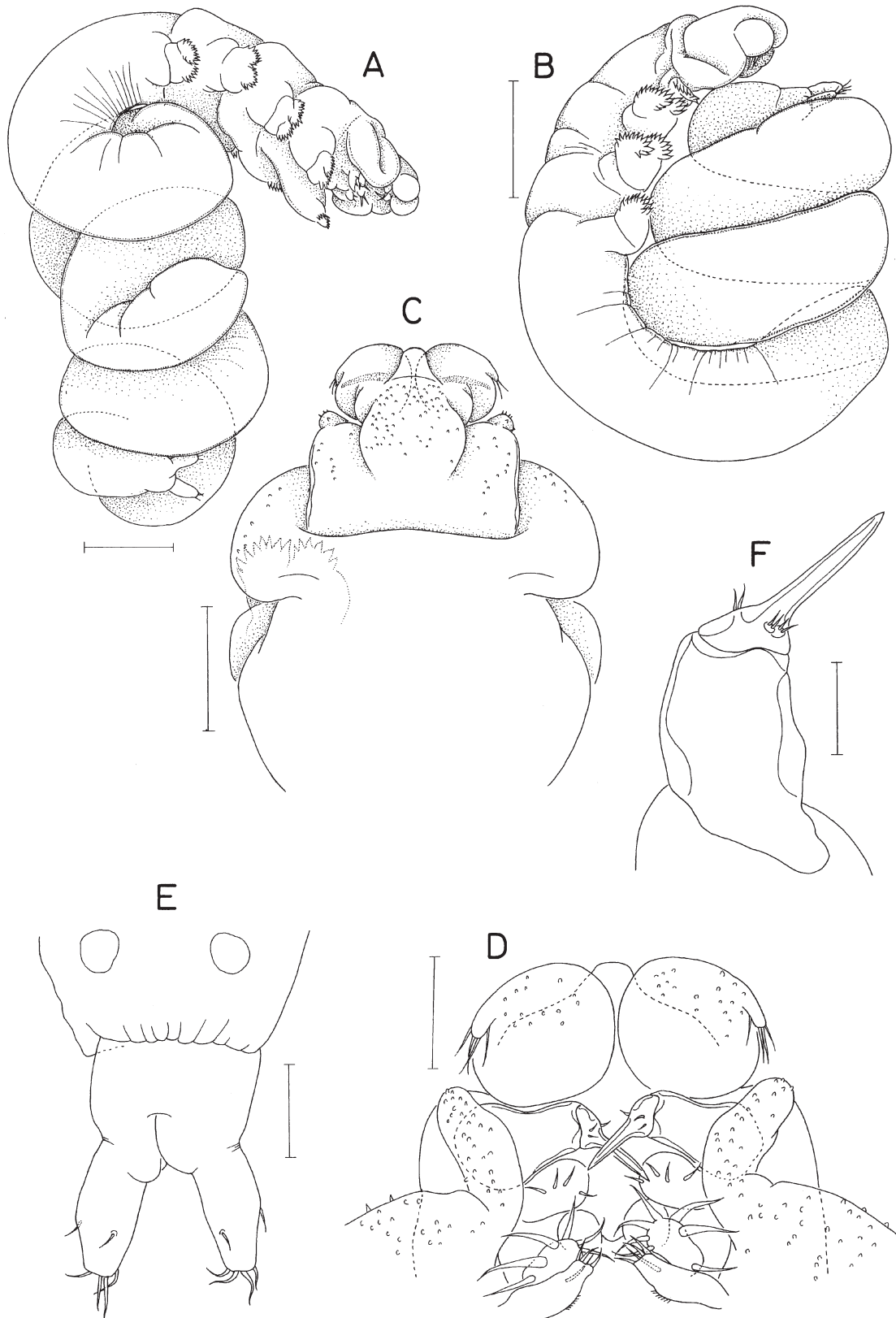


**FIGURE 412.** *Scolecodes helycinus* sp. nov., female. A, habitus, dorsal; B, habitus, dorsolateral; C, posterior end of body, dorsal; D, anterior part of prosome, dorsal; E, antenna; F, mandible; G, maxilla. Scale bats: A, B, 0.2 mm; C, D, 0.05 mm; E–G, 0.01 mm.

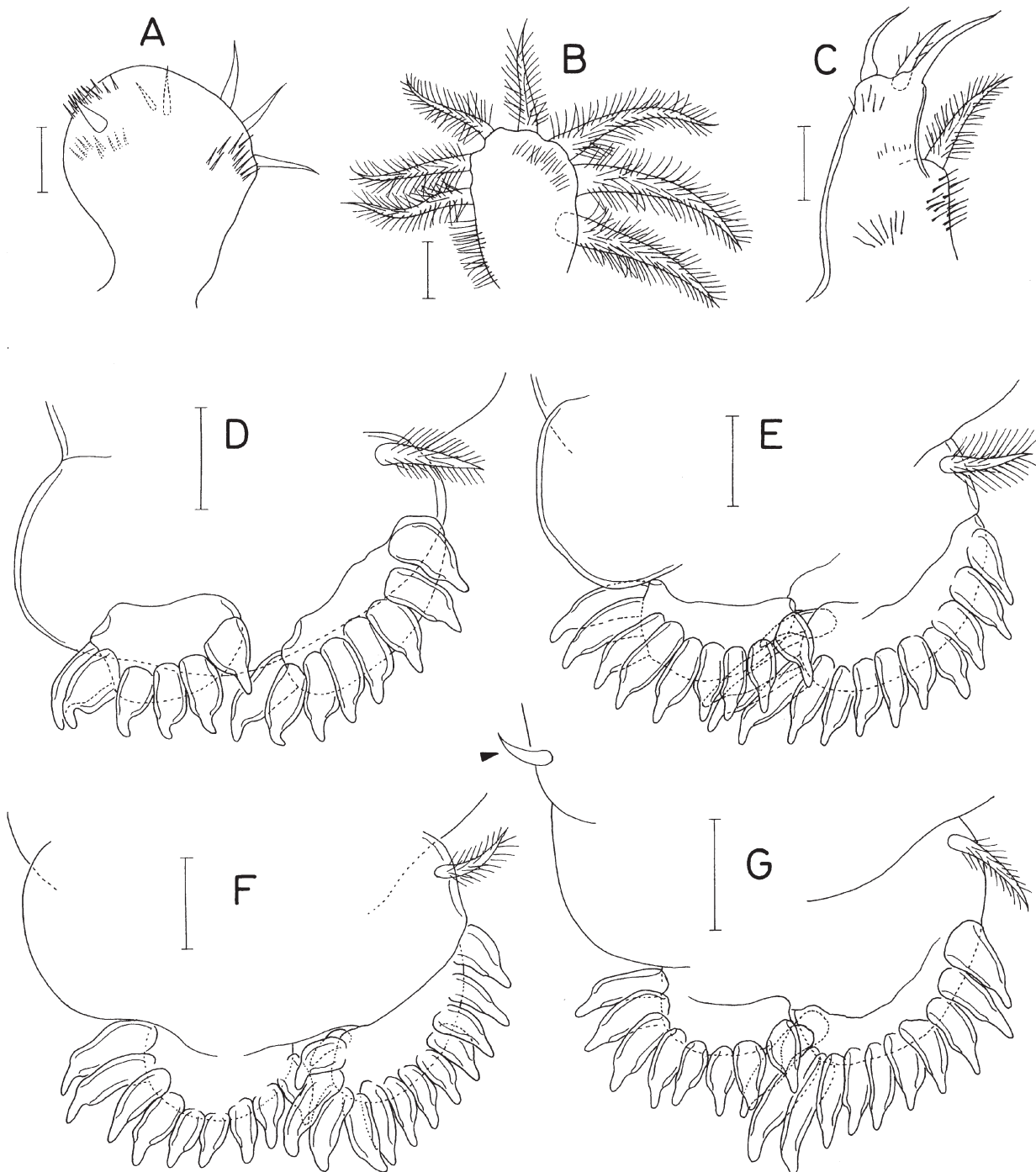
extracted from *Polyclinum isipingense* from Madagascar and other three samples were examined from *Eudistoma* species from New Caledonia, Mabul in Malaysia, and Madagascar. The specimens of the latter three samples are treated here as conspecific with the type material because we could not find any significant differences between these samples, although the setal numbers on the mandible and the legs, and the size and form of the setae on the mandibles and maxillae were found to be

highly variable between individuals within a single sample.

*Scolecodes helycinus* sp. nov. can easily be differentiated from its three congeners by the coiled body and by the presence of the inner seta on the coxa of leg 4. *Scolecodes helycinus* sp. nov. shares unsegmented exopods in legs 1–4 with the type species *S. huntsmani*, but it can readily be distinguished from the latter species by the two differences highlighted above, and by the



**FIGURE 413.** *Scolecodes helycinus* **sp. nov.**, female. A, B, habitus, right; C, anterior part of prosome, dorsal; D, cephalic region, ventral; E, posterior end of body, dorsal; F, antenna. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D, E, 0.05 mm; F, 0.02 mm.



**FIGURE 414.** *Scolecodes helicinus* **sp. nov.**, female. A, mandible; B, maxillule; C, maxilla; D, leg 1; E, leg 2; F, leg 3; G, leg 4. Scale bars: A–C, 0.01 mm; D–G, 0.02 mm.

presence of more setae (7, compared to 6 in *S. huntsmani*) on the maxillule, and significantly fewer setae on legs 1–4, (setal numbers of *S. huntsmani*, are 10, 16, 16, and 15 respectively on the exopods of legs 1–4, and 13, 16, 15, and 18 on the endopods, as redescribed by Illg (1958)).

It is notable that *S. helicinus* **sp. nov.** is associated with colonial ascidians, while its three congeners are

associated with solitary ascidians. Despite this, the body of *S. helicinus* **sp. nov.** is generally larger than those of the other three species.

## Genus *Janstockia* Boxshall & Marchenkov, 2005

**Diagnosis.** Body vermiform, elongate, cylindrical, consisting of cephalosome, long metasome and small abdomen. Cephalosome defined from metasome; metasome forming brood pouch and incorporating fifth pedigerous somite. Genital openings located posteriorly on prosome. Abdomen unsegmented, small, incompletely articulated from prosome. Caudal rami fused to somite, or apparently absent resulting from complete incorporation into rear margin of anal somite. Rostrum tapering. Antennule indistinctly 2- or 3-segmented. Antenna 3-segmented; comprising coxa, basis and unsegmented endopod terminating in claw. Labrum small. Mandible and maxillule lobate, bearing setae. Maxilla absent. Maxilliped 2-segmented. Legs 1–4 broad, biramous, each with unsegmented or obscurely 2-segmented protopod: basis with outer seta in all legs; basis of leg 1 lacking inner distal element. Exopods unsegmented, 2-segmented or indistinctly 3-segmented (leg 1 only); claw-like process present on exopods of legs 2–4. Endopods typically unsegmented, or indistinctly 3-segmented (leg 1 only). Leg 5 absent.

**Type species.** *Janstockia phallusiella* Boxshall & Marchenkov, 2005, by original designation.

**Remarks.** This genus was defined by Boxshall & Marchenkov (2005) after detailed comparison with related genera.

### *Janstockia clavelinae* sp. nov.

(Figs. 415, 416)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21441) and dissected paratype (♀, figured) from *Clavelina fecunda* (Sluiter, 1904), AURACEA 1995, south of Matemo, Ibo, Mozambique, depth 15 m, Monniot coll., 17 November 1995.

**Etymology.** The new species is named after *Clavelina*, the generic name of the type host.

**Description of female.** Body (Fig. 415A) vermiform, elongate, cylindrical; consisting of cephalosome, long metasome and short abdomen; body length 6.65 mm. Cephalosome (Fig. 415B, C) defined but not articulated from metasome; width 0.66 mm, length 0.47 mm, with paired expanded ventral folds covered with ornamentation of minute setules. Metasome with weak lateral constriction between first pedigerous somite and remaining part (Fig. 415B): distances between 4 leg pairs 0.32, 1.14, and 2.42 mm, respectively and distance from leg 4 to posterior margin of abdomen 2.21 mm. Fifth pedigerous and genital somites incorporated into metasome; copulatory pore present on posteroventral surface (Fig. 415E). Abdomen (Fig. 415D) 157×173 µm, unsegmented, bilobed posteriorly, defined from metasome by dorsal suture line, but lacking any suture line ventrally (Fig. 415E). Caudal

rami not defined; 6 small caudal setae present on apex of each posterior margin lobe (Fig. 415E).

Rostrum (Fig. 415F) small and tapering, with narrower apical part. Antennule (Fig. 415G) strongly tapering, indistinctly 3-segmented, ornamented with setules on first and second segments; first segment longer than remaining part; armature formula 0, 2+aesthetasc, and 9+2 aesthetascs. Antenna (Fig. 416A) stout, 3-segmented; first segment (coxa) very broad and short, unarmed; second segment (basis) wider than long, unarmed; terminal segment (endopod) produced into distal claw, armed with 4 small setae near middle.

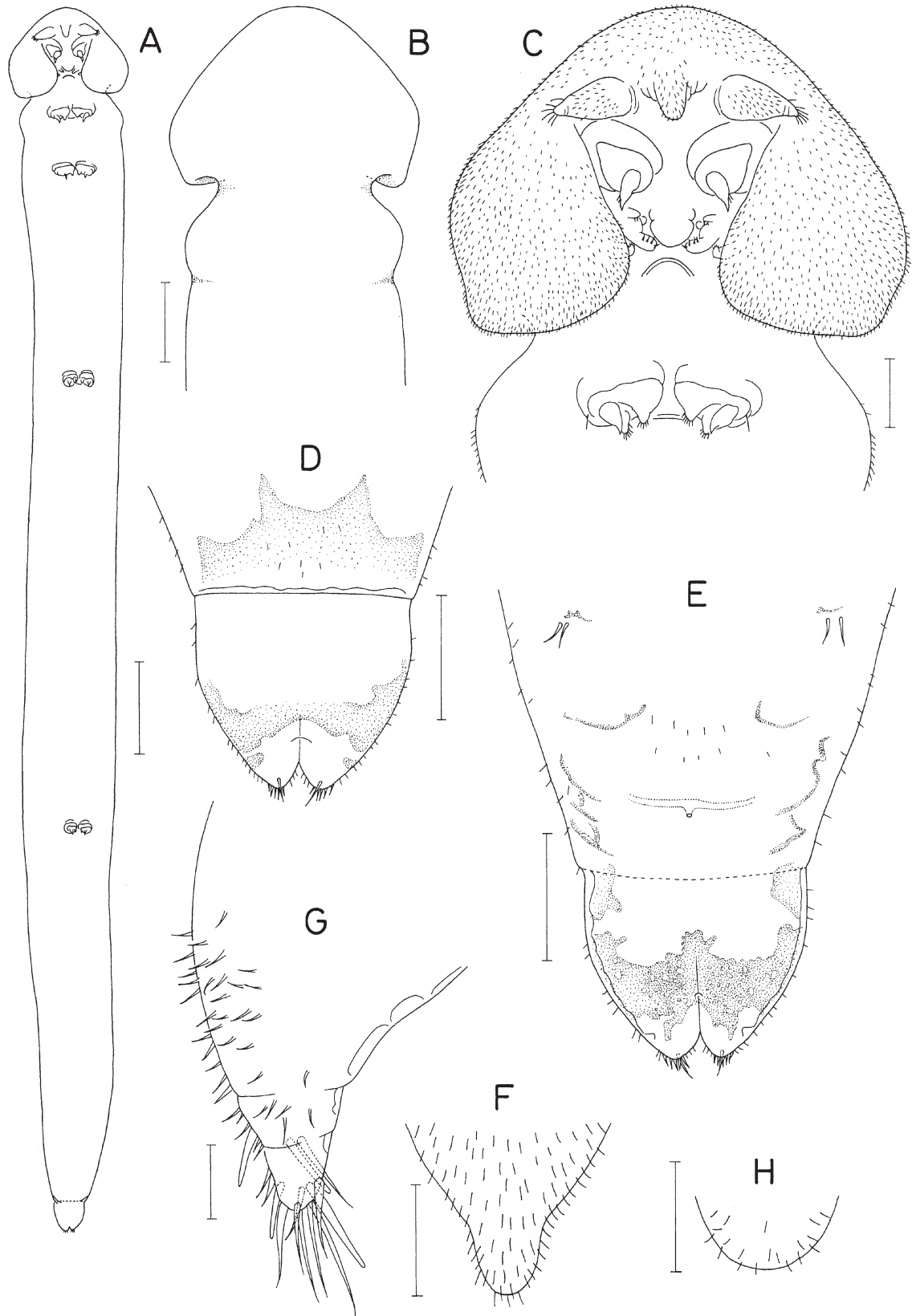
Labrum (Fig. 415H) small, semicircular. Mandible (Fig. 416B) as elongate lobe bearing 3 setae distally. Maxillule (Fig. 416C) broad, distally bilobed, and armed with 5 broad, plumose setae (1 on narrow outer lobe and 4 on broad inner lobe). Maxilla absent. Maxilliped (third mouthpart) (Fig. 416D) 2-segmented, unarmed, covered with setules; proximal segment tapering; distal segment with tapering distal tip.

Legs 1–4 wider than long, biramous with obscurely segmented protopods and unsegmented rami; coxa unarmed, but basis with pinnate outer seta. Leg 1 (Fig. 416E) with patches of fine spinules on ventral surface of coxa and inner ventrodistal surface of basis; exopod with claw-like process and 8 small setae; endopod smaller than exopod with 6 small setae. Leg 2 (Fig. 416F) with row of fine spinules on ventral surface of coxa; basis smooth; exopod with strong, claw-like process and 8 small setae; endopod with 9 small setae. Leg 3 shaped and armed as in leg 2. Leg 4 also shaped as leg 2, except bearing 7 setae on both rami.

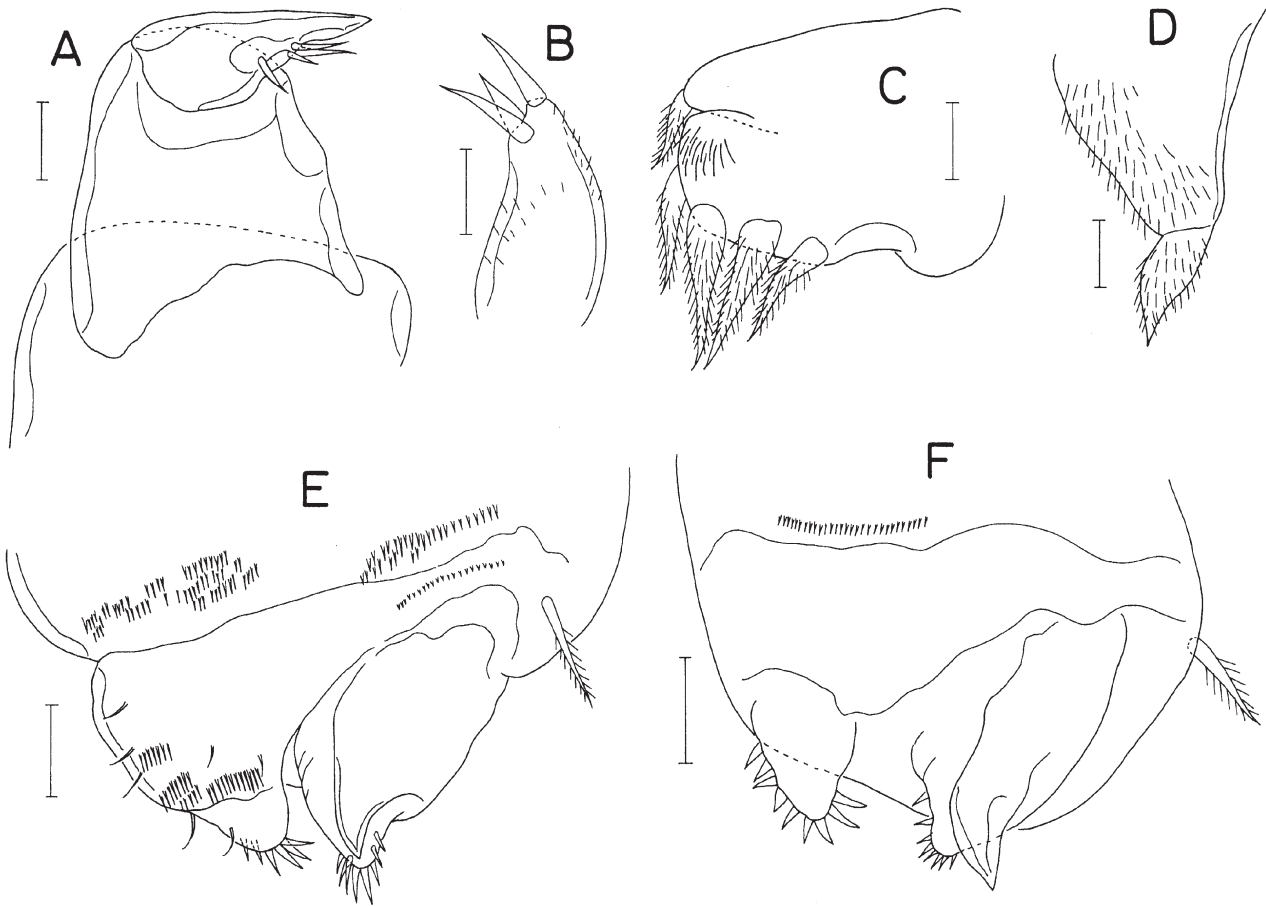
Leg 5 (Fig. 415E) represented by pair of small setae on ventral surface of metasome.

**Male.** Unknown.

**Remarks.** Two species are currently known in the genus *Janstockia*: *J. phallusiella* from the Suez Canal and Red Sea (Boxshall & Marchenkov, 2005; Kim I.H. *et al.*, 2016), and *J. truncata* Kim I.H. & Moon, 2011 from Korea (Kim I.H. & Moon, 2011). In these two species, the trunk bears a pair of lateral wing-like expansions on the first pedigerous somite (such wing-like expansions are absent in *J. clavelinae* sp. nov.), the basis of leg 1 bears a broad inner distal seta which is absent in *J. clavelinae* sp. nov., the mandible is armed with 7 setae compared with 3 setae in *J. clavelinae* sp. nov., the maxillule is armed with 6 or 7 setae (cf. 5 setae in *J. clavelinae* sp. nov.) and some of these setae expanded and globular (cf. all setae attenuated in *J. clavelinae* sp. nov.). These differences allow *J. clavelinae* sp. nov. to be readily differentiated from its two congeners.



**FIGURE 415.** *Janstockia clavelinae* sp. nov., female. A, habitus, ventral; B, anterior part of body, dorsal; C, cephalosome and leg 1, ventral; D, abdomen, dorsal; E, posterior end of body, ventral; F, rostrum; G, antennule; H, labrum. Scale bars: A, 0.5 mm; B, 0.2 mm; C–E, 0.1 mm; F, H, 0.05 mm; G, 0.02 mm.



**FIGURE 416.** *Janstockia clavelinae* sp. nov., female. A, antenna; B, mandible; C, maxillule; D, maxilliped; E, leg 1; F, leg 2. Scale bars: A, E, F, 0.02 mm; B–D, 0.01 mm.

***Janstockia dasicephala* sp. nov.**

(Figs. 417, 418)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21442) from *Eudistoma murrayi* (Kott, 1957) (MNHN-IT-2008-4123 = MNHN A3/EUD/162), CRRF OCDN 3757-S, Pemba, Tanzania (5°23.45'S, 39°37.86'E), depth 18 m, 29 January 1996.

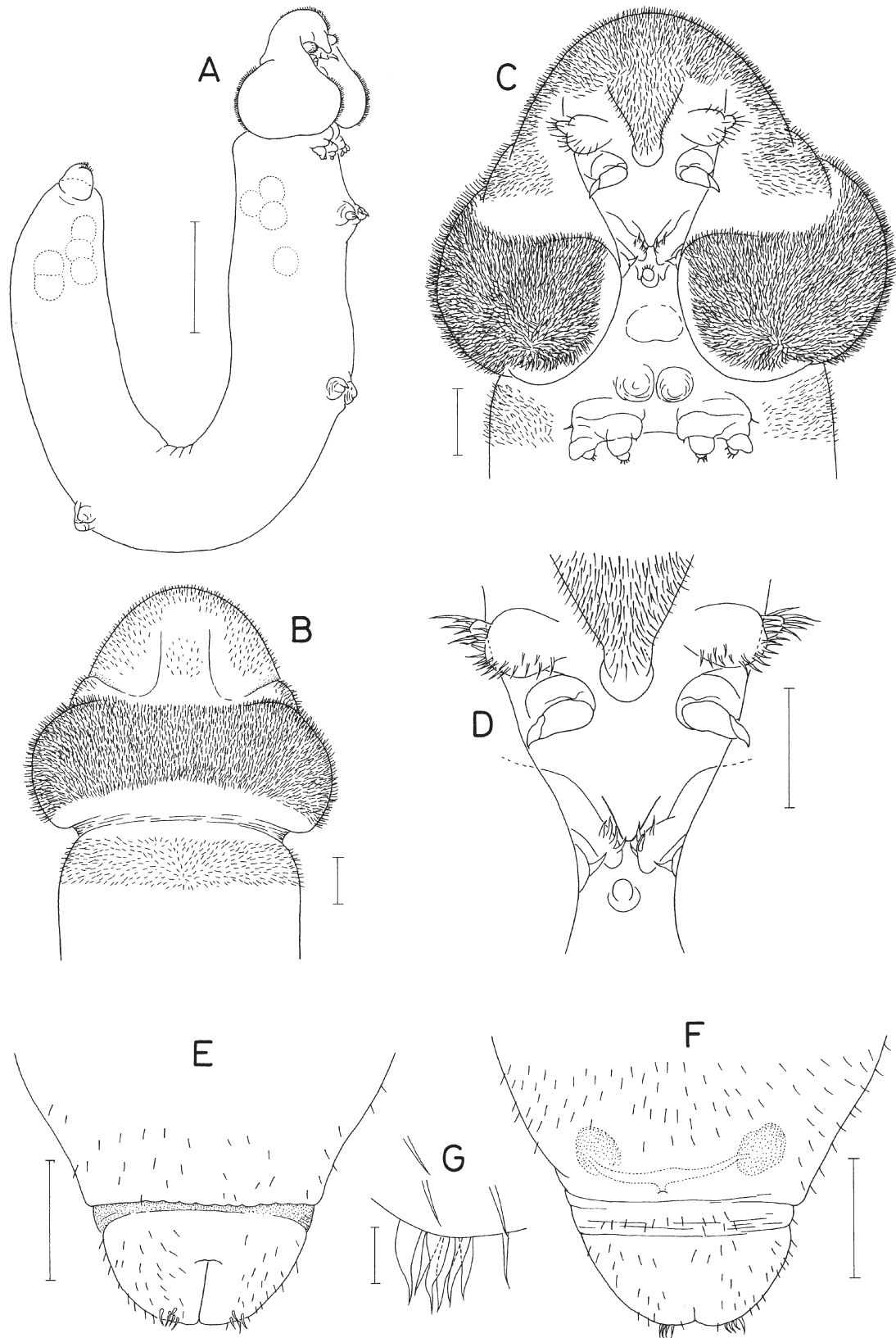
**Etymology.** The specific name is derived from the Greek *das* (=hairy) and *cephala* (=head), alluding to the dense hair-like ornamentation covering the cephalosoma of the new species.

**Description of female.** Body (Fig. 417A) vermiform, cylindrical, consisting of cephalosoma, metasoma, and small abdomen. Body length 4.36 mm. Cephalosoma (Fig. 417B, C) 509×655 µm, demarcated from trunk by constriction; surface of anterior half setulose, posterior half of cephalosoma laterally expanded and densely ornamented with broad band of setules. Metasoma maximum width 0.51 mm, entire metasoma forming brood pouch, strongly recurved dorsally; surface sparsely setulose except anteriorly where more dense setules

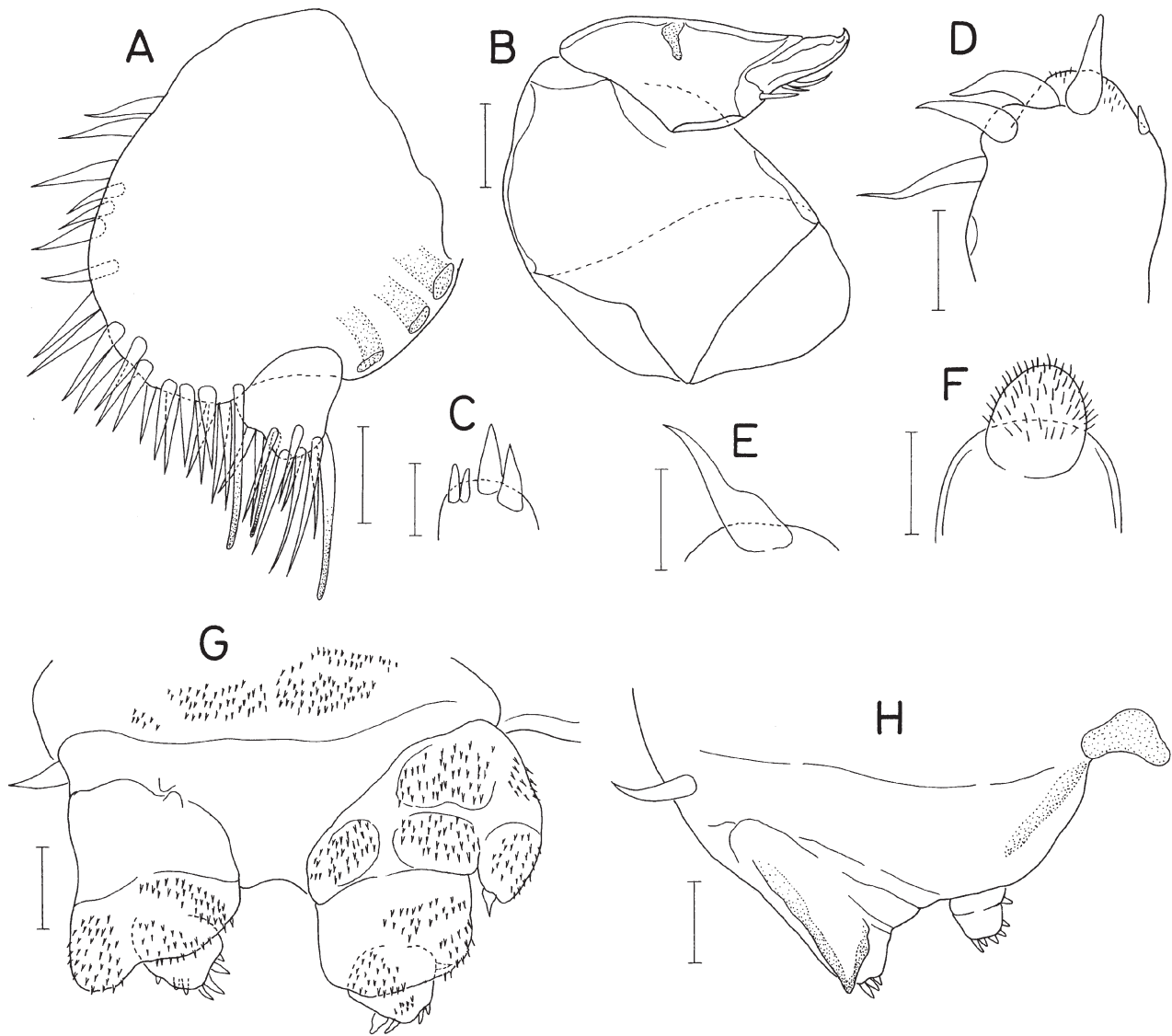
present at level of leg 1 (Fig. 417B). Pair of tubercles present on ventral surface of metasoma just anterior to base of first legs (Fig. 417C). Legs 1–4 separated from one another by intervals of 0.32, 0.77, and 1.40 mm; distance from leg 4 to posterior margin of abdomen 1.50 mm. Posterior end of metasoma incorporating genital somite, narrow, with copulatory pore on ventral surface (Fig. 417F). Abdomen (Fig. 417E, F) small, unsegmented, wider than long (102×186 µm) demarcated from metasoma by furrow dorsally (Fig. 417E) and by 2 or 3 indistinct folds ventrally (Fig. 417F). Posterior margin of abdomen weakly bilobed with median anal slit, caudal rami not delimited, represented by 6 minute caudal setae on each posterior margin lobe (Fig. 417G).

Rostrum (Fig. 417C, D) longer than wide, tapering towards rounded apex. Antennule (Fig. 418A) 2-segmented, consisting of expanded first segment (79×74 µm) bearing 23 setae +1 aesthetasc, and small second segment (22×22 µm) armed with 10 setae + 2 aesthetascs; setae crowded, small and naked. Antenna (Fig. 418B) extremely stout, 3-segmented; coxa and basis unarmed; unsegmented endopod about 1.6 times longer than wide





**FIGURE 417.** *Janstockia dasicephala* **sp. nov.**, female. A, habitus, right; B, cephalosome, dorsal; C, cephalosome and leg 1, ventral; D, antennal and oral region, ventral; E, urosome, dorsal; F, urosome, ventral; G, distal margin of urosome, showing caudal setae. Scale bars: A, 0.5 mm; B–F, 0.1 mm; G, 0.01 mm.



**FIGURE 418.** *Janstockia dasicephala* sp. nov., female. A, antennule; B, antenna; C, mandible; D, maxillule; E, third mouthpart; F, post-oral protuberance; G, leg 1; H, leg 2. Scale bars: A, B, D–H, 0.02 mm; C, 0.01 mm.

(44×28 μm), with trace of articulation in middle; armed with 3 small setae distally plus short, stout terminal claw, articulated from endopod.

Labrum (Fig. 417D) small and tapering. Mandible (Fig. 418C), maxillule (Fig. 418D), maxilliped (third pair of mouthparts; Fig. 418E) each represented by small lobe, bearing 4 setae, 5 setae (1 small, 4 large), and 1 seta, respectively. Small bimerous tubercle (Fig. 418F) present in ventral midline posterior to mouthparts (Fig. 417D).

Leg 1 (Fig. 418G) biramous with indistinctly 2-segmented protopod and 3-segmented rami, although articulation between first and second segments of both rami indistinct. Coxa ornamented with spinules on ventral surface; basis bearing outer seta. First endopodal segment broadened, with 1 small seta at inner distal corner. Third segment of both rami much narrower than

proximal segments. First and second exopodal segments and second endopodal segment unarmed. Third segment of exopod and endopod armed with 7 and 5 (or 6) small setae, respectively. Second exopodal segment and first and second endopodal segments ornamented with patches of spinules.

Leg 2 (Fig. 418H) consisting of unsegmented protopod, unsegmented exopod, and small, indistinctly 2-segmented endopod. Protopod with outer seta. Exopod indistinctly demarcated from protopod, tapering, with sclerotized, claw-like process and 3 setae. Endopod with 1 inner seta on first segment and 5 distal setae on second; all setae on rami minute. Leg 3 shaped as leg 2, but with only 4 setae on second endopodal segment. Leg 4 also shaped as leg 2, but with 6 setae on second endopodal segment. Leg 5 absent.

**Male.** Unknown.

**Remarks.** In the absence of anterolateral wings on the metasome, the lack of the inner distal seta on the basis of leg 1, and of any globularly expanded setae on the maxillule, *Janstockia dasicephala* **sp. nov.** is more similar to *J. clavelinae* **sp. nov.** than to *J. phallusiella* and *J. truncata*. However, *J. dasicephala* **sp. nov.** can be differentiated from *J. clavelinae* **sp. nov.** and other congeners by five outstanding features, as follows: (1) the posterior half of the cephalosome is expanded and its surface is densely covered with setules, (2) the antennule is distinctly 2-segmented and consists of a swollen first and small second segment, (3) the maxilliped is represented by a small lobe tipped with a seta, (4) a single, bimerous tubercle is present on the ventral midline posterior to the mouthparts, and (5) leg 1 lacks any claw-like process on the exopod. These differences are sufficient to justify the establishment of the new species.

### Genus *Ooneides* Chatton & Brément, 1915

**Diagnosis.** Body ovoid, laterally compressed: comprising cephalosome, first to fifth pedigerous somites and genital somite all completely fused plus extremely reduced abdomen. Entire prosome forming brood pouch with extreme dorsal expansion displacing cephalic appendages and abdomen, so that both positioned ventrally, close to each other. Abdomen rudimentary, not articulated from prosome, unsegmented or obscurely segmented. Caudal rami small, bearing small setae. Rostrum distinct. Antennule short, 2-segmented with second segment small. Antenna 3-segmented with small terminal claw. Labrum broad. Mandible and maxillule each as lobe bearing few setae. Maxilla and maxilliped absent. Leg 1 broad, lamellate, directed anteriorly, weakly bilobed distally, with claw on tip of inner lobe (endopod). Legs 2–5 absent.

**Type species.** *Ooneides amela* Chatton & Brément, 1915 by original monotypy.

**Remarks.** This genus may be characterised by its ovoid body and highly reduced abdomen, by the presence of vestigial mandibles and maxillules, the lack of the maxillae and maxillipeds, by the presence of a lamellate, unsegmented leg 1, and by the absence of legs 2–5. The discovery of an additional species described below, helps to further refine the generic boundaries of *Ooneides*.

### *Ooneides californica* **sp. nov.** (Fig. 419)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21443) from an ascidian of the family Didemnidae, La Jolla, California, USA, R. A. Lewin coll., 12 December 1985.

**Etymology.** The species name refers to the type locality, California.

**Description of female.** Body (Fig. 419A) ovoid, laterally compressed, unsegmented, with minute abdomen. Body length (prosoma length) 2.29 mm; dorsoventral depth 1.66 mm. Cephalosome not defined. Cephalic appendages and abdomen close to each other, both positioned on short ventral margin of body. Copulatory pore present on ventrodorsal surface of body, just anterior to base of abdomen. Abdomen (Fig. 419B) rudimentary, not articulated from prosoma, unsegmented, much wider than long. Caudal rami small, not articulated from abdomen; armed with 2 (on right caudal ramus) or 4 (on left caudal ramus) setae.

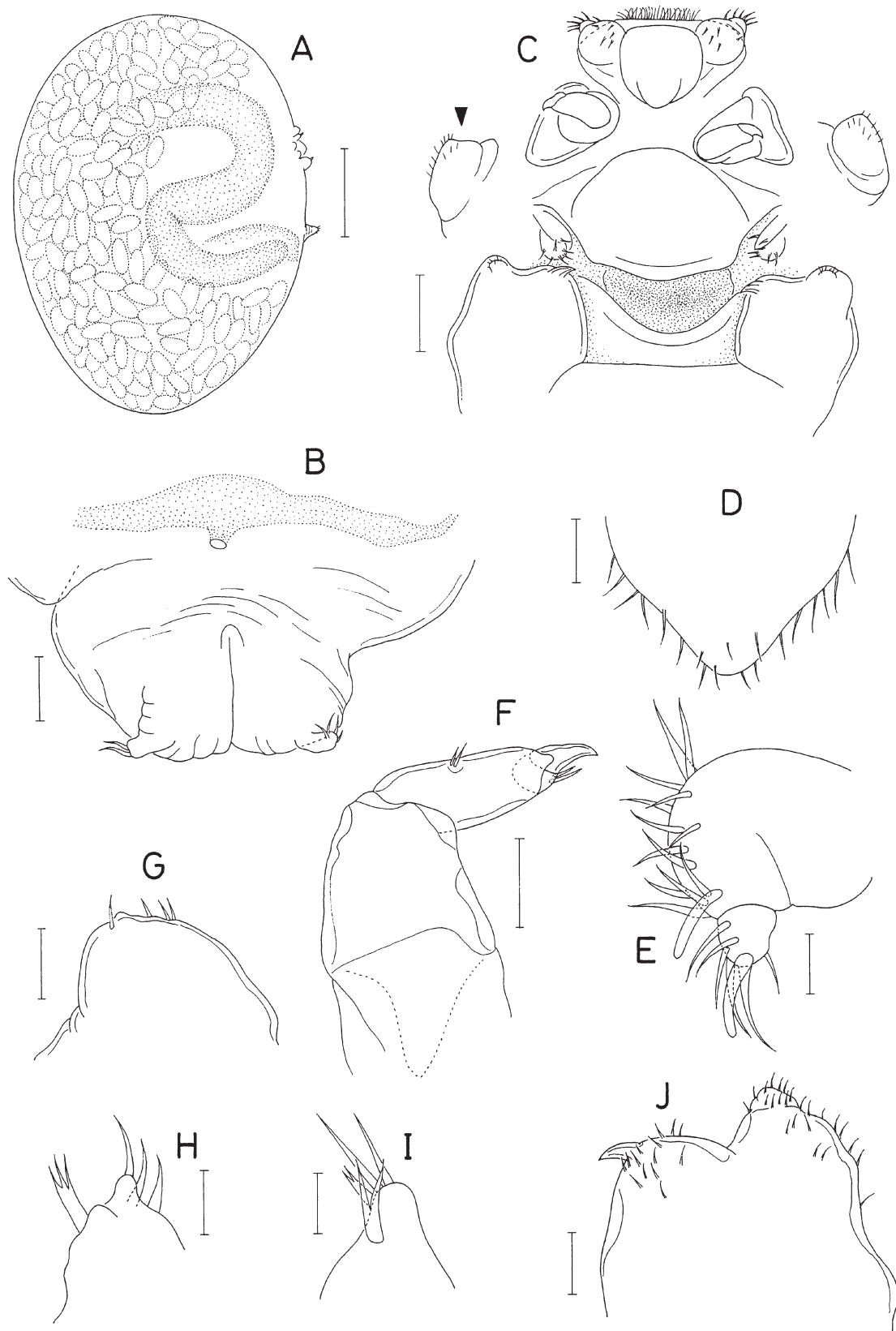
Rostrum (Fig. 419D) strongly tapering, wider than long, sparsely setulose along free posterior margin. Antennule (Fig. 419E) 2-segmented, strongly curved with expanded first segment and small second segment; armature comprising 13 setae and 1 aesthetasc on first segment, 6 setae and 1 aesthetasc on second. Antenna (Fig. 419F) stout, 3-segmented; coxa and basis unarmed; unsegmented endopod twice as long as wide (34×17 µm); armed with 4 small setae (2 in middle and 2 distal) plus small terminal claw, one-third as long as endopod and distinctly articulated at base.

Labrum (Fig. 419C) with smooth, convex posterior margin. Mandible (Fig. 419H) and maxillule (Fig. 419I) each as small lobe bearing 4 setae, some setae branched distally. Maxilla and maxilliped absent. Paired blunt tubercles (Fig. 419G) present lateral to oral region (indicated by arrowhead in Fig. 419C).

Leg 1 (Fig. 419J) wider than long, lamellate, directed anteriorly, unsegmented, distally bilobed; both lobes setulose; inner lobe bearing apical claw directed medially. Legs 2–5 absent.

**Male.** Unknown.

**Remarks.** *Ooneides amela*, the only previously known species of the genus, was initially recorded from the Mediterranean coast of France (Chatton & Brément, 1915) and later redescribed by Illg & Dudley (1961). *Ooneides californica* **sp. nov.** differs from *O. amela*, as follows: (1) the body is larger, 2.29 mm long, compared to 1.0 to 1.5 mm for *O. amela* measured by Chatton & Brément (1915) or 1.7 mm measured by Illg & Dudley (1961); (2) the rostrum is wider than long, cf. elongate in *O. amela*; (3) the mandible is a simple lobe bearing 4 setae, whereas in *O. amela* it is bilobed, bearing 9 (Chatton & Brément, 1915) or more than 10 setae (Illg & Dudley, 1961); (4) the maxillule is armed with 4 setae, compared to only 2 setae in *O. amela* (Illg & Dudley, 1961); (5) the mouthparts are exposed, whereas they are surrounded by four pairs of ventral lobes as illustrated by Chatton & Brément (1915) and Illg & Dudley (1961); and (6) a prominent tubercle present on each side of the oral region in the new species, which is not present in *O. amela*.



**FIGURE 419.** *Ooneides pacifica* sp. nov., female. A, habitus, right, showing nauplii inside; B, urosome, ventral; C, cephalic appendages and leg 1, ventral *in situ* view showing position of blunt latero-oral tubercles (arrowhead); D, rostrum; E, antennule; F, antenna; G, latero-oral tubercle; H, mandible; I, maxillule; J, leg 1. Scale bars: A, 0.5 mm; B, D, F, G, J, 0.02 mm; C, 0.05 mm; E, H, I, 0.01 mm.

### *Hamaticoxa* gen. nov.

**Diagnosis.** Body vermiform, cylindrical, consisting of cephalosome and elongate trunk. Trunk bilobed posteriorly due to fusion of caudal rami; vestiges of caudal setae present on apex of each lobe. Rostrum well-developed. Antennule short, broad, obscurely segmented, armed with minute setae. Antenna 3-segmented with small terminal claw. Labrum simple. Mandible consisting of coxal gnathobase transformed to powerful, strongly curved hook and small, lobate, unsegmented palp bearing few setae. Maxillule unsegmented with several setae. Maxilla indistinctly 3-segmented with several setae. Maxilliped and legs absent.

**Type species.** *Hamaticoxa nuda* gen. et sp. nov. by original designation.

**Etymology.** The generic name is formed from the combination of the Latin *hamat* (=hooked) and *cox* (=the hip), referring to the hooked coxa of the mandible.

**Remarks.** This new genus is characterised by its unusual mandible in which the coxal gnathobase is transformed to a powerful hook and the palp is rudimentary. Within the Notodelphyidae, a similarly hooked coxal gnathobase on the mandible is present only in *Ademoixys* gen. nov. However, these two genera cannot be confused, because in the latter the body is fusiform, with a free urosome and distinct caudal rami, the mandibular palp is biramous, and the maxillipeds and legs 1–5 are present.

### *Hamaticoxa nuda* gen. et sp. nov.

(Fig. 420)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21444) from *Distaplia* sp., Red Sea coast of Israel, 1962.

**Etymology.** The name is derived from the Latin *nud* (=naked), and alludes to the unornamented body surface of the new species.

**Description of female.** Body vermiform, cylindrical, consisting of cephalosome and elongate trunk (Fig. 420A); body surface smooth without ornamentation of setules or spinules. Cephalosome nearly rectangular, wider than long, slightly narrower than trunk, defined from trunk by lateral constriction, with truncate frontal margin. Trunk unsegmented, gradually narrowing posteriorly towards bilobed posterior margin incorporating paired caudal rami on either side of anal slit (Fig. 420B). Caudal rami fully fused to trunk; represented only by 6 caudal setae on tip of each posterior lobe of trunk (Fig. 420C). Paired spermatophores attached laterally near middle of trunk (Fig. 420A), each (Fig. 420D) 123×55 µm, with thick wall.

Rostrum (Fig. 420E, F) large, about twice as long as wide, with rounded apex. Antennule (Fig. 420I) small, strongly tapering, as long as wide, unsegmented, but

with 3 partial suture lines on posterior surface; armed with more than 10 minute setae, most positioned distally. Antenna (Fig. 420G) stout, 3-segmented, consisting of broad, unarmed coxa and basis, and narrow unsegmented endopod about 2.1 times longer than wide (97×46 µm); armed with 9 minute setae (3 middle, 2 subdistal, and 4 distal) plus small terminal claw (Fig. 420H), one-third as long as endopod, and articulated from endopod.

Labrum simple with straight posterior margin. Mandible (Fig. 420J, K) consisting of coxa and small, unsegmented palp; coxal gnathobase transformed to powerful, strongly curved hook, lacking armature or ornamentation; palp tapering, much shorter than coxal hook, armed with 4 small setae (2 subdistal and 2 distal). Maxillule (Fig. 420L) elongate, unsegmented, bearing 4 broad naked setae (1 proximal, 2 subdistal, and 1 distal). Maxilla (Fig. 420M) indistinctly 3-segmented and armed with 6 large and 2 small setae: 1 on first segment, 2 on second, and 5 on third (2 distal setae small); some of large setae feebly pinnate, others naked. Maxilliped absent. Legs 1–5 absent.

**Male.** Unknown.

**Remarks.** A pair of spermatophores was found attached in the middle of the trunk, not immediately adjacent to the more posteriorly located copulatory pore.

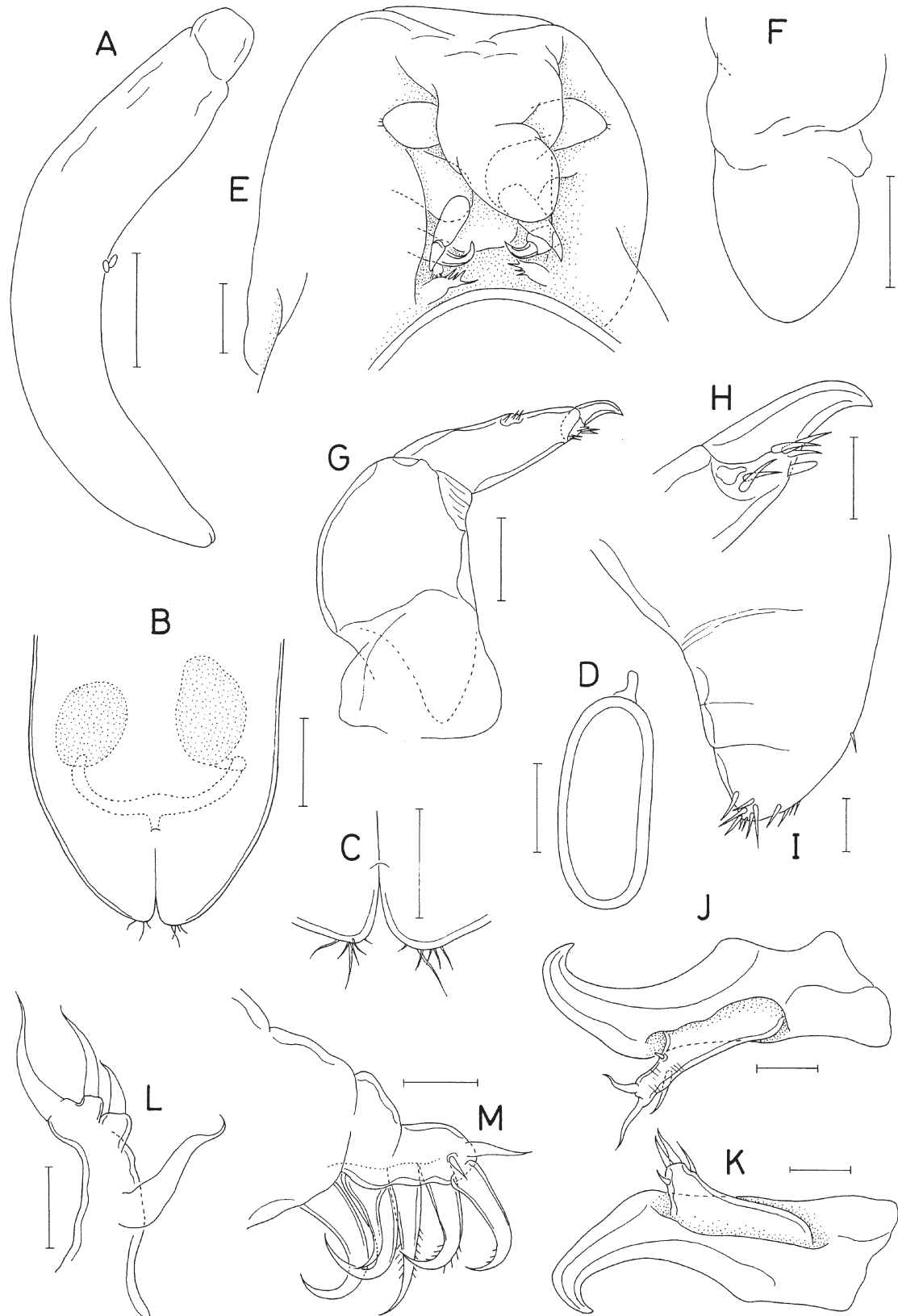
### *Adrodelphys* gen. nov.

**Diagnosis.** Body maggot-like, consisting of unsegmented prosome and small indistinctly 4-segmented urosome. Caudal rami completely fused with last abdominal somite, lacking caudal setae. Rostrum well-developed. Antennule short, 3-segmented with small terminal segment. Antenna 3-segmented with small terminal claw. Mandible biramous and unsegmented; coxa with short, unarmed gnathobase; palp comprising exopod fused with basis, armed with 5 setae, plus endopod also fused with basis and armed with 7 setae. Maxillule consisting of precoxa and biramous palp; precoxal arthrite with 5 setae; palp with 1 seta on epipodite, 2 on basis, 4 on exopod, and 3 on endopod. Maxilla distinctly 5-segmented with 3 endites on syncoxa, 1 seta only on basis, and 1, 1, and 3 setae on first to third endopodal segments, respectively. Maxilliped as small lobe bearing 2 setae distally. Legs 1 and 2 rudimentary, but setiferous. Legs 3–5 absent.

**Type species.** *Adrodelphys tectifera* gen. et sp. nov. by original designation.

**Etymology.** The generic name is derived from the Greek *adr* (=stout) and *-delphys*, the ending of many generic names in the family Notodelphyidae, referring to the stout body of the type species. Gender feminine.

**Remarks.** The establishment of this new genus is justified mainly by the characteristic unsegmented form of the mandible in which the coxal gnathobase is short with a truncate but unarmed medial margin. This



**FIGURE 420.** *Hamaticoxa nuda* gen. et sp. nov., female. A, habitus, dorsal; B, posterior part of trunk, ventral; C, caudal setae; D, spermatophore; E, cephalosome, oblique ventral; F, rostrum (damaged); G, antenna; H, distal part of antenna; I, antennule; J, K, mandibles; L, maxillule; M, maxilla. Scale bars: A, 1 mm; B, E, F, 0.1 mm; C, D, G, 0.05 mm; H–M, 0.02 mm.

gnathobase appears to be non-functional and no similar form of mandibular gnathobase has been reported from any other genus in the Notodelphyidae.

In the presence of all mouthparts plus legs 1 and 2, the new genus is comparable with *Sicyodelphys* Lafargue & Laubier, 1968. The major differences from *Adrodelphys* **gen. nov.**, are that *Sicyodelphys* has a uniramous mandible lacking the coxal gnathobase, an unsegmented maxillule, and biramous but unarmed legs 1 and 2.

### *Adrodelphys tectifera* **gen. et sp. nov.**

(Figs. 421, 422)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21445) from *Leptoclinides apertus* Monniot F., 1989 (syntype MNHN-IT-2008-4769 = MNHN A2/LEP/21), Canal Woodin, Île Ouen, New Caledonia, depth 27 m, Monniot coll., 16 September 1985.

**Etymology.** The species name is derived from the Latin *tect* (=a roof) and *fer* (=carry), referring to the presence of a dorsal tergite on the genital somite.

**Description of female.** Body (Fig. 421A) stout, inflated; body length 1.52 mm. Prosome unsegmented, 1.26 mm long, about twice as long as wide, slightly depressed, dorsoventral depth in middle 0.57 mm. In dorsal and ventral views (Fig. 421B, D), anterior part of prosome bearing 2 weak lateral constrictions delimiting cephalosome, first pedigerous somite, and remaining part of prosome. Free urosome (Fig. 421C) small, occupying about 20% of body length, consisting of genital somite and 3 abdominal somites; defined only by weak ventral and lateral constrictions; ornamented by numerous minute spinules on ventral surface. Genital somite characteristically with dorsal tergite (indicated by arrowheads in Fig. 421A, C). Anal somite bilobed posteriorly, incorporating caudal rami; caudal setae absent.

Rostrum (Fig. 421E) large, elongate, about 1.8 times longer than wide (126×71 µm), with thick wall and rounded apex. Antennule (Fig. 421F) small, 3-segmented; first segment broad and unarmed; second segment also broad and ornamented with many setules; third segment much narrower than proximal segments, subdivided proximally, armed with several longer setules (or setae). Antenna (Fig. 421G) 3-segmented, moderately slender; coxa and basis unarmed; endopod (last segment) about 2.6 times longer than wide (47×18 µm); armed with 7 small setae (3 in middle, 2 subdistal, and 2 distal) plus short terminal claw, about one-third as long as endopod.

Labrum small, not covering mouthparts (Fig. 421D). Mandible (Fig. 421H) unsegmented, without suture between coxa and basis; exopod and endopod also fused with basis; proximal part (coxa) bearing short, truncate gnathobase with setulose medial margin; exopod armed

with 5 setae (outermost seta small, one-third as long as other 4 setae); basis-endopod with 7 setae (3 medial and 4 distal). Maxillule (Fig. 421I) armed with 5 distinct setae on arthrite, 1 on epipodite, 2 on basis, 4 on exopod, and 3 on endopod; coxa lacking endite; all setae densely pinnate, setae on exopod much larger than others. Maxilla (Fig. 422A) 5-segmented; syncoxa with 5 setae grouped as 1, 2, and 2 on first to third endites; basis with 1 seta only; endopod with 1, 1, and 3 setae on first to third segments, respectively; proximal seta on syncoxa and 1 seta on third endopodal segment naked, all other setae pinnate. Maxilliped (Fig. 422B) as small lobe bearing 2 pinnate setae apically.

Legs 1 and 2 rudimentary. Leg 1 (Fig. 422C, D) represented by 2 setiferous lobes; outer lobe tipped with small secondary lobe and armed with 7 setae; inner lobe smaller than outer and armed with 2 setae. Leg 2 (Fig. 422E) represented by small lobe bearing 2 or 3 setae and 1 isolated outer seta. Legs 3-5 absent.

**Male.** Unknown.

**Remarks.** The coxal gnathobase of the mandible has an unarmed medial margin and appears non-functional in the adult female. The morphology of the preceding developmental stages is unknown.

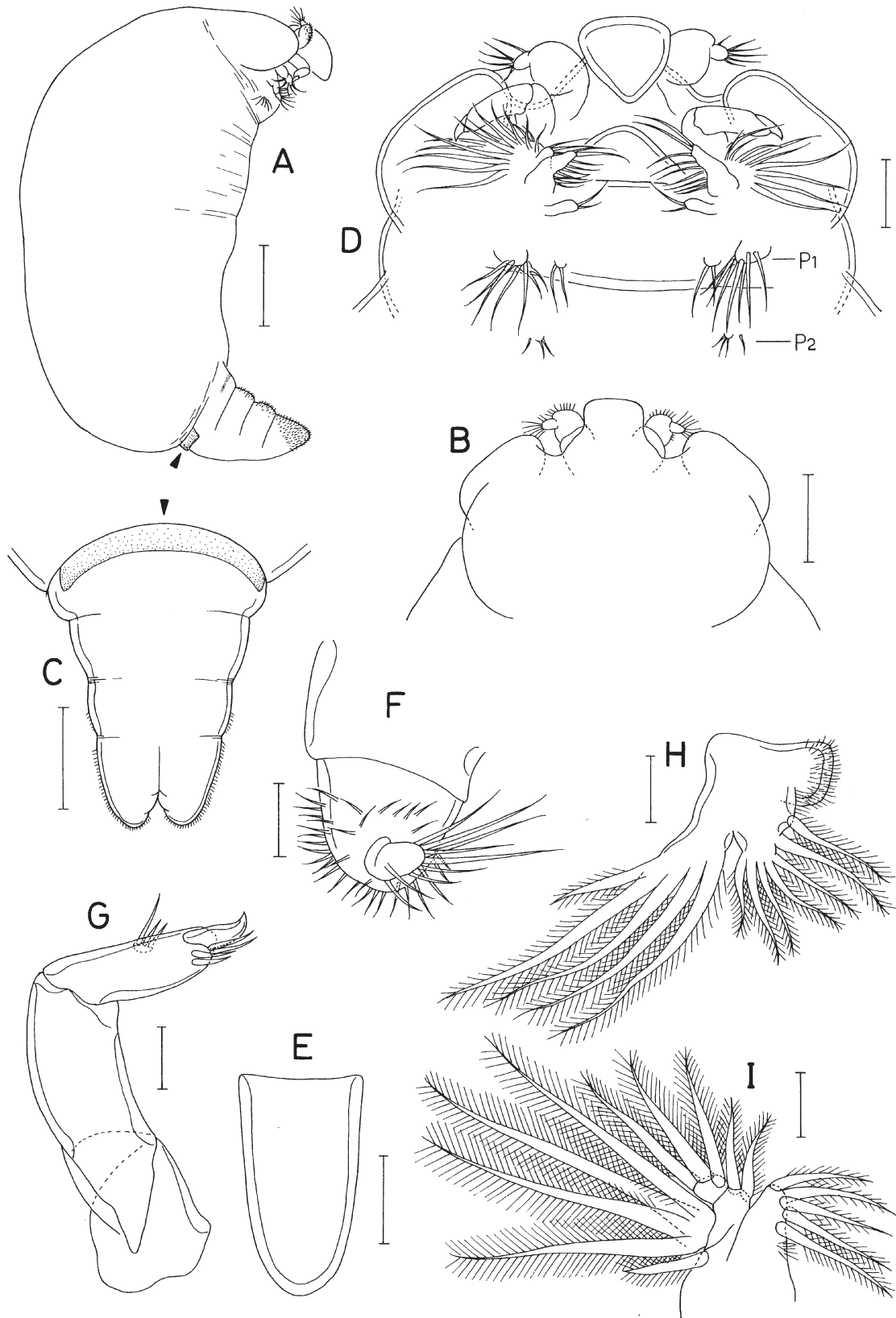
### *Phyllodelphys* **gen. nov.**

**Diagnosis.** Body vermiform, consisting of prosome and small urosome. Prosome divisible by constriction into cephalosome and metasome; with metasome forming brood pouch, much longer than wide, but variable in width depending on age. Free urosome 2-segmented, consisting of genital somite and unsegmented abdomen. Caudal rami rudimentary, bearing 5 minute setae of irregular form. Rostrum present. Antennule small, lobate, and setulose. Antenna consisting of coxa, basis, and unsegmented endopod bearing short terminal claw. Mandible consisting of coxa and palp; coxa with broad gnathobase bearing teeth and spinules on medial margin; palp consisting of basis bearing 1 seta, exopod bearing 4 setae, and unsegmented endopod bearing 5 setae. Maxillule unsegmented, bearing several setae, most leaf-like. Maxilla 2-segmented; first segment (syncoxa) with 2 setae; second segment (basis + endopod) with several setae (some leaf-like). Maxilliped unsegmented with broad, leaf-like setae. Legs absent.

**Type species.** *Phyllodelphys capensis* **gen. et sp. nov.** by original designation.

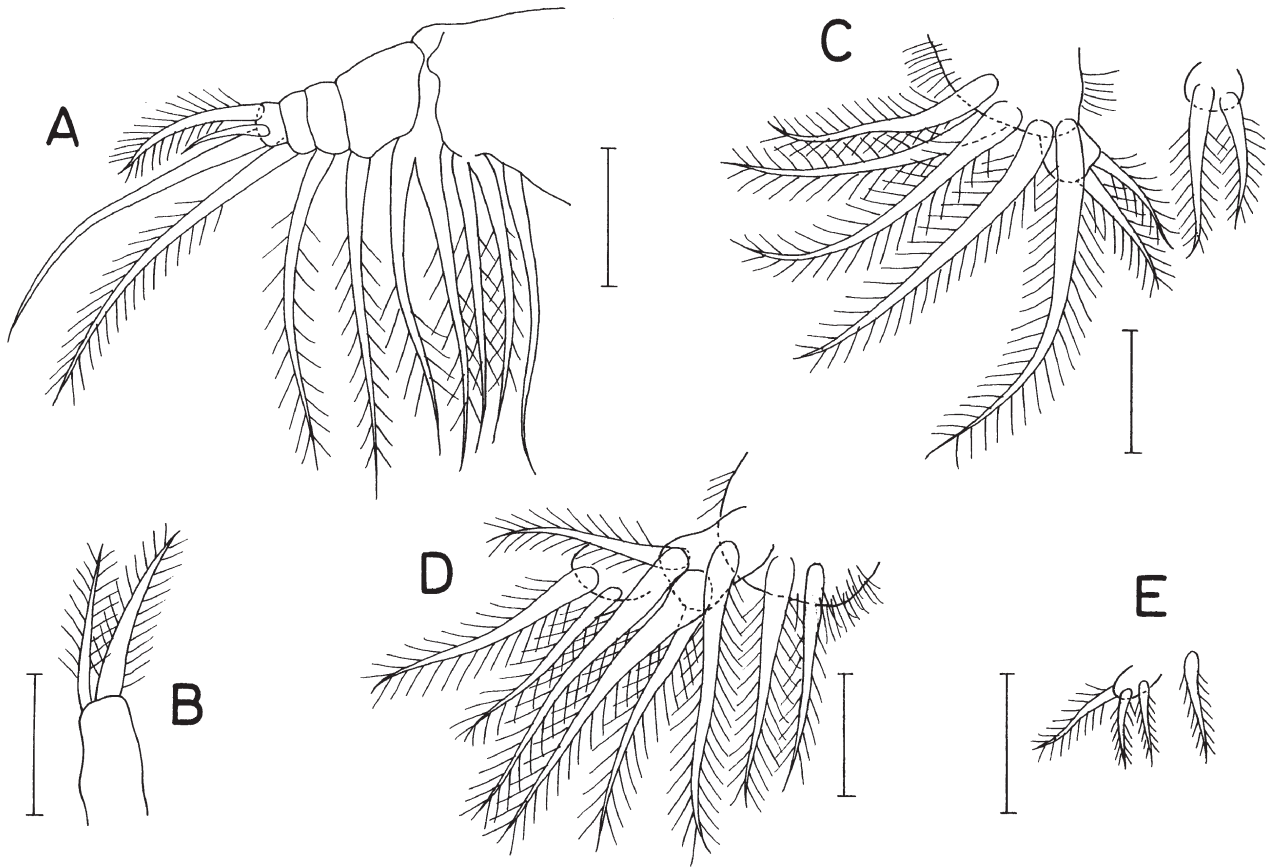
**Etymology.** The name is derived from the Greek *phyll* (=a leaf) and *delphys*. It alludes to the presence of the leaf-like setae on the posterior mouthparts. Gender feminine.

**Remarks.** *Phyllodelphys* **gen. nov.** has an elongate, vermiform body similar to that of several other genera within the Notodelphyidae, such as *Pythodelphys* Dudley & Solomon, 1966, *Lissodelphys* **gen. nov.**, and *Nodoscarus*



**FIGURE 421.** *Adrodelphys tectifera* gen. et sp. nov., female. A, habitus, right view showing tergite on genital somite (arrowhead); B, cephalosome, dorsal; C, urosome, dorsal view showing tergite on genital somite (arrowhead); D, cephalosome and anterior pedigerous somites, ventral; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D, E, 0.05 mm; F–I, 0.02 mm.





**FIGURE 422.** *Adrodelphys tectifera* gen. et sp. nov., female. A, maxilla; B, maxilliped; C, right leg 1; D, left leg 1; E, right leg 2. Scale bars: 0.02 mm.

**gen. nov.** The new genus can be separated from these other genera by the possession of the broad, leaf-like setae on the posterior mouthparts and the characteristic form of the coxal gnathobase in which the medial margin is denticulate and pectinate.

***Phyllodelphys capensis* gen. et sp. nov.**  
(Figs. 423, 424)

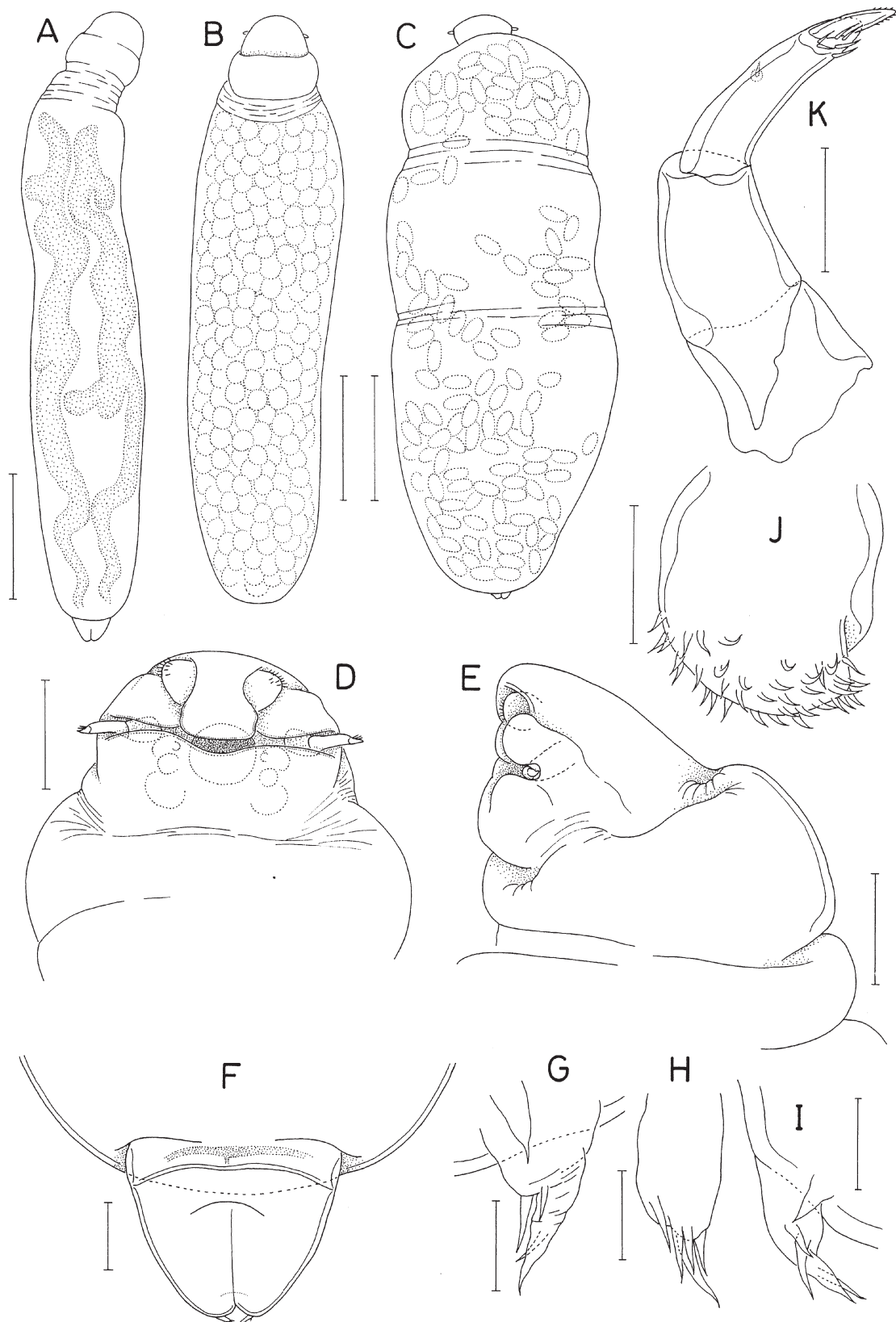
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21446), paratypes (4 intact ♀♀, MNHN-IU-2014-21447), and dissected paratypes (2 ♀♀, figured) from *Trididemnum* sp., southwest of Cape Town, South Africa, intertidal, Monniot coll., 05 February 1996.

**Etymology.** The type locality, Cape Town, provides the specific name of the new species.

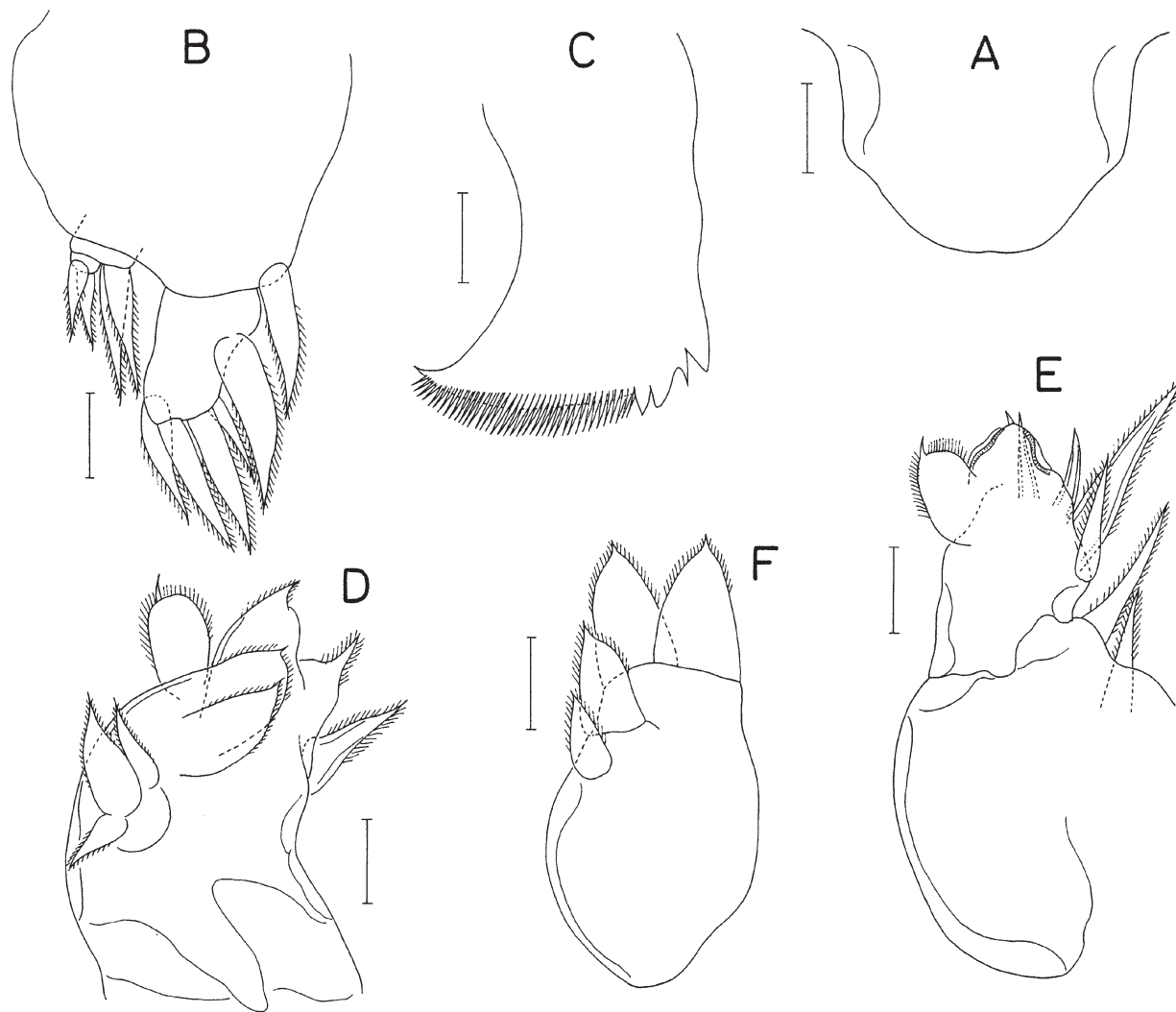
**Description of female.** Body (Fig. 423A-C) vermiform; body length 4.70-5.09 mm; body length of dissected specimen (Fig. 423B) 4.72 mm. Body width variable, narrow in non-ovigerous young adult (Fig. 423A), 1.19 mm in dissected ovigerous specimen (Fig. 423B), and much wider, 1.80 mm, in female with expanded

brood pouch containing nauplii. Prosome divisible by constriction into cephalosome and metasome: cephalosome (Fig. 423D, E) much narrower than metasome. Metasome divisible into short, narrower anterior part (possibly representing first pedigerous somite) and longer, broader remaining part. Metasome of expanded specimen (Fig. 423C) with 2 constrictions. Free urosome (Fig. 423F) small, gradually narrowing posteriorly; consisting of short genital somite bearing copulatory pore on ventral surface and unsegmented abdomen, wider than long (260×320 μ). Caudal rami (Fig. 423G-I) vestigial, bearing 5 minute setae of variable size.

Rostrum (Fig. 423D) broadened distally. Antennule (Fig. 423J) lobate, as long as wide, unsegmented, with indentation subdistally on dorsal margin, apparently unarmed, but ornamented with many short, thick setules on distal region. Antenna (Fig. 423K) 3-segmented, consisting of unarmed coxa and basis and unsegmented endopod; endopod distinctly narrower than proximal segments, about 3.1 times longer than wide (80×26 μm), with minute spinules on margins: armed with 7 small setae (1 subdistal and 6 distal) plus short terminal claw, one-third as long as endopod, almost straight.



**FIGURE 423.** *Phyllodelphys capensis* gen. et sp. nov., female. A, habitus of young adult, dorsal; B, habitus of ovigerous adult, dorsal; C, habitus of expanded adult containing nauplii, dorsal; D, anterior part of prosome, ventral; E, anterior part of prosome, left; F, urosome, ventral; G, H, I, caudal rami; J, antennule; K, antenna. Scale bars: A–C, 0.1 mm; D, E, 0.2 mm; F, 0.1 mm; G–I, 0.02 mm; J, K, 0.05 mm.



**FIGURE 424.** *Phyllodelphys capensis* gen. et sp. nov., female. A, labrum; B, mandibular palp; C, mandibular gnathobase; D, maxillule; E, maxilla; F, maxilliped. Scale bars: 0.02 mm.

Mouthparts positioned deep inside pre-oral cavity formed by anterior and posterior folds on ventral side of cephalosome (Fig. 423D). Labrum (Fig. 424A) smooth, unornamented, with broadly convex posterior margin. Mandible (Fig. 424B, C) consisting coxa and biramous palp: coxa (Fig. 424C) with broad gnathobase bearing 1 acutely pointed and 3 blunt teeth along distal third of medial margin and with remaining part of medial margin pectinate (spinulose); palp (Fig. 424B) consisting of basis, 2-segmented exopod, and unsegmented endopod; basis with 1 seta at mediobasal corner; exopod small, armed with 2 setae on each segment; endopod much larger than exopod, armed with 5 setae; setae on palp broad, but feebly pinnate. Maxillule (Fig. 424D) unsegmented, lobate, bearing 9 broad setae: 2 setae on medial margin, 4 leaf-like setae on distal margin, and 3 setae on outer margin. Maxilla (Fig. 424E) 2-segmented; first segment (syncoxa) bearing 2 setae medially; second segment (basis + endopod) bearing 4 setae (1 large and 3 small)

medially and bilobed distal part; each distal lobe tipped with 1 small spinule. Maxilliped (Fig. 424F) lobate, bearing 4 leaf-like setae of different sizes, 2 larger distal and 2 smaller subdistal setae.

Legs absent.

**Male.** Unknown.

**Remarks.** The functional significance of the flattened, leaf-like setae found on the maxillule and maxilliped is unknown.

***Lissodelphys* gen. nov.**

**Diagnosis.** Body elongate, cylindrical, vermiform, and unsegmented, narrowing anteriorly and posteriorly. Body surface smooth, lacking ornamentation of setules or spinules. Rostrum distinct. Antennule small, lobate, unsegmented. Antenna 2- or 3-segmented, with unsegmented endopod bearing small terminal claw. Labrum uncertain.

**TABLE 13.** Differences between notodelphyid genera with females sharing a vermiform body and lacking legs 1-4.

Genera	Defined urosome	A2	Mnd coxal gnathobase	Mnd palp	Mx1	Mx2	Mxp
<i>Pythodelphys</i> Dudley & Solomon, 1966	+	+	pectinate	+	+	+	X
<i>Lissodelphys</i> <b>gen. nov.</b>	X	+	pectinate	+	+	+	+
<i>Phyllodelphys</i> <b>gen. nov.</b>	+	+	pectinate & dentate	+	+	+	+
<i>Ophiodelphys</i> Bocquet & Stock, 1961	X	+	dentate	X	X	+	+
<i>Hamaticoxa</i> <b>gen. nov.</b>	X	+	hooked	+	+	+	X
<i>Nodoscarus</i> <b>gen. nov.</b>	X	+	X	+	+	X, +	X
<i>Haplostatus</i> Illg & Dudley, 1961	+	+	X	X, +	X	X	X
<i>Chilodelphys</i> <b>gen. nov.</b>	+	+	X	X	X	X	X
<i>Scaridelphys</i> <b>gen. nov.</b>	+	X	X	+	X	X	X

\*Abbreviations and symbols: A2, antenna; Mnd, mandible; Mx1, maxillule; Mx2, maxilla; Mxp, maxilliped; +, present; X, absent.

Mouthparts consisting of mandible, maxillule, maxilla, and maxilliped. Mandible consisting of coxa and biramous palp; coxa gnathobase narrow with pectinate medial margin; palp obscurely segmented, armed with 4 setae on outer lobe (exopod) and 5 setae on inner lobe (basis + endopod). Maxillule obscurely 2-segmented (precoxa and palp) or unsegmented; armed with 6 to 8 setae. Maxilla unsegmented or incompletely 2-segmented; armed with 5 setae. Maxilliped as small lobe bearing few setae. All setae of mouthparts naked. Legs absent.

**Type species.** *Lissodelphys guadeloupensis* **gen. et sp. nov.** by original designation.

**Other included species.** *Lissodelphys tahitiensis* **gen. et sp. nov.**

**Etymology.** The name is derived from *liss* (Greek meaning “smooth”), the prefix of the generic name of the host of the type species, *Lissoclinum fragile* (Van Name, 1902), and *-delphys*, the ending of many generic names in the Notodelphyidae.

**Remarks.** *Lissodelphys* **gen. nov.** appears to be closely related to the genus *Pythodelphys* in sharing a similarly elongate, vermiform body and a pectinate coxal gnathobase on the mandible. However, the new genus can be separated from *Pythodelphys* because the urosome is unsegmented and completely fused with the prosome, the body surface is smooth (densely setulose in *Pythodelphys*), the maxilliped is distinct (vestigial or absent in *Pythodelphys*), and the maxilla is 1- or 2-segmented (distinctly 4-segmented in *Pythodelphys*).

The differences between *Lissodelphys* **gen. nov.** and other vermiform genera of the Notodelphyidae that lack legs are summarised in Table 13.

***Lissodelphys guadeloupensis* gen. et sp. nov.**  
(Fig. 425)

**Typematerial.** Holotype (intact ♀, MNHN-IU-2014-21448)

and dissected paratypes (2 ♀♀, figured) from *Lissoclinum fragile* (Van Name, 1902), Fajou Island, Guadeloupe, depth 0-4 m, Monniot coll., 18 December 1980.

**Etymology.** The name of the new species is based on the type locality, Guadeloupe.

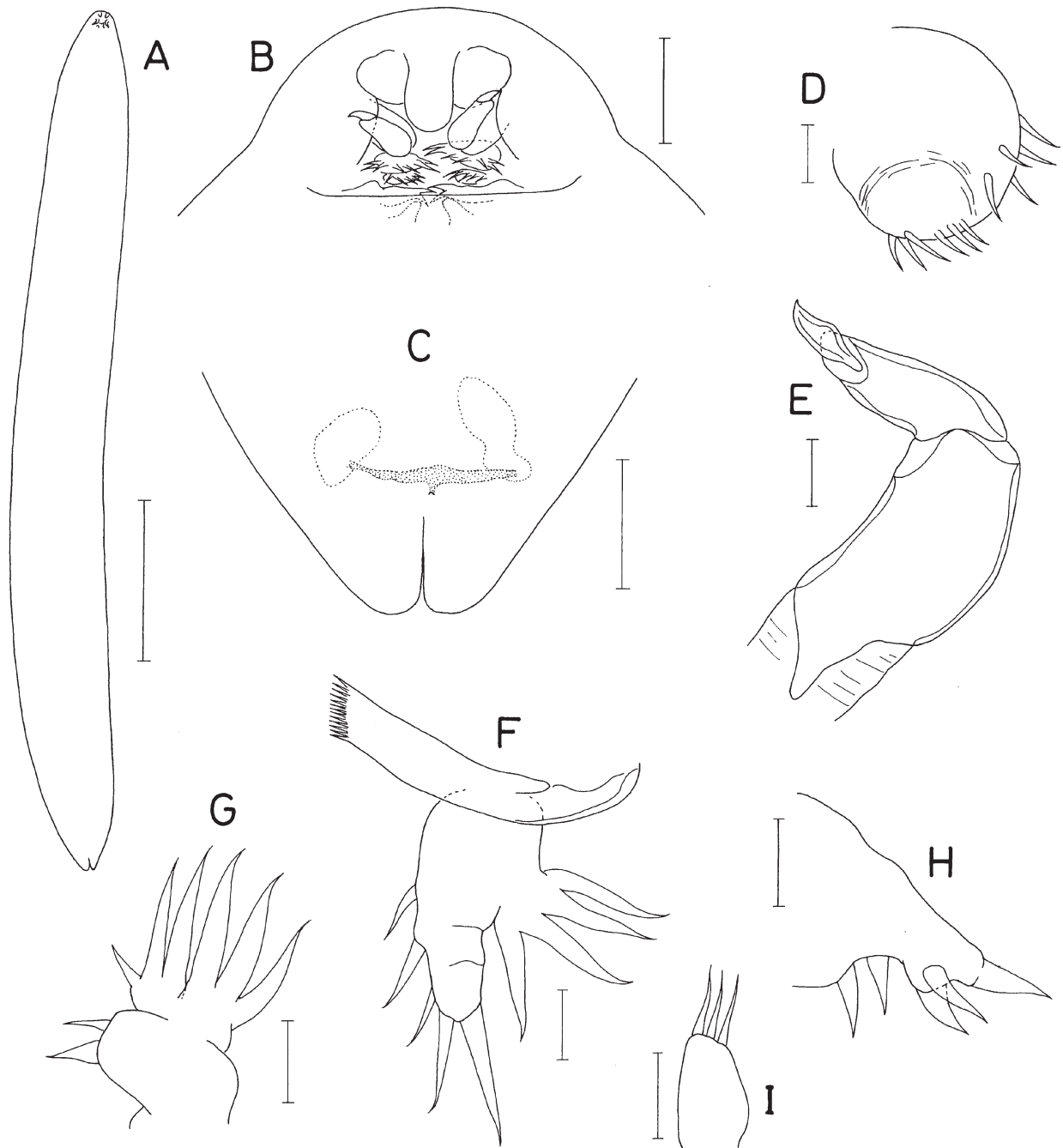
**Description of female.** Body (Fig. 425A) vermiform, elongate, cylindrical, and unsegmented, tapering anteriorly and posteriorly. Body length 5.5 mm; greatest body width 0.61 mm. Body surface smooth, unornamented, without wrinkles. Urosome not defined (Fig. 425C); posterior end of body bilobed with median (anal) incision. Copulatory pore and genital apparatus visible in posterior region of body (Fig. 425C).

Rostrum (Fig. 425B) distinct, longer than wide, with rounded distal margin. Antennule (Fig. 425D) small, unsegmented, lobate, as long as wide, with 11 small setae of equal length. Antenna (Fig. 425E) 2-segmented, unarmed, consisting of coxobasis and unsegmented endopod; endopod slightly shorter than basis; terminal claw small, about one-third as long as endopod.

Labrum not visible. Mandible (Fig. 425F) consisting of coxa and biramous palp; coxa with narrow, elongate gnathobase with simple, pectinate (spinulose) medial margin; palp unsegmented; short outer lobe (exopod) with 4 setae; longer inner lobe (basis plus endopod) with 2 traces of articulations on outer side and armed with 5 setae, grouped 1, 1, and 3. Maxillule (Fig. 425G) incompletely 2-segmented; first segment (precoxa) bearing 2 setae on medial margin; second segment (palp) indistinctly biramous with 3 setae on each ramus, medial seta of inner ramus distinctly shorter than other 5 setae. Maxilla (Fig. 425H) unsegmented, tapering, with 5 setae grouped as 2, 2, and 1. Maxilliped (Fig. 425I) as small lobe bearing 3 equal setae apically. All setae on mouthparts naked. Legs absent.

**Male.** Unknown.

**Remarks.** The incompletely 2-segmented maxillule armed with 8 setae is characteristic for this new species.



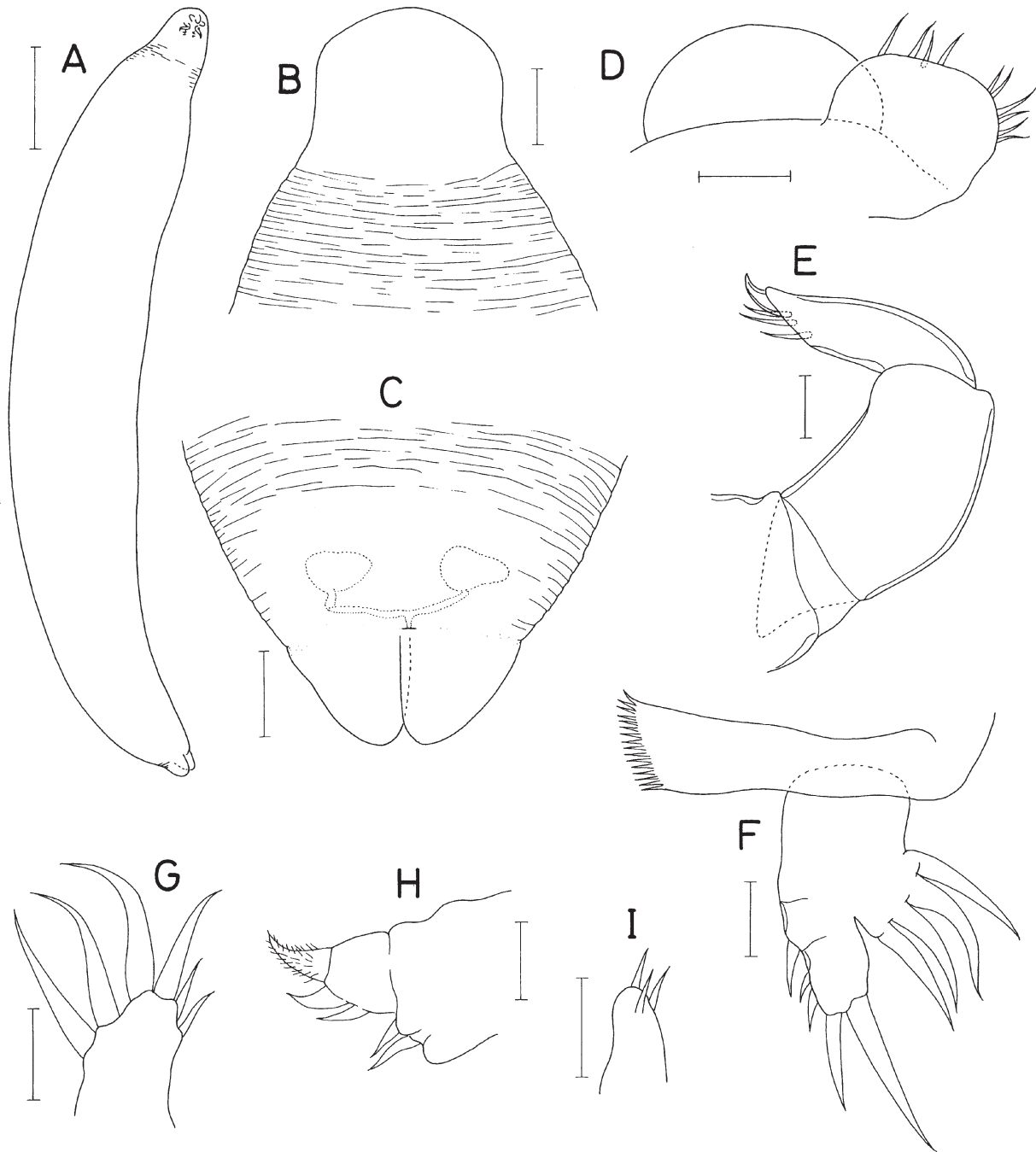
**FIGURE 425.** *Lissodelphys guadeloupensis* gen. et sp. nov., female. A, habitus, ventral; B, cephalic region, ventral; C, posterior end of body, ventral; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; I, maxilliped. Scale bars: A, 1 mm; B, 0.05 mm; C, 0.1 mm; D–I, 0.01 mm.

***Lissodelphys tahitiensis* gen. et sp. nov.**  
(Fig. 426)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21449) and dissected paratypes (2 ♀♀, figured) from *Lissoclinum fragile* (Van Name, 1902) (MNHN-IT-2008-4978 = MNHN A2/LIS/31), Papeete port, Tahiti, Monniot coll., June 1984.

**Etymology.** The name of the new species is based on the type locality, Tahiti.

**Description of female.** Body (Fig. 426A) vermiform, cylindrical, unsegmented, slightly tapering anteriorly and posteriorly. Body length 3.94 mm; greatest body width 0.65 mm across mid-region. Body surface with numerous, fine, transverse wrinkles (Fig. 426B, C) but lacking setules or spinules. Cephalic region narrowed. Posterior end of



**FIGURE 426.** *Lissodelphys tahitiensis* gen. et sp. nov., female. A, habitus, ventral; B, cephalic region, dorsal; C, posterior end of body, ventral; D, rostrum and left antennule, ventral; E, antenna; F, mandible; G, maxillule; H, maxilla; I, maxilliped. Scale bars: A, 0.5 mm; B, C, 0.05 mm; D, 0.02 mm; E–I, 0.01 mm.

body with deep medial incision, abruptly flattened so that anterior boundary superficially appearing as articulation (Fig. 426C).

Rostrum (Fig. 426D) distinct, much wider than long. Antennule (Fig. 426D) as small lobe, as long as wide, bearing 9 small setae (4 on anterior margin and 5 distally) of similar length. Antenna (Fig. 426E) 3-segmented, consisting of coxa, basis, and unsegmented endopod; coxa

and basis unarmed; endopod slightly shorter than basis: armed with 4 small setae distally plus small terminal claw, as long as adjacent setae.

Labrum not confirmed. Mandible (Fig. 426F) consisting of coxa and palp; coxal gnathobase elongate with simple, slightly broadened, pectinate medial margin: palp biramous; short outer lobe (exopod) with 4 setae; longer inner lobe (basis plus endopod) with traces of

2 articulations on medial side and 5 setae of unequal sizes, grouped as 1 and 4 (lacking seta on original basis region). Maxillule (Fig. 426G) as small lobe lacking any trace of articulation and armed with 6 setae (medial 2 setae distinctly smaller than others). Maxilla (Fig. 426H) indistinctly 2-segmented and armed with 5 setae (2 on first segment and 3 on second); distalmost seta plumose. Maxilliped (Fig. 426I) as small lobe bearing 3 small setae apically. Legs absent.

**Male.** Unknown.

**Remarks.** *Lissodelphys tahitiensis* **gen. et sp. nov.** closely resembles *L. guadeloupensis* **gen. et sp. nov.**: they both have the same body shape and exhibit the same setation patterns on the mandible, maxilla and maxilliped. The most significant differences between the two are in the maxillule, which is incompletely 2-segmented and armed with 8 setae in *L. guadeloupensis* **gen. et sp. nov.**, whereas it is unsegmented and armed with only 6 setae in *L. tahitiensis* **gen. et sp. nov.** Additional minor differences include: the body surface is smooth in *L. guadeloupensis* **gen. et sp. nov.** but rugose in *L. tahitiensis* **gen. et sp. nov.**, and the setae on the inner lobe (basis + endopod) of the mandible are arranged as 1, 1, and 3 in *L. guadeloupensis* **gen. et sp. nov.** but as 0, 1, 4 in *L. tahitiensis* **gen. et sp. nov.** These two species inhabit the same host species, *Lissoclinum fragile*, but were found in different zoogeographic regions.

### *Nodoscarus* **gen. nov.**

**Diagnosis.** Body elongate, vermiform, cylindrical, and unsegmented. Cephalosome not defined from metasome or obscurely defined from metasome by constriction. Urosome also not defined from metasome or defined from metasome by rudimentary dorsal suture line. Body surface usually covered with minute setules. Caudal rami rudimentary or absent. Rostrum present, usually large or rostrum absent. Antennule short, unsegmented or with traces of articulations. Antenna 3-segmented, comprising coxa, basis, and unsegmented endopod bearing small terminal claw. Labrum present, not covering oral appendages. Two or 3 pairs of mouthparts present. Mandible lacking coxa, represented only by lobate or biramous palp. Maxillule as unsegmented, setiferous lobe. Maxilla present or absent, if present, 1- to 3-segmented. Maxilliped and legs absent.

**Type species.** *Nodoscarus bretoni* **gen. et sp. nov.** by original designation.

**Other included species.** *Nodoscarus dakarensis* **gen. et sp. nov.**, *N. compressus* **gen. et sp. nov.**, *N. curvus* **gen. et sp. nov.**, *N. latirostris* **gen. et sp. nov.**, *N. scutatus* **gen. et sp. nov.**, *N. rectus* **gen. et sp. nov.**, *N. senisetatus* **gen. et sp. nov.**, and *N. quadrisetatus* **gen. et sp. nov.**

**Etymology.** The name is derived from the Greek *nod*

(=toothless) and *scari* (=a little worm) and refers to the absence of a coxa on the mandible. Gender masculine.

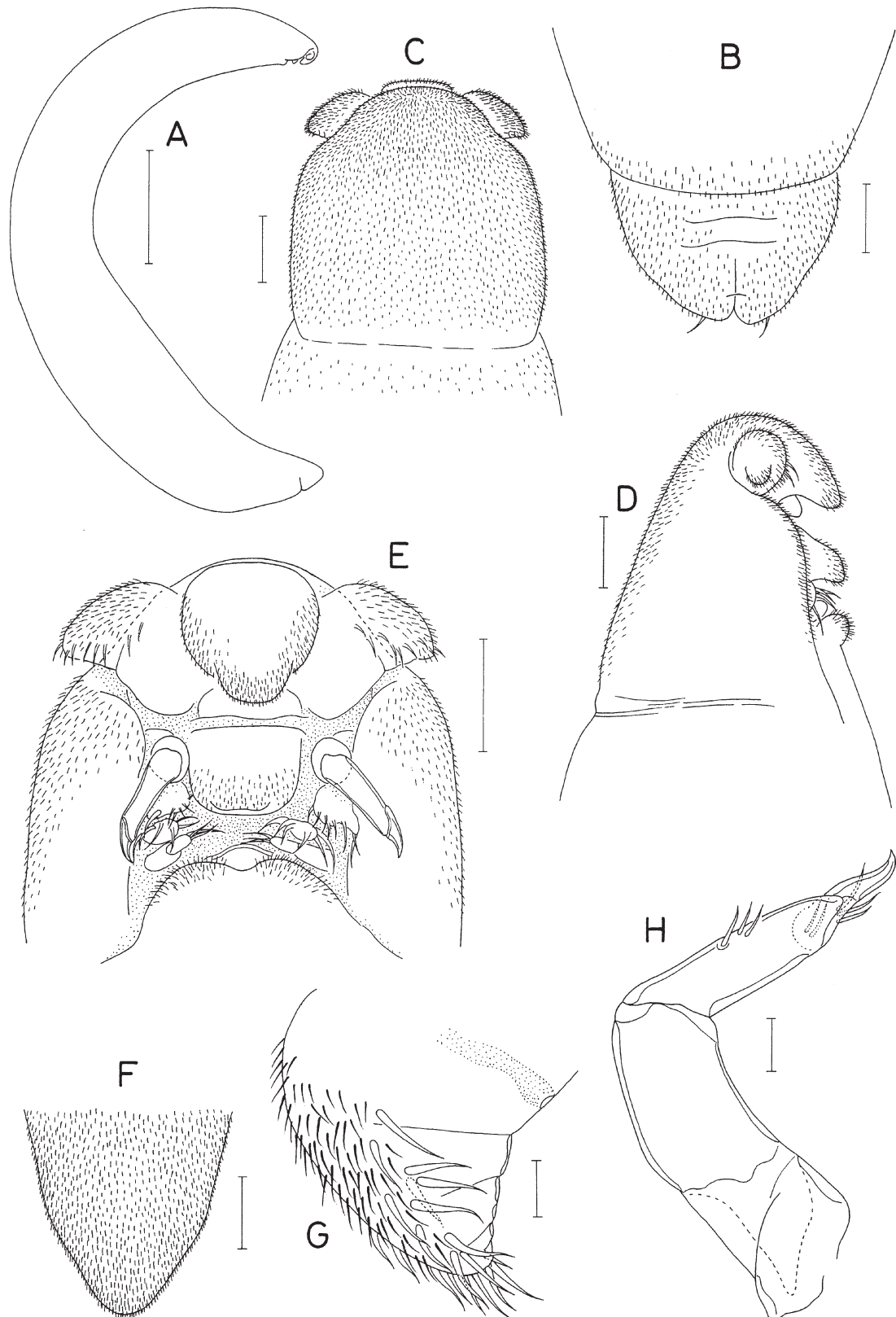
**Remarks.** *Nodoscarus* **gen. nov.** can readily be distinguished from the genera *Pythodelphys* and *Lissodelphys* **gen. nov.**, which share the same derived body form, by the absence of the coxa on the mandible.

In the genus *Pythodelphys*, the type species, *P. acurris* Dudley & Solomon, 1966, has a coxa on the mandible (Dudley & Solomon, 1966). Its only congener, *Pythodelphys illgi* Ooishi, 1998, lacks a mandibular coxa according to the original description (Ooishi, 1998). If Ooishi's observation is correct, *P. illgi* should be transferred to *Nodoscarus* **gen. nov.** However, inasmuch as *P. illgi* is so similar to *P. acurris* in respect of the morphology of the other appendages that we propose to tentatively retain *P. illgi* in *Pythodelphys* until the morphology of its mandible can be confirmed. The mandibular coxa of these vermiform notodelphyids is very easy to overlook due to its thinness and transparency.

Unlike *Lissodelphys* **gen. nov.**, the new genus *Nodoscarus* **gen. nov.** lacks maxillipeds, and the setation of the mandible, maxillule and maxilla is generally much better developed in *Nodoscarus* **gen. nov.** than in *Lissodelphys* **gen. nov.**

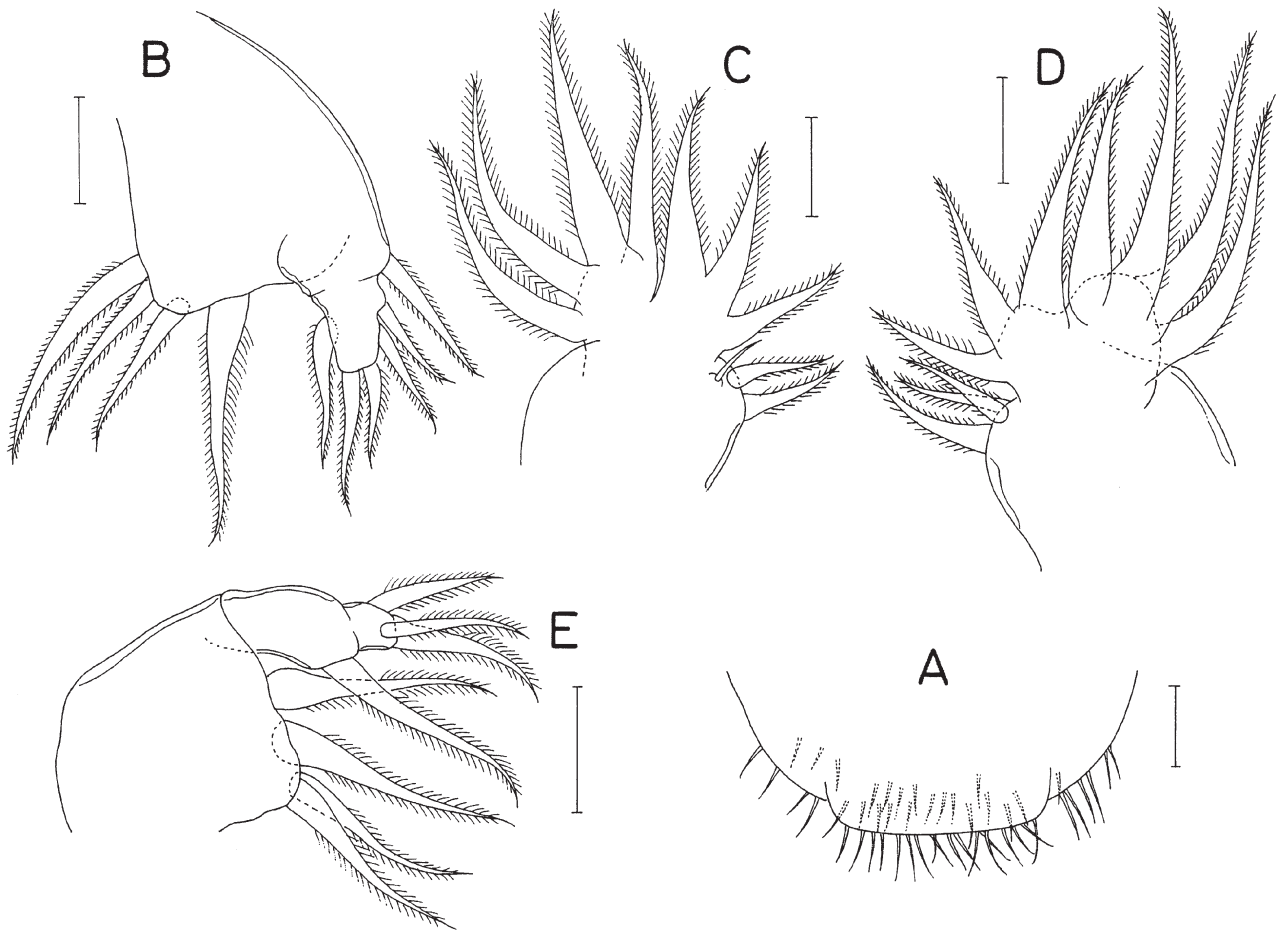
### Key to species of *Nodoscarus* **gen. nov.**

1. Three pairs of mouthparts present; maxillule (second pair) armed with more than 2 setae ..... 2  
Only 2 pairs of mouthparts present: maxillule armed with 2 setae ..... 8
2. Maxillule armed with fewer than 8 setae; maxilla 1- or 2-segmented, with fewer than 7 setae ..... 3  
Maxillule armed with more than 8 setae; maxilla 3-segmented armed with 7 or more setae ..... 4
3. Mandible, maxillule, and maxilla armed with 5, 7, and 6 setae, respectively ..... *N. dakarensis* **gen. et sp. nov.**  
Mandible, maxillule, and maxilla armed with 1, 6, and 2 setae, respectively ..... *N. compressus* **gen. et sp. nov.**
4. Maxilla with 2 setae on first segment (syncoxa) ..... 5  
Maxilla with 4 setae on first segment (syncoxa) ..... 6
5. Mandible with 7 setae; maxilla armed with 1 and 4 setae on second and third segments, respectively .....  
..... *N. curvus* **gen. et sp. nov.**  
Mandible with 9 setae; maxilla armed with 2 and 3 setae on second and third segments, respectively .....  
..... *N. latirostris* **gen. et sp. nov.**
6. Caudal rami absent; mandible with total of 10 setae .....  
..... *N. bretoni* **gen. et sp. nov.**  
Small caudal rami present; mandible with 9 setae ..... 7
7. Mandible biramous; rostrum narrowing in proximal third, widest in middle, and tapering along distal two-thirds .....  
..... *N. scutatus* **gen. et sp. nov.**  
Mandible uniramous; rostrum widest at proximal 40%, abruptly narrowing and tapering in distal 60% .....



**FIGURE 427.** *Nodoscarus bretoni* gen. et sp. nov., female. A, habitus, right; B, posterior end of body, dorsal; C, cephalosome, dorsal; D, cephalosome, right; E, cephalosome, ventral; F, rostrum; G, antennule; H, antenna. Scale bars: A, 1 mm; B–E, 0.1 mm; F–H, 0.02 mm.





**FIGURE 428.** *Nodoscarus bretoni* gen. et sp. nov., female. A, labrum; B, mandible; C, D, maxillules; E, maxilla. Scale bars: 0.02 mm.

- .....*N. rectus* gen. et sp. nov.  
 8. Rostrum well-developed; mandible with 6 setae.....  
 .....*N. senisetatus* gen. et sp. nov.  
 Rostrum absent; mandible with 4 setae.....  
 .....*N. quadrisetatus* gen. et sp. nov.

***Nodoscarus bretoni* gen. et sp. nov.**  
 (Figs. 427, 428)

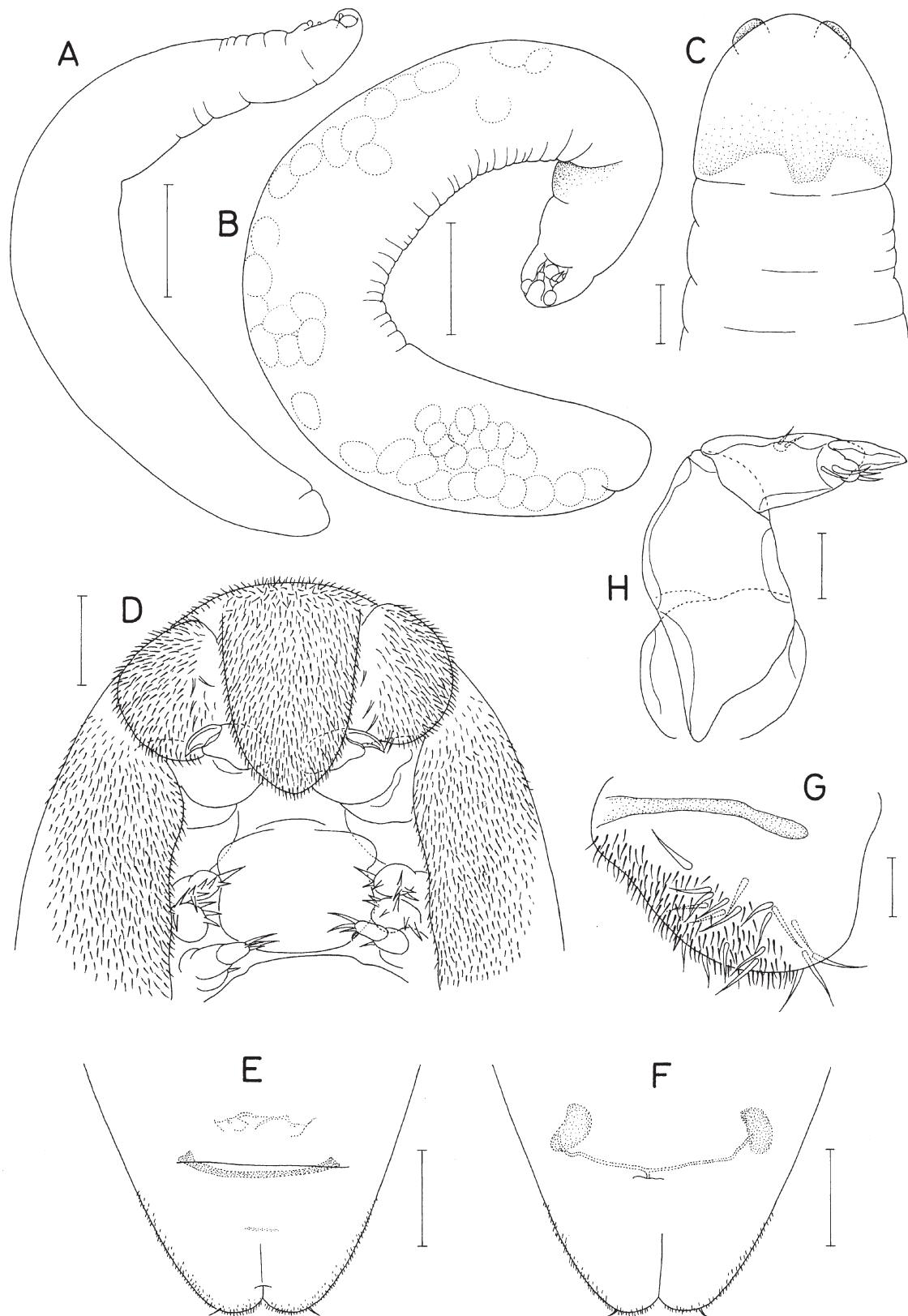
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21450), paratype (intact ♀, MNHN-IU-2014-21451), and dissected paratypes (2 ♀♀, figured) from *Pseudodistoma crucigaster* Gail, 1972 (MNHN-IT-2008-7337 = MNHN A1/PSE/73), Cerbère, Mediterranean coast of France, depth 19 m, G. Breton coll., 17 August 1996.

**Etymology.** The new species is named after G. Breton, Université de Renne, the collector of the type host.

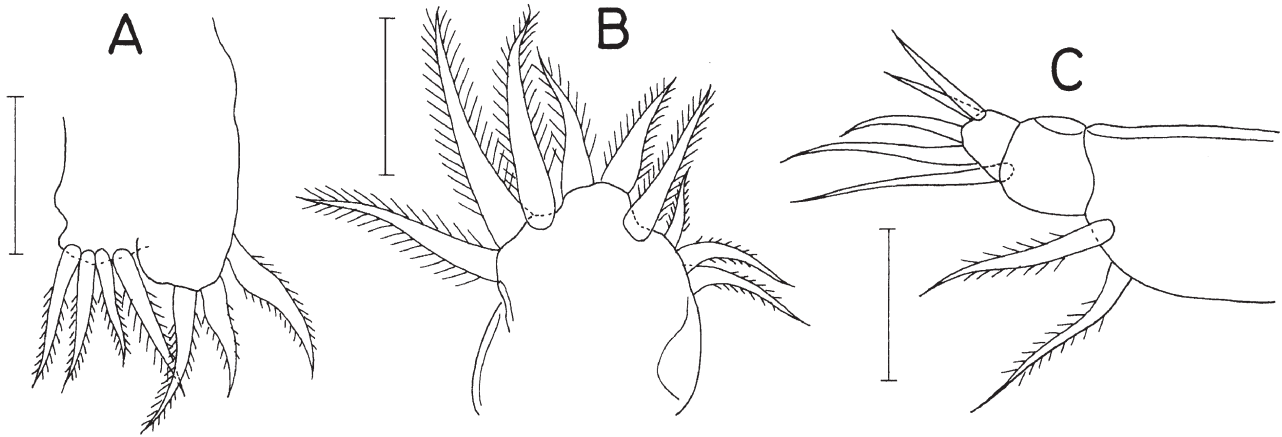
**Description of female.** Body (Fig. 427A) vermiform, cylindrical, unsegmented, and curved. Body length 6.83 mm; posterior half of body thicker (0.96 mm in diameter) than anterior half (0.71 mm in diameter). Body surface

densely ornamented with covering of fine setules. In lateral view, cephalic region tapering anteriorly and posterior region tapering posteriorly; cephalosome (Fig. 427C, D) discernible from metasome by lateral constriction. Free urosome (Fig. 427B) discernible from metasome by dorsal suture line, wider than long, with bilobed posterior margin; no trace of suture between metasome and urosome on ventral side. Caudal rami absent (fully incorporated into bilobed posterior margin), but 1 caudal seta present on tip of paired posterior lobes of abdomen.

Rostrum (Fig. 427E, F) large, as long as wide, tapering towards blunt apex. Antennule (Fig. 427G) short and broad, strongly tapering, 115×150 µm, with 3 or 4 partial sutures along posterior side; armed with setae and ornamented with setules; number of setae not confirmed due to resemblance to setules. Antenna (Fig. 427H) 3-segmented, moderately slender; first and second segments (coxa and basis) unarmed; third segment (endopod) about 3.5 times longer than wide (81×23 µm), as long as basis: armed with 8 small setae arranged as 3, 2, and 3, plus terminal claw slightly less than half length of endopod.



**FIGURE 429.** *Nodoscarus curvus* gen. et sp. nov., female. A, habitus of young adult, left; B, habitus of ovigerous adult, right; C, anterior region of body, dorsal; D, cephalosomal region, ventral; E, posterior end of body, dorsal; F, posterior end of body, ventral; G, antennule; H, antenna. Scale bars: A, B, 0.5 mm; C, E, F, 0.1 mm; D, 0.05 mm; G, H, 0.02 mm.



**FIGURE 430.** *Nodoscarus curvus* gen. et sp. nov., female. A, mandible; B, maxillule; C, maxilla. Scale bars: 0.02 mm.

Labrum (Fig. 428A) setulose, short and broad, with broad posteromedian protuberance. Mandible (Fig. 428B) lacking coxa; palp comprising outer protuberance (exopod) bearing 4 setae, and endopod indistinctly demarcated from basis and incompletely 2-segmented, with 1 seta on mediolateral corner of first segment, and 5 setae (2 medial, 2 distal, and 1 outer) on second segment; all setae on palp weakly pinnate. Maxillule (Fig. 428C, D) lobate, obscurely biramous distally, and armed with 2 or 3 setae on medial margin, 4 setae on outer ramus, and 3 setae on inner ramus (1 of 3 setae on medial margin small or may be lacking). Maxilla (Fig. 428E) 3-segmented and armed with 4, 1, and 3 pinnate setae on first to third segments, respectively; third segment incompletely articulated from second. Maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** Species of *Nodoscarus* gen. nov. can be differentiated from one another by the different setation patterns of the mouthparts. The mandible and maxillule of *N. bretoni* gen. et sp. nov. are each armed with 10 setae, the highest number of setae found in any species of *Nodoscarus* gen. nov.

***Nodoscarus curvus* gen. et sp. nov.**

(Figs. 429, 430)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21452), paratypes (2 intact ♀♀, MNHN-IU-2014-21453), and dissected paratype (♀, figured) from *Aplidium lobatum* Savigny, 1816, Mont Dore, New Caledonia, Monniot coll., 19 March 1987.

**Etymology.** The specific name refers to the curved body of the new species as usual for the genus.

**Description of female.** Body (Fig. 429A, B) vermiform, cylindrical, unsegmented, curved, densely

covered with numerous minute setules (setules not shown in Fig. 429A-C). Body length 3.64 mm; body width 0.51 mm at widest region in middle, slightly narrowing in anterior and posterior quarters. Cephalosome poorly defined from metasome (Fig. 429C), with rounded anterior margin. Posterior part of body bearing horizontal sclerotization bar and weak cleft (as vestige of articulation between metasome and urosome) on dorsal surface (Fig. 429E), copulatory pore on ventral surface (Fig. 429F), and shallow posteromedian incision. Caudal rami absent (fully incorporated into posterior margin of abdomen), but 1 small caudal seta present on each side.

Rostrum (Fig. 429D) large, longer than wide, weakly tapering towards rounded apex; surface covered with numerous setules. Antennule (Fig. 429G) as unsegmented lobe, much wider than long, densely setulose on ventral surface, armed with about 20 small setae. Antenna (Fig. 429H) stout, 3-segmented; coxa and basis unarmed; endopod distinctly shorter than basis, about 1.8 times longer than wide ( $44 \times 25 \mu\text{m}$ ); armed with 6 small setae (arranged as 2, 2, and 2) plus stout terminal claw, about half as long as endopod.

Labrum (Fig. 429D) broad with convex posterior margin. Mandible (Fig. 430A) represented only by lobate palp bearing 7 setae distally (4 on outer side and 3 on slightly projecting inner side). Maxillule (Fig. 430B) as lobe bearing 9 setae (3 on medial margin smaller than others). Maxilla (Fig. 430C) distinctly 3-segmented, with 2, 1, and 4 setae on first to third segments, respectively; setae on first segment weakly pinnate, remaining setae naked. Maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** Three characteristic features of *N. curvus* gen. et sp. nov. serve to differentiate it from its congeners: (1) the mandibular palp is armed with 7 setae; (2) the maxilla is distinctly 3-segmented and (3) is armed with

2, 1, and 4 setae on first to third segments, respectively. The presence of a single small caudal seta on the tip of the paired posterior abdominal lobes seems to be an additional differential feature of the new species.

***Nodoscarus scutatus* gen. et sp. nov.**

(Figs. 431, 432)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21454) from *Aplidium lobatum* Savigny, 1816 (MNHN-IT-2008-488 = MNHN A1/APL B/403), Ardoukoba, Djibouti, Monniot coll., October 1996.

**Etymology.** The specific name is derived from the Latin *scut* (=a shield) and refers to the shield-shaped rostrum of the new species.

**Description of female.** Body (Fig. 431A) vermiform, elongate, unsegmented, and curved. Body length 5.23 mm; body width 0.63 mm across widest region in middle. Cephalosome (Fig. 431B, C) defined from metasome by margins of cephalic shield, narrower than metasome. Posterior part of body bearing copulatory pore on ventral surface (Fig. 431D) and short, transverse dorsal slit (posterior part of body in Fig. 431A distorted) representing vestige of articulation between prosome and urosome. Caudal rami (Fig. 431D, E) present, slightly longer than wide (43×38 µm), incompletely articulated from abdomen, gradually narrowing distally; armed with 6 unequal caudal setae, all shorter than width of ramus at base, proximalmost seta longest.

Rostrum (Fig. 431G, H) large, shield-shaped, about twice as long as wide (231×119 µm), widest in middle; lateral margins parallel in proximal third, tapering and setulose in distal two-thirds. Antennule (Fig. 431H) small, lobate, subcircular, with mix of setae and setules on distal and posterior surfaces. Antenna (Fig. 431I) 3-segmented; coxa and basis unarmed; unsegmented endopod about 3.7 times longer than wide (62×17 µm), slightly shorter than basis: armed with 7 setae (arranged as 3, 2, and 2) plus slender terminal claw, about half as long as endopod.

Labrum (Fig. 431J) rather large, smooth, with rounded posterior margin. Mandible (Fig. 432A) represented by biramous palp, armed with 4 setae on outer ramus (exopod) and 5 setae on inner ramus (endopod). Maxillule (Fig. 432B) as unsegmented lobe, fan-like and armed with 9 broad setae, 2 on medial margin smaller than others. Maxilla (Fig. 432C) incompletely 3-segmented and armed with 4, 1, and 3 setae on first to third segments, respectively. All setae on mandible, maxillule and maxilla pinnate. Maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** The maxilla of *N. scutatus* gen. et sp. nov. is 3-segmented and armed with 4, 1, and 3 setae on the first to third segments, respectively, as in *N. bretoni* gen. et sp. nov. However, *N. scutatus* gen. et sp. nov. differs

in the possession of defined caudal rami, in the presence of 9 setae on the mandible (vs. 10 setae in *N. bretoni* gen. et sp. nov.), and of 9 setae on the maxillule (vs. 10 setae in *N. bretoni* gen. et sp. nov.). As an additional difference between the two species, the antennule of *N. bretoni* gen. et sp. nov. is strongly tapering and has partial articulations dorsally, whereas that of *N. scutatus* gen. et sp. nov. is globular and lacks any trace of an articulation.

It is notable that *N. scutatus* gen. et sp. nov. and *N. curvus* gen. et sp. nov. share the same species of ascidian host, *Aplidium lobatum*, but the former copepod species was collected from New Caledonia, while the latter came from off Djibouti in the Red Sea.

***Nodoscarus rectus* gen. et sp. nov.**

(Fig. 433)

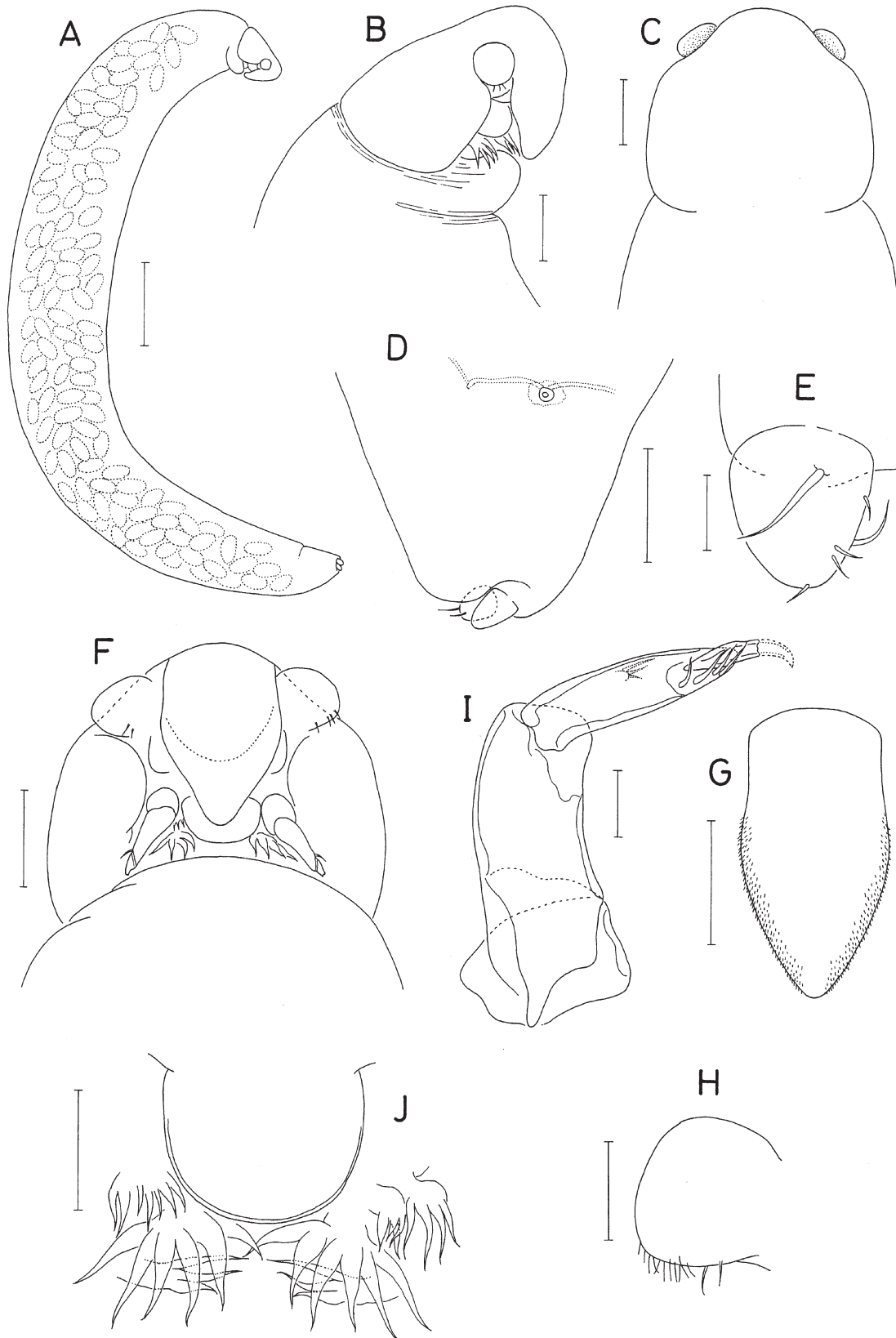
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21455), paratypes (2 intact ♀♀, MNHN-IU-2014-21456), and dissected paratypes (2 ♀♀, figured) from *Aplidium* sp., lobster wall, Mabul Island, Malaysia (04°14.53'N, 118°37.57'E), depth 17 m, 22 February 2004.

**Etymology.** The specific name is derived from the Latin *rect* (meaning “straight”) and refers to the linear body of the new species.

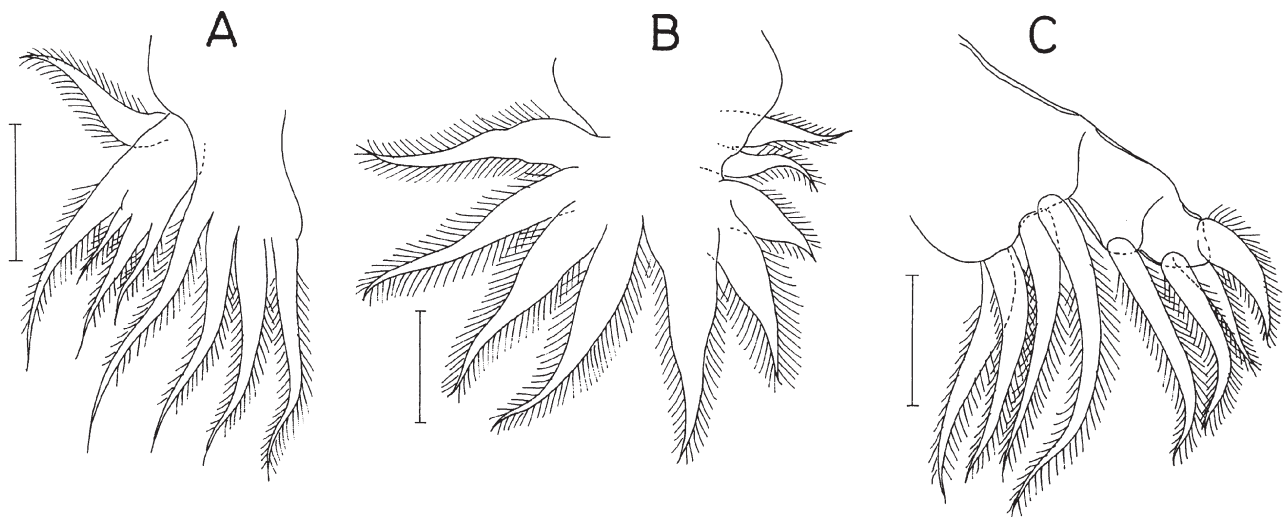
**Description of female.** Body (Fig. 433A) elongate, vermiform, cylindrical, straight, and unsegmented. Body length 5.57 mm; body width 0.63 mm. Cephalosome (Fig. 433B) semicircular, slightly wider than long, discernible from metasome by being narrower. Metasome entirely forming brood pouch, with parallel lateral margins. Urosome small, not articulated from metasome, but defined from metasome by being narrower. Caudal rami (Fig. 433C) small, about 1.5 times longer than wide (48×33 µm); armed with several setae or setules, 2 setae near middle larger than others.

Rostrum (Fig. 433D) large, elongate, about 0.7 times as long as cephalosome, 2.3 times longer than wide (210×91 µm), with nearly parallel lateral margins in proximal two-fifths, abruptly narrowing and tapering in distal three-fifths; ventral surface ornamented with fine setules. Antennule (Fig. 433E) lobate, unsegmented, armed and ornamented with mix of setae and setules distally. Antenna (Fig. 433F) 3-segmented; coxa and basis unarmed; endopod about 3.1 times longer than wide (59×19 µm); armed with 5 small setae (arranged as 1, 2, and 2) plus small terminal claw, less than half length of endopod.

Labrum short and broad, unornamented, with convex lateral margins and slightly concave posterior margin. Mandible (Fig. 433G) lobate, bearing 9 setae. Maxillule (Fig. 433H) also lobate, bearing 9 setae (3 medial setae distinctly smaller than others). Maxilla (Fig. 433I) 3-segmented and armed with 4, 1, and 3 setae on first to third segments, respectively; articulation



**FIGURE 431.** *Nodoscarus scutatus* gen. et sp. nov., female. A, habitus, right; B, cephalosome, right; C, cephalosome, dorsal; D, posterior end of body, ventrolateral; E, caudal ramus; F, cephalosome, ventral; G, rostrum; H, antennule; I, antenna; J, labrum and mouthparts *in situ*. Scale bars: A. 0.5 mm; B–D, F, G, 0.1 mm; E, I, 0.02 mm; H, J, 0.05 mm.



**FIGURE 432.** *Nodoscarus scutatus* **gen. et sp. nov.**, female. A, mandible; B, maxillule; C, maxilla. Scale bars: 0.02 mm.

between second and third segments incomplete; 2 of 3 setae on third segment shorter but broad. Maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** *Nodoscarus rectus* **gen. et sp. nov.** is very similar to *N. scutatus* **gen. et sp. nov.** They both possess defined caudal rami and have the same numbers of setae on the mandible, maxillule, and maxilla. In particular, the shapes of the setae on the maxilla are alike in these two species. The differences between them are very slight, but are sufficient to allow us recognize them as distinct species. The main differences are: (1) the caudal rami are not articulated from the urosome and are 1.45 times longer than wide in *N. rectus* **gen. et sp. nov.** but are clearly defined from urosome and 1.13 times longer than wide in *N. scutatus* **gen. et sp. nov.**; (2) the rostrum is widest in the proximal 40% and abruptly narrowing and tapering in the distal 60% in *N. rectus* **gen. et sp. nov.** but it is slightly narrower in the proximal third, widest in middle, and tapering in the distal two-thirds in *N. scutatus* **gen. et sp. nov.**; (3) the mandible is uniramous in *N. rectus* **gen. et sp. nov.** but biramous in *N. scutatus* **gen. et sp. nov.**; and (4) all five observed specimens of *N. rectus* **gen. et sp. nov.** have straight bodies whereas the single specimen of *N. scutatus* **gen. et sp. nov.** has a curved body.

***Nodoscarus latirostris* gen. et sp. nov.**

(Fig. 434)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21457) from *Cystodytes violatinctus* Monniot, F., 1988, Grand Terre, Canal

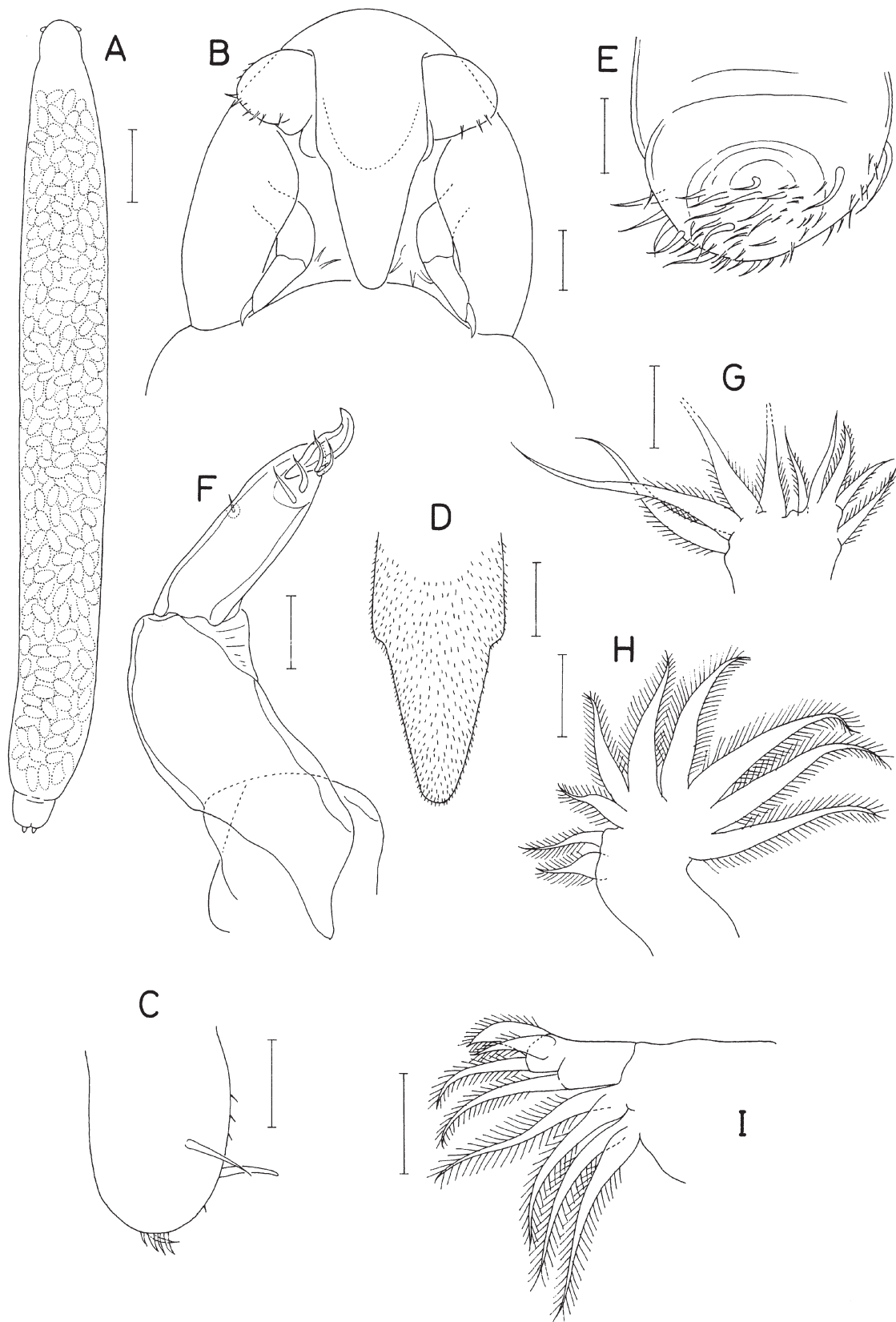
Woodin, New Caledonia, depth 3 m, Monniot coll., 18 September 1985.

**Etymology.** The specific name is derived from the Latin *lat* (=wide) and *rostr* (=snout), referring to the broad rostrum of the new species.

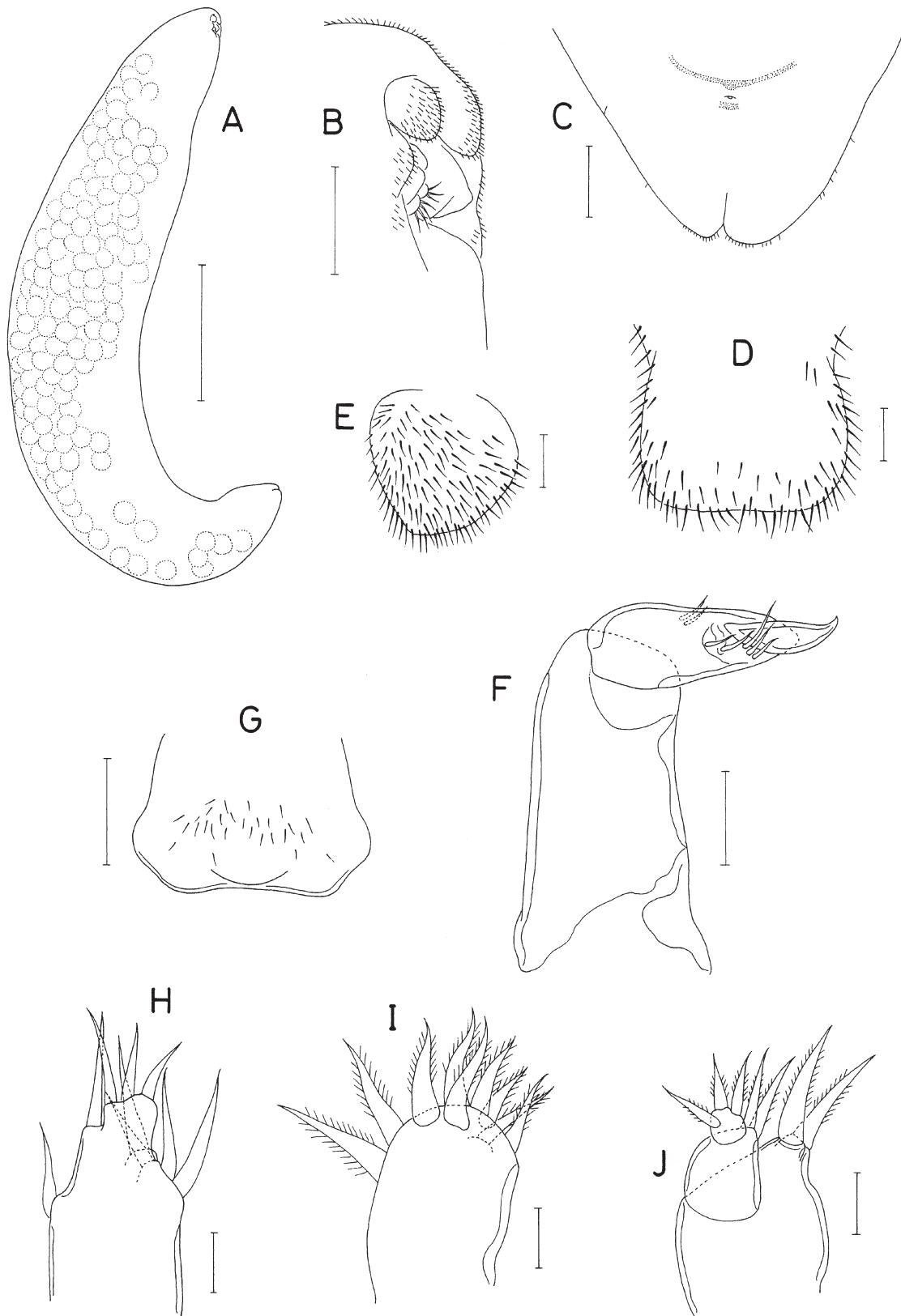
**Description of female.** Body (Fig. 434A) vermiform, cylindrical, unsegmented, tapering anteriorly and posteriorly. No traces of division of cephalosome, metasome, and urosome present. Posterior half of body recurved ventrally. Body length 5.54 mm; body width 1.03 mm at widest region in middle. Body surface ornamented with dense covering of fine setules anteriorly but becoming more sparse posteriorly. Posterodorsal region lacking any trace of transverse vestigial suture delimiting prosome from abdomen. Posterior margin of body bilobed, with median (anal) incision (Fig. 434C). Caudal rami fully incorporated into posterior margin; caudal setae lacking.

Rostrum (Fig. 434B, D) roughly quadrangular in ventral view, setulose, wider than long, with straight posterior margin and slightly convex lateral margins; both posterolateral corners rounded. Antennule (Fig. 434E) lobate, shorter than rostrum, unsegmented, setulose but lacking setae. Antenna (Fig. 434F) 3-segmented, first segment (coxa) obscure; basis unarmed; endopod about 2.2 times longer than wide ( $41 \times 18 \mu\text{m}$ ) and 0.7 times longer than basis: armed with 7 small setae (arranged as 2, 2, and 3) plus terminal claw half as long as endopod.

Labrum (Fig. 434G) with slightly concave posterior margin and convex lateral margins; ornamented with scattered setules on ventral surface. Mandible (Fig. 434H) lobate, unsegmented, armed with 9 setae (1 medial, 1 medial subdistal, 3 distal, and 4 outer); all setae naked. Maxillule (Fig. 434I) lobate with 9 pinnate setae

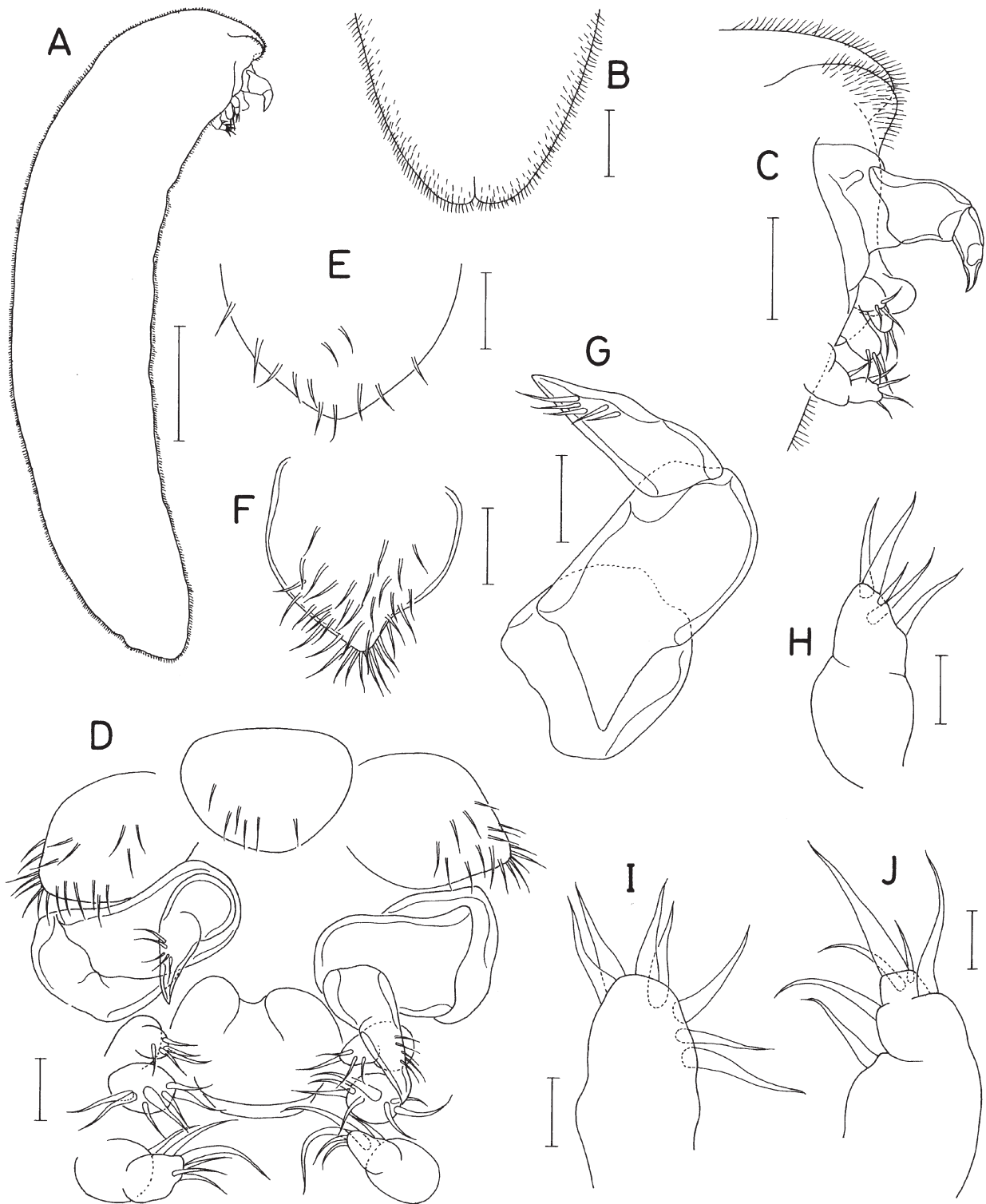


**FIGURE 433.** *Nodoscarus rectus* gen. et sp. nov., female. A, habitus, dorsal; B, cephalosome, ventral; C, caudal ramus; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule; I, maxilla. Scale bars: A, 0.5 mm; B–D, 0.05 mm; C, E–I, 0.02 mm.



**FIGURE 434.** *Nodoscarus latirostris* gen. et sp. nov., female. A, habitus, right; B, cephalic region, right; C, posterior end of body, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 1 mm; B, C, 0.1 mm; D–F, 0.02 mm; G, 0.05 mm; H–J, 0.01 mm.





**FIGURE 435.** *Nodoscarus dakarensis* gen. et sp. nov., female. A, habitus, right; B, posterior end of body, ventral; C, cephalic region, right; D, cephalic region, ventral; E, rostrum; F, antennule; G, antenna; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.2 mm; B, C, 0.05 mm; D–G, 0.02 mm; H–J, 0.01 mm.

increasing in length from inner to outer. Maxilla (Fig. 434J) distinctly 3-segmented, armed with 2, 2, and 3 setae on first to third segments, respectively; all setae weakly pinnate. Maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** In *Nodoscarus* **gen. nov.** the setation of the maxilla appears to vary according to species. In *N. latirostris* **gen. et sp. nov.** the maxilla is 3-segmented and armed with 2, 2, and 3 setae on the first to third segments, respectively. This setation pattern is unique within the genus, because in the four other congeners with a 3-segmented maxilla the setation pattern is 4, 1, and 3 (in *N. bretoni* **gen. et sp. nov.**, *N. scutatus* **gen. et sp. nov.**, and *N. rectus* **gen. et sp. nov.**), or 2, 1, and 4 (in *N. curvus* **gen. et sp. nov.**).

The form of the rostrum of *N. latirostris*, which is quadrangular in ventral view and wider than long, also serves to characterise this new species, considering that the rostrum of its congeners are typically longer than wide, or tapering with a rounded apex.

***Nodoscarus dakarensis* gen. et sp. nov.**  
(Fig. 435)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21458) and dissected paratype (♀, figured) from *Cystodytes roseolus* Hartmeyer, 1912 (MNHN-IT-2008-2602 = MNHN A3/CYS/4), Dakar, Senegal, dredge, IFAN coll., 21 January 1941.

**Etymology.** The new species is named after the type locality, Dakar, Senegal.

**Description of female.** Body (Fig. 435A) vermiform, cylindrical, slightly arched ventrally, unsegmented, surface densely covered with fine setules. Body length 1.30 mm; body width 0.25 mm across widest mid-region. Anterior and posterior extremities of body blunt; posterior margin (Fig. 435B) with weak median (anal) incision. No caudal rami or caudal setae present.

Rostrum (Fig. 435C-E) small, lobate, wider than long, setulose. Antennule (Fig. 435D, F) also lobate, unsegmented, wider than long with strongly tapering distal part; densely setulose and setae apparently absent. Antenna (Fig. 435G) 3-segmented, stout; coxa and basis unarmed; unsegmented endopod and terminal claw fused with each other, tapering to pointed tip, 2.5 times longer than wide (45×18 µm); armed with 5 small setae subdistally.

Labrum small, not covering mouthparts (Fig. 435D). Mandible (Fig. 435H) unsegmented, but with constriction near middle; armed with 5 naked setae (2 subdistal and 3 distal). Maxillule (Fig. 435I) as lobe bearing 7 subequal, naked setae (3 on medial margin). Maxilla (Fig. 435J) incompletely 2-segmented, armed with 6 naked setae, 1 on first segment and 5 (2 subdistal and 3 distal) on second; 1 distal seta markedly enlarged. Maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** *Nodoscarus dakarensis* **gen. et sp. nov.** can be distinguished from its congeners by the characteristic form of its antenna and the setation patterns of the mouthparts. The endopod and terminal claw of the antenna are completely fused, a rare feature within the Notodelphyidae. The mandible, maxillule and maxilla are armed with 5, 7, and 6 setae, respectively, each of these numbers is unique and not shared with any currently known species of *Nodoscarus* **gen. nov.**

***Nodoscarus compressus* gen. et sp. nov.**  
(Fig. 436)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21459) from *Leptoclinides* sp. (MNHN-IT-2008-4861 = MNHN A2/LEP/111), CRRF CRCHO 561, Baluan I., Papua New Guinea (2°32.27'S, 147°17.97'E), open reef, depth 24 m, L. Martin coll., 22 June 2003.

**Etymology.** The name of the new species refers to its laterally compressed body.

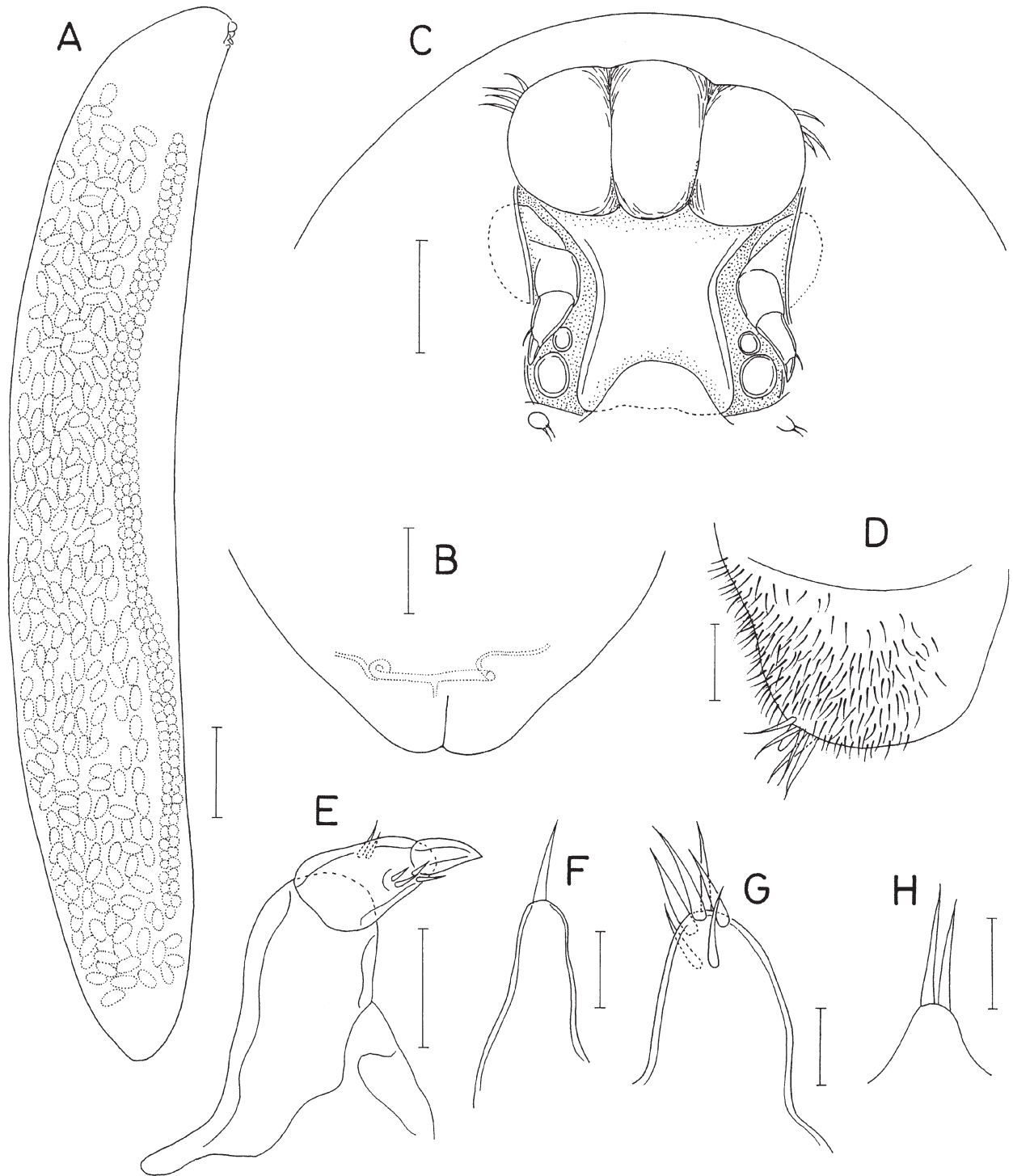
**Description of female.** Body (Fig. 436A) vermiform, slightly compressed laterally, smooth, almost straight, unsegmented. Body length 6.07 mm; dorsoventral depth of body 0.98 mm in middle. Both anterior and posterior regions of body narrowing; anterior region slightly curved ventrally; posterior end of body (Fig. 436B) weakly incised. No caudal rami or caudal setae present.

Rostrum (Fig. 436C) lobate, setulose. Antennule (Fig. 436C, D) also lobate, much wider than long, surface ornamented with numerous fine setules, armed with 5 or 6 small setae at anterodistal corner (1 short, blunt and aesthetasc-like). Antenna (Fig. 436E) stout, 2-segmented; first segment (coxobasis) unarmed; second segment (endopod) about 1.5 times longer than wide (22×15 µm), about half as long as coxobasis: armed with 6 small setae (arranged as 2, 2, and 2) plus short, stout terminal claw, about half as long as endopod. Antenna, labrum, and first and second mouthparts positioned in indented pre-oral cavity.

Labrum (Fig. 436C) large, unornamented, constricted at proximal third, gradually broadening in distal two-thirds, with almost straight posterior margin. Three pairs of mouthparts retained (Fig. 436C). Mandible (Fig. 436F) as unsegmented, digitiform lobe tipped with 1 naked seta. Maxillule (Fig. 436G) as stout lobe, bearing 6 naked setae (2 subdistal and 4 distal). Maxilla (third mouthpart, Fig. 436H) positioned just posterior to pre-oral cavity (Fig. 436C), as small lobe tipped with 2 subequal, naked setae. Post-oral swelling present between third pair of mouthparts (Fig. 436C), directed anteriorly, covering posterior part of labrum, with rounded margin. Maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** The unique numbers of setae on the

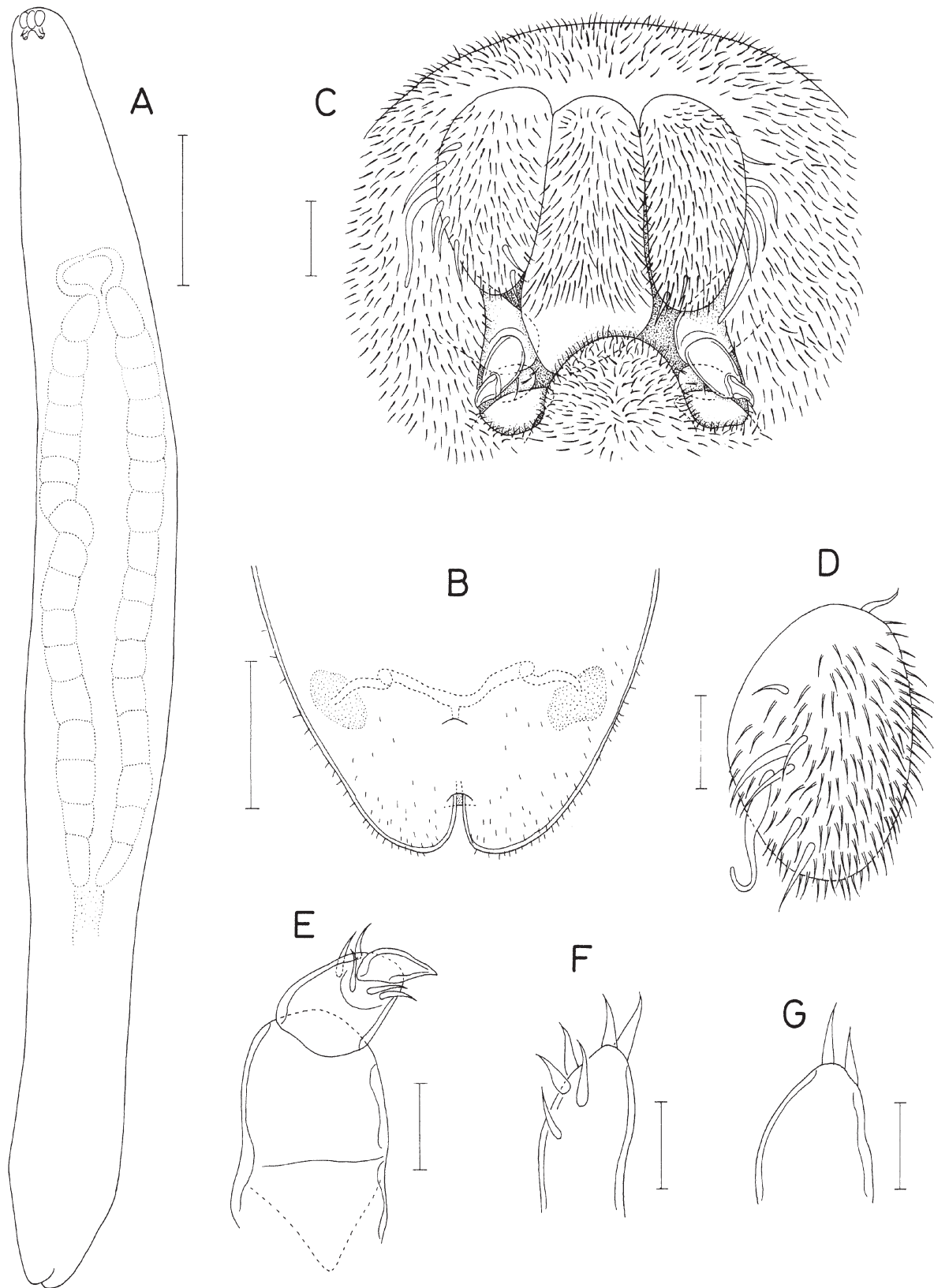


**FIGURE 436.** *Nodoscarus compressus* **gen. et sp. nov.**, female. A, habitus, right; B, posterior end of body, ventral; C, cephalic region, ventral; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla. Scale bars: A, 0.5 mm; B, 0.1 mm; C, 0.05 mm; D, E, 0.02 mm; F–H, 0.01 mm.

mandible, maxillule, and maxilla, which are 1, 6, and 2, respectively, allow *N. compressus* **gen. et sp. nov.** to be readily differentiated from its congeners. The slightly compressed body of the new species is also an unusual and characteristic feature of *N. compressus* **gen. et sp. nov.**

*Nodoscarus senisetatus* **gen. et sp. nov.**  
(Fig. 437)

**Type material.** Holotype (intact ♀, MNHN-IU-2009-5231), paratypes (2 intact ♀♀, MNHN-IU-2014-21460), and dissected paratype (♀, figured) from *Leptoclinides*



**FIGURE 437.** *Nodoscarus senisetatus* **gen. et sp. nov.**, female. A, habitus, ventral; B, posterior end of body, ventral; C, cephalic region, ventral; D, antennule; E, antenna; F, mandible; G, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C, D, 0.02 mm; E–G, 0.01 mm.

sp., ATIMO VATAE TA41, southeast of Madagascar (24°50.2'S, 47°10.7'E), depth 20 m, MNHN coll., 09 June 2010.

**Etymology.** The specific name is derived from the Latin *seni* (=six) and *set* (=bristle), referring to the presence of six setae on the mandible of the new species.

**Description of female.** Body (Fig. 437A) elongate, cylindrical, vermiform, unsegmented, straight, arched or sigmoid. Anterior third of body tapering anteriorly; posterior third of body narrower than mid-region. Body length 4.31 mm in figured, dissected specimen, 4.23 mm in holotype, and 2.88 and 2.90 mm in paratypes: body width 0.49 mm in dissected specimen. Body surface smooth (not wrinkled) in longer specimens, but displaying fine transverse wrinkles in shorter specimens (2 intact paratypes). Body surface ornamented with minute setules; setulation dense anteriorly but sparse in middle and posterior regions. Paired linear ovaries, occupying about half of body length, visible through body wall. Copulatory pore observable on posteroventral surface (Fig. 437B). Posterior end of body (Fig. 437B) bilobed, with deep median (anal) incision. Caudal rami and caudal setae absent.

Rostrum (Fig. 437C) large, longer than wide, covered with setules over most of ventral surface but naked distally. Antennule (Fig. 437C, D) lobate, much wider than long, densely setulose, armed with about 8 setae, longest seta bluntly tipped, aesthetasc-like. Antenna (Fig. 437E) small, stout, 2-segmented; first segment (coxobasis) unarmed, 1.5 times longer than wide; second segment (endopod) slightly longer than wide (14×12 µm), half as long as coxobasis: armed with 5 small setae distally plus stout terminal claw, 0.6 times as long as endopod, with pointed tip.

Labrum not discernible. Mouthparts positioned within pre-oral cavity; only 2 pairs of mouthparts present. Mandible (first pair, Fig. 437F) lobate, armed with 6 small, subequal setae. Maxillule (second pair, Fig. 437G) lobate, bearing 2 setae at tip. Large, anteriorly-directed, post-oral protuberance present posterior to mouthparts (Fig. 437C). Maxillae, maxillipeds, and legs absent.

**Male.** Unknown.

**Remarks.** *Nodoscarus senisetatus* **gen. et sp. nov.** differs from all of its congeners described above in having only two pairs of mouthparts (mandibles and maxillules). The large rostrum, the stout antenna, and the distinct posteromedian incision of the body are additional features which help to distinguish the new species.

***Nodoscarus quadrisetatus* gen. et sp. nov.**  
(Fig. 438)

**Type material.** Holotype ♀ (dissected and mounted on a slide, MNHN-IU-2014-21461) from *Leptoclinides robiginis* Monniot, F., 1989, south lagoon, New Caledonia.

**Etymology.** The specific name refers to the presence of four setae on the mandible.

**Description of female.** Body (Fig. 438A) vermiform, elongate, cylindrical, unsegmented, almost straight, surface densely covered with fine setules (setules not shown in Fig. 438A, B). Body length 6.25 mm; body width 0.93 mm in middle. Paired convoluted ovaries, occupying 70% of body length, visible through body wall. Body tapering slightly anteriorly. Posterior end of body (Fig. 438B) bilobed, with shallow median (anal) incision.

Rostrum absent (Fig. 438C). Antennule (Fig. 438C) as broad, semicircular lobe, surface covered with fine setules plus 1 or 2 small setae apically. Antenna (Fig. 438D) stout, 3-segmented: coxa short; basis only slightly longer than wide, unarmed; endopod about 1.4 times longer than wide (24×17 µm): armed with 1 subdistal and 3 small distal setae, plus short, stout terminal claw, half as long as endopod.

Labrum not discernible. Only 2 pairs of mouthparts present. Mandible (first pair, Fig. 438E) lobate, tipped with 4 naked setae. Maxillule (second pair, Fig. 438F) lobate, tipped with 2 setae. Large, anteriorly-directed, post-oral protuberance present posterior to oral region (Fig. 438C). Maxillae, maxillipeds, and legs absent.

**Male.** Unknown.

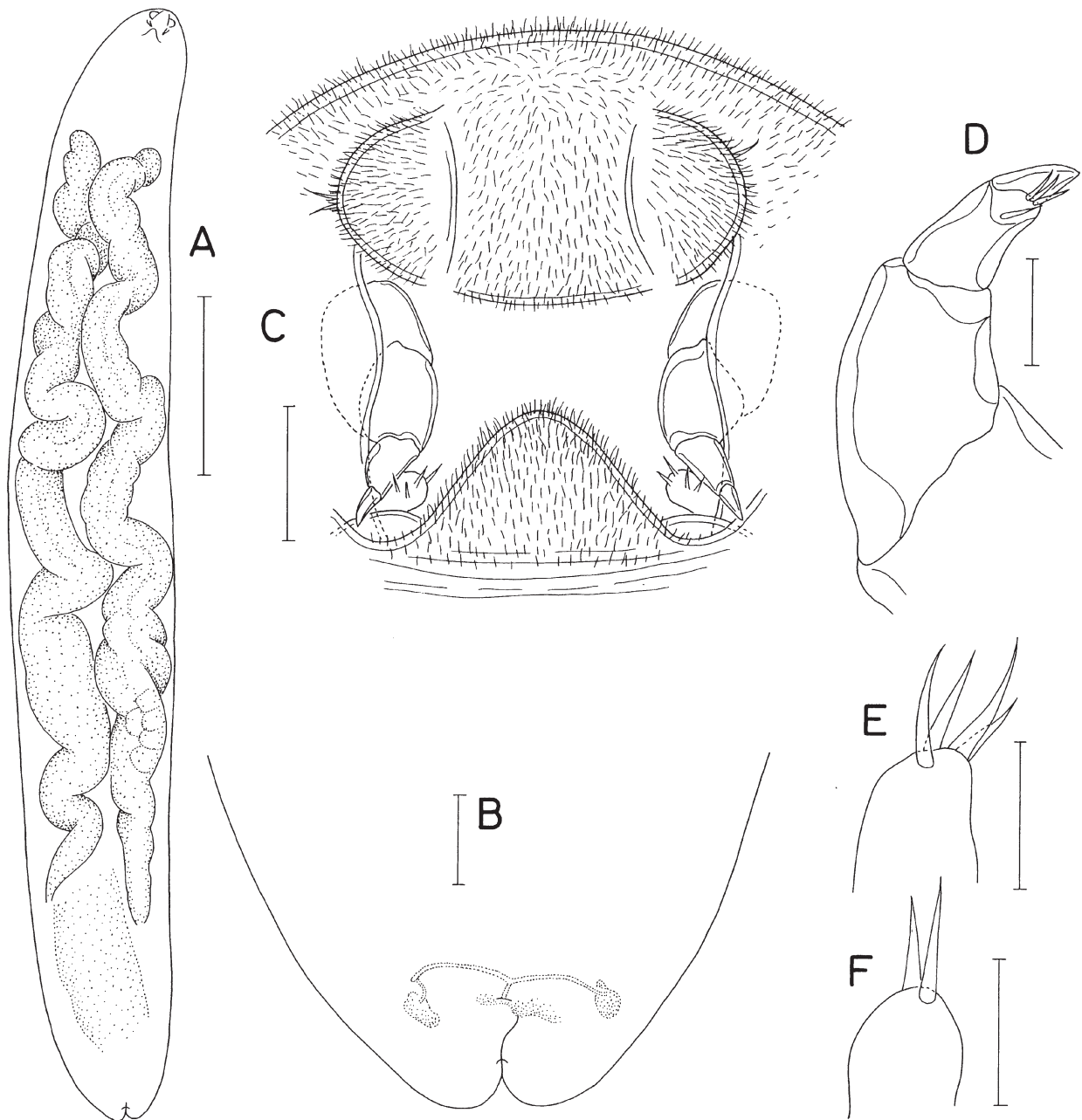
**Remarks.** *Nodoscarus quadrisetatus* **gen. et sp. nov.** is best compared with *N. senisetatus* **gen. et sp. nov.**, because both of these two species retain only two pairs of mouthparts and share the presence of 2 setae on the second pair (the maxillules). The new species can be distinguished from *N. senisetatus* **gen. et sp. nov.** by the lack of a rostrum and by the possession of 4 setae on the mandible (vs. 6 setae in *N. senisetatus* **gen. et sp. nov.**).

### ***Haplostatus* Illg & Dudley, 1961**

**Diagnosis.** Body vermiform, cylindrical, without any metameric division. Urosome not demarcated from prosome, indistinctly 3-segmented. Anal somite tipped with pair of claws. Rostrum distinct, semicircular. Antennule as unsegmented lobe. Antenna 2-segmented. Antennae and vestigial mouthparts positioned within pre-oral cavity. Labrum distinct. Mouthparts absent or represented by 1 pair of small, bimerous lobes. Legs absent.

**Type species.** *Haplostatus incubatrix* Illg & Dudley, 1961 by original designation.

**Remarks.** The discovery of a second species enables us to better define the genus *Haplostatus*. In both species the urosome is segmented and carries a pair of claws posteriorly on the anal somite, and the antennae and mouthparts are located within a pre-oral cavity. These are the major diagnostic features of *Haplostatus*. The genera *Pholeterides* and *Sicyodelphys* were described as possessing a 3- or 4-segmented urosome, terminating in



**FIGURE 438.** *Nodoscarus quadrisetatus* gen. et sp. nov., female. A, habitus, ventral; B, posterior end of body, ventral; C, cephalic region, ventral; D, antenna; E, mandible; F, maxillule. Scale bars: A, 1 mm; B, 0.1 mm; C, 0.05 mm; D–F, 0.02 mm.

a pair of claws on the anal somite, as in *Haplostatus*, but these two genera both have legs, unlike *Haplostatus*.

***Haplostatus dakarensis* sp. nov.**

(Fig. 439)

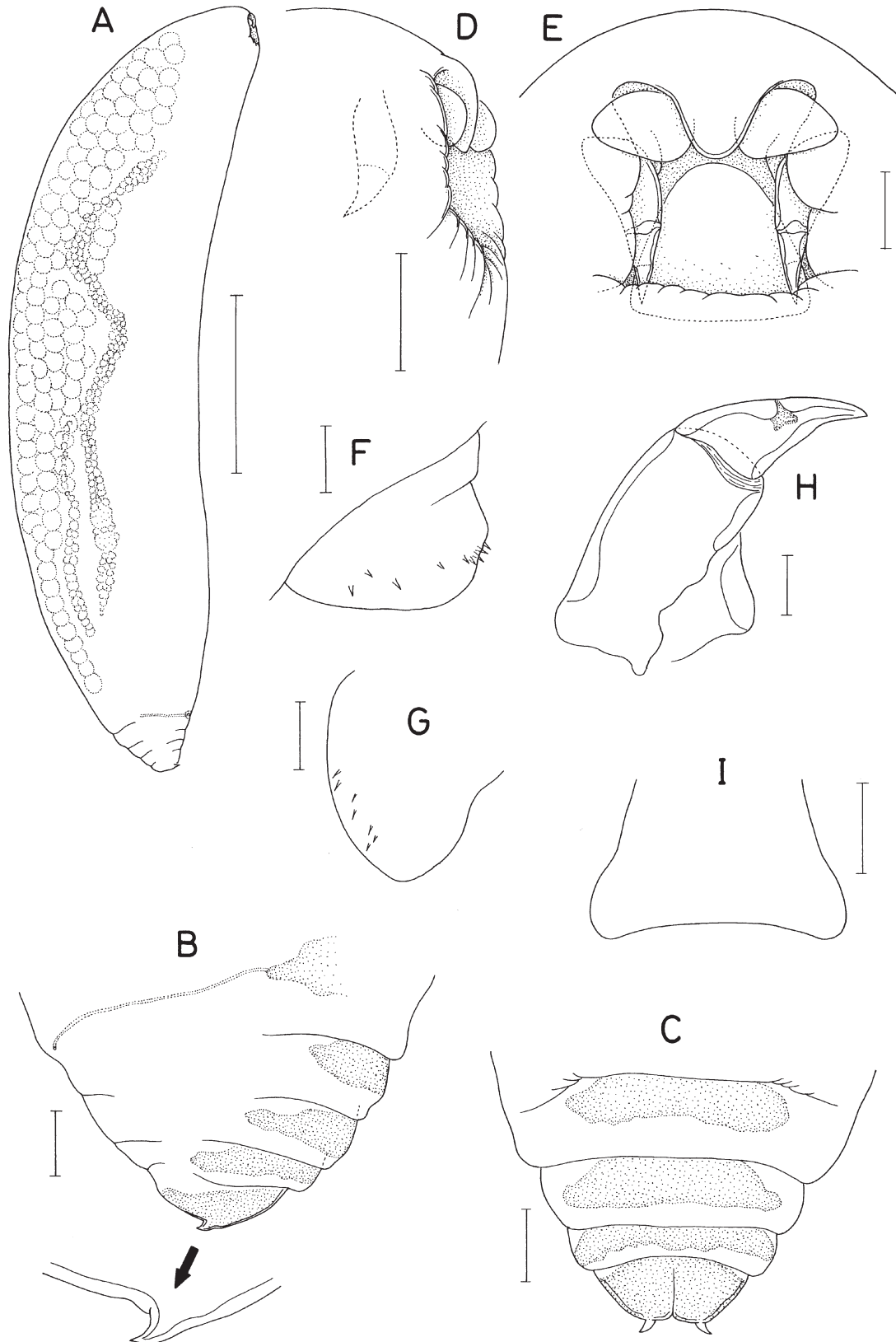
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21462), paratype (intact ♀, MNUN-IU-2014-21463), and dissected paratype (♀, figured) from *Cystodytes roseolus*

Hartmeyer, 1912 (MNHN-IT-2008-2603 = MNHN A3/CYS/36), off Dakar, Senegal, Leung Tar kit coll.

**Additional material.** 3 ♀♀ (MNHN-IU-2018-1915) from the same host species and same locality as the type material.

**Etymology.** The name of the new species refers to the type locality, Dakar, Senegal.

**Description of female.** Body (Fig. 439A) vermiform, cylindrical, slightly arched ventrally, narrowing anteriorly and posteriorly, without any metameric subdivision. Body



**FIGURE 439.** *Haplostatus dakarensis* **sp. nov.**, female. A, habitus, right; B, posterior end of body, left, with inset showing claw-like process on anal somite; C, posterior end of body, dorsal; D, cephalic region, right; E, cephalic region, ventral; F, antennule, dorsal; G, antennule, ventral; H, antenna; I, mandible. Scale bars: A, 1 mm; B–D, 0.1 mm; E, I, 0.05 mm; F–H, 0.02 mm.

length 4.42 mm in holotype; greatest width 1.12 mm in middle; body lengths of 2 paratypes 3.04 and 5.20 mm. Body surface smooth, without ornamentation of setules or wrinkles. Free urosome (Fig. 439B, C) short, occupying 7% of total body length, obscurely 3-segmented, with additional partial suture line (or wrinkle) dorsally, anterior to first urosomite and 4 faint sclerotization bands on dorsal side (Fig. 439C). Last urosomite (anal somite) weakly bilobed; each lobe tipped with small, pointed, claw-like process (Fig. 439B, C).

Rostrum (Fig. 439D, E) distinct, slightly wider than long, tapering towards rounded distal margin. Antennule (Fig. 439F, G) lobate, unsegmented, wider than long, ornamented with few, minute spinules subdistally. Antenna (Fig. 439H) located deep inside pre-oral cavity (Fig. 439D); stout, 2-segmented, both segments unarmed; distal (endopodal) segment strongly tapering, fused to terminal claw, leaving only partial non-sclerotized region as vestige of articulation.

Labrum (Fig. 439I) broadening posteriorly, located deep inside pre-oral cavity, unornamented, with slightly concave posterior margin. Mandibles, maxillules, maxillae, maxillipeds and legs absent.

**Male.** Unknown.

**Remarks.** *Haplostatus incubatrix*, the type species of the genus, is associated with the compound ascidian *Cystodytes dellechiaiei* (Della Valle, 1877) found in the Mediterranean Sea (Illg & Dudley, 1961). *Haplostatus dakarensis* **sp. nov.** differs from the type species as follows: (1) the body surface is smooth, without setules or wrinkles, compared to the presence of an ornamentation of fine setules over the entire body surface in *H. incubatrix*, as described by Illg & Dudley (1961); (2) the antennule is wider than long and carries a few spinules, compared to the antennule of *H. incubatrix* which is longer than wide (Illg & Dudley, 1961); (3) the endopod and terminal claw of the antenna are fused, compared to the free terminal claw of *H. incubatrix*; and (4) the mouthparts are all lacking, whereas one pair of mouthparts is retained in *H. incubatrix*.

### ***Chilodelphys* gen. nov.**

**Diagnosis.** Body stout, maggot-shaped, divisible into cephalosome, metasome, and urosome. Cephalosome incompletely articulated from metasome, with expanded ventral region. Free urosome small, indistinctly 2-segmented, consisting of genital somite and unsegmented abdomen bearing caudal rami. Rostrum distinct. Antennule 2-segmented with setae on distal segment. Antenna 3-segmented, consisting of short coxa, basis, and unsegmented endopod bearing small terminal claw. Labrum lobate. Mouthparts absent. Three pairs of large ventral lobes present in oral region. Legs 1–4 absent. Leg 5 transformed to horn-like, pointed process bearing 1 minute seta proximally on outer margin.

**Type species.** *Chilodelphys cerasta* **gen. et sp. nov.** by original designation.

**Etymology.** The name is derived from the Greek *chil* (=lip) plus *-delphys*, and alludes to the presence of three pairs of lip-like swellings in the oral region.

**Remarks.** The new genus is characterised by its autapomorphic feature, the possession of the three pairs of large lobes in the oral region. It is possible that these lobes represent transformed mouthparts but without the additional evidence provided by, for example, a series of ontogenetic stages or the presence of recognizable setation elements, we prefer to use a neutral terminology. Despite the lack of mouthparts and legs 1–4, a transformed leg 5 and a distinct free urosome bearing caudal rami are present.

### ***Chilodelphys cerasta* gen. et sp. nov.**

(Fig. 440)

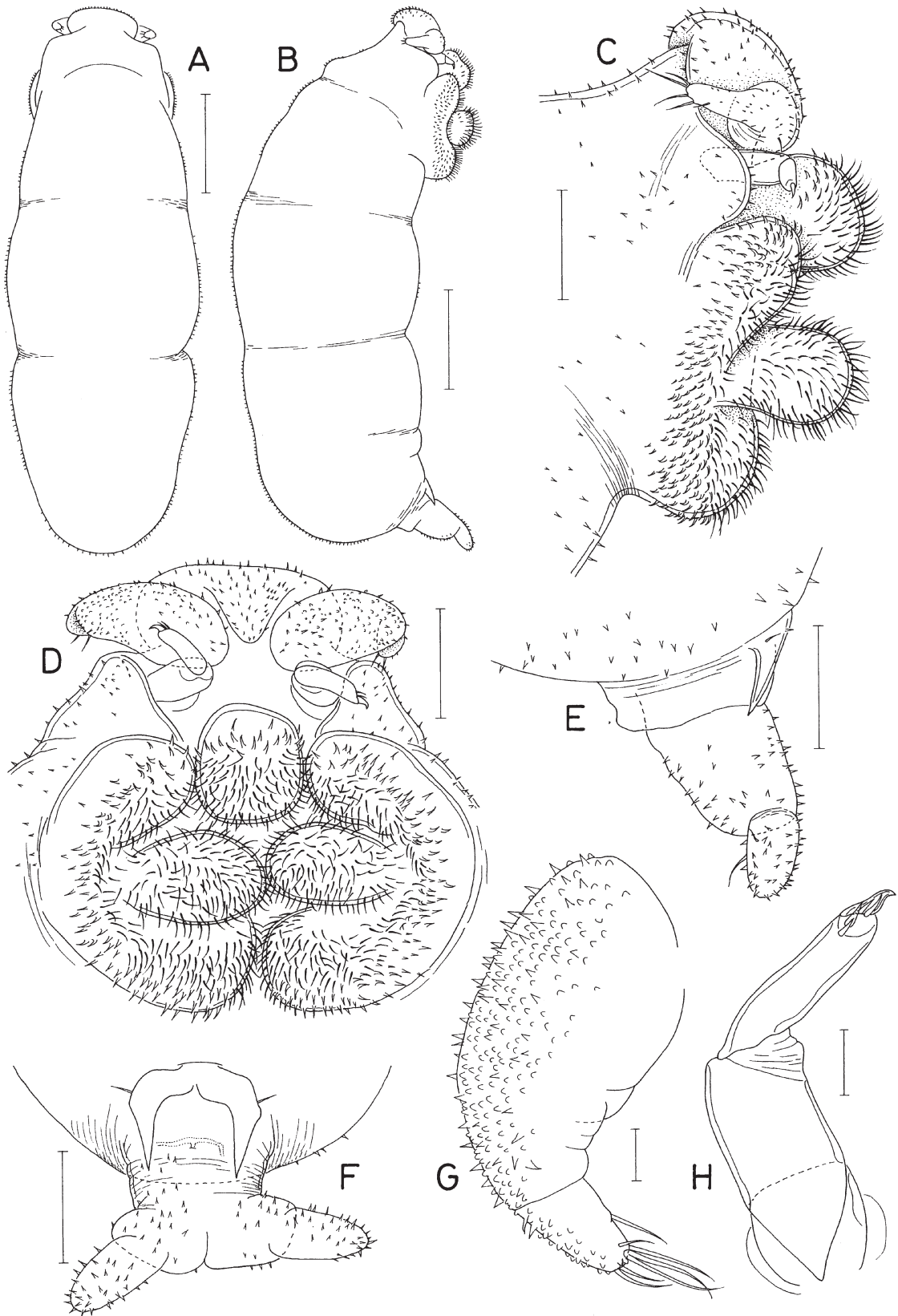
**Type material.** Holotype (intact ♀, MNHN-IU-2014-21464) and dissected paratype (♀, figured) from *Didemnum cuculliferum* (Sluiter, 1909), south lagoon, New Caledonia, depth 10–40 m. Monniot coll., 1985.

**Etymology.** The specific name is derived from the Greek *cerast* (=horned) referring to the presence of the horn-like leg 5.

**Description of female.** Body maggot-shaped (Fig. 440A, B), slightly arched ventrally, divisible into cephalosome, metasome, and urosome. Body length 1.75 mm; maximum body width 0.54 mm across middle of metasome. Cephalosome incompletely articulated from metasome, with expanded ventral region. Metasome subdivided by 2 constrictions into 3 parts; middle part widest; posterior part longest and bearing transformed leg 5 posteroventrally (Fig. 440E, F). Body surface covered with numerous fine spinules. Free urosome (Fig. 440F, G) directed posteroventrally, small, about 200 µm long, indistinctly 2-segmented, consisting of genital somite and abdomen. Abdomen about twice as long as genital somite, ornamented with scattered fine spinules on surface. Caudal rami about 1.8 times longer than wide (86×48 µm), incompletely articulated from abdomen; ornamented with scattered fine spinules on surface, and bearing 1 small seta dorsally.

Rostrum (Fig. 440D) broad, strongly tapering towards rounded apex. Antennule (Fig. 440G) tapering, 2-segmented, 170 µm long, curved dorsally, covered with fine spinules and papillae; first segment lacking setae; second segment occupying 23% of total antennule length, armed with 7 small setae of unequal lengths, longest seta as long as segment. Antenna (Fig. 440H) 3-segmented, including short unarmed coxa; unarmed basis; slender unsegmented endopod about 3.5 times longer than wide (56×16 µm), as long as basis; armed with 2 subdistal and 2 distal setae plus very small terminal claw, about 0.2 times as long as endopod.





**FIGURE 440.** *Chilodelphys cerasta* gen. et sp. nov., female. A, habitus, dorsal; B, habitus, right; C, cephalic region, right; D, cephalic region, ventral; E, urosome, right; F, urosome, ventral; G, antennule; H, antenna. Scale bars: A, B, 1 mm; C–F, 0.1 mm; G, H, 0.02 mm.

Labrum (Fig. 440C, D) as ventrally protruding, setule-covered lobe. Mouthparts absent, but 3 pairs of large ventral lobes present in oral region; each lobe densely covered with setules distally and fine spinules proximally; middle lobe protruding ventrally. Mouth not discernible.

Legs 1–4 absent. Leg 5 (Fig. 440E, F) positioned on posteroventral surface of metasome, transformed into horn-like, pointed process bearing 1 minute seta proximally on outer margin.

**Male.** Unknown.

**Remarks.** The three pairs of swellings in the oral region may represent vestiges of the mouthparts but no evidence is currently available to support this interpretation.

### *Scaridelphys* gen. nov.

**Diagnosis.** Body elongate, cylindrical, vermiform, consisting of prosome and rudimentary free abdomen. Body surface covered with minute spinules or papillae. Prosome unsegmented or with traces of suture lines. Abdomen small, unsegmented, obscurely articulated from prosome. Caudal rami and caudal setae absent. Antennule globular or lobate. Antenna absent. Labrum present. Mandible represented by small lobe positioned lateral to labrum. Other mouthparts absent. Legs absent.

**Type species.** *Scaridelphys papillata* gen. et sp. nov. by original designation.

**Other included species.** *Scaridelphys deplanata* gen. et sp. nov.

**Etymology.** The name is derived from the Greek *scari* (=a little worm) and *-delphys*, alluding to the worm-like body form of the new genus. Gender feminine.

**Remarks.** Within the Notodelphyidae, *Scaridelphys* gen. nov. has the most simplified body. The new genus may be compared with *Haplostatus* in the extreme reduction of the mouthparts but further reductions occur in the new genus, i.e., it lacks the rostrum and antenna and has a small, unsegmented urosome.

### *Scaridelphys papillata* gen. et sp. nov.

(Fig. 441)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21465) and paratype (intact ♀, MNHN-IU-2014-21466) from *Didemnum poecilomorpha* Monniot F. & Monniot C., 1996 (Type MNHN-IT-2008-3239 = MNHN A2/DID.C/230), north of Sulawesi, Indonesia (01°51.52'N, 125°03.84'E), depth 40 m, 20 May 1993.

**Etymology.** The specific name alludes to the papillate ornamentation of the body and lobate antennules.

**Description of female.** Body (Fig. 441A) elongate, vermiform, cylindrical, consisting of cephalosome, long metasome and small urosome: body length 7.13 mm.

Cephalosome (Fig. 441B, C) slightly longer than wide, 0.87 mm wide, snake-head-shaped, gradually broadening posteriorly, but not articulated from metasome. Metasome 0.76 mm wide; posterior quarter slightly narrower than anterior three quarters. Body surfaces covered with minute papillae, dense on dorsal and lateral surfaces, and sparse on ventral surface. Copulatory pore present posteroventrally on metasome (Fig. 441D). Free abdomen (Fig. 441D) small, unsegmented, bilobed, incompletely articulated from metasome, with deep posteromedian incision, each lobe subcircular, as long as wide; both lobes connected at base. Caudal rami and caudal setae absent.

Rostrum absent. Antennule (Fig. 441B, C) represented by large spherical lobe, covered with papillae, but unarmed. Antenna absent. Labrum (Fig. 441B) positioned posterior to antennule, strongly tapering towards blunt apex, surface covered with papillae. One pair of minute lobes (Fig. 441B, E), probably vestigial mandibles, positioned lateral to labrum. Other mouthparts absent. Legs absent.

**Male.** Unknown.

**Remarks.** This is a relatively large species, with a total body length of 7.13 mm, which is markedly larger than its congener described below.

### *Scaridelphys deplanata* gen. et sp. nov.

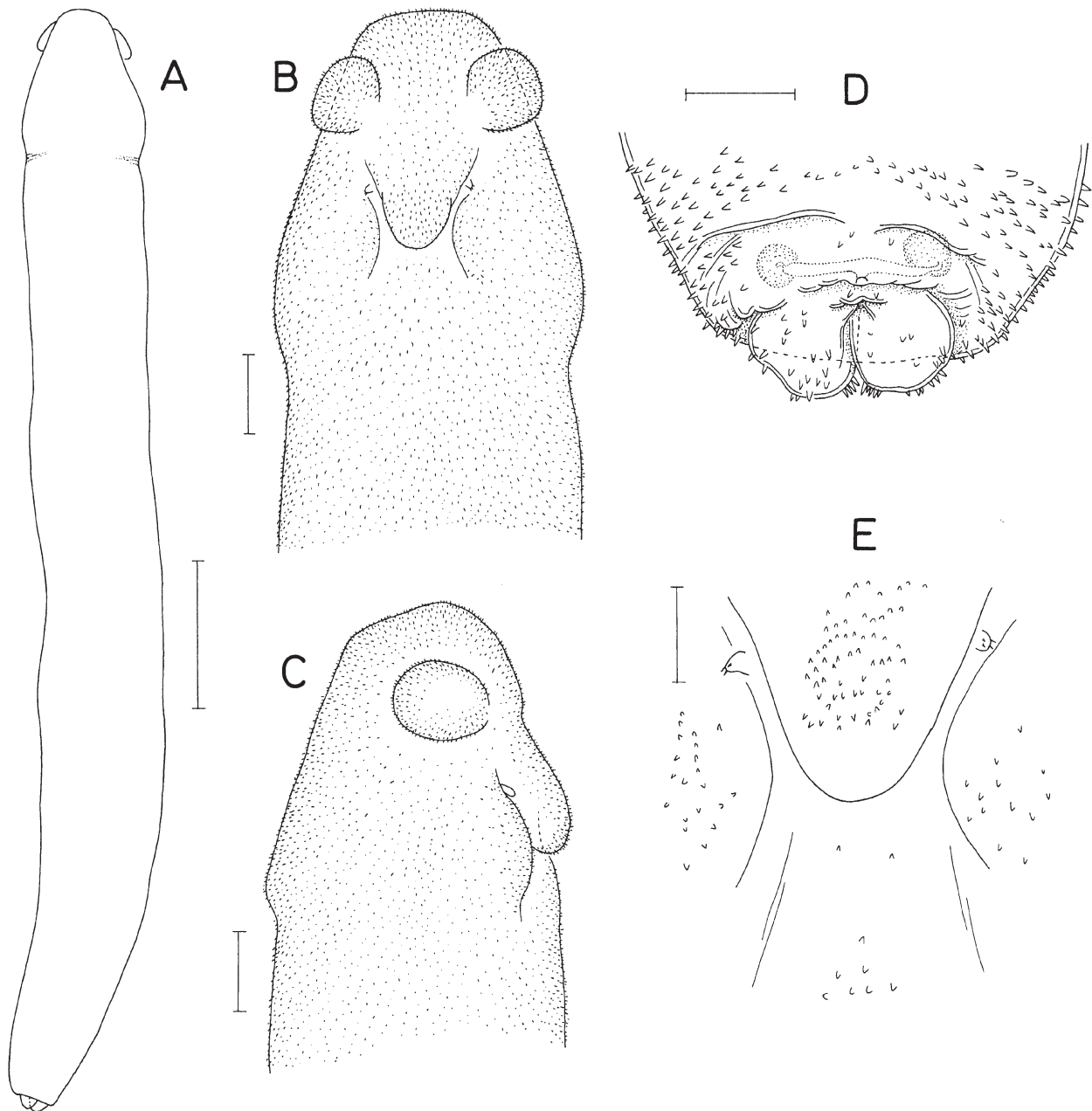
(Fig. 442)

**Type material.** Holotype ♀ (intact, MNHN-IU-2014-21467) from *Didemnum parau* Monniot C & Monniot F., 1987 (MNHN-IT-2008-3200 = MNHN A2/DID.C/533), CRRF OCDN 8855-K, Baluan, Papua New Guinea (02°32.27'N, 147°17.97'E), depth 7 m, 22 June 2003.

**Etymology.** The specific name is derived from the Latin *deplanat* (=flattened), referring to the dorsoventrally depressed body.

**Description of female.** Body (Fig. 442A) dorsoventrally flattened, flatworm-shaped. Body length 4.42 mm; greatest body width 770 µm across cephalosome. Body surfaces covered with ornamentation of minute papillae, densely on dorsal surface and sparsely on ventral surface. Cephalosome (Fig. 442B) nearly quadrate, with truncate frontal margin. Cephalosome and 4 pedigerous somites discernible by 4 faint dorsal suture lines: lengths of cephalosome and pedigerous somites approximately 0.81, 0.41, 0.27, 1.2, and 1.6 mm, respectively. Last metasomite gradually narrowing posteriorly. Free urosome (Fig. 442C) small, 177×208 µm, articulated from trunk on ventral surface, but without any trace of articulation on dorsal surface, weakly bilobed distally, with shallow posteromedial (anal) incision. Caudal rami and caudal setae absent.

Rostrum absent. Antennule (Fig. 442D) represented by small anterolateral prominence (Fig. 442B) tipped with about 5 small setae. Antenna absent. Labrum (Fig. 442E) longer than wide, broadening distally, with slightly convex distal margin. Mouth visible beneath labrum (Fig.



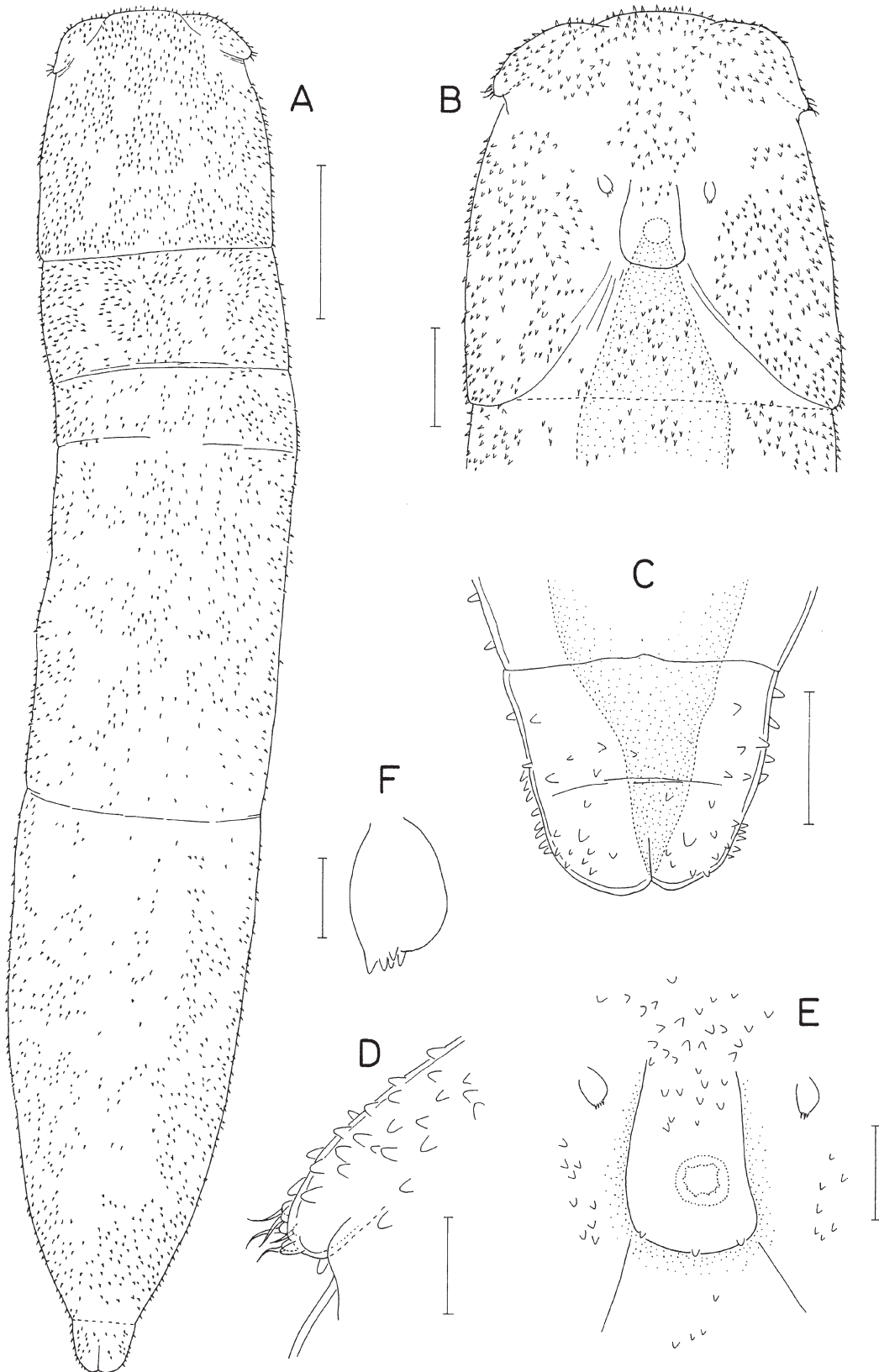
**FIGURE 441.** *Scaridelphys papillata* **gen. et sp. nov.**, female. A, habitus, dorsal; B, cephalic region, ventral; C, cephalic region, right; D, posterior end of body, ventral; E, oral region. Scale bars: A, 1 mm; B, C, 0.2 mm; D, E, 0.1 mm.

442E). One small, vestigial lobe (Fig. 442E, F) tipped with several papillae, probably representing mandible, present on each side of base of labrum. Other mouthparts absent. Legs absent.

**Male.** Unknown.

**Remarks.** This species is treated as congeneric with *Scaridelphys papillata* **gen. et sp. nov.** on the grounds that both retain the antennules, the labrum, and one pair of vestigial mouthparts, but lack antennae and any vestiges of other mouthparts. The pair of vestigial appendages is tentatively interpreted here as the mandibles, mainly on the basis of its position lateral to the base of the labrum. There

are several differences between these two species: the body is cylindrical in the type species but flattened in *S. deplanata* **gen. et sp. nov.**, the cephalosome is snake-head-shaped in the type species and but quadrate in *S. deplanata* **gen. et sp. nov.**, the antennule is spherical in *S. papillata* **gen. et sp. nov.** but represented by a small lobe in *S. deplanata* **gen. et sp. nov.**, the labrum tapers distally in *S. papillata* **gen. et sp. nov.** but broadens distally in *S. deplanata* **gen. et sp. nov.**, and the rear margin of the abdomen is bilobed with a deep posteromedian incision in *S. papillata* **gen. et sp. nov.** but is weakly bilobed with a shallow posteromedian incision in *S. deplanata* **gen. et sp. nov.**



**FIGURE 442.** *Scaridelphys deplanata* **gen. et sp. nov.**, female. A, habitus, dorsal; B, cephalic region, ventral; C, posterior end of body, ventral; D, right antennule, ventral; E, oral region, ventral; F, antenna. Scale bars: A, 0.5 mm; B, 0.2 mm; C, E, 0.1 mm; D, 0.05 mm; F, 0.02 mm.

### *Socotradelphys* gen. nov.

**Diagnosis.** Body maggot-shaped, consisting of unsegmented prosome and vestigial urosome. Body surface ornamented with sparsely scattered, minute spinules. Urosome unsegmented, positioned posterodorsally on prosome, bilobed posteriorly, with deep posteromedial incision. Caudal rami lobate, lacking caudal setae. Cephalosome with large, bulbous ventrolateral processes positioned in same plane as labrum. Antenna rudimentary, but segmented and tipped with claw; positioned between bases of labrum and ventrolateral process. Labrum large, conical. Mouthparts absent. Leg 1 as globular lobe, located posterior to labrum. Legs 2–5 absent.

**Type species.** *Socotradelphys unipedata* gen. et sp. nov. by original designation.

**Etymology.** The generic name *Socotradelphys* is derived from “Socotra Island”, Yemen, the type locality of the type species, and *-delphys*. Gender feminine.

**Remarks.** Boxshall & Marchenkov (2007) analysed the phylogenetic relationships between five highly transformed genera within the Notodelphyidae and referred to them as the *Bremenia*-group. These genera are *Bremenia* Chatton & Harant, 1915, *Achelidelphys* Lafargue & Laubier, 1977, *Anoplodelphys* Lafargue & Laubier, 1978, *Paranoplodelphys* Boxshall & Marchenkov, 2007, and *Pholeterides*. *Socotradelphys* gen. nov. certainly belongs to this group and is characterised by its extremely simplified body structure. It lacks the rostrum, antennules, mouthparts, and legs 2–4. Within the group, *Socotradelphys* gen. nov. appears to be more closely related to *Anoplodelphys* than to the other genera, because it carries a pair of ventrolateral processes on the cephalosome. However, all known species of *Anoplodelphys* have a rostrum and paired antennules, plus at least two pairs of biramous legs (legs 1 and 2) so the lack of a rostrum and antennules, and the possession of a uniramous leg 1 only, serves to distinguish the new genus from *Anoplodelphys*.

### *Socotradelphys unipedata* gen. et sp. nov. (Fig. 443)

**Type material.** Holotype (intact ♀, MNHN-IU-2009-5058), paratype (intact ♀, MNHN-IU-2014-21468), and dissected paratype (♀, figured) from *Didemnum* sp. (MNHN-IT-2008-3381 = MNHN A2/DID.C/581), Socotra Island, Yemen, Monniot coll., September 1996.

**Etymology.** The specific name refers to the presence of only a single pair of legs in the new species.

**Description of female.** Body (Fig. 443A) maggot-shaped, gradually broadening posteriorly, consisting of unsegmented prosome and small, rudimentary urosome, with thin, soft epidermis. Body length 2.12 mm; body width 0.65 mm across widest region in posterior 20% of

body. Body surface ornamented with sparsely scattered, fine spinules. Cephalosome (Fig. 443B) with pair of swollen, lateral processes; processes bulbous, gradually broadening distally, directed ventro-medially, extending to level of tip of labrum. Urosome (Fig. 443C) indistinctly 2-segmented, positioned on dorsal surface of prosome near posterior end; first somite obscure, fused with prosome; second wider than long (77×94 µm), bilobed posteriorly, with deep posteromedian incision in rear margin; ornamented with scattered spinules. Caudal rami small, lobate, 19×14 µm, indistinctly articulated from abdomen, unarmed but ornamented with several spinules.

Rostrum and antennules absent. Antenna (Fig. 443D) extremely small, 2-segmented, positioned between base of labrum and ventrolateral lateral processes (Fig. 443B); second segment subdivided by lateral constriction, tipped with small claw. Labrum (Fig. 443B) large, longer than wide, tapering towards rounded apex. Mouth visible beneath labrum (Fig. 443B). Mouthparts absent. Leg 1 represented by paired globular lobes positioned close to each other on mid-ventral surface, posterior to apex of labrum (Fig. 443B). Legs 2–5 absent.

**Male.** Unknown.

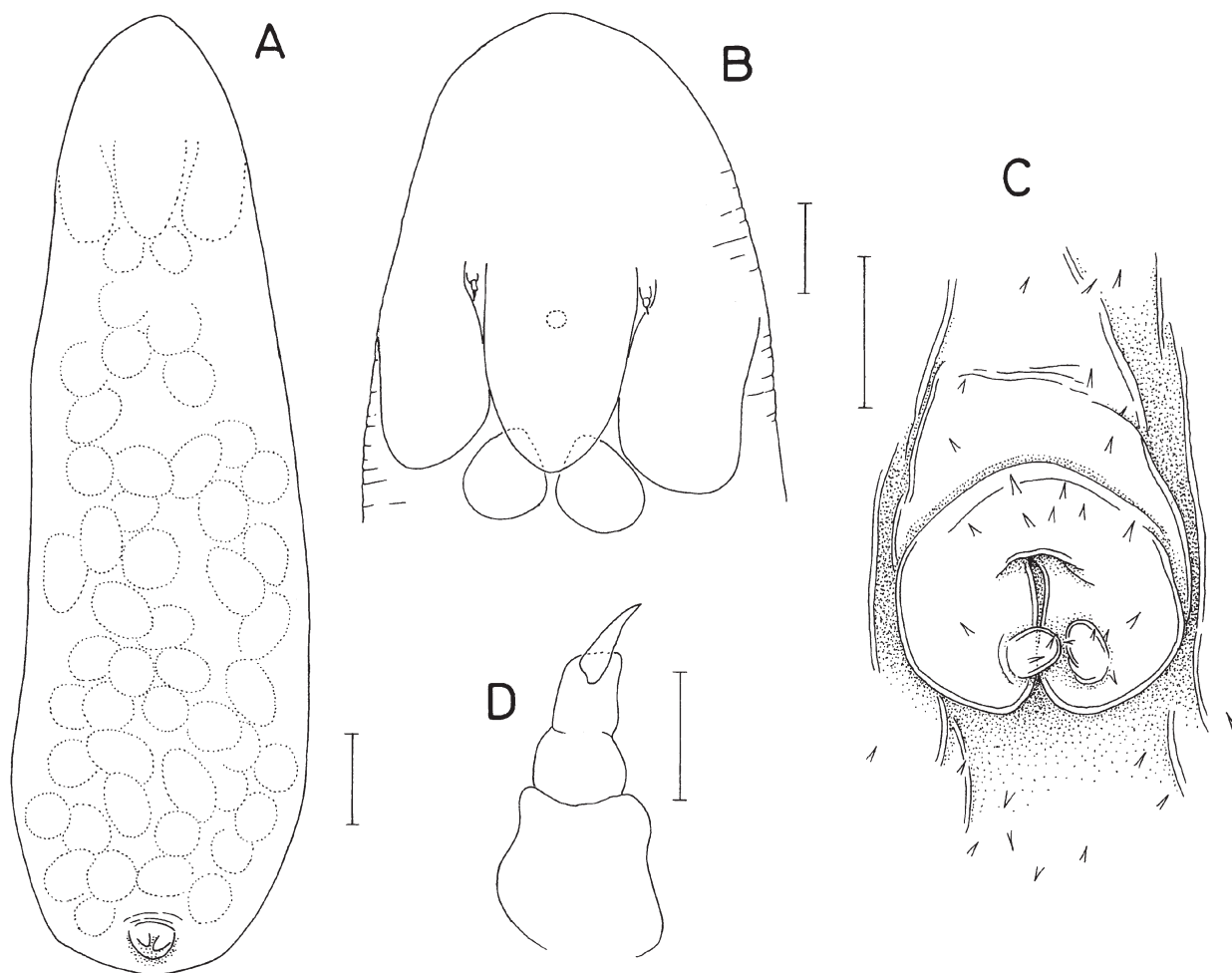
### *Aplodelphys* gen. nov.

**Diagnosis.** Body cylindrical, consisting of unsegmented prosome and small urosome. Body surface covered with fine spinules. Urosome unsegmented, positioned at posterior end of prosome, bearing lobate caudal rami. Caudal setae absent. Rostrum and antennules lacking. Antenna small, 2-segmented with terminal claw. Labrum large, conical, posteriorly-directed, extending slightly beyond distal tip of leg 1 rami. Mouthparts absent. Legs 1 and 2 positioned ventrally and directed posteriorly. Leg 1 biramous; rami digitiform, unsegmented and conical; both rami equal in length. Leg 2 as in leg 1 but with slightly smaller rami. Legs 3–5 absent.

**Type species.** *Aplodelphys conica* gen. et sp. nov. by original designation.

**Etymology.** The name is derived from the Greek *apl* (=simple) and *-delphys*, referring to the simple body structure of the new genus.

**Remarks.** *Aplodelphys* gen. nov. shows extreme reduction in appendages, a feature that it shares with *Socotradelphys* gen. nov. and *Paranoplodelphys*. *Aplodelphys* gen. nov. lacks ventrolateral processes on the cephalosome and bears biramous legs 1 and 2, which separates it from *Socotradelphys* gen. nov. It lacks antennules but has paired antennae and a biramous leg 2, which serve to distinguish it from *Paranoplodelphys*.



**FIGURE 443.** *Socotradelphys unipedata* gen. et sp. nov., female. A, habitus, dorsal; B, cephalic region, ventral; C, urosome; D, antenna. Scale bars: A, 0.2 mm; B, 0.1 mm; C, 0.05 mm; D, 0.01 mm.

***Aplodelphys conica* gen. et sp. nov.**

(Fig. 444)

**Type material.** Holotype (intact ♀, MNHN-IU-2014-21469), paratypes (2 intact ♀♀, MNHN-IU-2014-21470), and dissected paratype (♀) from *Didemnum rodriguesi* Rocha & Monniot F, 1993 (MNHN-IT-2008-3295 = MNHN A2/DID.C/199), Citrons Bay, New Caledonia, depth 3-40 m, Thomassin coll., 27 March 1987.

**Additional material.** 2 ♀♀ (MNHN-IU-2018-1916) from the same species of host and same locality as the type material.

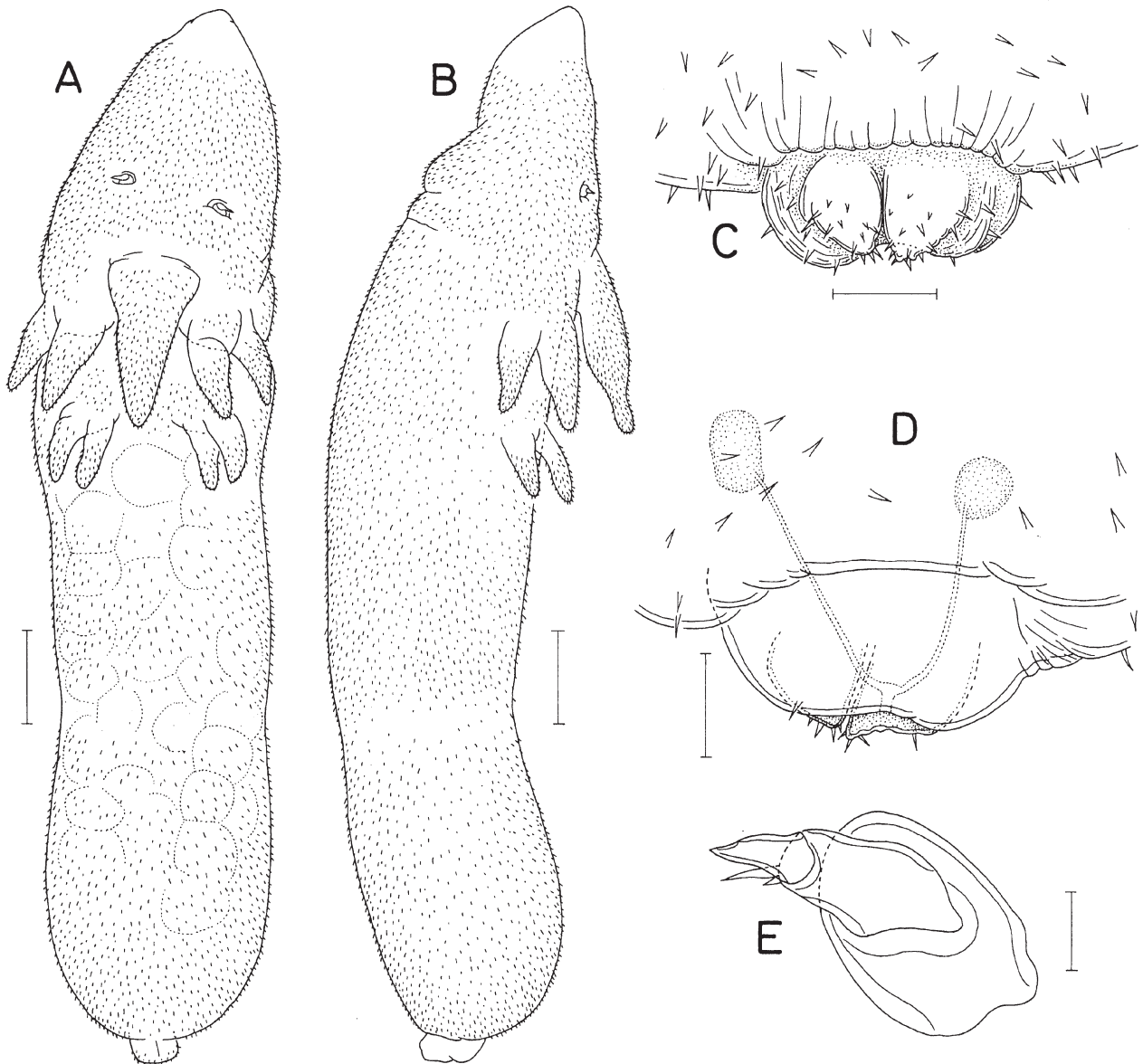
**Etymology.** The species name refers to the conical cephalosoma of the new species.

**Description of female.** Body (Fig. 444A, B) cylindrical, consisting of unsegmented prosome and small urosome. Body length 2.29 mm in holotype, 1.91 and 2.67 mm in 2 paratypes; greatest width 0.51 mm across region of leg 1. Body surface ornamented with fine spinules. Cephalosoma conical anteriorly. Posterior

third of body slightly constricted, with width of 0.44 mm; posterior margin of prosome rounded. Urosome (Fig. 444C, D) small, located at posterior end of prosome, unsegmented, about twice as wide as long. Caudal rami (Fig. 444C) tubercle-like, spinulose, positioned on dorsal surface of urosome; lacking caudal setae. Copulatory pore positioned close to apex of urosome (Fig. 444D).

Rostrum and antennules absent. Antenna (Fig. 444E) small, 2-segmented, positioned at 18% of total body length; first segment (coxobasis) wider than long, unarmed; second segment (endopod) slightly longer than wide; armed with 2 small setae distally plus stout terminal claw, half as long as endopod, with pointed tip.

Labrum (Fig. 444A, B) large, conical, directed posteriorly, extending slightly beyond tip of leg 1; insertion of labrum at 26% of body length. No mouthparts present. Legs 1 and 2 (Fig. 444A, B) biramous with unsegmented, conical, posteriorly-directed rami. Both rami equal in length; rami of leg 2 slightly smaller than those of leg 1.



**FIGURE 444.** *Aplodelphys conica* gen. et sp. nov., female. A, habitus, ventral; B, habitus, right; C, urosome, dorsal; D, urosome, ventral; E, antenna. Scale bars: A, B, 0.2 mm; C, D, 0.05 mm; E, 0.01 mm.

Legs 1 and 2 positioned at 29 and 40% of body length, respectively. Legs 3-5 absent.

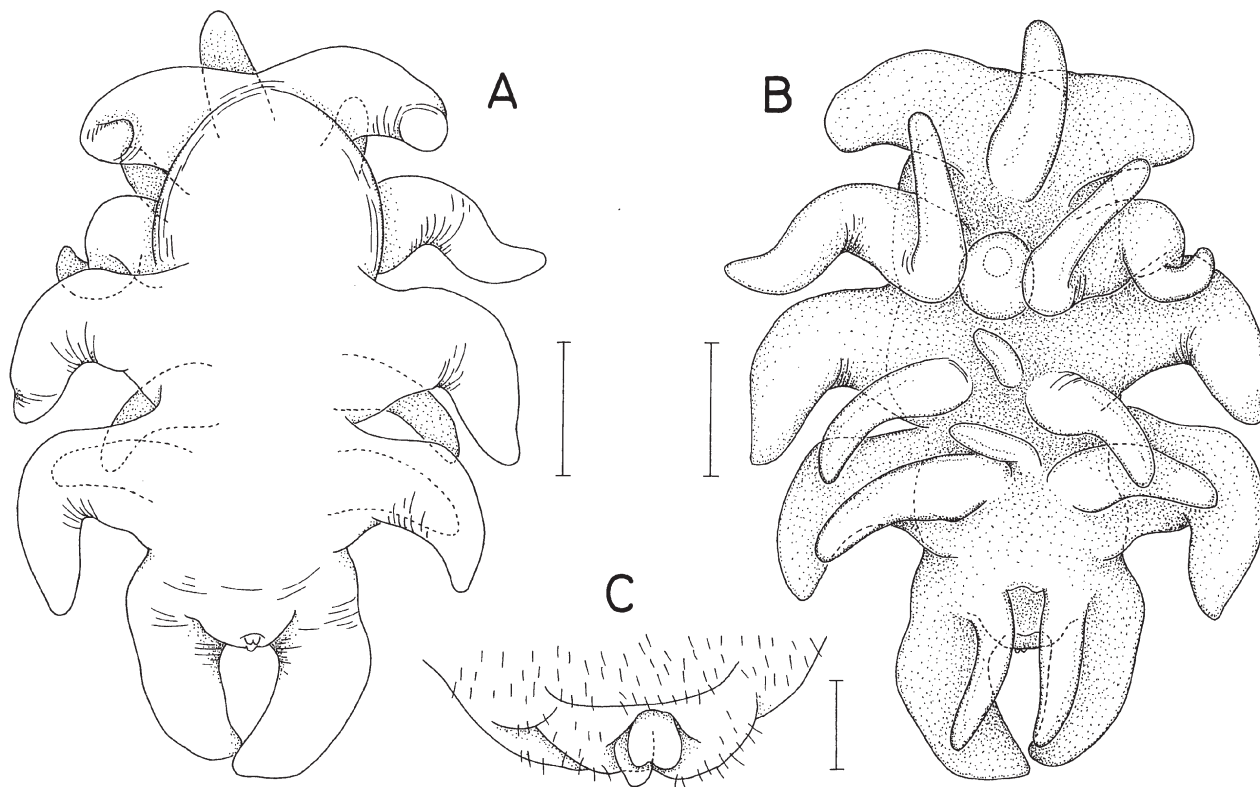
**Male.** Unknown.

#### Genus *Achelidelphys* Lafargue & Laubier, 1977

**Diagnosis.** Body unsegmented, stellate, with small abdominal lobe posteriorly. Frontal margin of cephalosome merging into tapering, laterally-directed antennular lobes and produced into tapering conical rostrum. Body surface often wrinkled, ornamented with fine spinules. Abdomen present as small lobe at posterior end of body; rear margin bilobed, representing incorporated caudal rami either side

of anal slit: caudal setae lacking. Rostrum anteroventrally-directed, digitiform. Antennules as tapering lobes located laterally on frontal margin. Antenna absent. Labrum globular, ventrally-directed lobe. Mouthparts absent. Legs 1-3 biramous, transformed, originating laterally and occupying entire margin of somite: both rami digitiform, exopods larger than endopods. Leg 4 biramous and similar to legs 1-3, or uniramous, comprising exopodal lobe only. Unpaired digitiform metasomal processes present on mid-ventral surface between legs in some species. Leg 5 absent.

**Type species.** *Achelidelphys steinitzi* Lafargue & Laubier, 1977, by original designation.



**FIGURE 445.** *Achelidelphys bifida* sp. nov., female. A, habitus, dorsal; B, habitus, ventral; C, urosome, dorsal. Scale bars: A, B, 0.5 mm; C, 0.1 mm.

***Achelidelphys bifida* sp. nov.**  
(Fig. 445)

**Type material.** Holotype ♀ (intact, MNHN-IU-2014-21471) from *Didemnum poecilomorpha* Monniot F & Monniot C, 1996 (Type MNHN-IT-2008-3239 = MNHN A2/DID.C/230), CRRF OCDN 1379-J, north of Sulawesi, Indonesia (01°51.52'N, 125°03.84'E), depth 40 m, 20 May 1993.

**Etymology.** The species name refers to the biramous leg 4 of the new species

**Description of female.** Body (Fig. 445A, B) unsegmented, stellate. Body length 2.20 mm measured from anterior margin of cephalosome to distal tip of urosome. Greatest width 1.95 mm between lateral tips of leg 2 exopods. Body surface ornamented with minute setules (Fig. 445C). Urosome (Fig. 445C) present as small lobe at posterior end of body, fused with prosome, bearing 2 small, unequal lobes (probably caudal rami) at posterior margin; caudal setae absent.

Rostrum (Fig. 445B) positioned on ventral surface of cephalosome, digitiform, anteroventrally-directed, tapering, about 3 times longer than wide. Antennules (Fig. 445A, B) as paired tapering anterolateral processes on cephalosome, each with dorsally curved tip. Antennae absent. Labrum (Fig. 445B) as globular, ventrally-directed lobe, positioned between leg 1 pair. Mouthparts absent.

Legs 1–4 biramous (Fig. 445B). Rami of leg 1 subequal in length; exopod directed laterally, curved, slightly broader than endopod; endopod directed ventrally and curved anteriorly. Exopods of legs 2–4 broader than that of leg 1, tapering, about twice as long as wide. Exopods of legs 2 and 3 laterally-directed and curved posteriorly. Exopod of leg 4 posteromedially-directed. Endopods of legs 2–4 shorter and narrower than exopods, digitiform, about 3 times longer than wide, laterally-directed in legs 2 and 3, but posteriorly-directed in leg 4. Digitiform mid-ventral processes present between leg pairs 2 and 3 (Fig. 445B). Leg 5 absent.

**Male.** Unknown.

**Remarks.** With laterally-directed legs 1–4 and a metasome not extending beyond the insertion of leg 4, the new species belongs to the genus *Achelidelphys*, as defined by Boxshall & Marchenkov (2007). Within the genus, *A. bifida* sp. nov. is most closely related to *A. steinitzi* Lafargue & Laubier, 1977 in having two median ventral processes, one between leg 2 pair and the other between leg 3 pair. However, *A. bifida* sp. nov. can be differentiated from *A. steinitzi* and other congeners by the biramous condition of leg 4. Within the *Bremenia*-group of notodelphyids, a biramous leg 4 was previously recorded in the genera *Bremenia* and *Pholeterides*, as well as in three species of *Anoplodelphys* (*A. corneci* Lafargue & Laubier, 1978, *A. galli* Lafargue & Laubier, 1978, and



*A. incerta* Lafargue & Laubier, 1978). However, all these species possess paired antennae, which are lacking in *A. bifida* **sp. nov.**

## Discussion

The sheer number of new species and genera revealed here is remarkable. Prior to this study the family Notodelphyidae comprised 200 valid species accommodated in 46 valid genera (Walter & Boxshall, 2020), and here we have added 178 new species and established 37 new genera. The family now comprises a total of 378 species distributed across 83 genera. Several of the new genera proposed here are monotypic, however in terms of species richness at the genus level, the mean number of species per genus before to this study was 4.3 and this has now risen to 4.6.

The large number of new genera reflects the fragmentary state of our current knowledge of the morphospace occupied by the Notodelphyidae and its constituent genera. Like Nineteenth Century zoologists we were faced with a spectacular array of novel morphological diversity within a family which needed exploration. We were fortunate in being able to build on the pioneering revisionary works of Illg (1958) and Illg & Dudley (1961; 1965), but it has still been necessary to focus closely on taxonomic judgements about where boundaries lie between genera. In many cases the availability of a wider range of related taxa has allowed us to re-assess and determine generic boundaries with increased confidence because more evidence was available, however in some cases our taxonomic judgements defining genera are best estimates and will need to be robustly tested as new material and/or molecular data become available.

A particular challenge in exploring the Monniot collection and the new taxa it contains has been the apparent mosaic pattern of evolution within the family. There are numerous examples of taxa which exhibit an overall highly derived set of character states combined with one or more distinctly plesiomorphic features. A good example is *Procampodelphys nodosus* **gen. et sp. nov.** which has a derived caterpillar-like body and the rami of legs 1 to 4 are reduced to unsegmented lobes, but it carries both an inner coxal seta and an inner basal seta on the protopod of leg 1. The possession of the inner coxal seta on leg 1 is an extraordinarily plesiomorphic character state for such a highly derived parasite. Similarly, on the basis of a suite of shared characters the new genus, *Borixys* **gen. nov.**, belongs to a cluster of genera including *Doroxys*, *Loboixys*, *Prodoroxys* **gen. nov.**, *Notoixys* **gen. nov.** and *Cystixys* **gen. nov.**, all of which are characterised by the lack on an inner coxal seta on leg 4, however, its type species, *B. simplex*, possesses this inner coxal seta. The phylogenetic framework that would allow us to interpret such apparently incongruent character states either as

retained ancestral states or as character state reversals, does not currently exist.

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## References

- Allman, G.J. (1847) Description of a new genus and species of Entomostraca. *Annals and Magazine of Natural History*, 20, 1–9, pls 1–2.  
<https://doi.org/10.1080/037454809496001>
- Aurivillius, C.W.S. (1882) Bidrag till kannedomen om Krustaceer, som lefva hos Mollusker och Tunikater. *Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar*, 8, 41–117, pls. 13–16.
- Baird, W. (1850) *The Natural History of the British Entomostraca*. The Ray Society, London, 364 pp, pls 1–36.  
<https://doi.org/10.5962/bhl.title.39641>
- Bocquet, C. & Stock, J.H. (1960) Copépodes parasites d'invertébrés des côtes de France. XI. Le genre *Notodelphys*, de la famille des Notodelphyidae. *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen (C)*, 63 (1), 123–136.
- Bocquet, C. & Stock, J.H. (1961) Copépodes parasites d'invertébrés des côtes de France. XIII. Les genres Ophioseidimorphes de la famille des Notodelphyidae. *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen (C)*, 64 (2), 212–226.
- Boxshall, G.A. & Halsey, S.H. (2004) *An Introduction to Copepod Diversity*. The Ray Society, London, 966 pp.
- Boxshall, G.A. & Huys, R. (1998) The ontogeny and phylogeny of copepod antennules. *Philosophical Transactions of the Royal Society of London, Series B*, 353, 765–786.  
<https://doi.org/10.1098/rstb.1998.0242>
- Boxshall, G.A. & Marchenkov, A. (2005) A new genus of notodelphyid copepod (Crustacea, Copepoda, Cyclopoida) from a compound ascidian host collected in the Suez Canal.

*Zoosystema*, 27 (3), 483–497.

- Boxshall, G.A. & Marchenkov, A. (2007) A revision of *Bremetia*-group of genera (Copepoda: Notodelphyidae), with descriptions of a new genus and four new genera. *Zootaxa*, 1459, 37–68.  
<https://doi.org/10.11646/zootaxa.1459.1.2>
- Brady, G.S. (1878) *A monograph of the free and semi-parasitic Copepoda of the British islands*. Vol. 1. The Ray Society, London, 148 pp, pls 1–33.  
<https://doi.org/10.5962/bhl.title.58691>
- Buchholz, R. (1869) Beiträge zur Kenntniss der innerhalb der Ascidien lebenden parasitischen Crustaceen des Mittelmeeres. *Zeitschrift für wissenschaftliche Zoologie*, 19, 99–155, pls. 5–11.  
<https://doi.org/10.5962/bhl.title.53715>
- Canu, E. (1891) Les Copépodes marins du Boulonnais. V. Les semi-parasites. *Bulletin Scientifique de la France et de la Belgique*, 23, 467–487.
- Canu, E. (1892) Le copépodes du Boulonnais. Morphologie, embryologie, taxonomie. *Travaux du Laboratoire de Zoologie Maritime de Wimereux-Ambleteuse*, 6, 1–354, pls. 1–30.  
<https://doi.org/10.5962/bhl.title.58678>
- Carus, J.V. (1885) *Prodromus Faunae Mediterraneae. Vol. I. Coelenterata, Echinodermata, Vermes, Arthropoda*. Stuttgart: E. Schweizerbart, 524 pp.
- Chatton, É. & Brément, E. (1911) Sur un ascidicole nouveau du genre *Ophioseides* Hesse, *Ophioseides abdominalis*, parasite des aplidiens. *Bulletin de la Société Zoologique de France*, 36 (5), 29–33.  
<https://doi.org/10.5962/bhl.part.27645>
- Chatton, É. & Brément, E. (1915) Sur un nouveau copepode ascidicole incubateur *Ooneides amela* n. g., n. sp. parasite des *Leptoclinum*. *Bulletin de la Société Zoologique de France*, 40, 135–143.
- Costa, O.G. (1840) Catalogo dei Crostacei. In: *Fauna del Regno di Napoli ossia enumerazione di tutti gli animali che abitano le diverse regioni di questo regno e le acque che le bagnano, contenente la descrizione de nuovi o poco esattamente conosciuti, con figure ricavate da originali viventi e dipinte al naturale*. Napoli, Azzolino & Compagno, pp. 1–7.
- Costa, O.G. (1852) Catalogo dei Crostacei. Entomostraca. In: *Fauna del Regno di Napoli ossia enumerazione di tutti gli animali che abitano le diverse regioni di questo regno e le acque che le bagnano, contenente la descrizione de nuovi o poco esattamente conosciuti, con figure ricavate da originali viventi e dipinte al naturale*. Napoli, Azzolino & Compagno, pls. 1–4.
- Da Rocha, R.M., Gamba, G.A. & Zanata, T.B. (2012) *Aplidium* (Ascidiacea, Polyclinidae) in central coast, Brazil. *Zootaxa*, 3565, 18–30.  
<https://doi.org/10.11646/zootaxa.3565.1.2>
- Dana, J.D. (1853) On the classification and geographical distribution of Crustacea. *Report on Crustacea of the United States Exploring Expedition under the command of Capt. Charles Wilkes, U.S.N., during the years 1838- 1842*, pp. 1395–1592.  
<https://doi.org/10.5962/bhl.title.50387>
- Dudley, P.L. (1966) *Development and Systematics of Some Pacific Marine Symbiotic Copepods. A Study of the Biology of the Notodelphyidae, associates of Ascidiaceans*. University of Washington Press, Seattle and London, 282 pp.
- Dudley, P.L. (1968) A light and electron microscopic study of tissue interactions between a parasitic copepod, *Scolecodes huntsmani* (Henderson), and its host ascidian, *Styela gibbsii* (Stimpson). *Journal of Morphology*, 124 (3): 263–272, pls 1–5.  
<https://doi.org/10.1002/jmor.1051240302>
- Dudley, P.L. & Solomon, D.N. (1966) *Pythodelphys acurris*, a new genus and species of Copepoda (Notodelphyidae) from the Pacific Ocean. *Crustaceana*, 11, 314–320.  
<https://doi.org/10.1163/156854066X00649>
- Giesbrecht, W. (1882) Beiträge zur Kenntniss einiger Notodelphyiden. *Mittheilungen aus der Zoologischen Station zu Neapel*, 3, 293–372, pls. 22–24.
- Gotto, R.V. (1975) Some new notodelphyid copepods from Australia. *Bulletin Zoologisch Museum, Universiteit van Amsterdam*, 4(19), 165–177.
- Gotto, R.V. (1981) *Paralobodelphys setipoda* n. gen. n. sp. (Cyclopoida, Notodelphyidae): an ascidicolous copepod from the Great Barrier Reef, Australia. *Crustaceana*, 40 (2), 173–177.  
<https://doi.org/10.1163/156854081X00570>
- Gotto, R.V. (1993) *Commensal and Parasitic Copepods Associated with Marine Invertebrates (and Whales)*. In: Doris, M., Kermack, R.S., Barnes, K. & Crothers, J.H. (Eds.), *Synopsis of the British Fauna (New Series)*, 46. Published for The Linnean Society of London & The Estuarine and Coastal Sciences Association, pp. 1–264.
- Grygier, M.J. (1993) *Sphaerothylacus* is a notodelphyid copepod, not a parasitic cirripede. *Monoculus Copepod Newsletter*, Oldenburg, 25, 23–25.
- Gurney, R. (1927) Report on the Crustacea-Copepoda (littoral and semi-parasitic). In: Cambridge Expedition to the Suez Canal, 1924. *Transactions of the Zoological Society of London*, 22 (4), 451–577.  
<https://doi.org/10.1111/j.1096-3642.1927.tb00207.x>
- Hesse, E. (1864) Observations sur des Crustacés rares ou nouveaux des côtes de France. *Annales des Sciences naturelles, Zoologie*, 5 (1), 333–358, pls 11–12.
- Hesse, E. (1866a) Observations sur des Crustacés rares ou nouveaux des côtes de France. *Annales des Sciences naturelles, Zoologie*, 5 (5), 265–279, pl. 9.
- Hesse, E. (1866b) Observations sur des Crustacés rares ou nouveaux des côtes de France. *Annales des Sciences naturelles, Zoologie*, 5 (6), 51–87, pl. 4.
- Hesse, E. (1869) Description d'un nouveau genre de Crustacés habitant les ascidies et de quelques espèces du même groupe. *Annales des Sciences naturelles, Zoologie*, 5 (11), 287–308.
- Hesse, E. (1871) Observations sur les Crustacés rares ou nouveaux des côtes de France. *Annales des Sciences naturelles, Zoologie*, 5, 15 (2), 1–50, pls 1–2.
- Hippeau-Jacquotte, R. (1980) La forme mâle atypique du Copépode ascidicole Notodelphyidae *Pachypygus gibber*

- (Thorell, 1879): description et synonymie avec *Agnathaner minutus* Canu, 1891. *Bulletin du Muséum national d'Histoire naturelle, Paris, Zoologie* 2, 455–470.
- Ho, J.-s., (1984) Copepoda associated with sponges, cnidarians, and tunicates of the Sea of Japan. *Reports of the Sado Marine Biological Station, Niigata University*, 14, 23–61.
- Ho, J.-s. & Kim, I.-H. (2009) Two species of Copepoda parasitic in the algal-bearing ascidian *Didemnum molle* (Herdman), in Okinawa, Japan. *Proceedings of the Biological Society of Washington*, 122 (4), 414–425.  
<https://doi.org/10.2988/09-05.1>
- Holmes, J.M.C. & Gotto, R.V. (1987) Some ascidicolous copepods new to British and Irish waters. *The Irish Naturalists' Journal*, 22 (8), 340–343.
- Humes, A.G. & Gooding, R.U. (1964) A method for studying the external anatomy of copepods. *Crustaceana*, 6, 238–240.  
<https://doi.org/10.1163/156854064X00650>
- Huys, R. & Boxshall, G.A. (1991) *Copepod Evolution*. The Ray Society, London, 468pp.
- Illg, P.L. (1951) A new genus and species of notodelphyoid copepod from Japan. *Journal of the Washington Academy of Sciences*, 41, 30–34. [<https://www.jstor.org/stable/24531659>]
- Illg, P.L. (1958) North American copepods of the family Notodelphyidae. *Proceedings of the United States National Museum*, 107 (3390), 463–649.  
<https://doi.org/10.5479/si.00963801.108-3390.463>
- Illg, P.L. (1970a) Report on ascidicole Copepoda collected during the Melanesia Expedition of the Osaka Museum of Natural History, Osaka, Japan. *Publications of the Seto Marine Biological Laboratory*, 18, 169–188.  
<http://hdl.handle.net/2433/175632>
- Illg, P.L. (1970b) Occurrence in Sagami Bay, Japan, of *Scolecodes*, a remarkable copepod parasite of ascidians. *Publications of the Seto Marine Biological Laboratory*, 18, 69–74.  
<https://doi.org/10.5134/175627>
- Illg, P.L. & Dudley, P.L. (1961) Notodelphyid copepods from Banyuls-sur-Mer. *Vie et Milieu*, Supplement 12, 1–126.
- Illg, P.L. & Dudley, P.L. (1965) Notodelphyid copepods from the vicinity of Naples. *Pubblazioni della Stazione Zoologica di Napoli*, 34, 373–451.
- Jones, J.B. (1974) New Notodelphyidae (Copepoda: Cyclopoida) from solitary ascidians. *New Zealand Journal of Marine and Freshwater Research*, 8, 255–273.  
<https://doi.org/10.1080/00288330.1974.9515503>
- Jones, J.B. (1979) New Notodelphyidae (Copepoda: Cyclopoida) from New Zealand solitary ascidians. *New Zealand Journal of Marine & Freshwater Research*, 13, 533–544.  
<https://doi.org/10.1080/00288330.1979.9515830>
- Jones, J.B. & Montez Moreno, A.A. (1981) *Lonchidiopsis setosus* n. sp. (Copepoda: Notodelphyidae) from Venezuela. *Systematic Parasitology*, 3, 53–57.  
<https://doi.org/10.1007/BF00012239>
- Kerschner, L. (1879) Über zwei neue Notodelphyiden nebst Bemerkungen über einige Organisationsverhältnisse dieser Familie. *Denkschriften der Kaiserlichen Akademie der Wissenschaften, Wien*, 41L, 155–196, pls. 1–6.
- Kim, I.-H. (2012) *Invertebrate fauna of Korea, vol. 21, no. 20. Ascidicolous Copepods*. Flora and Fauna of Korea. National Institute of Biological Resources, Ministry of Environment, Korea, 138 pp.
- Kim, I.-H. & Moon, S.Y. (2011) Eight new species of ascidicolous copepods from the eastern coast of Korea (Crustacea, Copepoda, Cyclopoida). *Ocean Science Journal*, 46, 23–46.  
<https://doi.org/10.1007/s12601-011-0003-1>
- Kim, I.-H., Cruz-Rivera, E., Sherif, M. & El-Sahharm, S. (2016) Cyclopoid copepods (Ascidicolidae, Notodelphyidae) associated with *Phallusia nigra* Savigny, 1816 (Ascidacea) in the Red Sea: A new ascidicolid and first descriptions of the males from two notodelphyids. *Journal of Crustacean Biology*, 36, 553–566.  
<https://doi.org/10.1163/1937240X-00002439>
- Koehler, R. (1890a) Les Crustacés parasites des Ascidies. *Naturaliste*, 12 (78), 131–134, figs 1–8.
- Koehler, R. (1890b) Les Crustacés parasites des Ascidies. *Naturaliste*, 12 (79), 137–138, figs 9–12.
- Lafargue, F. & Laubier, L. (1968) *Sicyodelphys bocqueti*, nouveau genre et nouvelle espèce de copépode Notodelphyidae en Méditerranée occidentale. *Comptes rendus de l'Académie des Sciences, Paris, D*, 267, 2163–2166.
- Lang, K. (1948) Copepoda Notodelphyoida from the Swedish west-coast with an outline on the systematics of the copepods. *Arkiv for Zoologi*, 40(14), 1–36, pl. 1.
- Leuckart, R. (1859) Carcinologisches. *Archiv für Naturgeschichte*, 25(1), 232–266, pls 6–7.  
<https://doi.org/10.5962/bhl.part.7027>
- Marchenkov, A. & Boxshall, G.A. (2003) A new notodelphyid copepod, *Paranotodelphys illgin* sp. (Copepoda, Cyclopoida), parasitic in the ascidian *Corynascidia herdmani* Ritter in the North Pacific. *Systematic Parasitology*, 54, 43–52.  
<https://doi.org/10.1023/A:1022197927318>
- Marchenkov, A. & Boxshall, G.A. (2004) The notodelphyid genus *Doroixys*, 1879 (Crustacea: Copepoda) with the description of a new species from the Russian Far East. *Systematic Parasitology*, 58, 223–233.  
<https://doi.org/10.1023/B:SYPA.0000032934.58155.47>
- Monniot, C. (1961) *Notodelphys echinata* nov. sp., nouvelle espèce de Copépodes parasites d'Ascidies de la région de Banyuls-sur-Mer. *Bulletin du Muséum National d'Histoire Naturelle, Paris*, 33 (2), 213–217, figs. 1–2.
- Monniot, C. (1963) *Kystodelphys drachi* n. g. n. sp., Copépode enkysté dans une branchie d'Ascidie. *Vie et Milieu*, 14 (2), 263–273.
- Monniot, C. (1981) Description de Copépodes ascidicoles (Notodelphyidae et Ascidicolidae) de la pente continentale du golfe de Gascogne. *Bulletin du Muséum National d'Histoire Naturelle, Paris, Section A, Zoologie, Biologie et Écologie Animales*, 4 (3), 431–454.
- Monniot, C. (1983) *Microrra angulata* n. g., n. sp. et *Remex obesus* n. g., n. sp., copépodes parasites d'une ascidie de Guadeloupe. *Cahiers de Biologie Marine*, 24, 459–467.  
<https://doi.org/10.21411/CBM.A.607E6AE2>
- Monniot, C. (1986) Présence en Guadeloupe de deux phénotypes

- femelles du copépode ascidicole *Pachypyrgus macer* Illg, 1958. *Systematic Parasitology*, 8, 151–162.  
<https://doi.org/10.1007/BF00009871>
- Monniot, C. & Monniot, F. (1987) Abundance and distribution of tunicates on the northern continental slope of the Gulf of Mexico. *Bulletin of Marine Science*, 41 (1), 36–44.
- Norman, A.M. & Scott, T. (1906) *The Crustacea of Devon and Cornwall*. London, 232 pp., pls 1–24.
- Oldewage, W.H. (1994) Description of *Doropygus pyurus* n. sp. (Copepoda, Notodelphyidae) from *Pyura stolonifera* (Ascidacea) in South Africa. *South African Journal of Zoology*, 29, 212–216.  
<https://doi.org/10.1080/02541858.1994.11448350>
- Ooishi, S. (1961) A notodelphyoid copepod, *Pachypyrgus gibber* (Thorell), newly found in Japan. *Report of Faculty of Fisheries, Prefectural University of Mie*, 4, 81–92.
- Ooishi, S. (1962) Four species of Notodelphyoid copepods newly found in Japan. *Report of Faculty of Fisheries, Prefectural University of Mie*, 4, 7–25.
- Ooishi, S. (1963) On two new notodelphyoid copepods from the Bay of Matoya. *Report of Faculty of Fisheries, Prefectural University of Mie*, 4, 419–428.
- Ooishi, S. (1972) Notodelphyid copepods associated with compound ascidians in Akkeshi Bay, Japan. *Publications of the Seto Marine Biological Laboratory*, 19 (5), 303–325.  
<https://doi.org/10.5134/175727>
- Ooishi, S. (2006) *Loboixys ryukyuensis* (Crustacea: Copepod: Cyclopoida: Notodelphyidae), a new genus and species, living in the compound ascidian *Diplosoma virens* at Okinawa, Japan. *Proceedings of the Biological Society of Washington*, 119 (3), 373–383.  
[https://doi.org/10.2988/0006-324X\(2006\)119\[373:LRCCCN\]2.0.CO;2](https://doi.org/10.2988/0006-324X(2006)119[373:LRCCCN]2.0.CO;2)
- Ooishi, S. & Illg, P.L. (1973) A new species of Notodelphyid copepod associated with *Pterygascidia longa* (Van Name, 1918) from the Basilan Strait, Philippines. *Zoologische Mededelingen*, 46 (17), 217–230. [<http://www.repository.naturalis.nl/record/318023>]
- Ooishi, S. & Illg, P.L. (1986) A notodelphyid copepod, *Lonchidiopsis hartmeyeri* Vanhöffen, associated with a simple ascidian from Ago Bay. *Bulletin of National Science Museum, Tokyo*, A, 12 (2), 45–59.
- Sanamyan, K. & Gleason, D.F. (2009) Ascidiaceans of the genus *Aplidium* collected on shallow hard-bottom reefs of coastal Georgia (Atlantic coast of N America, U.S.A.). *Zootaxa*, 2066, 50–58.  
<https://doi.org/10.11646/zootaxa.2066.1.2>
- Sars, G.O. (1921) An account of the Crustacea of Norway with short descriptions and figures of all the species, Vol. 8. Copepoda. Monstrilloidea and Notodelphyoida, Bergen, pp. 1–91, pls. 1–37.
- Schellenberg, A. (1922) Neue Notodelphyiden des Berliner und Hamburger Museums mit einer Übersicht der ascidienwohnenden Gattungen und Arten. *Mitteilungen aus dem Zoologischen Museum in Berlin*, 10 (2), 217–274.  
<https://doi.org/10.1002/mmnz.4830100201>
- Scott, T. (1888) A revised list of the Crustacea of the Firth of Forth. *Report of the Fishery Board of Scotland*, 6 (3), 235–262.
- Seo, I.S. & Lee, K.S. (1996) Two species of notodelphyid Copepoda (Cyclopoida) associated with solitary ascidians (Tunicata). *The Korean Journal of Systematic Zoology*, 12 (4), 289–304.
- Seo, I.S. & Lee, K.S. (1997) *Doropygus hoi*, a new species, and redescription of *Doropygus pinguis* Ooishi, 1962 (Copepoda, Cyclopoida, Notodelphyidae) associated with solitary ascidians in Korea. *Korean Journal of Biological Sciences*, 1, 553–563.
- Seo, I.S. & Lee, K.S. (1998) Three species of notodelphyid copepods (Cyclopoida) associated with the solitary ascidians (Tunicata) in Korea. *The Korean Journal of Systematic Zoology*, 14 (4), 391–413.
- Sewell, R.B.S. (1949) The littoral and semi-parasitic Cyclopoida, the Monstrilloidea and Notodelphyoida. *Scientific Reports of the John Murray Expedition*, 9 (2), 17–199, figs. 1–41.
- Sluiter, C.P. (1884) Über einen in Ascidien schmarotzenden Wurzelkrebs. *Natuurkundig Tijdschrift voor Nederlandsch-Indië*, 43 (4), 201–224, pl. 1.
- Stock, J.H. (1950) Parasitic or commensal? *Notodelphys weberi*, a new South African ascidicole copepod. *The Amsterdam Naturalis*, 1 (2), 36–42.
- Stock, J.H. (1951) Some notes on *Notodelphys rufescens* Thorell, 1860, new to the Dutch fauna. *Beaufortia*, 6, 1–4.
- Stock, J.H. (1967) Report on the Notodelphyidae (Copepoda, Cyclopoida) of the Israel South Red Sea Expedition. Israel South Red Sea Expedition. *Bulletin of the Sea Fisheries Research Station, Israel*, 46 (Reports 27), 1–126.
- Stock, J.H. (1970) Notodelphyidae and Botryllophilidae (Copepoda) from the West Indies. *Studies on the Fauna of Curaçao and other Caribbean Islands*, 123, 1–45.
- Stock, J.H. (1993) *Adenaplostoma monniotorum* n. gen., n. sp., a strange copepod parasite of a compound ascidian from New Caledonia (Crustacea, Copepoda, Cyclopoida, Ascidiocolidae). *Bulletin du Muséum national d'Histoire naturelle, Paris, Zoologie* 4 (15), (A) (1–4), 117–123.
- Stock, J.H. & Humes, A.G. (1970) On four new notodelphyid copepods, associated with an octocoral, *Parerythropodium fulvum* (Forskål), in Madagascar. *Zoologischer Anzeiger*, 184, 193–212.
- Thorell, T. (1859) Bidrag til Kännedomen om Krustaceer som lefva i arter af Släktet *Ascidia* L. *Kongliga Svenska vetenskaps-akademiens handlingar*, 3 (8), 1–84.  
<https://doi.org/10.5962/bhl.title.58671>
- Walter, T.C. & Boxshall, G. (2020) World of Copepods database. Notodelphyidae Dana, 1853. Available from: <http://www.marinespecies.org/aphia.php?p=taxdetails&id=106421> (accessed 18 February 2020)
- WoRMS Editorial Board (2020) World Register of Marine Species. Available from: <http://www.marinespecies.org> (accessed 18 February 2020)