



Prochelator tupuhi* sp. nov., the first record of Desmosomatidae Sars, 1897 (Crustacea: Isopoda) from New Zealand waters

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Abstract

Prochelator tupuhi sp. nov. is the first record of the genus *Prochelator* Hessler, 1970 from Southern Hemisphere waters, and the first record of the family Desmosomatidae from New Zealand. The new species can be distinguished from all other species of the genus by the following characters: body elongate, without spine-like ventral elongations on pereonites 1–4, pereonite 1 as high as pereonite 5, mesial lobe of the maxilla much shorter than in the other species of the genus, reaching only half the length of the lateral lobe, carpus of pereopod 1 distinctly produced at the base of the claw, propodus broadest at the articulation to the carpus, tapering distally.

Key words: Isopoda, Desmosomatidae, *Prochelator*, New Zealand, taxonomy, new species

Introduction

The asellote family Desmosomatidae Sars, 1897 has a global distribution. Most species of the genus *Prochelator* Hessler, 1970 have been described from the North Atlantic Ocean (Brenke *et al.* 2005). Examination of the NIWA collections reveal at least a further ten species in six genera, namely *Mirabilicoxa* Hessler, 1970, *Chelator* Hessler, 1970 (3 species), *Desmosoma* Sars, 1864, cf. *Eugerda* Meinert, 1890 (2 species), *Eugerdella* Kussakin, 1965 (2 species) and *Prochelator* Hessler, 1970. This investigation indicates that the approximate expected diversity for Desmosomatidae in New Zealand waters will be similar to that which is known for other regions. The NIWA collections are extensive and the largest marine invertebrate collection in New Zealand, but prior to 2007, an epibenthic sledge (EBS) was not used for sampling around New Zealand (the sole exception being by Lincoln in October/November 1979 and April 1980 (see Lincoln 1985). The Brenke design of the EBS (Brenke 2005) was first deployed on two back-to-back expeditions under the Oceans 2020 program. Given that the present study describes the first record of Desmosomatidae from New Zealand waters, and that collecting efforts for “small macrofauna” has in the past been minimal, it would be reasonable to expect “comparable” diversity within the family to that of other regions with further EBS sampling.

Recent collections made in the Atlantic sector of the Southern Ocean (ANDEEP material, ANtarctic benthic DEEP-sea biodiversity, colonisation history and recent community patterns); personal observation and see Brandt *et al.* 2004, data for Brandt *et al.* (2007a, b) include a further 11 undescribed species of *Prochelator*. Samples from southern Australian waters (Poore *et al.* 1994, Brix 2006) contained no specimens of the genus *Prochelator*. The NIWA collection contained two species of *Prochelator* and this paper describes one these species, the first record of Desmosomatidae from New Zealand waters.

Prochelator is known from the Arctic Ocean (Kussakin 1999), the Nordic Seas (Brandt 1993, Svavarsson 1993), around Iceland (Brix & Svavarsson, unpublished data), the western North Atlantic Ocean (Hessler 1970), the South Atlantic Ocean (Brandt *et al.* 2005, Brenke *et al.* 2005) and the Atlantic sector of the Southern Ocean (ANDEEP I– III), while desmosomatids were highly diverse in all samples from the Weddell Sea and around the Scotia Arc (Brandt *et al.* 2007a, b).

Methods

Specimens were identified using a Leica MZ 9.5 dissecting microscope and illustrated using a “Leitz MI 85” compound microscope (ZMH, Hamburg) and an Olympus BX 20 with a *camera lucida*. The methods are described in Brix (2006). The terminology of the most important setal types is presented in Brix (2007) or follows Watling (1989).

The following collection material was studied for comparison:

USNM 125107	<i>Prochelator abyssalis</i> Hessler, 1970, holotype female
USNM 125108	<i>Prochelator hampsoni</i> Hessler, 1970, holotype female
USNM 125109	<i>Prochelator incomitatus</i> Hessler, 1970, holotype female
USNM 138731	<i>Prochelator sarsi</i> (George, 2001), holotype female
AM P59082	<i>Prochelator litus</i> Hessler, 1970, paratype female
AM P59075	<i>Prochelator abyssalis</i> Hessler, 1970, paratype female
AM P59197	<i>Prochelator hampsoni</i> Hessler, 1970, paratype female
AM P58781	<i>Prochelator lateralis</i> (Sars, 1897), other material
ZMUC CRU	<i>Prochelator serratum</i> , nontype Isopoda, det. E. Fresi, Ischia N., Italy 80–110 m, May 1968
ZMUC CRU-7027	<i>Prochelator lateralis</i> (Sars, 1897), syntypes
ZMH K-40331 A–K	<i>Prochelator angolensis</i> Brenke, Brix und Knuschke, 2005, holotype female
ZMH K-40322 to K-40323	<i>Prochelator angolensis</i> Brenke, Brix und Knuschke, 2005, paratypes female

Abbreviations: P 1–7 = pereopods 1–7; Plt = pleotelson; Pl 1–5 = pleopods 1–5; Prn 1–7 = pereonites 1–7; ZMH = Zoological Museum of Hamburg; ZMUC = Zoologisk Museum, University of Copenhagen; AM = Australian Museum, Sydney; NIWA = National Institute of Water and Atmospheric Research, New Zealand; USNM = United States National Museum of Natural History, Smithsonian Institution, Washington DC.

Taxonomy

Desmosomatidae Sars, 1897

Eugerdellatinae Hessler, 1970

Prochelator Hessler, 1970

Synonymy: *Prochelator* Hessler, 1970: 27–28; Mezhov, 1986: 139; Kussakin, 1999: 278; George, 2001: 1840; Brenke, Brix and Knuschke, 2005: 180.

Type species: *Eugerdella lateralis* Sars, 1899; original designation Hessler (1970).

Composition: *P. angolensis* Brenke, Brix & Knuschke, 2005; *P. abyssalis* Hessler, 1970; *P. hampsoni* Hessler, 1970; *P. incomitatus* Hessler, 1970; *P. lateralis* (Sars, 1899); *P. litus* Hessler, 1970; *P. sarsi* George, 2001; *P. uncatatus* Hessler, 1970; *P. kussakini* Mezhov, 1986; *P. serratum* (Fresi & Schiecke, 1969); *P. tupuhi* sp. nov.

Diagnosis: Pereopod 1 large, carpo-chelate, dactylus and propodus forming movable counterpart to large spine-like claw-seta on distal end of carpus. Inferior margin of carpus of pereopod 1 with one midventral seta and a slender seta distally proximal to claw-seta. Pleotelson with posterolateral spines.

Generic remarks: The genus *Prochelator* was erected by Hessler (1970) who transferred the type species from *Eugerdella* to *Prochelator* and described five new species of *Prochelator*. *Desmosoma serratum* was recently transferred to *Prochelator* by Brenke *et al.* (2005). Five publications have subsequently defined the genus (Hessler 1970, Mezhov 1986, Kussakin 1999, George 2001 and Brenke *et al.* 2005). The present diagnosis differs from the diagnosis presented by George (2001) in including species with uniramous uropods. In Desmosomatidae, the uropods are biramous in the plesiomorphic condition but the exopod is reduced and is completely absent in approximately half of the described species. Thinking about Hessler's (1970) statement about reduction of the exopod, the loss of the exopod might be homoplasious within the family. Although the phylogenetic significance of these reductions is questioned due to the presence or absence in species of the same genus, the reduction may serve well as species-level diagnostic character, but not as a generic character. Precise definition of the apomorphies is important, as the genera *Prochelator* and *Chelator* closely resemble each other. According to Hessler (1970) the prefix "Pro-" refers to the fact, that *Chelator* is probably derived from a species of *Prochelator*. But accepting phylogenetic systematics and the concept of monophyly, a present-day taxon cannot be assumed to be derived from another present-day taxon, but rather both are derived from a common ancestor.

To assess the taxonomic position of *Prochelator* and *Chelator*, a detailed discussion of all characters (possible apomorphies) and a phylogenetic analysis would be necessary. The principal character shared by *Prochelator* and *Chelator* is the chela of pereopod 1. *Chelator* can be distinguished from *Prochelator* by the ventral projection at the base of the claw-seta of the former. This projection is the only distinguishing character that can be identified when comparing generic diagnoses of both genera.

The ventral setae on the carpus of pereopod 1 were so uniform between the species that Hessler (1970) assigned to *Prochelator*, that he gave them the formal designation of "accessory setae". Hessler (1970) used this term for *Prochelator* but not for *Chelator*. He describes the ventral row of small setae on the lower margin of the carpus in species of *Chelator* as a row of setae, of which none can be labelled as "accessory seta". The term "accessory seta" is confusing and may be synonymised with the term "major seta" (Hessler 1970). Both terms are not used in the present paper; instead the setal types on the articles of the pereopods are described. A single midventral seta on the lower margin of the carpus is unique to *Prochelator*. This midventral seta can be used to distinguish *Prochelator* and *Chelator*, in addition to the projection at the base of the claw-seta listed as the only distinguishing character in the paragraph above.

Other desmosomatid species with a chelate pereopod 1 can be distinguished from *Prochelator* and *Chelator* by apomorphies. Species included in *Oecidiobanchus* possess a propodus that is more enlarged than the carpus with the dactylus folding against the ventral margin of the propodus. Unique to *Oecidiobanchus* is the small branchial chamber (Hessler 1970). *Disparella* possess a large cephalic spine at the point of insertion of the antennula. Such a cephalic spine is also found e.g. in *Prochelator lateralis* and *P. uncatus*, but not in any species of *Chelator*. The distinguishing apomorphy of *Disparella*, which separates the genus from *Prochelator*, is the elongate slender propodus (more than 3.5 times long as wide) and the setation on the ventral margin of the carpus of pereopod 1. *Disparella* possess a well defined row of setae behind the claw-seta. Such a row is not found in *Prochelator* or *Chelator*. Pereopods 2–4 of *Disparella* species are obviously setose (carpus > 20 setae, propodus > 8 setae in adult) while in *Prochelator* the carpus of the anterior pereopods have no more than 10 setae in a row (except *P. hampsoni*).

Although the comparison of characters shows that *Prochelator* and *Chelator* are very similar, *Prochelator* and *Chelator* should be treated as separate genera based on the following reasoning: it is not possible to homologize the setae on the ventral margin of the carpus of pereopod 1, and no transformation series can be postulated explaining how the midventral setae (*Prochelator*) and the few small setae (*Chelator*) originated.

The uniramous uropod in *P. incomitatus* and *P. angolensis* may have evolved convergently because the loss of the exopod is an apparently homoplasious character state as it occurs in genera that are otherwise widely disparate; the body form of females differs clearly between the two genera; posterolateral spines on the pleotelson are always present in females of *Prochelator* while in females of *Chelator* these posterolateral spines are absent. Furthermore, females of *Chelator* are more compact and the pereonites are rounded, while species of *Prochelator* have a different profile from lateral view. While in some species of *Prochelator* the posterior pereonites and the pleotelson are flattened, in species of *Chelator* the pleotelson is as high as pereonite 5, the rounded pleotelson form giving the body outline a more compact look than in *Prochelator*. In *Chelator* the first four body segments are more compact than in *Prochelator* (the first pereonite in *Chelator* twice as high as pereonite 5).

***Prochelator tupuhi* sp. nov. (Figs. 1–5)**

Material examined: Holotype: ♀ (preparatory, 3.1 mm), east of Christchurch, South Island, western Chatham Rise, 44°30.10'S, 174°18.79'E, 25 Oct 1979, 760 m, stn. S147 (NIWA 33747).

Paratypes: 1 ♂ (adult, 3.2 mm; allotype), same data as holotype (NIWA 33748). 2 ♀ (adult) 44°45.00'S, 174°30.00'E, 18 Aug 1966, 765–854 m, stn F753 (NIWA 33749). 1 ♀ (adult) stn. F755 and 2 ♀ stn. S/47 (NIWA 33750).

Type locality: Western Chatham Rise, east of Christchurch, South Island, New Zealand, 44°30.10'S, 174°18.79'E.

Distribution: Eastern New Zealand; at depths of 760 to 864 m, from the general type locality at more than one station.

Diagnosis: Body widest at pereonite 2; length about 4.6 times longer than width of pereonite 2. *Pereonites* 1–4 in female slightly higher than pereonites 5–7 in lateral view, in male as high as pereonites 5–7. *Pereonite* 1 length 1.4 times pereonite 2 length. *Pereonite* 5 length 0.8 times width. *Coxae* 1–4 anteriorly produced, each with robust acute setae. *Pereopod* 1 carpus broadest at articulation of propodus, slightly produced at base of claw-seta. Carpus of pereopods 2–4 about twice as long as carpus of pereopod 1. *Pleotelson* with posterolateral spines located at 0.6 of pleotelson length. *Uropods* biramous, exopod about half as long as endopod.

Description of holotype (Fig. 1): *Body* 3.1 mm long, 4.68 times longer than width of Prn 2. Prn 1 width 1.42 times cephalon width in dorsal view. Prn 1 length 1.5 Prn 2 length, 0.84 Prn 2 width. Prn 5 width 0.82 length, anterior margin straight, lateral margin slightly convex. *Coxae* 1–4 produced, with large acute robust setae. *Pleotelson* length 0.98 width, large posterolateral spines present. Lateral margins convex, posterior margin slightly rounded.

Antennula (Fig. 2) with six articles. Article 1 1.69 width, with four broom setae. Article 2 length 6.43 width, 2.01 article 1 length; distally with two large articulated broom setae and two small slender setae, marginally with two small slender setae. Article 3 length 3.5 width, with one short slender seta, article 4 length 3.3 width, distally with one broom seta, distal article length 3.5 width, terminally with one aesthetasc, one broom seta and two long slender setae. Articles 2–5 length relative to article 1: 2.01: 0.64: 0.5: 0.45: 0.32.

Antenna (Fig. 2) incomplete or partly missing, only four articles available.

Mandible (Fig. 2) palp article 1 with one small distal seta, article 2 ventrodistally with two small setulate setae, dorsally with rows of numerous fine microtrichia apical article with nine ventral seta, distal one longest. Incisor process with three teeth. Lacinia mobilis of left mandible with three teeth, spine row containing eight spines. Molar process with 13 fine setae.

Maxillula (Fig. 2) mesial lobe about 0.7 lateral lobe length, with 25 setae. Lateral lobe 3.75 times longer than wide, marginally with pairs of fine microtrichia terminally with 12 strong robust setae.

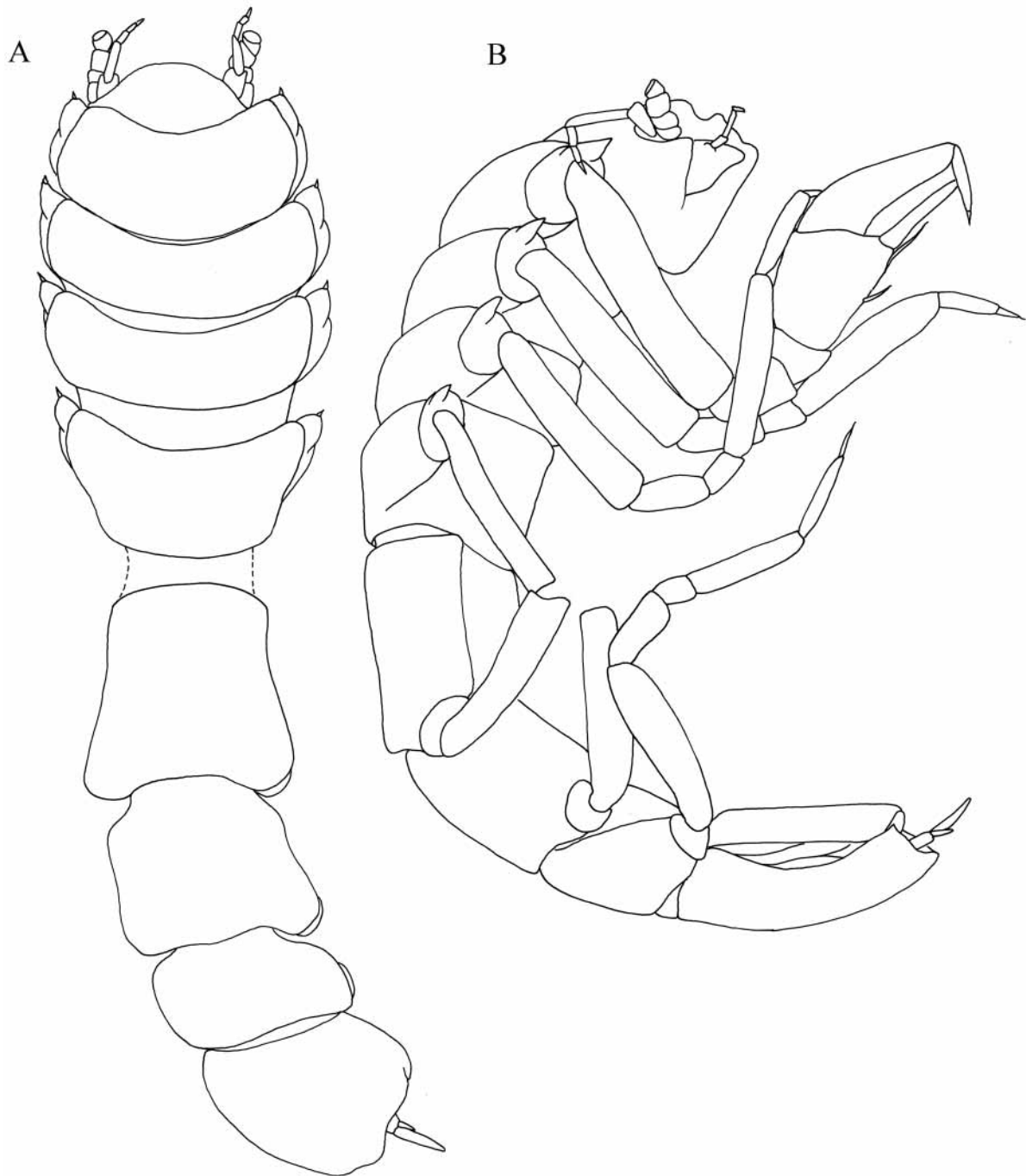


FIGURE 1: *Prochelator tupuhi* sp. nov., holotype female, habitus dorsal (A, pereonites 5–7 and pleotelson not precise in dorsal view, pleotelson contorted to the left side of specimen), lateral (B).

Maxilla (Fig. 2) mesial lobe 0.48 length of lateral lobes, terminally with 21 setae. Lateral lobe (one lobe lost during dissection) basally with two slender setae, terminally with 18 setae.

Maxilliped (Fig. 2) epipodite length 3.85 width, length 1.06 endite length. Endite with two retinaculae, terminally with numerous fine setae. Margin of endite and palp articles 1 – 3 with row of fine setae. Palp article 2 with three setae on mesial margin and two setae on lateral margin, article 3 with five setae on mesial margin and one seta on lateral margin, article 4 with two setae, article 5 with three setae. Article 1 length 0.45 width, article 2 length 0.76 width, article 3 length 1.04 width, article 4 length 2.4 width, article 5 length 1.5 width.

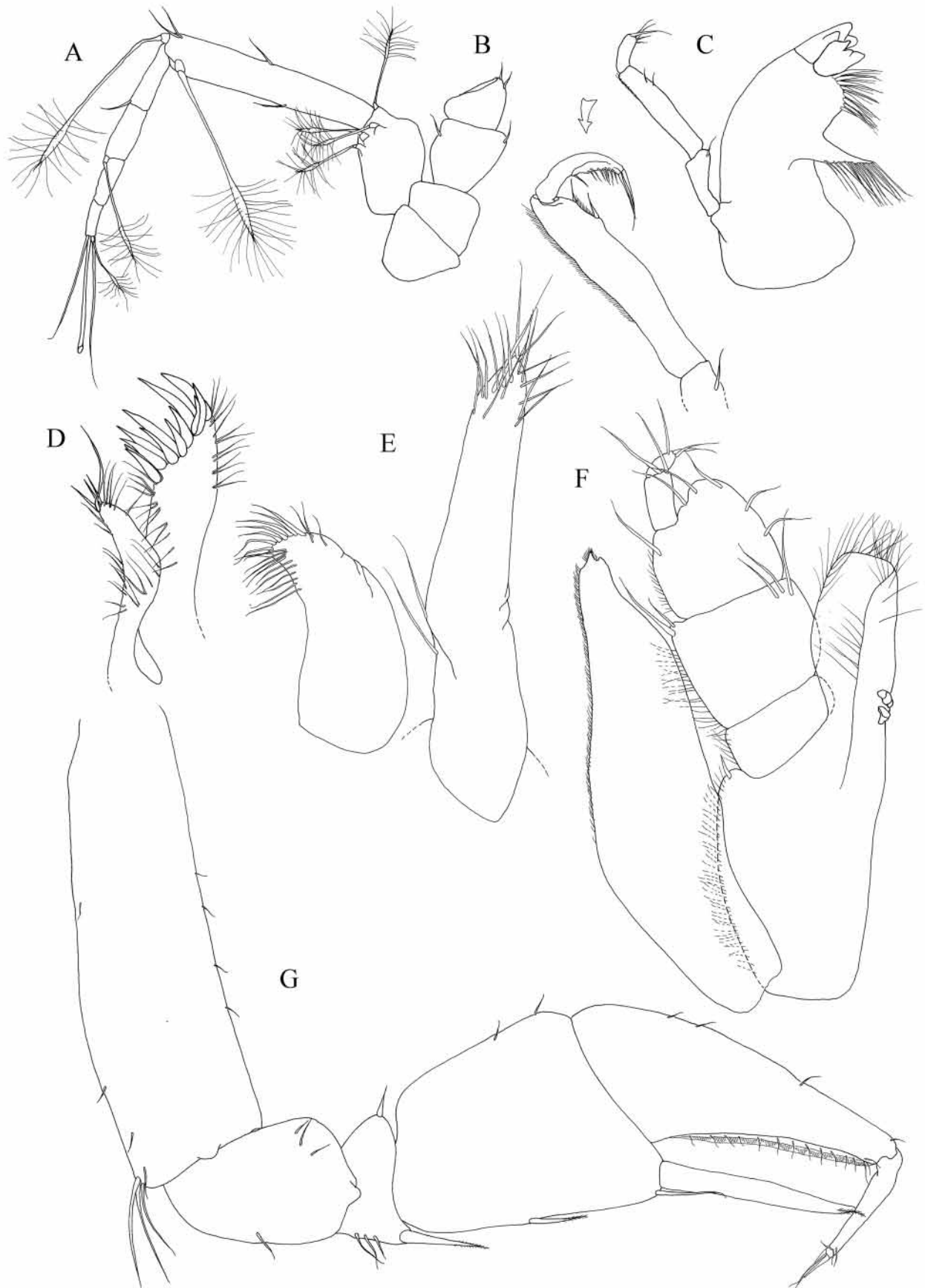


FIGURE 2: *Prochelator tupuhi* sp. nov., paratype female, antennula (A), antenna (B), mouthparts (C–F): left mandible (C), maxillula (D), maxilla (inner and outer lobe) (E), maxilliped (F), P 1 (G)



FIGURE 3: *Prochelator tupuhi* sp. nov., paratype female, pereopods (A–D): P 2 (A), P 3 (B), P 4 (C), P 5 (D).

Pereopod 1 (Fig. 2) Basis length 3.48 width, ventrally proximal to ischium with three slender setae, marginally with eight small setae. Ischium length 1.34 width, with few small setae. Merus length 0.32 width, ventrally with three small setae, ventrodistally with one robust distally setulate seta, dorsally one stout simple seta. Carpus length 1.42 width, distoventrally with large spine-like claw-seta and slender penultimate seta,

medioventrally with one small distally setulate seta, dorsally two small setae. Propodus length 2.82 width, dorsally with four small setae, ventrally fringed with fine setae inserted in cuticular membrane and 14 small setae. Dactylus length 6 times width. Claw of dactylus with one cuspidate and one conate setae, two slender setae medially.

Pereopod 2 (Fig. 3) Basis length 4.4 width, ventrally proximal to ischium with three slender setae. Ischium length 2.3 width, ventrally with three simple setae, dorsally with one small seta. Merus length 4.31 width, ventrally with four distally setulate setae, distodorsally with one simple seta. Carpus length 5.12 width, with ventral and dorsal rows of setae, ventrally with 12 distally setulate setae, dorsally 18 simple setae. Propodus length 5.12 width, ventrally with three small setae, distodorsally one simple seta. Dactylus length 6 times width. Claw of dactylus with one conate seta.

Pereopod 3 and *4* are similar to pereopod 2, differing only in the number of setae.

Pereopod 5 (Fig. 3) Basis length 3.9 width, medially with two broom setae. Ischium length 2.37 width, dorsally with row of five slender setae. Merus length 1.3 width, with two small setae. Carpus length 3.17 width, with ventral row of 13 long slender setae and dorsal row of 11 setae, distodorsally one small broom seta. Propodus length 2.75 width, with ventral row of nine long setae and dorsal row of 10 setae, additionally with two simple setae. Dactylus length 5.25 times width, mediolaterally with two small slender setae. Claw of dactylus with one long conate seta, two adjacent slender setae.

Pereopod 6 and *7* are similar to pereopod 5, differing only in the number of setae.

Pleopod 2 (operculum) (Fig. 4) length 1.2 width. Lateral margins straight, distal margin straight, with 30 simple setae.

Pleopod 3 (Fig. 4) Endopod length 1.31 width, distally with 3 long plumose setae. Exopod length 0.73 endopod length, margins hirsute, with one small distal seta.

Pleopod 4 (Fig. 4) Endopod oval-shaped, length 1.97 width. Exopod length 12 times width, distally with one long plumose seta.

Pleopod 5 (Fig. 4) Endopod only, length 3.08 width.

Uropods (Fig. 4) biramous. Endopod length 1.4 protopod length, 7.9 times longer than wide, marginally with one slender and two broom setae, distally with three small, one slender and six broom setae. Exopod length 5 times width, 0.3 endopod length, terminally with two setae. Protopod length 4.6 width, with few small slender setae.

Male:

Habitus (Fig. 5) similar to female, but Prn 1–4 as high as Prn 5–7, Plt with larger posterolateral spines.

Pleopod 1 (Fig. 5) 4.72 times longer than distal width, tips with distal bulges bearing four slender setae.

Pleopod 2 (Fig. 5) Sympod oval-shaped, length 1.37 width, lateral margin rounded, with seven slender setae. Endopod inserting at 0.49 of sympod's length.

Discussion: *Prochelator tupuhi* sp. nov. is assigned to the genus *Prochelator* on the basis of the carpo-chelate pereopod 1 (Wägele 1989, Brenke *et al.* 2005), one stout distally setulate seta midway on the ventral margin of the carpus, and the slender penultimate seta next to the large claw-seta.

Prochelator tupuhi is easy to distinguish from *P. incomitatus* and *P. angolensis* by having biramous uropods. Both of the latter species possess a very compact anterior part of the body, with pereonite 1 being twice as long as pereonite 2. Characters distinguishing *P. tupuhi* from other species of the genus with biramous uropods are: relatively elongate body without spine-like ventral elongations on pereonites 1–4 (as in *P. lateralis*, *P. uncatus* and *P. hamponi*). The remaining species of the genus are anteriorly compact, pereonites 1–4 are higher than pereonites 5–7 from lateral view. In *P. tupuhi* pereonite 1 is as high as pereonite 5, the medial lobe of the maxilla is much shorter than in the other species of the genus, reaching only half the length of the outer lobe. The carpus of pereopod 1 is distinctly produced at the base of the claw-seta, the propodus is broadest at the articulation to the carpus and tapers distally.

Etymology: The epithet is the Māori word *tupuhi* meaning thin (noun in apposition).

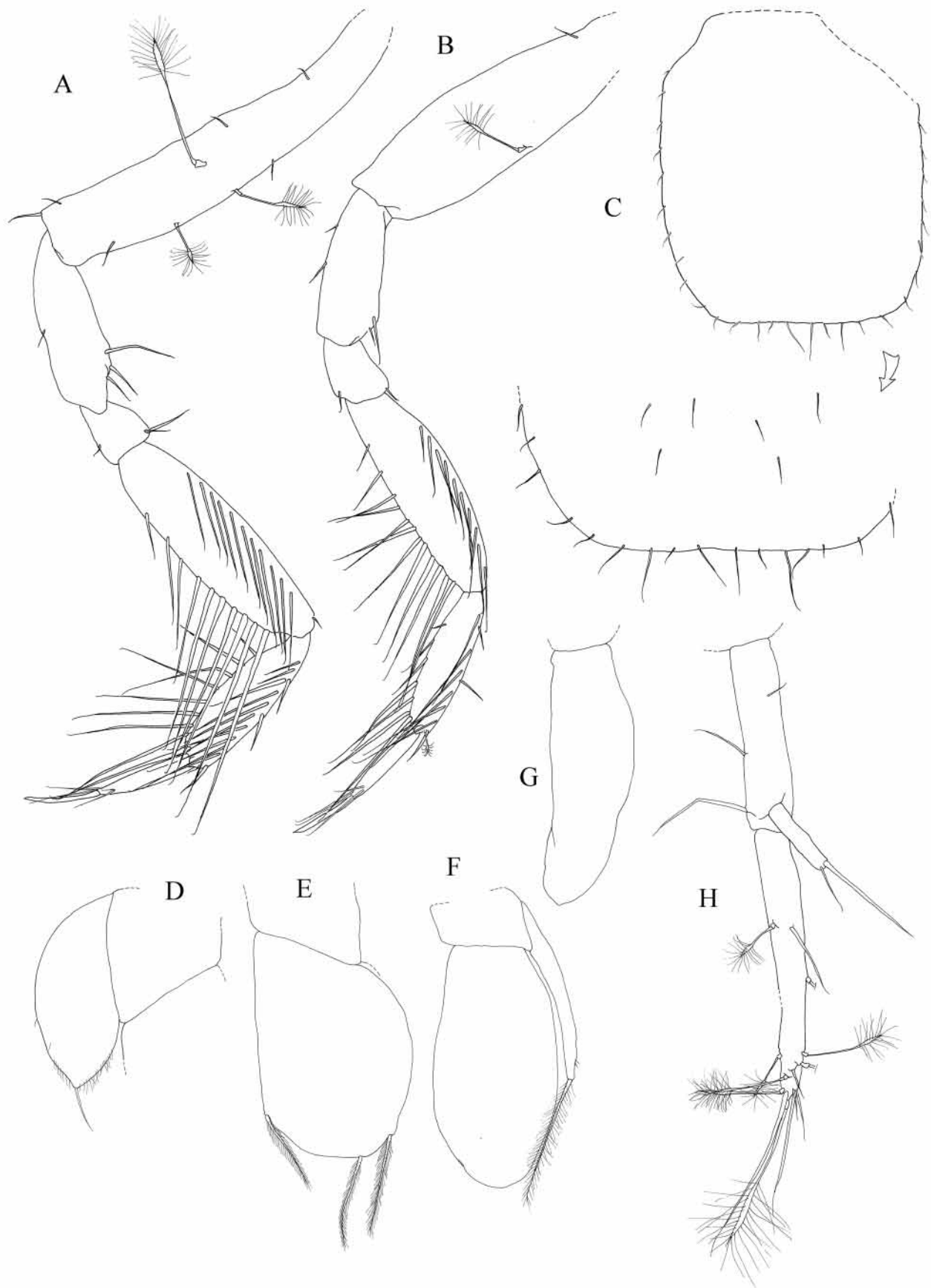


FIGURE 4: *Prochelator tupuhi* sp. nov., paratype female, pereopods (A–B): P 6 (A), P 7 (B), pleopods (C–H): operculum (C), exopod of Pl 3 (D), endopod of Pl 3 (E), Pl 4 (F), Pl 5 (G), uropod (H).

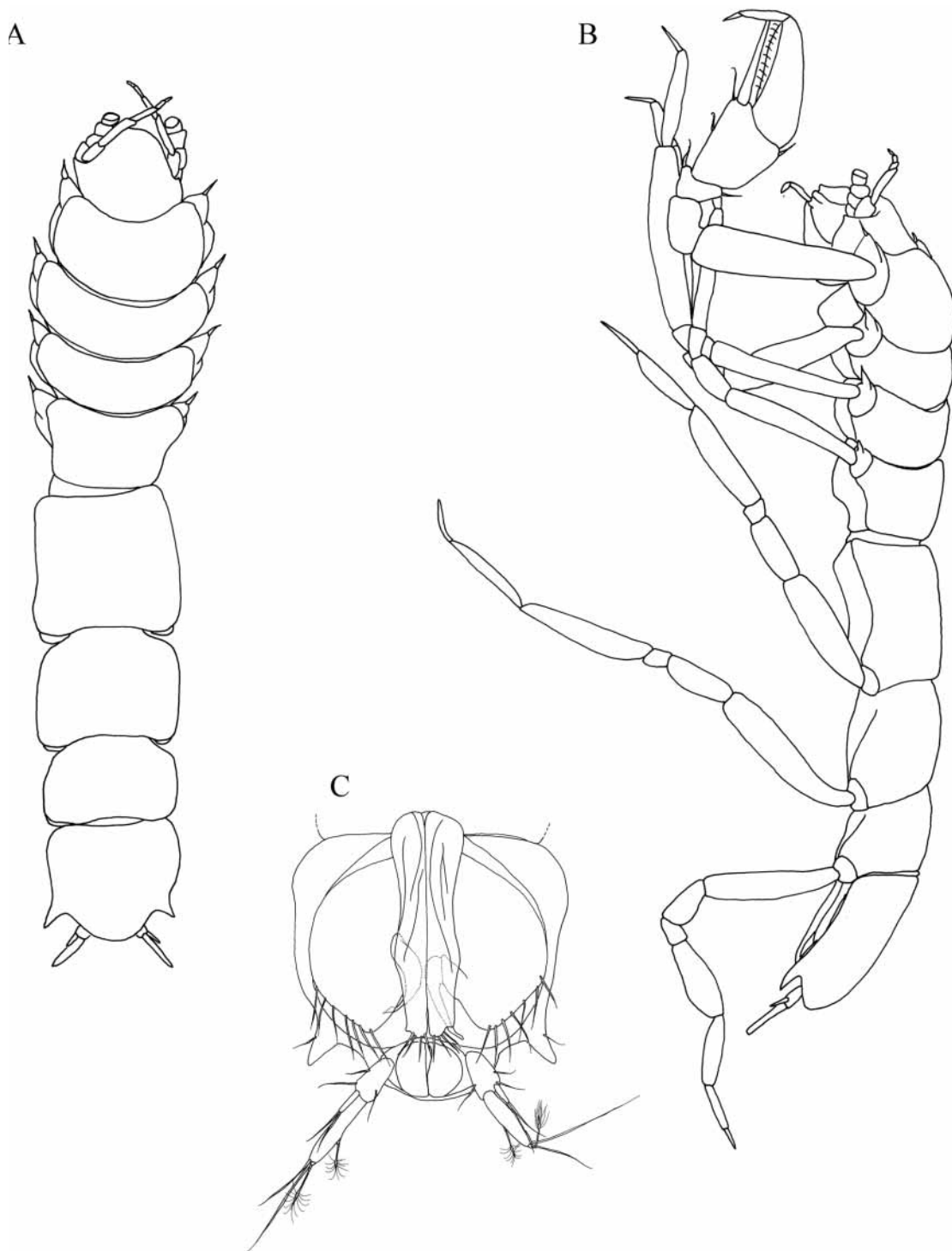


FIGURE 5: *Prochelator tupuhi* sp. nov., allotype male, habitus dorsal (A), lateral (B), pleotelson ventral (C).

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