

The genus *Floresorchestia* (Amphipoda: Talitridae) on Cocos (Keeling) and Christmas Islands

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Abstract

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The widespread Indo-West Pacific and Caribbean talitrid genus *Floresorchestia* is reported from Cocos (Keeling) and Christmas Islands for the first time and a new species, *F. poorei* is described. *Floresorchestia poorei* is common on the beaches of West Island, Cocos (Keeling).

Keywords

Crustacea, Amphipoda, Talitridae, Cocos (Keeling) Islands, Christmas Island, taxonomy, new species, *Floresorchestia poorei*

Introduction

As part of the Circum-Australian Amphipod Project (CAAP) a team of Australian Museum biologists collected extensively at Cocos (Keeling) Islands and Christmas Island during October 2008. Among the collections was a new species of *Floresorchestia* from sheltered sand beaches at Cocos (Keeling) Islands. A small population of *Floresorchestia* was also found at Dolly Beach on Christmas Island but no mature males were collected and we cannot describe it at this time. There are few other beaches on Christmas Island with suitable habitat. At the time of its collection the population was small, sheltering under coconuts and restricted to the edges of a small stream in the middle of Dolly beach.

Floresorchestia is a widespread coastal and forest-dwelling genus which occurs mainly on islands in the Indian and Pacific Oceans and in the Caribbean Sea. It is a straightforward genus to recognize because of the autapomorphic stridulating organs on the epimera. Unfortunately early species such as *F. pickeringi* (Dana, 1853), *F. floresiana* (Weber, 1892), *F. anomala* (Chevreux, 1901) and *F. ancheidos* (K.H. Barnard, 1916) were not well described in a modern sense and this has led to confusion in later identifications. Recently Miyamoto & Morino (2008) have produced modern detailed descriptions which reveal newly recognised species-level characters in the genus. In this paper we describe a new species, *F. poorei* from Cocos (Keeling) Islands and report an undescribed population of *Floresorchestia* from Christmas Island.

We think there are unrecognized species hidden in the synonymies of *F. anomala* and *F. floresiana*. We also suspect there are additional undiscovered species scattered throughout the numerous Indo-West Pacific islands. This is an important

area of investigation because this widespread Indo-West Pacific and Caribbean genus, with little means of dispersal, holds an important biogeography story.

Location

Cocos (Keeling) is an isolated atoll in the north-eastern Indian Ocean. Until the 1840's it was forested and was the site of a huge seabird rookery. In the early 1800s the habitat was destroyed and replaced with Coconut trees. The only remaining intact habitat in this set of islands is at North Keeling Island about 20 km north of Cocos (Keeling). The islands of Cocos (Keeling) are ringed by white calcareous sand beaches. *Floresorchestia poorei* is common in the supralittoral zone on these beaches wherever suitable habitat occurs. We strongly suspect *Floresorchestia poorei* was living at Cocos (Keeling) before the transformation, but there is a possibility that it was introduced with the Coconut plantations. If they were there before the transformation then they should be living on North Keeling Island.

Micro-morphology of *Floresorchestia*

The maxillipedal palp in talitrids may be fully developed, reduced to a small rectangular article, reduced to a button-shaped article or fused to article 3 of the palp. In *Floresorchestia poorei* it is reduced into a button-shaped article (fig. 1C).

The male gnathopod 1 and female gnathopod 2 have well developed lobes on the posterior margin of the merus, carpus and propodus (figs 1D, H, J, 2D). These lobes are covered in short palmate setae (fig. 2E, F) of Oshel & Steele (1988: 96, fig. 16). Palmate setae have a solid base radiating into short distal tines and may be used in rasping or scouring. They take

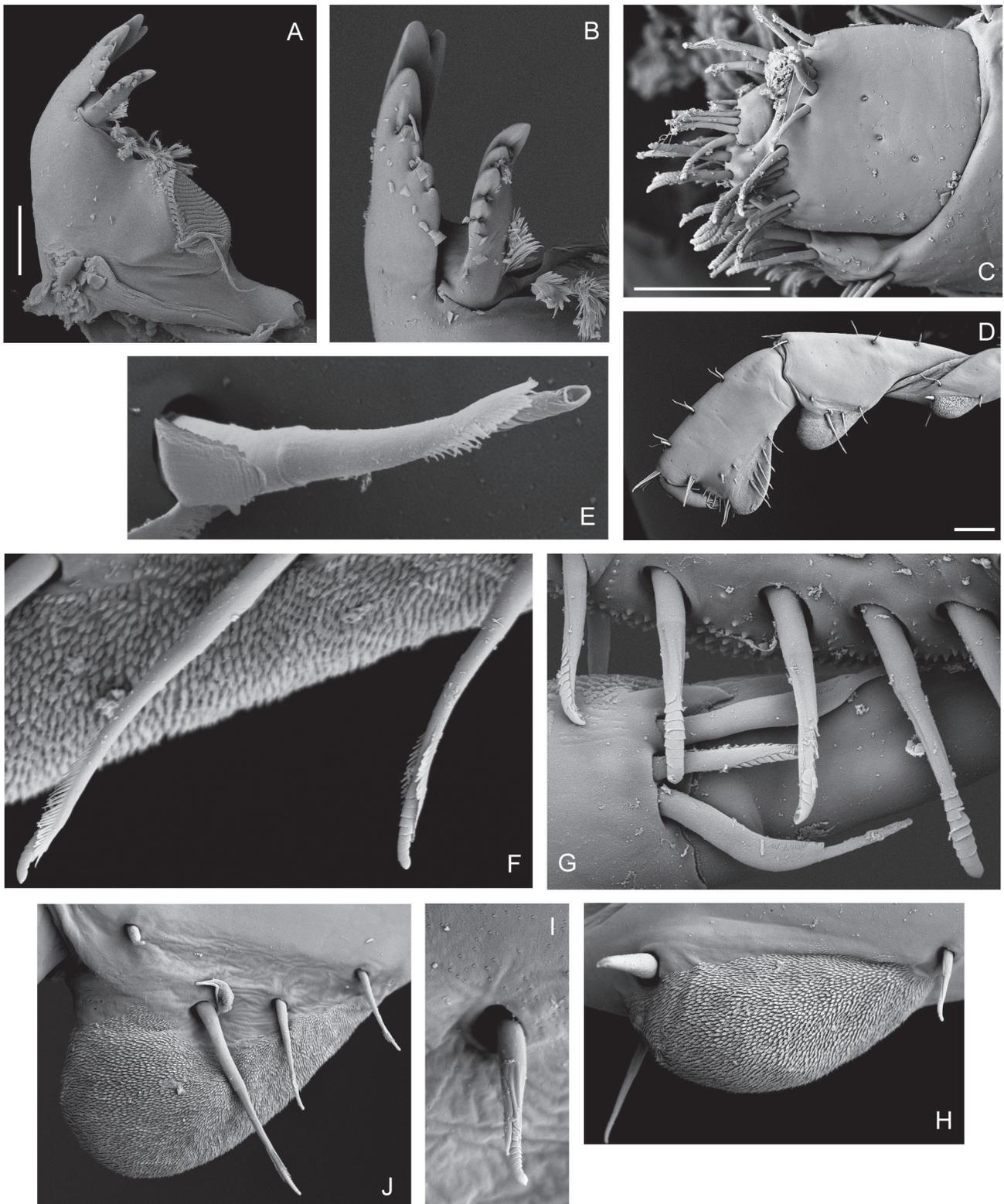


Figure 1. *Floresorchestia poorei* sp. nov., A–B, paratype, female, AM P80543: left mandible; B, left mandible incisor; C, paratype, female, AM P80543: maxilliped palp article 4. D–J, paratype, male, AM P80544: male gnathopod 1; E, propodus posterolateral serrate seta; F, propodus posterolateral serrate setae; G, palm and dactylus showing cuspidate setae along palm; H, merus showing posterior lobe covered in palmate setae; I, propodus lateral cuspidate seta; J, carpus showing posterior lobe covered in palmate setae. Scale bars: A, B and D represent 100 μ m, C represents 50 μ m.

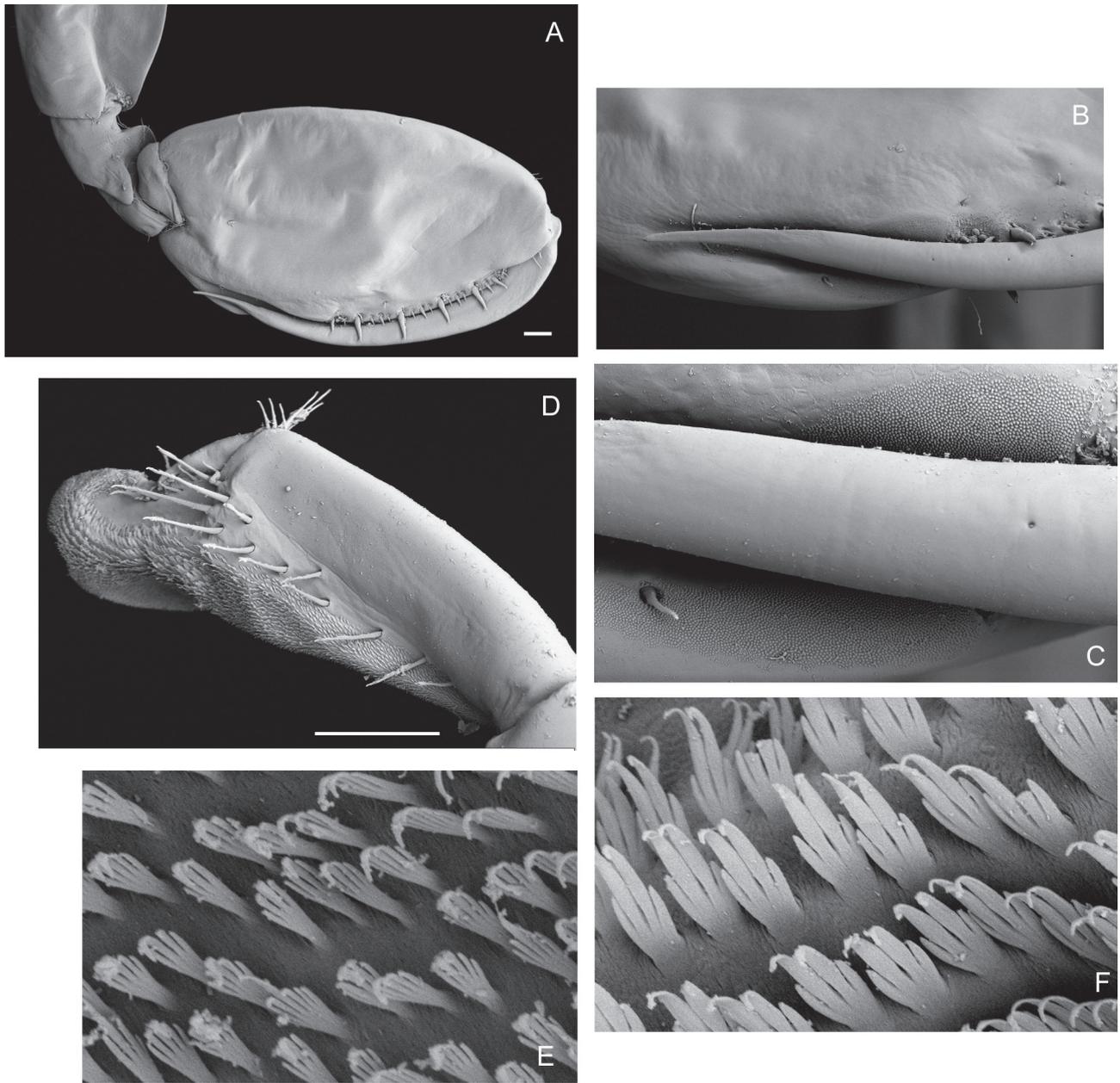


Figure 2. *Floresorchestia poorei* sp. nov., A–C, gnathopod 2, paratype, male, AM P80544: B, posteromedial margin of palm showing attenuated dactylus fitting into groove with cuticular patch; C, cuticular patch. D–F, gnathopod 2, paratype, female, AM P80543: E, small palmate setae on propodus; F, large palmate setae on propodus. Scale bars: A and D represent 100 μ m.

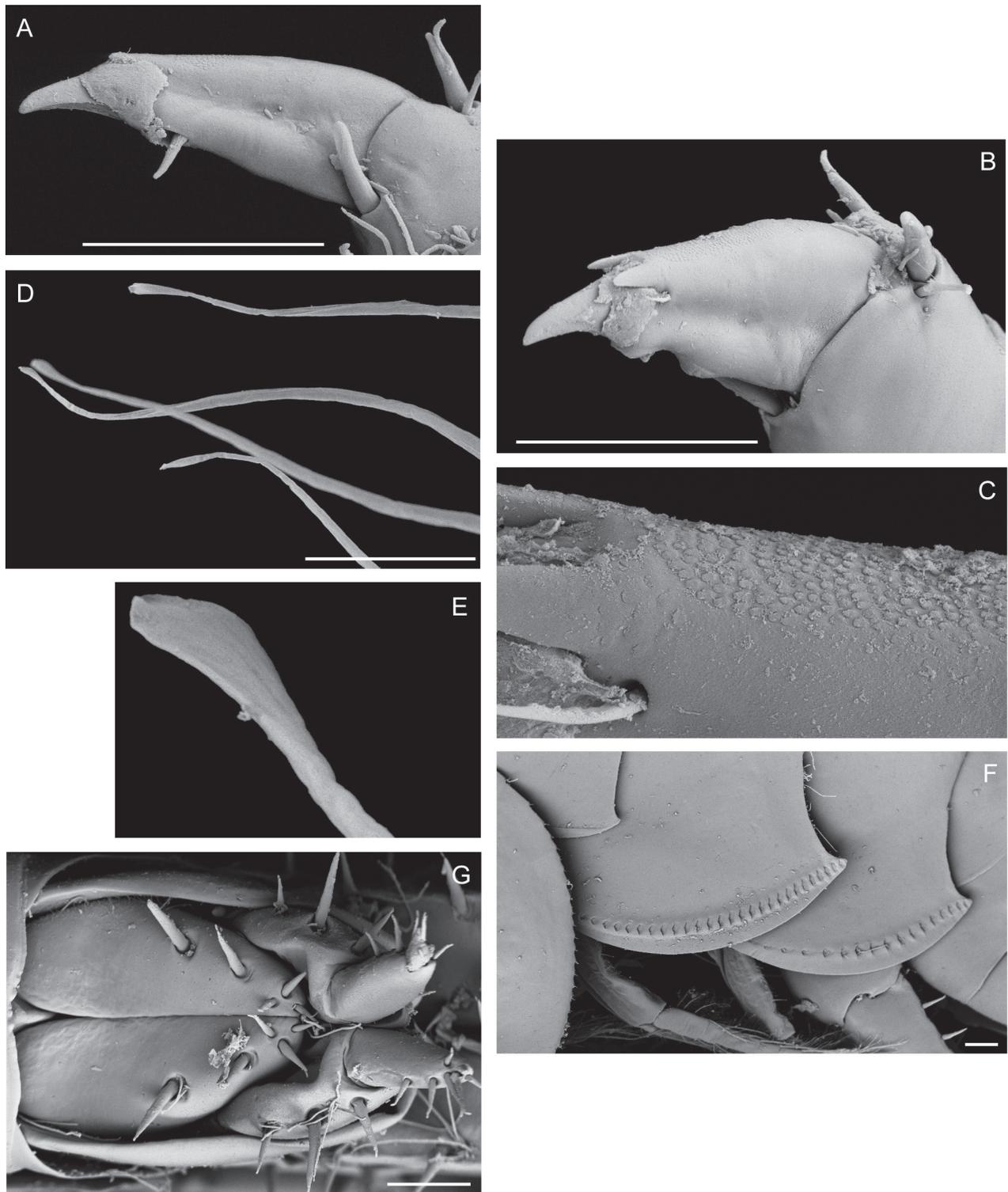


Figure 3. *Floresorchestia poorei* sp. nov., A–C, paratype, female, AM P80543: A, pereopod 3 dactylus; B, pereopod 4 dactylus; C, denticulate patch on dactylus of pereopod 4; D–G, paratype female, AM P80532: D–E, spatulate setae on oostegite of gnathopod 2; F, stridulating organ on epimera 2 and 3, basis of pereopod 7 posterior margin; G, telson and uropod 3. Scale bars: A, B, F and G represent 100 μm , D represents 20 μm .

slightly different forms depending on their position on the lobes. Whatever the function these lobes are widespread within the talitrids. In males they are found on different combinations of the merus, carpus and propodus of gnathopod 1 and in females, and males of a number of land-hopper genera, they occur on gnathopod 2.

On the surface of the propodus of gnathopod 1 there are least two types of sensory setae. Both of these setal types appear to have pores at the tips. Cuspidate setae occur along the palm (fig. 1G) and on the lateral and medial surfaces (fig. 1I). A short, slender, sharp projection arises from the side of the shaft and a row of denticles covers the distal end. At the tip is a distinct pore. The posterolateral serrate setae (fig. 1E, F) have a long, slender shaft with setules, distal denticles and a terminal pore, similar to the plumodenticulate setae of Watling (1989, 22, fig. 4E) and the serrate setae of Garm (2004, fig 8a, c).

On male gnathopod 2 the anterior margin of the basis and ischium develop lateral and medial flanges which form a cradle for the propodus (fig. 2A). The dactylus is distally attenuated and fits into a groove along the posteromedial margin of the propodus (fig. 2B). At the corner of the palm where the groove begins there is a distinct cuticular patch of tiny denticles (fig. 2C). This patch forms an abrasive pad which may assist holding.

The cuspidate dactylus of pereopod 3 tapers evenly along its margin (fig. 3A), but the dactylus of pereopod 4 is thickened at the base and a distinct notch occurs along the posterior margin (fig. 3B). On the anterodistal margin of the dactyli of pereopods 3 and 4 there is a dense patch of about 20 rows of what appears to be tiny denticles (fig. 3C). These patches occur in other talitrids and also on pereopods 5–7. A patch of what appears to be spatulate setae is shown on the dactylus of pereopods 5 and 6 of *Notorchestia naturaliste* (Serejo & Lowry 2008: 186, fig. 18). The function of these patches is not known.

Among female talitrids three types of setae have been documented on the oostegites: simple setae, curl-tipped setae and setae with multi-furcate tips. In *Floresorchestia poorei* a fourth type occurs. The long slender setae (fig. 3D) become splayed at the tip (fig. 3E) to form a spatulate locking mechanism.

Although ‘slits’ on the epimeral plates of *Floresorchestia* have been mentioned many times, only Bousfield (1970, 1971) has ever considered their function as stridulating organs. The serrate posterior margin of the basis of pereopod 7 has also been mentioned many times, most recently by Miyamoto & Morino (2008). We have had a close look at this morphology (figs 3F). The so called ‘slits’ are relatively complex structures with a raised anterior border and an immediately posterior hollow bowl or slit. Bousfield (1970, 1971) referred to these structures as stridulating ridges and we agree that these ridges form a stridulating organ. And the stridulator appears to be the unique, strongly serrate posterior margin with tiny robust setae on the basis of pereopod 7. The interesting thing is that they occur on both sexes so the function is probably not to attract a mate.

The telson in *Floresorchestia* may be entire, apically

notched partially cleft or in the case of *F. poorei* completely cleft (fig. 3G). The telson appears to be enclosed by the sides of urosomite 3 and the peduncle of uropod 3.

Material and methods

The descriptions were generated from a DELTA database (Dallwitz 2005) to the talitrid genera and species of the world. All material is lodged in the Australian Museum, Sydney (AM). Abbreviations are: **A**, antenna; **G**, gnathopod; **UL**, upper lip; **MD**, mandible; **LL**, lower lip; **MX**, maxilla; **MP**, maxilliped; **P**, pereopod; **pl**, pleopod; **T**, telson; **U**, uropod; **L**, left; **R**, right.

Talitridae Rafinesque, 1815

Floresorchestia Bousfield, 1984

Orchestia floresiana group Bousfield, 1971: 267.

Floresorchestia Bousfield, 1984: 205. —Miyamoto & Morino, 2008: 838.

Type species. *Orchestia floresiana* Weber, 1892, original designation.

Included species. *Floresorchestia* includes 14 species: *F. ancheidos* (K. H. Barnard, 1916); *F. anomala* (Chevreux, 1901); *F. anoquesana* (Bousfield, 1971); *F. anpingensis* Miyamoto & Morino, 2008; *F. floresiana* (Weber, 1892); *F. guadalupensis* Ciavatti, 1989; *F. hanoiensis* Hou & Li, 2003; *F. monospina* (Stephensen, 1935); *F. pectenispina* (Bousfield, 1970); *F. pickeringi* (Dana, 1853); *F. poorei* sp. nov.; *F. samoana* (Bousfield, 1971); *F. vitilevana* (J.L. Barnard, 1960); *F. yehyuensis* Miyamoto & Morino, 2008.

Description. *Head.* *Mandible* left lacinia mobilis 5-dentate or 4-dentate. *Maxilliped* palp article 2 distomedial lobe well developed, article 4 reduced, button-shaped.

Pereon. *Gnathopod 1* posterior margin of merus, carpus and propodus each with lobe covered in palmate setae; palm transverse. *Gnathopod 2* subchelate. *Pereopods 2–4* coxae wider than deep. *Pereopods 6–7* longer than pereopods 3–5. *Pereopod 6* posterior lobe inner view posteroventral corner subquadrate or posteroventral corner rounded. *Pereopod 7* basis posterior margin with distinct minute serrations, each with a small seta.

Pleon. *Pleopods* all well developed. *Pleopod 1* peduncle with or without sparse marginal setae. *Pleopod 2* peduncle with or without sparse marginal setae; outer ramus longer than peduncle. *Pleopod 3* peduncle with or without marginal robust setae. *Epimera 2–3* each with stridulating organs just above ventral margins. *Uropod 1* peduncle distolateral robust seta present; inner ramus with marginal robust setae; outer ramus without marginal robust setae or with one long midmedial seta (in male). *Uropod 2* not sexually dimorphic; outer ramus with marginal robust setae. *Uropod 3* ramus shorter than peduncle. *Telson* with marginal and apical robust setae.

Female (sexually dimorphic characters). *Gnathopod 1* posterior margin of merus, carpus and propodus each without lobe covered in palmate setae; palm slightly acute. *Gnathopod*

2 mitten-shaped.

Habitat. Supralittoral and terrestrial amphipods of tropical rain forests, mangroves and beaches in the Indo-West Pacific and Caribbean.

Remarks. *Floresorchestia* belongs to a group of Indo-West Pacific genera which includes *Microrchestia* Bousfield, 1984, *Platorchestia* Bousfield, 1982, *Protorchestia* Bousfield, 1982, *Sinorchestia* Miyamoto & Morino, 1999 and *Talorchestia* Dana, 1853. They all share a 5 dentate left lacinia mobilis, subchelate male gnathopod 2, well developed pleopods and uropod 1 without marginal robust setae on the outer ramus (except *Sinorchestia nipponensis* which has marginal robust setae on the outer ramus). Within the group *Floresorchestia*, *Platorchestia*, *Sinorchestia* and *Talorchestia* have cuspidactylate pereopods. Only *Floresorchestia* and *Platorchestia* have the reduced button-shaped fourth articles on the palps of the maxilliped and distally attenuated dactyli on male second gnathopods. Both of these genera have wide distributions.

Floresorchestia monospina (Stephensen, 1935) and *F. pectenispina* (Bousfield, 1970) differ from other species in the genus in having a long, marginal slender robust seta with a modified tip on the outer ramus of male uropod 1 (Bousfield 1970). *Floresorchestia hanoiensis* Hou & Li, 2003, *F. malayensis* (Tattersall, 1921), *F. samoana* (Bousfield, 1971) and *F. vitilevana* (J.L. Barnard, 1960) differ from other species in the genus in not having stridulating organs on epimera 2 and 3. In other respects these species appear to be *Floresorchestia* and *F. hanoiensis* has pitting on the face of epimera 1 and 2. *Floresorchestia pickeringi* (Dana, 1853) needs to be redescribed to confirm its status in the genus.

Floresorchestia ancheidos (K.H. Barnard, 1916), *F. anomala* (Chevreux, 1901) and *F. floresiana* (Weber, 1892), type species of the genus, are all poorly described species and *F. anomala* and *F. floresiana* are the source of questionable synonymies from wide-ranging localities. These species also need to be redescribed based on new material from the type localities using modern characters as outlined by Miyamoto & Morino (2008) before realistic distributions for species in the genus can be determined.

***Floresorchestia poorei* sp. nov.**

(Figures 1 – 7)

Material examined. Holotype: Indian Ocean, Cocos (Keeling) Islands, West Island, Rumah Baru, (12°09'22"S 96°49'41"E), beach wrack, J.K. Lowry and K.B. Attwood, 8 Oct 2008, (stn MI WA 819), AM P80192 (ovigerous female, 9.2 mm).

Paratypes: type locality, AM P80193 (male, 11.7 mm); AM P80194 (many specimens); AM P80532 (female); AM P80543 (female); AM P80544 (male); AM P80549 (male).

Other material: Indian Ocean, Cocos (Keeling) Islands, West Island, Government House Beach, (12°05'04"S 96°52'54"E), sand beach, J.K. Lowry, L.E. Hughes and K.B. Attwood, 7 Oct 2008, (stn MI WA 780), AM P.80545 (many specimens). Indian Ocean, Cocos (Keeling) Islands, West Island, beach near "Two Trees dive site", (12°05'04"S 96°52'54"E), J.K. Lowry, L.E. Hughes and K.B. Attwood, 7 Oct 2008, (stn MI WA 779), AM P.80547 (6 males, 7 females).

Type locality. Rumah Baru, West Island, Cocos (Keeling) Islands, Indian Ocean (12°09'22"S 96°49'41"E).

Etymology. Named for our good friend Gary Poore in thanks for his help over the years and in recognition of his immense contribution to the field of carcinology.

Description. Based on holotype, ovigerous female, AM P80192.

Head. Eye large (greater than 1/3 head length). *Antenna 1* short, rarely longer than article 4 of antenna 2 peduncle. *Antenna 2* up to half body length; peduncular articles narrow; article 5 longer than article 4. *Mandible* left lacinia mobilis 5-dentate. *Maxilliped* palp article 2 distomedial lobe well developed, 4 reduced, button-shaped.

Pereon. *Gnathopod 1* sexually dimorphic; parachelate; coxa 1 smaller than coxa 2; posterior margin of merus, carpus and propodus each without lobe covered in palmate setae, in male only; propodus subrectangular, propodus posterior margin with 3 cuspidate setae along posterior margin, propodus posterior margin with 3 serrate setae along posterior margin; palm acute, palm with 4 serrate setae; dactylus longer than palm. *Gnathopod 2* sexually dimorphic; mitten-shaped; coxal gill simple or slightly lobate; basis anterior margin smooth, basis expanded proximally; ischium without posterodistal lobe on medial surface; posterior margin of merus, carpus and propodus each with lobe covered in palmate setae; carpus well developed (not enclosed by merus and propodus), posterior lobe present, projecting between merus and propodus; palm obtuse, smooth, not lined with robust setae, palm without patch of tiny denticles at corner of palm; dactylus subequal in length to palm, not attenuated distally; gill simple, not incised. *Pereopods 2–4* coxae wider than deep. *Pereopods 3–7* cuspidactylate. *Pereopod 4* subequal or slightly shorter than pereopod 3; carpus significantly shorter than carpus of pereopod 3; dactylus thickened proximally with a notch midway along the posterior margin. *Pereopod 5* propodus distinctly longer than carpus. *Pereopods 6–7* longer than pereopods 3–5. *Pereopod 6* not sexually dimorphic; slightly shorter than pereopod 7; posterior lobe inner view posteroventral corner rounded, posterior margin perpendicular to ventral margin, posterior lobe with ridge, posterior lobe with 1–2 marginal setae. *Pereopod 7* not sexually dimorphic; basis lateral sulcus absent, basis posterior margin with distinct minute serrations, each with a small seta, posterodistal lobe present, shallow, broadly rounded; distal articles (merus and carpus) slender; merus posterior margin evenly rounded; propodus setation without large distal tuft of setae. *Oostegites* long (length greater than 2 x width), longer than wide, weakly setose (6–11 setae), setae with spatulate tips.

Pleon. *Pleopods* all well developed. *Pleopod 1* peduncle with marginal slender setae; biramous, outer ramus shorter than peduncle, inner ramus subequal in length to outer; inner ramus with 9 articles; outer ramus with 6 articles. *Pleopod 2* peduncle with marginal slender setae; biramous, inner ramus subequal in length to outer, outer ramus shorter than peduncle; inner ramus with 7 articles. *Pleopod 3* peduncle without marginal setae. *Pleopod 3* biramous, inner ramus subequal in length to outer, outer ramus shorter than peduncle; rami

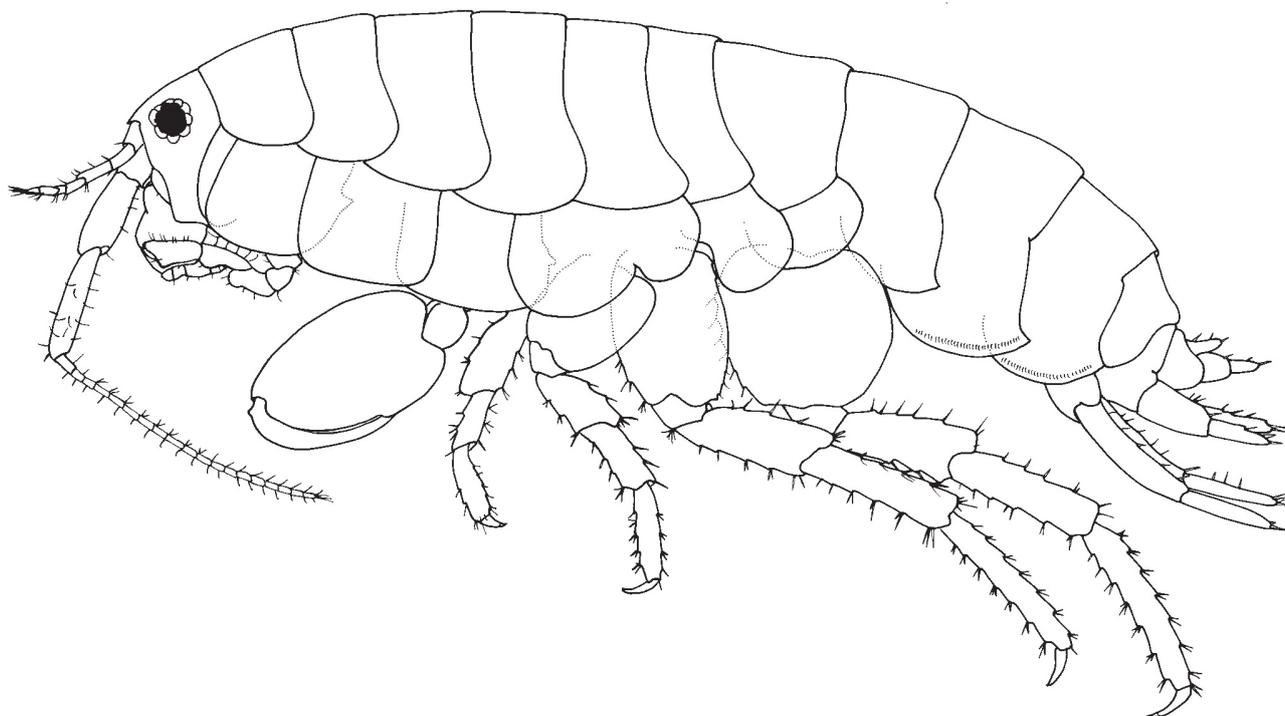


Figure 4. *Floresorchestia poorei* sp. nov., paratype, male, 11.7 mm, AM P80193.

multarticulate; inner ramus with 6 articles; outer ramus with 6 articles. *Epimera* 2–3 each with a stridulating organ just above ventral margins. *Epimera* 2 subequal in length to epimeron 3, with 27 ridges. *Epimera* 3 with 17 ridges, posterior margin smooth, without setae, posteroventral corner with small subacute tooth, ventral margin without robust setae. *Uropod* 1 not sexually dimorphic; peduncle with 8 robust setae, distolateral robust seta small; with simple tip; inner ramus subequal in length to outer ramus, with 3 marginal robust setae; outer ramus without marginal robust setae. *Uropod* 2 not sexually dimorphic; peduncle with 6 robust setae; inner ramus subequal in length to outer ramus, with 2 marginal robust setae; 1 marginal robust setae. *Uropod* 3 peduncle with 3 robust setae; ramus shorter than peduncle, ramus linear (narrowing), with 2 marginal robust setae, with 4–5 apical setae. *Telson* longer than broad, completely cleft, with 5 marginal and apical robust setae per lobe.

Male (sexually dimorphic characters). Based on male, AM P80193. *Gnathopod* 1 subchelate, posterior margin of merus, carpus and propodus each with lobe covered in palmate setae; propodus subtriangular with well developed posterodistal lobe, anterior margin with 3 groups of robust setae, lateral surface with 2 cuspidate setae, posterolateral surface with 5 serrate setae, propodus posterior margin without cuspidate or serrate setae along posterior margin; palm transverse, dactylus subequal in length to palm. *Gnathopod* 2 subchelate; basis slightly expanded; ischium distal triangular posterodistal lobe

on medial surface; posterior margin of merus, carpus and propodus each without lobe covered in palmate setae; carpus triangular, reduced (enclosed by merus and propodus), posterior lobe absent, not projecting between merus and propodus; propodus subovate; propodus twice as long as wide; palm acute, lined with robust setae; palm with cuticular patch of tiny denticles at corner of palm, posteromedial surface of propodus with groove; dactylus longer than palm, attenuated distally.

Habitat. Living in the supralittoral zone on sheltered beaches under seaweeds and debris.

Remarks. *Floresorchestia poorei* is currently the only species in the genus with a fully cleft telson.

Distribution. North-Eastern Indian Ocean. Cocos (Keeling) Islands (current study).

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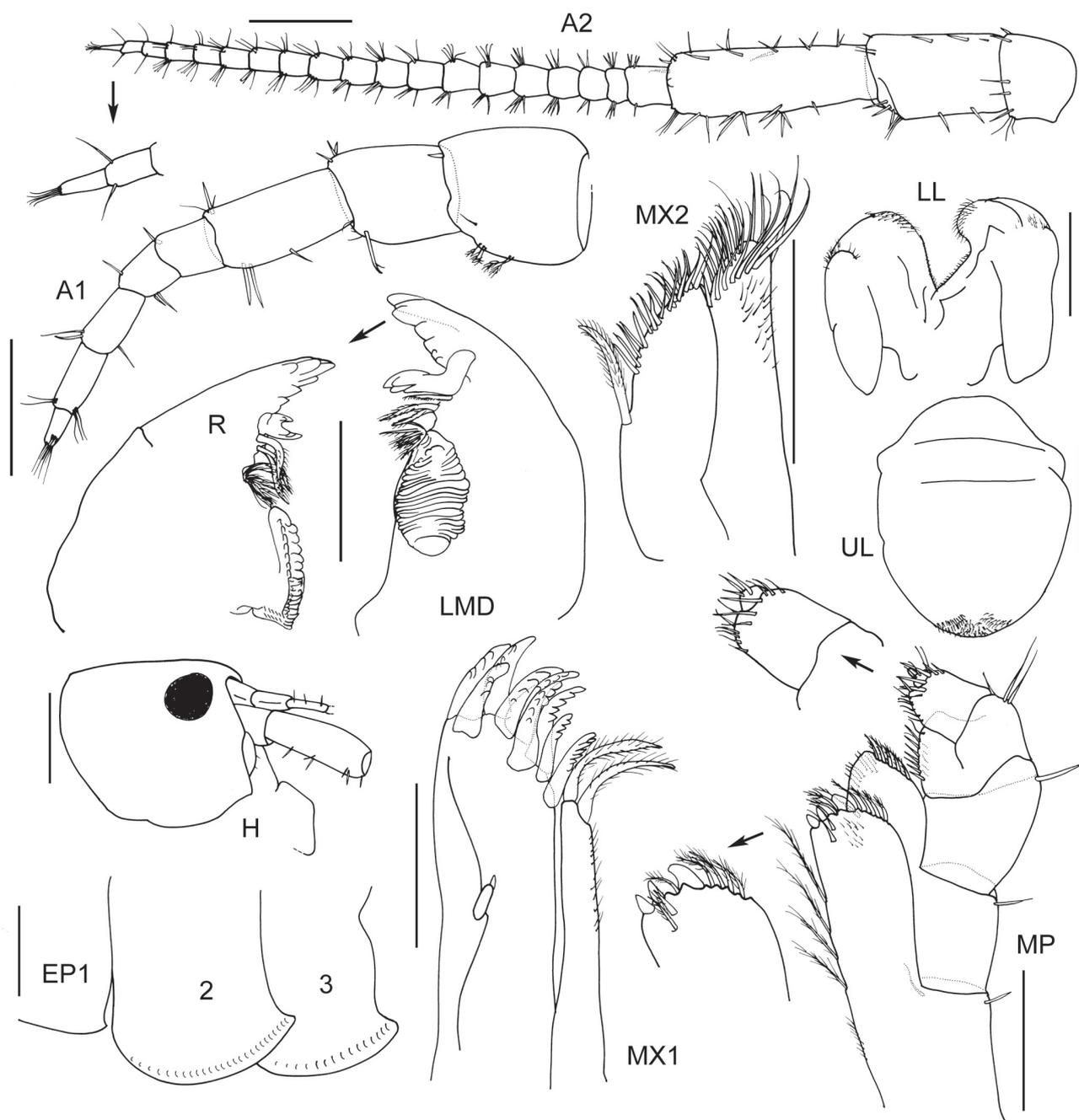


Figure 5. *Floresorchestia poorei* sp. nov., holotype, ovigerous female, 9.2 mm, AM P80192. Scale bars: H, Ep1–3 represent 0.5 mm, remainder represent 0.2 mm.

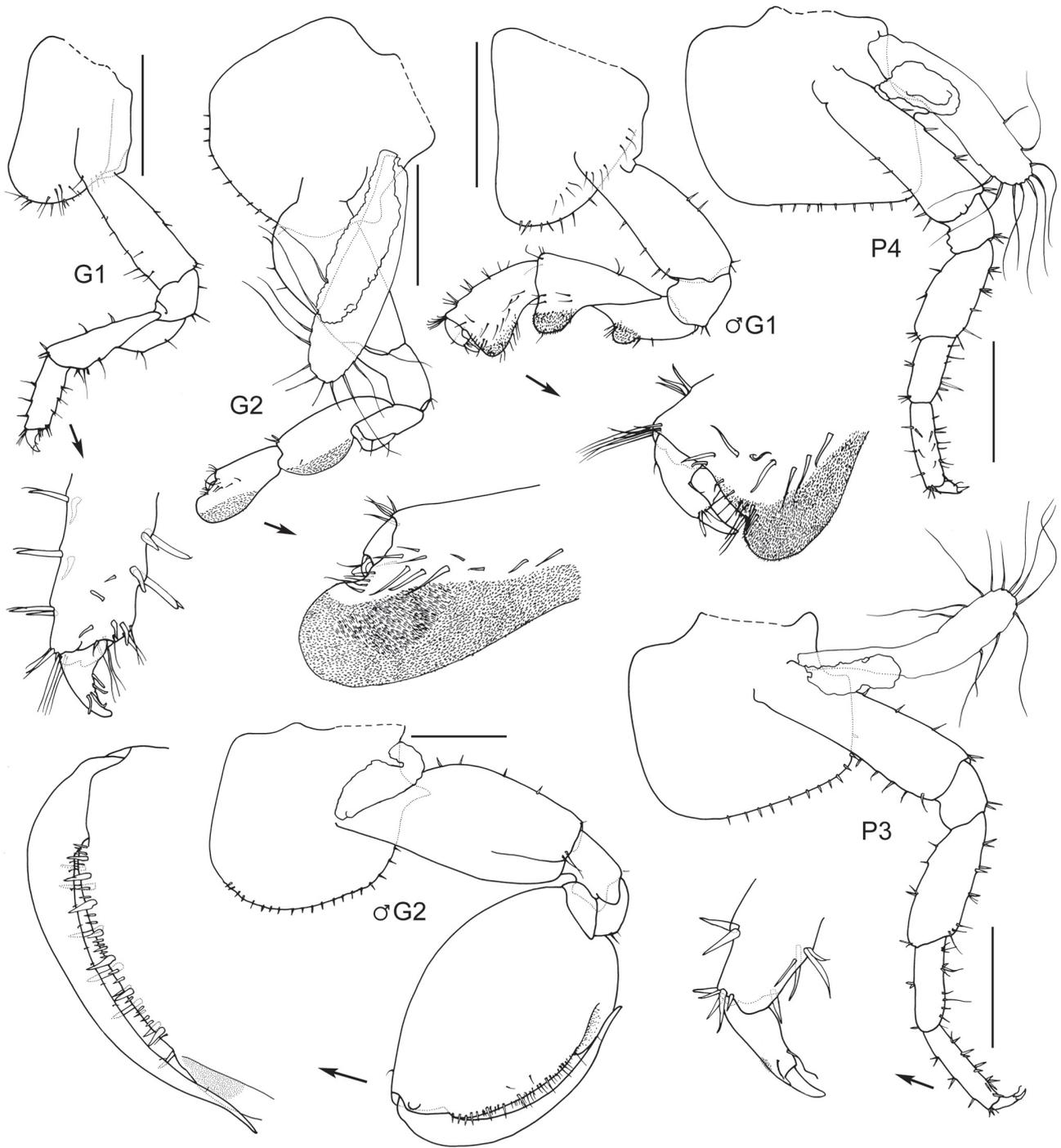


Figure 6. *Floresorchestia poorei* sp. nov., holotype, ovigerous female, 9.2 mm, AM P80192, paratype, male, 11.7 mm, AM P80193. Scale bars represent 0.5 mm.

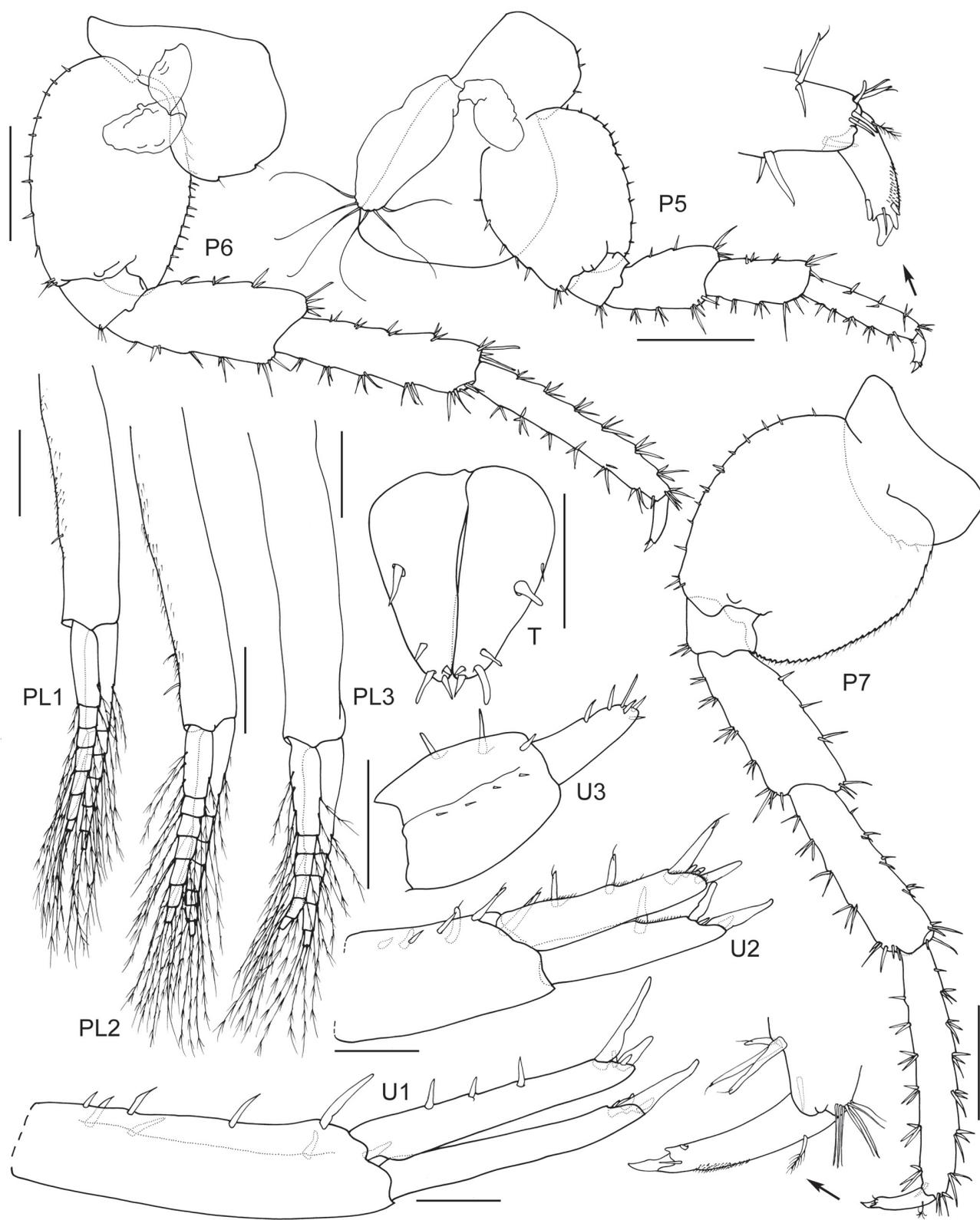


Figure 7. *Floresorchestia poorei* sp. nov., holotype, ovigerous female, 9.2 mm, AM P80192. Scale bars: P5–7 represent 0.5 mm, remainder represent 0.2 mm.

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