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Two new species of Eulepethidae (Polychaeta) from Australian seas

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Abstract

Exploration of poorly known regions of the Australian continental margin has resulted in the discovery of two new species in the scale worm family Eulepethidae. *Grubeulepis kurnai* **sp. nov.** occurs in southeastern Australia while *Proeulepethus payungu* **sp. nov.** was collected at one site in the Indian Ocean on the continental margin of Western Australia. *Pareulepis malayana* (Horst, 1913), also collected from the continental margin of Western Australia, is newly recorded from Australia, representing a range extension of that species previously known from Madagascar, Malaysia and the South China Sea. Four species, and four of the six known genera of Eulepethidae are now known from Australian waters. The family Eulepethidae remains species-poor compared with most polychaete families, and now comprises 21 species world wide.

Key words: Australia, Eulepethidae, scale-worms, taxonomy, continental slope, continental shelf

Introduction

The Eulepethidae is one of 6 polychaete families known as “scale-worms”, in which the dorsal cirri of alternating segments are modified to form overlapping scales which cover all or most of the dorsum (Fauchald, 1977). Eulepethids are distinguished from all other scale worms by the neuroaciculae which are distally enlarged to form a “hammer-head” like structure supporting the truncate distal margin of the neuropodium; this structure is the synapomorphy for the family (Fauchald & Rouse, 1997; Glasby & Fauchald, 2000; Pettibone, 1969). The history of taxa now placed within the Eulepethidae has been summarised by Pettibone (1969) who distinguished 4 genera. Twenty one species of Eulepethidae are now recognised, including *Grubeulepis kurnai* **sp. nov.** and *Proeulepethus payungu* **sp. nov.** described here (Table 1).

Besides the unique “hammer-head” like neuroaciculae, other distinguishing characteristics of Eulepethidae from other scale worms are:

• the presence in all genera of 12 pairs of elytrae on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 24 (the long-bodied genera *Eulepethus* and *Mexieulepis* have additional, much smaller elytrae on posterior segments commencing segment 27 or 28);

• presence of 10–13 pairs of branchiae on non-elytrae-bearing segments commencing segment 6 or 8 (branchial structures also occur in several other scale-worm taxa: Sigalionidae, where they are modified dorsal tubercles, and in several genera of Polynoidae (*eg Branchinotogluma*, *Branchipolynoe*, *Opisthotrochopodus*) where they occur in different positions and on elytral and non-elytral parapodia; these structures are therefore considered unlikely to be homologous with the branchiae of Eulepethidae);

• the small spherical prostomium, stout notochaetae and 2 pairs of plate-like jaws are all characters similar to those found in the scale-worm family Aphroditidae (Eulepethidae were found to be sister group to the clade (Acoetidae+Aphroditidae) in the cladistic analysis of Rouse & Fauchald (1997).

Eulepethids are known from coastal regions of the Pacific, Indian and Atlantic oceans but mainly from equatorial latitudes; the most northerly species is *Mexieulepis amioi* (Imajima, 1974) at 35°N latitude from Japan while the most southerly is *Grubeulepis kurnai* **sp. nov.** described here at 38°S latitude from southeastern Australia. Eulepethids also have restricted bathymetric distributions: only four species have maximum depths in the range

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TABLE 1. List of known species of Eulepethidae

Genus species	Original combination	Geographical distribution	Depth range	Number of specimens	Sources
Eulepthus hamifer	*Eulepis hamifera* Grube, 1875	Philippine Islands, East China Sea, Japan	10–80	<10	Pettibone, 1969, 1986; Uschakov, 1972; Imajima, 2003
Grubeulepis augeneri	*Grubeulepis augeneri* Pettibone 1969	East Atlantic (Africa)/Adriatic/ Gulf of Mexico	19–87	>10	Pettibone, 1969, 1986
Grubeulepis ecuadorensis	*Grubeulepis ecuadorensis* Pettibone 1969	Southeast Pacific, Ecuador	37	1	Pettibone, 1969, 1986
Grubeulepis fimbriata	*Eulepis fimbriata* Treadwell, 1901	Atlantic Ocean, West Indies to Brazil	0–33	>10	Pettibone, 1969, 1986
Grubeulepis geayi	*Eulepis geayi* Fauvel, 1918	Indo-West Pacific	0–2	<10	Pettibone, 1969, 1986
Grubeulepis katzmanni	*Grubeulepis katzmanni* Pettibone 1986	Adriatic	20–60	4	Pettibone, 1986
Grubeulepis kurnai **sp. nov.**	*Grubeulepis kurnai* **sp. nov.**	southern Australia	7–16	71	this paper
Grubeulepis malayensis	*Grubeulepis malayensis* Nishi, 2001	Malaysia	0–2	2	Nishi, 2001
Grubeulepis mexicana	*Eulepethus mexicana* Berkeley & Berkeley, 1939	California, Panama, Gulf of Mexico, Venezuala	0–48	>10	Pettibone, 1969, 1986
Grubeulepis sulcatisetis	*Pareulepis sulcatisetis* Jones, 1962	Jamaica	0–2	2	Pettibone, 1969, 1986
Grubeulepis tebblei	*Grubeulepis tebblei* Pettibone 1969	Southeast Atlantic, West Africa	11–13	2	Pettibone, 1969, 1986
Grubeulepis westoni	*Grubeulepis westoni* Pettibone 1986	North Carolina, Gulf of Mexico, Caribbean, Puerto Rico	15-80	>10	Pettibone, 1986; Uschakov, 1972; Laverde-Castillo, 1992
Lamelleulepethus biminiensis	*Lamelleulepethus biminiensi s* Pettibone, 1986	North Atlantic, Bahamas to Gulf of Mexico	19–30	10	Pettibone, 1986
Lamelleulepethus orensanzi	*Lamelleulepethus orensanzi* Pettibone, 1986	South Atlantic, Uruguay	0–8	1	Pettibone, 1986
Mexieulepis amioi	*Japoeulepis amioi* Imajima, 1974	Japan	30	1	Imajima, 1974
Mexieulepis weberi	*Eulepis weberi* Horst, 1922	North Atlantic, North Carolina to Venezuala	0–30	>10	Pettibone, 1969, 1986
Pareulepis malayana	*Eulepis malayana* Horst, 1913	Indian Ocean (Madagascar) to South China Sea, Japan, northwestern Australia	22–499	<10	Pettibone, 1969, 1986; Imajima, 1997; this paper
Pareulepis wyvillei	*Eulepis wyvillei* McIntosh, 1885	North Atlantic, Bermuda/Caribbean	7–795	<10	Pettibone, 1969, 1986
Proeulepethus challengeriae	*Eulepis challengeriae* McIntosh, 1885	West Indies	713–823	1	Pettibone, 1969, 1986
Proeulepethus clarki	*Proeulepethus clarki* Pettibone, 1986	Caribbean	257–414	7	Pettibone, 1986
Proeulepethus payungu **sp. nov.**	*Proeulepethus payungu* **sp. nov.**	Indian Ocean coast, Western Australia	201–206	2	this paper

400–800 m, the remainder occurring at depths of 80 m or shallower (Table 1). Seven species of Eulepethidae are known to occur intertidally. Little is known of the ecology of most eulepethids although two species are apparently commensal, both with tube-dwelling polychaetes: *Grubeulepis geayi* (Fauvel, 1918) being a possible commensal with another scale-worm, *Polyodontes melanotus* (Acoetidae) while *G.malayensis* lives in empty tubes of *Mesochaetopterus selangorus* (Chaetopteridae; Nishi, 2001).

The only record of Eulepethidae from Australian waters is Hutchings (2000) who reported "*Grubeulepis* cf. *geayi* and *Mexieulepis* species" from Bass Strait in southeastern Australia and one specimen of a species of *Mexieulepis* from the Gulf of Carpentaria in northern Australia; subsequently Wilson (2003) provided an identification guide to the same species, and the genera as defined by Pettibone (1969;1986). Here we show that "*Grubeulepis* cf. *geayi* and *Mexieulepis* species" of Hutchings (2000) and Wilson (2003) represent adults and juveniles of a single species, described as *Grubeulepis kurnai* **sp. nov.** Systematic benthic sampling of the Arafura Sea in northern Australia in 2005 resulted in discovery of a single specimen of *Eulepethus hamifer* (Grube, 1875) representing a new record for Australia (G.D.F.Wilson *et al*, 2006). Extensive benthic sampling of the continental margin of Western Australia during 2005–2008 (Poore, *et al.*, 2008) has generated material of two additional species, identified below as *Proeulepethus payungu* **sp. nov.** and *Pareulepis malayana* (Horst, 1913), the latter representing a range extension of that species previously known from Madagascar, Malaysia and the South China Sea. Low abundances are apparently typical for Eulepethidae collections; all but 5 species in the family are known from fewer than 10 specimens (Table 1) and even where extensive benthic sampling discovers eulepethids, relatively few specimens are collected (Uebelacker, 1984; Uebelacker & Johnson, 1984; Williams, *et al.*, 2010). *Grubeulepis kurnai* **sp. nov.**, with 71 specimens, appears to be better represented in collections than any other eulepethid.

The best identification tools for Eulepethidae remain the two reviews of Pettibone (1969;1986), together with the information presented in Tables 1 and 2 below which distinguish the two new species described here.

Material and methods

Sampling. The material reported here was generated from eastern Bass Strait in southeastern Australia and from research voyages aimed at documenting the fauna of previously poorly-known areas of the continental margin of Western Australia (Poore, *et al.*, 2008; Williams, *et al.*, 2010). Collector for MSL-LV stations was the late N. Coleman and colleagues, Marine Science Laboratories, Queenscliff, Australia; collectors for SS07/2005 and SS10/2005 stations were G.C.B.Poore and colleagues (Poore, *et al.*, 2008; Williams, *et al.*, 2010). Gear used and locations of samples is described in those papers.

Morphology, morphometrics and systematics. Descriptions of morphology follow characters and terminology of Pettibone (1969;1986). Generic definitions also follow Pettibone (1969;1986), and descriptions of the family and of genera are not repeated here.

Museum abbreviations. AM—Australian Museum, Sydney, Australia; MAGNT—Museum and Art Gallery of the Northern Territory, Darwin, Australia; MV—Museum Victoria, Melbourne, Australia.

Grubeulepis kurnai sp. nov.

Figures 1–7

Material Examined. Holotype: Australia: Bass Strait: near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S8, 38º22´S 147º12´E, 28 Jan 1990, 15.3 m, MV F64546. Sampling method, 0.25 m^2 quadrat driven 10 cm into sand; enclosed 10 cm sediment removed by water venturi suction and filtered directly through a 750 micron mesh bag on bottom (sampling method identical for all MSL-LV stations below).

Paratypes (6 specimens): Australia: Bass Strait: 1 km off Delray Beach, Stn MSL-LV 5 D2, 38º14´S 147º22´E, 29 Jan 1990, 16 m, 1 paratype, MV F64563; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S6, 38º22´S 147º12´E, 28 Jan 1990, 16 m, 1 paratype, MV F64569; 1 km off Delray Beach, Stn MSL-LV 5 T5, 38º14´S 147º22´E, 29 Jan 1990, 15 m, 1 paratype, MV F64550; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S5, 38º22´S 147º12´E, 23 Jan 1989, 15.5 m, 1 paratype, MV F64551; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S6, 38º22´S 147º12´E, 23 Jan 1989, 16 m, 1 paratype, MV F64561; 1 km off Delray Beach, Stn MSL-LV 1 D8, 38º14´S 147º22´E, 23 Jan 1989, 16.5 m, 1 paratype, MV F64579.

Non-type material: Australia: Bass Strait: 1 km off Delray Beach, Stn MSL-LV 3 T2, 38º14´S 147º22´E, 27 Jan 1989, 16.5 m, 1 specimen, MV F64554; 1 km off Delray Beach, Stn MSL-LV 4 D2, 38º14´S 147º22´E, 17 Jan 1989, 16 m, 1 specimen, MV F64568; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S8, 38º22´S 147º12´E, 23 Jan 1989, 15.3 m, 1 specimen, MV F64567; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S7, 38º22´S 147º12´E, 28 Jan 1990, 16 m, 1 specimen, MV F64566; 1 km off Delray Beach, Stn MSL-LV 6 D8, 38º14´S 147º22´E, 29 Jan 1990, 16.5 m, 1 specimen, MV F64562; 1 km off Delray Beach, Stn MSL-LV 5 D4, 38º14´S 147º22´E, 29 Jan 1990, 16 m, 1 specimen, MV F64559; 1 km off Delray Beach, Stn MSL-LV 4 D5, 38º14´S 147º22´E, 17 Jan 1989, 16 m, 2, MV F64558; 1 km off Delray Beach, Stn MSL-LV 4 D3, 38º14´S 147º22´E, 17 Jan 1989, 16 m, 1 specimen, MV F64564; 1 km off Delray Beach, Stn MSL-LV 3 D7, 38º14´S 147º22´E, 11 Jan 1989, 15.5 m, 1 specimen, MV F64557; 1 km off Delray Beach, Stn MSL-LV 3 T3, 38º14´S 147º22´E, 24 Jan 1989, 14.8 m, 5 specimens, MV F64555; 1 km off Delray Beach, Stn MSL-LV 4 T2, 38º14´S 147º22´E, 24 Jan 1989, 16.5 m, 1 specimen, MV F64541; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S4, 38º22´S 147º12´E, 28 Jan 1990, 14.5 m, 2 specimens, MV F64547; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S1, 38º22´S 147º12´E, 23 Jan 1989, 15.5 m, 1 specimen, MV F64581; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S1, 38º22´S 147º12´E, 23 Jan 1989, 15.5 m, 1 specimen, MV F64544; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 5 S5, 38º22´S 147º12´E, 28 Jan 1990, 15.5 m, 1 specimen, MV F64542; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 6 S4, 38º22´S 147º12´E, 28 Jan 1989, 14.5 m, 1 specimen, MV F64540; 1 km off Delray Beach, Stn MSL-LV 4 T1, 38º14´S 147º22´E, 24 Jan 1989, 16.6 m, 1 specimen, MV F64548; 1 km off Delray Beach, Stn MSL-LV 5 T8, 38º14´S 147º22´E, 29 Jan 1990, 15.4 m, 3 specimens, MV F64538; 1 km off Delray Beach, Stn MSL-LV 6 D3, 38º14´S 147º22´E, 29 Jan 1990, 16 m, 3 specimens, MV F64549; 1 km off Delray Beach, Stn MSL-LV 5 D2, 38º14´S 147º22´E, 29 Jan 1990, 16 m, 1 specimen, MV F64582; 1 km off Delray Beach, Stn MSL-LV 6 D5, 38º14´S 147º22´E, 29 Jan 1990, 16 m, 1 specimen, MV F64571; 1 km off Delray Beach, Stn MSL-LV 4 D7, 38º14´S 147º22´E, 11 Jan 1989, 15.5 m, 1 specimen, MV F64536; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 6 S6, 38º22´S 147º12´E, 28 Jan 1990, 16 m, 1 specimen, MV F64578; *Grubeulepis* sp MoV 737; 500 m off Woodside Beach, eastern Bass Strait, Stn SWOP93 18 3, 38º33.05´S 146º59.317´E, 1993, 7 m, 1 specimen, MV F166648; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 4 S8, 38º22´S 147º12´E, 23 Jan 1989, 15.3 m, 1 specimen, MV F64576; 1 km off Delray Beach, Stn MSL-LV 2 T2, 38º14´S 147º22´E, 1 Jan 1989, 16.5 m, 2 specimens, MV F64553; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S7, 38º22´S 147º12´E, 23 Jan 1989, 16 m, 1 specimen, MV F64570; 1 km off Delray Beach, Stn MSL-LV 6 D2, 38º14´S 147º22´E, 29 Jan 1990, 16 m, 2 specimens, MV F64556; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 6 S5, 38º22´S 147º12´E, 28 Jan 1990, 15.5 m, 2 specimens, MV F64545; 1 km off Delray Beach, Stn MSL-LV 4 D6, 38º14´S 147º22´E, 17 Jan 1989, 15.8 m, 3 specimens, MV F64552; 1 km off Delray Beach, Stn MSL-LV 3 D5, 38º14´S 147º22´E, 17 Jan 1989, 16 m, 1 specimen, MV F64574; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 1 S5, 38º22´S 147º12´E, 9 Jan 1989, 15.5 m, 1 specimen, MV F64577; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 3 S6, 38º22´S 147º12´E, 23 Jan 1989, 16 m, 1 specimen, MV F64580; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S6, 38º22´S 147º12´E, 9 Jan 1989, 16 m, 1 specimen, MV F64583; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 1 S2, 38º22´S 147º12´E, 9 Jan 1989, 16 m, 2 specimens, MV F64575; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 1 S4, 38º22´S 147º12´E, 9 Jan 1989, 14.5 m, 1 specimen, MV F64573; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S2, 38º22´S 147º12´E, 9 Jan 1989, 16 m, 2 specimens, MV F64572; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 1 S6, 38º22´S 147º12´E, 9 Jan 1989, 16 m, 1 specimen, MV F64565; 1 km off Delray Beach, Stn MSL-LV 2 D6, 38º14´S 147º22´E, 23 Jan 1989, 15.8 m, 1 specimen, MV F64560; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 2 S5, 38º22´S 147º12´E, 9 Jan 1989, 15.5 m, 1 specimen, MV F64543; near Seaspray, 1 km off The Honeysuckles, Stn MSL-LV 1 S7, 38º22´S 147º12´E, 9 Jan 1989, 16 m, 2 specimens, MV F64537; 1 km off Delray Beach, Stn MSL-LV 1 T4, 38º14´S 147º22´E, 1 Jan 1989, 14.8 m, 1 specimen, MV F64539.

Description. Adults: Size range of material examined 3–24 mm long (n= 42; holotype 23 mm), 1–7 mm wide including chaetae (holotype 6 mm), 20–37 segments (holotype 37 segments). Elytrae 12 pairs on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21 and 24, becoming more elongate towards the posterior end (Figure 1A). First pair of elytrae with 0–10 papillae on the anterior margin (6 papillae in the holotype), elytrae 2 to 12 with distinct lateral leaf projection between the anterior and posterior surfaces. Elytron 2 with 4–23 lateral lobes (23 in holotype). Elytron 8 with 7–11 lateral lobes (9 in holotype) and elytron 12 with 17–27 (17 in holotype). Lateral processes of elytrae digitiform, smaller individuals tend to have articulate lateral processes (Figures 1B–E).

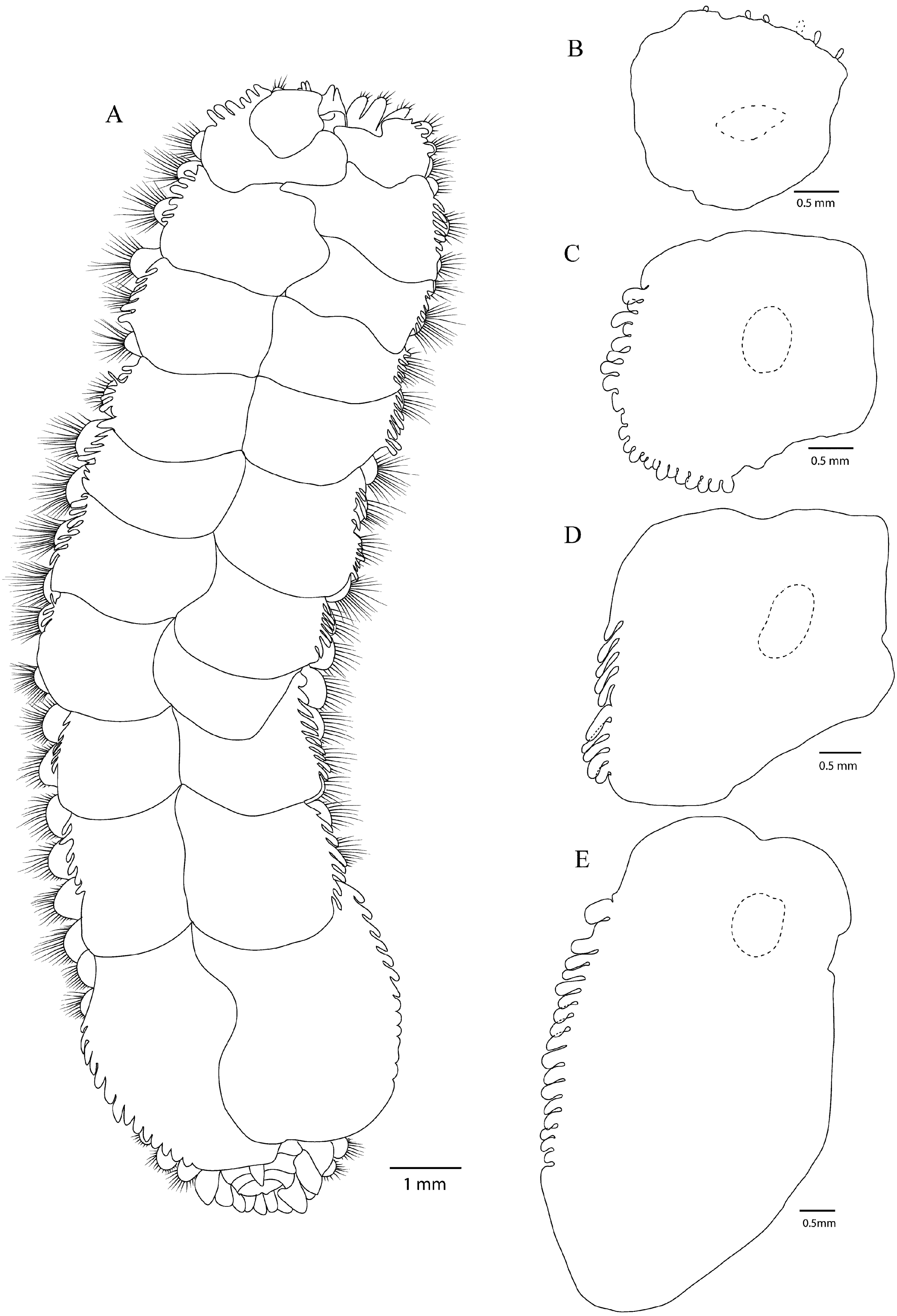

FIGURE 1. *Grubeulepis kurnai* **sp. nov.**, holotype MV F64546: A, Entire animal, dorsal view, first right elytron removed; B, 1st right elytron; C, 2nd left elytron; D, 8th left elytron; E, 12th left elytron.

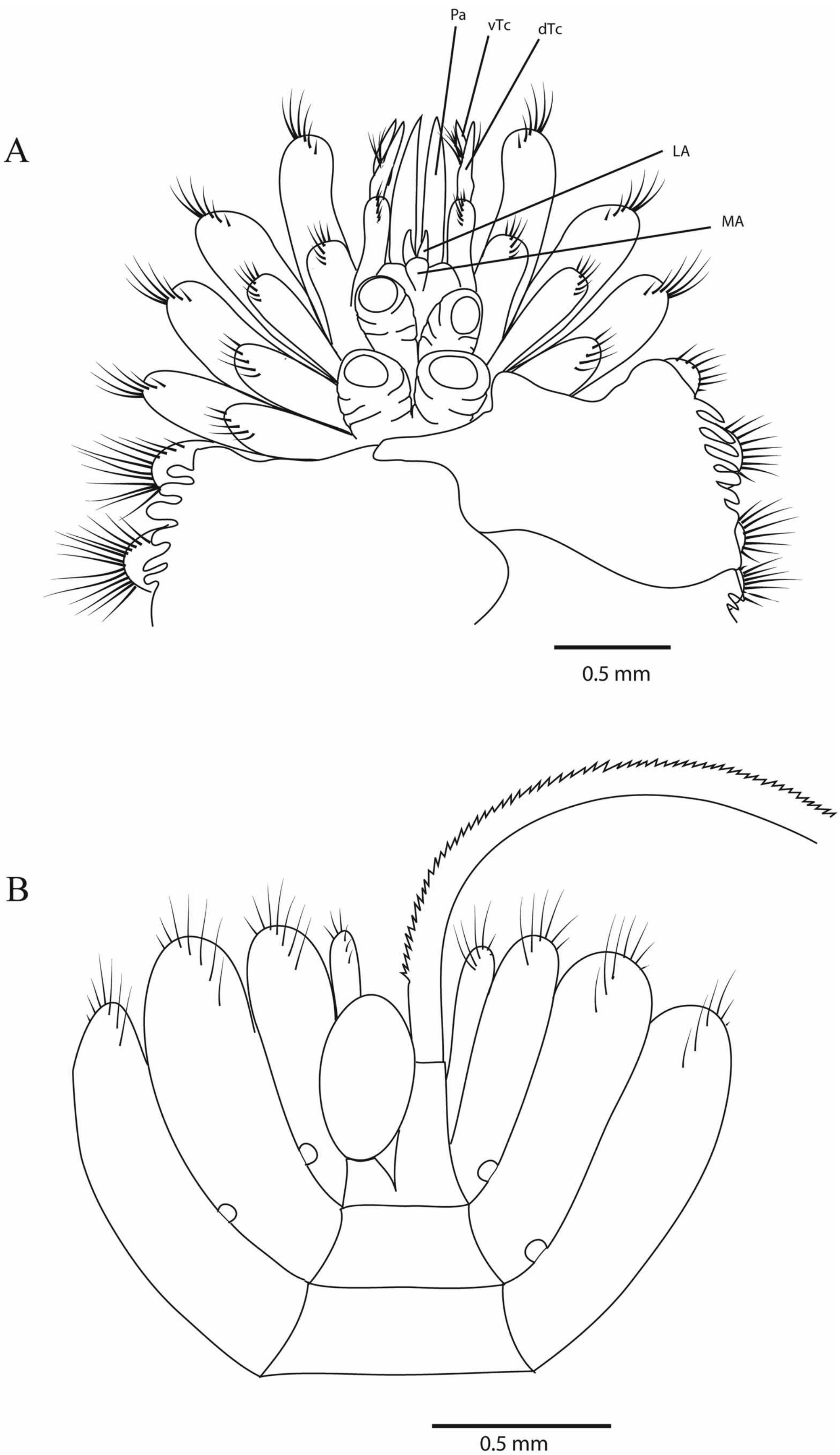

FIGURE 2. *Grubeulepis kurnai* **sp. nov.**, holotype MV F64546: A, Head region and protomium, first and second elytrae removed, dorsal view; Figure labels: Pa; Palps, vTc; Ventral Tentactular Cirrus, dTC; Dorsal Tentactular Cirrus, MA; Median Antenna, LA; Lateral Antenna. B, Pygidium and final posterior segments, left and right cirrus present, ventral view.

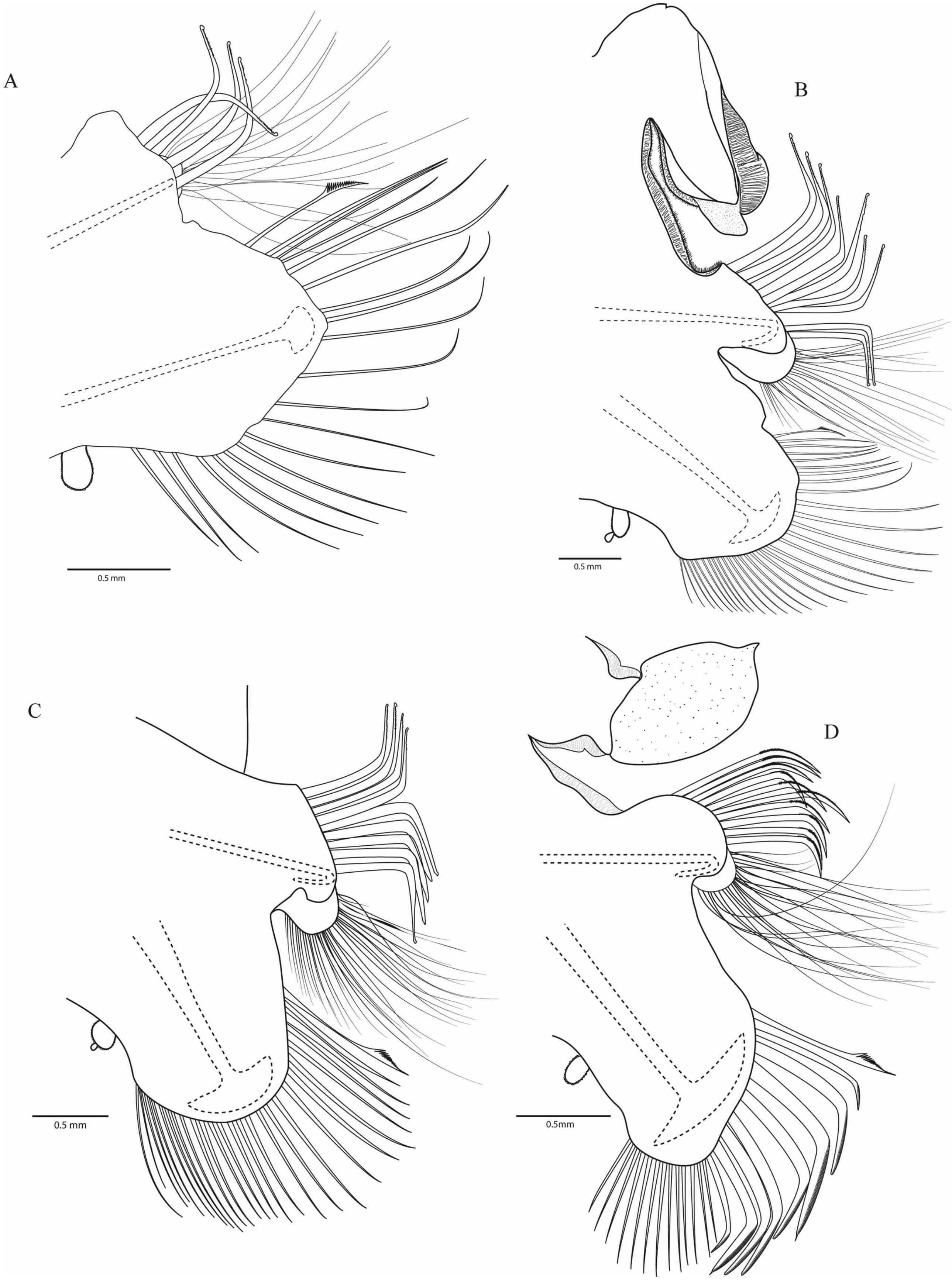

FIGURE 3. *Grubeulepis kurnai* **sp. nov.**, holotype MV F64546: A, parapodium segment 3, anterior view; B, branchial parapodium segment 14, anterior view; C, lamelligerous parapodium segment 27, anterior view; D, lamelligerous parapodium segement 32, anterior view.

Branchiae 11 pairs on segments 8, 10, 12, 14, 16, 18, 20, 22, 23, 25, 26 as defined by the presence of distally attached branchial cirrus, replaced by fleshy lamellae on the 27th and following segments. The lamellae are foliform, reducing in size towards the posterior end (Figure 3D). The branchiae project from the dorsal region of the parapodia and have dorsal and ventral ciliated bands, along with distally attached branchial cirrus (Figure 3B).

Prostomium (Figure 2A) is covered by the 2nd segment, antenna and palps reduced and eyes absent. Median antenna small and aspidate, attached to the prostomium on the dorsal margin. Lateral antennae conical and attach laterally relative to the median antenna.

Parapodia biramous, each ramus supported by single amber aciculum, notoaciculum of median and posterior segments with hooked tip, neuroaciculum throughout expanded distally to form malleiform distal plates (Figure 3A–D). Dorsal-most notochaetae amber, curved with the distal edge serrated and disciform tip (Figure 4A). Ventral notochaetae are also curved but not serrated, and form a sharp point at the tip. Notopodial capillaries densely bunched on the lower half of the notopodium, projecting from a fleshy lump on the lower notopodial lobe. Capillaries of two forms, the first entirely smooth and tapering to a fine point (Figure 4B), the second with serrated ventral margin continuing for a third of the length of the capillary (Figure 4C). Dorsal-most neurochaetae are pectinate (Figure 4F), more ventral neurochaetae are smooth capillaries that taper to a fine point, capillary chaetae becoming thinner in more ventral positions (Figure 4D, E). On posterior segments upper notochaetae and neurochaetae are both much stouter, notochaetae are sharply bent, serrated on the outer margin and taper evenly to a point (Figure 4H), neurochaetae are longer, sharply bent with a distinct corrugated pattern on the outer margin distal to the bend and narrow abruptly to a point (Figure 4G).

Pygidium of all intact specimens with right cirrus long, minutely papillated on one side only for most of the length except the basal-most part; left cirrus ovoid (Figure 2B).

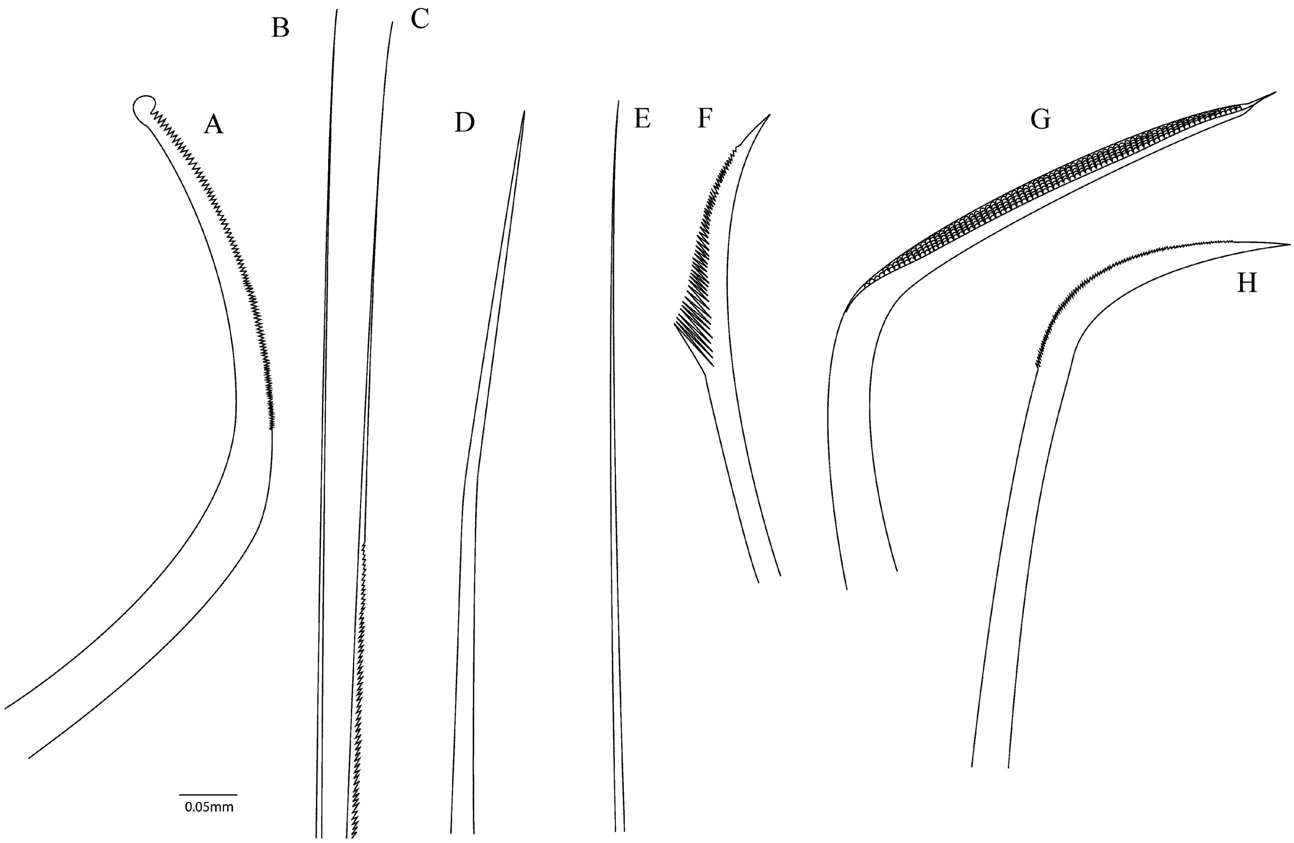

FIGURE 4. *Grubeulepis kurnai* **sp. nov.**, holotype MV F64546: A, hooked upper notochaetae, segment 14; B, capillary notochaeta, segment 14; C, capillary notochaeta, segment 14; D, dorsal neurochaeta, segment 14; E, ventral neurochaeta, segment 27; F, pectinate neurochaeta, segment 27; G, dorsal neurochaeta, segment 32; H, dorsal notochaeta, segment 32.

Juveniles: Size range of material examined 1.5–7 mm long (n= 11; holotype 5 mm), 1–2.5 mm wide (holotype 2 mm) including chaetae, 12–26 segments (holotype 25). Elytrae 12 pairs on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21 and 24, however the 11th and 12th pairs are greatly reduced and the 12th pair of elytrae is absent in some of the smaller juveniles. First pair of elytrae have 1–11 papillae on the anterior margin (8 in holotype); a scatter plot of number of papillae on the anterior margin of the first elytron versus body length (Figure 6) shows that size is a poor predictor of number of papillae (R^2= 0.1). Elytrae 2 to 12 show the same lateral anterior to posterior projections, however the biggest difference seen between juveniles and adults is the presence of articulate lateral processes on the elytrae of juveniles (Figures 5E–G). A scatterplot of number of lateral processes on the second elytron versus body length (Figure 7) demonstrates the progression from articulate to inarticulate lateral processes with increasing size of specimen.

Branchiae display the same morphology and attach from the eighth segment onwards, however due to the reduced size of juveniles the posterior branchiae are either not developed or absent, this is evident in the holotype with eight pairs of branchiae.

Biramous parapodia similar in form to adults (Figures 5A–D). Notopodial chaetae similar to that of adults; hooked notochaetae include forms with smooth and forms finely serrated on distal margin. Notopodial capillaries of juveniles are equivalent to those seen in adults as are upper pectinate, and smooth fine ventral neurochaetae. However the dorsal neurochaetae of juveniles differ from adults: in the anterior and mid-regional segments neurochaetae of juveniles are stout and slightly denticled, compared to smooth slender chaetae ending in a fine point which are seen in adult animals. Posterior stout hooked neurochaetae from the dorsal region of the neuropodia also differ between juveniles and adults: juveniles have two spinous rows on the distal edge (Figure 5H), whereas adults have a distinctly corrugated pattern (Figure 4F).

Other morphological characters showed no differences between juvenile and adult specimens.

Etymology. The species name *kurnai* pays respect to the Aboriginal people of the Kurnai Nation whose traditional lands in eastern Victoria include that part of the Bass Strait coast where *Grubeulepis kurnai* **sp. nov.** occurs.

Distribution and habitat. *Grubeulepis kurnai* **sp. nov.** occurs in eastern Bass Strait, southeastern Australia in depths of 7–16.6 metres from medium to coarse sand sediments with mean grain size in the range 0.3–2.1 mm; mud content, measured at 6 stations, was in the range 0.7–4.7%. *Grubeulepis kurnai* **sp. nov.** was only collected using a SCUBA-operated airlift; extensive sampling with epibenthic sleds and Smith McIntyre Grabs throughout Bass Strait, including many adjacent stations and mostly in the depth range 22–90 m (Wilson & Poore, 1987), failed to collect even a single eulepethid, nor were any found during two extensive surveys of nearby Port Phillip Bay using Smith McIntyre Grabs in depths 5–22 m (Poore, *et al.*, 1975; Wilson, *et al.*, 1998). One possible explanation is that *Grubeulepis kurnai* **sp. nov.** lives in tubes of another benthic organism and is not normally collected unless the suction of SCUBA-collected airlift is applied. The habitat at one location was described by the collector thus: "Fine-medium grained sandy bed. Very sparse epibiota, typically a few red algae, some *Pseudogorgia godeffroyi*, drift from scattered inshore reef comprising of *Amathia*, sometimes with pycnogonid passengers and the small gastropods. Strong tidal longshore currents with rippled bed." (J.E.Watson, pers. comm. 2010).

Discussion. The genus *Grubeulepis* contains ten species (Pettibone 1986, Nishi 2001), which are compared in Table 2.

Grubeulepis kurnai **sp. nov.** is most similar to *G. geayi* (Fauvel, 1918), but can be separated by the differences in the number of branchiae (11 pairs in *G. kurnai* versus 13 pairs in *G. geayi*), the number of papillae on elytrae (0–10 in the first elytron in *G. kurnai* versus 3–4 in *G. geayi*), the number of lateral processes of elytrae (in 2nd, 8th and 12th of both species, see Table 2), the shape of posterior lamellae (foliform in *G. kurnai* versus subconical in *G. geayi*), the notochaetae and neurochaetae shape (see Table 2), and the longer anal cirrus (minutely papillated on one side in *G. kurnai* versus smooth in *G. geayi*). The two species also differ the segments where the posterior lamellae start to form although of course this character is dependent on number of branchiae, which they replace posteriorly, thus posterior lamellae commence on segment 27 in *G. kurnai* **sp. nov.** and on segment 28 in *G. geayi*. The shape of the posterior lamellae differs in *G. kurnai* **sp. nov.** with leaf shaped (foliform), compared to *G. geayi* in which the posterior lamellae are subreniform and subconical.

Additional differences between *G. kurnai* **sp. nov.** and *G. geayi* include variation in the notochaetae and the neurochaetae; a more spinous and disciform tipped hooked notochaetae is present in *G. kurnai* **sp. nov.** (Figure 4A). *Grubeulepis kurnai* **sp. nov.** lacks the limbate chaetae present in *G. geayi* (Pettibone, 1969: Figure 18e, c). The upper neurochaetae of posterior segments in *G. kurnai* **sp. nov.** are very stout, curved downwards and has a distinct corrugation on distal edge (Figure 4G) whereas in *G. geayi* the corresponding neurochaetae of posterior segments are stout, taper abruptly to long fine tips and are smooth (Pettibone, 1969: Figure 20b). (Stout curved distally corrugated upper neurochaetae similar to those in *G. kurnai* **sp. nov.** are also present on posterior segments in *G.mexicana*; see Pettibone 1969: Figure 27c).

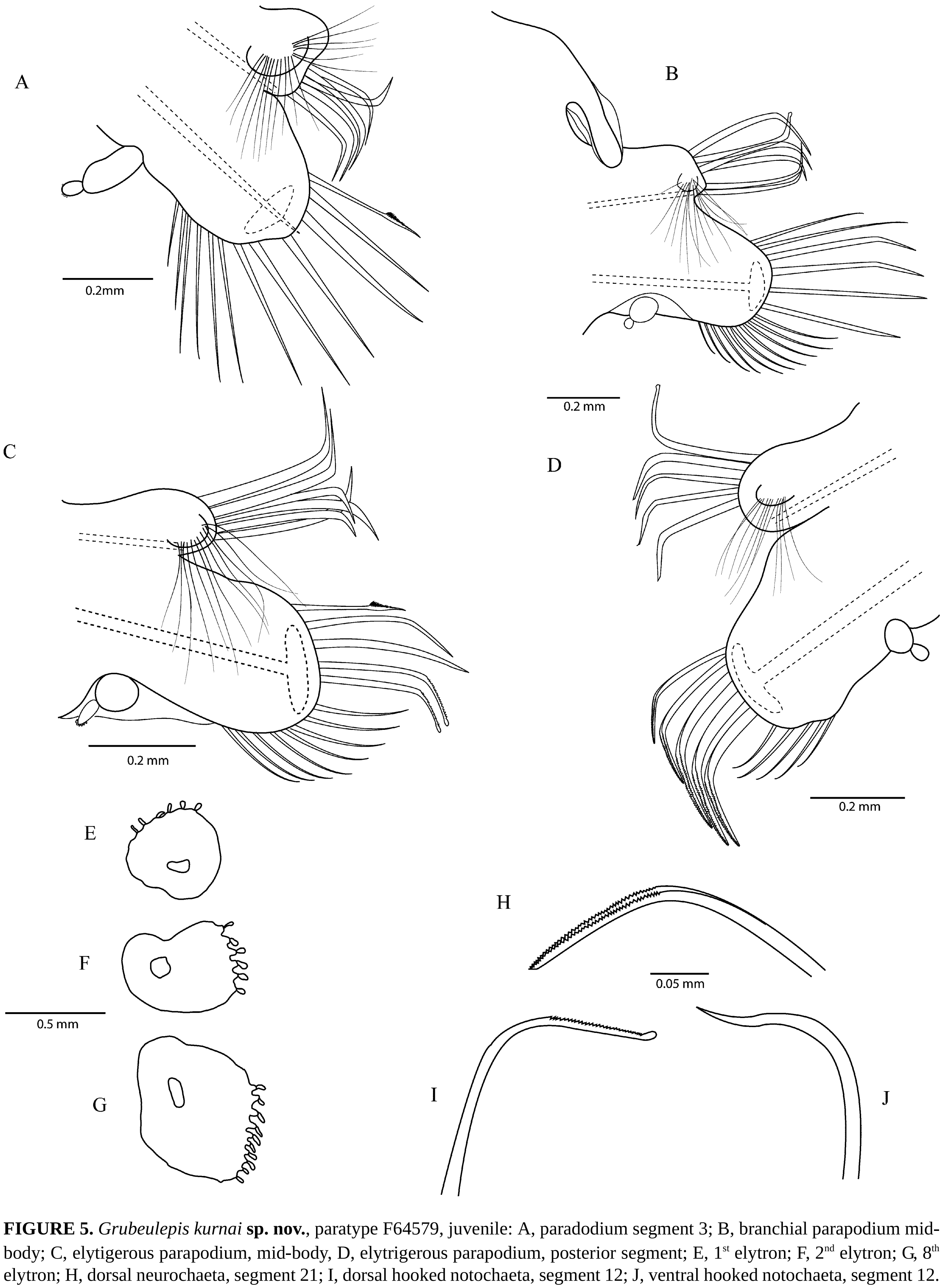

FIGURE 5. *Grubeulepis kurnai* **sp. nov.**, paratype F64579, juvenile: A, paradodium segment 3; B, branchial parapodium mid-body; C, elytigerous parapodium, mid-body, D, elytrigerous parapodium, posterior segment; E, 1st elytron; F, 2nd elytron; G, 8th elytron; H, dorsal neurochaeta, segment 21; I, dorsal hooked notochaeta, segment 12; J, ventral hooked notochaeta, segment 12. E–G share scale bar; H–J share scale bar.

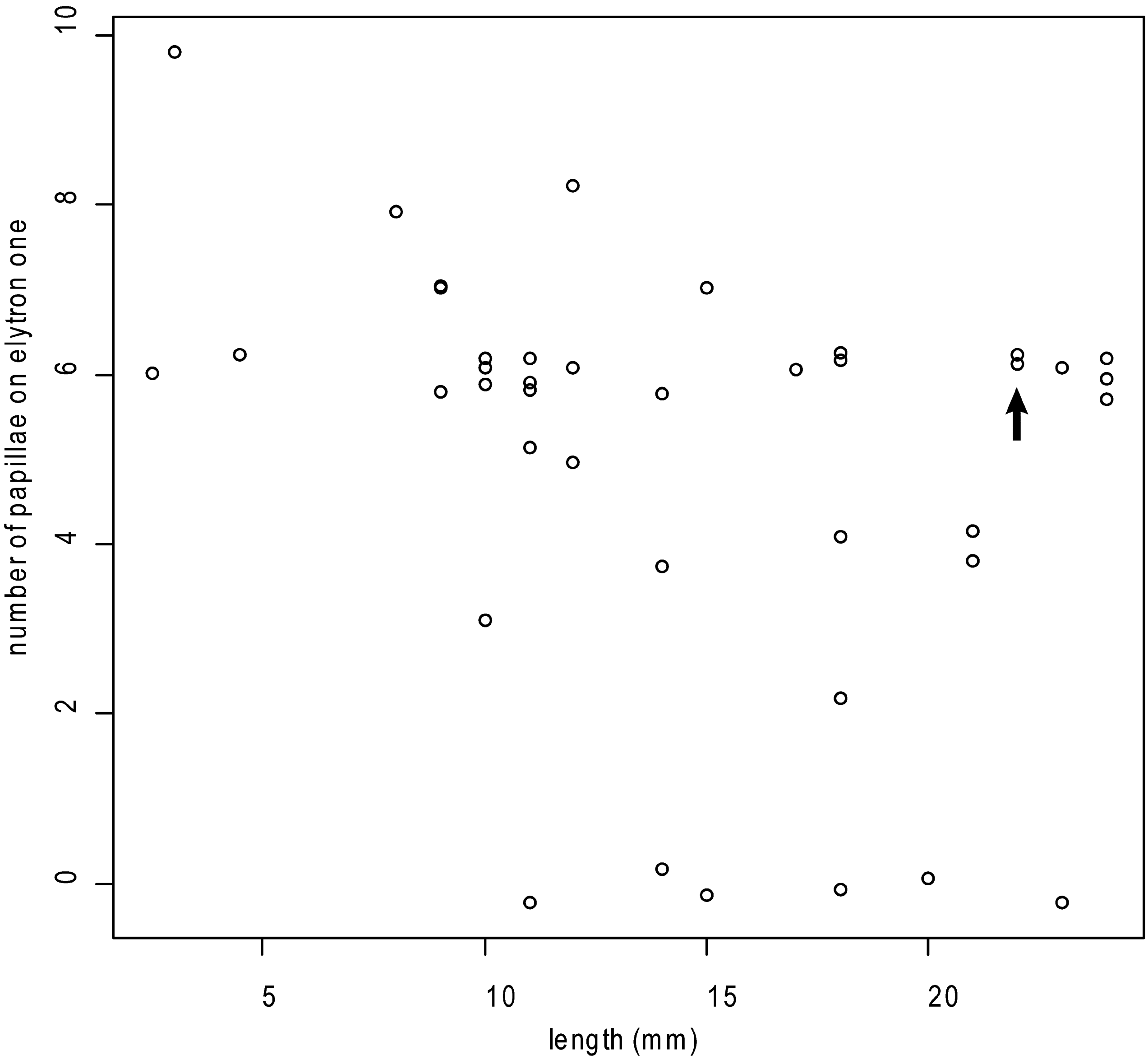

FIGURE 6. *Grubeulepis kurnai* **sp. nov.**, number of papillae on first elytrae versus body length (holotype arrowed; points jittered to avoid overplotting).

Other apparent differences between *G. kurnai* **sp. nov.** and *G. geayi* must be interpreted cautiously since they are size-related: papillae are more numerous on the first elytrae in *G. kurnai* **sp. nov.** compared to *G. geayi*, however as demonstrated above the number of papillae on the first elytrae decreases with size (Figure 6). *Grubeulepis kurnai* **sp. nov.** has more numerous lateral processes on 2nd, 8th and 12th elytrae in comparison to *G. geayi* (see Table 2). However, in our material articulate lateral processes occur in smaller specimens, and are apparently replaced by non-articulate lateral processes in larger specimens (Figure 7). Pettibone (1986) notes a similar trend in the presence of articulate lateral processes in juveniles to non-articulate in adult specimens in *G. mexicana*. We have provided this information in Table 2 based on published information but it is not clear whether descriptions have been based on juveniles or adults, therefore caution is required when using form of lateral processes on eyltrae for taxonomic purposes.

Grubeulepis kurnai **sp. nov.** is also similar to *G. mexicana, G. katzmanni* and *G.tebblei* in that all have 11 pairs of branchiae. However *Grubeulepis mexicana* differs from *G. kurnai* **sp. nov.** in that lateral processes of elytrae are biarticulate and tripartite in *G. mexicana*, and not articulate in *G. kurnai* **sp. nov.** in all specimens exceeding 12 mm in length. *Grubeulepis kurnai* **sp. nov.** lacks eyes, and additional differences separating the new species from *Grubeulepis katzmanni* and *G. tebblei* include form of posterior lamellae, form of notochaetae, presence of limbate neurochaetae and form of the anal cirrus (Table 2).

TABLE 2. Comparison of species of *Grubeulepis* .

	Size range (length x width, mm)	No. of segments	Eyes	1st elytrae papillae	2nd elytrae lateral processes	8 th elytrae lateral processes	12 th elytrae lateral processes	Lateral processes of elytrae	No. of branchial pairs
G. geayi (Fauvel, 1918)	21–40 x 5–8	36–39	absent	3–4	3	8	17–21	not articulate	13
G. kurnai **sp. nov.**	3–24 x 1–7	20–37	absent	0–10	4–23	7–11	17–27	not articulate	11
G. fimbriata (Treadwell, 1901)	14–24 x 4–6	37–38	2 pairs	2	5–17	?	15–17	not articulate	12
G. eucuadorensis Pettibone, 1969	35x8	40	3 pairs	absent	3–13	3–13	13	not articulate	12
G. westoni Pettibone, 1986	30–40 x 6–8	38–40	2–3 pairs	absent	3–20	3–20	13–20	not articulate	12–13
G. malayensis Nishi, 2001	28–30 x 8	38–40	1 pair	absent	4–16	4–16	16	not articulate	10
G. mexicana (Berkeley & Berkeley, 1939)	33+ x 9+	>37	2–5 pairs	7	3–25	3–25	25	biarticulate, some tripartite	11
G. katzmanni Pettibone, 1986	6–9 x 2	29–31	3 pairs	>17	1–6	1–6	6	not articulate (wide oval)	11
G. sulcatisetis (Jones, 1962)	9.5–10 x 2.4	32	3 pairs	7	4–10	4–10	10	biarticulate	10
G. augeneri Pettibone, 1969	11.5–17 x 3.5–4	33	2 pairs	11–12	3–8	3–8	8	biarticulate	12–13
G. tebblei Pettibone, 1969	13–17 x 4	33	2 pairs	8	4–12	4–12	12	biarticulate	11

continued.

	posterior lamellae start segment, form	Notochaete hooks anterior	Notochaete hooks posterior	Acicular neurochaetae present segment(s)	Neurochaete hooks posterior
G. geayi (Fauvel, 1918)	28, subreniform to subconical	spinous: fine tip or flatterned spatulate end	spinous	3 & 4	curved to fine point
G. kurnai **sp. nov.**	27, foliform	spinous with disciform tip or fine tip	spinous with fine tip	3	stout, curved down, corrugated distal edge
G. fimbriata (Treadwell, 1901)	28, subconical	smooth, spoon shape tip	smooth, spoon shape tip	absent	same as anterior
G. eucuadorensis Pettibone, 1969	28, subreniform to subconical	smooth	?	3–8	stout, curved down and spinous distal edge
G. westoni Pettibone, 1986	29, conical	spinous	strongly roughened and spinous	3	stout bend down, spinous or roughened on distal edge
G. malayensis Nishi, 2001	26, subcordiform to subconical	spinous, tapering fine tip or flattened tip	?	2–5	stout, curved down and spinous distal edge
G. mexicana (Berkeley & Berkeley, 1939)	27, oval to lanceolate	spinous	?	3	stout, curved down and corrugated
G. katzmanni Pettibone, 1986	27, conical	smooth, flattened or spatulate tips	smooth	3	stout, curved down and finely spinous distal edge
G. sulcatisetis (Jones, 1962)	27, pyriform to subconical	smooth, spatulate tip	?	absent	stout bend down, spoon shaped tip, spinous on distal edge
G. augeneri Pettibone, 1969	28–29, subcordiform to lanceolate	smooth	?	absent	stout, curved down and finely spinous distal edge
G. tebblei Pettibone, 1969	27, subcordiform	smooth	?	absent	stout, curved down, spatulate tip

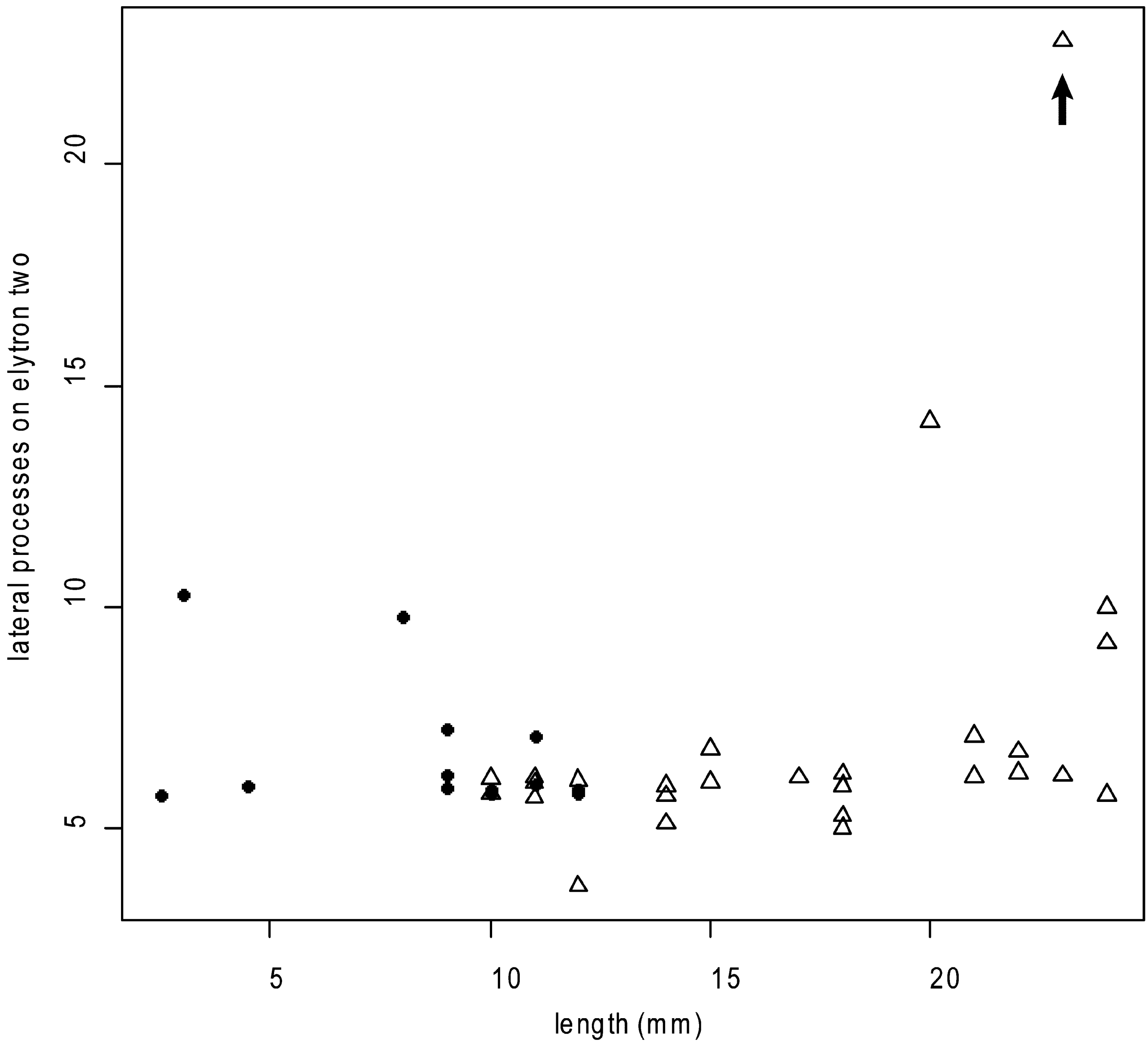

FIGURE 7. *Grubeulepis kurnai* **sp. nov.**, number of lateral processes on the second elytrae versus body length, (closed circles: simple lateral processes; open triangles, articulated lateral processes, holotype arrowed; points jittered to avoid overplotting).

Pareulepis malayana (Horst, 1913)

Eulepis malayana Horst, 1913: 154, figure 2.
Pareulepis malayana.—Pettibone, 1969: 12, figures 6–10; Pettibone, 1986: 24 (full synonymy).

Material examined. Australia: Western Australia (Indian Ocean coast): Jurian Bay region, L10 400, Stn SS07/2005 126, 29º51.617´S 114º22.317´E, 2 Jan 2005, 499 m, Smith-McIntyre Grab, 1 specimen, MV F162463; Two Rocks region, T4 400, Stn SS07/2005 136, 31º39.700´S 114º58.87´E, 4 Aug 2005, 403 m, Smith-McIntyre Grab, 2 specimens, MV F185646; off Barrow Island, Stn SS10/2005 170, 20º59.083´S 114º54.417´E, 13 Jan 2005, 101 m, beam trawl, 1 specimen, MV F161028; off Pelsart Island, near Geraldton, Stn SS07 2005 122, 29º0.167´S 113º46.433´E, 2 Jan 2005, 409 m, Sherman sled, 1 specimen, MV F161277; Indian Ocean, Bunbury region, L13 400, SS07/2005 152, 32º59.92´S 114º34.57´E, 6 Aug 2005, 417 m, Smith-McIntyre Grab, 3 specimens, MV F185643; Bunbury region, L13 400, Stn SS07/2005 153, 33º0.02´S 114º34.730´E, 7 Aug 2005, 399 m, Smith-McIntyre Grab, 5 specimens, MV F185650.

Description of variation. Size range of material examined (based on 3 entire specimens, the remainder are fragments apparently within this size range): 23–32 mm long, 3.5–5.4 mm wide including parapodia, 2,1–3.3 mm wide excluding parapodia, 34–36 segments. Elytrae 12 pairs on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21 and 24, becoming more elongate towards the posterior end. First pair of elytrae with 4–15 papillae on the anterior margin, elytrae 2 to 12 with distinct lateral notches on lateral margin. Elytron 2 with 1–2 notches, elytron 8 with 1–2 notches, and elytron 12 with 1–3 notches. Upper neurochaetae of posterior segments slightly darker and thicker than those in ventral positions.

Distribution and habitat. Previously recorded from the Malay Archipelago and from Vietnam, from 22–94 metres (Gallardo, 1968; Pettibone, 1986); that distribution is here extended to the Indian Ocean coast of Western Australia to 29ºS and a maximum depth of 499 metres.

Discussion. The material reported here from the Indian Ocean coast of Western Australia conforms closely to the description and figures of Pettibone (1969); only variations in descriptive characters are reported above. This material extends the range both latitudinaly (from 5ºS to 29ºS) and bathymetrically (maximum depth from 94 to 499 metres).

***Proeulepethus payungu* sp. nov.**

Figures 8–11

Material examined. Holotype: Australia: Western Australia (Indian Ocean coast): off Ningaloo South, Stn SS10/2005 146, 22º4.767´S 113º47.767´E, 10 Jan 2005, 206–201 m, beam trawl, MV F166646.

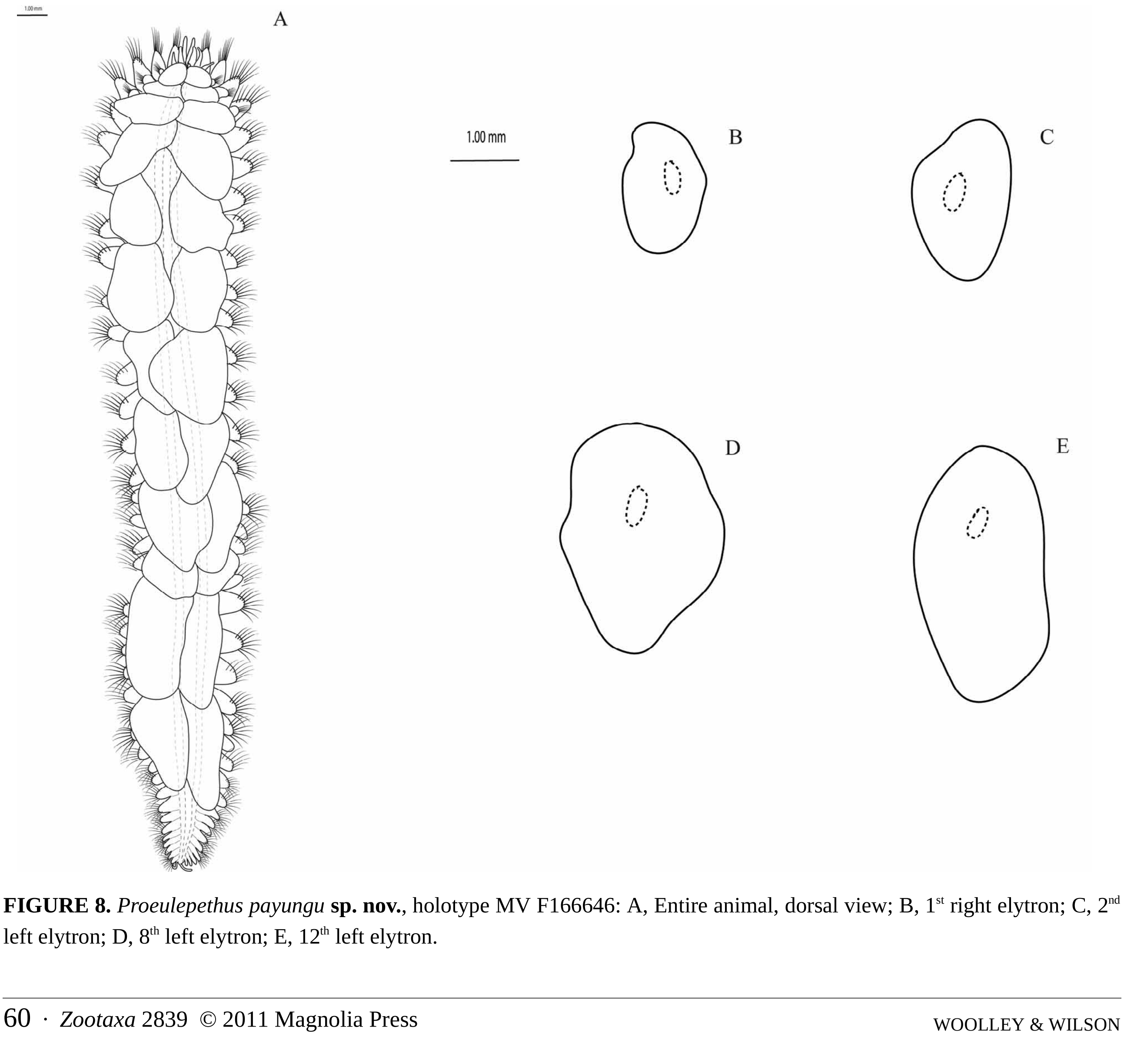

FIGURE 8. *Proeulepethus payungu* **sp. nov.**, holotype MV F166646: A, Entire animal, dorsal view; B, 1st right elytron; C, 2nd left elytron; D, 8th left elytron; E, 12th left elytron.

Paratypes (2 specimens): Australia: Western Australia (Indian Ocean coast): off Ningaloo South, Stn SS10/2005 146, 22º4.767´S 113º47.767´E, 10 Jan 2005, 206–201 m, beam trawl [data as for holotype], 2 paratypes, MV F166647, MV F166649.

Description. Three specimens, all entire: Holotype 25 mm long, 4.8 mm wide including parapodia, 2.5 mm wide excluding parapodia, 36 segments. Two paratypes: 17, 20 mm long; 3.8, 4 mm wide including parapodia; 2.0, 2.7 mm wide excluding parapodia; 37, 39 segments. Elytrae 12 pairs on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21 and 24, becoming more elongate towards the posterior end (Figure 8A). All elytrae entire, without papillae or marginal fimbriae or notches, first and second pair irregular-ovoid and wider than long (Figures 8B, 8C), elytrae becoming more elongate posteriorly, elytrae 6 and 12 longer than wide (Figures 8D, 8E). Branchiae 10 pairs on segments 8, 10, 12, 14, 16, 18, 20, 22, 23, 25, replaced by fleshy lamellae on the 26th and following segments. Branchiae attached to the dorsal region of the parapodia, with dorsal and ventral ciliated bands, and distally attached branchial cirrus (Figure 10D). The lamellae are flattened triangles with rounded corners, widest near the base and nearly symmetrical, reducing in size posteriorly (Figure 10E).

Prostomium (Figure 9A) is barely visible beneath the elytrophores of segment 2, eyes absent. Median antenna conical, attached to the prostomium posterior to the attachment of the lateral antennae. Lateral antennae conical and longer than the median antenna and taper to a point. Palps conical and tapering and slightly longer than the first parapodium (Figure 9A).

Dorsal cirri present on posterior side of upper margin of parapodia 3 (Figure 10B) and 6. Ventral cirri of segment 2 asymmetrical, widest basally and taper to a fine tip (Figure 10A), on segment 3 ventral cirrus shorter with blunt tip and widest at about midpoint (Figure 10B), on median segments ovoid, articulated, with minute tip section (Figure 10C, D). Parapodia biramous, each ramus supported by a single amber aciculum, neuroaciculum expanded distally to form malleiform distal plates (Figures 10A–E). Notochaetae of anterior segments include dorsal bundle of amber serrate hooks with tapering tip and a few hooks with disciform tip (Figure 11B) and ventral bundle of fine capillaries which include smooth and finely spinous forms (Figures 11D, E). Notochaetae on posterior segments include dorsal bundle of amber serrate hooks with tapering tip (Figure 11G), hooks with disciform tip absent, hooks heavier and more numerous than on anterior segments. Ventral bundle of capillary notochaetae of posterior segments with both smooth and serrate forms similar to those of anterior segments. Neurochaetae similar throughout anterior and posterior segments and include an even array of bilimbate chaetae abruptly tapering to fine tips (Figure 11F) and non-limbate chaetae (‘acicular chaetae’ of Pettibone, 1969) with blunt tips (Figure 11A) and a single pectinate neurochaeta in dorsal-most position (Figure 11C).

Anal cirri broken on the holotype and on paratype MV F166649, paratype MV F166647 with left cirrus short and tapering, right cirrus about 3 times as long but apparently broken, available basal sections of all cirri smooth (Figure 9B).

Etymology. The species name *payungu* pays respect to the language group of the Aboriginal people whose traditional lands in northwestern Western Australia include that part of North-west Cape closest to where *Proeulepethus payungu* **sp. nov.** was collected.

Distribution and habitat. *Proeulepethus payungu* **sp. nov.** is known only from the Indian Ocean on the continental margin of Western Australia at about 22ºS at a depth of 206–211 metres.

Discussion. The genus *Proeulepethus* was erected by Pettibone (1986) to contain two species of Eulepethidae with elytral margins entire, lacking notches, papillae or fimbriae. *Proeulepethus challengeriae* (McIntosh, 1885) is incompletely known, based on a single damaged anterior fragment and is here treated as Eulepethidae *incertae sedis*. *Proeulepethus clarki* Pettibone, 1986 is the remaining species and can be distinguished from *Proeulepethus payungu* **sp. nov.** as follows: In *P.clarki* the median antenna is about as long as the lateral antennae (although inserted more posteriorly) and the ventral palps are about twice the length of the first parapodium (Pettibone, 1986 Figure 16A), and notochaetal hooks include blunt-tipped forms (Pettibone, 1986 Figure 18C), whereas in *Proeulepethus payungu* **sp. nov.** the median antenna is slightly longer than the lateral antennae and the ventral palps are only slightly longer than the first parapodium, and blunt-tipped notochaetal hooks are absent.

Proeulepethus payungu **sp. nov.** is known only from the Indian Ocean on the continental margin of Western Australia while the other members of *Proeulepethus* Pettibone, 1986, *P.challengeriae* and *P.clarki*, are only known from the Caribbean region. All known records of *Proeulepethus* species are from the depths of ~200–800 metres (other eulepethid genera are all known from much shallower depths) so the apparently disjunct distribution of the genus may simply reflect a relative lack of suitable samples at depths exceeding 200 m.

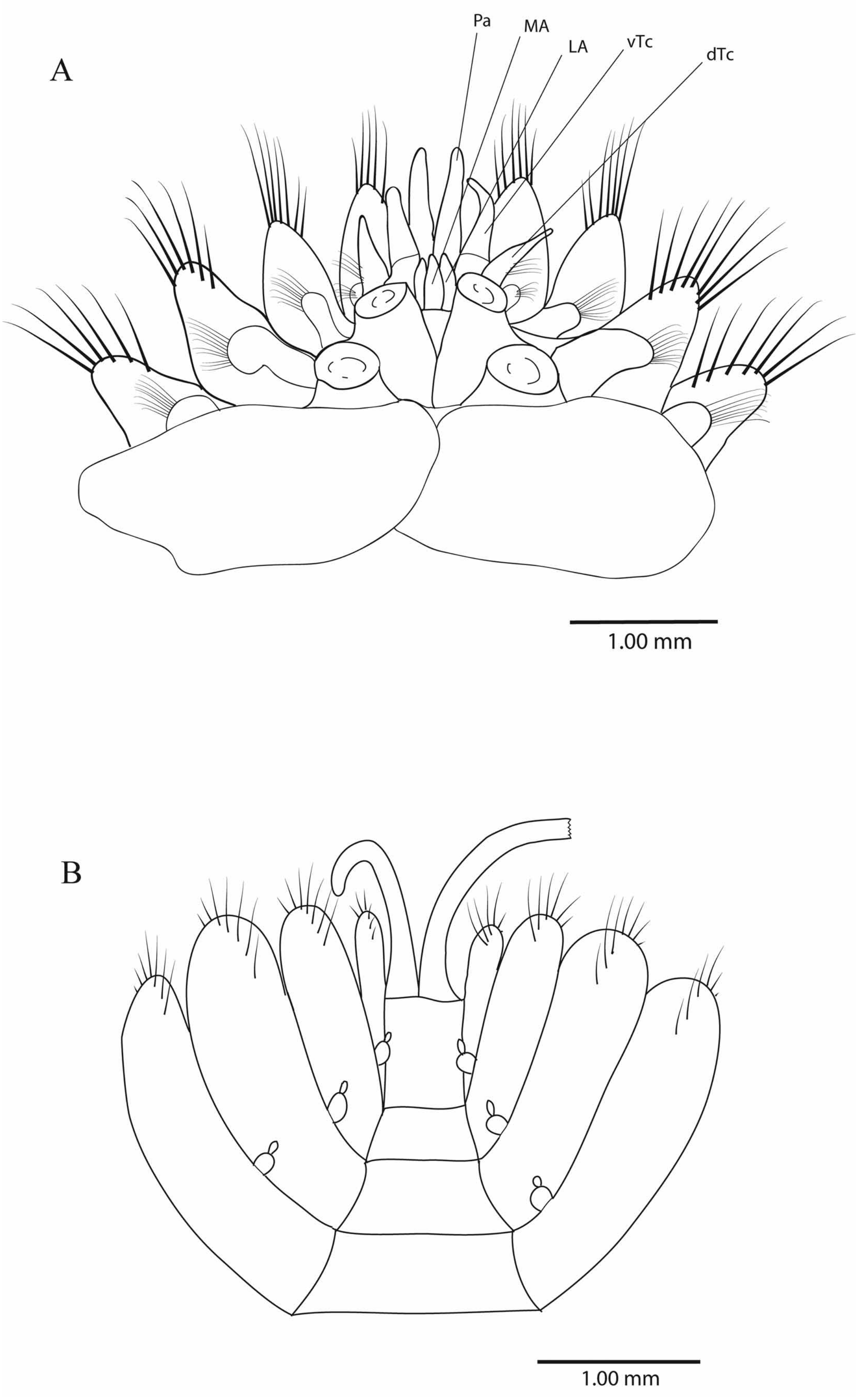

FIGURE 9. *Proeulepethus payungu* **sp. nov.**, holotype MV F166646: A, Head region and prostomium, first and second elytrae removed, dorsal view; Figure labels: Pa—palps; vTc—ventral tentactular cirrus; dTC; dorsal tentactular cirrus; MA—median antenna; LA—lateral antenna. B, Pygidium and final posterior segments, left and right cirrus present, ventral view.

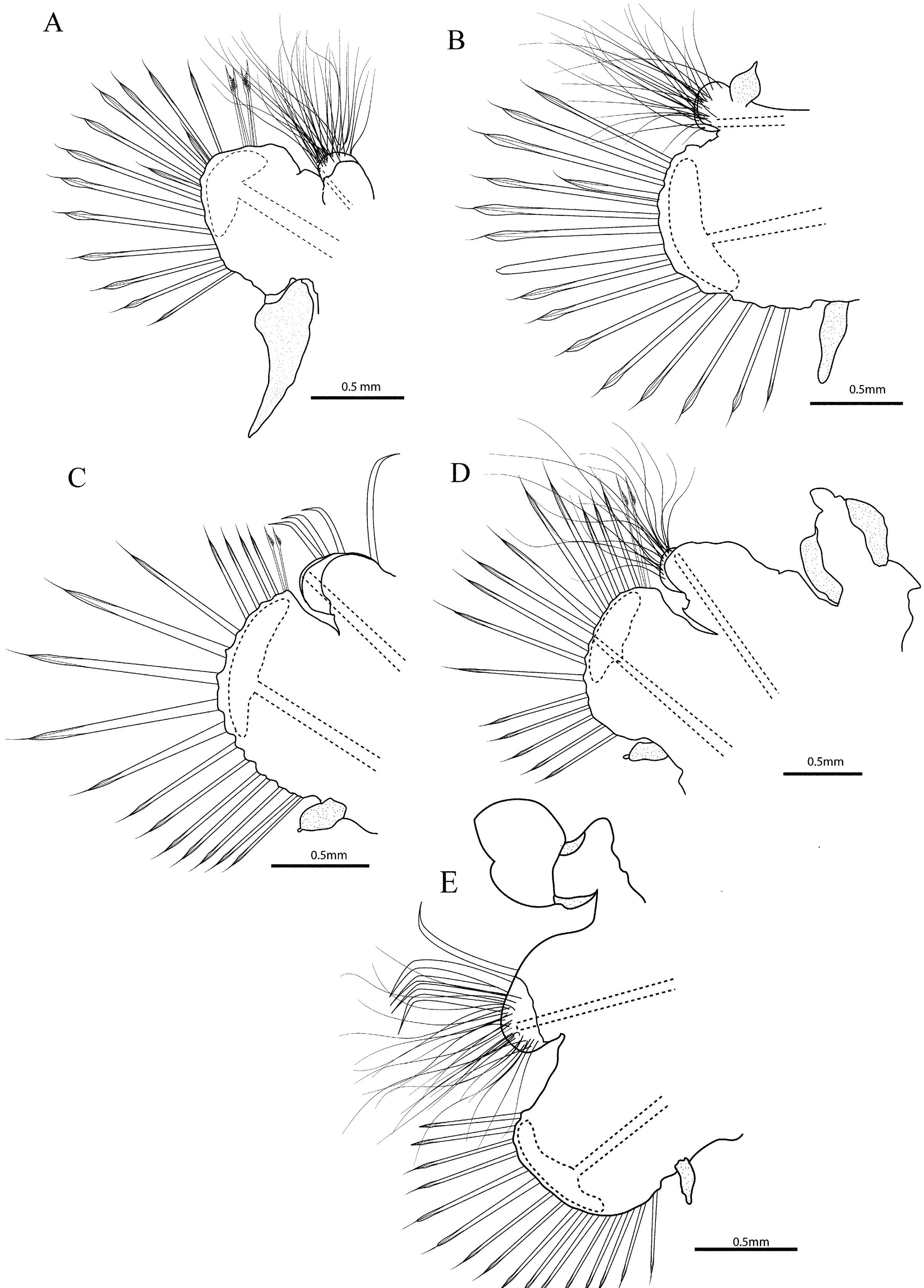

FIGURE 10. *Proeulepethus payungu* **sp. nov.**, holotype MV F166646: A, parapodium segment 2, anterior view; B, parapodium segment 3, posterior view; C, parapodium segment 11, anterior view; D, branchial parapodium segment 14, anterior view; E, lamelligerous parapodium segment 26, anterior view.

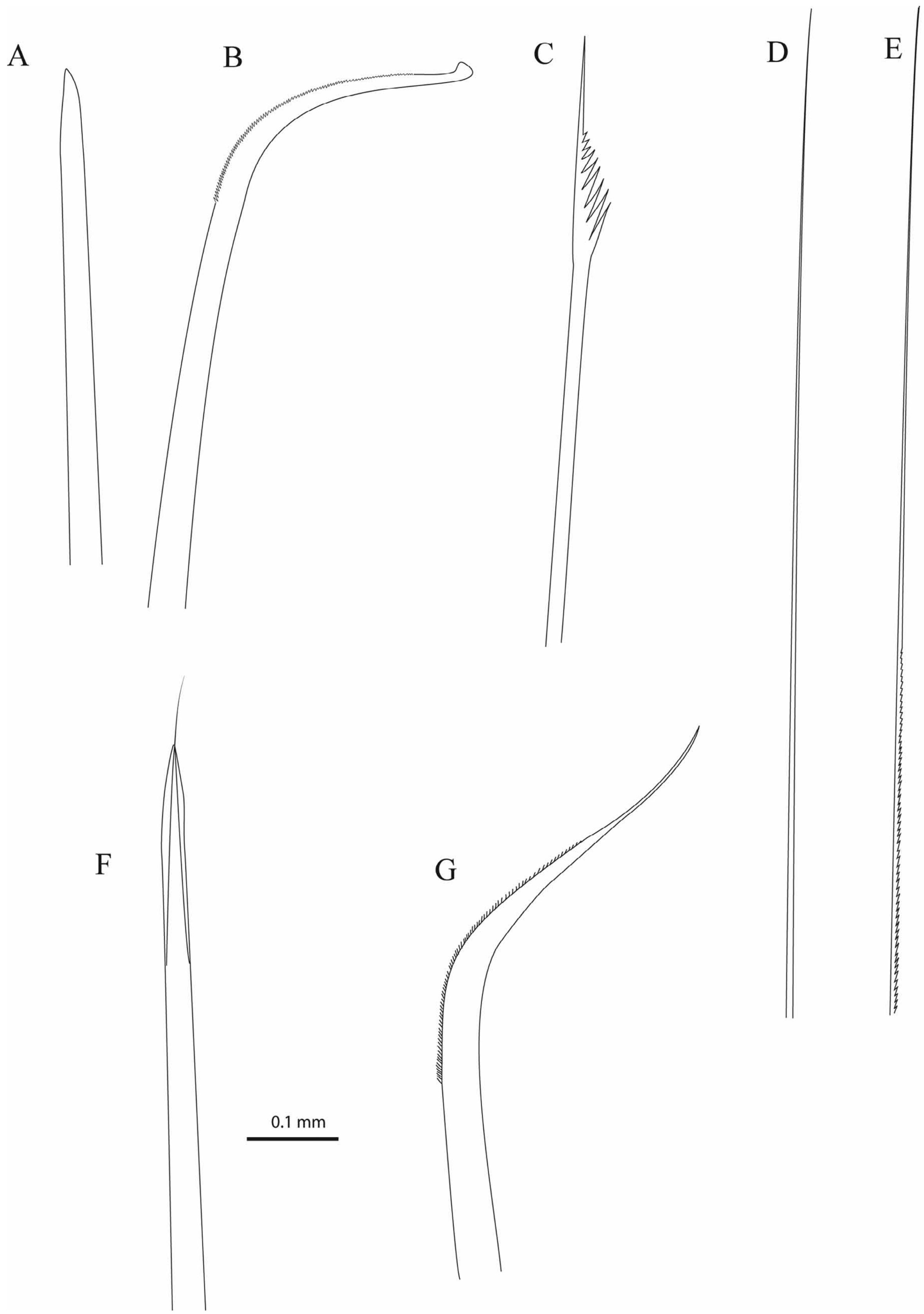

FIGURE 11. *Proeulepethus payungu* **sp. nov.**, holotype MV F166646: A, neurochaeta from mid-fascicle segment 3; B, hooked upper notochaeta segment 11; C, pectinate neurochaeta segment 11; D, capillary notochaeta segment 14; E, capillary notochaeta segment 14; F, bilimbate neurochaeta segment 14; G, dorsal notochaeta segment 26.

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