Zootaxa 5093 (5): 569–583
https://www.mapress.com/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5093.5.6
http://zoobank.org/urn:lsid:zoobank.org:pub:6A22F8F6-82A2-46B0-B965-51C2C38840E6

Maerid amphipods (Crustacea: Amphipoda) from Okinawa, Japan with description of a new species

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Abstract

Two species of Maeridae are reported from extensive tidal flat collections on the east coast of Okinawa Island, Japan. A range extension is reported for *Ceradocus mizani* Lim, Azman & Othman, 2010. *Elasmopus mukuinu* **sp. nov.** is described and is most similar to species in the *Elasmopus pectenicrus* (Bate, 1862) group in Hughes & Lowry (2011). The new species is distinguished from other species based on the gnathopod 2 propodus bearing a subrectangular hump near insertion of the dactylus, the propodus being covered in dense tufts of long setae and the posterior margins of pereopods 5, 6, and 7 (almost smooth, serrate, and crenulate, respectively).

Key words: *Elasmopus mukuinu* **sp. nov.**, Maeridae, new species, Okinawa, *Ceradocus mizani*

Introduction

Amphipods in the family Maeridae are distinguished by having a magni- and aequiramous third uropod (Krapp-Schickel 2008). Lowry & Hughes (2009) also include the following defining characteristics for amphipods in the family Maeridae: having the anteroventral head margin notched, sexual dimorphism in gnathopod 2, and subequal coxae 1–3. In 2011–2012, a survey of the impact of Kaichu Doro causeway construction on the environment and biota of tidal flats was carried out (Reimer *et al.* 2013). The Kaichu Doro connects Katsuren Peninsula of Okinawa main island to the smaller Henza-jima Island across extensive subtropical tidal flats. During the survey, two species of maerid amphipods were collected: one in the genus *Ceradocus* Costa, 1853 and one in the genus *Elasmopus* Costa, 1853.

From Japan, four species of *Ceradocus* have been documented: *C. capensis* Sheard, 1939 from Hiroshima Prefecture; *C. inermis* Hirayama, 1986 from Kumamoto Prefecture; *C. kiiensis* Ariyama, 2019 from Wakayama Prefecture; and *C. leavis* Oleröd, 1970 from Okinawa Prefecture.

Nakamura *et al.* (2019) reported eight species of *Elasmopus* from Japan and surrounding waters: *E. hooheno* Barnard, 1970; *E. japonicus* Stephensen, 1932; *E. koreanus* Kim & Kim, 1991; *E. nanshaensis* Ren, 1998; *E. nkjaf* Nakamura, Nakano, Ota & Tomikawa, 2019; *E. pectenicrus* (Bate, 1862); *E. rapax* Costa, 1853; and *E. smirnovi* Bulycheva, 1952. However, only two species have been documented from Japanese waters (*E. japonicus* from Wakayama Prefecture and *E. nkjaf* from Okinawa Prefecture).

Closer examination of the two species collected herein has revealed that the *Ceradocus* species is a new record in Okinawa and the *Elasmopus* species is new to science. The morphologies of the two species are described in the present paper.

Materials and methods

Rubble and sediment samples were collected from ten stations along the tidal flat at Kaichu-Doro, Okinawa Island, Japan between November 2011 and July 2012 (Table 1). Samples were immediately elutriated with 10 ml of formalin following the methods of White (2013) to remove amphipods. The contents of the sieve (500 µm mesh) were then transferred to a vial and preserved in 99.5% EtOH before rough sorting and identifying amphipods.

Accepted by K. Tomikawa: 12 Jan. 2022; published: 1 Feb. 2022

Specimens were transferred to glycerol for morphological examination under a Zeiss Stemi 2000C stereomicroscope. The body length from the tip of the rostrum to the base of the telson was measured along the dorsal curvature to the nearest 0.1 mm. Dissected specimens were illustrated using a Meiji MT5900L phase contrast microscope with an Olympus U-DA drawing tube attached. Illustrations were digitally inked following Coleman (2003) in Adobe Illustrator 2020 using a Wacom® Intuos Pro Pen Tablet. Specimens denoted by NMST are deposited in the National Museum of Nature and Science in Tokyo, Japan. Remaining specimens are stored at the University of the Ryukyus Museum (Fujukan).

Taxonomy

Family Maeridae Krapp-Schickel, 2008

Genus *Ceradocus* Costa, 1853

(Figs 1A, B, 2–3)

Ceradocus mizani Lim, Azman & Othman, 2010
Ceradocus mizani Lim, Azman & Othman, 2010: 24–31, figs 1–5.

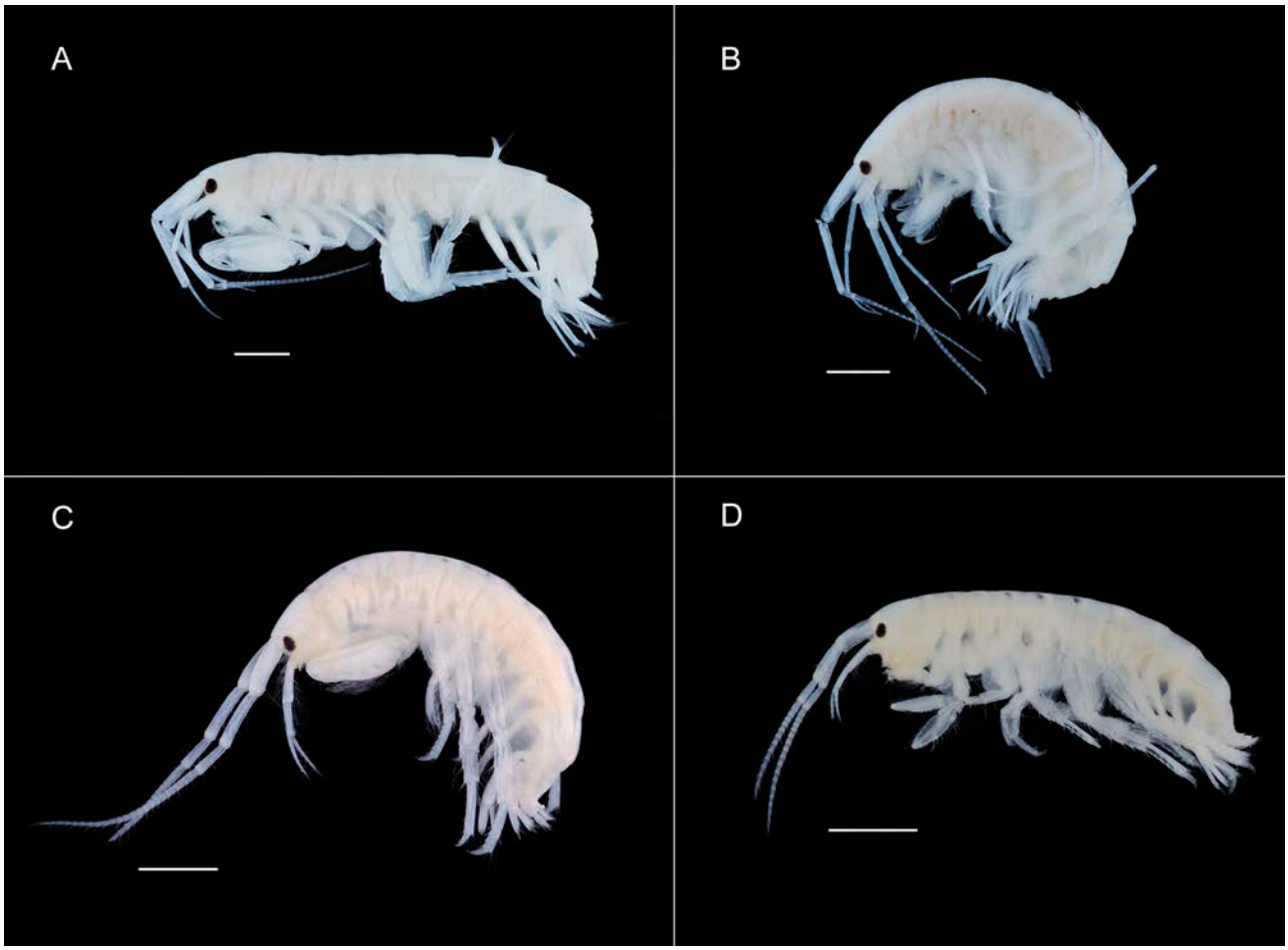

FIGure 1. Photographs of examined specimens. A, *Ceradocus mizani*, male, 8.7 mm, (uropod 3 missing), 2 February 2012, Kaichu Doro Site 4N, NMST-Cr 29016; B, *C. mizani,* female, 8.7 mm, 2 February 2012, Kaichu Doro Site 4N, NMST-Cr 29016. C,*Elasmopus mukuinu* **sp. nov.**, holotype, male, 6.1 mm, 27 April 2012, Kaichu Doro Site 2N, NMST-Cr 29017; ; D, *E. mukuinu* **sp. nov.**, paratype, female, 4.2 mm, same station data, NMST-Cr 29019. Scale bars: 1 mm.

Material examined. 13 specimens, 17 November 2011, Kaichu Doro Site 2S; 2 specimens, 17 November 2011, Kaichu Doro Site 4N; 1 specimen, 17 November 2011, Kaichu Doro Site 4S; 9 specimens, 2 February 2012, Kaichu Doro Site 2S; 2 specimens, 2 February 2012, Kaichu Doro Site 4N, NMST-Cr 29016, Male, 8.7 mm, Female, 8.7 mm; 14 specimens, 2 February 2012, Kaichu Doro Site 4S; 12 specimens, 27 April 2012, Kaichu Doro Site 2S; 3 specimens, 27 April 2012, Kaichu Doro Site 3S; 22 specimens, 27 April 2012, Kaichu Doro Site 4S; 4 specimens, 19 July 2012, Kaichu Doro Site 2S.

Diagnosis. *Gnathopod 2* of male asymmetrical; larger male gnathopod 2 propodus palm with two large trapezoidal projections distally; smaller male gnathopod 2 propodus palm without large projections. *Pereopods 5–7* bases with acute posterodistal lobe. *Pleonites and urosomites 1–3* with many dorsal serrations, *epimera 1–3* with posterior, posteroventral, and ventral teeth. *Uropod 3* enlarged, both rami wide.

Description of male (8.7 mm). Head (Fig. 1A): eyes ovate; lateral cephalic lobe rounded, anteroventral margin with notch, anteroventral corner rounded. *Antenna 1*: length 1.8 × length of antenna 2; peduncular articles 1–3 length ratio 1.0 : 0.9 : 0.2; article 2 ventral margin lined with short setae; accessory flagellum 4-articulate; flagellum 26-articulate. *Antenna 2*: peduncular article 2 gland cone reaching to end of article 3, flagellum 12-articulate.

Pereon. *Gnathopod 1* (Fig. 2A): subchelate; coxa anterior margin produced, anteroventral corner acute, basis anterior margin with few short setae, posterior margin with few long and short setae; merus subcylindrical with short and long setae; carpus as long as propodus, medial surface with 5 rows of simple setae and 5 rows of plumose setae, propodus palm oblique, serrate, densely setose; dactylus falcate. *Gnathopod 2* (Fig. 2C, D): assymetrical, coxa subquadrate; larger gnathopod 2 basis slender, anterior margin with 1 long and several short setae, posterior margin with 3 short and 3 long setae; merus with sharp posteroventral spine; carpus compressed, subtriangular; propodus subrectangular, palm oblique with two large trapezoidal projections and a medial depression, with several robust setae along margin; dactylus falcate, reaching 0.5 × length of propodus; smaller gnathopod 2 basis slender, anterior margin with 1 long and several short setae, posterior margin with several medium setae; merus with sharp posteroventral spine; carpus about 0.8 × length of propodus; propodus palm oblique, weakly sinuate, with several robust setae along margin; dactylus falcate, reaching 0.4 × length of propodus. *Pereopod 3*: coxa square; basis moderately slender, both margins lined with short setae; merus slightly shorter than propodus; carpus and propodus subequal in length; dactylus stout. *Pereopod 4*: coxa subtriangular; basis moderately slender, anterior margin lined with short setae, posterior margin with medium setae; merus slightly shorter than propodus; carpus and propodus subequal in length; dactylus stout. *Pereopods 5–6* missing. *Pereopod 7*: basis weakly expanded, posterior margin straight, serrate, posteroventral corner with acute process; merus slightly broadened, shorter than carpus and propodus; dactylus stout.

Pleon. *Pleonites 1–3* (Fig. 2F–H): serrated dorsally. *Epimera 1–3* (Fig. 2E): posterior margins serrate, epimeron 3 posteroventral margin strongly produced. *Urosomite 1* (Fig. 2I): with 11 dorsal serrations; *Urosomite 2* (Fig. 2J);: with 6 dorsal serrations. *Uropod 1*: peduncle slightly longer than rami, with ventrodistal spur, 1 basofacial seta, inner margin lined with robust setae, rami subequal in length, each with several robust marginal setae and apices each with 3 robust setae. *Uropod 2*: peduncle shorter than rami, inner margin lined with robust setae, rami subequal in length, each with several robust marginal setae and apices each with 3 robust setae. *Uropod 3* missing. *Telson* (Fig. 2B): deeply cleft, each lobe with 3 subapical setae, outer margin of each lobe with 1 plumose seta.

Description of female (8.7 mm). Similar in all aspects to male except for the following. *Gnathopod 1* (Fig. 3E): smaller than in male. *Gnathopod 2* (Fig. 3F): symmetrical, coxa subrectangular; basis slender, anterior margin with few short setae, posterior margin with few long setae; merus with sharp posteroventral spine; carpus about 0.5 × length of propodus; propodus palm oblique, serrate, with several robust setae along margin; dactylus falcate, reaching 0.5 × length of propodus. *Pereopod 5* (Fig. 3A): coxa with anteroventral lobe; basis weakly expanded, posterior margin straight, serrate, posteroventral corner with acute process; merus slightly broadened, shorter than carpus and propodus; dactylus stout. *Pereopod 6* (Fig. 3B): coxa with small anteroventral lobe and 2 medium setae; basis weakly expanded, posterior margin straight, serrate, posteroventral corner with acute process; merus slightly broadened, shorter than carpus and propodus; dactylus stout. *Pereopod 7* (Fig. 3C): coxa with 2 anteroventral setae; basis weakly expanded, posterior margin straight, serrate, posteroventral corner with acute process; merus slightly broadened, shorter than carpus and propodus; dactylus missing. *Uropod 3* (Fig. 3D): peduncle less than half length of rami, with several robust setae; rami subequal, foliaceous, margins lined with robust setae, apices each with 4 robust setae.

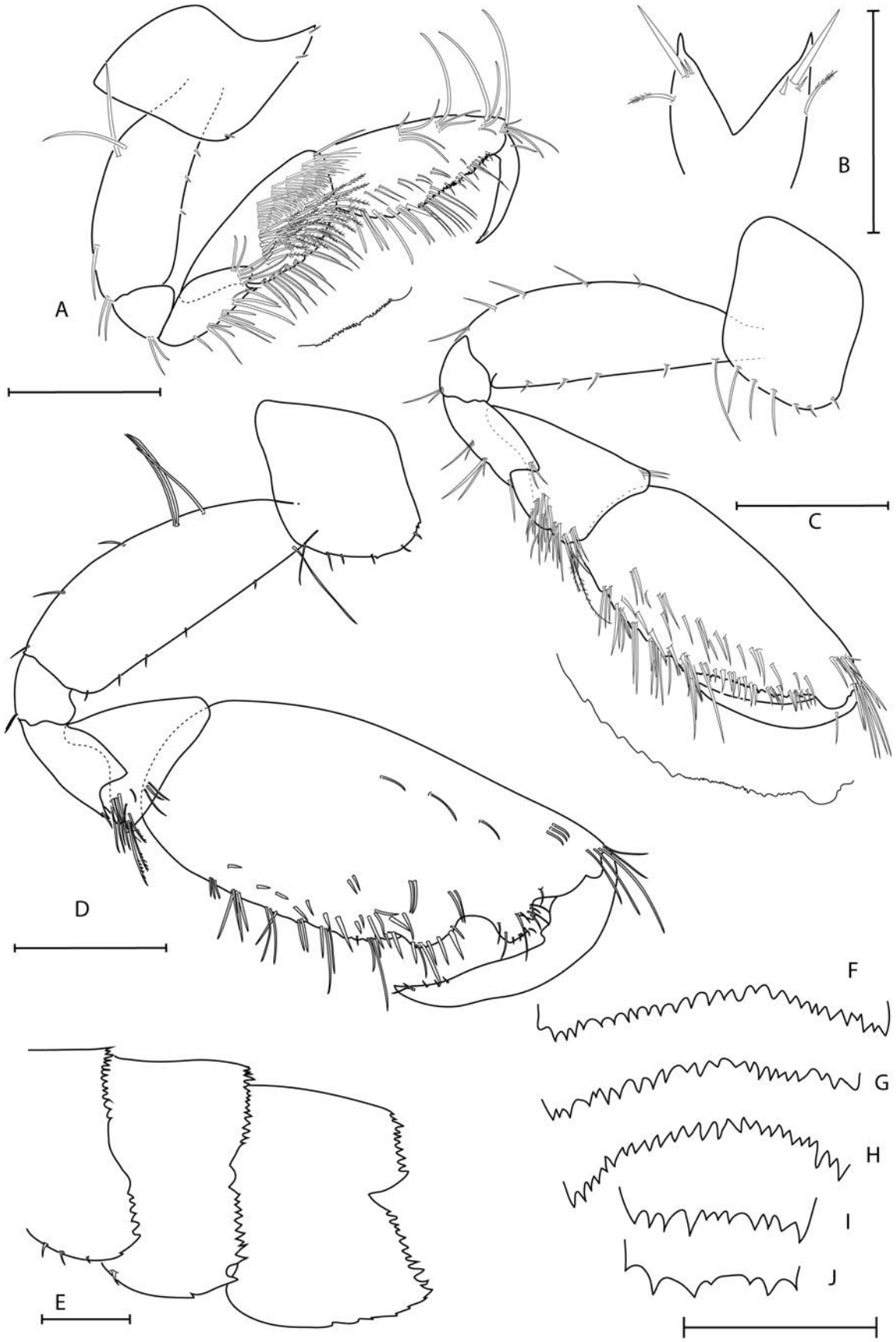

FIGure 2. *Ceradocus mizani* Lim, Azman & Othman, 2010 male, 8.7 mm. A, gnathopod 1, medial; B, telson; C, small gnathopod 2, medial; D, large gnathopod 2, medial; E, epimera 1–3; F, pleonite 1, dorsal; G, pleonite 2. Dorsal; H, pleonite 3, dorsal; I, urosomite 1, dorsal; J, urosomite 2, dorsal. Scale bars: 0.5 mm.

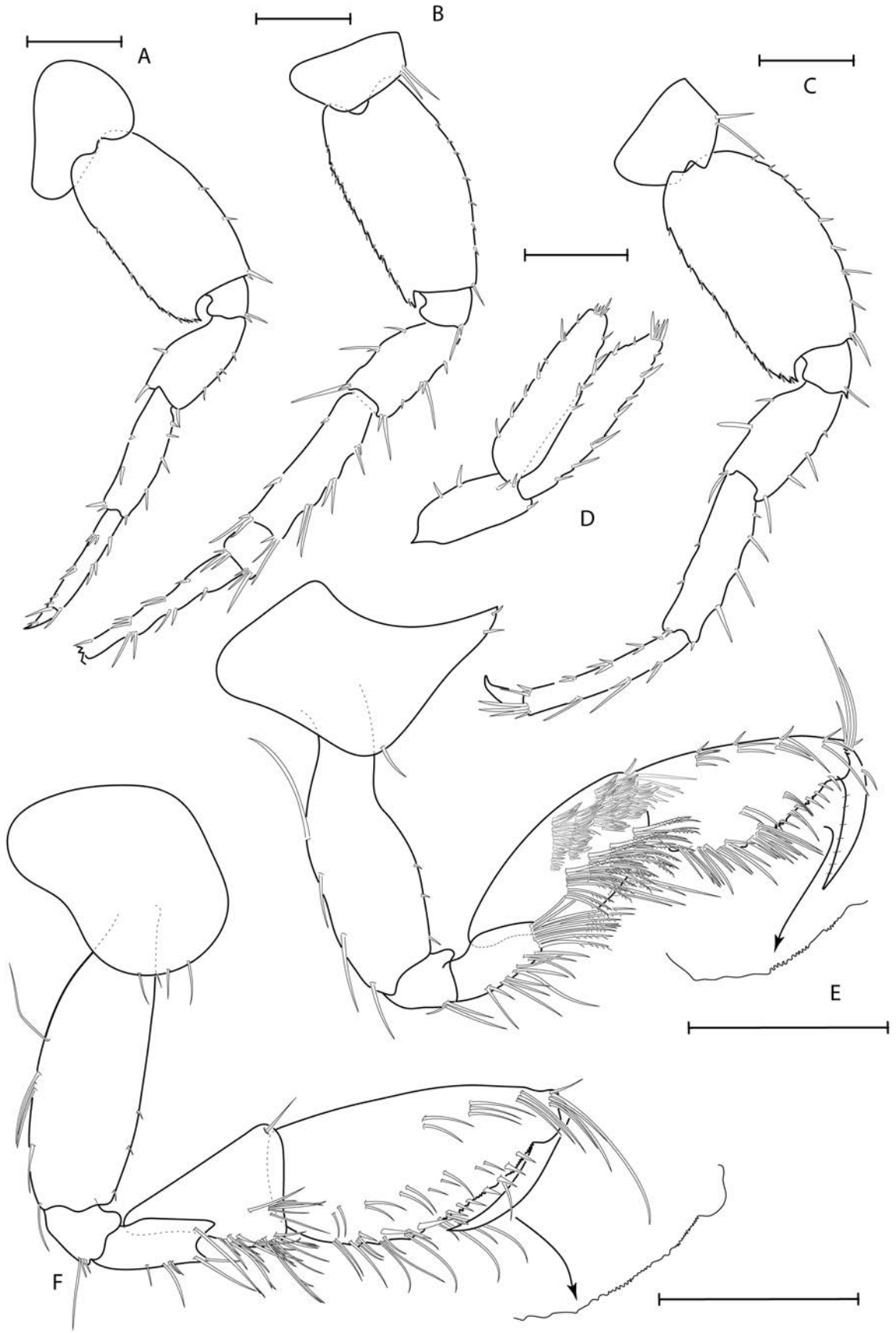

FIGure 3. *Ceradocus mizani* Lim, Azman & Othman, 2010 female, 8.7 mm. A, pereopod 5; B, pereopod 6; C, pereopod 7; D, uropod 3; E, gnathopod 1, medial; F, gnathopod 2, medial. Scale bars: 0.5 mm.

r emarks. The specimens examined from Okinawa agree closely with the original description of *Ceradocus mizani* with two discrepancies. Lim *et al.* (2010) describe the posterior margins of pereopods 5–7 bases as casteloserrate, but the illustration is clearly crenulate, as seen in the Okinawan specimens. The trapezoidal projections on the propodus palm of the larger male gnathopod 2 in the Okinawan specimens match the illustration provided by Lim *et al.* (2010), although the original description simply states that the palm is sculptured. Pending examination of type material and more material from Okinawa, the authors feel confident that this species is correctly identified as *C. mizani*. Collection of *C. mizani* from Okinawa Island increases the number of Japanese *Ceradocus* species to five. *Ceradocus mizani* differs from the other Japanese species in the following: *C. capensis* has a more transverse male gnathopod 2 palm with a rounded projection and few serrations on epimera 1–3 posterior margins; *C. inermis* has a more transverse male gnathopod 2 palm with pointed projection and few serrations on epimera 1–3 posterior margins; *C. kiiensis* has a shallow excavation on male gnathopod 2 propodus palm; and *C. laevis* has a triangular projection on male gnathopod 2 propodus palm. In addition, *C. mizani* is similar to *rubromaculatus* sensu Ren, 1998, but *C. rubromaculatus* differs in having a longer antenna 1 peduncle, a less pronounced projection on the male gnathopod 2 propodus palm, few serrations on epimera 1–3 posterior margins, and more robust setae on the telson.

Distribution. Japan: Okinawa, (present study); Malaysia, Terengganu: Pulau Perhentiaan Besar, South China Sea (Lim *et al.* 2010).

Genus *Elasmopus* Costa, 1853

Elasmopus mukuinu sp. nov.

(Figs 1C, D, 4–9)

Material examined. Holotype: male, 6.1 mm, 27 April 2012, Kaichu Doro Site 2N, 26° 19’55.70”N, 127° 54’52.50”E, rubble bottom, from sediment wash, 1 m depth, K. N. White and I. Kawamura col., NMST-Cr 29017; Paratype: male 5.1 mm, same station data, NMST-Cr 29018; Paratype: male 4.7 mm, same station data, NMST-Cr-29225; Paratype: female, 4.2 mm, same station data, NMST-Cr 29019.

Other material examined. 1 specimen, 17 November 2011, Kaichu Doro Site 2N; 1 specimen, 17 November 2011, Kaichu Doro Site 2S; 5 specimens, 17 November 2011, Kaichu Doro Site 3S; 11 specimens, 17 November 2011, Kaichu Doro Site 5N; 12 specimens, 9 specimens, 2 February 2012, Kaichu Doro Site 3N; 2 February 2012, Kaichu Doro Site 3S; 17 specimens, 2 February 2012, Kaichu Doro Site 5N; 16 specimens, 2 February 2012, Kaichu Doro Site 5S, NMST-Cr 29021; 9 specimens, 27 April 2012, Kaichu Doro Site 2N, NMST-Cr 29021; 9 specimens, 27 April 2012, Kaichu Doro Site 3N; 16 specimens, 27 April 2012, Kaichu Doro Site 3S; 14 specimens, 27 April 2012, Kaichu Doro Site 4N; 94 specimens, 27 April 2012, Kaichu Doro Site 5N; 23 specimens, 27 April 2012, Kaichu Doro Site 5S; 4 specimens, 19 July 2012, Kaichu Doro Site 3N; 2 specimens, 19 July 2012, Kaichu Doro Site 3S.

Diagnosis. *Gnathopod 2* of male propodus palm medial surface with subrectangular hump near insertion of dactylus, distomedial shelf rounded with dense plumose setae, subpalmar surface with dense tufts of long setae. *Pereopod 5* posterior margin convex, almost smooth, without long setae. *Pereopod 6* posterior margin concave, serrate, without long setae. *Pereopod 7* posterior margin convex, crenulate, without long setae. *Epimeron 3* posteroventral margin with notch. *Uropod 3* inner ramus length 0.8 x outer ramus length, rami distally truncated.

Description of male (holotype, 6.1 mm).

Head (Fig. 4C): eyes ovate; lateral cephalic lobe rounded, anteroventral margin with notch, anteroventral corner subquadrate. *Antenna 1* (Fig. 4A): length 2.4 × length of antenna 2; peduncular articles 1–3 length ratio 1.0 : 0.9 : 0.6; all articles sparsely setose; accessory flagellum 2-articulate, second article minute; (Fig. 4B) flagellum 19-articulate. *Antenna 2* (Fig. 4A): flagellum 6 articulate, densely setose. *Maxilliped* (Fig. 8G): inner plate with dense plumose setae, outer plate reaching half of palp article 2, densely setose, apical margin with plumose setae, palp article 3 apically setose, 0.7 × palp article 2. *Lower lip* (Fig. 8F): inner lobes rounded, setose outer lobes with small gape, marginally setose. *Maxilla 1* (Fig. 8C): outer plate with two rows of serrate setae, palp 2 articulate, article 2 with 8 apical plumose setae. *Maxilla 2* (Fig. 8B): inner and outer plates with dense apical setae, inner plate lined with marginal setae. *Mandible* (Fig. 8A, D): incisors dentate, left lacinia mobilis weakly dentate, right lacinia mobilis strongly dentate; molars triturative; palp well developed, 3 articulate, article 1 shorter than article 2, article 3 long (about 3 × as long as broad) subequal in length with article 2, moderately falcate. *Upper lip* (Fig. 8E): apically rounded, setose.

Pereon (Fig. 4A): body smooth, covered with sparse setae. *Gnathopod 1* (Fig. 6A, C): subchelate; coxa anterior margin concave, anteroventral corner slightly produced, subquadrate ventral margin with several long and short setae; basis posterior margin with 7 long medial setae; merus without posterodistal tooth; carpus about 1.5 × as long as broad, shorter than propodus, posterior margin densely setose, propodus palm subacute, straight, smooth, densely setose; dactylus apically subacute, symmetrical. *Gnathopod 2* (Fig. 5E–H): subchelate; basis slender, posterior margin with 3 long medial setae; merus with subquadrate distoventral corner; carpus compressed, lobate, length 1.6 × width; propodus expanded with dense medial brushes of setae, palm convex, medial surface with subrectangular hump near insertion of dactylus bearing three marginal spine-setae, distomedial shelf rounded with dense plumose setae, palm reaching 0.6 × length of propodus, subpalmar surface with dense tufts of long setae; dactylus apically subacute, reaching 0.4 × length of propodus. *Pereopod 3* (Fig. 4A): coxa longer than broad, with four long and several short ventral setae; basis posterior margin with 3 long and several short setae. *Pereopod 4* (Fig. 4B): coxa posterior margin concave, with 2 long and several short ventral setae; basis posterior margin with 2 long and a few short setae; propodus with posterior margin with several robust setae. *Pereopod 5* (Fig. 7D): coxa bilobed, posterior lobe with two short setae; basis expanded, posterior margin rounded, almost smooth, without long setae; merus slightly broadened; merus, carpus, propodus with few long slender setae. *Pereopod* 6 (Fig. 6B): coxa bilobed, anterior lobe with two setae, posterior lobe with two short setae; basis expanded, posterior margin convex, serrate, without long setae; merus slightly broadened; merus, carpus, propodus with few long slender setae. *Pereopod 7* (Fig. 7C): coxa ventral margin slightly convex, anterior margin with two plumose setae; basis expanded, posterior margin rounded, crenulate, without long setae; merus slightly broadened; merus, carpus, propodus with many long slender setae.

Pleon (Fig. 4A): *Epimera 1–3* smooth, bare; epimeron 3 (Fig. 5D): posteroventral margin with notch. *Uropod 1* (Fig. 5C): peduncle 1.4 × length of outer ramus, with several facial setae; inner and outer rami subequal in length, each with several robust marginal setae. *Uropod 2* (Fig. 5B): peduncle 1.2 × length of outer ramus with two robust setae; inner and outer rami subequal in length each with several robust marginal setae. *Uropod 3* (Fig. 5A): inner ramus length 0.8 × outer ramus length, outer ramus subequal in length with peduncle; rami distally truncated, with short apical robust setae; Telson missing.

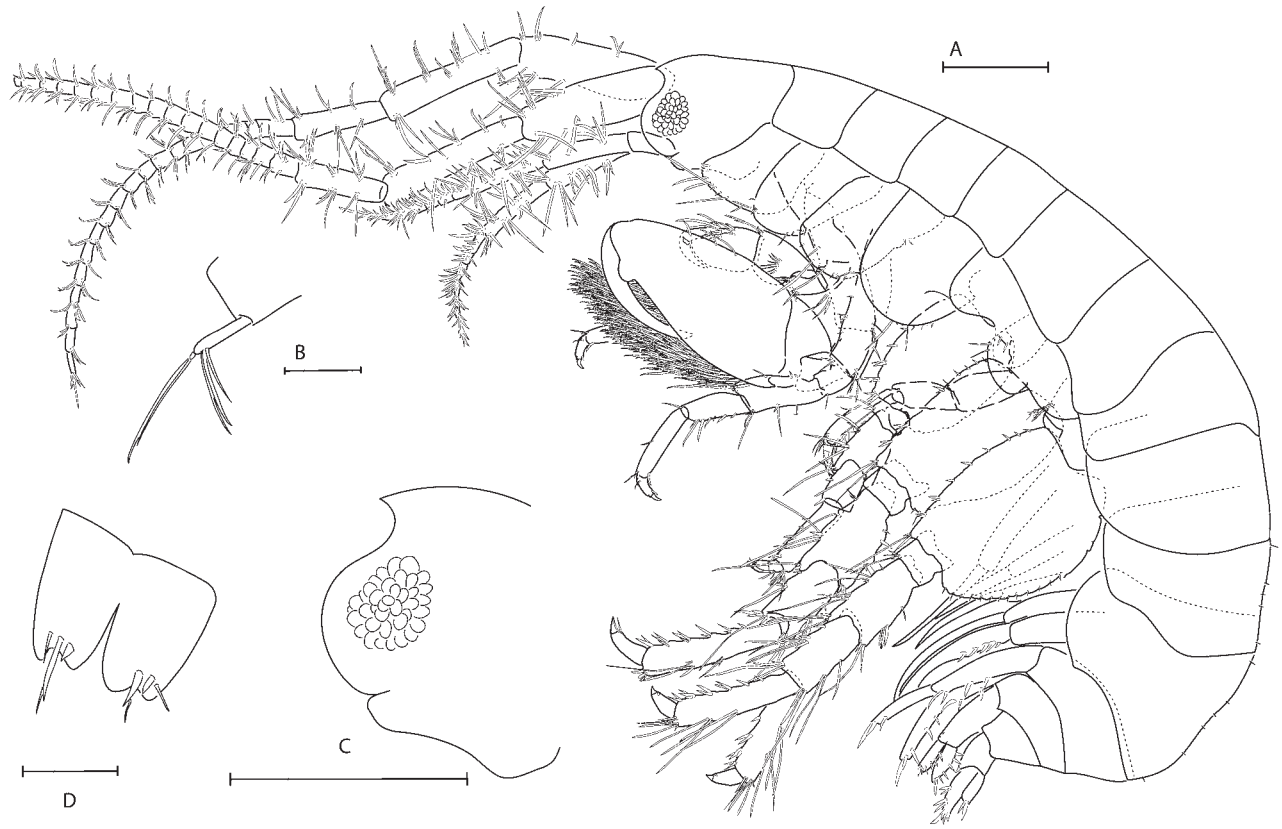

FIGure 4. *Elasmopus mukuinu* **sp. nov.**, holotype male, 6.1 mm. A, habitus; B, antenna 1 accessory flagellum; C, head. paratype male, 4,7 mm. D, telson. Scale bars: 0.5 mm (A, C), 0.1 mm (B, D).

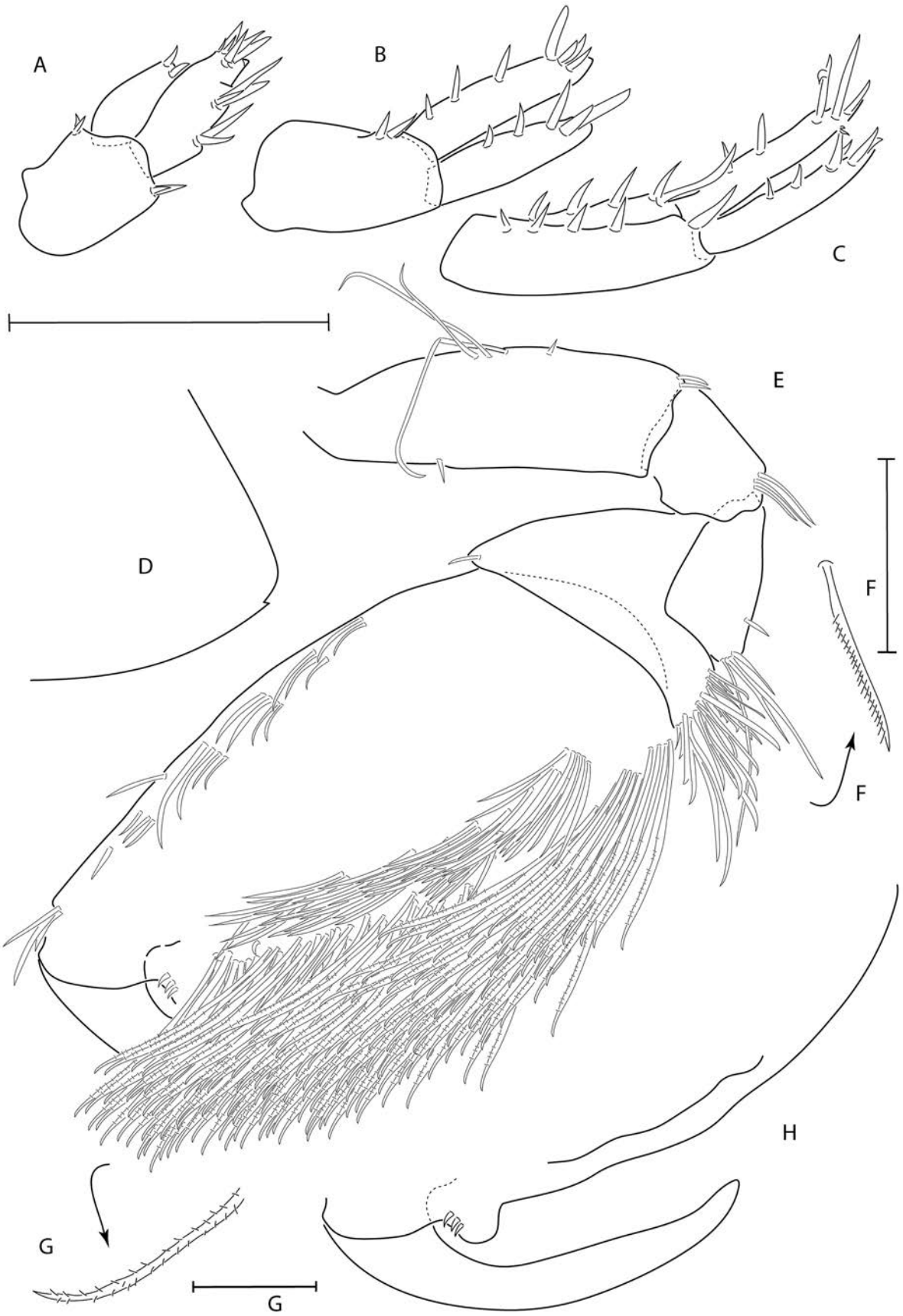

FIGure 5. *Elasmopus mukuinu* **sp. nov.**, holotype male, 6.1 mm. A, uropod 3; B, uropod 2; C, uropod 1; D, epimeron 3 posteroventral corner; E, gnathopod 2, medial; F, enlarged plumose seta from carpus; G, enlarged plumose seta on propodus; H, gnathopod 2 propodus palm, setae removed. Scale bars: 0.5 mm (A–E, H), 0.1 mm (F,G).

FIGure 6. *Elasmopus mukuinu* **sp. nov.**, holotype male, 6.1 mm. A, gnathopod 1, lateral; B, pereopod 6; C, gnathopod 1, medial; D, telson. Scale bars: 0.5 mm.

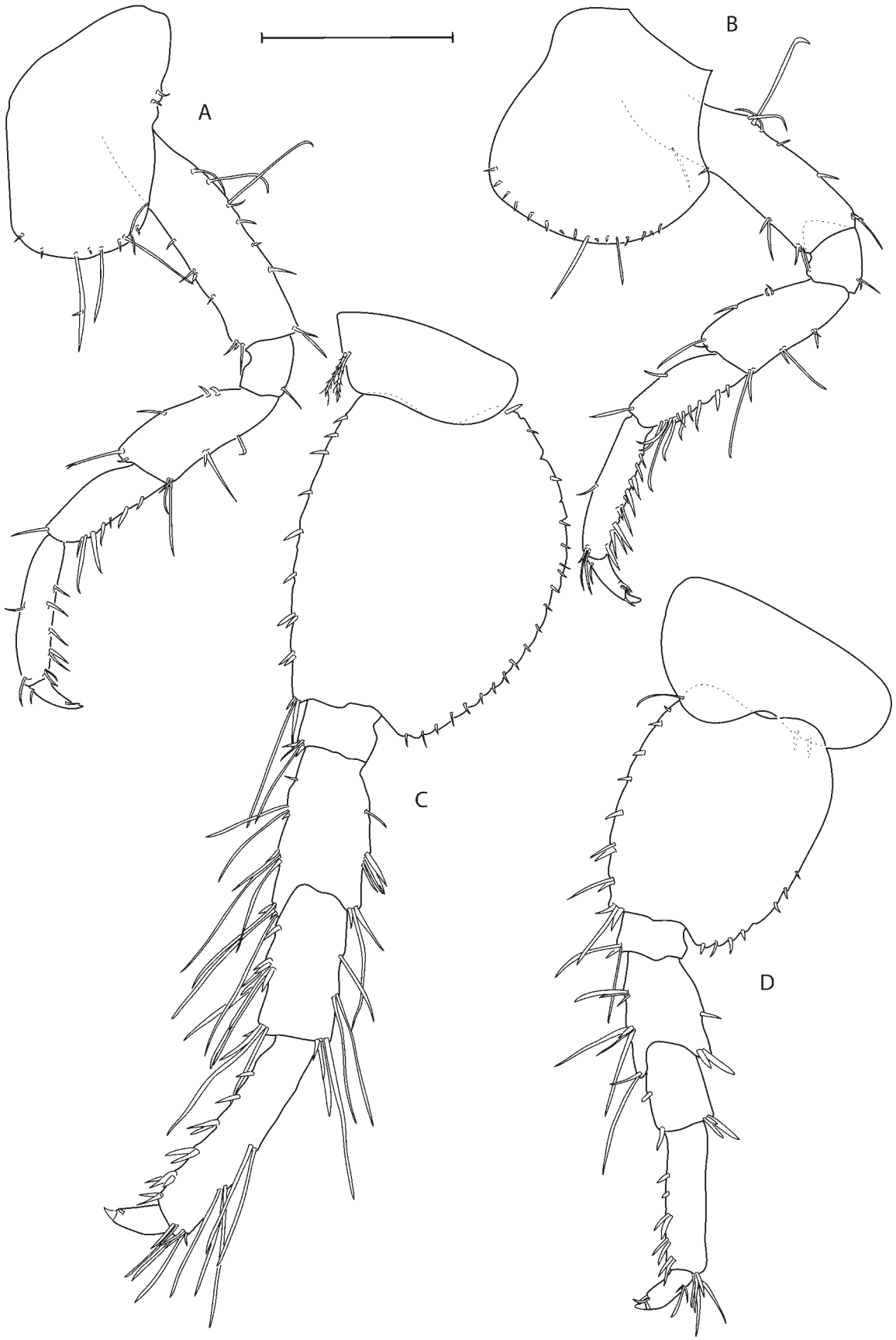

FIGure 7. *Elasmopus mukuinu* **sp. nov.**, holotype male, 6.1 mm. A, pereopod 3; B, pereopod 4; C, pereopod 7; D, pereopod 5. Scale bar: 0.5 mm.

FIGure 8. *Elasmopus mukuinu* **sp. nov.**, paratype male, 5.1 mm. A, right mandible; E, upper lip. Holotype male, 6.1 mm. B, maxilla 2; C, maxilla 1; D, left mandible; F, lower lip; G, maxilliped. Scale bars: 0.5 mm.

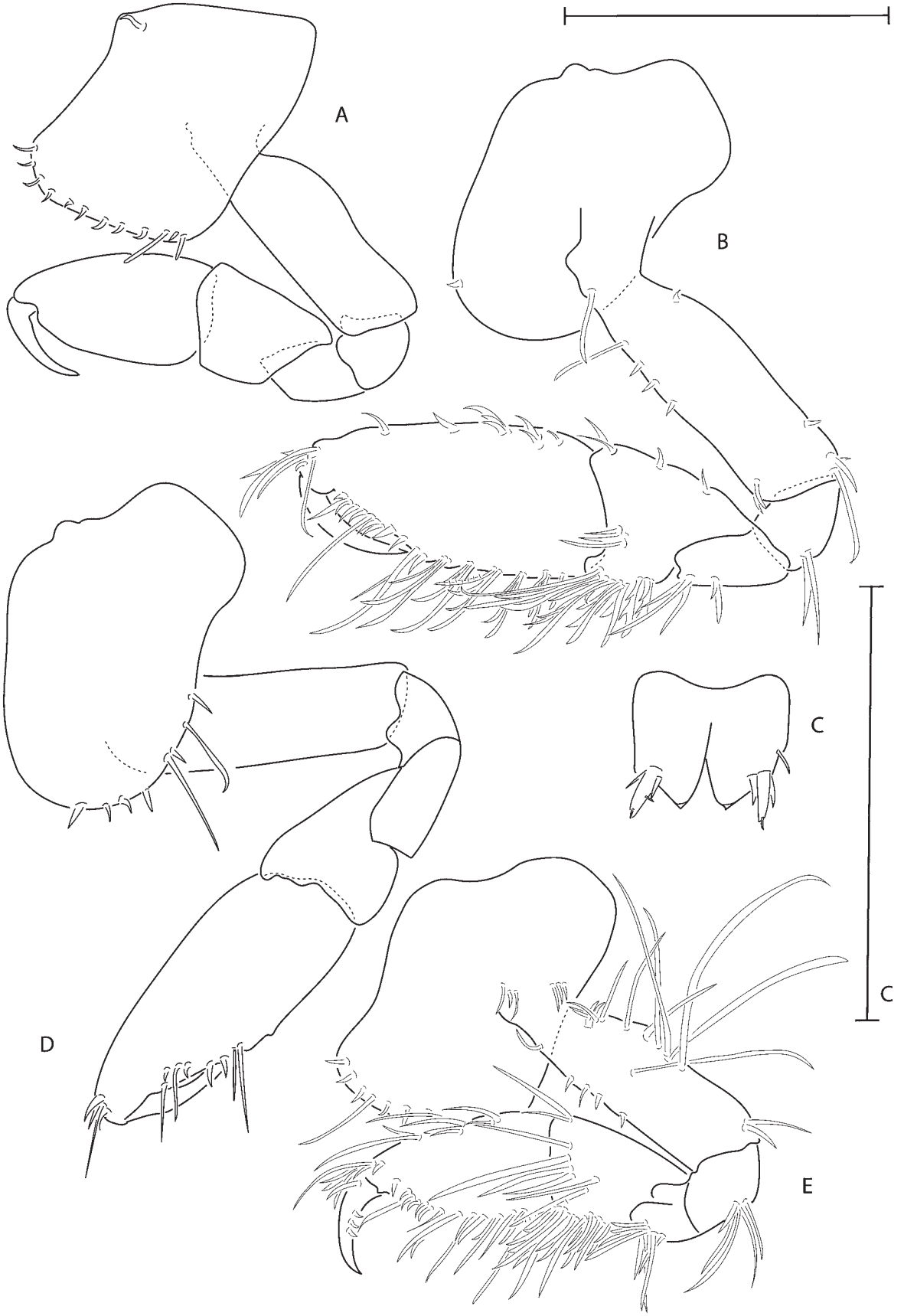

FIGure 9. *Elasmopus mukuinu* **sp. nov.**, paratype female, 4.2 mm. A, gnathopod 1, lateral; B, gnathopod 2, medial; C, telson; D, gnathopod 2, lateral; E, gnathopod 1, medial. Scale bars: 0.5 mm.

Description of female (paratype, 4.2 mm). Similar in all aspects to male except for the following. *Gnathopod 1* (Fig. 9A, E): coxa with several short setae; basis with 7 long medial setae; propodus palm tapered, moderately setose; dactylus with three small spines. *Gnathopod 2* (Fig. 9B, D): basis posterior margin lacking long medial setae; propodus not expanded, lacking dense medial brushes of setae, palm convex, without hump, distomedial shelf straight with moderately setose, subpalmar surface lacking plumose setae. *Telson* (Fig. 9C): length 0.9 × width, moderately cleft (50%), pointed distally, each lobe with 2 robust setae and 2 slender setae.

e tymology. After the Japanese word 'mukuinu', meaning 'shaggy dog' and referring to the long, thick, and unkempt, plumose setae on the gnathopod 2 propodus (pronounced moo-koo-ee-noo).

r emarks. *Elasmopus mukuinu* **sp. nov.** is similar to all species in the *E. pectenicrus* group as defined by Hughes & Lowry (2011) in having a short mandibular palp article 3, long bunches of setae on male gnathopod 2 propodus, and at least one crenulate posterior margin on pereopod 5–7 bases. The *E. pectenicrus* group includes *Elasmopus brasiliensis* (Dana, 1853); *E. canarius* Krapp-Schickel & Ruffo, 1990; *E. carteri* Hughes & Lowry; 2011; *E. crenulatus* Berents, 1983; *E. leveque* Hughes & Lowry, 2011; *E. nanshaensis* Ren, 1998; *E. otus* Hughes & Lowry, 2011; *E. pectenicrus* (Bate, 1862); *E. spinibasus* Sivaprakasam, 1970; and *E. yunde* Barnard, 1974 (Hughes & Lowry 2011). The new species differs from all mentioned species in having dense plumose setae covering the distomedial shelf (no plumose setae mentioned in other descriptions) and pereopod 5–7 posterior margins all serrate or crenulate (some or all casteloserrate in others). Of this group, the new species is most similar to *E. nanshaensis* in having a subrectangular hump on male gnathopod 2 propodus palm, but differs in having a rounded distomedial shelf (subrectangular in *E. nanshaensis*) and in having a concave posterior margin on pereopod 6 basis (tapering in *E. nanshaensis*). *Elasmopus yunde* also shares the subrectangular hump and the rounded distomedial shelf on male gnathopod 2 propodus with the new species but differs in having all posterior margins of pereopods 5–7 casteloserrate and a straight posterior margin on pereopod 6 basis. *Elasmopus mukuinu* **sp. nov.** shares the concave pereopod 6 basis posterior margin with *E. pectenicrus*, but *E. pectenicrus* differs due to the triangular hump on the palm of gnathopod 2 propodus and casteloserrate pereopod 6 basis posterior margin. In addition, *Elasmopus mukuinu* **sp. nov.** is similar to *Elasmopus souzafilhoi* Senna, 2011 in having long plumose setae on gnathopod 2 propodus palm, but the latter species has a casteloserrate posterior margin on pereopod 7 basis.

Distribution. Japan: Okinawa, (present study).

Acknowledgements

Funding for this study was provided by a National Science Foundation Grant: Collaborative Research: ARTS: Understanding Tropical Invertebrate Diversity Through Integrative Revisionary Systematics and Training (1856421). This study was also supported by grants from Risona Bank's Okumura Corporation Trust Fund for Construction, Environment and Technology and the Nissei Foundation's Research Grant for Environmental Issues to James Davis Reimer. Additional funding came from the Rising Star Program and the International Research Hub Project for Climate Change and Coral Reef/Island Dynamics, both at the University of the Ryukyus. Study design and assistance was provided by James Davis Reimer, Doris Albinsky, Iori Kawamura, and Nathan White. Logistical support and facilities were provided by Georgia College & State University Department of Biological and Environmental Sciences. Comments from the editor and an anonymous reviewer greatly improved the manuscript. Special thanks go to Elizabeth Durham for her assistance with digital inking.

TAble 1. Kaichu Doro Site station data.
KNW: Kristine N. White, NSW: Nathan S. White, IK: Iori Kawamura, DA: Doris Albinsky

Site	Substrate	Depth (m)	Latitude (N)	Longitude (E)	Collector
2N	Rubble	1	26° 19'55.7"	127° 54'52.5"	KNW, IK
2S	Rubble	1	26° 19'52.7"	127° 54'51.5"	NSW, DA
3N	Sand, seagrass	1	26° 19'58.2"	127° 55'52.2"	KNW, IK
3S	Mud, macroalgae	1	26° 19'52.8"	127° 55'53.1"	NSW, DA
4N	Rubble, macroalgae	1	26° 20'9.8"	127° 56'23.5"	KNW, IK
4S	Rubble	1	26° 20'7.1"	127° 56'23.5"	NSW, DA
5N	Sand, rubble	1	26° 20'25.6"	127° 56'42.4"	KNW, IK
5S	Sand, rubble, mud	1	26° 20'20.2"	127° 56'42.9"	NSW, DA

l iterature cited

Ariyama, H. (2019) Two species of *Ceradocus* collected from coastal areas in Japan, with description of a new species (Crustacea: Amphipoda: Maeridae). *Zootaxa*, 4658 (2), 297–316.
https://doi.org/10.11646/zootaxa.4658.2.5

Barnard, J.L. (1970) Sublittoral Gammaridea (Amphipoda) of the Hawaiian Islands. *Smithsonian Contributions to Zoology*, 34, 1–286.
https://doi.org/10.5479/si.00810282.34

Barnard, J.L. (1974) Gammaridean Amphipoda of Australia, Part II. *Smithsonian Contributions to Zoology*, 139, 1–148.
https://doi.org/10.5479/si.00810282.103

Bate, C.S. (1862) *Catalogue of the specimens of amphipodous Crustacea in the collection of the British Museum, London*. British Museum of Natural History, London, United Kingdom, 399 pp., 58 pls.
https://doi.org/10.5962/bhl.title.20901

Berents, P.B. (1983) The Melitidae of Lizard Island and adjacent reefs, the Great Barrier Reef, Australia (Crustacea: Amphipoda). *Records of the Australian Museum*, 35, 101–143.
https://doi.org/10.3853/j.0067-1975.35.1983.313

Bulycheva, A.I. (1952) New species of amphipods (Amphipoda, Gammaridea) from the Sea of Japan. *Trudy Zoologicheskogo Instituta*, 12, 195–250.

Coleman, C. (2003) "Digital inking": How to make perfect line drawings on computers. *Organisms Diverity Evolution*, 3, 1–14.
https://doi.org/10.1078/1439-6092-00081

Costa, A. (1853) Relazione sulla memoria del Dottor Achille Costa, di ricerche su' crostacei amfipodi del regno di Napoli. *Rendiconto della Societa Reale Borbonica, Accademia delle Scienze*, 2, 167–178.
https://doi.org/10.5962/bhl.title.2070

Dana, J.D. (1853) Crustacea. Part II. *In*: *United States Exploring Expedition. During the years 1838, 1839, 1840, 1841, 1842. Under the command of Charles Wilkes. Vol. 14. U. S. N. C.* Sherman. Philadelphia, pp. 689–1618.

Hirayama, A. (1986) Taxonomic studies on the shallow water gammaridean Amphipoda of west Kyushu, Japan. VI. Lysianassidae (*Orchomene*), *Megaluropus* family group, Melitides [sic] (*Cottesloe, Jerbarnia, Maera, Ceradocus, Eriopisella*, *Dulichiella*). *Publications of the Seto Marine Biological Laboratory*, 31, 1–35.
https://doi.org/10.5134/176120

Hughes, L.E. & Lowry, J.K. (2011) The genus *Elasmopus* (Crustacea: Amphipoda: Maeridae) in Australian waters. *Journal of Natural History*, 45, 579–628.
https://doi.org/10.1080/00222933.2010.534825

Kim, W. & Kim, C.B. (1991) The marine amphipod crustaceans of Ulreung Island, Korea, Part III. *The Korean Journal of Zoology*, 34, 323–337.

Krapp-Schickel, T. (2008) What has happened with the *Maera*—clade (Crustacea, Amphipoda) during the last decades? *Bollettino del Museo Civico di Storia Naturale di Verona*, 32, 3–32.

Krapp-Schickel, T & Ruffo, S. (1990) Marine amphipods of the Canary Islands with description of a new species of *Elasmopus*. *Miscel-lània Zoològica*, 14, 53–58.

Lim, J.H.C., Azman, B.A.R. & Othman, B.H.R. (2010) Melitoid amphipods of the genera *Ceradocus* Costa, 1853 and *Victoriopisa* Karaman and Barnard, 1979 (Crustacea: Amphipoda: Maeridae) from the South China Sea, Malaysia. *Zootaxa*, 2348 (1), 23–39.
https://doi.org/10.11646/zootaxa.2348.1.2

Lowry, J.K. & Hughes, L.E. (2009) Maeridae, the *Elasmopus* group. *Zootaxa*, 2260 (1), 643–702.
https://doi.org/10.11646/zootaxa.2260.1.33

Nakamura, Y., Nakano, T., Ota, Y. & Tomikawa, K. (2019) A new species of the genus *Elasmopus* from Miyako Island, Japan (Crustacea: Amphipoda: Maeridae). *Zootaxa*, 4544 (3), 395–406.
https://doi.org/10.11646/zootaxa.4544.3.5

Oleröd, R. (1970) Littoral gammaridean Amphipoda from Mindoro, the Phillipines. *Zoologischer Anzeiger*, 184, 359–396.

Reimer, J., Yang, S, White, K.N., Asami, R., Fujita, K., Hongo, C., Ito, S., Kawamura, I., Maeda, I., Mizuyama, M., Obuchi, M., Sakamaki, T., Tachihara, K., Tamura, M., Tanahara, A., Yamaguchi, A. & Jenke-Kodama, H. (2013) Effects of causeway construction on environment and biota of subtropical tidal flats in Okinawa, Japan. *Marine Pollution Bulletin*, 94, 153–167.
https://doi.org/10.1016/j.marpolbul.2015.02.037

Ren, X. (1998) Studies on the family Melitidae (Crustacea: Amphipoda) from Nansha Islands, South China Sea. *Studies on Marine Fauna and Flora and Biogeography of the Nansha Islands and Neighbouring Waters*, 3, 195–218.

Senna, A.R. (2011) A new species of *Elasmopus* (Amphipoda: Hadzioidea: Maeridae) from Suape Harbor, Northeastern Brazilian coast. *Biological Sciences*, 83, 1031–1040.
https://doi.org/10.1590/S0001-37652011005000027

Sheard, K. (1939) Studies in Australian Gammaridea (I) the genus *Ceradocus*. *Records of the Australian Museum*, 6, 275–295.

Sivaprakasam, T.E. (1970) Amphipods of the genera *Maera* Leach and *Elasmopus* Costa from the east coast of India. *Journal*

of the Marine Biological Association of India, 10, 34–51.
Stephensen, K. (1932) Some new amphipods from Japan. *Annotationes Zoologicae Japonenses*, 13, 487–501.
White, K.N. (2013) All things in moderation: using formalin to coerce leucothoid amphipods out of the rubble (Crustacea: Amphipoda: Leucothoidae). *Marine Biodiversity*, 43, 163–166.
https://doi.org/10.1007/s12526-012-0126-3