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Thylakogaster namibiensis sp. nov. (Isopoda: Asellota: Janiroidea), a new species of Haplomunnidae from the southeast Atlantic deep sea*

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Abstract

Thylakogaster namibiensis sp. nov., a new deep-sea species belonging to the family Haplomunnidae Wilson, 1976 is described from the southeast Atlantic Ocean. The differences of the new species to the other species of the genus *Thylakogaster* Wilson and Hessler, 1974 are discussed. Main characters distinguishing *T. namibiensis* sp. nov. from its congeners are the presence of cuticular spines on the lateral margins of the pereonites 1–7, the low number of spines on the pleotelson, and the number of five terminal flagellar articles bearing aesthetascs on the antenna 1 of the copulatory male. The new species, *T. namibiensis,* is the first member of this genus found in the southeast Atlantic Ocean and at a depth of 5415 m, it is also the deepest which a member of the genus has ever been found.

Key words: Crustacea, Peracarida, *Thylakogaster*, taxonomy, Angola Basin, Me 48-1 / Diva 1, Me 63-2 / Diva 2

Introduction

Over the last few decades the deep sea of the World ocean has generated increased scientific interest, especially with respect to biodiversity studies (Lambshead *et al.* 2002; Brandt *et al.* 2004). Yet knowledge on macrobenthic life and species composition on oceanic abyssal plains is still relatively insignificant. Considerable taxonomic studies are necessary to complete our knowledge about the deep-sea organisms.

During the expeditions Diva 1 (Meteor 48-1, 2000; Balzer *et al.* 2006) and Diva 2 (Meteor 63-2, 2005; Meteor 63-2, 2005) (Diva: Latitudinal Gradients of Deep-Sea BioDIVersity in the Atlantic Ocean) benthos samples were taken from the Cape Basin, Angola abyssal plain and the Guinea Basin in the Atlantic Ocean.

The Diva 1 expedition sampled seven stations in the Angola Basin. More than 1800 Asellota were found. 21 specimens belong to the family Haplomunnidae (Tab. 1). During the Diva 2 expedition, samples were taken at eight stations in the three basins. To date(app. 10% of the material is sorted so far) ~2400 Asellota were found, but only six specimens belong to the family Haplomunnidae (Tab. 1).

The genus *Thylakogaster* Wilson and Hessler, 1974 comprises three described species currently, and is represented from the deep-sea of the Atlantic and Pacific oceans with a maximum depth range from 1135 to 5223 m (Wilson & Hessler 1974). The species *T. lobotourus* Wilson and Hessler, 1974 is known from the Bermuda slope at a depth from 1135 to 2223 m and Mid-Atlantic Ridge, *T. majusculus* Wilson and Hessler, 1974 has been found in the Argentine Basin at from 3305 to 5223 m, and *T. peterpauli* Wilson and Hessler, 1974 is known from the equatorial Atlantic Ocean at depths from 3459 to 3783 m. More *Thylakogaster*

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specimens have been found in the east equatorial Pacific Ocean and in the northern and equatorial Atlantic, but until now, these specimens have not been identified to species level (Cunha & Wilson 2003).

In this contribution the new species *Thylakogaster namibiensis* sp. nov. is described.

TABLE 1: The 27 Haplomunnid specimens from the DIVA 1 and 2 Expeditions. 14 of the 27 specimens belong to a new species of the genus *Thylakogaster*. Expedition ID: D1 = Diva 1; D2 = Diva 2; stat. = station; stage *sensu* Wolff 1962; ZMH= Zoological Museum Hamburg; DZMB WHV = Deutsches Zentrum für Marine Biodiversitätsforschung / German Center for Marine Biodiversity Research, Wilhelmshaven; Gen No.= genetic sequence available. For depth or other further information see Meteor reports.

ID	stat.	genus	species	sex and stage	depository	ceph.-pereon length [µm]	notes
D1-HM1	344	*Thylakogaster*	*namibiensis sp. nov.*	♂	ZMH	1200	drawings
D1-HM2	348	*Thylakogaster*	*namibiensis sp. nov.*	juv. II	ZMH	~750	heavy damaged
D1-HM3	348	*Thylakogaster*	*namibiensis sp. nov.*	♀; juv. IV	ZMH	1125	good state
D1-HM4	350	*Thylakogaster*	*namibiensis sp. nov.*	♀	DZMB WHV	4000	very good state
D1-HM5	350	*Thylakogaster*	*namibiensis sp. nov.*	♀; juv. IV	DZMB WHV	~1180	damaged, Basis of legs only
D1-HM6	340	*Abyssaranea*	*Rupis*	♂	DZMB WHV		
D1-HM7	340	*Thylakogaster*	*cf. namibiensis sp. nov*	juv. III	DZMB WHV	~1210	heavy damaged, squeezed
D1-HM8	340	*Thylakogaster*	*namibiensis sp. nov.*	♀	ZMH	~1590	damaged, Basis of legs only
D1-HM9	340	*Thylakogaster*	*namibiensis sp. nov.*	♂	ZMH	1900	drawings
D1-HM10	344	*Thylakogaster*	*namibiensis sp. nov.*	♀, juv. II	DZMB WHV	1630	good state, PI–IV and A1–A2
D1-HM11	344	*Thylakogaster*	*namibiensis sp. nov*	♀, juv. V	DZMB WHV	~1160	damaged, Basis of legs only
D1-HM12	350	*Thylakogaster*	*cf. namibiensis sp. nov*	juv. II	DZMB WHV	~1040	damaged, only PI,II+VI complete
D1-HM13	350	*Thylakogaster*	*namibiensis sp. nov.*	♀	DZMB WHV	2450	good state, Plt broken, PI, VI+VII
D1-HM14	340	*Thylakogaster*	*namibiensis sp. nov.*	♀	DZMB WHV	~2300	damaged, Basis of legs only
D1-HM15	340	*Thylakogaster*	*cf. namibiensis sp. nov*	juv. IV	DZMB WHV	~1100	damaged, only PI+II complete
D1-HM16	318	*Abyssaranea*	*Rupis*		DZMB WHV		
D1-HM17	340	*Abyssaranea*	*Rupis*		DZMB WHV		
D1-HM18	348	*Abyssaranea*	*Rupis*	♀	DZMB WHV		
D1-HM19	344	Haplomunnidae	sp. in. det.		DZMB WHV		heavy damaged, squeezed
D1-HM20	340	*Abyssaranea*	*Rupis*	♀	DZMB WHV		
D1-HM21	344	Haplomunnidae	sp. in. det.		DZMB WHV		heavy damaged, squeezed
D2-HM1	40	*Thylakogaster*	*cf. peterpauli*	♀	DZMB WHV	~1820	body and Plt impressed
D2-HM2	40	*Thylakogaster*	*cf. peterpauli*	juv.	DZMB WHV	~1360	good state
D2-HM3	63	*Abyssaranea*	*Rupis*	♀	DZMB WHV		
D2-HM4	90	*Abyssaranea*	*Rupis*	♂	DZMB WHV		
D2-HM5	40	*Abyssaranea*	*Rupis*	♀	DZMB WHV		Gen No. 12
D2-HM6	89	*Abyssaranea*	*Rupis*	♀	DZMB WHV		Gen No.156

Material and methods

During the RV Meteor expedition Diva 1, from July 6th to August 2nd 2000, samples were taken from the Angola abyssal plain (south-east Atlantic Ocean) at six areas along a transect of about 365 nm (850 km) westwards of Namibia. The samples were taken with an epibenthic sledge (EBS; Brenke 2005). At four stations (station #340, #344, #348, #350; depth range: 5387–5415 m), specimens of *Thylakogaster namibiensis* sp. nov. were discovered.

The Diva 2 expedition (M63-2) from 26th February to 30th March 2005 made a total of eight deployments in three different areas: Northern Cape Basin (area 1), Northern Angola Basin (area 2) and Guinea Basin (area 3). The samples were taken across a depth range of 5000 m and 5500 m. At four stations (station #40 in the Cape Basin and #63, #89, #90 in the Guinea Basin) specimens of Hapolomunidae were discovered. No specimens of *T. namibiensis* sp. nov. were found in Diva 2 samples.

The samples were washed through a sieve (mesh size 300µm) with seawater and fixed in 70 % ethanol. Habitus drawings of dorsal and lateral views and detailed drawings of the pleotelson were made of the specimen using a light microscope equipped with a “camera lucida”. The animals and their appendages were measured under a microscope, using both an ocular and an object micrometer. The cephalothorax-pereon length was measured in lateral view from the anterior margin of the cephalon to the posterior margin of pereonite 7 (with reference to Wilson & Hessler 1980, Tab. 1). All dissected appendages were transferred onto slides and fixed in water-free glycerine-gelatine including phenol, then stained with “light green”. The partition of the antennas in peduncle and flagellum follows Wägele (1983), the nomenclature of setae follows Hessler (1970) and Watling (1989).

For comparison with the new species additional material from the National Museum of Natural History was examined: *Thylakogaster peterpauli* Wilson and Hessler, 1974: paratype 1-3 USNM 141467*; T. lobotourus* Wilson and Hessler, 1974: Holotype ♂ USNM 141471*; T. majusculus* Wilson and Hessler, 1974: Paratype ♂ USNM 141470.

The type material of *T. namibiensis* sp. nov. is deposited in the Zoological Museum Hamburg, Germany.

Abbreviations: A1—antenna 1; A2—antenna 2; A—flagellar articles with aesthetascs; Ceph—cephalon; EBS—epibenthic sledge; F—flagellar articles; l / r—left / right; Md—mandible; Mx 1—maxilla 1; Mx 2—maxilla 2; Mxp—maxilliped; nm—nautical mile; P—peduncle articles; P 1–7—pereopods 1–7; Plt—pleotelson; Plp 1–5—pleopods 1–5; Urp—uropods; ♂—male; ♀—female; ZMH—Zoological Museum Hamburg; USNM—US National Museum of Natural History.

TAXONOMY

Haplomunnidae Wilson, 1976

Synonymy: Haplomunnidae Wilson, 1976: 572; Kussakin, 1988: 355; Cunha and Wilson 2003: 5

Thylakogaster Wilson and Hessler, 1974

Synonymy: Thylakogaster Wilson and Hessler 1974: 48; Kussakin, 1988: 356; Cunha and Wilson, 2003: 10

Type species: Thylakogaster peterpauli Wilson and Hessler, 1974

Composition: T. lobotourus Wilson and Hessler, 1974; *T. majusculus* Wilson and Hessler, 1974; *T. peterpauli* Wilson and Hessler, 1974; *Thylakogaster namibiensis sp. nov.*

Diagnosis (modified from Wilson & Hessler 1974). Body dorsoventrally flat and convex, except pleotelson. Cephalon without rostrum. Pereonite 3 widest. Pleotelson spherical and reflext anteriorly, lying dorsally on the pereon. Pereopod 1 shortest, subchelate, robust. Pereopods 2–7 long and slender walking legs. Uropods uniramous.

The following characters are added to the genus definition: Coxa of pereopod 1 fused with pereonite 1. Dorsolateral margins of all 7 pereonites with cuticular spines. Spines also developed on the coxae of all pereopods.

Remarks. During investigation of the different descriptions, figures and specimens of *Thylakogaster* species we noticed, that the additional characters above were not included in the family or genus diagnosis. The Coxa of pereopod 1 is not fused and the spines are also not developed in all genera of the Haplomunnidae. Therefore it seems to be necessary to add these characters to the genus diagnosis.

***Thylakogaster namibiensis* sp. nov. (Figs. 1–5)**

*Material:*14 specimens of *Thylakogaster namibiensis* sp. nov. were found at four stations during the Diva 1 expedition (Tab. 1).

Holotype: ♂, 1.9 mm, Area 4, Station #340 (EBS 09): 18°18.3’S 004°41.3’E to 18°19.4’S 004°41.9’E, 5395 m depth; ZMH K-40840 A–N, 14 slides. (Diva 1 Id No.: D1-HM9)

Paratype (Allotype): 1 ♀, 1.6 mm, Area 4, Station #340 (EBS 09): 18°18.3’S 004°41.3’E to 18°19.4’S 004°41.9’E, 5395 m depth; ZMH K-40842. (D1-HM8)

Paratypes: 1 ♂, 1.2mm, Area 5, Station #344 (EBS 10): 17° 06.2' S 004° 41.7' E to 17° 07.5' S 004° 42.3' E, 5415 m depth; ZMH K-40841 A–L, 12 slides. (D1-HM1). 1 juvenile (stage IV) 1.1mm (D1-HM3) and 1 juvenile (stage II) 0.7mm (D1-HM2) both from Area 6, Station #348 (EBS 11): 16° 18.1' S 005° 27.2' E to 16° 19.3' S 005° 27.2' E, 5387m depth; ZMH K-40843, K-40844.

Distribution. Known only from the Angola Basin, Atlantic Ocean, 850 km west of Namibia. Depth range: 5387–5415 m.

Etymology. Thylakogaster namibiensis sp. nov. is named after the sample locality: the new species was sampled 850 km westwards of the African coast off Namibia, in the Atlantic Ocean.

Diagnosis. Cephalothorax-pereon length 3 times longer than wide. Antenna 1 of copulatory male consisting of 3 articles in peduncle and 12 in flagellum, aesthetascs present on articles 9–13 (formula: P3–F12[A8–12]). Article 3 length 1.1 article 2 length. Antenna 2 with 6 articles in peduncle and 11 in flagellum. Pleotelson length 0.66 cephalothorax-pereon length, length 1.34 width. Pleotelson with 30–40 simple spines developed on each lateral half. Uropods mace-like, broadened, inserting beneath broad keel close to rounded tip of pleotelson. Pleotelson nearly as long as broad, with rounded tip and small disto-medial projection, laterally expanded into 2 huge bumps on either side of frontal indentation.

Description of male (description of pereopods from juvenile paratypes): Body (Fig. 1a–d) compact, cephalothorax-pereon length width 1.51, dorsoventrally flat and convex, unpigmented.

Cephalothorax (Fig. 1a, b, e) rounded, length 0.27 cephalothorax-pereon length. Clearly visible frons-clypeal ridge developed anteriorly. Cephalon fused completely to first pereonite. Antennal insertion located on small projection on dorso-lateral surface.

Pereon (Fig. 1a, b) with 1–2 spines on lateral margins of pereonites 1–7 next to coxae. Pereonites 1–3 of subequal proportions. Pereonite 3 widest. Pereonites 4–7 decreasing in length, with one or 2 small simple spines on ventral margins.

Pleotelson (Fig. 1a, d, e, g) nearly as long as wide, length 0.66 cephalothorax-pereon length (measured basis of Plt to apex), with rounded tip; located dorsally above pereon and covering more than last 6 pereonites; laterally expanded into 2 huge bumps on either side of a frontal indentation. Pleotelson with 30–40 simple spines on each lateral side, often broken off at ends. Frontal indentation spineless. Uropods tiny, positioned on projecting lobes on ventral side close to pleotelson tip. Comb-like row of thin, unequally bifid setae below insertion of uropods (Fig. 1c)on both posterior margins (Fig. 1d). Setae more closely together than lateral cuticular spines on pleotelson. Both setae and spines increasing in length from tip to basis of pleotelson.

Pleopods 1 and 2 in a posterio-dorsal position due to rounded form and position of pleotelson. Pleotelson covered entirely with spines in both sexes. External surfaces of male pleopods 1 and 2 equipped with single rows of spines. Surface of female operculum completely covered with strong spines.

Antenna 1 (Fig. 2c, d): about as long as cephalothorax-pereon length, inserting dorso-medially at basis of A2. 3 articles in peduncle: article 1 with 1 broom seta and 1 short simple seta on disto-frontal margin (Fig. 2f). Article 2 with 1 plumose seta on disto-ventral margin. Article 3 without setae. Length ratio of peduncle articles: 1:0.7:0.8. Flagellum composed of 12 articles. Article 1 short, second article elongated, article 12 tiny (Fig. 2e). Length ratio of flagellar articles: 1:5.5:2:2.2:2:2.5:2.5:2.8:2:1.5:2.2:0.25. Flagellar articles with 1–2 fine simple seta. Flagellar articles 8–12 with 1 single aesthetasc each.

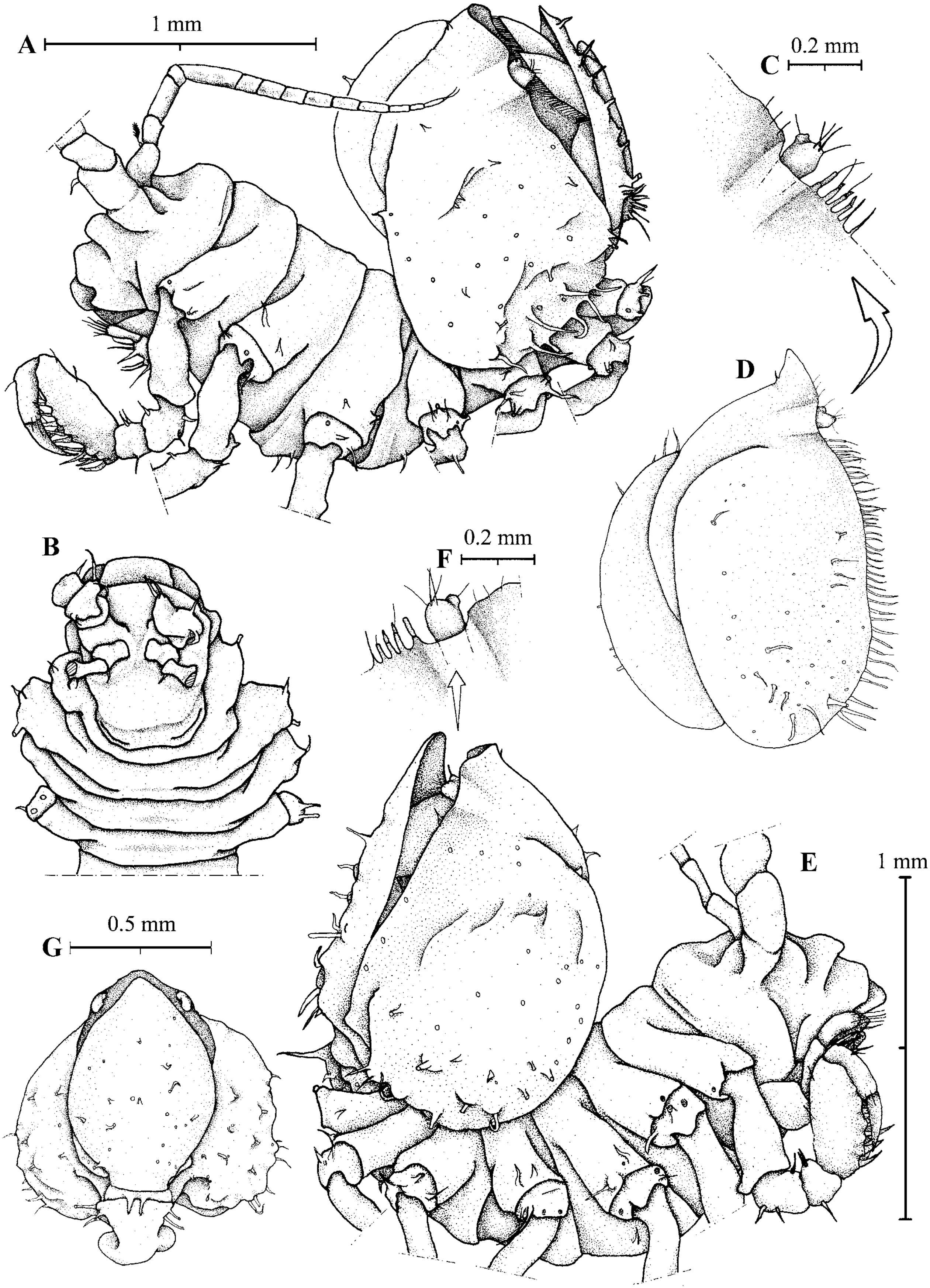

FIGURE 1: *Thylakogaster namibiensis* sp. nov., holotype ♂. A, lateral view 1;95 mm cephalothorax-pereon length; B, dorsal view of ♂ cephalon and pereonites 1 to 4, C, detailed view of ♂ left uropod; D, lateral view of ♂ pleotelson; E, allotype ♀, lateral view 1;8 mm cephalothorax-pereon length; F, detailed view of ♀ left uropod; G, terminal view of ♀ pleotelson with operculum. A, B, D same scale.

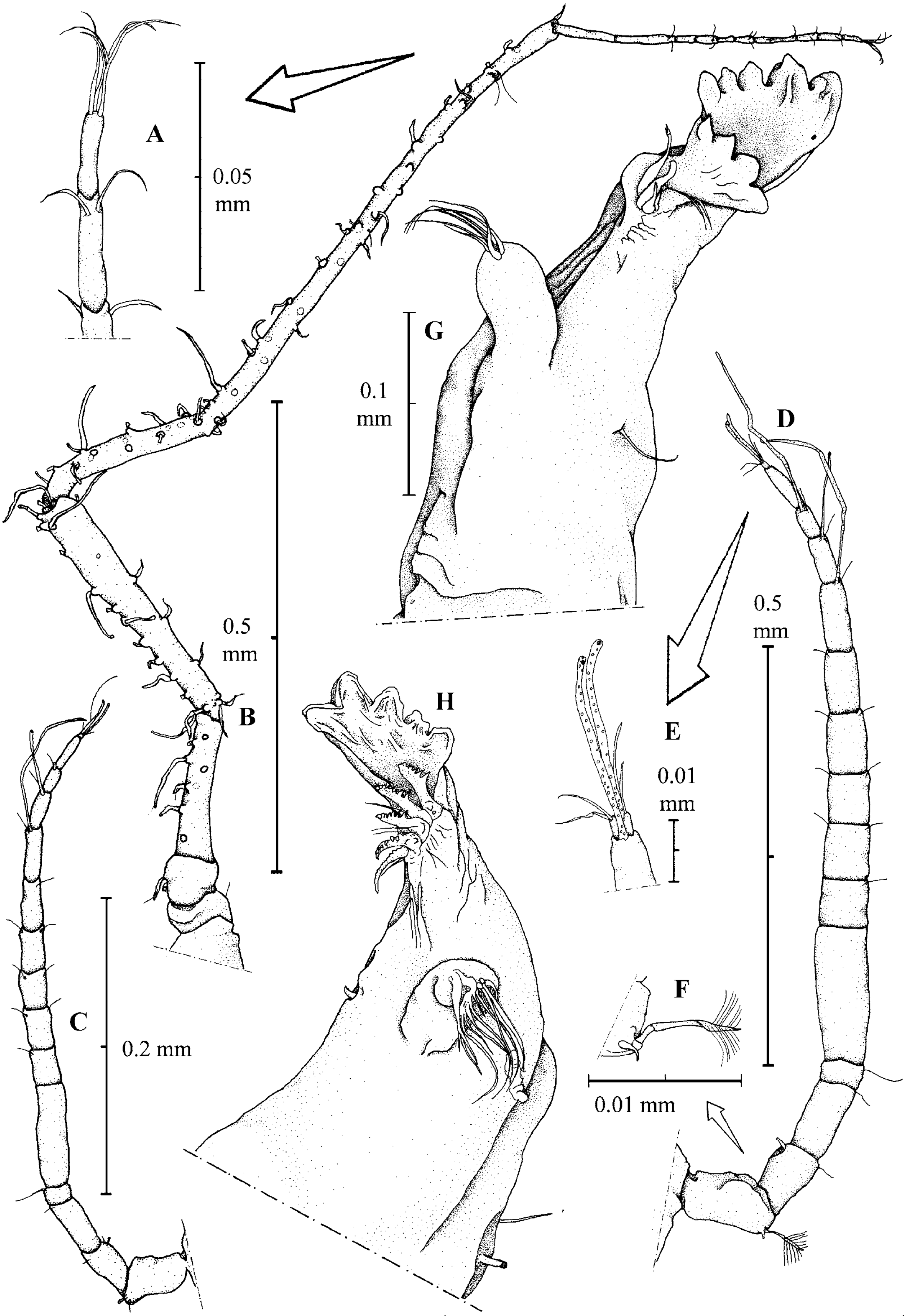

FIGURE 2: *Thylakogaster namibiensis* sp. nov., paratype ♂. A, tip of antenna 2; B, antenna 2; C, antenna 1; holotype ♂; D, antenna 1; E, tip of antenna 1; F, detailed view of broom seta on first peduncle article; G, H, left and right mandible.

Antenna 2 (Fig. 2b): length 2.0 cephalothorax-pereon length. Peduncle with 6 articles (Articles 1 broken off, article 2 damaged during dissection). Articles 1–4 short (only articles 2–4 are illustrated). Article 3 with 1 small seta on ventral side. Article 4 with 2 unequally bifid setae on dorsal side. Articles 5 and 6 elongated, bearing unequally bifid setae at irregular intervals (Articles 5 partially fractured in illustrated specimen). Setae insert with slight elevation, most setae broken off. Length ratio of peduncle articles: 1:1.1:0.5:1:8:14. Flagellum with 11 articles, first and second elongated, remaining articles smaller, subequal. Flagellar articles 1, 3 and 5 without setae, 8 with 1, articles 2, 4, 7, 9 and 10 with 2 setae. Article 6 with 3 small and thin simple setae. Article 11 with 5 long, thin setae on distal end (Fig. 2a).

Mandibles (Fig. 2g, h): proximally broad, tapering distally, without palp. Left mandible with long, slender, simple, medial seta. Right mandible with 1 short, simple seta medially and 1 slender, simple spine and short, strong spine laterally.

Left incisor process with 5 teeth with cuticular wrinkles, ventral-most tooth largest, remaining teeth decreasing in size to dorsal side. *Lacinia mobilis* of left mandible broad, bearing 4 prominent teeth and 1 small tooth. Setal row of 4 curved spines and 2 slender, simple setae. Molar process finger-like, with 7 long, slender, simple setae.

Right incisor process with 5 broad teeth of approximately same size, with cuticular wrinkles. Setal row of 5 curved spines, each spine serrated with 7 strong, short teeth; between curved spines some long and slender simple setae. Molar process finger-like, distal with 12 long, slender, simple setae.

Maxilla 1 (Fig. 3e, f): Outer lobe of left maxilla 1 terminally with 11 spine-like setae: 6 stout and rough serrated setae, 4 long setae serrated and equipped with a dense comb of fine setae and 1 simple, fine, ventral seta. Outer lobe of right maxilla 1 terminally with 11 spine-like setae of comparable size: 7 stout and rough serrated setae, 2 setae serrated and equipped with dense comb of fine setae and ventrally 2 simple fine setae. Inner lobe of right maxilla 1 with 3 long and slender setae.

Maxilla 2 (Fig. 4a, b): middle and outer lobe subequal in length. Tips of middle and outer lobes with 3 long, single, side, plumose seta and 1 simple, media seta. Outer lobe also with 2 combs of 4 fine setae latero-distally. Inner lobe shorter and broader than middle and outer lobes. Inner lobe with 11 simple setae: 8 short on tip and 3 long on median margin. Proximal to these with 3 long and 7 small additional setae.

Maxilliped (Fig. 3a–d): epipodite small and triangular, carrying numerous fine setae on its surface and lateral margins, reaching only half of length of lobe. Lateral margin of lobe irregularly rounded, tip truncated, with simple setae. Distal part of lateral margin of lobe with row of fine setae. Medial margin of lobe straight. Lobes connected by 5 (left lobe 3, right lobe 2) retinacula (Fig. 3b, d). Retinacula with 5 prominent teeth and cuticular wrinkles. Palpus long and slender, about twice as long as lobe. Palpus tapering distally, composed of 5 articles. All articles with numerous fine setae on surface and lateral margins. Length ratio of articles: 0.3:0.7:1:1.5:1.2. All articles with thin, long setae as follows: 1 with single seta, 2 with 2, 3 with 4, 4 with 3 and 5 with 7 long setae.

Pereopods (Fig. 4c–f): all pereopods insert on elongated lateral projection (Fig. 1a, e)

Pereopod 1 (Fig. 4d): robust, length 1.3 cephalothorax-pereon length, subchelate with prominent, strong, unequally bifid setae of altering length on basis, ischium, merus and carpus. Basis with 1 unequally bifid seta on ventral margin. Ischium length 0.5 basis length, with 3 unequally bifid setae and 2 simple setae on ventral and 2 unequally bifid setae on dorsal margin. Merus short, with 6 unequally bifid setae, 3 on ventral and 3 on dorso-frontal margin. Carpus elongated, longer than basis, with 11 strong unequally bifid on ventral margin opposite to propodus and dactylus and 5 additionally unequally bifid setae on proximal medial surface.
Propodus with row of 5 fine setae on ventral and 2 simple setae on dorsal margin. Dactylus with 9 long simple setae (Fig. 4f).

Pereopods 2–7 slender, sub-similar walking legs. Coxa of pereopods 2 to 7 recognizable but fused with pereonites and only slightly movable. All coxae with 3–5 strong, simple spines.

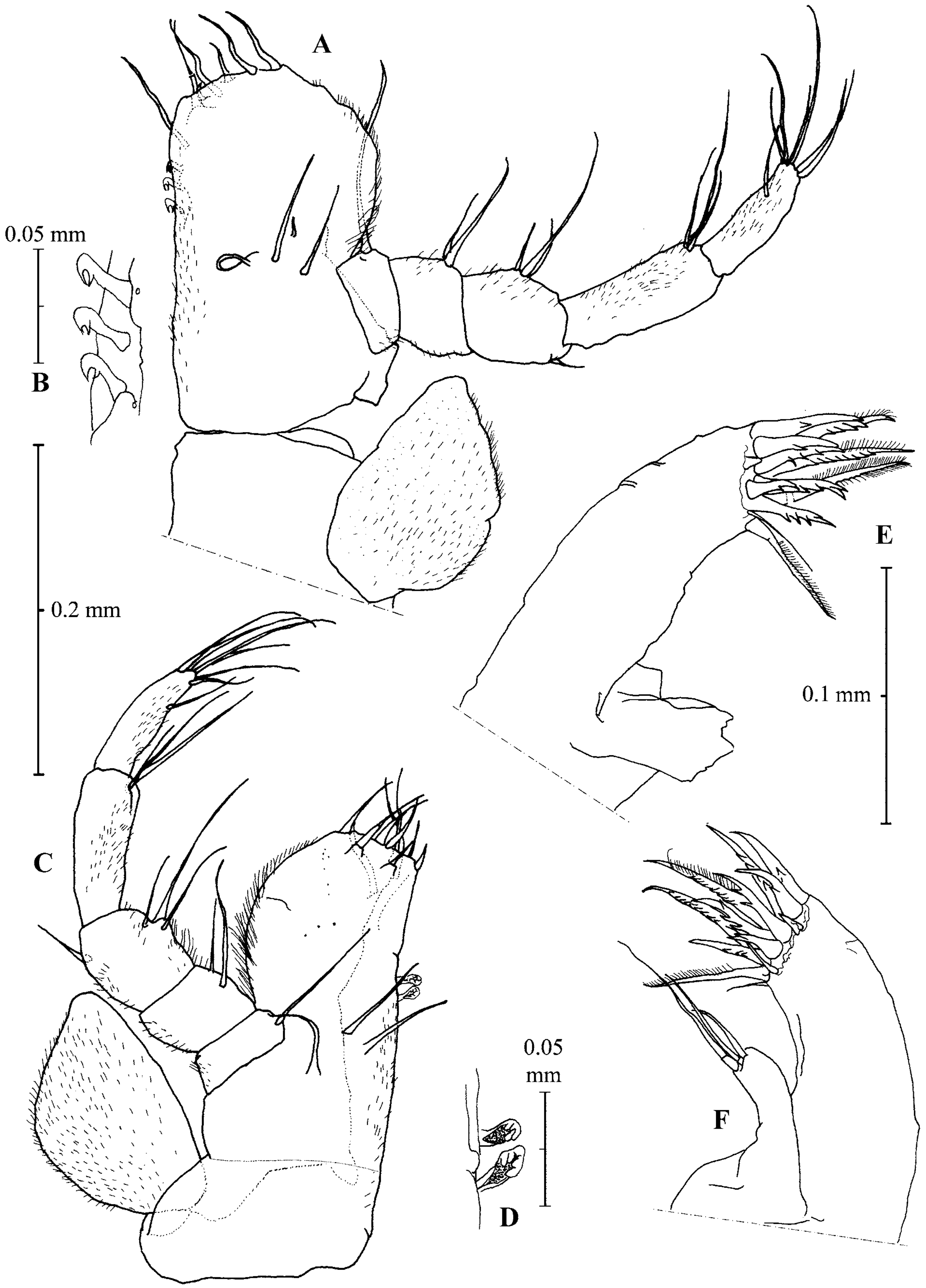

FIGURE 3: *Thylakogaster namibiensis* sp. nov., holotype ♂. A–D, left and right maxilliped with epipodite and detailed view of retinacula; E, F, left and right maxilla 1.

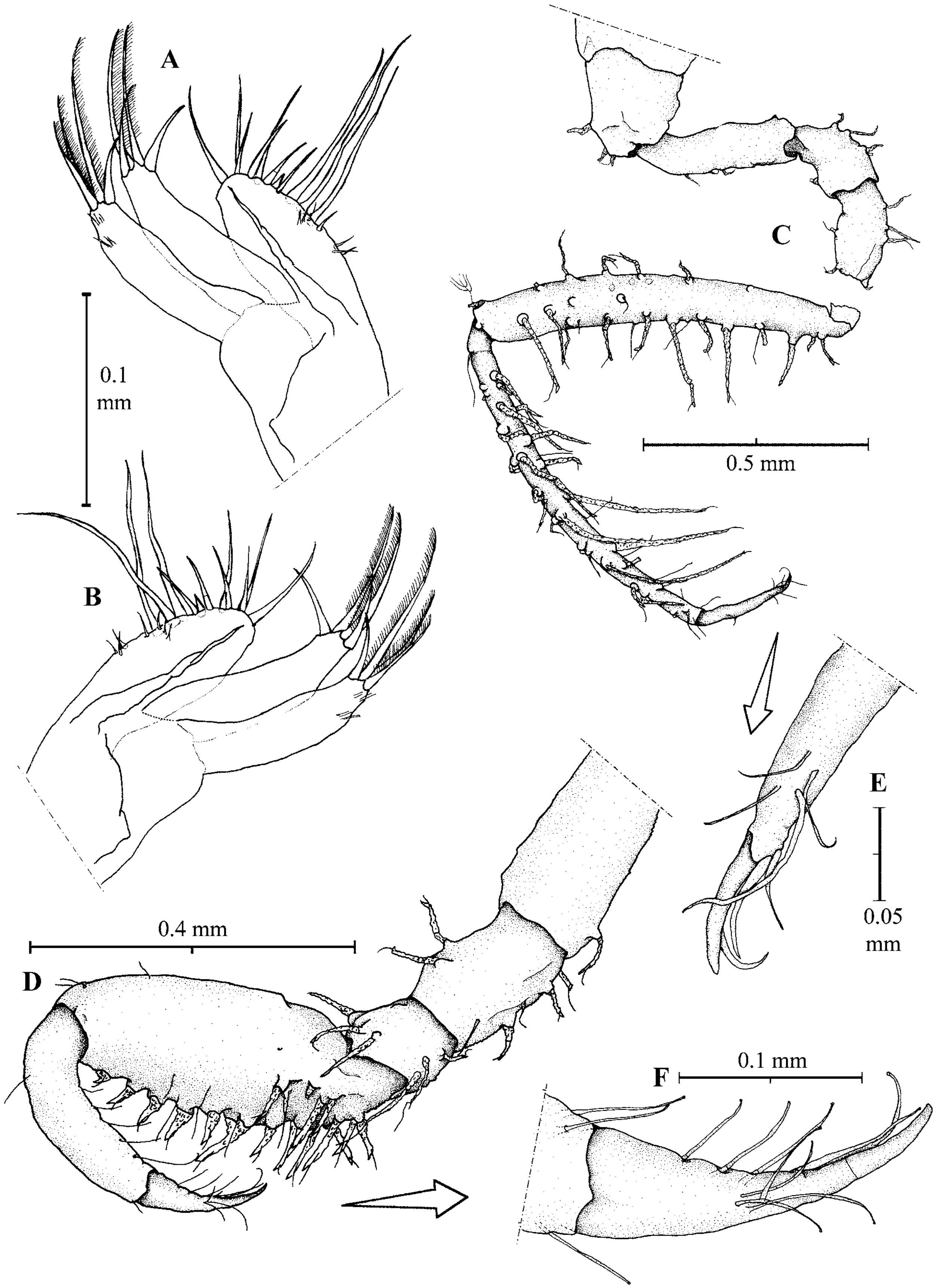

FIGURE 4: *Thylakogaster namibiensis* sp. nov., holotype ♂. A, B, left and right maxilla 2. C, E, paratype ♂, pereopod 2; D, F, holotype ♂, pereopod 1.

Pereopod 2 (Fig. 4c): length 1.4 cephalothorax-pereon length. Basis with 3 slender simple setae on ventral margin (see remarks). Ischium as long as broad, with 5 unequally bifid setae, 1 on ventral and 4 on dorsal margin. Merus with 2 setae on ventral and 4 setae on dorsal margin. Carpus long, slender, with row of long unequally bifid setae and long simple setae on ventral margin opposite to propodus. 4 unequally bifid setae dorsally and additionally 1 broom seta distally. Propodus narrower, but as long as carpus. Propodus with more than 18 long, robust, unequally bifid setae. Terminally with 7 slender, simple setae. Dactylus with 7 long simple setae (Fig. 4e).

Pleopods (Fig. 5a–e): male pleopods 1 and 2 forming posterio-ventral part of pleotelson, completely covering branchial cavity.

Pleopod 1 (Fig. 5a): male pleopod 1, length 3.7 width, lateral margins nearly parallel, tapering in the distal fifth. Ventral surface with row of 4 strong spines each. Disto-lateral corners with 8 small, hair-like setae.

Pleopod 2 (Fig. 5e): male pleopod 2, length 3.0 width ,with 2 rows of 7 cuticular spines on external surface. Lateral margin with dense row of long, slender setae. Stylet (endopodite) short, robust, stylet length 0.33 protopod length. Exopodite forms a small lobe disto-medial of endopodite.

Pleopod 2 (Fig. 1g): female pleopod 2 tapering distally, truncate proximally, completely covering branchial cavity. External surface with irregularly distributed cuticular spines.

Pleopod 3 (Fig. 5b): exopodite elongated and hemispherical, 2-articulated, lateral and disto-medial margins with rows of numerous long, hair-like setae, distal article with 1 simple seta apically. Endopod length 1.4 width, distally rounded, with 3 strong, plumose, terminal setae and hair-like, medial and apical setae.

Pleopod 4 (Fig. 5c): transparent, small, length 2.5 width, without setae, exopodite slender.

Pleopod 5 (Fig. 5d): transparent, small, length 2.8 width ratio, without setae, exopodite reduced.

Uropods (Fig. 1c, f): inserting beneath broad keel on ventral margin of branchial cavity close to tip of pleotelson, uniramous, cylindrical. Distal part swollen, rounded, with 5 hair-like setae.

Remarks. The copulatory male described bares only the antenna 1 and the first pereopods. The rest of the long appendages were broken off at their basis. For description of the lost antenna and the pereopod 2, a comparably large paratype was used. Except for the individuals described here, the long and extremely fragile antenna 1, antenna 2 and pereopods 3 to 7 were broken off on all specimens of *T. namibiensis* sp. nov., or the specimens were significantly smaller. Male and female of *T. namibiensis* show no sexual dimorphism, besides the female may be expanded if oostegites are developed.

The inner lobe of the left maxillula and the distal part of the merus of pereopod 2 were damaged during dissection. The cuticular wrinkles on the surface of pleopod 3 may be artefacts.

Discussion

Only 0.63% of all Asellota collected during the Diva 1 and Diva 2 expeditions (using anEBS) are members of the Haplomunnidae. This result corresponds with the general statement of Wilson (1976) that within the deep-sea isopods, the Haplomunnidae are only a small family of low abundance and few species. This low abundance of specimens is comparable to levels reported by Harrison (1988). At present, the family Haplomunnidae consists of five genera with 10 described species (exclusive of *T. namibiensis* sp. nov.; compare Cunha & Wilson 2003; Just 2003). The new species *T. namibiensis* is the first member of this genus found in the southeast Atlantic Ocean and the depth of 5415 m is the deepestthat a member of the genus has ever been found. 14 of 27 specimens of the Hapolomunidae from the Diva expeditions belong to *Thylakogaster namibiensis sp. nov.* Of the remaining specimens, nine belong to the species *Abyssaranea rupis*, two individuals probably belong to the species *T. peterpauli* and the remaining two individuals are not identified to genus level.

Wilson and Hessler (1974) and Cunha and Wilson (2003) described different characters to discriminate the previously known species *T. lobotourus*, *T. majusculus* and *T. peterpauli*. Since the new species *T. namibiensis* differs only slightly from the other three species, these characters are no longer sufficient and in need of discussion.

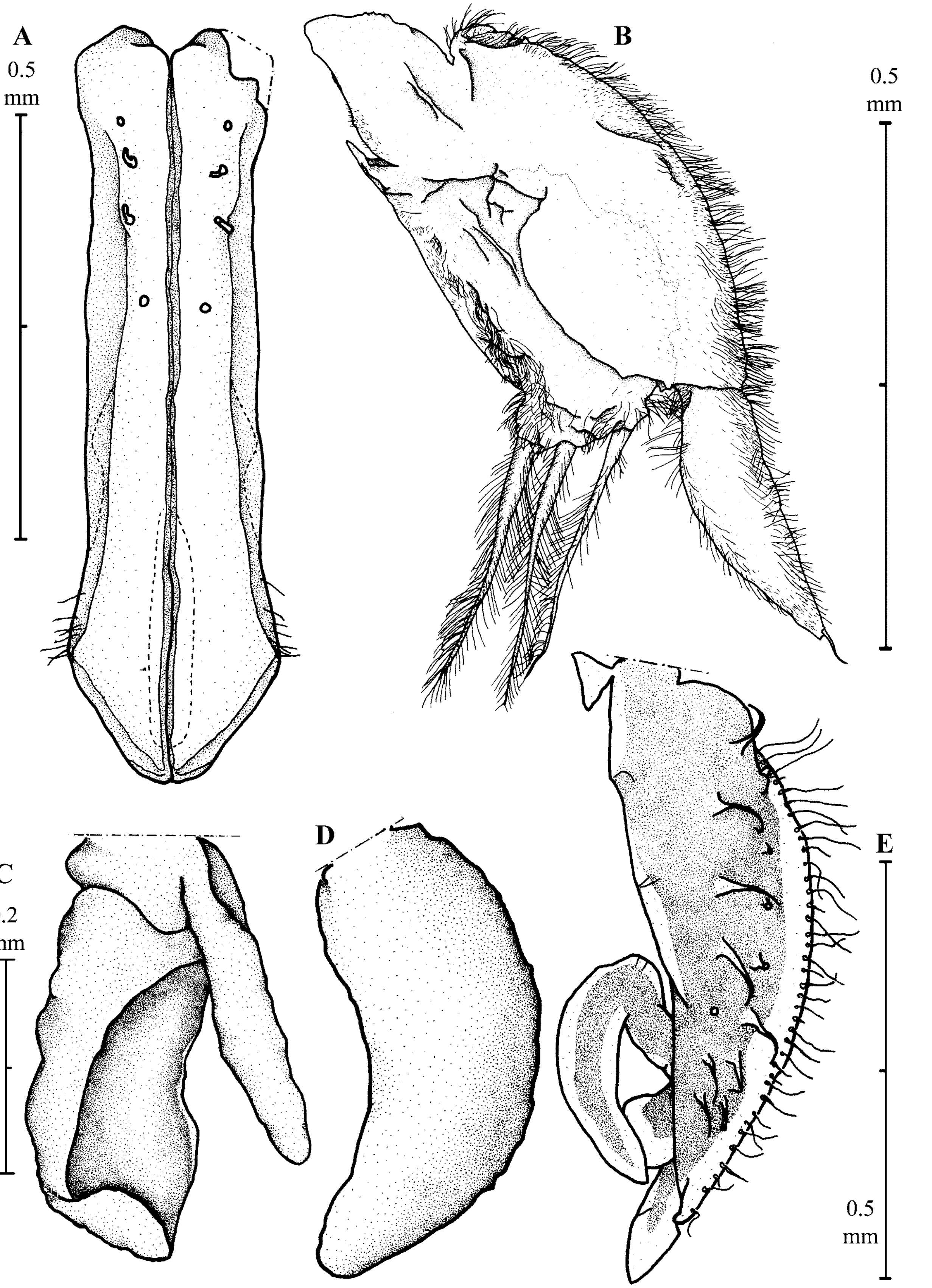

FIGURE 5: *Thylakogaster namibiensis* sp. nov., holotype ♂. A, pleopod 1; B, pleopod 3; C, pleopod 4; D, pleopod 5; E, pleopod 2.

Wilson & Hessler (1974) use the total number of articles in the A1 and the length - width ratio of the intermediate articles 12–16 to classify the species. However, the calculated ratio range of the intermediate articles 12–16 from the species *T. lobotourus* overlap a little with the other species. Also the length relation between articles 3 and 2 as well as 4 and 2 can be used for a preliminary identification of the species. The length ratio of articles 4 and 2 is 0.4:1 for *T. lobotourus* and *Thylakogaster namibiensis*. But the length ratio of articles 3 and 2 of *T. namibiensis* is 1.1:1. However the character is considered of low diagnostic value, because only a small number of individuals have been investigated and therefore little information about intraspecific variability exists.

On the other hand, we consider the location and number of aesthetascs per article is a useful character. Antenna 1 of all four species differs clearly in the number of flagellar articles, as well as in the number of articles bearing aesthetascs.

Comparing the number of peduncle articles (P), flagellar articles (F), and flagellar articles bearing aesthetascs [A] significant differences between the species were observed: *T. lobotourus*: P3–F23[A2–23]; *T. majusculus*: P3–F22[A2–22]; *T. peterpauli* P3–F19[A12–19]; *T. namibiensis* sp. nov. P3–F12[A8–12] (Fig. 2c, d).

Hence, *T. namibiensis* sp. nov. has the lowest number of total flagellar articles and articles bearing aesthetascs. The number of flagellar articles and articles bearing aesthetascs is regarded as a good and constant diagnostic character (Lincoln 1985) and it can well be used to discriminate between species of the genus *Thylakogaster.*

Furthermore, Cunha and Wilson (2003:14) mention the following characters: "The amount of setae, distal to large central seta on the ventral margin of the carpus of the pereopod 1 differ: *T. lobotourus*: 5–6; *T. majusculus*: 7–9; *T. peterpauli*: 7." *T. namibiensis* sp. nov. bears 5 setae distal to the large central seta on the carpus of the pereopod 1 (Fig. 4d). If this character overlap was already known to the species *T. majusculus* and *T. peterpauli,* now the overlap is even stronger with the species *T. lobotourus* and *T. namibiensis*. Consequently, the character is here considered of low systematic value.

In addition, we compared the total length of the pereopod 2 of the different species. The length of the pereopod 2 of *T. namibiensis* sp. nov. (Fig. 4c) in comparison to the cephalothorax-pereon length is 1:2.6. In the species *T. lobotourus* and *T. peterpauli* the length ratio is 1:0.52-0.56 (for *T. majusculus* this data are not available). Therefore the pereopod 2 of *T. namibiensis* is notably longer than in the other species.

Cunha and Wilson (2003:13) state "The antenna (A2) of *T. lobotourus* is longer with a longer flagellum and smaller setae than in *T. peterpauli* (antenna ~ 3.1 and 2.5 cephalothorax-pereon length for *T. lobotourus* and *T. peterpauli*, respectively)". In the species *T. Majusculus*, Wilson & Hessler (1974: 56) describe the antenna to be identical to *T. peterpauli*. The length of the antenna of *T. namibiensis* sp. nov. (Fig. 2b) in comparison to the cephalothorax-pereon length is 1:1.8: shorter than in all other species.

Cunha and Wilson (2003:13) also point out that "Spines on body and pleotelson differ among the species. Relative to each other, the number of spines decrease in the order: T. *majusculus* > *T. peterpauli* > *T. lobotourus*. The length of the spines shows a different trend as they decrease in the order: *T. lobotourus* > *T. majusculus* > *T. peterpauli*. The pleotelson in *T. lobotourus* has spines fewer (10–15% less for the same area) but longer (1.1 times) than in *T. peterpauli*".

The pleotelson of *T. namibiensis* sp. nov. is equipped with 30–40 simple spines, less than half the number of cuticular spines as any of the other specimen, but the length of the spines is comparable to those of the other species. After precisely checking the type material and all drawings, we found that all species of the genus (known to date) have spines on the lateral margins of the pereonites and coxae. Specifying the exact number of cuticular spines on the spherical pleotelson and the first pleopods, is extremely difficult. The spines are not distributed symmetrically on the lateral sides of the pleotelson and the differences are only small (10%), hence it is essential to determine every spine precisely. A comparative character ("more or less than …") like the number of spines and their length is a further problem, because it requires that all species are simultaneously available to the investigator for species discrimination.

Additionally, the disto-lateral corners of the male pleopod 1 (Fig. 5a) are not so prominent, and the pleopod 1 has less number of spines in *T. namibiensis* compared with *T. peterpauli*. Unfortunately there are no drawings of the pleopod 1 in the other species. Wilson and Hessler (1974) describe the shape of the tip of the pleotelson and the shape of the uropods. But the pleotelson and the uropods are similar and it is difficult to separate the four species by these characters.

The above arguments demonstrate that all of the described species of the genus *Thylakogaster* are very similar. Neither female nor juvenile specimens can be distinguished with the known characters. Assuming that animals without marsupium and developed pleopods 1, but which are of the same size as the herein described copulatory male, are females, the proportion of females in our samples is 50%. *T. namibiensis* sp. nov. bears only a small number of further characteristical traits. From the characters mentioned by Wilson and Hessler (1974) and Cunha and Wilson (2003) only some arguments related to the antenna 1 and antenna 2 can be used to discriminate the new species from the others without doubt.

The presence of the cuticular spines on the lateral margins of the pereonites 1 to 7 together with the number of five terminal flagellar articles bearing aesthetascs is the most prominent diagnostic character for the identification of *Thylakogaster namibiensis* sp. nov.

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