



## Polycirridae (Annelida, Terebelliformia) from Lizard Island, Great Barrier Reef, Australia

JOÃO MIGUEL de MATOS NOGUEIRA<sup>1,\*</sup>, PAT HUTCHINGS<sup>2</sup> & ORLEMIR CARRERETTE<sup>1</sup>

<sup>1</sup>Laboratório de Poliquetologia (LaPol), Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, Rua do Matão, travessa 14, n. 101, 05508-090, São Paulo, SP, Brazil.

<sup>2</sup>Australian Museum Research Institute, The Australian Museum, 6 College Street, 2010, New South Wales, Australia

\*Corresponding author: [nogueira@ib.usp.br](mailto:nogueira@ib.usp.br)

### Abstract

In a survey of the polychaetes of the Lizard Island Group, sixteen species of polycirrids were found, from material collected during the two weeks Lizard Island Taxonomic Workshop, together with material collected by previous projects of the Australian Museum based at Lizard Island, including CReefs (<http://www.aims.gov.au/creefs/field-program.html>). Those species are distributed as follows: two species of *Amaeana* Hartman, 1959, one new species of *Hauchiella* Levinson, 1893, 2 species of *Lysilla* Malmgren, 1866, one of which is new to science, and 11 species of *Polycirrus* Grube, 1850, eight of which are new to science. Keys for identification of these genera and species are provided, together with full descriptions for all species, except for those with recent descriptions, and comparisons with the morphologically most similar congeners, in the case of the new species.

**Key words:** Polychaeta, taxonomy, morphology, new species, Queensland

### Introduction

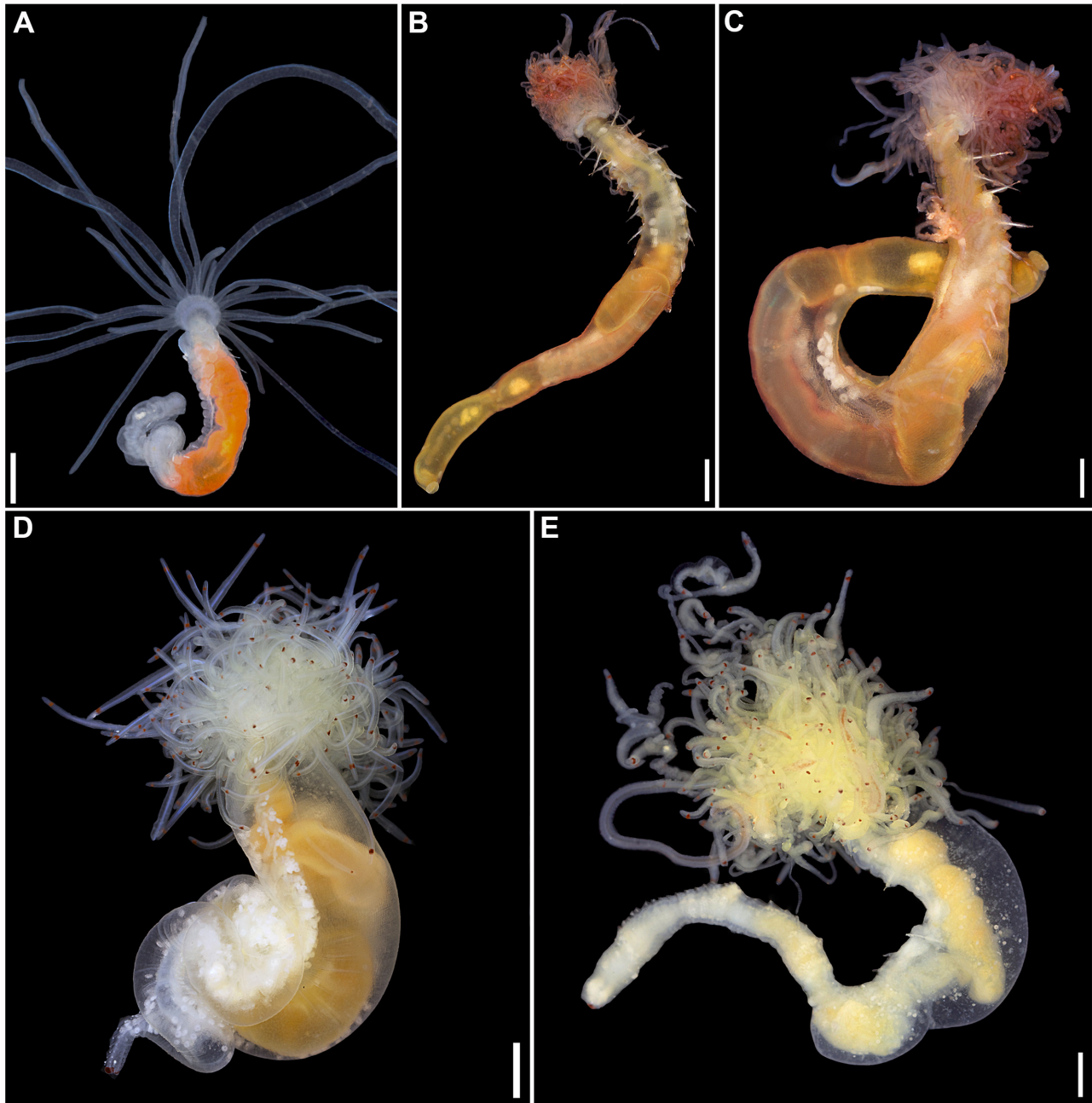
In August 2013 the Australian Museum hosted the 11<sup>th</sup> International Polychaete Conference and immediately after the meeting a group of researchers attended a workshop held at Lizard Island Research Station (a facility of the Australian Museum), funded by the Lizard Island Reef Research Foundation. The purpose of the workshop was to document some of the polychaete fauna of Lizard Island, on the northern Great Barrier Reef. This is one of a series of papers describing the polychaete fauna, which are produced in this special issue of *Zootaxa*.

Prior to this study, Hutchings and Glasby (1986) had described three species of *Polycirrus* from Lizard Island and a species of *Amaeana* from the region. In this paper we describe 10 new species belonging to three genera within the newly erected family the Polycirridae (Nogueira *et al.* 2013; Fitzhugh *et al.* 2015). Another two species, belonging to a fourth genus, were described elsewhere (Nogueira *et al.* 2015). While polychaetes are abundant around Lizard Island and on the Great Barrier Reef, they have been poorly documented and no comprehensive surveys have been carried out (Hutchings 2008). Polychaetes occur within coral substrates but are also abundant in inter-reefal sediments.

### Material and methods

Part of the material included in the present study was collected along the Lizard Island Taxonomic Workshop, which was held at the Lizard Island Research Station, from 12–23 August, 2013. Collections were made daily by snorkeling and SCUBA diving, from the intertidal zone to ~30 m deep, covering most types of habitats found in the Lizard Island Group, including coral reefs, mangroves and sandy beaches, with sandy, muddy and coral rubble substrates (see Ribas & Hutchings 2015, this volume for location of sampling sites and their co-ordinates). Number of specimens per registration number are 1 unless stated otherwise.

Coral rubble and coral pieces were broken up by hand or using a hammer and polychaetes were sorted alive under a stereomicroscope, relaxed in magnesium chloride solution, and preserved in 4% formalin. Later, material was rinsed with clean seawater and transferred to 70% ethanol solution. Selected specimens of three species were photographed alive and those photos are included in Figure 1. All material has been deposited at the Australian Museum (AM). Material collected during the workshop was under Permit number G12/35718.1 issued by the Great Barrier Reef Marine Park Authority.



**FIGURE 1.** Live specimens. A. *Polycirrus rubrointestinalis* n. sp.; B–C. *Polycirrus cruciformis* n. sp.; D–E. *Polycirrus oculus* n. sp. D, AM W.44612, other specimens not preserved. Scale bars: A, D, E = 0.3 mm, B = 0.2 mm, C = 0.15 mm. All photos by Alexander Semenov.

In addition to the material collected during the Lizard Island Taxonomic Workshop, we have also included material collected during other projects carried out by the Australian Museum staff at Lizard Island or on nearby reefs. In particular, material collected during CReefs sampling program (<http://www.aims.gov.au/creefs/field-program.html>) was available for study, as Lizard Island was one of three CReefs sampling sites and we had access to the terebellid material housed either in the AM or in Northern Territory Museum (NTM).

Specimens were studied using stereomicroscopes and representatives of all species were photographed. Notopodia and neuropodia from different regions of the body were removed, mounted on slides with Aquatex® and examined and photographed using compound microscopes. For SEM examination, 1–2 specimens of some species were dehydrated in a series of ethanol solutions in progressively stronger concentration, then critical-point dried, sputter-coated with gold, and examined at the SEM Laboratory of the Australian Museum. Photos under stereo- and compound microscopes were also taken at the SEM Laboratory, AM, with a Spot Flex camera; under stereomicroscope, the specimens were kept in position with a glass coverslip and photographed from a Petri dish with black bottom. Images were produced with Helicon Focus version 5.3, from multiple images, each focused on different planes. All photos were edited with Adobe Photoshop CS6 software. Photos of live animals were taken by Alexander Semenov. In Remarks we have abbreviated the Great Barrier Reef to the GBR.

## Results

### Taxonomic account

#### Family Polycirridae Malmgren, 1866

**Diagnosis.** Transverse prostomium attached to dorsal surface of upper lip; basal part usually as thick horseshoe-shaped crest without eyespots, frequently covering segment 1 laterally and extending ventrally, terminating lateral to mouth; distal part as flaring lobes restricted to base of upper lip, or extending along the lip and terminating near anterior margin, mid-dorsal process sometimes present. Buccal tentacles of at least two types, short ones uniformly cylindrical or expanded at tips, long ones distally expanded, spatulated; modified stouter and longer tentacles specialised at tips present in members of some genera. Peristomium forming lips; upper lip large, frequently circular and convoluted, folded into three lobes, swollen lower lip, varying from button-like, restricted to oral area, to expanded as cushion-like structure, sometimes across entire ventrum. Segments throughout biannulated or with more annulations; segment 1 reduced, usually visible dorsal and ventrally, laterally covered by expanded prostomium, but visibility of segment 1 largely determined by state of preservation of specimen. Segment 2 distinctly narrower than following segments, constricting body posteriorly to “head”; segment 2 usually with rectangular or pentagonal mid-ventral shield at beginning of mid-ventral groove, sometimes extending anteriorly through segment 1 until near posterior margin of lower lip. Body wall papillate throughout, papillae frequently larger and more abundant on ventro-lateral pads of anterior segments; pads present usually from segments 2–3 to last with notopodia, if these are present. Notopodia beginning from segment 3, extending for few segments in most taxa; bilobed, elongate notopodia, lobes about same size or posterior lobe longer; notopodia absent in two genera. Notochaetae winged and/or pinnate; winged notochaetae with relatively wide and conspicuous wings (“broadly-winged”), or wings distinctly narrow (“narrowly-winged”), chaetae acicular, wings inconspicuous under light microscopy and visible under SEM as fine hairs; pinnate chaetae have successive rows of spines in circular to elliptical arrangement. Neuropodia, if present, beginning posteriorly to notopodia, sometimes only after notopodia terminate; neurochaetae as avicular uncini or tapered acicular spines; neuropodia absent in three genera. Nephridial and genital papillae present, usually at anterior bases of all notopodia. Pygidium smooth or with rounded ventral papilla.

**Remarks.** Polycirrids were initially described as a subfamily of Terebellidae Malmgren, 1866, a classification followed by subsequent authors (Day 1967; Fauchald 1977), but recently Nogueira *et al.* (2013) raised all subfamilies of Terebellidae *lato sensu* to familial level. The monophyly of the terebellid group was subsequently confirmed by (Fitzhugh *et al.* 2015), corroborating previous studies by Colgan *et al.* (2001), Glasby *et al.* (2004), and Garraffoni & Lana (2008).

Secondary reductions/losses of noto- and neuropodia occurred independently along several lineages of Polycirridae (Fitzhugh *et al.* 2015), and currently the family comprises six genera, defined by the presence and morphology of noto- and neuropodia, and the type of neurochaetae present. Among members of *Biremis blandi* Polloni, Rowe & Teal 1973, the only known species in this genus, notopodia are absent and neuropodia are bilobed, bearing avicular uncini. In *Polycirrus* Grube, 1850, both noto- and neuropodia are present, the latter bearing avicular uncini. Members of *Lysilla* Malmgren, 1866 and another monotypic genus, *Enoplobranchus sanguineus* (Verrill, 1873), only have notopodia, neuropodia are absent, the latter genus with branched notopodia; *Hauchiella*

Levinsen, 1893 lacks both noto- and neuropodia, being completely achaetous, and *Amaeana* Malmgren, 1866 is defined by the presence of both parapodial lobes, but not together on the same segment, and the neuropodia bearing acicular spines.

Although Fitzhugh *et al.* (2015) found that only *Hauchiella*, with two species at that time (a third species is described herein), was monophyletic, these genera are kept for practical reasons, at least until more comprehensive analyses using both morphological and molecular characters are performed.

### Key for Identification of Genera of Polycirridae found at Lizard Island

- 1. Parapodia present, at least on some segments . . . . . 2
- Parapodia absent throughout . . . . . *Hauchiella*
- 2. (1) Noto- and neuropodia present, occurring together on some segments or not . . . . . 3
- Only notopodia present, neuropodia absent throughout . . . . . *Lysilla*
- 3. (2) Neuropodia bearing avicular uncini . . . . . *Polycirrus*
- Neuropodia bearing acicular spines . . . . . *Amaeana*

### Genus *Hauchiella* Levinsen, 1893

*Hauchiella*.—Hutchings & Glasby 1986: 323.

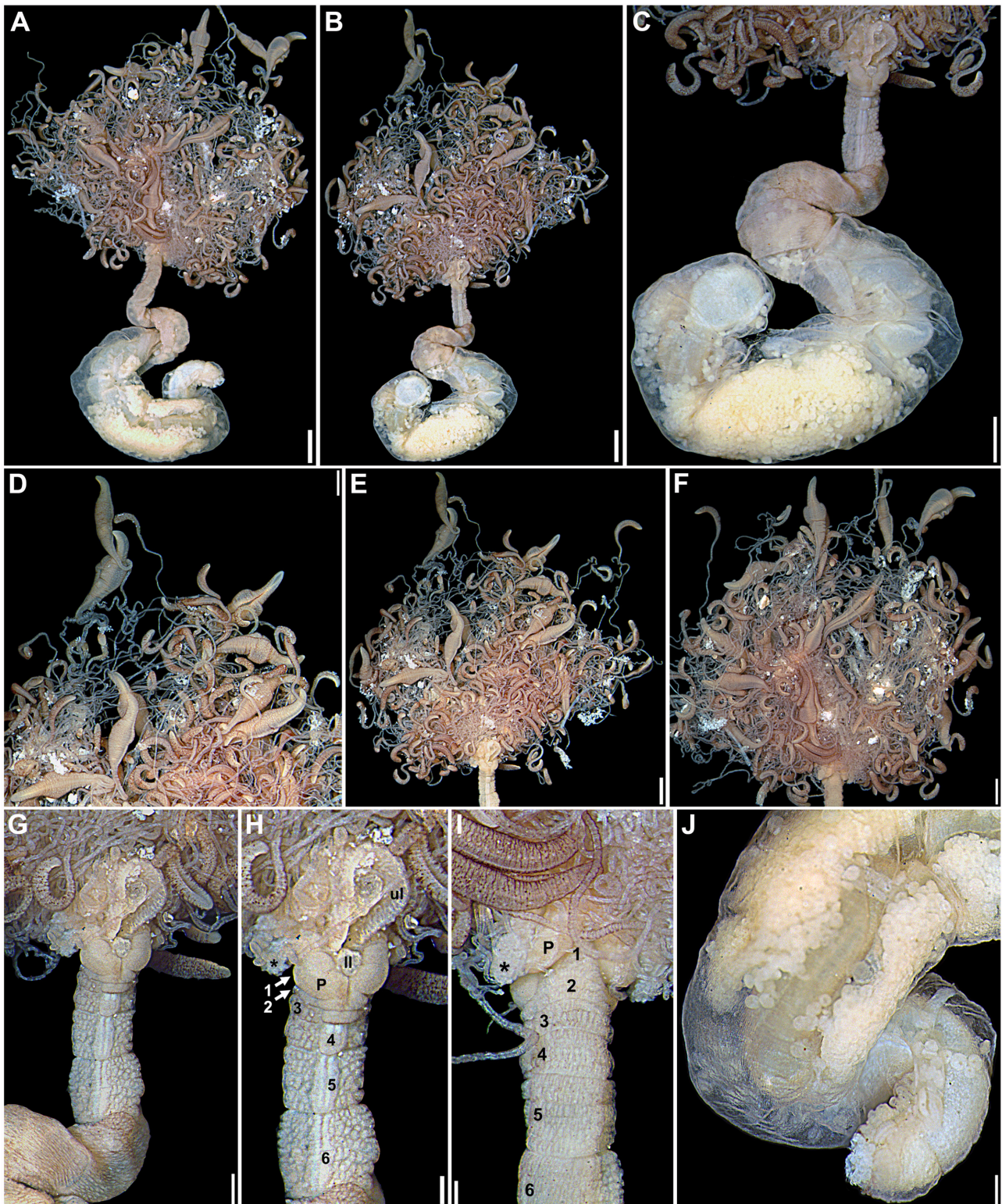
**Type-species.** *Polycirrus tribullata* McIntosh, 1869, by original designation.

**Diagnosis.** Transverse prostomium attached to dorsal surface of upper lip; basal part usually as thick horseshoe-shaped crest, frequently covering segment 1 laterally and terminating lateral to mouth; distal part as flaring lobe restricted to base of upper lip. Buccal tentacles of at least two types, short ones uniformly cylindrical, long ones spatulated; stouter and longer tentacles specialised at tips may also be present. Peristomium forming lips; upper lip relatively short, hood-like, circular to elliptical; swollen lower lip, button-like, restricted to oral area. Segments throughout biannulated or with more annulations, segment 1 reduced, usually visible dorsal and ventrally, laterally covered by expanded prostomium. Segment 2 distinctly short, narrower than following segments, usually with rectangular or pentagonal mid-ventral shield at beginning of mid-ventral groove, sometimes extending anteriorly through segment 1 until near posterior margin of lower lip. Body wall with transverse rows of papillae throughout or only anteriorly, papillae distinctly larger and more abundant on ventro-lateral pads of anterior segments, these usually present from segment 2. Parapodia absent throughout. Nephridia usually visible by transparency through body wall, genital papillae or pores only usually present. Pygidium smooth to crenulated, or with rounded ventral papilla.

**Remarks.** *Hauchiella* is a very unusual genus of polychaetes. The genus lacks both noto- and neuropodia, and, consequently, completely lacks chaetae; therefore members of *Hauchiella* challenge the definition of polychaetes as a whole. However, the affiliation of the species of *Hauchiella* to Terebelliformia and, consequently, to polychaetes, is undeniable, requiring the name Polychaeta to include forms with no chaetae at all. On the other hand, the absence of both noto- and neuropodia, characters used to distinguish between species of the other genera of polycirrids, results in very few characters available to distinguish between species of *Hauchiella*. Two species of *Hauchiella* were known prior to this study, we describe a third species herein.

### Key for Identification of the World Species of *Hauchiella*

- 1. Nephridia present, visible through transparent body wall, with or without associated papillae . . . . . 2
- Nephridia inconspicuous or absent, not visible through the body wall . . . . . *Hauchiella tentaculata* n. sp.
- 2. (1) Genital papillae present on segments 6–8. . . . . *Hauchiella tribullata*
- Papillae absent, nephridial sacs visible through the body wall, with minute pores . . . . . *Hauchiella renilla*



**FIGURE 2.** *Hauchiella tentaculata* n. sp., holotype NTM W.023154. A–B. Entire worm, dorsal and ventral views (anteriorly), respectively; C. Whole body, ventral view (anteriorly); D. Tips of buccal tentacles; E–F. Anterior end with buccal tentacles, ventral and dorsal views, respectively; G–H. Close ups of the anterior end in progressively higher magnifications, ventral view; I. Close up of the anterior end, dorsal view; J. Posterior end. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium; ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 0.6 mm, C, F = 0.4 mm, D = 0.3 mm, E = 0.5 mm, G, J = 0.15 mm, H–I = 0.1 mm.

***Hauchiella tentaculata* n. sp.**

(Fig. 2)

*Hauchiella renilla* Hutchings & Glasby 1986: 323–325, figs 2a, b; 12B (in part).

**Type material.** Holotype: NTM W.023154, Mermaid Cove, 14°23'15.101"S, 145°16'19.776"E, 2–3 m, coll. C. Glasby & C. Watson, 2010, fore reef (mid-shelf), complete specimen, 7 mm long, ~1 mm maximum width, at abdomen. Paratypes: AM W.199608 and AM W.199609, both from the Lizard Island lagoon, 14°40'S, 145°27'E, originally paratypes of *H. renilla* Hutchings & Glasby, 1986.

**Other material examined.** AM W.199603, AM W.199592, AM W.199602, AM W.199600, all from Lizard Island lagoon, 14°40'S, 145°27'E.

**Comparative material examined.** Holotype of *Hauchiella tribullata*, BMNH 1921.5.1.4120. Holotype of *Hauchiella renilla*, AM W.199607; paratypes of *Hauchiella renilla*, AM W.199610, AM W.199611, AM W.199614.

**Description.** Prostomium at base of upper lip, both basal and distal parts developed, basal part as thickened horseshoe-shaped crest, distal part as flaring spongy lobes; prostomium covering segment 1 laterally and continuing ventrally, terminating posteriorly to lower lip, below mouth (Fig. 2A–C, E–I). Numerous buccal tentacles, of three types; short ones remarkably thin, uniformly cylindrical; intermediate tentacles distally broader, spatulated; long tentacles with thin, uniformly cylindrical peduncle and progressively widening distally towards cylindrical swelling, followed by relatively long, tapered tip, with deep groove (Fig. 2A–G). Peristomium restricted to lips, upper lip relatively short, longer than wide; lower lip short, rounded, button-like (Fig. 2B–C, E, G–H). Body with short, almost uniformly cylindrical thoracic region of 6 progressively longer segments, followed by increasingly more swollen abdomen (Fig. 2A–J). Thoracic segments annulated, with several rows of papillae, especially ventrally; papillae extending onto anterior abdominal segments, progressively less numerous, followed by distinctly swollen posterior region, with inconspicuous segmentation and fragile body wall (Fig. 2A–C, G–J). Segment 1 short, conspicuous all around; segment 2 longer dorsally, as short annulation ventrally, with relatively large mid-ventral shield at beginning of mid-ventral groove (Fig. 2A–C, E–I). Ventrum highly glandular, paired ventro-lateral pads extending to segment 6, covered with relatively large papillae arranged in several transverse rows (Fig. 2B–C, E, G–H). Holotype with abdomen full of gametes (oocytes), present from segment 7, but distinctly more abundant on posterior body; nephridial and genital papillae inconspicuous or not seen, and nephridia also not visible through body wall (Fig. 2A–C, E–J). Pygidium surrounded by crown of papillae, all about same size (Fig. 2A, J).

**Remarks.** As said above, the absence of noto- and neuropodia, and the consequent inapplicability of all chaetal-related characters, renders it difficult to distinguish between species of *Hauchiella*, but to date, all have been described from very different habitats and localities.

*Hauchiella tribullata* McIntosh, 1869 is a large species, the holotype incomplete and in two pieces, ~20 mm long, 2 mm wide at widest point of body (anteriorly), with robust anterior segments until around segments 15–20, then tapering to uniformly cylindrical, slightly narrower posterior body. The holotype has very few buccal tentacles remaining, all apparently uniformly cylindrical, a large, convoluted upper lip of width greater than length, and large, rounded nephridial papillae on segments 6–8. This species was described from St Magnus Bay, Shetlands, Scotland, dredged from 165 m on muddy substrates.

The second species in this genus, *H. renilla* Hutchings & Glasby, 1986 is smaller, the holotype 12 mm long, ~2.5 mm wide, with narrower segments until segment 10, then swollen, with fragile body wall and inconspicuous segmentation. The buccal tentacles are of at least two types, the long ones distally spatulated, with relatively long tips, and the upper lip is distinctly longer than wide. Nephridial and genital papillae are absent, but 10 pairs of elongate nephridial sacs are visible through the transparent body wall, with minute pores visible in some mature material having body wall distended with oocytes. This species was described from the Australian Capital Territory, Wreck Bay (type locality), in depths of 5–10 m, and with additional material collected from One Tree Island on the southern GBR, as well as Lizard Island lagoon, but this latter material was re-examined and found to have been misidentified. These specimens are now transferred to *H. tentaculata* n. sp. as they possess the long specialised tentacles and a similar upper lip and thus clearly differ from the type material of *H. renilla*.

*Hauchiella tentaculata* n. sp. is also a smaller and more fragile species than *H. tribullata*, the holotype complete, 7 mm long, ~1 mm wide at widest point (mid-abdomen), with narrow, clearly marked and uniformly cylindrical anterior segments, until segment 6, then body distinctly swollen, with fragile body wall, inconspicuous

segmentation and coelom full of oocytes, visible through the transparent body wall. The long buccal tentacles of *H. tentaculata* n. sp. are highly specialised at tips, resembling those of some species of *Lysilla* and *Amaeana*, and a few of *Polycirrus*, with narrow, uniformly cylindrical peduncle, distally widening towards deeply grooved cylindrical swelling, with pointed tip. The upper lip is longer than wide, but smaller than in members of *H. renilla*, while the anterior segments are highly papillated ventrally, more than in specimens of both the other species of this genus. Nephridia have not been observed in *H. tentaculata* n. sp. and there are no visible nephridial or genital papillae, even though the body wall is transparent and oocytes and the gut are visible.

**Etymology.** The name “*tentaculata*” is attributed for this species in reference to the modified long tentacles, which are not known to occur in any other species of this genus.

**Habitat.** Shallow waters 2–3 m on ‘fore reef’ (mid-shelf) in amongst coral rubble.

**Type locality.** Mermaid Cove, 14°23'15.101”S, 145°16'19.776”E, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard region.

## Genus *Lysilla* Malmgren, 1866

*Lysilla*.—Hutchings & Glasby 1986: 325.

**Type-species.** *Lysilla loveni* Malmgren, 1866, by original designation.

**Diagnosis.** Transverse prostomium attached to dorsal surface of upper lip; basal part as thick horseshoe-shaped crest; distal part restricted to base of upper lip, with flaring lobes and sometimes also a mid-dorsal process. Buccal tentacles of three types, short tentacles thin, uniformly cylindrical, intermediate ones spatulated, long buccal tentacles spatulated or more specialised, with uniformly cylindrical peduncle distally widening towards cylindrical swelling and pointed to blunt tip. Peristomium forming lips; upper lip large, frequently circular and convoluted, folded into three lobes; short and swollen lower lip, only mid-ventral and usually button-like. Segments biannulated throughout, segment 1 reduced, usually visible dorsally and ventrally, laterally covered by expanded prostomium. Segment 2 distinctly short, narrower than following segments, with rectangular or pentagonal mid-ventral shield at beginning of mid-ventral groove, sometimes extending anteriorly through segment 1 until near posterior margin of lower lip. Body wall papillate throughout, papillae distinctly larger and more abundant on ventro-lateral pads of anterior segments; pads usually from segment 2 to last with notopodia. Notopodia beginning from segment 3, extending for few segments; bilobed, elongate notopodia, lobes about same size; notochaetae throughout usually with distinctly narrow wings, acicular, wings inconspicuous under light microscopy, only visible under SEM; pinnate chaetae sometimes present. Neuropodia absent. Nephridial and genital papillae usually present, at anterior bases of all notopodia. Pygidium smooth or with rounded ventral papilla.

**Remarks.** The genera *Lysilla* and *Amaeana* are very similar, the only difference being the presence of neuropodia bearing acicular spines in the latter genus, while neuropodia and neurochaetae are absent in *Lysilla*. As a consequence, incomplete specimens are unidentifiable unless neuropodia are present, and possibly some species of *Lysilla* described from incomplete material may in fact belong to *Amaeana*. This has already happened with *A. apheles* (Hutchings, 1974), originally described as a species of *Lysilla* and transferred to *Amaeana* when complete specimens were found (Hutchings & Glasby 1986; Nogueira *et al.* 2015). Prior to this study four species were known from Australia.

## Key for the Identification of Species of *Lysilla* found at Lizard Island

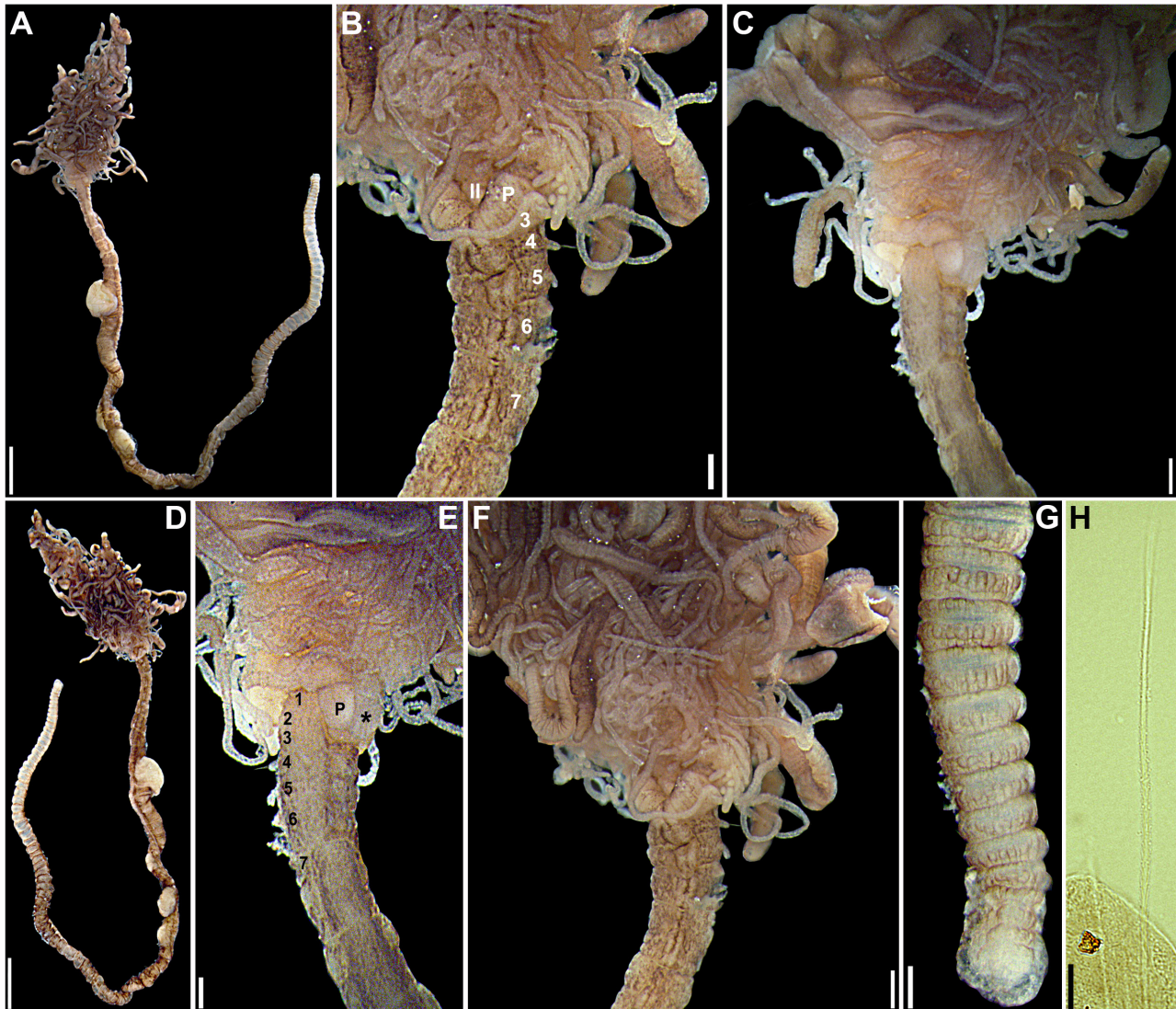
1. Body elongate and slender, of uniform width throughout; 5 pairs of notopodia, on segments 3–7 . . . . . *Lysilla longilinea* n. sp.
- Body distinctly swollen anteriorly and posteriorly, mid-body narrower and uniformly cylindrical; 9–13 pairs of notopodia, on segments 3 to 11–15 . . . . . *Lysilla pacifica*

*Lysilla longilinea* n. sp.

(Fig. 3)

**Type material.** Holotype: AM W.47407, CReefs, High Rock, Lizard Island, 20 m, coll. Lynda Avery by SCUBA, Sep 2010, complete, ~15 mm long, ~0.2 mm wide (uniformly), with 86 segments.

**Comparative material examined.** Holotype of *Lysilla bilobata*, AM W.7586. Holotype of *Lysilla jenacubinnae*, AM W.199643. Holotype of *Lysilla laciniata*, AM W.199626. Non-types of *Lysilla loveni*, AM W.9143, USNM 49637. Non-types of *Lysilla pacifica*, AM W.5219, AM W.12290 (6), AM W.199622 (11), AM W.19334 (3).



**FIGURE 3.** *Lysilla longilinea* n. sp., holotype NTM W.47407. A, D. Entire worm, dorsal and ventral views (anteriorly), respectively; B–C. Anterior end, left ventro-lateral and right dorso-lateral views, respectively; E–F. Close ups of the anterior end, right dorso-lateral and left ventro-lateral views, respectively; G. Posterior end; H. Notochaetae, segment 5. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium, \* = distal part of prostomium. Scale bars: A, D = 1 mm, B–C = 0.15 mm, E–G = 0.1 mm, H = 10  $\mu$ m.

**Description.** Preserved body brown to purple, including tentacles. Elongate and slender body, of almost uniform width throughout, delicate (Fig. 3A–G). Prostomium at base of upper lip, basal part as thick horseshoe-shaped crest, distal part as flaring lobes; prostomium extending ventrally and posteriorly, both parts meeting mid-ventrally, posteriorly to lower lip (Fig. 3B–C, E–F). Three types of buccal tentacles present, short tentacles thin, uniformly cylindrical, intermediate ones spatulated, long tentacles progressively widening towards cylindrical swelling, with blunt tip; tentacles annulated throughout, including tips of long tentacles, with transverse rows of papillae (Fig. 3A–F). Peristomium restricted to lips; upper lip short, not clearly visible, covered by mass of buccal



tentacles; lower lip short, swollen, hemispherical to cylindrical, surrounded by prostomial ventral extensions (Fig. 3B–C, E–F). Body completely covered with rectangular to square papillae, more abundant ventrally, but ventrolateral pads not defined; ventral papillae arranged in 5–6 well defined transverse rows per segment anteriorly, 2–3 rows per segment posteriorly; papillae rectangular and each completely covered with minute rounded to spherical papillae (Fig. 3A–G). Segment 1 only conspicuous mid-dorsally, laterally and ventrally covered by expanded prostomium; segment 2 conspicuous dorsally and continuing ventrally as short annulation, with relatively large mid-ventral shield at beginning of mid-ventral groove; groove bordered by paired longitudinal crests through posterior body (Fig. 3B–C, E–F). Notopodia extending for 5 segments, until segment 7; short, roughly cylindrical notopodia, distally blunt; first pair of notopodia slightly shorter than following pairs and slightly ventral to them. Notopodia with single chaeta in each row, both pinnate, striations only visible under higher magnifications of light microscopy (Fig. 3H). Nephridial and genital papillae not visible. Pygidium with pair of large, rounded ventral papillae and 6–7 smaller papillae lateral and dorsally, papillae progressively smaller towards dorsal side (Fig. 3G).

**Remarks.** The holotype and the only known specimen of *Lysilla longilinea* n. sp. is a very slender and proportionally elongate worm, brown to purple after preservation, with highly specialised long buccal tentacles and only five pairs of notopodia, on segments 3–7, bearing pinnate chaetae.

Of the 13 described species of *Lysilla*, only two species have notopodia terminating on segment 10 or before, *L. loveni* Malmgren, 1866, originally described from Sweden and with notopodia extending until segments 8–10, with winged notochaetae in both rows, and *L. macintoshi* Gravier, 1907, described from material from Antarctica and with notopodia extending to segments 7–8, with pinnate chaetae in both rows, as in the holotype of *L. longilinea* n. sp. Members of *L. macintoshi* differ from the holotype of *Lysilla longilinea* n. sp., in being larger animals, anteriorly swollen, with larger lips and large genital papillae surrounding bases of notopodia of segments 6–8.

**Etymology.** We attribute the name “*longilinea*” for this species as a reference to the remarkably elongate and slender body shape of the holotype.

**Habitat.** Associated with dead coral substrate.

**Type locality.** High Rock, 14°44'33"S, 145°33'8"E, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard region.

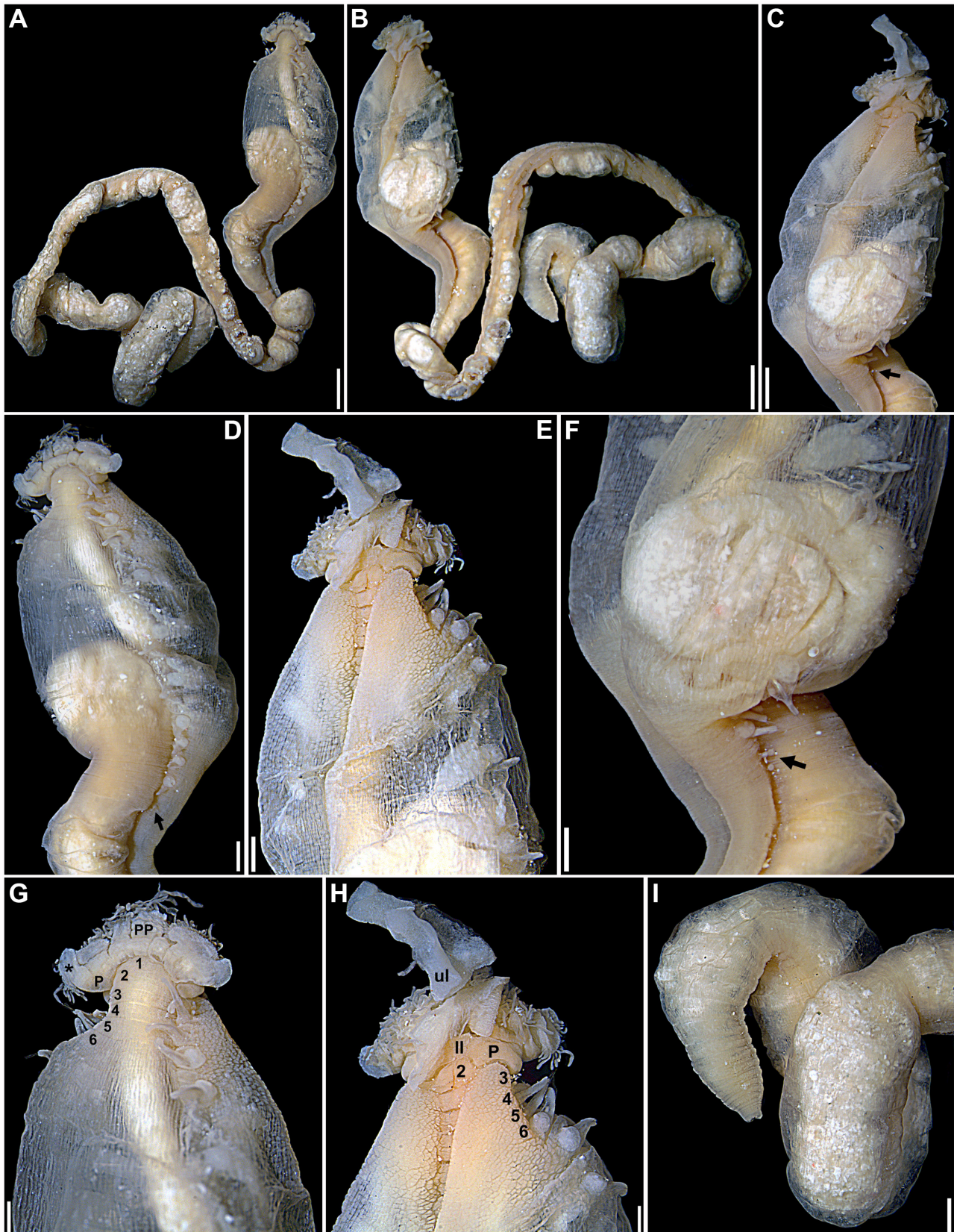
### *Lysilla pacifica* Hessle, 1917

(Figs 4, 5A)

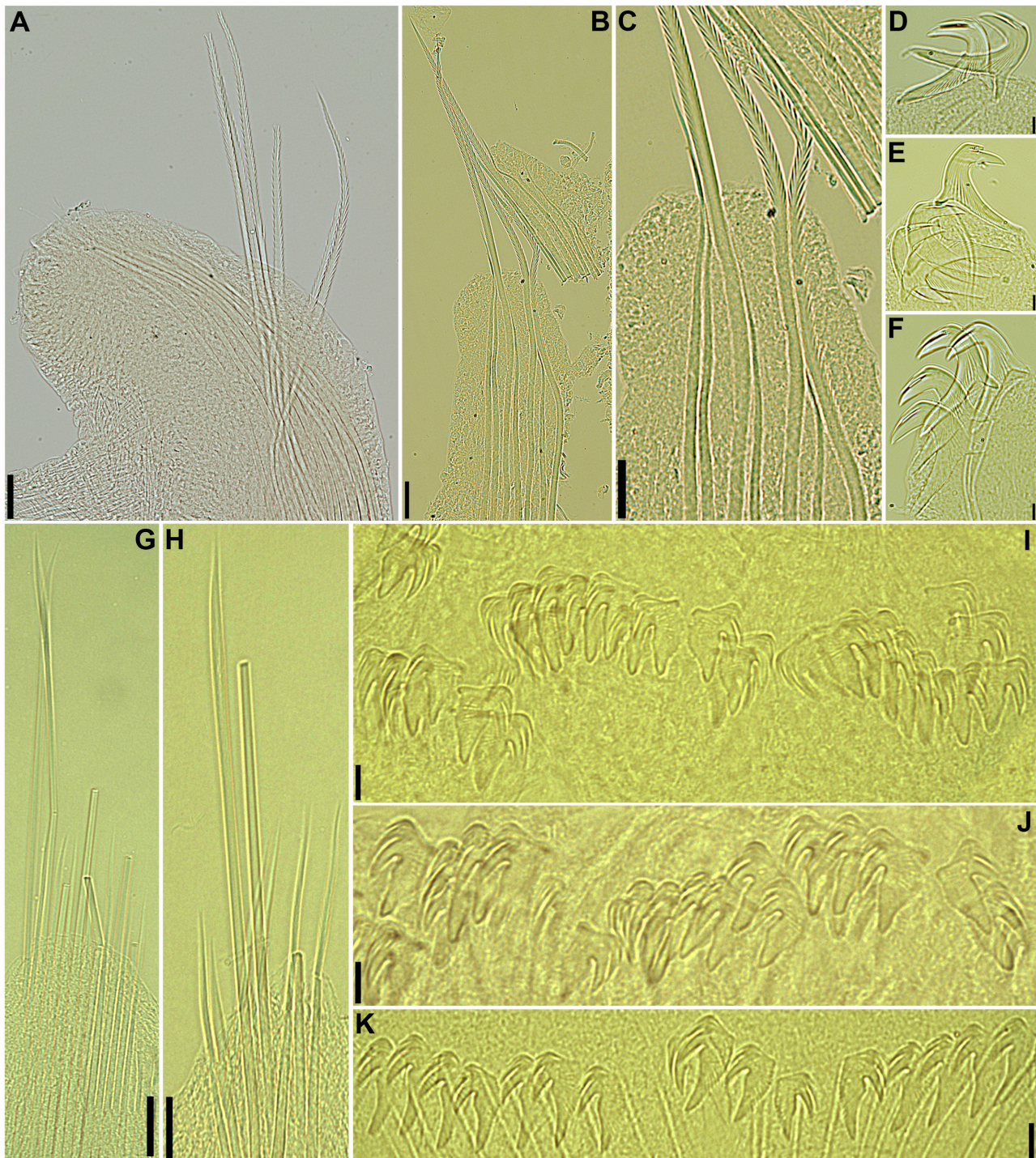
**Material examined.** AM W.47520, Lizard Island, Blue Lagoon, 500 m east of Palfrey Island, 14°40'S, 145°28'E, 9 Oct 1978, large corer, fine sticky sediment, 12 m, coll. Jones & Short, complete specimen, ~50 mm long, ~4 mm maximum width; AM W.47406, Lizard Island, Watsons Bay, 400 m off Chinamans Ridge, 14°40'S, 145°27'E, sand with filamentous algae, 12 m, 13 Oct 1978, complete, in good state of preservation although with some damage on thorax.

**Other material examined.** New South Wales: AM W.4209, Forster, Wallis Lake, boatsheds, 32°11'S, 152°30'30"E, 24 May 1968; AM W.5696, Botany Bay, Towra Point, 34°6'S, 151°9'48"E.

**Description.** Preserved body beige to light brown. Elongate body, distinctly swollen anteriorly, abruptly tapering to narrow, cylindrical abdomen, wider posteriorly (Fig. 4A–I). Prostomium at base of upper lip, both basal and distal parts developed, basal part as thick horseshoe-shaped crest, distal part with large, rounded flaring lobes and also short squared to rectangular mid-dorsal process; prostomium covering segment 1 laterally and terminating laterally to lower lip, near mouth (Fig. 4A–E, G–H). Most buccal tentacles missing, remaining ones of two sizes, long ones slightly expanded at tips (Fig. 4A–E, G–H); material from New South Wales with highly specialised long tentacles, progressively widening towards cylindrical swelling, with pointed tip. Peristomium restricted to lips, upper lip distinctly longer than wide, convoluted (upper lip torn off during manipulation of specimen AM W.47520, kept in a microvial inside original vial); lower lip short, rectangular, deeply grooved (Fig. 4A–E, G–H). Body anteriorly swollen, abruptly expanded on segments 3–6, then becoming less markedly expanded, progressively broader until segments 9–10, abruptly tapering from posterior part of segment 9 through segment 15, then less markedly through segment 20; posterior body swollen, abruptly tapering to pygidium; faint segmentation after termination of notopodia, with fragile body wall (Fig. 4A–I). Segments biannulated, segment 1 only conspicuous mid-dorsally, laterally and ventrally covered by expanded prostomium; segment 2 narrower and



**FIGURE 4.** *Lysilla pacifica*, AM W.47520 (superior part of upper lip accidentally torn off, joined with the rest of the body for the ventral photos). A–B. Entire worm, dorsal and ventral views (anteriorly), respectively; C–D. Thorax, left ventro-lateral and right dorso-lateral views, respectively; E. Anterior end, left ventro-lateral view; F. Close up of the termination of notopodia; G–H. Close ups of the anterior end, right dorso-lateral and left ventro-lateral views, respectively; I. Posterior end. Numbers refer to segments; unspecified arrows point to last notopodium. Abbreviations: ll = lower lip, P = basal part of prostomium, PP = prostomial process, ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 1.5 mm, C = 1 mm, D = 0.6 mm, E–F, I = 0.5 mm, G = 0.4 mm, H = 0.3 mm.



**FIGURE 5.** *Lysilla pacifica*, AM W.47520, A. Notochaetae, segment 8. *Polycirrus oculus* n. sp., holotype NTM W.23159, B–C. Progressively closer views of the notochaetae of segment 19; D. Uncini, segment 23; E–F. Uncini of two posterior neuropodia. *Polycirrus rubrointestinalis* n. sp., paratype AM W.47658, G–H. Notochaetae, segments 6 and 12, respectively; I–K. Uncini, segments 6, 12 and 24, respectively. Scale bars: A–B, G = 30  $\mu$ m, C, H = 20  $\mu$ m, D–F = 5  $\mu$ m, I–K = 6  $\mu$ m.

shorter than following segments, with relatively small, bilobed mid-ventral shield at beginning of mid-ventral groove, shield slightly longer and broader than that of segment 3, extending anteriorly until ventral edge of lower lip (Fig. 4A–E, G–H). Ventrums highly glandular, covered with minute papillae, arranged in poorly defined ventrolateral pads on segments 2–11; papillae slightly larger and more numerous on anterior segments; smooth body wall from segment 12, with paired longitudinal crests bordering mid-ventral groove through posterior body. Notopodia extending through 11–13 segments, until segment 13 in one specimen, 15 in the other; relatively short, cylindrical notopodia, with equal sized lobes and distally blunt tips, first pair and that of segment 14 shorter, last pair much

shorter (Fig. 4A–H). Pinnate notochaetae in both rows (Fig. 5A). Nephridial and genital papillae anterior to bases of all notopodia except for last pair of specimen with 13 pairs; nephridia enlarged, rounded and swollen, with minute papillae at apex on segments 6–14 (Fig. 4A–H). Pygidium crenulated, with rounded ventral papilla (Fig. 4I).

**Remarks.** The most distinctive character of *L. pacifica* is the remarkably elongate upper lip, resembling the upper lip of some telothelepods (Nogueira *et al.* 2010, 2013). The original description of this species (Hessle 1917) states there are 9–12 pairs of notopodia in Japanese specimens, although this is based on three poorly preserved specimens and in one of these there are 9 pairs on one side and 12 on the other. The material from Lizard Island has between 11–13 pairs of notopodia and similar variation occurs in other material from Eastern Australia. We also found that in specimens with 13 pairs of notopodia the last pair is very reduced and easily overlooked (Fig. 3F). Fresh material from the type locality should be re-examined to confirm the range of number of pairs of notopodia present.

Hutchings & Glasby (1986) examined the syntypes of *L. pacifica*, found 10–11 pairs of notopodia and concluded that the species also occurred along the east coast of Australia, although it would be useful to confirm this with molecular studies. Kupriyanova (pers comm.) has found some species of serpulids occurred both in Japan and on the east coast of Australia.

**Type locality.** Bonin Islands, Southern Japan.

**Distribution.** Pacific Ocean, from southern Japan to New South Wales, along the east coast of Australia.

### Genus *Polycirrus* Grube, 1850, emended

*Polycirrus*.—Hutchings & Glasby 1986: 330–332; Glasby & Hutchings 2014: 13–14.

**Type-species.** *Polycirrus medusa* Grube, 1850, by monotypy.

**Diagnosis.** Transverse prostomium attached to dorsal surface of upper lip, usually covering segment 1 laterally and extending ventrally, terminating lateral to mouth; basal part of prostomium usually as thick crest; crest almost straight, horseshoe-shaped, curved to semicircular, or inverted V-shaped, probably strongly dependent on preservation. Distal part of prostomium low, of uniform length, restricted to base of upper lip, sometimes as flaring lobe, or extending along the lip and terminating near anterior margin. Buccal tentacles of at least two types, short ones uniformly cylindrical, long ones spatulated; modified stouter and longer tentacles with specialised tips may be present. Peristomium forming lips; upper lip large, frequently circular and convoluted, folded into three lobes; swollen lower lip, entire or divided into two parts, varying from button-like, restricted to oral area, to expanded as cushion-like structure, and sometimes occurring across entire ventrum. Segments throughout biannulated or with more annulations; segment 1 reduced, usually visible dorsally and ventrally, laterally covered by expanded prostomium. Segment 2 distinctly narrower than following segments, usually with rectangular or pentagonal mid-ventral shield at beginning of mid-ventral groove, sometimes extending anteriorly through segment 1 until near posterior margin of lower lip. Body wall papillate throughout, papillae distinctly larger and more abundant on ventro-lateral pads of anterior segments, present usually from segment 2 to last with notopodia. Notopodia beginning from segment 3, extending for variable number of segments, terminating anteriorly in most taxa; bilobed, elongate notopodia, lobes about same size or post-chaetal lobe longer. Notochaetae winged, with wings of variable width, and/or pinnate. Neuropodia, beginning posteriorly to notopodia, frequently only after notopodia terminate; neurochaetae as avicular uncini of types 1 or 2. Nephridial and genital papillae usually present, anterior to bases of all notopodia, or only anteriorly. Pygidium smooth or with rounded ventral papilla.

**Remarks.** *Polycirrus* is a well-known genus of Terebelliformia, but the taxonomy of its species has always been considered as difficult. Recently, Glasby & Hutchings (2014) reviewed the group, designated a neotype for the type species, *P. medusa* Grube, 1850, and provided redescriptions for all species in this genus based on re-examination of type material.

The diagnosis above emends that by Glasby & Hutchings (2014) because it does not consider the hirsute-type of notochaetae of Glasby & Hutchings (2014). Wings of notochaetae of *Polycirrus* are of variable width, usually conspicuous under intermediate magnification of light microscopy, broadly-winged *sensu* Fitzhugh *et al.* (2015), but some species have very narrowly-winged chaetae, acicular, with wings inconspicuous under higher magnifications of light microscopy, as also occurs in some species of *Amaeana* and *Lysilla*. In the case of the

species with broadly-winged notochaetae, sometimes the layers of chitin of the wings spread apart and these chaetae may assume a hirsute appearance under light microscopy. Under the SEM, however, the wings are always hirsute, independent of state of preservation, even in acicular chaetae, and the only variation observed is in the width of the wings.

On the other hand, in some cases Glasby & Hutchings (2014) considered as “hirsute” chaetae that in our opinion are pinnate. For instance, Glasby & Hutchings described the notochaetae of *P. latidens* as hirsute, however in all cases we have seen chaetae with regularly arranged “hairs” under light microscopy, as represented in their Fig. 33c (Glasby & Hutchings 2014: 65), they are pinnate under the SEM. For these reason, we consider the hirsute type of notochaetae of Glasby & Hutchings (2014) as misleading, as it may refer to poorly preserved broadly-winged or to pinnate chaetae.

Glasby & Hutchings (2014) suggested an intraspecific variation of 5 segments on the number of pairs of notopodia, and of 4 segments on the beginning of neuropodia, and that these two characters were independent of each other. We consider, however, these characters are linked, so that a variation in the number of pairs of notopodia implies in similar variation in the beginning of neuropodia. So, the relative distance between termination of notopodia and beginning of neuropodia is more important than segment numbers where these occur, considering some little variation in segment numbers may occur.

Several other characters of polycirrids are also directly related to the number of pairs of notopodia. Frequently, the paired ventro-lateral pads are present until the segment on which notopodia terminate, although they may be less conspicuous posteriorly. Furthermore, the body is usually swollen anteriorly and tapers abruptly on last segments with notopodia. Similarly, in most species, nephridial and genital papillae are present anterior to bases of all notopodia. An intraspecific variation on the number of pairs of notopodia also implies variation in the number of pairs of ventro-lateral pads and nephridial and genital papillae present. For that reason, in most taxa the termination of notopodia determines the transition between a thorax and an abdomen. Such demarcation is not clear in specimens of several taxa of Terebelliformia, and because of that Nogueira *et al.* (2010, 2013) suggested the names “thorax” and “abdomen” should be used with caution, but it is usually conspicuous among polycirrids.

In regards to beginning of neuropodia, we suggest that four groups of *Polycirrus* can be recognized, those in which: (1) neuropodia begin on anterior segments, up to segment 10; (2) neuropodia begin near to the termination of notopodia, on the last segment with notopodia, or close to that (with an obvious overlap between groups 1 and 2 in the cases of species with few pairs of notopodia); (3) neuropodia begin immediately to shortly after the termination of notopodia; (4) neuropodia begin more posteriorly, with a gap of several achaetous segments between termination of notopodia and beginning of neuropodia (see Fitzhugh *et al.* 2015). Within each group, a variation of some segments is acceptable, but usually no more than three segments.

However, except for few cases of aberrant specimens, we have never observed any intraspecific variation which would cause an overlap between groups 2 and 3. A variation in the number of pairs of notopodia present is accompanied by a similar change in the beginning of neuropodia, so that a variation between “neuropodia beginning on the last segment with notopodia, or close to that” and “neuropodia beginning immediately or shortly after notopodia terminate” does not occur, even if that means a difference of a single segment.

We also interpret the types of uncini slightly differently from Glasby & Hutchings (2014). Glasby & Glasby (2006) divided the types of uncini of *Polycirrus* into two types, based on morphometrics. However, the differences between types 1 and 2 of uncini should be based on not only morphometrics but also on other characters. For example, type 1 uncini are usually minute, with short, triangular heel directed posteriorly, relatively high base, horizontally aligned with the heel, and a short neck; while type 2 uncini are usually larger, with longer heel directed downwardly, low base, at an angle with the heel, and elongate neck. For this reason, some uncini which would be considered by Glasby & Hutchings (2014) as type 2 are treated herein as type 1, such as in the case of *P. culcita* n. sp. (see below).

### Key for Identification of Species of *Polycirrus* found at Lizard Island

1. Neuropodia beginning before termination of notopodia . . . . . 2
- Neuropodia beginning after termination of notopodia . . . . . 5
2. (1) Neuropodia beginning close to termination of notopodia . . . . . 3
- Neuropodia beginning from anterior segments . . . . . 4

3. (2) Nine pairs of notopodia, bearing winged chaetae in both rows; neuropodia beginning from the penultimate segment with notopodia, segment 10, with type 1 uncini . . . . . *Polycirrus minutus* n. sp.  
 - Thirteen pairs of notopodia, bearing pinnate chaetae in both rows; neuropodia beginning from the last segment with notopodia, segment 15, with type 2 uncini . . . . . *Polycirrus glossochelius* n. sp.
4. (2) Ten pairs of notopodia, on segments 3–12, winged notochaetae in both rows . . . . . *Polycirrus rubrointestinalis* n. sp.  
 - Eleven or twelve pairs of notopodia, on segments 3–14, winged and pinnate notochaetae present. . . *Polycirrus papillatus* n. sp.
5. (1) Only winged notochaetae present . . . . . 6  
 - Pinnate notochaetae present . . . . . 8
6. (5) At least 10 pairs of notopodia, on segments 3–12; inconspicuous nephridial/genital papillae. . . . . 7  
 - Eight pairs of notopodia, on segments 3–10; nephridial/genital papillae on segments 3–9 . . . . . *Polycirrus cruciformis* n. sp.
7. (6) Neuropodia beginning 3 segments after termination of notopodia . . . . . *Polycirrus culcita* n. sp.  
 - Neuropodia beginning from first segment after termination of notopodia . . . . . *Polycirrus variabilis*
8. (5) Prostomium not projecting laterally . . . . . 9  
 - Prostomium projecting laterally as one elongate tentacular horn at each side of body . . . . . *Polycirrus brutus* n. sp.
9. (8) Up to 16 pairs of notopodia, on segments 3–18; neuropodia beginning from first segment after termination of notopodia . . . 10  
 - Eighteen pairs of notopodia, on segments 3–20; neuropodia beginning from third segment after termination of notopodia . . . . . *Polycirrus oculus* n. sp.
10. (9) Vento-lateral pads smooth to lightly papillated, covered by minute papillae; pinnate notochaetae in posterior row; type 2 uncini . . . . . *Polycirrus boholensis*  
 - Vento-lateral pads tessellated, covered on large, swollen papillae; winged notochaetae in posterior row; type 1 uncini. . . . . *Polycirrus bicrinalis*

***Polycirrus minutus* n. sp.**

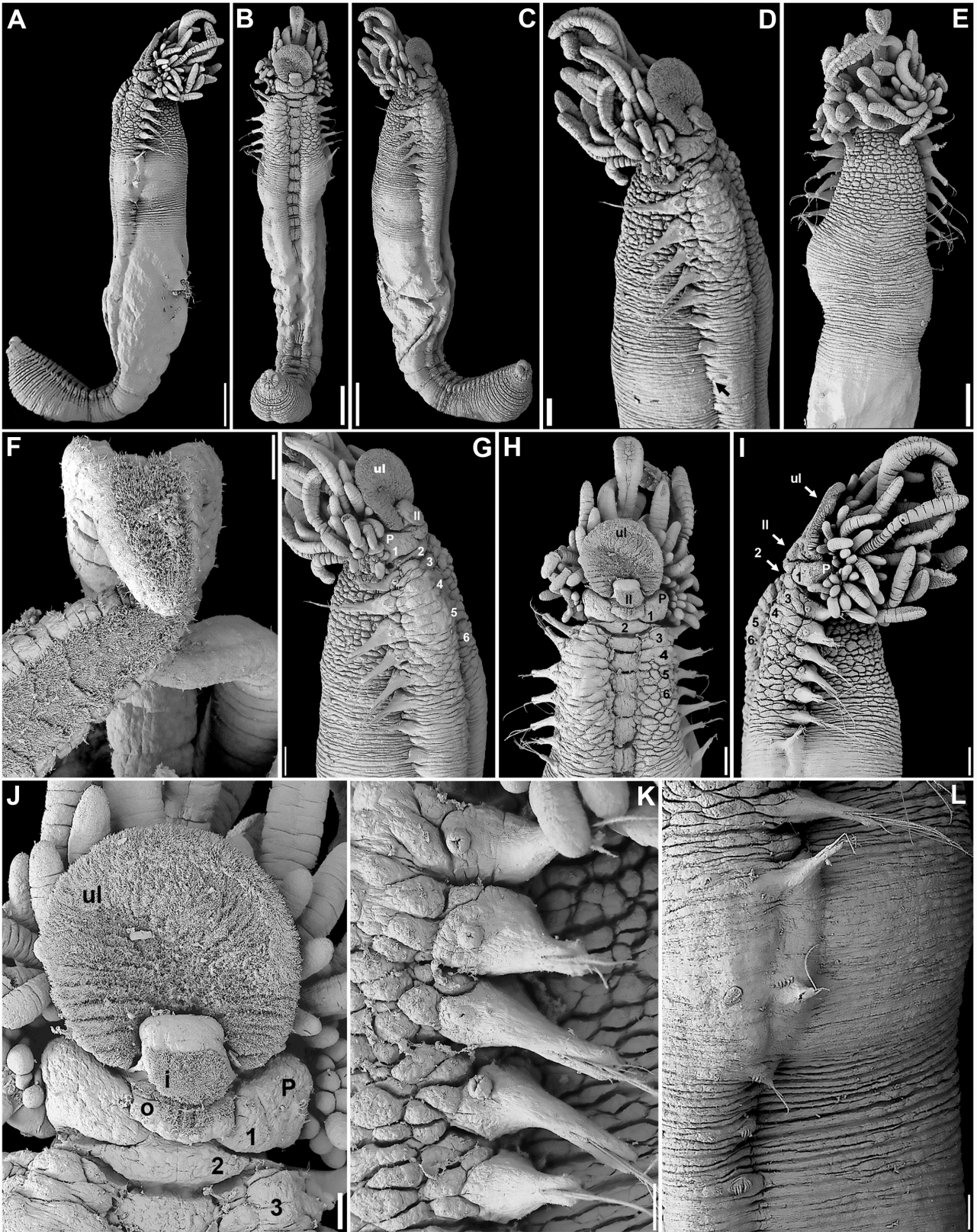
(Figs 6–7)

**Type material.** Holotype: AM W.47640, MacGillivray Reef, 14°39'23"S, 145°29'3"E, coarse coral rubble, 22 m, 29 Aug 2010, CReefs, posteriorly incomplete, 2 mm wide, 6 mm long, gravid, in good condition. Paratype: AM W.47638 (1 mounted on SEM pin), between small patch reefs just inside Lizard Island lagoon entrance, 14°40'S, 145°28'E, medium to fine sand, 18 m, coll. Jones & Short, hand corer, 9 Oct 1978.

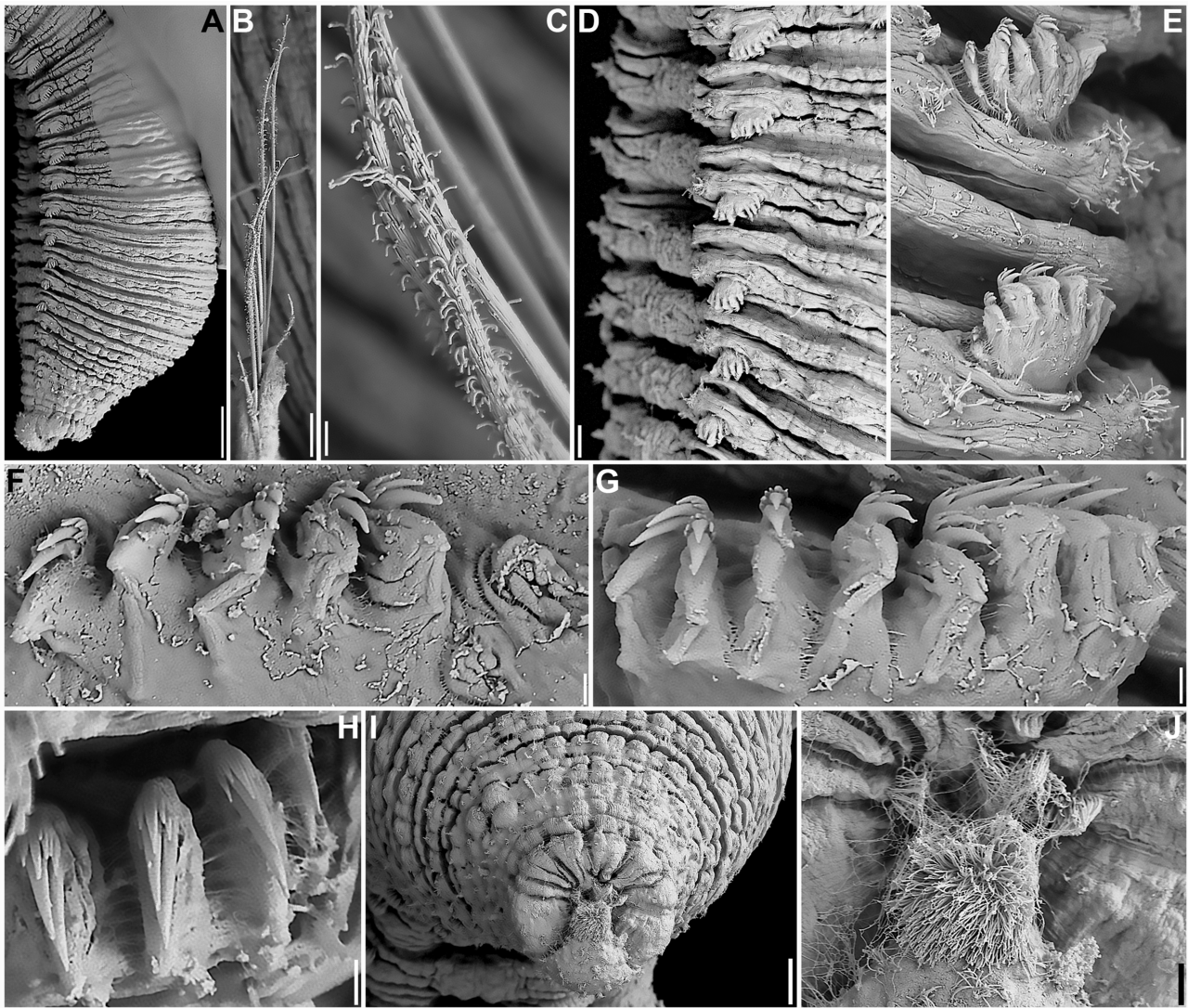
**Other material examined.** AM W.47639, Mermaid Cove (buoy), 14°38'46"S, 145°27'13"E, coral rubble, 7 m, 27 Aug 2010, CReefs; AM W.47641, North Direction Island, 14°44'43"S, 145°30'18"E, coral rubble, 8.5 m, 4 Sep 2010, CReefs.

**Description.** Transverse prostomium attached to dorsal surface of base of upper lip; basal part as thick, curved crest, distal part poorly developed, as low lobe of uniform length at base of upper lip (Fig. 6A–D, G–H). Buccal tentacles of two types, both spatulated at tips, with deeper groove, long ones with thinner uniformly cylindrical peduncle before spatulated tip (Fig. 6A–I). Peristomium forming lips; short, circular upper lip, hood-like, heavily ciliated; short, swollen lower lip, divided in two parts, inner region button-like, almost rectangular, distal half heavily ciliated, outer region short and narrow, rectangular, shelf-like, also ciliated (Fig. 6A–D, G–H, J). Segment 1 reduced, visible mid-dorsal and ventrally, laterally covered by expanded prostomium; segment 2 visible all around, distinctly narrower than following segments, with relatively large, rectangular mid-ventral shield (Fig. 6A–D, G–J). Tessellated, highly papillated ventro-lateral pads of anterior segments, present until segment 10, last 2 pairs progressively less developed (Fig. 6A–D, G–K). Notopodia extending for 9 segments, until segment 11; elongate, bilobed notopodia, lobes of equal size, last 2 pairs of notopodia markedly shorter, especially last one (Figs 6A–E, G–I, K; 7B). Narrowly-winged notochaetae in both rows (Fig. 7B–C). Neuropodia beginning from segment 10, penultimate with notopodia; sessile neuropodia on first two pairs, on segments 10–11, at bases of notopodia, as short, raised pinnules after notopodia terminate, with scattered tufts of cilia (Figs 6A–C, L; 7A, D–G). Minute, type 1 uncini throughout, with elongate, distally pointed prow, crest with single elongate and sharp tooth on first row above main fang, surrounded by single row of shorter, irregularly sized teeth at base, medial tooth larger, and short neck (Fig. 7D–H). Nephridial and genital papillae only present on segments 3–6, lateral to bases of notopodia (Fig. 6A–D, G–I, K). Pygidium with rounded ventral papilla and crenulated rim, anus heavily ciliated (Figs 6A–C; 7A, I–J).

**Remarks.** *Polycirrus minutus* n. sp. is a small species, with distal part of prostomium restricted to the base of the upper lip; circular upper lip; button-like lower lip, divided in two parts; tessellated ventro-lateral pads; few pairs of notopodia, 9 pairs only, extending until segment 11, with evenly-sized lobes and bearing narrowly-winged, acicular notochaetae; neuropodia beginning from the penultimate thoracic segment, segment 10, with type 1 uncini; and nephridial and genital papillae present on segments 3–6, ventral to the bases of notopodia, the last pair almost inconspicuous.



**FIGURE 6.** *Polycirrus minutus* n. sp., paratype AM W.47638. A–C. Entire worm, left lateral, ventral and right lateral views, respectively; D–E. Thorax right lateral and dorsal views, respectively, arrow points to last notopodium; F. Tips of some tentacles; G–I. Close ups of the anterior end, right lateral, ventral and left lateral views, respectively; J. Close up of the oral area; K. Notopodia of segments 3–7, ventral view; L. Close up of the transition between thorax and abdomen. Numbers refer to segments. Abbreviations: i = inner region of lower lip, ll = lower lip, o = outer region of lower lip, P = basal part of prostomium, ul = upper lip. Scale bars: A–C = 300  $\mu$ m, D, G–I = 100  $\mu$ m, E = 200  $\mu$ m, F = 30  $\mu$ m, J–K = 40  $\mu$ m, L = 50  $\mu$ m.



**FIGURE 7.** *Polycirrus minutus* n. sp., paratype AM W.47638. A. Posterior end, left lateral view; B–C. Notochaetae, segment 7; D–E. Progressively closer views of abdominal neuropodia; F–H. Uncini, segment 10, anterior and posterior abdominal segments, respectively; I–J. Progressively closer views of the posterior end, frontal view. Scale bars: A = 100  $\mu$ m, B, D = 20  $\mu$ m, C = 3  $\mu$ m, E = 7  $\mu$ m, F–H = 2  $\mu$ m, I = 40  $\mu$ m, J = 10  $\mu$ m.

Glasby & Hutchings (2014) suggested a variation of up to 5 segments in the number of pairs of notopodia present, and 4 segments for the beginning of neuropodia. Currently among known species of *Polycirrus*, only nine have up to 14 pairs of notopodia and neuropodia beginning near to the termination of notopodia. Of these, six have type 1 uncini, as in *P. minutus* n. sp. Those species are *P. breviuncinatus* Carrerette & Nogueira, 2013, *P. broomensis* Hartmann-Schröder, 1979, *P. dodeka* Hutchings, 1990, *P. hesslei* Monro, 1930, *P. latidens* Eliason, 1962, and *P. rosea* Hutchings & Murray, 1984; of these *P. broomensis* and *P. rosea* were originally described from Australian waters.

*Polycirrus breviuncinatus* differs from *P. minutus* n. sp. in having a large, cushion-like lower lip, not divided in regions; smooth ventro-lateral pads; 13 pairs of notopodia, extending until segment 15 and bearing winged notochaetae, wings conspicuous under light microscopy; neuropodia beginning on the last thoracic segment, segment 15; and nephridial and genital papillae inconspicuous or absent (Carrerette & Nogueira 2013).

Members of *P. minutus* n. sp. differ from *P. broomensis* because this latter species has a holotype of 35 mm in length, and is incomplete, with 32 segments, with a cushion-like and deeply corrugated lower lip; 12 pairs of notopodia, extending until segment 14, with post-chaetal lobe longer and bearing winged chaetae in anterior row of notochaetae, pinnate chaetae in posterior row; neuropodia beginning from the last thoracic segment, segment 14, with pectinate uncini; and nephridial and genital papillae present until segment 11 (Glasby & Hutchings 2014).



*Polycirrus dodeka* is also small, with a body ~1 cm long; with a large, cushion-like outer region of the lower lip; 12 pairs of notopodia, extending until segment 14, with longer post-chaetal lobe and bearing winged chaetae in both rows of notochaetae, wings conspicuous under light microscopy; neuropodia beginning from the last thoracic segment, segment 14; and nephridial and genital papillae present until the last pair of notopodia (Glasby & Hutchings 2014).

*Polycirrus hesslei* differs from *P. minutus* n. sp. as the holotype of the latter is 5 cm long, and it has the distal part of prostomium extending along the upper lip and terminating near the anterior border of the lip; cushion-like and deeply corrugated outer region of the lower lip; smooth, inflated and transversely wrinkled ventro-lateral pads; 13 pairs of notopodia, extending until segment 15, with longer post-chaetal lobe and probably bearing pinnate chaetae in both rows, according to the line drawings provided by Glasby & Hutchings (2014: 61, Fig. 30C); neuropodia beginning from the last thoracic segment, segment 15; and nephridial and genital papillae present until segment 9 (Glasby & Hutchings 2014).

*Polycirrus latidens* is also larger than *P. minutus* n. sp., the holotype of *P. latidens* is 1.7 cm long, with larger, cushion-like and deeply grooved outer region of the lower lip; smooth, inflated and transversely ridged ventro-lateral pads; 12 pairs of notopodia, extending until segment 14, with longer post-chaetal lobes and probably bearing pinnate chaetae in both rows, according to the line drawings provided by Glasby & Hutchings (2014: 65, Fig. 33c); neuropodia beginning from the last thoracic segment, segment 14; and nephridial and genital papillae present until segment 8, ventral to the bases of notopodia (Glasby & Hutchings 2014).

*Polycirrus rosea* described from New South Wales, Australia is perhaps the species most similar to *P. minutus* n. sp. Both taxa share similar dimensions of the body, type of notochaetae, and beginning of neuropodia from segment 10, with few uncini per torus, of type 1. These species are distinguished, however, because among members of *P. rosea* the outer region of the lower lip is cushion-like, rectangular, extending across entire ventrum; the ventro-lateral pads are almost smooth; there are 12 pairs of notopodia, extending until segment 14, with longer post-chaetal lobe; neuropodia begin on the fifth segment before the termination of notopodia, segment 10; and nephridial and genital papillae are inconspicuous or absent (Glasby & Hutchings 2014), which differs from *P. minutus* n. sp.

**Etymology.** The specific name refers to the small size of the species.

**Habitat.** In course coral rubble in 22 m.

**Type locality.** MacGillivray Reef, 14°39'23"S, 145°29'31"E, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard region.

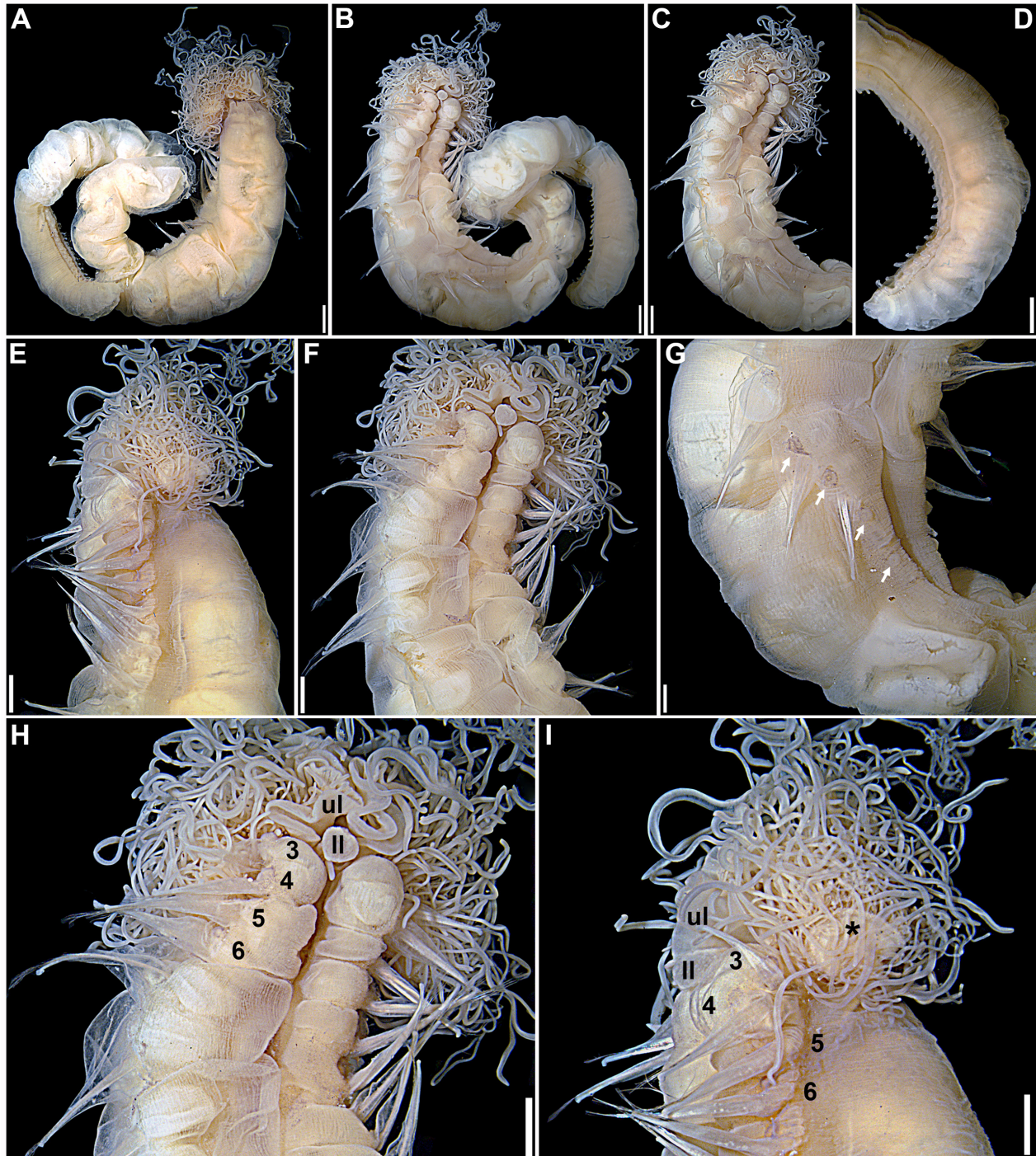
### ***Polycirrus glossochelius* n. sp.**

(Figs 8–9)

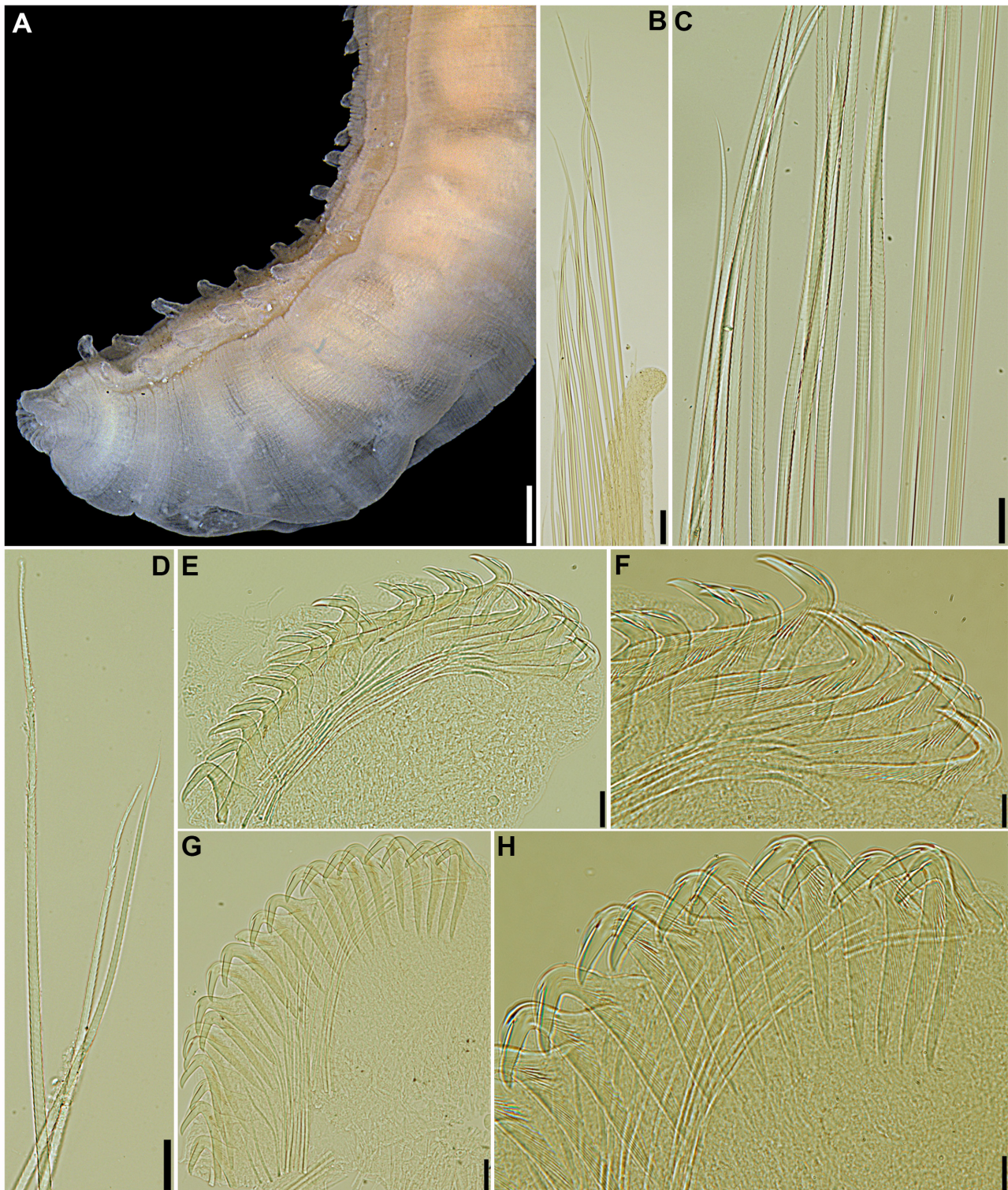
**Type material.** Holotype: AM W.47642, between South and Palfrey Islands, Lizard Island Group, under rock, 20 m, coll. P. Hutchings, complete specimen, in excellent state of preservation, 35 mm long and 5 mm maximum width.

**Description.** Transverse prostomium attached to dorsal surface of upper lip; basal part as thick, curved crest across dorsum, extending laterally and posteriorly, covering segment 1 laterally and terminating lateral to lower lip; distal part at base of upper lip, as flaring lobes (Fig. 8A, E, I). Buccal tentacles of two types, both thin, slightly spatulated and with deeper groove at tip, long tentacles not very different from short ones, just longer and stouter (Fig. 8A–C, E–F, H–I). Peristomium forming lips; short, circular upper lip, hood-like, convoluted; small but elongate lower lip, tubular, projecting forwards as tongue-like process, not divided in two parts (Fig. 8B–C, E–F, H–I). Segment 1 not conspicuous all around; segment 2 reduced, visible mid-dorsal and mid-ventrally; body progressively broader and longer until segment 10, then abruptly tapering to uniformly cylindrical posterior body, beginning from the termination of notopodia; large anterior abdominal segments, with thin body wall and poorly marked segmentation, posterior body with clearly defined, compacted segments (Figs 8A–I; 9A). Smooth, oblong, distinctly inflated and poorly defined paired ventro-lateral pads, present on segments 3–15, last two pairs distinctly smaller (Fig. 8B–C, F–H). Notopodia extending for 13 segments, until segment 15; distinctly elongate, bilobed notopodia, lobes of same size, first and last two pairs slightly shorter (Fig. 8A–C, E–I). Pinnate notochaetae in both rows, those from posterior row only pinnate at tips (Fig. 9B–D). Neuropodia beginning from segment 15, last

segment with notopodia, neuropodia as short, raised pinnules (Figs 8A–B, D, G; 9A). Type 2 uncini throughout, elongate prow and heel, the latter obliquely directed downwards, crest with single elongate and sharp tooth on first row of secondary teeth above main fang, surrounded by crown of minute teeth at base, and elongate neck (Fig. 9E–H). Large nephridia, visible through transparent body wall; nephridial and genital papillae present on segments 3–17, anterior to bases of notopodia, extending for two segments after notopodia terminate; last four pairs of genital papillae distinctly larger, especially those of segments 14–15, with large openings (Fig. 8B–C, E–I). Pygidium with ventral papilla and low, crenulated lobe, of even height all around (Figs 8A, D; 9A).



**FIGURE 8.** *Polycirrus glossochelius* n. sp., holotype AM W.47642. A–B. Entire worm, left dorso-lateral and ventral views (anteriorly), respectively; C. Thorax, ventral view; D. Posterior end, left lateral view; E–F. Anterior end, left dorso-lateral and ventral views, respectively; G. Transition between thorax and abdomen, ventral view, arrows point to genital papillae; H–I. Close ups of the anterior end, ventral and left dorso-lateral views, respectively. Numbers refer to segments. Abbreviations: ll = lower lip, ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 1.5 mm, C–F, H–I = 1 mm, G = 0.6 mm.



**FIGURE 9.** *Polycirrus glossochelius* n. sp., holotype AM W.47642. A. Posterior end, left lateral view; B–D. Notochaetae, segment 9. E–F. Uncini, segment 18. G–H. Uncini, posterior segment. Scale bars: A = 500  $\mu$ m, B = 100  $\mu$ m, C–D = 30  $\mu$ m, E, G = 20  $\mu$ m, F, H = 10  $\mu$ m.

**Remarks.** The holotype of *P. glossochelius* n. sp. is a stout, complete specimen, 35 mm long, with the distal part of prostomium at the base of the upper lip; circular and convoluted upper lip; short, rounded and protruding lower lip, tongue-like; smooth, inflated and poorly defined ventro-lateral pads; 13 pairs of notopodia, extending until segment 15, with evenly-sized lobes and pinnate chaetae in both rows of notochaetae; neuropodia beginning on the last segment with notopodia, segment 15, as relatively thin and elongate pinnules after notopodia terminate,

bearing type 2 uncini. The most remarkable character of this species however, is the presence of genital papillae for two segments beyond the termination of notopodia, until segment 17, the last four pairs distinctly larger, especially those of segments 14 and 15.

Fifteen species of *Polycirrus* have 8–18 pairs of notopodia, considering the variation on the beginning of notopodia suggested by Glasby & Hutchings (2014), and neuropodia beginning before the termination of notopodia, but close to it. Of these, only three species have type 2 uncini, *P. aquila* Caullery, 1944, *P. medius* Hesse, 1917, and *P. quadratus* Hutchings, 1990.

Members of *P. aquila* differ from those of *P. glossochelius* n. sp., as the former have a lower lip with different morphology, although also protruding; tessellated ventro-lateral pads; 16 pairs of notopodia, extending until segment 18, with longer post-chaetal lobe; neuropodia beginning from the penultimate segment with notopodia, segment 17; and genital papillae terminating before the termination of notopodia, on segment 16 (Glasby & Hutchings 2014).

*Polycirrus glossochelius* n. sp. differs from *P. medius* because in this latter species the outer region of the lower lip is cushion-like, extending until near the posterior margin of segment 4; 17 pairs of notopodia, extending until segment 19; neuropodia begin from the fifth segment before the termination of notopodia, segment 15, and uncini have a single tooth above the main fang, while *P. glossochelius* n. sp. has uncini with a second row of minute secondary teeth at the base of the tooth above main fang; and genital papillae do not extend beyond segment 8 (Glasby & Hutchings 2014).

*Polycirrus quadratus* differs from the holotype of *P. glossochelius* n. sp., as the former species has the distal part of prostomium extending until near the anterior margin of the upper lip; cushion-like outer region of the lower lip, extending until near the posterior margin of segment 5 (according to Glasby & Hutchings 2014: 100, Fig. 55a); there are 12 pairs of notopodia, extending until segment 14 and bearing winged chaetae in both rows; and genital papillae do not extend beyond segment 7 (Glasby & Hutchings 2014).

**Etymology.** The specific name “*glossochelius*” derives from the Greek words “*glossa*” (= tongue) and “*chelius*” (= lip), in reference to the tongue-like shape of the lower lip.

**Habitat.** Under rubble on reef front, 20 m deep.

**Type locality.** Between South and Palfrey Islands, 14°41'48.61"S, 145°26'40.68"E, Lizard Island Group, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard region.

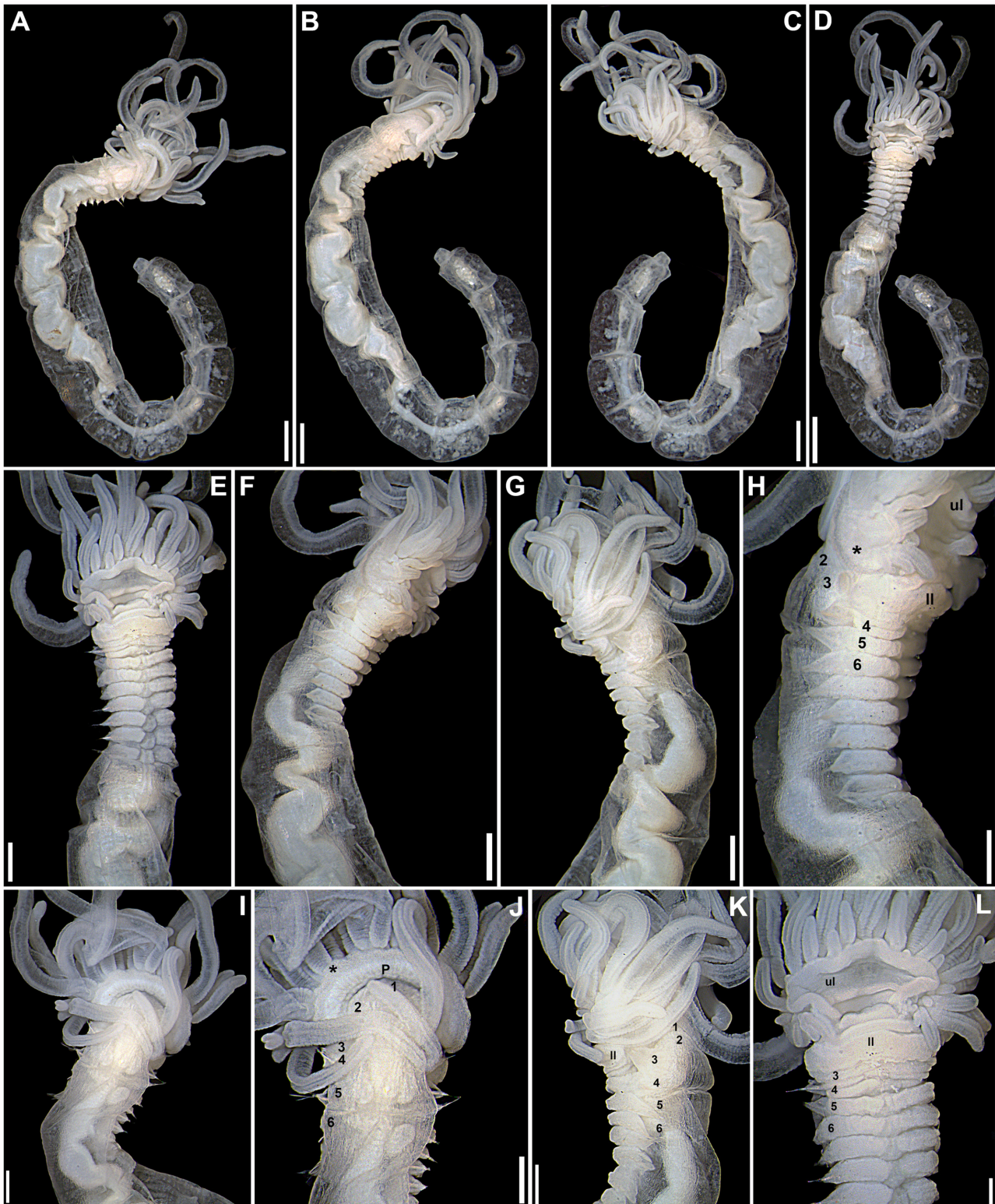
### ***Polycirrus rubrointestinalis* n. sp.**

(Figs 1A, 5G–K, 10–13)

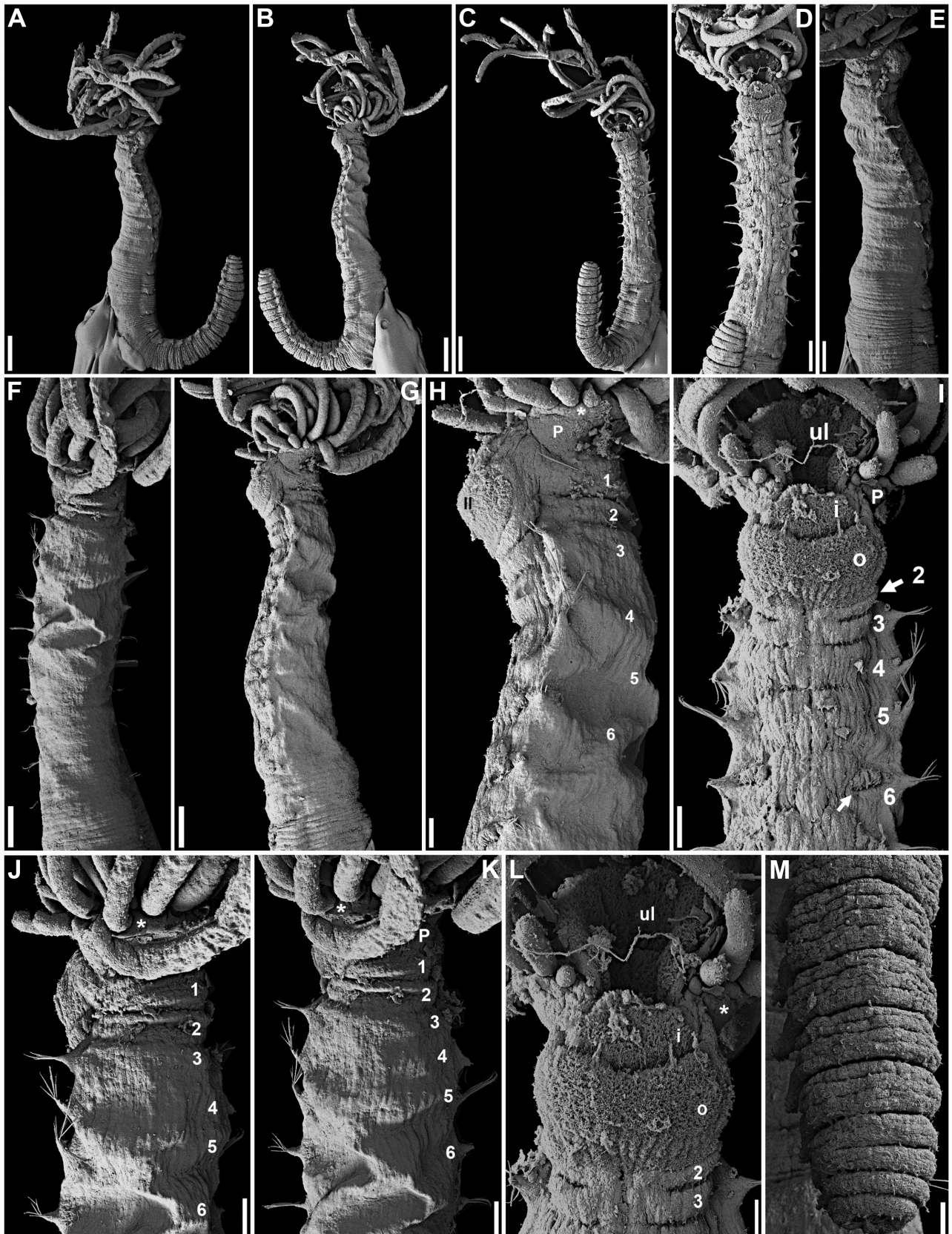
**Type material.** Holotype: AM W.47655, MI QLD 2193, 4 mm long, 1.0 mm wide, posteriorly incomplete, Mermaid Cove (buoy), 14°38'46"S, 145°27'13"E, coarse coral rubble, 7 m, 27 Aug 2010, CReefs. Paratypes: AM W.45457, MI QLD 2449 (on SEM pin), incomplete specimen, 1.5 mm long and 0.4 mm maximum width; AM W.47650, MI QLD 2449 (15), from 1–1.2 mm long and 0.1–0.3 mm maximum width; AM W.47651, MI QLD 2342 (on SEM pin); AM W.47658, MI QLD 2248 (on SEM pin), Bommie Bay, 14°39'41"S, 145°28'19"E, coarse coral rubble, 9 m, 12 Sep 2010, CReefs; AM W.47652 (6), from same locality; AM W.47653, MI QLD 2205 (3), south of Mermaid Cove, 14°38'53"S, 145°27'E, coarse coral rubble, 14.5 m, 1 Sep 2010, CReefs; AM W.47654, MI QLD 2205, south of Mermaid Cove, 14°38'53"S, 145°27'E, coarse coral rubble, 14.5 m, 1 Sep 2010, CReefs.

**Other material examined.** AM W.44266, MI QLD 2337 (2); AM W.44269, MI QLD 2342 (3); AM W.44598, MI QLD 2396; AM W.44602, MI QLD 2397; AM W.44606, MI QLD 2399; AM W.44618, MI QLD 2410; AM W.44619, MI QLD 2410 (2); AM W.47657, MI QLD 2410; AM W.44590, MI QLD 2396; AM W.47656, MI QLD 2202, MacGillivray Reef, 14°38'53"S, 145°29'11.760"E, coarse coral rubble, 14 m, Aug 2010, CReefs; AM W.47659, LI-10-062, MacGillivray Reef, deep reef slope, 14°39'25"S, 145°28'22"E, coral rubble, 7–12 m, 3 Sep 2010, CReefs.

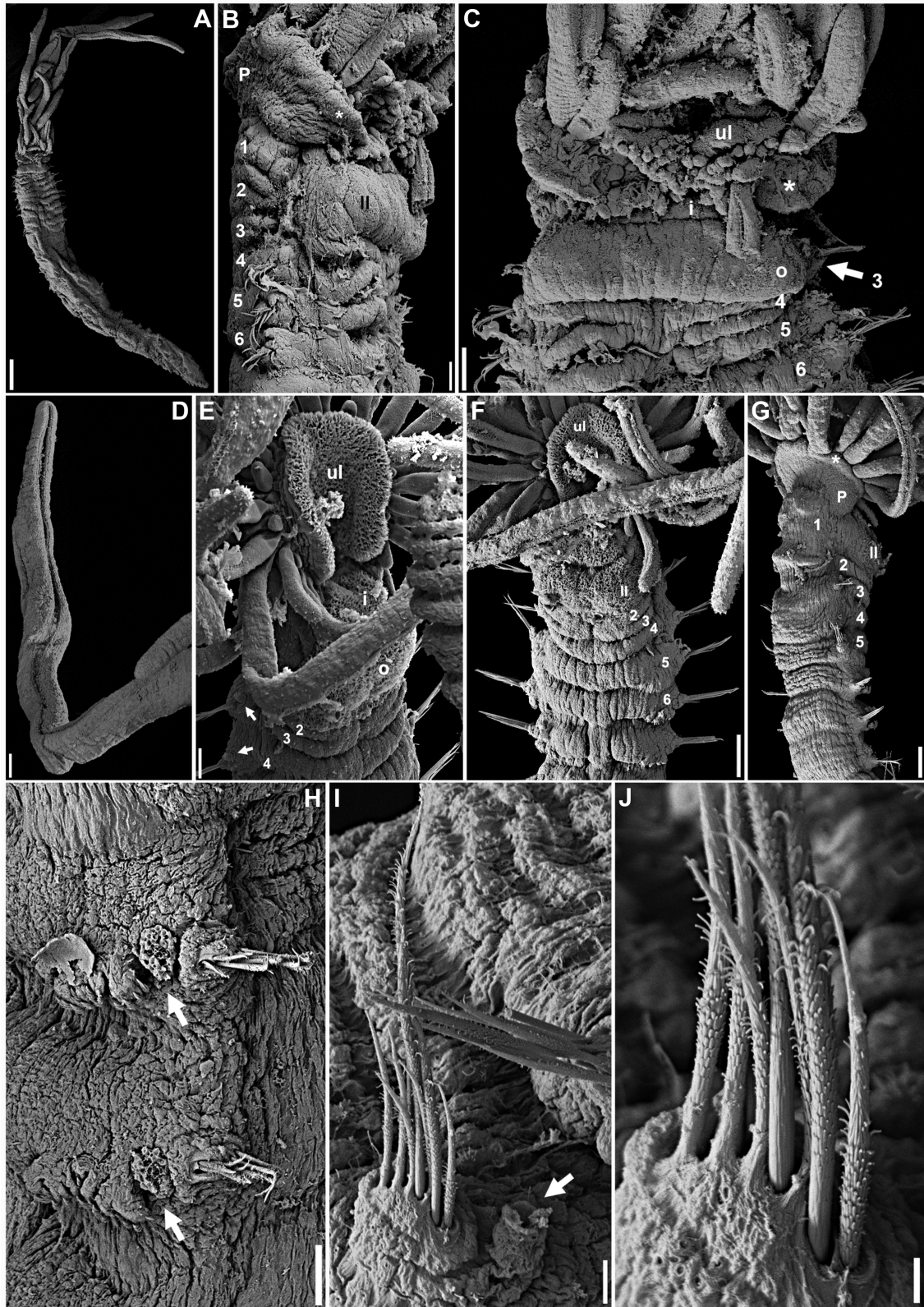
**Comparative material examined.** Holotype of *Polycirrus rosea*, AM W.196900.



**FIGURE 10.** *Polycirrus rubrointestinalis* n. sp., holotype AM W.47655. A–D. Entire incomplete worm, dorsal, right and left lateral, and ventral views (anteriorly), respectively; E–G. Thorax, ventral, right and left lateral views, respectively; H–I. Closer views of the thorax, right lateral and dorsal views, respectively; J–L. Close ups of the anterior end, dorsal, left lateral and ventral views, respectively. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–D = 0.4 mm, E–K = 0.2 mm, L = 0.1 mm.



**FIGURE 11.** *Polycirrus rubrointestinalis* n. sp., paratype AM W.47651. A–C. Entire worm, right and left lateral, and ventral (anteriorly) views, respectively; D–G. Thorax, ventral, right lateral, dorsal and left lateral views, respectively; H–K. Anterior end, left lateral, ventral and two dorsal views under slightly different angles, respectively; unspecified arrow in I points to first neuropodium; L. Close up of the oral area; M. Posterior end, left dorso-lateral view. Numbers refer to segments. Abbreviations: i = inner region of lower lip, ll = lower lip, o = outer region of lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–C = 300  $\mu$ m, D–G = 150  $\mu$ m, H = 50  $\mu$ m, I–K = 70  $\mu$ m, L–M = 40  $\mu$ m.



**FIGURE 12.** *Polycirrus rubrointestinalis* n. sp., paratype AM W.47658. A. Entire worm, ventral view; B–C. Close ups of the anterior end, right ventro-lateral and ventral views, respectively; D. Tip of tentacle. Paratype AM W.45457, E–G. Close ups of the anterior end, right ventro-lateral, ventral and right dorso-lateral views, respectively; H. Close up of parapodia of segments 6–7; I. Close up of notopodia of segments 4–5; J. Notochaetae from anterior row, segment 5. Numbers refer to segments; unspecified arrows point to nephridial and genital papillae. Abbreviations: i = inner region of lower lip, ll = lower lip, o = outer region of lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A = 700  $\mu$ m, B = 75  $\mu$ m, C–D, F = 100  $\mu$ m, E = 50  $\mu$ m, G = 150  $\mu$ m, H = 30  $\mu$ m, I = 10  $\mu$ m, J = 4  $\mu$ m.

**Description.** Minute worms, in life with whitish transparent body and buccal tentacles, and distinctly red anterior half of the digestive tract (Fig. 1A). Transverse prostomium attached to dorsal surface of upper lip; basal part as thick almost semicircular crest, distal part poorly developed, as low lobe of uniform length at base of upper lip (Figs 1A; 10A–B, H–J; 11B, E, G–L; 12B–C, G). Buccal tentacles of two types, both of almost uniform width, very slightly spatulated at tips, with deeper groove, long ones with slightly thinner, uniformly cylindrical peduncle before spatulated tip (Figs 1A; 10A–L; 11A–L; 12A–G). Peristomium forming lips; almost circular upper lip; swollen lower lip, divided in two parts, rectangular inner region, restricted to oral area, outer region large, cushion-like, rectangular, extending across ventrum (Figs 10B–H, K–L; 11A–E, G–I, L; 12A–C, E–G). Segment 1 reduced, only visible mid-dorsally, laterally covered by prostomium and ventrally by expanded lower lip; segment 2 same width as following segments, visible all around or covered by lower lip (Figs 10A–L; 11A–L; 12A–C, E–G). Smooth to slightly crenulated ventro-lateral pads of anterior segments, present until segment 12, although less conspicuous posteriorly (Figs 10B–H, K–L; 11C–E, G–I, L; 12A–C, E–F). Notopodia extending for 10 segments, until segment 12; short, conical notopodia, not clearly bilobed (Figs 10A–L; 11A–K; 12A–C, E–J; 13A–C). Broadly-winged notochaetae on both rows, wings only at tips of chaetae, conspicuous under light microscopy (Figs 5G–H; 12H–J; 13B–D). Neuropodia beginning from segments 5 or 6; neurochaetae as type 1 uncini, crest with single elongate and sharp tooth in first row above main fang, with two additional rows of shorter, irregularly sized teeth at base (Figs 5I–K; 13E–H). Nephridial and genital papillae present at bases of all notopodia, elongate, anterior to bases of notopodia anteriorly, between parapodial lobes and rounded after beginning of neuropodia (Figs 11C–D, G–I, L; 12B–C, E–I; 13A–B). Pygidium smooth (Figs 11A–D, M; 12A).

**Variation.** Among the specimens examined there was considerable variation in the morphology of the anterior end, including upper and lower lips, visibility of segment 2, and position of first pair of notopodia in relation to the lower lip. We attribute such variation to different degrees of muscular contraction at the time of preservation and it is important to document this observation, because these characters are useful to distinguish among species.

The upper lip is usually large, circular, but it may appear longer than wide, circular, or wider than long depending on muscular contraction, and when fully contracted the upper lip may be distinctly shorter (compare Figs 10D–F, H, L; 11C–D, I, L; 12B–C, E–F).

When the body is fully relaxed, segments 2 and 3 are visible ventrally (Figs 11A–L; 12E–G), but in most specimens, including the holotype, the first pair of notopodia originates at the level of the lower lip, the segment 2 is only visible dorsally and in some specimens not even the segment 3 is visible ventrally (Figs 10A–L; 12B–C).

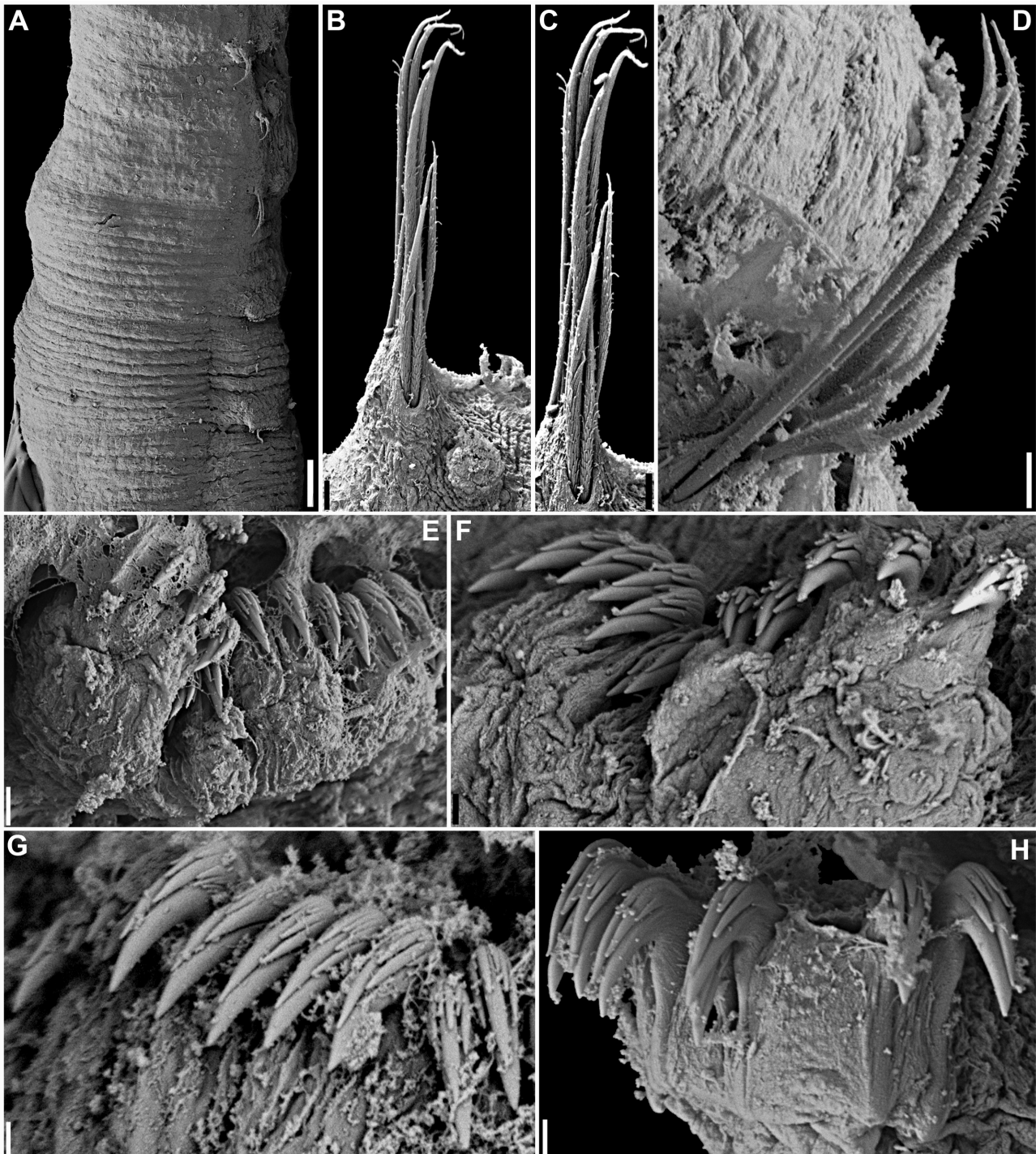
**Remarks.** Members of *P. rubrointestinalis* n. sp. are minute worms, with the distal part of prostomium restricted to the base of the upper lip; with large, rectangular and cushion-like lower lip extending across the ventrum; clearly defined, smooth to slightly crenulated ventro-lateral pads; 10 pairs of notopodia, extending until segment 12, not clearly bilobed and bearing winged notochaetae in both rows; neuropodia beginning anteriorly, from segments 5–6, with type 1 uncini throughout; and nephridial and genital papillae extending to the last pair of notopodia.

Several species of *Polycirrus* have neuropodia beginning from anterior segments, up to segment 10, but most of them have a larger number of pairs of notopodia, extending for more than 15 segments. Of the species of *Polycirrus* known prior to this study, seven have up to 15 pairs of notopodia and uncini beginning from up to segment 10, of those, only *P. pumilis* Hartmann-Schröder, 1990, *P. rosea* Hutchings & Murray, 1984, and *P. minutus* n. sp., all originally known from Australian waters, have type 1 uncini throughout.

*Polycirrus rubrointestinalis* n. sp. differs from *P. minutus* n. sp. because this latter species has short, button-like and mid-ventral lower lip, uncini beginning from the penultimate thoracic segment, segment 10, and nephridial and genital papillae are only present until segment 6.

*Polycirrus pumilis* described from northern New South Wales, Australia, shares several similarities with specimens of *P. rubrointestinalis* n. sp., such as similar body size, morphology of the anterior end, including upper and lower lips, and similar number of pairs of notopodia and segments on which neuropodia begin, 10–11 pairs and segment 7 in *P. pumilis*, respectively, 10 pairs and segments 5–6 in *P. rubrointestinalis* n. sp. Members of these species differ, however, because in *P. pumilis* chaetae of both rows are pinnate, and nephridial and genital papillae are inconspicuous (Glasby & Hutchings 2014).





**FIGURE 13.** *Polycirrus rubrointestinalis* n. sp., paratype AM W.47651. A. Transition between thorax and abdomen; B–C. Progressively closer views of one notopodium of segment 5; E–F. Thoracic neuropodia, segments 6 (1<sup>st</sup> neuropodium) and 11, respectively; G–H. Abdominal neuropodia, segments 13 (1<sup>st</sup> abdominal) and posterior one, respectively. Paratype AM W.47658, D. notochaetae, segment 7. Scale bars: A = 70  $\mu$ m, B–C = 7  $\mu$ m, D = 10  $\mu$ m, E = 4  $\mu$ m, F–H = 2  $\mu$ m.

*Polycirrus rosea*, also originally described from New South Wales, Australia, shares with *P. rubrointestinalis* n. sp. similar dimensions of the body, morphology of the anterior end and ventro-lateral pads, number of pairs of notopodia and type of notochaetae present, and uncinal morphology. These species are distinguished, however, because neuropodia begin on segment 10, and nephridial and genital papillae are inconspicuous among members of *P. rosea* (Glasby & Hutchings 2014); in contrast, in *P. rubrointestinalis* the neuropodia begin on segments 5 or 6 and nephridial and genital papillae are conspicuous.

**Etymology.** The specific name “*rubrointestinalis*” refers to the red anterior half of the digestive tract. During

the Lizard Island Taxonomic Workshop, members of this species, which were abundant in our collections, were called as “red gut *Polycirrus*”, because this character is very distinctive in live specimens.

**Habitat.** Common species in shallow water around Lizard Island, in amongst coral rubble.

**Type locality.** Mermaid Cove (buoy), 14°38'46"S, 145°27'13"E, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard Region.

***Polycirrus papillatus* n. sp.**

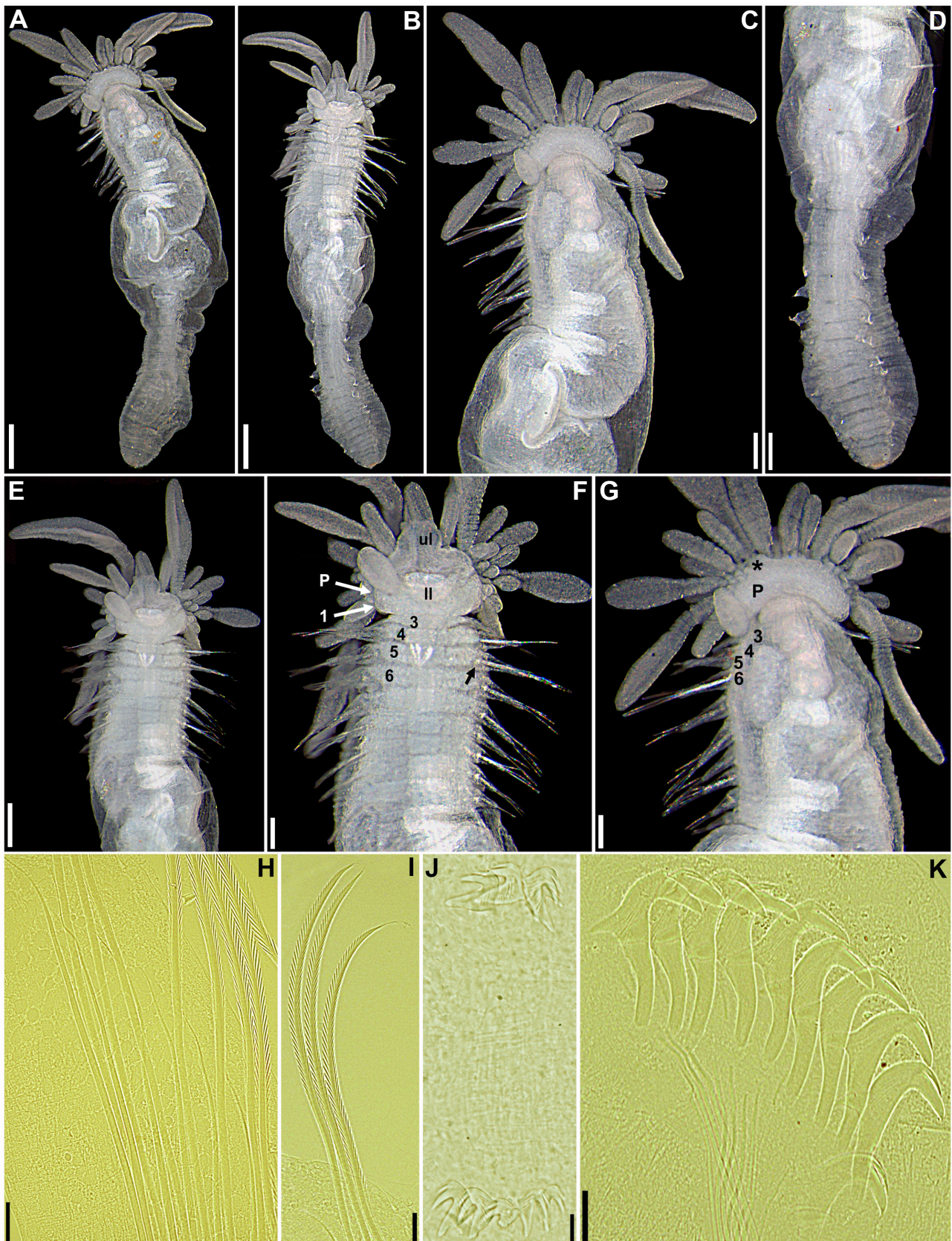
(Figs 14–17)

**Type material.** Holotype: AM W.45149, MI QLD 2442, complete specimen, in good state of preservation, ~1.9 mm long, 0.4 mm maximum width. Paratypes: AM W.47661 (1 mounted on SEM pin), North Direction Island, lagoon patch reef, 14°44'43"S, 145°30'18"E, 4 Sep 2010, CReefs; AM W.47660, MI QLD 2396; AM W.44271, MI QLD 2344; AM W.44622, MI QLD 2413 (on SEM pin); AM W.44527, MI QLD 2387 (2, 1 mounted on slide); AM W.47690, MI QLD 2203.

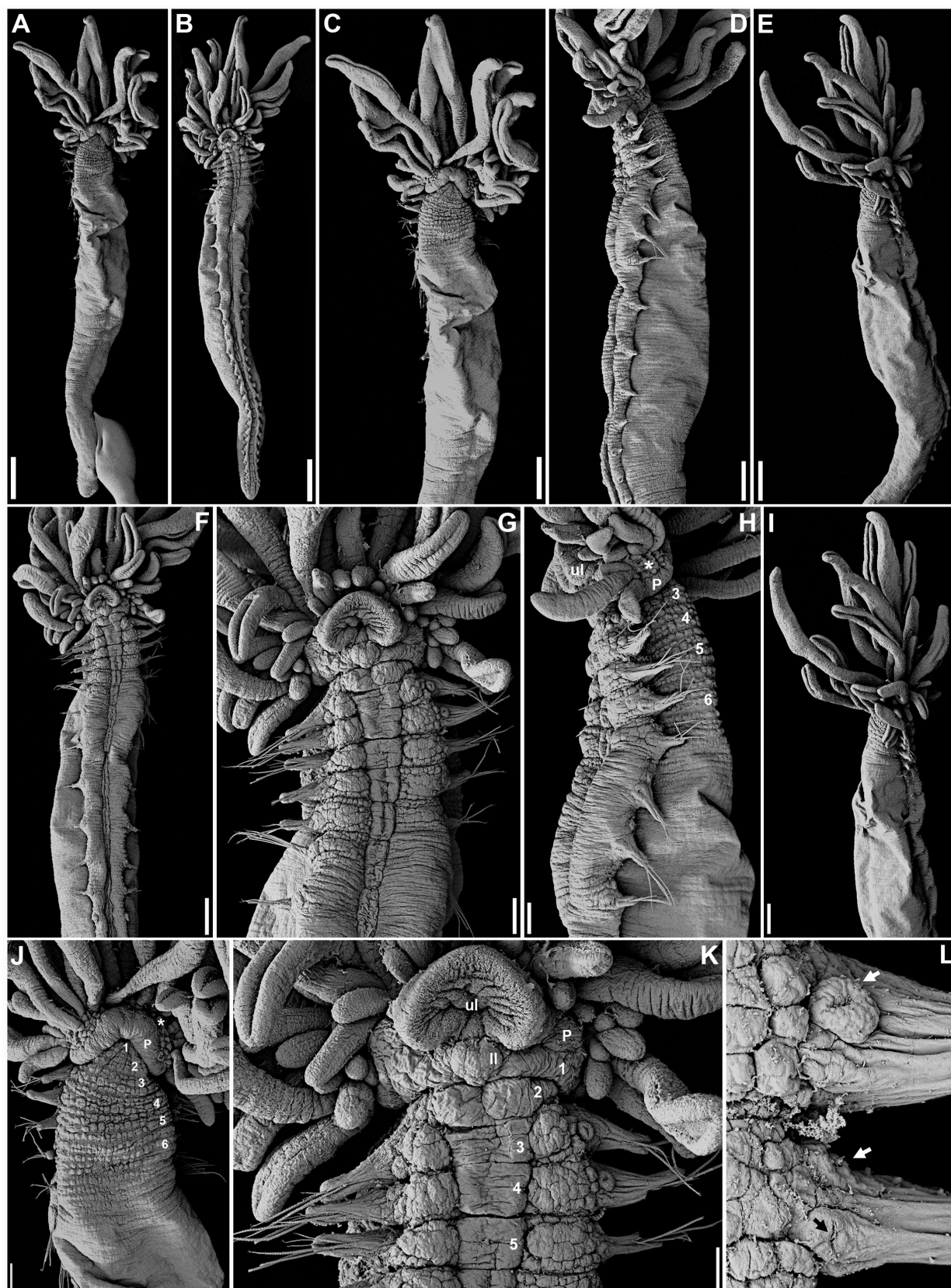
**Description.** Minute worms, with transverse prostomium attached to dorsal surface of base of upper lip; basal part as thick, curved crest, distal part poorly developed, as low lobe of uniform length at base of upper lip (Figs 14A–C, E–G; 15A–K; 16B–C). Buccal tentacles of two types, both of almost uniform width, spatulated at tips, with deeper groove, long ones with slightly thinner, uniformly cylindrical peduncle before spatulated tip (Figs 14A–C, E–G; 15A–K; 16A–C). Peristomium forming lips; short, circular upper lip, hood-like; short, swollen lower lip, button-like, restricted to oral area (Figs 14B, E–F; 15B, F–H, K; 16B–C). Segment 1 reduced, visible dorsal and ventrally, laterally covered by expanded prostomium; segment 2 visible all around, distinctly narrower than following segments, with relatively large, rectangular mid-ventral shield (Figs 14A–C, E–G; 15A–K; 16B–C). Highly papillated ventro-lateral pads of anterior segments, pads present until segment 11, last 2 pairs poorly developed; segments 12–14, last 3 segments with notopodia, distinctly swollen, pads inconspicuous (Figs 14B, D–F; 15B, D, F–H, K; 16B–C). Notopodia extending for 11–12 segments, until segments 13–14; elongate, bilobed notopodia, lobes of same size (Figs 14A–G; 15A–L; 16A–C; 17A–B, D, F). Narrowly-winged, acicular noto chaetae in anterior row, with fewer chaetae, pinnate chaetae in posterior row; winged chaetae distinctly shorter, wings inconspicuous under light microscopy, as short hairs under SEM (Figs 14H–I; 17A–F). Neuropodia beginning from segment 5, first and second pairs of neuropodia with 1–2 uncini only at each side (Fig. 15L); minute, type 1 uncini until first segment after termination of notopodia, with short, triangular heel directed posteriorly, single, elongate and sharp tooth in first row above main fang, with two rows of shorter, irregularly sized teeth at base, and short neck (Figs 14J; 17F–G); and larger, type 2 uncini from second abdominal segment, with thin, elongate prow and heel, the latter obliquely directed downwards, crest with single elongate and sharp tooth on first row above main fang, surrounded by crown of minute teeth at base, and elongate neck (Figs 14K; 17H–I). Nephridial and genital papillae present at bases of all notopodia, ventral to notopodia on segments 3–4, anterior to notopodia after beginning of neuropodia (Figs 15B, D, F–H, K–L; 16B–C; 17A, F). Pygidium smooth (Figs 14A–B, D; 15A–B; 16A–B, D).

**Variation.** We noticed considerable variation amongst the material examined, regarding anterior end characters, which are commonly used for species distinction in this genus. The upper lip may have thinner, convoluted walls, or stouter, straight margins (compare Figs 14A–B, E–F; 15B, F–G, K; 16B–C). We attribute these to methods of preservation and consider it as an intraspecific variation. In addition, there is also a slight variation in the number of pairs of notopodia present, as most specimens, including the holotype, have 12 pairs, extending until segment 14, while some others, such as paratype AM W.44622 (mounted on SEM pin), have only 11 pairs, on segments 3–13 (Fig. 16A–C).

**Remarks.** This is another species of minute worms a few millimeters in length, with the distal part of prostomium at the base of the upper lip; button-like lower lip; clearly defined and highly papillated ventro-lateral pads; 12 pairs of notopodia, on segments 3–14, with evenly-sized lobes, winged chaetae in anterior row of noto chaetae and pinnate chaetae in posterior row; neuropodia beginning anteriorly, from segment 5, with type 1 uncini on thoracic chaetigers, and type 2 from the second abdominal segment; and nephridial and genital papillae extending until the last pair of notopodia.



**FIGURE 14.** *Polycirrus papillatus* n. sp., holotype AM W.45149. A–B. Entire worm, dorsal and ventral views, respectively; C. Anterior end, dorsal view; D. Posterior end, ventral view; E. Anterior end, ventral view; F–G. Close ups of the anterior end, ventral and dorsal views, respectively, arrow points to first neuropodium; H. Notochaetae of anterior row, segment 4; I. Tips of notochaetae of posterior row, segment 4; J. Uncini, segments 7–8; K. Uncini, segment 18. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 200  $\mu$ m, C–E = 100  $\mu$ m, F–G = 70  $\mu$ m, H–I = 30  $\mu$ m, J = 7  $\mu$ m, K = 20  $\mu$ m.

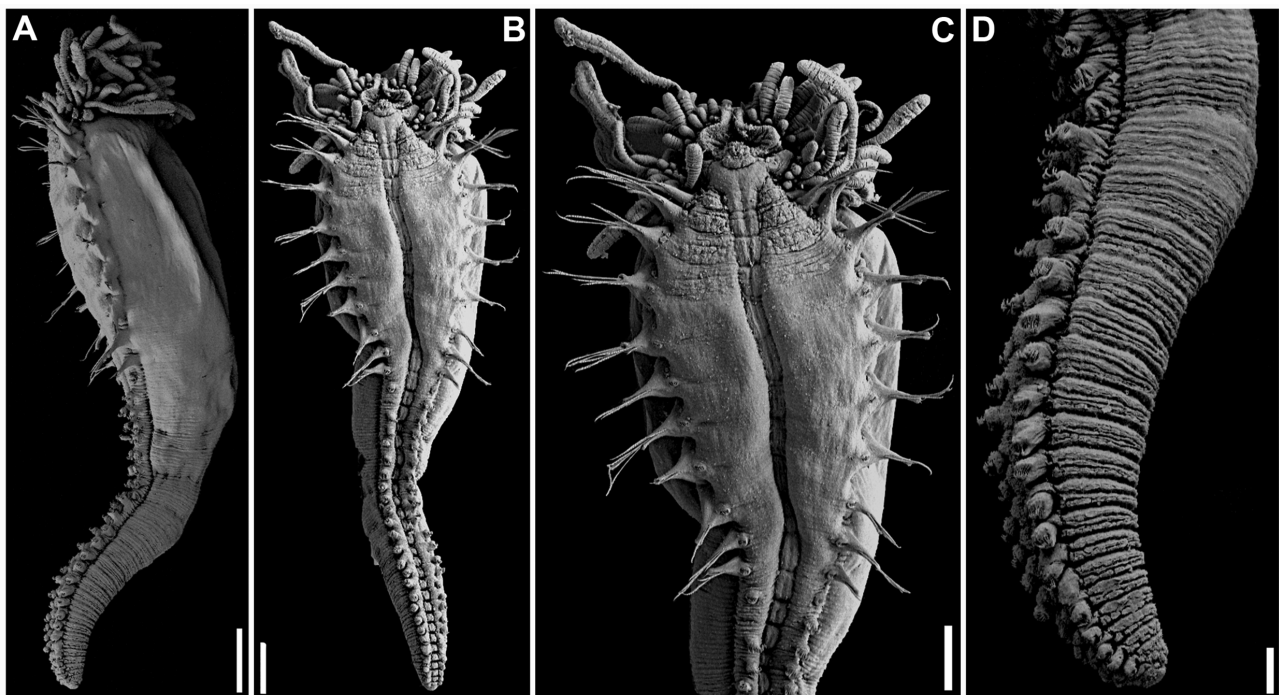


**FIGURE 15.** *Polycirrus papillatus* n. sp., paratype AM W.47661. A–B. Entire worm, dorsal and ventral views, respectively; C. Anterior end, dorsal view; D–F. Thorax, left lateral, right dorso-lateral and ventral views, respectively; G–J. Anterior end, ventral, left lateral, right dorso-lateral and dorsal views, respectively; K. Close up of the anterior end, ventral view; L. Notopodia, segments 4–5, white arrows point to nephridial papillae, black arrow points to first neuropodium. Numbers refer to segments. Abbreviations: Il = lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 400  $\mu$ m, C–D, F, I = 200  $\mu$ m, E = 300  $\mu$ m, G–H, J = 75  $\mu$ m, K = 50  $\mu$ m, L = 10  $\mu$ m.

The species with few pairs of notopodia and neuropodia beginning from anterior segments are the same as discussed for *P. rubrointestinalis* n. sp. with the addition of *P. norvegicus* Wollebaek, 1912, with 16 pairs of notopodia, on segments 3–18, since *P. papillatus* n. sp. has 12 pairs of notopodia. Of these species, however, only three have type 1 uncini on thoracic segments and type 2 uncini on abdomen: *P. clavatus* (Kinberg, 1867), *P. holthei* Londoño-Mesa & Carrera-Parra, 2005, and *P. porcatus* Knox & Cameron, 1971, this latter species originally described from Port Phillip Bay, Victoria, Australia.

*Polycirrus clavatus* is distinguished from *P. papillatus* n. sp. in having 15 pairs of notopodia, on segments 3–17, with pinnate chaetae in both rows, and nephridial and genital papillae are absent on last pairs of notopodia, only present until segment 11 (Carrerette & Nogueira 2013; Glasby & Hutchings 2014).

*Polycirrus holthei* also has pinnate chaetae in both rows of notochaetae (Glasby & Hutchings 2014), while the holotype of *P. porcatus*, originally described from Victoria, differs from *P. papillatus* n. sp. in having the same type of chaetae on both rows, although we suspect from the line drawings provided by Glasby & Hutchings (2014: 95, Fig. 52c) that these chaetae would appear pinnate under SEM, instead of “hirsute”, as described originally by Knox & Cameron (1971); and uncini with conspicuous dorsal button below main fang (Glasby & Hutchings 2014), while in *P. papillatus* n. sp. the dorsal button is inconspicuous.



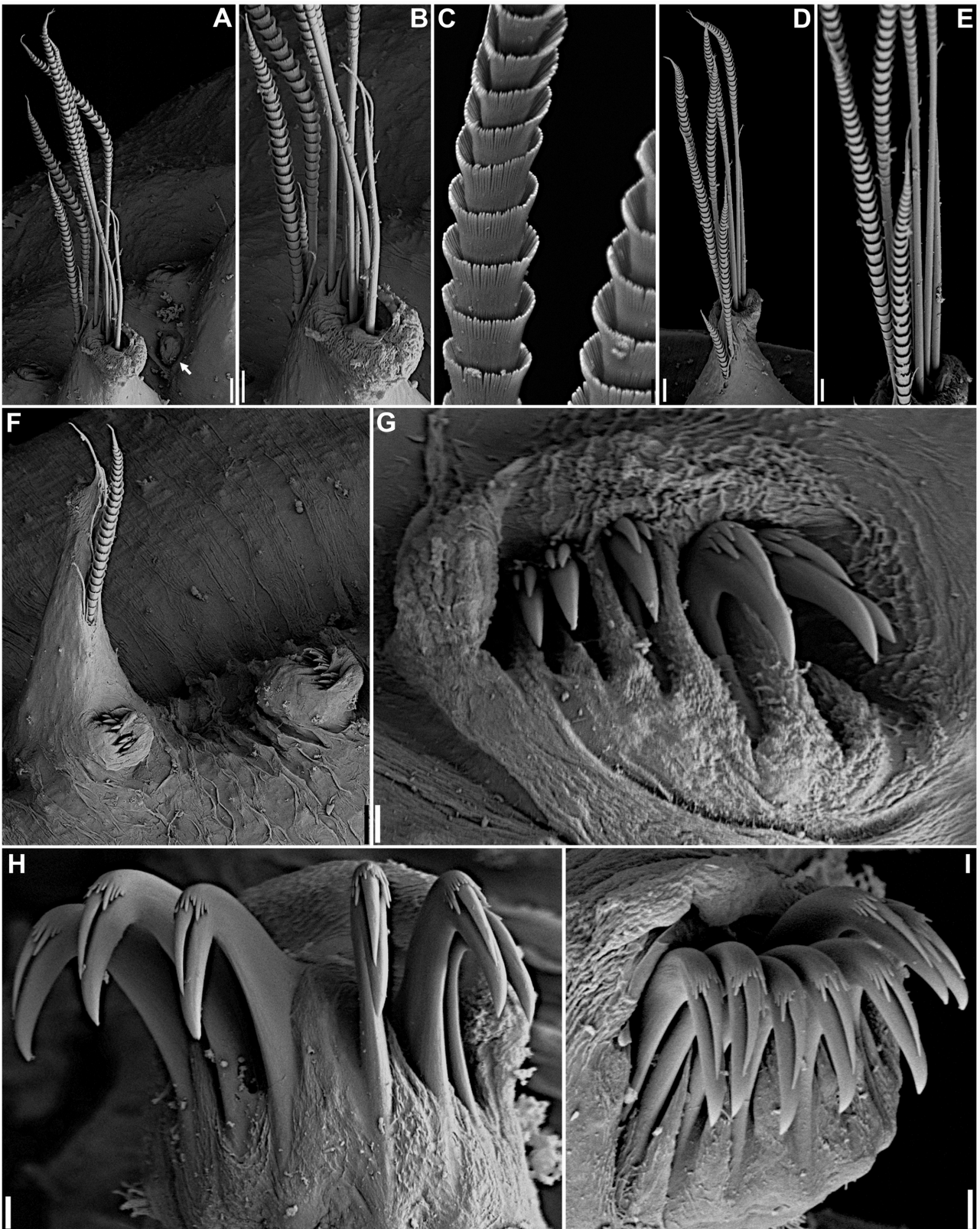
**FIGURE 16.** *Polycirrus papillatus* n. sp., paratype AM W.44622. A–B. Entire worm, left dorso-lateral and ventral views, respectively; C. Thorax, ventral view; D. Posterior end, left lateral view. Scale bars: A–B = 0.4 mm, C = 0.2 mm, D = 0.1 mm.

**Etymology.** The specific name “*papillatus*” refers to the highly papillated ventral pads.

**Habitat.** Several sites around Lizard Island, North Direction Island and Yonge Reef in amongst *Halimeda*, and under rubble in shallow water.

**Type locality.** North West of Watson’s Bay, 14°39’41.2”S, 145°26’26”E, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard Island region.



**FIGURE 17.** *Polycirrus papillatus* n. sp., paratype AM W.47661. A–E. Progressively closer views of one notopodium and notochoetae of segment 7, under different magnifications and angles of visualization; arrow points to genital papilla of segment 8; F. Parapodia, segments 13–14, last thoracic and first abdominal segments; G–I. Neuropodia, segments 11 (thoracic), 15 and posterior one (both abdominal), respectively. Scale bars: A, D, F = 20  $\mu$ m, B = 15  $\mu$ m, C = 2  $\mu$ m, E = 10  $\mu$ m, G = 3  $\mu$ m, H = 4  $\mu$ m, I = 5  $\mu$ m.

***Polycirrus cruciformis* n. sp.**

(Figs 1B–C, 18–19)

**Type material.** Holotype: AM W.47663, MacGillivray Reef, 14°39'23"S, 145°29'31"E, CReefs, posteriorly incomplete, 5 mm in length, 1.5 mm in width. Paratype: AM W.47664, MI QLD 2380 (on SEM pin).

**Description.** Minute worm, a few mm in length; in life, orange to reddish body, with red buccal tentacles (Fig. 1B–C). Transverse prostomium attached to dorsal surface of base of upper lip; basal part as thick, curved to inverted V-shaped crest, distal part poorly developed, as low lobe of uniform length at base of upper lip (Figs 1B; 18A–J, L–M; 19A). Buccal tentacles of three types, short and intermediate tentacles narrower at bases and distally blunt, long tentacles densely papillated at tips, with narrow, cylindrical peduncle, distally widening towards cylindrical swelling and blunt, deeply grooved tip (Figs 18A–M; 19K–L). Peristomium forming lips; short, circular upper lip, hood-like; short, swollen lower lip, button-like, restricted to oral area (Fig. 18A–J, L–M). Segment 1 inconspicuous all around; segment 2 conspicuous, distinctly narrower than following segments, with relatively large, rectangular mid-ventral shield (Figs 18A–J, L–M; 19A). Highly papillated ventro-lateral pads of anterior segments, pads present until segment 9, less papillated posteriorly (Figs 18B–G, L–M; 19A). Notopodia extending for 8 segments, until segment 10, last pair much shorter; elongate, bilobed notopodia, lobes of equal size (Figs 18A–J, L–M; 19A–E). Narrowly-winged notochaetae in both rows (Fig. 19A–E). Neuropodia beginning from segment 11, first after termination of notopodia (Fig. 19A–B); type 1 uncini, with short, triangular heel directed posteriorly, single, elongate and sharp tooth in first row above main fang, with another row of shorter, irregularly sized teeth at base, medial tooth larger, and short neck (Fig. 19F–J). Nephridial and genital papillae present at bases of notopodia of segments 3–9, inconspicuous on last pair of notopodia (visible in life, Fig. 1B–C), genital papillae anterior and slightly ventral to notopodia (Figs 18B–G, L–M; 19A–B). Pygidium with rounded ventral papilla and crown of evenly sized rounded papillae (Figs 18A–C; 19M–O).

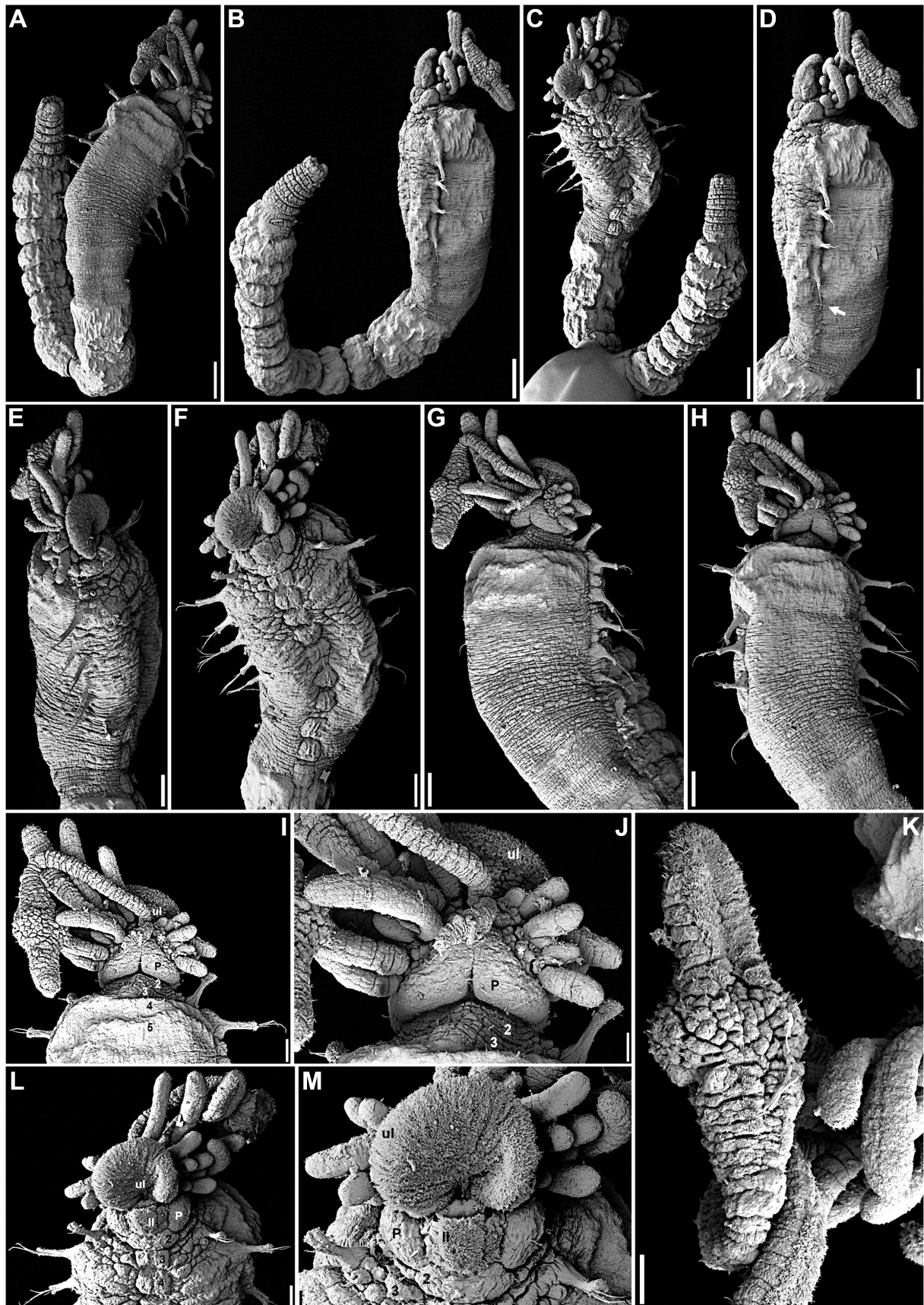
**Remarks.** *Polycirrus cruciformis* n. sp. is another minute worm, with the distal part of prostomium restricted to the base of the upper lip; button-like lower lip; highly papillated, not clearly defined ventro-lateral pads; only 8 pairs of notopodia, on segments 3–10, with narrowly-winged, acicular chaetae in both rows, wings inconspicuous under light microscopy; neuropodia beginning immediately after the termination of notopodia, on segment 11, and bearing type 1 uncini throughout; and nephridial and genital papillae conspicuous at bases of all notopodia, except for the last pair, which is distinctly shorter than the preceding ones. In addition, the long buccal tentacles of the holotype of *Polycirrus cruciformis* n. sp. are highly modified, progressively widening towards cylindrical papillate swelling, with blunt tip.

Among the species of *Polycirrus* known previously to the present study, 11 have up to 13 pairs of notopodia terminating up to segment 15, and neuropodia beginning after termination of notopodia; out of those, seven [*P. antarcticus* (Willey, 1902), *P. medusa* Grube, 1850, *P. papillosus* Carrerette & Nogueira, 2013, *P. parvus* Hutchings & Glasby, 1986, *P. paucidens* Hutchings & Glasby, 1986, *P. tessellatus* Hutchings & Glasby, 1986, and *P. variabilis* Hutchings & Glasby, 1986] have type 1 uncini throughout.

*Polycirrus antarcticus* has a large, rectangular lower lip extending across ventrum; 11 pairs of notopodia, until segment 13; neuropodia beginning three segments after the termination of notopodia, on segment 16; and inconspicuous or absent nephridial and genital papillae (Glasby & Hutchings 2014).

*Polycirrus medusa* is the type species of this genus and, although reported worldwide, for a long time it remained a largely unknown taxon, until Glasby & Hutchings (2014) designated a neotype from the type locality and provided a redescription for the species. However, several characters remain unknown due to the state of preservation of the neotype, such as the morphology of the buccal tentacles and the anterior end. Members of *P. medusa* differ from *P. cruciformis* n. sp. as they have 12 pairs of notopodia, extending until segment 14, with longer post-chaetal lobe and bearing pinnate chaetae in anterior row of notochaetae; and nephridial and genital papillae only extend until segment 8 (Glasby & Hutchings 2014).

Members of *P. papillosus* differ from those of *P. cruciformis* n. sp. in having the distal part of prostomium extending along the upper lip until near the anterior margin of the lip and spatulated long buccal tentacles. In addition, they also differ from *P. cruciformis* n. sp., as they have 11–14 pairs of notopodia, with pinnate chaetae in anterior row of notochaetae, and inconspicuous to absent nephridial and genital papillae (Carrerette & Nogueira 2013).



**FIGURE 18.** *Polycirrus cruciformis* n. sp., paratype AM W.47664. A–C. Entire worm, dorsal, left lateral and ventral views (anteriorly), respectively; D–H. Thorax, left lateral, right ventro-lateral, ventral, right dorso-lateral and dorsal views, respectively, arrow in C points to last notopodium; I–J. Close ups of the anterior end, dorsal view, in progressively higher magnifications; K. Close up of the tip of a long buccal tentacle; L–M. Close ups of the anterior end, ventral view, in progressively higher magnifications. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–C = 150  $\mu$ m, D–H = 100  $\mu$ m, I, L = 50  $\mu$ m, J = 30  $\mu$ m, K = 40  $\mu$ m, M = 20  $\mu$ m.





**FIGURE 19.** *Polycirrus cruciformis* n. sp., paratype AM W.47664. A. Close up of the thorax, left lateral view, arrow points to last notopodium; B. Close up of parapodia of segments 9–11; C–D. Notopodia, segments 9 and 6–7, respectively; E. Close up of one notopodium of segment 7; F–H. Neuropodia, segments 11, 14 and posterior one, respectively; I–J. Close ups of posterior uncini; K–L. Close ups of one long tentacle, in progressively higher magnifications; M–N. Posterior end, dorsal and left dorso-lateral views, respectively; O. Close up of the pygidium, left dorso-lateral view. Scale bars: A = 60  $\mu\text{m}$ , B = 20  $\mu\text{m}$ , C = 8  $\mu\text{m}$ , D, L = 15  $\mu\text{m}$ , E = 5  $\mu\text{m}$ , F = 3  $\mu\text{m}$ , G = 2  $\mu\text{m}$ , H–J = 1  $\mu\text{m}$ , K = 30  $\mu\text{m}$ , M–N = 40  $\mu\text{m}$ , O = 10  $\mu\text{m}$ .

*Polycirrus parvus* originally described from Western Australia is separated from *P. cruciformis* n. sp., because *P. parvus* has long buccal tentacles spatulated; larger, cushion-like lower lip; 10 pairs of notopodia, extending until segment 12; uncini somewhat intermediate between types 1 and 2, with elongate neck, but otherwise as type 1; and inconspicuous to absent nephridial and genital papillae (Glasby & Hutchings 2014).

*Polycirrus paucidens* was also originally described from Australian waters, from Bass Strait, southern Australia. Members of this species are different from those of *P. cruciformis* n. sp. as the former have the distal part of prostomium extending until near the anterior margin of the upper lip; notopodia with longer post-chaetal lobe; neuropodia bearing intermediate uncini between types 1 and 2, with elongate neck but otherwise as type 1; and inconspicuous to absent nephridial and genital papillae (Glasby & Hutchings 2014).

*Polycirrus tessellatus* is another Australian species, only known from Victoria. Members of this species also differ from those of *P. cruciformis* n. sp. in having the distal part of prostomium extending until near the anterior margin of the upper lip; larger lips, the lower lip cushion-like across ventrum, reaching segment 3; 10 pairs of notopodia, extending to segment 12; and neuropodia beginning from segment 15, with a gap of two achaetous segments between termination of notopodia and beginning of neuropodia (Glasby & Hutchings 2014).

Finally, *P. variabilis* was originally described from material from the Lizard Island Group and differs from the holotype of *P. cruciformis* n. sp. because *P. variabilis* has the distal part of prostomium extending until near the anterior margin of the upper lip; the long buccal tentacles are spatulated; larger lower lip, cushion-like, extending across ventrum; 10–15 pairs of notopodia, with longer post-chaetal lobe; and nephridial and genital papillae inconspicuous or absent (Glasby & Hutchings 2014).

**Etymology.** The specific name “*cruciformis*” refers to the shape of the tips of long buccal tentacles, with subdistal cylindrical inflation and blunt tip, from the Latin “*crucis*” = cross.

**Habitat.** Found in amongst beds of *Halimeda* at 12 m.

**Type locality.** MacGillivray Reef, 14°39'23"S, 145°29'31"E, Lizard Island Group, Great Barrier Reef, Australia

**Distribution.** Known only from the Lizard Island region.

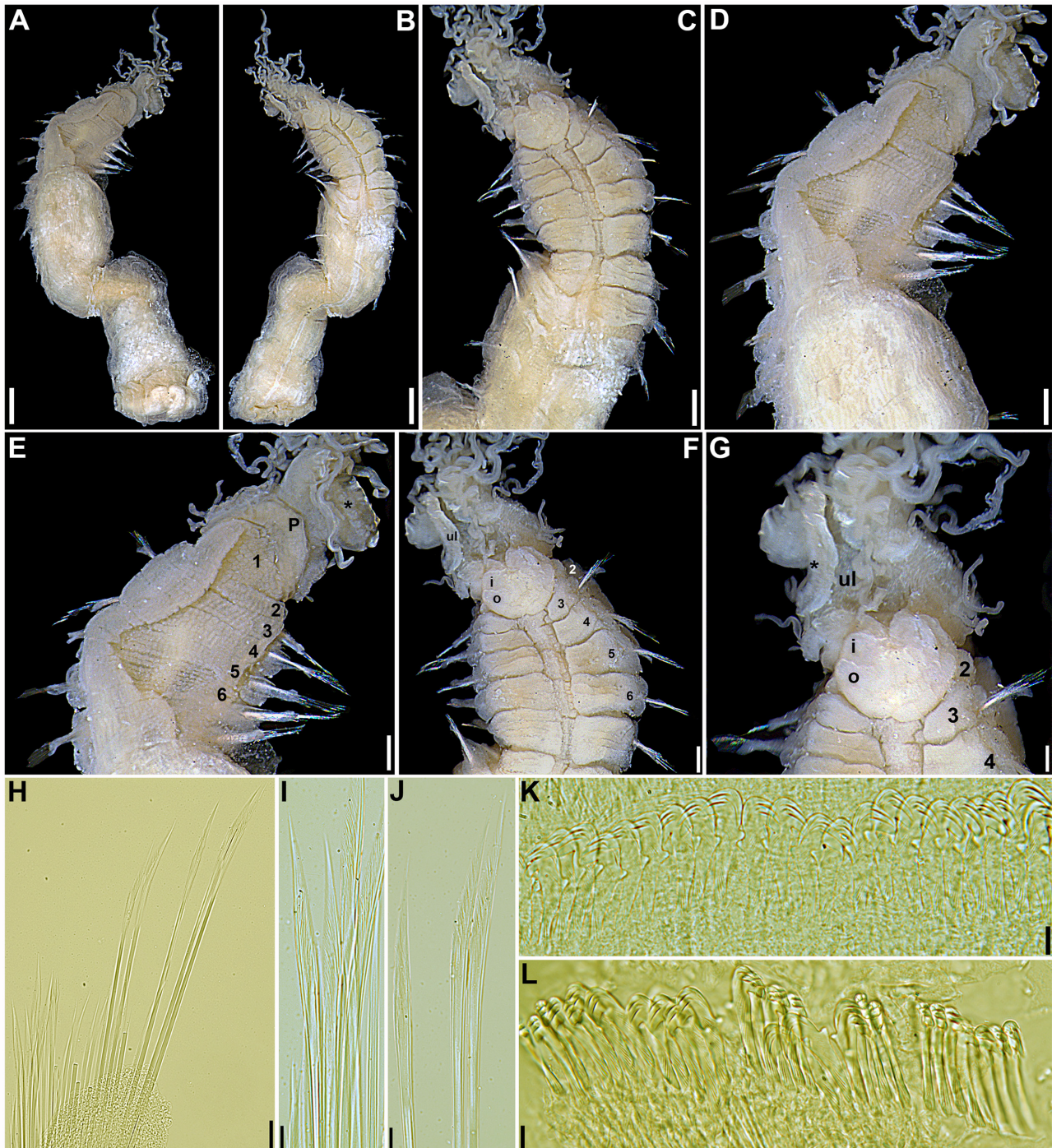
### ***Polycirrus culcita* n. sp.**

(Fig. 20)

**Type material.** Holotype: AM W.47643, Watsons Bay, 100 m of Chinamans Ridge, soft sediments with patchy seagrasses, 9 m, coll. Jones & Short, hand corer, 13 Oct 1978, incomplete, in good state of preservation, an anterior fragment with 20 segments, ~9 mm long, 1.3 mm maximum width, at end of fragment.

**Comparative material examined.** Holotype of *Polycirrus parvus*, AM W.199628. Paratypes of *Polycirrus parvus*, AM W.199630 and AM W.199631. Paratypes of *Polycirrus tessellatus*, AM W.199468, AM W.199469.

**Description.** Transverse prostomium attached to dorsal surface of upper lip; basal part as thick, horseshoe-shaped crest, distal part extending along upper lip and terminating near anterior margin (Fig. 20A–G). Few buccal tentacles remaining, all almost uniformly cylindrical, relatively thin and elongate (Fig. 20A–G). Peristomium forming lips; large upper lip, convoluted, longer than wide; lower lip divided in two regions, inner region button-like, outer region cushion-like, rounded and deeply corrugated, extending far from oral area, but not covering entire ventrum (Fig. 20A–G). Segment 1 only visible dorsally, relatively large, covered by expanded prostomium and lower lip laterally and ventrally, respectively; segment 2 terminating ventro-laterally, also covered by expanded lower lip (Fig. 20A–G). Smooth, swollen, clearly defined ventro-lateral pads with transverse corrugations, extending until segment 9, then body distinctly swollen, with poorly defined segmentation and fragile body wall (Fig. 20A–D, F–G). Notopodia extending for 10 segments, until segment 12; elongate, bilobed notopodia, post-chaetal lobe longer (Fig. 20A–G). Broadly-winged notochaetae *sensu* Fitzhugh *et al.* (2015) in both rows, wings only at tips, striated, conspicuous under light microscopy (Fig. 20H–J). Neuropodia beginning from segment 15, third after termination of notopodia, first two pairs almost sessile, then as short pinnules; uncini with elongate neck, otherwise as type 1, crest with single elongate and sharp tooth per row in first two rows above main fang, with additional row of shorter, irregularly sized teeth at base, medial tooth larger, and conspicuous dorsal button (Fig. 20K–L). Nephridial and genital papillae inconspicuous throughout, at least under stereomicroscopy (Fig. 20A–G). Pygidium unknown.



**FIGURE 20.** *Polycirrus culcita* n. sp., holotype AM W.47643. A–B. Entire incomplete worm, dorsal and ventral views, respectively; C–D. Anterior end, dorsal and ventral views, respectively; E–G. Close ups of the anterior end, dorsal and two ventral views, in progressively higher magnifications; H. Notochaetae, segment 5; I–J. Close up of the tips of notochaetae from anterior and posterior rows, respectively, segment 5; K–L. Uncini, segments 16 and 20, respectively. Numbers refer to segments. Abbreviations: i = inner region of lower lip, ll = lower lip, o = outer region of lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 500  $\mu$ m, C = 300  $\mu$ m, D–F = 200  $\mu$ m, G = 100  $\mu$ m, H = 30  $\mu$ m, I–J = 10  $\mu$ m, K–L = 7  $\mu$ m.

**Remarks.** The holotype is the only known specimen of *P. culcita* n. sp., it is incomplete and ~1 cm long, with the distal part of prostomium extending until near the anterior margin of the upper lip; rounded, cushion-like lower lip; clearly defined, swollen ventro-lateral pads, smooth except for transverse corrugations; 10 pairs of notopodia, on segments 3–12, with longer post-chaetal lobe and bearing broadly-winged chaetae in both rows; neuropodia beginning on the third segment after the termination of notopodia, segment 15, and bearing uncini with elongate neck, but otherwise type 1; and with inconspicuous or absent nephridial and genital papillae.

Similarly to *Polycirrus cruciformis* n. sp., *P. culcita* n. sp. is a species with few pairs of notopodia and neuropodia beginning shortly after the termination of notopodia. So, the species morphologically most similar to *P. culcita* n. sp. are the same as those already discussed for *P. cruciformis* n. sp., with the addition of *P. mexicanus* Rioja, 1947, since *P. culcita* n. sp. has two more pairs of notopodia than *P. cruciformis*. *Polycirrus cruciformis* n. sp. and *P. culcita* n. sp. differ because the former species has the distal part of prostomium restricted to the base of the upper lip; button-like and mid-ventral lower lip; 8 pairs of notopodia, with evenly sized lobes; neuropodia beginning from the first segment after the termination of notopodia, with typical type 1 uncini, with short neck; and nephridial and genital papillae present until segment 9. The holotype of *P. culcita* n. sp., on the other hand, has the distal part of prostomium extending along the upper lip until near the anterior margin of the lip; cushion-like, rounded lower lip, extending across ventrum and reaching segment 3; 10 pairs of notopodia, extending to segment 12 and with longer post-chaetal lobe; neuropodia beginning on the third segment after the termination of notopodia, segment 15, with type 1 uncini with elongate neck; and nephridial and genital papillae are inconspicuous or absent.

*Polycirrus antarcticus* has the distal part of prostomium restricted to the base of the upper lip; large, rectangular lower lip extending across ventrum; 11 pairs of notopodia, until segment 13, with evenly sized lobes; and type 1 uncini with short neck (Glasby & Hutchings 2014).

Members of *P. medusa* differ from the holotype of *P. culcita* n. sp., as they have 12 pairs of notopodia, extending until segment 14 and bearing pinnate chaetae in anterior row of notochaetae; and nephridial and genital papillae are present until segment 8 (Glasby & Hutchings 2014).

*Polycirrus mexicanus* is a poorly known species, for which type material could not be located by Hutchings & Glasby (2014), thus, only the original description, missing several important characters, is available. According to Rioja (1947), members of *P. mexicanus* have 14–18 pairs of notopodia, with pinnate chaetae in posterior row; and uncini with similar morphology to those of *P. culcita* n. sp., but with a single tooth above main, while in our specimen there are three rows of secondary teeth.

Members of *P. papillosus* have tessellated, highly papillated ventro-lateral pads; 11–14 pairs of notopodia, with pinnate chaetae in anterior row of notochaetae; and neuropodia beginning from the second abdominal segment, with type 1 uncini with short neck (Carrerette & Nogueira 2013).

Another Australian species, *P. parvus* described from north-west Australia from depths of 40–80 m, is separated from the holotype of *P. culcita* n. sp. because its members have neuropodia beginning from the second segment after notopodia terminate (Glasby & Hutchings 2014). They also differ in the relative proportions of the upper lip, in *P. parvus* the anterior extension of the lip is much shorter than in *Polycirrus culcita* n. sp., where the upper lip is almost three times longer than wide.

*Polycirrus paucidens* is different from the holotype of *P. culcita* n. sp. because *P. paucidens* has 7–9 pairs of notopodia; neuropodia beginning slightly more posteriorly, bearing intermediate uncini between types 1 and 2 (Glasby & Hutchings 2014) but with a morphology different from those of *P. culcita* n. sp.

Members of *P. tesselatus* Hutchings & Glasby, 1986 differ from *P. culcita* n. sp. in having tessellated ventro-lateral pads and nephridial and genital papillae extending to segment 10 (Glasby & Hutchings 2014). The paratypes of *P. tesselatus*, while having tessellated ventral pads they lack a distinct ventral groove, which is very conspicuous in *P. culcita* n. sp.

Finally, *P. variabilis* Hutchings & Glasby, 1986, known from material from the Lizard Island region, differs from the holotype of *P. culcita* n. sp. because members of this species have larger lower lip, rectangular; tessellated ventro-lateral pads; narrowly-winged, acicular notochaetae; and type 1 uncini with short neck and 1–2 rows of secondary teeth (Glasby & Hutchings 2014).

**Etymology.** The specific name “*culcita*” refers to the expanded lower lip in this species and derives from the Latin.

**Habitat.** Soft sediments with patchy seagrasses, 9 m.

**Type locality.** 100 m of Chinamans Ridge, 14°40’S, 145°28’E, Watsons Bay, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard Island region.

## *Polycirrus variabilis* Hutchings & Glasby, 1986

*Polycirrus variabilis* Hutchings & Glasby 1986: 345–347, figs 11, 12e.

*Polycirrus variabilis*.—Glasby & Hutchings 2014: 108–109, fig. 61.

**Type material.** Holotype: AM W.199538, Lizard Island lagoon, 14°40'S, 145°27'E, 1977.

**Other material examined.** Queensland, Lizard Island, AM W.45141 (2), MI QLD 2435.

**Remarks.** This species was recently redescribed (Glasby & Hutchings 2014) and our specimens are in agreement with that redescription, having notopodia on segments 3–18, neuropodia beginning on segment 19, and similar general morphology of the anterior end and the ventral pads. The species was originally described from Lizard Island.

**Habitat.** In coral substrate, 7–12 m.

**Type locality.** 14°40'S, 145°27'E, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Only known from the Lizard Island region.

## *Polycirrus brutus* n. sp.

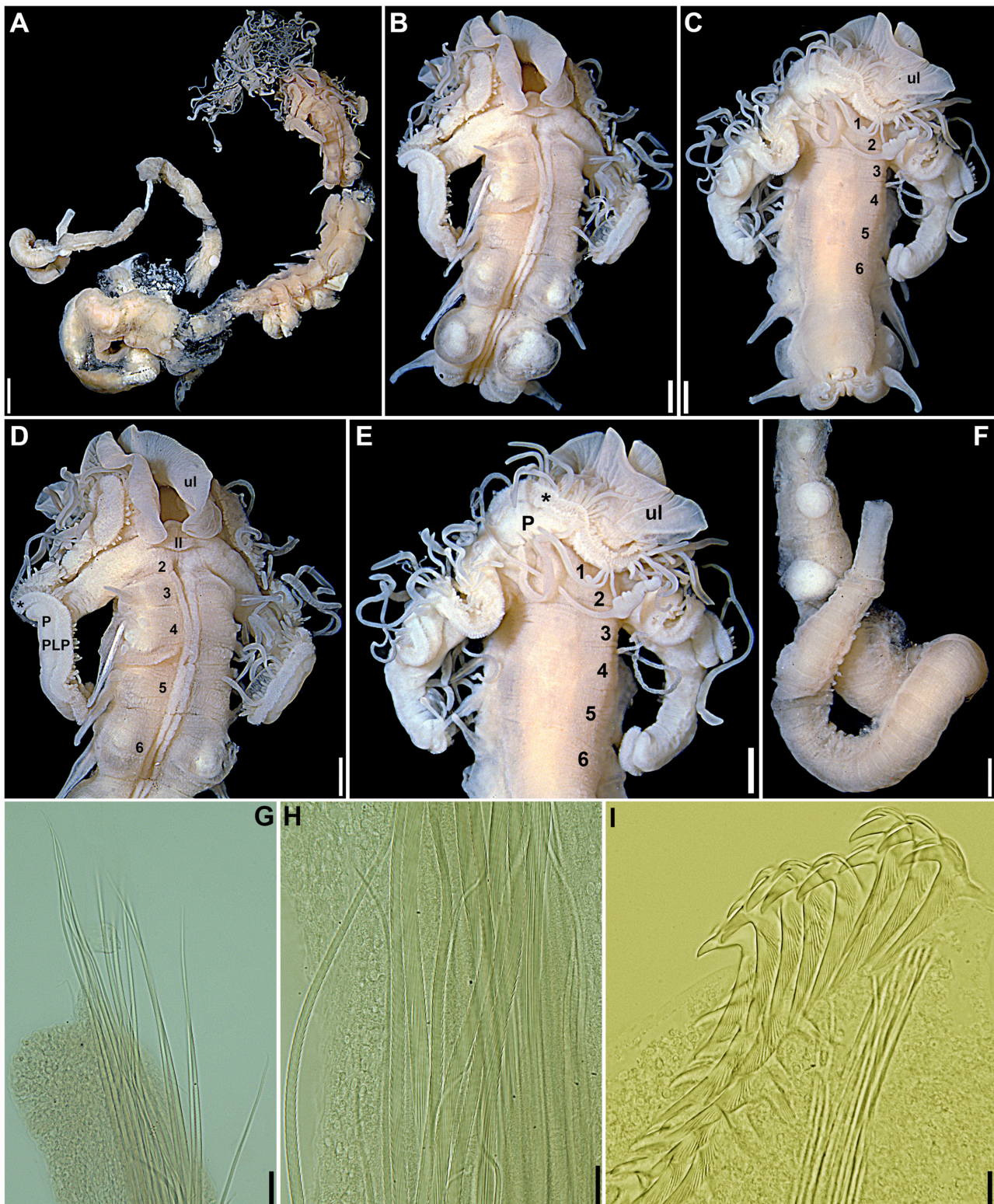
(Fig. 21)

**Type material.** Holotype: NTM W.023152, Palfrey Island, 14°41'28.572"S, 145°26'29.940"E, 10 m, coll. Coleman & Smith, 9 Apr 2008, apparently complete specimen, in four pieces, some centimetres long, not measured due to state of preservation. Paratype: AM W.47691, CReefs, LI-10-021, Mrs Watson Beach, 14°39'41"S, 145°22'27"E, 10 m.

**Description.** Transverse prostomium attached to dorsal surface of upper lip; prostomium projecting laterally as one deeply grooved, tentacular prostomial process at each side; basal part as thick crest across dorsum, extending laterally and posteriorly, covering segment 1 laterally and terminating lateral to lower lip; poorly developed distal part, at base of upper lip, also extending along prostomial lateral processes (Fig. 21A–E). Few buccal tentacles remaining, of two types, short tentacles uniformly cylindrical, long ones slightly spatulated at tips (Fig. 21A–E). Peristomium forming lips; elongate and narrow upper lip, distinctly longer than wide, convoluted; small, button-like lower lip (Fig. 21A–E). Segment 1 only conspicuous mid-dorsally; segment 2 reduced, visible all around; body of uniform width and segments progressively longer until segment 10, then abruptly tapering to uniformly cylindrical posterior body, beginning from the termination of notopodia; large anterior abdominal segments, with thin body wall and poorly marked segmentation, posterior body with clearly defined, compacted segments (Fig. 21A–F). Slightly papillated, poorly defined ventro-lateral pads, present on segments 3–15, last pairs smaller (Fig. 21A–B, D). Notopodia extending for 13 segments at least (depending on the specimen being complete anteriorly), until segment 15; distinctly elongate, bilobed notopodia, lobes of equal size, first pair shorter (Fig. 21A–E). Paratype (complete, gravid) with 16 pairs of notopodia. Pinnate notochoetae in both rows (Fig. 21G–H), those from posterior row only pinnate at tips. Beginning of neuropodia unclear due to state of preservation of specimen, but apparently neuropodia only beginning after termination of notopodia, as thin, elongate pinnules (Fig. 21A, F). Paratype with neuropodia beginning immediately after the last pair of notopodia. Uncini intermediate between types 1 and 2, with short neck, but otherwise as type 2 (Fig. 21G). Large nephridia, visible by transparency through body wall; nephridial and genital papillae present on segments 3–15, anterior and ventral to bases of notopodia (Fig. 21A–B, D). Pygidium smooth to crenulated, with rounded ventral papilla (Fig. 21A, F).

**Remarks.** The holotype of *P. brutus* n. sp. is a specimen broken in four pieces, with both anterior and posterior ends. It seems to be complete, but there is great difference in width between fragments and perhaps a piece with few anterior segments is missing. The specimen has prostomium only at base of upper lip; button-like lower lip; slightly papillated, poorly defined ventro-lateral pads; 13 pairs of notopodia (16 pairs in paratype), with neuropodia beginning immediately after the termination of notopodia, so noto- and neuropodia do not occur simultaneously on any segment. Notopodia bear pinnate chaetae in both rows and neuropodia have type 2 uncini with remarkably short neck for this type of uncini. Nephridial and genital papillae are present at the bases of all notopodia.

However, the most distinctive character of this specimen is the prostomium continuing laterally by one pair of long, deeply grooved tentacle-like extensions, like a pair of horns pointing posteriorly. The upper lip of *P. brutus* n. sp. is also remarkable, distinctly longer than wide, convoluted, resembling that of some telothelepods (Nogueira *et al.* 2010, 2013).



**FIGURE 21.** *Polycirrus brutus* n. sp., holotype NTM W.023152. A. Entire worm, ventral view (fragments arranged to simulate the animal is entire); B–C. Anterior end, ventral and dorsal views, respectively; D–E. Close ups of the anterior end, ventral and dorsal views, respectively; F. Posterior end, left dorso-lateral view; G–H. Progressively higher magnifications of the notochaetae of segment 14; I. Uncini, mid-abdominal segment. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium, PLP = prostomial lateral process, ul = upper lip, \* = distal part of prostomium. Scale bars: A = 1.5 mm, B–F = 0.5 mm, G = 30  $\mu$ m, H = 15  $\mu$ m, I = 10  $\mu$ m.

The only other known species of *Polycirrus* with similar horn-like prostomial lateral extensions is *P. nonatoi* Carrerette & Nogueira, 2013, which also has longer than wide upper lip. Members of these species differ, however, because among members of *P. nonatoi* the tentacle-like prostomial extensions are shorter, with shallower groove; the distal part of prostomium extends along the upper lip until near the anterior margin of the lip; the lower lip is distinctly larger, rounded, cushion-like across the ventrum, reaching the anterior margin of segment 4 mid-ventrally; the ventro-lateral pads are clearly defined and highly papillated; notopodia have elongate post-chaetal lobe and bear narrowly-winged chaetae in the anterior row of notochaetae; and, although the original description states that members of *P. nonatoi* have type 1 uncini, these structures are intermediate between types 1 and 2, with strongly bent back and relatively short heel, but otherwise as type 2, although much shorter than those of other taxa with this type of uncini (Carrerette & Nogueira 2013). The holotype of *P. brutus* n. sp., on the other hand, has more typical type 2 uncini, although still intermediate between types 1 and 2, with a distinctly short neck for this type of uncini.

Although the prostomium is far less developed, not forming tentacular extensions, *P. coccineus* Grube, 1870 also has prostomial lateral extensions and narrow and elongate upper lip. In addition to the absence of tentacular extensions, members of this species differ from *P. brutus* n. sp. by having larger, cushion-like lower lip across ventrum; highly papillated, tessellated ventro-lateral pads; 20 pairs of notopodia, extending until segment 22, with longer post-chaetal lobe; and nephridial and genital papillae only present until segment 9 (Glasby & Hutchings 2014).

**Etymology.** We attribute the name “*brutus*” to this species after the character Brutus, from the cartoon “Popeye the Sailor”, in reference to the pair of prostomial horn-like lateral extensions, which resemble the curved arms of a very strong man.

**Habitat.** Coral rubble at 10 m.

**Type locality.** Palfrey Island, 14°41'28.572"S, 145°26'29.940"E, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Only known from the Lizard region.

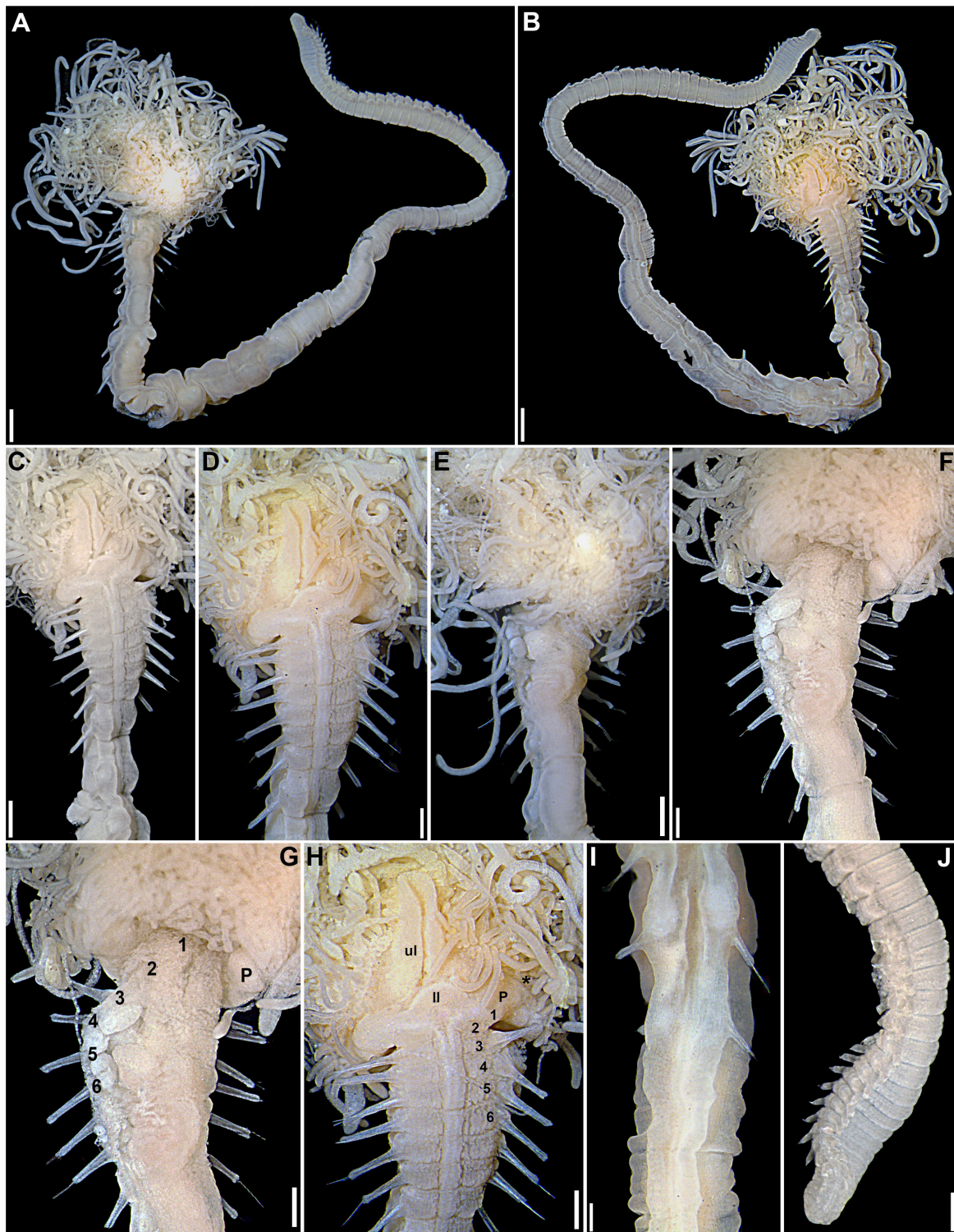
### ***Polycirrus oculus* n. sp.**

(Figs 1D–E, 5B–F, 22)

**Type material.** Holotype: NTM W.23159, Lizard Island, off SW Palfrey Island, 14°41'39.408"S, 145°26'29.724"E, coll. Glasby & Watson, 8 Apr 2008, complete specimen, with ~71 segments, 14 mm long, 0.6–0.7 maximum width. Paratype: AM W.44612, MI QLD 2400, gravid, no eyespots remaining after preservation.

**Description.** In life, white to yellowish transparent body and buccal tentacles, with one pair of red eyespots near tips of buccal tentacles, apparently present on all tentacles, and one spot at pygidium (Fig. 1D–E). Transverse prostomium attached to dorsal surface of base of upper lip; basal part as thick semicircular crest across dorsum, extending lateral and posteriorly, covering segment 1 laterally and terminating lateral to lower lip; poorly developed distal part, as low lobe of uniform length at base of upper lip (Fig. 22A–H). Buccal tentacles of two types, short tentacles uniformly cylindrical, slightly expanded at tips, long ones spatulated at tips (Fig. 21A–H). Peristomium forming lips; elongate and narrow upper lip, longer than wide, slightly convoluted; small, button-like lower lip, rounded (Fig. 22B–D, H). Segments 1 and 2 reduced, both visible all around; body slightly broader until segment 5, gently tapering until segment 10, then of relatively uniform width, cylindrical (Fig. 22A–J); posterior thoracic segments with notopodia in ventro-lateral position, laterally to longitudinal crests bordering mid-ventral groove, same position as that of neuropodial pinnules on abdomen (Fig. 22B, I); large anterior abdominal segments, with thin body wall and poorly marked segmentation, posterior body with clearly defined, compacted segments (Fig. 22A–B, I); paratype with highly swollen anterior and mid-body regions, and cylindrical, gently tapering posteriorly (Fig. 1D). Highly papillated and clearly defined ventro-lateral pads, present on segments 3–11, last two pairs less developed (Fig. 22B–D, H). Notopodia extending for 18 segments, until segment 20; distinctly elongate, bilobed notopodia, lobes of equal size, first and last pairs slightly shorter (Fig. 22A–I). Narrowly-winged, acicular notochaetae in anterior row, wings inconspicuous under light microscopy; notochaetae of posterior row with pinnate distal half (Fig. 5B–C). Neuropodia beginning from segment 23, third after termination of notopodia, as thin, elongate pinnules (Fig. 22A–B, J). Remarkably few uncini per torus, 2 uncini per torus on anterior abdominal segments, 4 on posterior ones; type 2 uncini, with thin, elongate prow and heel, the latter obliquely directed downwards, crest with single elongate and sharp tooth in first row above main fang, surrounded by crown

of minute teeth at base, and elongate neck (Fig. 5D–F). Nephridial and genital papillae present on segments 3–9, anterior and ventral to bases of notopodia, not visible on notopodia of segments 10–20 (Fig. 22B–D, F–I). Pygidium smooth to crenulated, with rounded ventral papilla (Fig. 22A–B, J).



**FIGURE 22.** *Polycirrus oculus* n. sp., holotype NTM W23159. A–B. Entire worm, dorsal and ventral views (anteriorly), respectively, arrow points to the last notopodium; C–F. Progressively higher magnifications of the anterior end, ventral and dorsal views, respectively; G–H. Close ups of the anterior end, dorsal and ventral views, respectively; I. Transition between thorax and abdomen, ventral view; J. Posterior end, left lateral view. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 0.5 mm, C = 0.3 mm, D–H, J = 0.2 mm, I = 0.15 mm.



**Remarks.** The holotype of *P. oculus* n. sp. is complete, just over 1 cm in length; with distal part of prostomium at the base of the upper lip; longer than wide upper lip; short, button-like lower lip; highly papillated and clearly defined ventro-lateral pads; 18 pairs of notopodia, extending until segment 20, with evenly-sized lobes and narrowly-winged, acicular notochoetae in anterior row, and distally pinnate chaetae in posterior row; neuropodia beginning shortly after the termination of notopodia, on segment 23, as relatively thin and elongate pinnules, bearing type 2 uncini; and nephridial and genital papillae extending until segment 9. The most remarkable character of this species, however, is the presence of paired red spots near tips of tentacles, possibly eyespots, which are not known to occur in any other species of *Polycirrus*, but those spots are only visible in live material (Fig. 1D–E), disappearing after preservation.

Glasby & Hutchings (2014) report that only two previously known species of *Polycirrus* have 13–23 pairs of notopodia with neuropodia beginning after the termination of notopodia, these are *P. bicrinalis* Hutchings & Glasby, 1986, originally described from Lizard Island, and *P. decipiens* (Gravier, 1905), known from the Gulf of Aden, Indian Ocean. However, both these species have type 1 uncini, and therefore, are clearly different from *P. oculus* n. sp.

Other species with 13–23 pairs of notopodia and neuropodia beginning close to the termination of notopodia, and with type 2 uncini include *P. aquila* Caullery, 1944, *P. coccineus* Grube, 1870, and *P. medius* Hessle, 1917. *Polycirrus aquila* is a species originally described from Indonesia and members of this taxon differ from *P. oculus* n. sp. in having almost circular upper lip; larger, rectangular, cushion-like lower lip, extending across the ventrum; 16 pairs of notopodia, extending until segment 18, with longer post-chaetal lobe and pinnate chaetae in both rows of notochoetae; neuropodia beginning shortly before the termination of notopodia, on segment 17; and nephridial and genital papillae present until the termination of notopodia (Glasby & Hutchings 2014).

*Polycirrus coccineus* was described by Grube (1870) from Red Sea material, which specimens have circular upper lip; 20 pairs of notopodia, extending until segment 22, with longer post-chaetal lobe and pinnate chaetae in both rows; and neuropodia beginning on the last segment with notopodia, segment 22 (Glasby & Hutchings 2014).

Members of *P. medius*, a species originally described from Japan, present narrow, mid-ventral, rectangular and cushion-like lower lip, extending until the posterior part of segment 4; 17 pairs of notopodia, extending until segment 19, with pinnate chaetae in both rows of notochoetae; and neuropodia beginning shortly before the termination of notopodia, on segment 17 (Glasby & Hutchings 2014).

**Etymology.** The specific name “*oculus*” refers to the presence of many eyes, as one pair of eyespots near tips of all tentacles, visible in live material; from the Latin “*oculeus*” = full of eyes.

**Habitat.** Collected amongst coral rubble in shallow water.

**Type locality.** Off SW Palfrey Island, 14°41'39.408"S, 145°26'29.724"E, Lizard Island Group, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard region.

### ***Polycirrus boholensis* Grube, 1878**

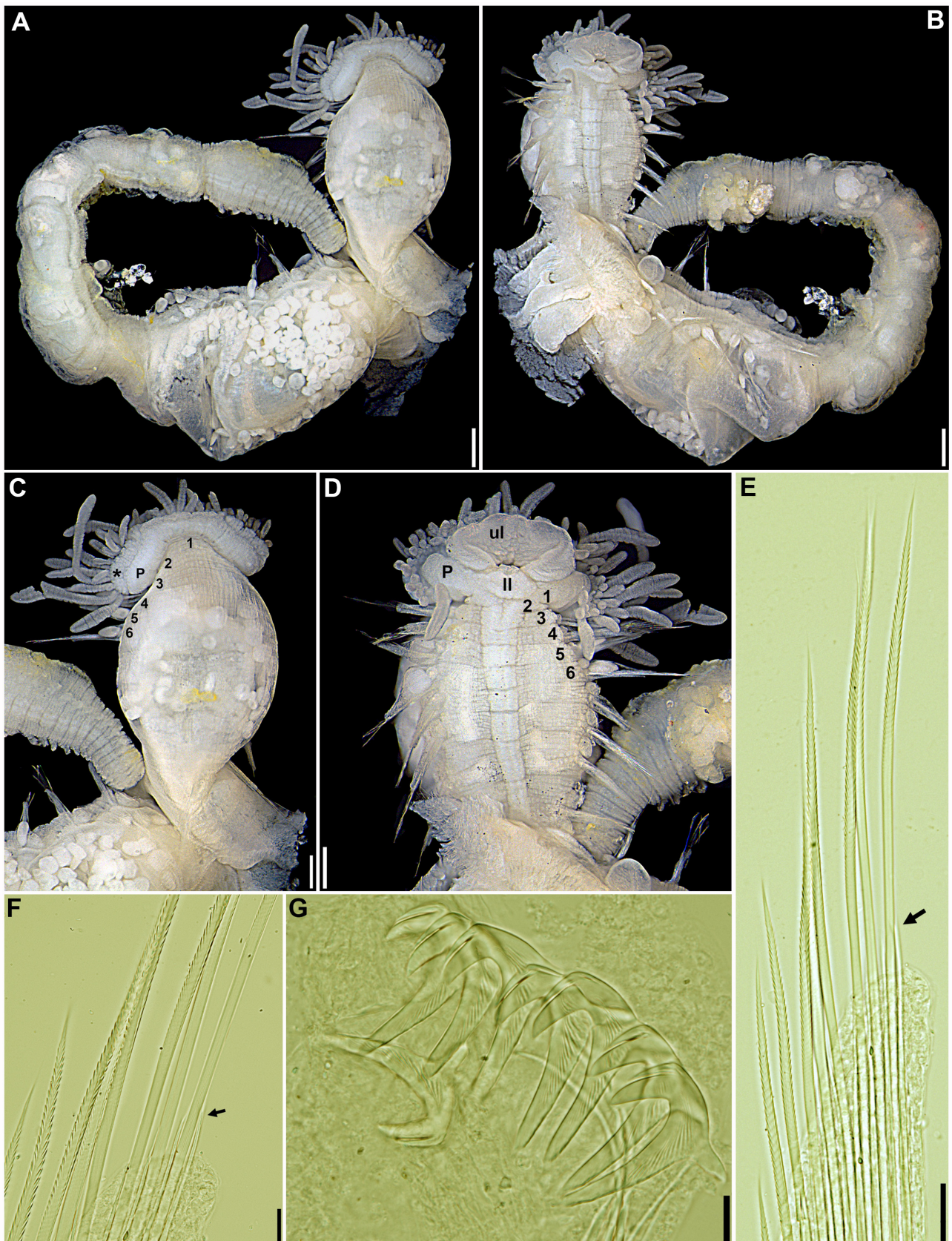
(Fig. 23)

*Polycirrus boholensis* Grube 1878: 242–243, pl. XIII, fig. 7.

*Polycirrus boholensis*.—Hutchings & Glasby 1986: 334–336, fig. 6g–k.

**Material examined.** AM W.44955, MI QLD 2423, complete specimen damaged at posterior thorax, ~7 mm long, 1 mm maximum width, gravid; AM W.44960, MI QLD 2424; AM W.44521, MI QLD 2390 (2).

**Description.** Transverse prostomium attached to dorsal surface of base of upper lip; basal part as thick, curved to horseshoe-shaped crest across dorsum, extending laterally and posteriorly, covering segment 1 laterally and terminating lateral to lower lip; poorly developed distal part, as low lobe of uniform length throughout, at base of upper lip (Fig. 23A–D). Buccal tentacles of two types, both spatulated at tips, with deeper groove, long ones relatively short, with thinner uniformly cylindrical peduncle before spatulated tip (Fig. 23A–D). Peristomium forming lips; short, hood-like upper lip, distinctly broader than high, slightly convoluted; short, swollen lower lip, button-like (Fig. 23B, D). Segment 1 reduced, visible mid-dorsally and ventrally, laterally covered by expanded prostomium; segment 2 reduced, visible all around; body anteriorly swollen, segments progressively wider until



**FIGURE 23.** *Polycirrus boholensis*, AM W.44955. A–B. Entire worm, dorsal and ventral views (anteriorly), respectively; C–D. Close ups of the anterior end, dorsal and ventral views, respectively; E–F. Progressively higher magnifications of the notochaetae of segment 7, arrows point to tip of notochaeta from anterior row; G. Uncini, mid-abdominal segment. Numbers refer to segments. Abbreviations: ll = lower lip, P = basal part of prostomium, ul = upper lip, \* = distal part of prostomium. Scale bars: A–B = 300 µm, C–D = 200 µm, E = 30 µm, F = 15 µm, G = 10 µm.

segment 8, and progressively longer until segment 10, then with swollen posterior thorax, abruptly tapering posteriorly to uniformly cylindrical posterior body, beginning from the termination of notopodia; large anterior abdominal segments, with thin body wall and poorly marked segmentation, posterior body with clearly defined, compacted segments (Fig. 23A–D). Highly papillated ventro-lateral pads, present from segment 2 to segments 10–12, last pair distinctly less conspicuous (Fig. 23B–D). Notopodia extending for 11–16 segments; remarkably elongate, bilobed notopodia, lobes of equal size, first pair shorter (Fig. 23A–D). Narrowly-winged, acicular chaetae in anterior row of notochaetae, pinnate chaetae in posterior row, only pinnate at distal third; chaetae from anterior row much shorter, tips barely protruding from parapodial lobes (Fig. 23E–F). Neuropodia beginning from first segment after notopodia terminate, varying according with number of pairs of notopodia present; neuropodia as short, raised pinnules (Fig. 23A–D). Type 2 uncini throughout, elongate prow and heel, the latter obliquely directed downwards, crest with single elongate and sharp tooth in first row of secondary teeth above main fang, surrounded by crown of minute teeth at base, and elongate neck (Fig. 23G). Nephridial and genital papillae anterior to bases of all notopodia, except for last 1–2 pairs, those of segments 6–9 larger (Fig. 23B, D). Pygidium smooth to crenulate, with rounded ventral papilla (Fig. 23A, C).

**Remarks.** The holotype of *P. boholensis* is in poor state of preservation, but matches the description above in all aspects, except for not having conspicuous nephridial and genital papillae (Glasby & Hutchings 2014). This species has previously been found in Australia, among material from Queensland, including Lizard Island and other regions of the GBR, but Australian specimens have nephridial papillae extending until the termination of notopodia (Hutchings & Glasby 1986). Considering the type locality is in the Philippines, we agree with Hutchings & Glasby (1986) and Glasby & Hutchings (2014) in that this species also occurs in northeastern Australia, and interpret the absence of nephridial and genital papillae on the holotype as most likely due to the poor state of preservation of that specimen.

**Habitat.** In amongst coral rubble on outer reef in shallow water.

**Type locality.** Bohol, Philippines.

**Distribution.** Philippines to northeastern Australia.

### ***Polycirrus bicrinalis* Hutchings & Glasby, 1986**

*Polycirrus bicrinalis* Hutchings & Glasby 1986: 333–334, figs 6a–f; 12D.

*Polycirrus bicrinalis*.—Glasby & Hutchings 2014: 26–29, fig. 10.

**Material examined.** Holotype: AM W.199637, Lizard Island, 14°40'S, 141°28'E; AM W.47666, (2), Mrs Watson Beach, 14°39'41"S, 145°22'27"E, CReefs.

**Remarks.** The material collected during CReefs was gravid with numerous oocytes within the coelom.

**Type locality.** Lizard Island, 14°40'S, 145°27'E

**Distribution.** Known from NorthWest Australia and Queensland.

### **Genus *Amaeana* Hartman, 1959**

*Amaea* Malmgren 1866: 392.

*Amaeana*.—Hutchings & Glasby 1986: 320; Nogueira *et al.* 2015: 3–9.

**Type-species.** *Polycirrus trilobatus* Sars, 1863, by original designation.

**Diagnosis.** Transverse prostomium attached to dorsal surface of upper lip, usually covering segment 1 laterally and extending ventrally, terminating lateral to mouth; basal part usually as thick crest, curved to inverted V-shaped; distal part low, usually as flaring lobes, frequently with mid-dorsal process. Buccal tentacles of at least two types, short ones uniformly cylindrical, long ones spatulated; stouter and longer tentacles specialised at tips may be present. Peristomium forming lips; upper lip large, frequently circular and convoluted, folded into three lobes, swollen lower lip, button-like, restricted to oral area. Segments throughout biannulated or with more annulations, with transverse rows of papillae; segment 1 reduced, usually visible dorsal and ventrally, laterally covered by

expanded prostomium. Segment 2 distinctly narrower than following segments, usually with rectangular or pentagonal mid-ventral shield at beginning of mid-ventral groove, sometimes extending anteriorly through segment 1 until near posterior margin of lower lip. Body wall papillate throughout, papillae distinctly larger and more abundant on ventro-lateral pads of anterior segments, present usually from segment 2 to last with notopodia. Notopodia beginning from segment 3, extending for variable number of segments, usually few pairs present; bilobed, elongate notopodia, lobes about same size. Notochaetae throughout usually narrowly-winged, acicular, wings inconspicuous under light microscopy, only visible under SEM; pinnate chaetae sometimes present. Neuropodia beginning posteriorly to notopodia, with gap of several achaetous segments in between; neurochaetae as distally tapered acicular spines. Nephridial and genital papillae present, usually at anterior bases of all notopodia. Pygidium smooth or with rounded ventral papilla.

**Remarks.** Nogueira *et al.* (2015) revised this genus, described seven new species and increased to 12 the number of valid taxa in this group. The most important diagnostic character of *Amaeana* is the presence of neuropodia bearing acicular spines, instead of uncini, as occurs in *Polycirrus*. Two species of *Amaeana* were found among the material collected in the Lizard Island Group. Full descriptions of these species are provided by Nogueira *et al.* (2015).

### Key for Identification of Species of *Amaeana* found at Lizard Island

1. Nine pairs of notopodia, on segments 3–11; neuropodia from segment 15, each bearing 5–6 capillary spines. . . . . *Amaeana breviachaeta*
- Ten pairs of notopodia, on segments 3–12; neuropodia from segment 21, each bearing single basally swollen and distally truncate spine. . . . . *Amaeana crassispinulata*

### *Amaeana breviachaeta* Nogueira, Carrerette & Hutchings, 2015

*Amaeana breviachaeta* Nogueira *et al.* 2015: 13–14, figs 3C–E, 4.

**Material examined.** Holotype: AM W.46526, Watsons Bay, fine sandy sediment, 9 m, coll. Capa & Hutchings, on SCUBA, 30 Aug 2010, CReefs, posteriorly incomplete specimen, in good state of preservation, with 28 segments, ~5 mm long, 1.1 mm wide.

**Remarks.** The holotype is only known specimen of this species collected at Lizard Island, in fine sandy sediment, at 9 m (Nogueira *et al.* 2015).

**Type locality.** Watsons Bay, 14°39'30"S, 145°26'56"E, Lizard Island, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard Island region.

### *Amaeana crassispinulata* Nogueira, Carrerette & Hutchings, 2015

*Amaeana crassispinulata* Nogueira *et al.* 2015: 24–27, figs 12–13.

**Material examined.** Holotype: AM W.47365, Lizard Island lagoon, cored in sediment between bommies, coll. Jones & Short, 9 Oct 1978, complete specimen, in good state of preservation except for posterior damage, 7 mm long, 1 mm wide.

**Remarks.** The holotype is the only known specimen of this species collected at Lizard Island, at 18 m (Nogueira *et al.* 2015).

**Type locality.** Lizard Island lagoon, 14°40'S, 145°28'E, Great Barrier Reef, Australia.

**Distribution.** Known only from the Lizard Island region.

## Discussion

This study increases the known diversity of polycirrids from Lizard region. Prior to this study, one species of *Hauchiella* had been recorded and this is now redescribed as another species, plus three species of *Polycirrus* previously described. However this study reveals a much greater diversity especially of the genus *Polycirrus* many of which are small species living in the sediment in amongst coral rubble. While extensive collecting was carried out during the two week workshop supplemented by collections during the CReefs expeditions, we suggest that additional collecting, especially in deeper water sediments in the inter-reefal areas, will reveal more species. Polycirrids are fragile non tubicolous species which need to be carefully extracted from rubble washings under the microscope and this certainly explains why this family was previously so poorly known.

Due to the shortage of previous studies in the region and the limited number of collections so far made in the area, several of our new species are described from a single specimen. It is highly desirable that future studies add information on intra-specific variation, as more specimens of those species are found.

## Acknowledgments

We would like to thank the Lizard Island Reef Research Foundation for support, which enabled JMMN and PH to attend the workshop, and to Anne Hoggett and Lyle Vail, Co-Directors of Lizard Island Research Station, for their support during the workshop, acting as boat drivers and buddies. Other participants at the workshop provided additional material and Alexander Semenov photographed live specimens some of which are included in our plates. We also thank Sue Lindsey of the Australian Museum for her substantial help with the SEMs. Also many thanks are due to Steve Keable, Collection Manager of Marine Invertebrates and Anna Murray. The visits of JMMN to Sydney in 2013 and 2014 were funded by FAPESP (procs 2010/52116–4 and 2014/11250–0, respectively). We would like to thank two reviewers who provided useful suggestions to improve the quality of the paper.

## References

- Carrerette, O. & Nogueira, J.M.M. (2013) Four new species of *Polycirrus* Grube, 1850 (Polychaeta: Terebellidae) from Campos Basin, southeastern Brazil. *Zootaxa*, 3626 (1), 146–172.  
<http://dx.doi.org/10.11646/zootaxa.3626.1.6>
- Caullery, M. (1944) *Polychètes sédentaires de l'Expédition du Siboga: Ariciidae, Spionidae, Chaetopteridae, Chloraemidae, Opheliidae, Oweniidae, Sabellariidae, Sternaspidae, Amphictenidae, Ampharetidae, Terebellidae*. Vol. 24. Siboga-Expeditie, Leiden, 204 pp.
- Colgan, D.J., Hutchings, P.A. & Brown, S. (2001) Phylogenetic relationships within the Terebellomorpha. *Journal of Marine Biological Association of the United Kingdom*, 81, 765–773.  
<http://dx.doi.org/10.1017/S002531540100457X>
- Day, J.H. (1967) *A monograph on the Polychaeta of Southern Africa*. British Museum (Natural History), London, 878 pp.  
<http://dx.doi.org/10.5962/bhl.title.8596>
- Eliason, A. (1962) Die Polychaeten der Skagerak-Expedition 1933. *Zoologiska bidrag från Uppsala*, 33, 207–293.
- Fauchald, K. (1977) The polychaete worms. Definitions and keys to the orders, families and genera. *Natural History Museum of Los Angeles County Museum, Science Series* 28, 1–188.
- Fitzhugh, K., Nogueira, J.M.M., Carrerette, O. & Hutchings, P. (2015) An assessment of the status of Polycirridae genera (Annelida: Terebelliformia) with the evolutionary transformation series of characters within the family. *Zoological Journal of the Linnean Society*, 2015, 1–36.  
<http://dx.doi.org/10.1071/IS07006>
- Garraffoni, A.R.S. & Lana, P.C. (2008) Phylogenetic relationships within the Terebellidae (Polychaeta: Terebellida) based on morphological characters. *Invertebrate Systematics*, 22, 605–626.  
<http://dx.doi.org/10.1071/IS07006>
- Glasby, C.J., Hutchings, P.A. & Hall, K. (2004) Phylogeny of the polychaete order Terebellomorpha (Polychaeta: Terebellidae) based on morphology. *Journal of Marine Biological Association of the United Kingdom*, 84, 961–971.  
<http://dx.doi.org/10.1017/S0025315404010252h>
- Glasby, C.J. & Glasby, T.M. (2006) Two types of uncini in *Polycirrus* (Polychaeta: Terebellidae: Polycirrinae) revealed using geometric morphometrics. *Journal of Natural History*, 40 (5–6), 237–253.  
<http://dx.doi.org/10.1080/00222930600627137>

- Glasby, C.J. & Hutchings, P. (2014) Revision of the taxonomy of *Polycirrus* Grube, 1850 (Annelida: Terebellida: Polycirridae). *Zootaxa*, 3877 (1), 1–117.  
<http://dx.doi.org/10.11646/zootaxa.3877.1.1>
- Gravier, C. (1905) Sur deux types nouveaux de Terebelliens *Anisocirrus* novo gen., *decepiens*, *Aponobranthus* novo gen., *perrieri* novo sp. *Bulletin du Museum d'Histoire Naturelle*, Paris, 11, 437–444.
- Gravier, C. (1907) *Annélides polychètes Expedition Antarctique française*. Masson Cie, Paris, 75 pp.
- Grube, A.E. (1850) Die Familien der Anneliden. *Archiv für Naturgeschichte Berlin*, 1691, 249–364.
- Grube, A.E. (1870) Beschreibungen neuer oder weniger bekannter von Hr. Ehrenberg gesammelter Anneliden des rothen Meeres. *Monatsberich der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, 1869, 484–521.
- Grube, A.E. (1878) Annulata Semperiana. Beiträge zur Kenntniss der Anneliden fauna der Philippinen nach den von Herrn Prof. Semper mitgebrachten Sammlungen. *Memoires l'Académie Imperiale des Sciences de St. Petersburg*, Série 7, 25, 1–300.
- Hartman, O. (1959) Catalogue of the polychaetous annelids of the world. Part II. *Occasional Papers of the Allan Hancock Foundation*, 23, 355–628.
- Hartmann-Schröder, G. (1979) Die Polychaeten der tropischen Nordwestküste Australiens (zwischen Derby im Norden und Port Hedland im Süden). Teil 2. In: Hartmann-Schröder, G. & Gerd Hartmann. *Zur Kenntnis des Eulitorals der australischen Küsten unter besonder Berücksichtigung der Polychaeten und Ostracoden. Mitteilungen aus dem Hamburgischen zoologischen Museum und Institut*, 76, 77–218.
- Hartmann-Schröder, G. (1990) Teil 15. Die Polychaeten der subtropisch-tropischen und tropischen Ostküste Australiens zwischen Lake Macquarie (New South Wales) im Süden und Gladstone (Queensland) im Norden. In: Hartmann-Schröder, G. & Hartmann, G. *Zur Kenntnis des Eulitorals der australischen Küsten unter besonderer Berücksichtigung des Polychaeten und Ostracoden. Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 87, 41–87.
- Hessle, C. (1917) Zur Kenntnis der terebellomorphen Polychaeten. *Zoologiska Bidrag från Uppsala*, 5, 39–258.
- Hutchings, P.A. (1974) Polychaeta of Wallis Lake, New South Wales. *Proceedings of the Linnean Society of New South Wales*, 98, 175–195.
- Hutchings, P.A. (1990) Terebellidae (Polychaeta) from the Hong Kong region. In: Moreton, B. (Ed.), *Proceedings of the Second International Workshop on the Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986*. University of Hong Kong, Hong Kong, pp. 377–412.
- Hutchings, P.A. (2008) Chapter 22. Worms. In: Hutchings, P.A., Kingsford, M.K. & Hoegh-Guldberg, O. (Eds.), *The Great Barrier Reef, Biology, Environment and Management*. CSIRO Publishing, Melbourne, pp. 246–261
- Hutchings, P.A. & Glasby, C.J. (1986) The Polycirrinae (Polychaeta: Terebellidae) from Australia. *Records of the Australian Museum*, 38, 319–350.  
<http://dx.doi.org/10.3853/j.0067-1975.38.1986.185>
- Hutchings, P.A. & Murray, A. (1984) Taxonomy of polychaetes from the Hawkesbury River and the southern estuaries of New South Wales, Australia. *Records of the Australian Museum Supplement*, 3, 1–119.  
<http://dx.doi.org/10.3853/j.0812-7387.3.1984.101>
- Kinberg, J.G.H. (1867) Annulata nova. *Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar. Tjugondetredje. Årgängen Med Tretton Taflor, Stockholm*, No. 9, 337–355.
- Knox, G.A. & Cameron, D.B. (1971) Port Phillip Survey Pt. 2. (4). Polychaeta. *Memoirs of the National Museum of Victoria*, 32, 21–41.
- Levinsen, G.M.R. (1893) Annulata, Hydroidae, Anthozoa, Porifera. *Udbytte af Kanonbaaden "Hauche" togter i de Danske indenfor Skagen i Aarene*, 1893, 321–464.
- Londoño-Mesa, M.H. & Carrera-Parra, L.F. (2005) Terebellidae (Polychaeta) from the Mexican Caribbean with description of four new species. *Zootaxa*, 1057, 1–44.
- Malmgren, A.J. (1866) Nordiska Hafs-Annulater. *Öfversigt af Konglia Vetenskaps-Akademiens Förhandlingar, Stockholm*, 22, 355–410.
- McIntosh, W.C. (1869) On the structure of the British nemerteans, and some new British annelids. *Transactions Royal Society of Edinburgh*, 25, 249–252.
- Monro, C.C.A. (1930) Polychaete worms. *Discovery Reports*, 2, 1–222.
- Nogueira, J.M.M., Carrerette, O. & Hutchings, P. (2015) Review of *Amaeana* Hartman, 1959 (Annelida, Terebelliformia, Polycirridae), with descriptions of seven new species. *Zootaxa*, 3994, 1–52.  
<http://dx.doi.org/10.11646/zootaxa.3994.1.1>
- Nogueira, J.M.M., Fitzhugh, K. & Hutchings, P. (2013) The continuing challenge of phylogenetic relationships in Terebelliformia (Annelida: Polychaeta). *Invertebrate Systematics*, 27, 186–238.  
<http://dx.doi.org/10.1071/IS12062>
- Nogueira, J.M.M., Hutchings, P.A. & Fukuda, M.V. (2010) Morphology of terebelliform polychaetes (Annelida: Polychaeta: Terebelliformia), with a focus on Terebellidae. *Zootaxa*, 2460, 1–185.
- Polloni, P.T., Rowe, G.T. & Teal, J.M. (1973) *Biremis blandi* (Polychaeta: Terebellidae), new genus, new species, caught by D.S.R.V. "Alvin" in the Tongue of the Ocean, New Providence, Bahamas. *Marine Biology*, 20, 170–175.  
<http://dx.doi.org/10.1007/BF00351456>
- Ribas, J. & Hutchings, P. (2015) Lizard Island Polychaete Workshop: sampling sites and a checklist of polychaetes. *Zootaxa*,

4019 (1), 7–34.

<http://dx.doi.org/10.11646/zootaxa.4019.1.4>

- Rioja, E. (1947) Estudios anelidologicos. XVII. Contribucion al conocimiento de los anelidos poliquetos de Baja California y Mar de Cortes. *Anales del Instituto de Biologia, Mexico*, 18, 197–224.
- Sars, M. (1863) Geologiske og zoologiske lagttagelser, anstillede paa en Reise i en Deel af Trondhjems stift i Sommeren 1862. *Nyt Magazin for Naturvidenskaberne*, 12, 253–340.
- Verrill, A.E. (1873) Report upon the invertebrate animals of Vineyard Sound and the adjacent waters, with an account of the physical characters of the region. *Reports of the United States Fish Commission*, 1871–72, 295–778.
- Willey, A. (1902) Polychaeta. *Report on the collections of natural history made in the Antarctic regions during the voyage of the Southern Cross*, XII, 262–283.
- Wollebaek, A. (1912) Nordeuropaeiske Annulata Polychaeta. I. Ammocharidae, Amphictenidae, Ampharetidae, Terebellidae og Serpulidae. *Skrifter udgivne af Videnskabssekabet i Christiania. I Matematisk-Natur Klasse 1911*, 18, 1–144.