



Two new species and new records of *Microprosthema* Stimpson, 1860 (Crustacea: Decapoda: Stenopodidea: Spongicolidae) from the Indo-West Pacific

TOMOMI SAITO¹ & ARTHUR ANKER²

¹Usa Marine Biological Institute, Kochi University, Usa-cho, Tosa, Kochi 781-1164, Japan. E-mail: t-saito@kochi-u.ac.jp

²Tropical Marine Science Institute (TMSI), National University of Singapore, 18 Kent Ridge Road, Singapore 119227, Republic of Singapore. E-mail: arthuranker7@gmail.com

Abstract

Two new species of the spongicolid shrimp genus *Microprosthema* Stimpson, 1860 are described and illustrated on the basis of material collected recently in Australia and Japan. Type specimens of *Microprosthema ningaloo* sp. nov. were collected on Ningaloo Reef, Western Australia, whereas type specimens of *Microprosthema pallidum* sp. nov. were collected on a coral reef off Ishigaki Island, Ryukyu Archipelago, southern Japan. *Microprosthema ningaloo* sp. nov. and *M. pallidum* sp. nov. differ from all other species of the genus by a combination of morphological characters, including the gill-exopod formulae, and by their diagnostic colour patterns. This study increases the total number of species described in the genus *Microprosthema* to 16, nine of them in the Indo-West Pacific. In addition, new records are provided for *M. lubricum* Saito & Okuno, 2011 (Guam), *M. plumicorne* (Richters, 1880) (Red Sea, Mariana and Marshall Islands, French Polynesia), *M. scabricaudatum* (Richters, 1880) (Red Sea, Glorieuses and Tuamotu Islands), and *M. validum* Stimpson, 1860 (Red Sea, Madagascar, Singapore, French Polynesia), significantly extending their previously known distribution ranges.

Key words: Decapoda, Stenopodidea, Spongicolidae, *Microprosthema*, new species, Australia, Japan, Indo-West Pacific

Introduction

The stenopodidean shrimp genus *Microprosthema* Stimpson, 1860 represents an exception among the typically deep-water Spongicolidae Schram, 1986, with all 14 hitherto known species (Table 1) occurring in shallow water habitats, mainly on coral and rocky reefs and adjacent seagrass-rubble flats. Seven species of *Microprosthema* have been previously described from the Indo-West Pacific: *M. fujitai* Saito & Okuno, 2011; *M. lubricum* Saito & Okuno, 2011; *M. personatum* Jiang & Li, 2014; *M. plumicorne* (Richters, 1880); *M. scabricaudatum* (Richters, 1880); *M. takedai* Saito & Anker, 2012, and *M. validum* Stimpson, 1860 (Stimpson 1860; Richters 1880; Holthuis 1946; Baba et al. 1968; Devaney & Bruce 1987; Saito & Okuno 2011; Saito & Anker 2012; Jiang & Li 2014; see also Table 1). In the present study, two additional Indo-West Pacific species are described and illustrated based on material recently collected in Australia and Japan. Furthermore, new records are provided for *M. lubricum*, *M. plumicorne*, *M. scabricaudatum* and *M. validum*.

The material examined in this study is deposited in the following institutions: National Museum of Nature and Science, Tokyo, Japan (NSMT); Natural History Museum and Institute, Chiba, Japan (CBM); Coastal Branch of the Natural History Museum and Institute, Chiba, Japan (CMNH); Kitakyushu Museum of Natural History and Human History, Kitakyushu, Japan (KMNH, currently also holding collections formerly deposited in the Zoological Laboratory, Faculty of Agriculture, Kyusyu University, ZLKU); Zoological Reference Collection, Lee Kong Chian Natural History Museum, Singapore (ZRC); Museum and Art Galleries of the Northern Territory, Darwin, Australia (NTM); Western Australian Museum, Perth, Australia (WAM); Muséum National d'Histoire Naturelle, Paris, France (MNHN); Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt, Germany (SMF); Zoologisches Museum, Christian-Albrechts-Universität, Kiel, Germany (ZMK); Naturalis Biodiversity Center, Leiden, the Netherlands (RMNH); Oxford University Museum of Natural History, Oxford, United Kingdom

(OUMNH); Bernice P. Bishop Museum, Honolulu, USA (BPBM); Allan Hancock Foundation, University of Southern California, Santa Maria, USA (AHF); Florida Museum of Natural History, University of Florida, Gainesville, USA (FLMNH-UF); and National Museum of Natural History, Smithsonian Institution, Washington DC, USA (USNM). Other abbreviations used in the text: cl, postorbital carapace length, in mm; fcn, field collection number (also corresponding to a photo voucher of the specimen); ov., ovigerous. The term tooth (or sharp tooth) is here used for fixed, usually sharp, spine-like projections on the carapace, pleon, antenna, third maxilliped, and third pereopod. Counts of the teeth on the lateral margins of the antennal scale and uropods include the terminal tooth. Setae were omitted from most drawings for better clarity.

Comparative material examined

(includes material examined and identified by Joseph Goy, pers. comm., marked as^{JG})

***Microprosthema emmiltum* Goy, 1987.** Type material: holotype, female, cl 5.2 mm (USNM 231363), paratype, female, cl 3.8 mm (USNM 231364), Ecuador, Galapagos Islands, Isla Santa Maria.

***Microprosthema fujitai* Saito & Okuno, 2011.** Type material: holotype, female, cl 3.0 mm (NSMT-Cr 21265), allotype, male, cl 2.0 mm (NSMT-Cr 21266), Japan, Ryukyu Islands, Okinawa.

***Microprosthema granatense* Criales, 1997.** Type material: holotype, male, cl 3.5 mm (USNM 275993), Colombia, Caribbean coast, Granate Bay.

***Microprosthema inornatum* Manning & Chace, 1990.** Type material: holotype, male, cl 1.8 mm (USNM 221894), United Kingdom, Central Atlantic, Ascension Island.

***Microprosthema loensis* Goy & Felder, 1988.** Type material: holotype, ov. female, cl 4.3 mm (USNM 233999), USA, Florida, Looe Key.

***Microprosthema lubricum* Saito & Okuno, 2011.** Type material: holotype, ov. female, cl 3.3 mm (CMNH-ZC 01067), Japan, Ryukyu Islands, Kerama Islands. Non-type material: 1 ov. female, cl 2.4 mm (FLMNH UF Arthropoda 16363), French Polynesia, Society Islands, Moorea; 1 ov. female, cl 3.9 mm (FLMNH UF Arthropoda 28138), 1 male, cl 2.5 mm (FLMNH UF Arthropoda 28139), USA, Mariana Islands, Guam.

***Microprosthema plumicorne* (Richters, 1880).** Non-type material: 1 ov. female, cl 2.6 mm (FLMNH UF Arthropoda 23325), 1 male, cl 3.1 mm (FLMNH UF Arthropoda 23265), 1 male, cl 2.9 mm (FLMNH UF Arthropoda 23267), 1 male, cl 2.6 mm (FLMNH UF Arthropoda 23320), French Polynesia, Society Islands, Moorea; 1 female, cl 2.5 mm, 1 male, cl 2.6 mm (ZRC 2014.0345), USA, Mariana Islands, Guam (material in poor condition); 1 ov. female, cl 3.3 mm (BPBM S10032), USA, Marshall Islands, Enewetak Atoll^{JG}; 1 male, cl not measured (FLMNH UF Arthropoda 24935), Australia, Queensland, Heron Island; 1 juv. female, cl 1.3 mm (FLMNH UF Arthropoda 35989), Saudi Arabia, Red Sea, Thuwal.

***Microprosthema manningi* Goy & Felder, 1988.** Type material: holotype, male, cl 4.3 mm (USNM 233997), allotype, ov. female, cl 5.9 mm (USNM 233998), Belize, Carrie Bow Cay.

***Microprosthema scabricaudatum* (Richters, 1880).** Type material: holotype, female, cl 3.5 mm (ZMK-Cr 1087), Mauritius, Fouquet Island. Non-type material: 1 female, cl 3.2 mm, 1 male, cl 2.0 mm (MNHN, no number), France, Mozambique Channel, Glorieuses Islands^{JG}; 1 female, cl 2.4 mm (RMNH D41316), Eritrea, Red Sea, Dahlak Archipelago, Museri Island^{JG}; 1 female, cl 2.7 mm (RMNH D41317), Israel, Red Sea, "Wadi Treibe" (?)^{JG}; 1 female, cl 2.7 mm (CBM-ZC 3241), Japan, Ryukyu Islands, Kume Island; 2 males, cl 2.8 and 3.0 mm, ov. female, cl 3.0 mm, juv., cl 1.5 mm (ZLKU 11094), Japan, Ryukyu Islands, Amami-oshima Island; 1 ov. female, cl 3.2 mm (SMF 8628), French Polynesia, Tuamotu Islands, Makatea^{JG}; 1 ov. female, cl 3.5 mm (FLMNH UF Arthropoda 1857), French Polynesia, Tuamotu Islands, Rangiroa Atoll^{JG}.

***Microprosthema semilaeve* (von Martens, 1872).** Non-type material: 1 male, cl 4.5 mm (USNM 184533), USA, Florida, Dry Tortugas; 1 ov. female, cl 3.9 mm (USNM 244439), Bahamas, Grand Bahama, Freeport; 1 male, cl 3.0 mm (OUMNH ZC. 2008-14-053), Panama, Caribbean coast, Bocas del Toro; 1 male, cl 3.3 mm (OUMNH ZC. 2012-10-019), Brazil, Alagoas, Maceió.

***Microprosthema takedai* Saito & Anker, 2012.** Type material: holotype, ov. female, cl 1.7 mm (FLMNH UF Arthropoda 16271), allotype: male, cl 2.3 mm (FLMNH UF Arthropoda 16504), French Polynesia, Society Islands, Moorea.

TABLE 1. Geographical ranges of the 16 presently known species of *Microprosthemina* Stimpson, 1860

Species name	Currently known geographic range	References
<i>Microprosthemina emmitium</i> Goy, 1987	Eastern Pacific: Galapagos; Panama; Mexico	Goy 1987
<i>Microprosthemina fujitai</i> Saito & Okuno, 2011	Indo-West Pacific: Japan (Ryukyu Is.)	Saito & Okuno 2011
<i>Microprosthemina granatense</i> Criales, 1997	Western Atlantic: Colombia (Granate Bay)	Criales 1997
<i>Microprosthemina inornatum</i> Manning & Chace, 1990	Central & Western Atlantic: Ascension I.; NW Gulf of Mexico	Manning & Chace 1990; Goy & Martin 2013
<i>Microprosthemina loensis</i> Goy & Felder, 1988	Western Atlantic: SE USA (Florida)	Goy & Felder 1988
<i>Microprosthemina lubricum</i> Saito & Okuno, 2011	Indo-West Pacific: Japan (Ryukyu Is.); Mariana Is.* (Guam); French Polynesia (Society Is.)	Saito & Okuno 2011; Minemizu 2013
<i>Microprosthemina manningi</i> Goy & Felder, 1988 (= <i>Microprosthemina jareckii</i> Martin, 2002)	Western Atlantic: Belize; Mexico; British Virgin Is.; SE USA (Florida)	Goy & Felder 1988; Martin 2002 (as <i>M. jareckii</i>); Goy & Martin 2013
<i>Microprosthemina ningaloo</i> sp. nov.	Indo-West Pacific: W Australia (Ningaloo Reef)	present study
<i>Microprosthemina pallidum</i> sp. nov.	Indo-West Pacific: Japan (Ryukyu Is.)	Minemizu 2013 (as <i>M. sp. 2</i>); present study
<i>Microprosthemina personatum</i> Jiang & Li, 2014	Indo-West Pacific: South China Sea (Xisha Is.)	Jiang & Li 2014
<i>Microprosthemina plumicorne</i> (Richters, 1880)	Indo-West Pacific: Saudi Arabia* (Red Sea); Mauritius; Japan (Ryukyu Is.); Philippines* (Mactan I.); Mariana Is.* (Guam); Marshall Is.* (Enewetak Atoll); Australia (Great Barrier Reef*); Norfolk I.; French Polynesia* (Society Is.)	Richters 1880; Coleman 1991; Minemizu 2013; present study; A. Anker, pers. obs.
<i>Microprosthemina scabricaudatum</i> (Richters, 1880)	Indo-West Pacific: Israel* (Red Sea); Eritrea* (Dahlak); Mauritius; Gloucesters Is.*; Japan (Ryukyu Is.); Papua New Guinea; Marshall Is. (Enewetak Atoll); French Polynesia (Society Is., Tuamotu Is.*)	Richters 1880; Holthuis 1946; Baba et al. 1968; Devaney & Bruce 1987; Salvat & Bacchet 2011; Saito & Anker 2012
<i>Microprosthemina semilaeve</i> (von Martens, 1872)	Western Atlantic: SE USA (Florida); Cuba; Bahamas; Mexico; Colombia; Honduras; Panama; Brazil (Fernando de Noronha, Alagoas*)	Martens 1872; Alves et al. 2008; Goy & Martin 2013; present study
<i>Microprosthemina takedai</i> Saito & Anker, 2012	Indo-West Pacific: Japan (Ryukyu Is.); French Polynesia (Society Is.)	Salvat & Bacchet 2011 (as <i>M. cf. validum</i>); Saito & Anker 2012; Minemizu 2013
<i>Microprosthemina tortugasensis</i> Goy & Martin, 2013	Western Atlantic: SE USA (Florida)	Goy & Martin 2013
<i>Microprosthemina validum</i> Stimpson, 1860 (= <i>Stenopusculus crassimanus</i> Richters, 1880)	Indo-West Pacific: Egypt* (Red Sea); Madagascar* (Nosy-Bé); Mauritius; Chagos Is.; Pakistan; S China (Hong Kong); Japan (Kochi*); Ryukyu Is.; Malaysia (Kedah); Indonesia (Java, Sulawesi, Ambon*, Biak*); Singapore*; Australia (Western Australia*, New South Wales, Great Barrier Reef); French Polynesia* (Society Is.)	Stimpson 1860; Richters 1880 (as <i>S. crassimanus</i>); De Man 1888; Lanchester 1901; Holthuis 1946; McNeill 1968; Johnson 1976; Ghory et al. 2005; Kuitert & Debelius 2009 (partly as <i>M. scabricaudatum</i>); Saito & Anker 2012; Minemizu 2013; present study

* designates new record (see comparative material)

Microprosthema validum Stimpson, 1860. Non-type material: 1 female, cl 2.6, 1 male, cl 2.7 mm (RMNH D41307), Egypt, Red Sea, Gulf of Aqaba, Sinai, “Magrash” (?)^{JG}; 2 males, cl 4.9 mm (USNM 205926), Pakistan, Cape Monze; 1 female, cl 2.7 mm (FLMNH UF Arthropoda 14039), Madagascar, Nosy-Bé, Nosy Komba; 1 female, cl 4.3 mm (NSMT Cr-22372), Indonesia, Ambon, Morela; 1 male, cl 3.0 mm (RMNH D15203), 1 ov. female, cl 3.6 mm, 1 male, cl 3.7 mm (RMNH D15204), Indonesia, Papua, Biak Island^{JG}; 1 male, cl 2.0 mm (ZLKU 11098), Japan, Ryukyu Islands, Ishigaki Island; 2 females, cl 2.9–3.1 mm, 1 male, cl 3.1 mm (NSMT Cr-8176), Hong Kong; 1 female, cl 4.2 mm (CMNH-ZC 00972), 1 male, cl 2.9 mm (CMNH-ZC 00973), Japan, Ryukyu Islands, Kume Island; 1 female, cl 3.7 mm (CMNH-ZC 00586), Japan, Kochi; 1 female, cl 3.2 mm, 1 male, cl 3.4 mm (NTM Cr 002601), Australia, Western Australia, Broome; 1 female, cl 2.1 mm (FLMNH UF Arthropoda 17458), 1 male, cl 3.2 mm (FLMNH UF Arthropoda 16948), 1 male, cl 3.0 mm (FLMNH UF Arthropoda 17538), Australia, Queensland, Lizard Island; 1 ov. female, cl 3.5 mm, 1 male, cl 2.7 mm (AHF 1249-02), French Polynesia, Tahiti, Papeete^{JG}.

Systematics

Spongicolidae Schram, 1986

Microprosthema Stimpson, 1860

Microprosthema ningaloo sp. nov.

(Figs. 1–6)

Type material. Australia, Western Australia. Holotype: ov. female, cl 3.7 mm (WAM C55835, ex-FLMNH UF Arthropoda 28031), Ningaloo Reef, Norwegian Channel, 22°61.86S 113°63.68E, large coral heads, in deep crevice of growth on large oyster, depth 6–7 m, leg. V. Ivanenko & A. Anker, 19 May 2010 [fcn AUST-7553]. Allotype: male, cl 2.9 mm (WAM C55836, ex-FLMNH UF Arthropoda 28033), same collection data as for holotype [fcn AUST-7555]. Paratypes: 1 ov. female, cl 3.2 mm (FLMNH UF Arthropoda 27915), Ningaloo Reef, Norwegian Channel, 22°67.04S 113°64.96E, in crevices of dead coral rubble, depth 2–3 m, leg. A. Anker, 23 May 2010 [fcn AUST-7413]; 1 male, cl 2.6 mm (FLMNH UF 27706), same collection data as for previous paratype [fcn AUST-7159].

Description. Females. Rostrum (Figs. 1, 2A, B) slender, directed slightly downwards, overreaching mid-length of antennal scale, 0.40–0.46 of carapace length, narrowly triangular in dorsal view; dorsal margin armed with 7 to 9 anteriorly directed teeth, posterior-most tooth small, situated posterior to orbital margin; ventral margin armed with three small teeth, posterior-most tooth blunt, somewhat separated from distal 2 teeth; each lateral margin usually with minute tooth at about mid-length.

Carapace (Figs. 1, 2A, B) with postrostral median ridge extending to epigastric region; supraorbital tooth stout, area posterior to supraorbital tooth with several additional teeth; orbital margin concave; antennal tooth large, acuminate; pterygostomial margin produced anteriorly, with several teeth, latter similar in size; gastric region with scattered, relatively small tubercles; cervical groove distinct, posterior margin with cincture of several tubercles of various sizes; hepatic region with relatively large tooth; anterolateral region with scattered, anteriorly directed teeth of different sizes; branchial and postcervical groove areas sometimes with scattered, small tubercles.

Sixth thoracic sternite (Fig. 2C) with medially jointed pair of slender, contiguous lobes; each distolateral angle produced; lateral margin unarmed; ventral surface concave, unarmed. Seventh thoracic sternite with pair of broad subrectangular plates; distolateral angle rounded; lateral and anteromesial margins unarmed; ventral surface concave, unarmed. Eighth thoracic sternite with pair of smaller trapezoid plates; distolateral angle rounded; lateral and anteromesial margins unarmed; ventral surface concave, unarmed.

Pleonal somites (Fig. 1) not sculptured; third to fifth somites with 1 or 2 short transverse depression(s) laterally. First pleonal somite short, divided into 2 sections by distinct transverse carina; anterior section with pleuron unarmed on lateral surfaces, posteroventrally ending in process supported by short transverse carina; posterior section with pleuron unarmed laterally; posteroventral margin unarmed or armed with few small teeth. Second to sixth pleura unarmed on lateral surfaces; third to sixth pleura with produced ventral margins, sometimes terminating in large tooth, unarmed or armed with few extra anterior and posterior teeth. Second pleonal somite

with rather distinct transverse carina, extending to about mid-height of pleuron. Third pleonal somite longest. Fourth pleonal somite with anteroventral margin bearing 2 small teeth. Sixth pleonal somite unarmed, posteroventral angle produced in triangular lobe.

Telson (Fig. 2D) subrectangular, slightly constricted near base, gradually tapering distally, about 1.7 times as long as maximum width; dorsal surface with shallow median groove flanked by dorsolateral carinae each bearing 2 or 3 strong, symmetrically situated teeth, and 2 submedian pairs of small teeth, anterior pair near telson base, posterior pair at about 0.25 length of telson; lateral margins each armed with 1 small submarginal tooth near base and 1 strong tooth posterior to mid-length; posterior margin generally convex, armed with 3 teeth, 2 lateral and 1 median.

Eyes (Fig. 3A) well developed; cornea narrower and shorter than peduncle, hemispherical, darkly pigmented; dorsal and anterior surfaces of eyestalk armed with several minute denticles.

Antennular peduncle (Fig. 3B) overreaching mid-length of antennal scale. First article subequal to combined length of distal 2 articles, armed with 1 strong distal tooth on mesial surface; stylocerite strongly curved inwards, distally acute. Second article armed with 3 mesial teeth and 1 stronger distolateral tooth. Third article unarmed. Flagellum slender, long, about twice as long as carapace.

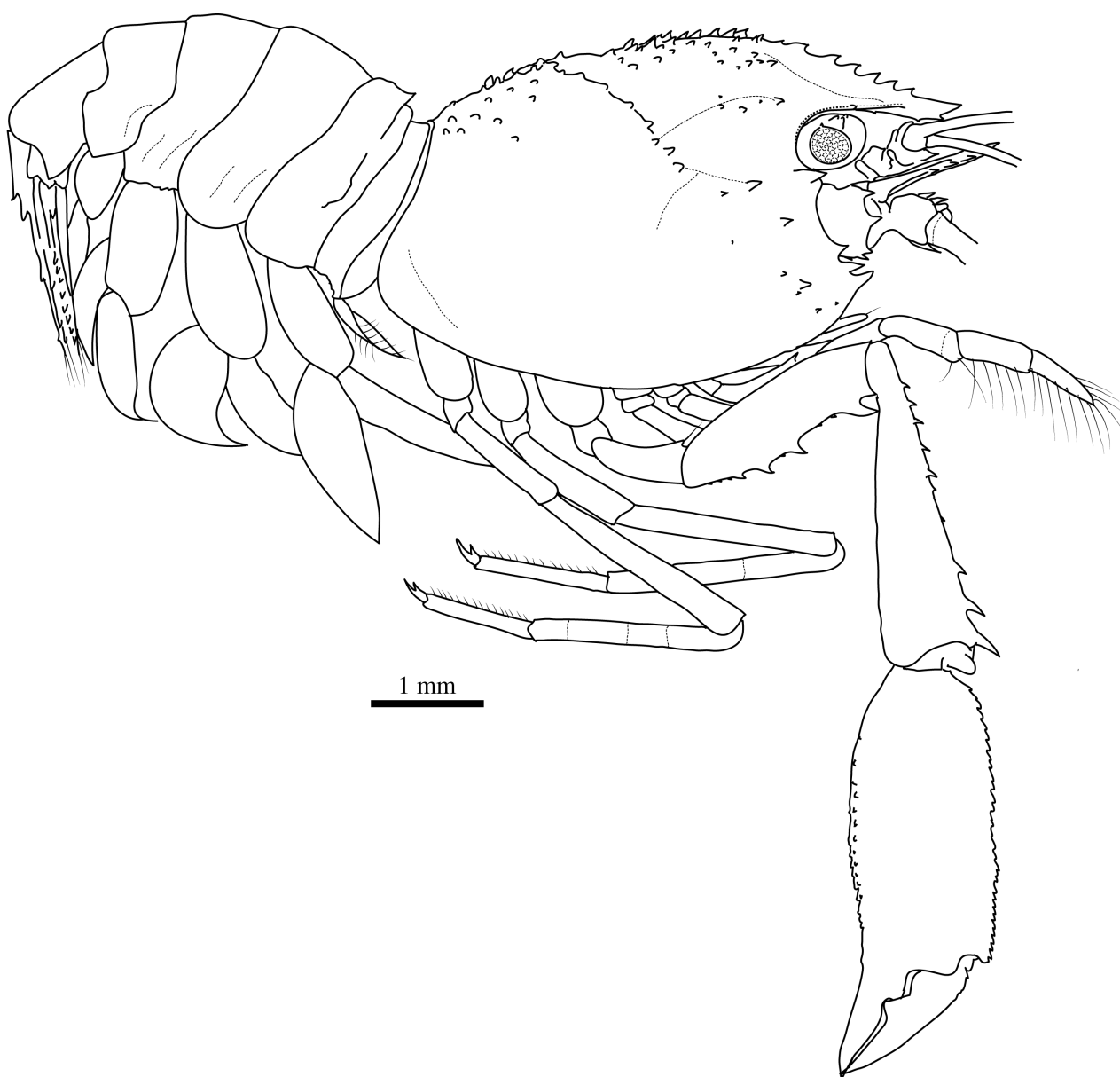


FIGURE 1. *Microprosthemella ningaloo* sp. nov., holotype, female (cl 3.7 mm) from Ningaloo Reef, Western Australia (WAM C55835): habitus, lateral view.

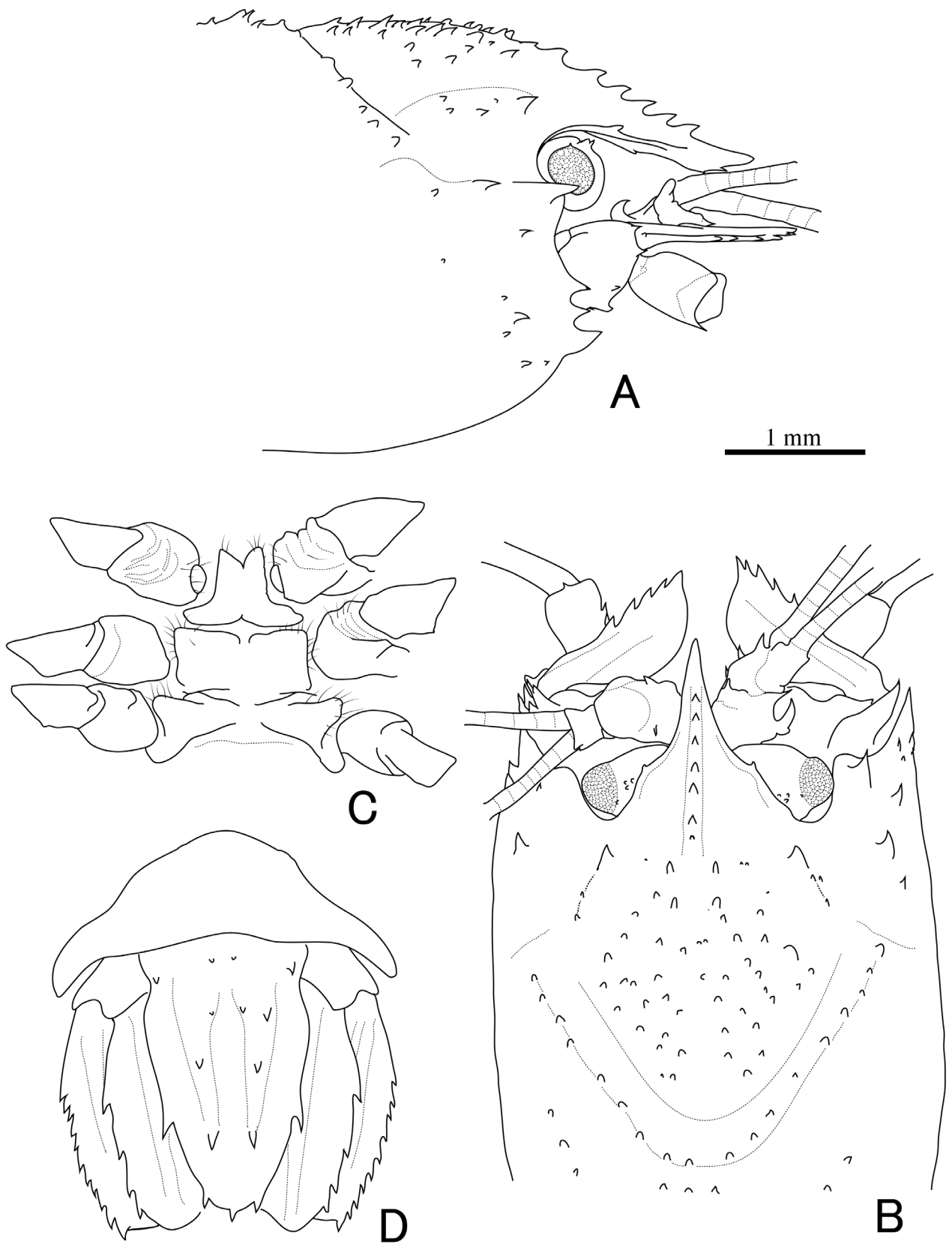


FIGURE 2. *Microprosthemella ningaloo* sp. nov., holotype, female (cl 3.7 mm) from Ningaloo Reef, Western Australia (WAM C55835): A—carapace and cephalic appendages, lateral view; B—same, dorsal view; C—sixth to eighth thoracic sternites, ventral view; D—sixth pleonal somite, telson and uropods, dorsal view.

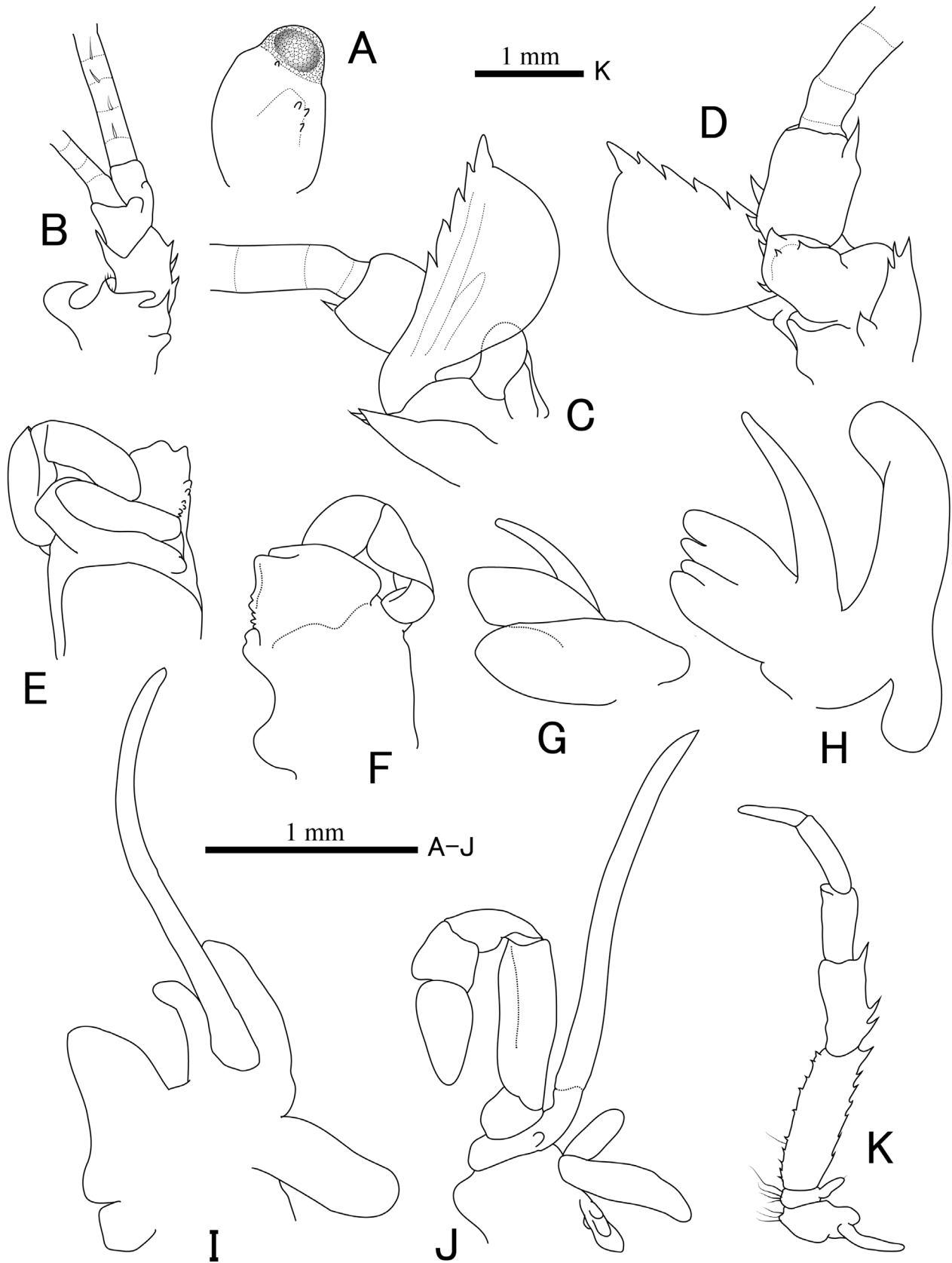


FIGURE 3. *Microprosthemina ningaloo* sp. nov., holotype, female (cl 3.7 mm) from Ningaloo Reef, Western Australia (WAM C55835): A—left eye, dorsal view; B—left antennule, dorsal view; C—left antenna, dorsal view; D—left antenna, ventral view; E—left mandible, dorsal (lateral) view; F—same, ventral (mesial) view; G—left maxillule, mesial view; H—left maxilla, mesial view; I—left first maxilliped, mesial view; J—left second maxilliped, ventral view; K—left third maxilliped, ventral view.

Antenna (Fig. 3C, D) with stout basicerite bearing 2 moderately large, distolateral teeth, and some additional teeth of various sizes on ventrolateral surface; mesial margin with laminate process. Antennal scale about 2.4 times longer than broad, lateral margin nearly straight, armed with 5 or 6 teeth, dorsal surface with 2 longitudinal carinae. Carpocerite short, reaching level of third article of antennular peduncle, armed with few strong teeth on mesial and lateral margins. Flagellum slender, long, about 4 times as long as carapace.

Mandible (Fig. 3E, F) robust; palp composed of 3 articles, distal article oval, furnished with dense setae, intermediate article subequal to distal article in length, distally with tuft of setae; molar and incisor processes clearly separated.

Maxillule (Fig. 3G) robust, with simple, slender, distally tapering endopod; coxal endite suboval, with submarginal row of stiff setae on lateral surface; basal endite moderately broad, truncate distally, with several slender spinules and sparse, long spiniform setae.

Maxilla (Fig. 3H) with curved, slender endopod; both coxal and basal endites bilobed; scaphognathite well developed, anterior lobe subquadrate distally, posterior lobe short, widening posteromesially.

First maxilliped (Fig. 3I) with endopod not subdivided, tapering distally; basal endite large, subtriangular, with concave mesial margin; coxal endite short, unilobed; exopod with well-developed flagellum; epipod large, feebly bilobed.

Second maxilliped (Fig. 3J) with moderately broad endopod; dactylus tapering distally; propodus anteromesially truncate, about 0.6 times as long as dactylus; carpus slightly elongate, cup-shaped; merus about 2.7 times as long as carpus, oblong, mesial margin bearing row of stiff setae; ischium compressed laterally; epipod elongate, with podobranch rod-like, with few small lamellae proximally; exopod with well-developed flagellum.

Third maxilliped (Fig. 3K) overreaching tip of antennal scale by length of dactylus and propodus. Dactylus tapering distally; lateral margin furnished with row of long setae extending to propodus, distomesial surface with shallow depression furnished with dense grooming setae. Carpus subequal to propodus in length, unarmed, distoventral margin slightly projecting. Merus armed with 3 strong teeth on dorsolateral margin. Ischium compressed laterally, armed with row of several unequally spaced, minute teeth on ventromesial margin, and with row of several stronger teeth, decreasing in size proximally, on dorsolateral margin. Epipod elongate, rod-like. Exopod reduced to rudimentary flagellum.

First pereopod (Fig. 4A) slender, overreaching tip of antennal scale by length of dactylus, with well-developed carpo-propodal grooming apparatus; all articles unarmed; dactylus about 0.4 of chela length; palm subcylindrical; carpus slender, about 1.4 of chela length; merus about 0.8 of carpal length; ischium about 0.8 of meral length.

Second pereopod (Fig. 4B) longer than first pereopod, overreaching tip of antennal scale by length of chela and carpus; all articles unarmed; dactylus about 0.4 of chela length; palm subcylindrical; carpus about 1.8 times as long as chela; merus about 0.7 of carpal length; ischium about 0.6 of meral length.

Third pereopod (Fig. 4C, D) longest and strongest, overreaching tip of antennal scale by length of chela and carpus. Chela about 1.2 times as long as carapace. Dactylus about 0.4 of chela length; dorsal margin slightly curved, with minute blunt or subacute teeth; cutting edge proximally with large triangular tooth, otherwise unarmed. Fixed finger slightly longer than dactylus, hooked distally, cutting edge proximally with large blunt tooth fitting into hiatus on opposed cutting edge of dactylus. Palm subcylindrical, about 2.2 times as long as wide; dorsal margin sharply carinate, with row of numerous small teeth of similar size; ventral margin not carinate, with irregular longitudinal rows of minute teeth, extending to proximal half of fixed finger; lateral surface unarmed; mesial surface with scattered, small tubercles and granules. Carpus widening distally, about 3.7 times as long as wide, approximately 0.7 of chela length; dorsal margin armed with several, widely spaced, strong teeth of various sizes, distal-most strongest; lateral surface armed with irregular row of smaller teeth; mesial surface divided by weak longitudinal ridge along midline, dorsomesial surface with some irregular longitudinal rows of minute tubercles and granules, ventromesial surface with more numerous, scattered, minute tubercles and granules. Merus about 0.9 of carpal length; dorsal margin with row of several spaced teeth; ventral margin with row of much stronger teeth, distal-most tooth strongest, stout; lateral surface with scattered spinules and granules; mesial surface with rows of small teeth and granules. Ischium about 0.6 of meral length; distodorsal angle bluntly projecting; all margins and surfaces unarmed.

Fourth and fifth pereopods (Fig. 4E–G) similar in shape and length. Dactylus compressed laterally, about 3 times as long as wide, biunguiculate. Propodus about 3 times as long as dactylus, not subdivided; ventral margin armed with numerous (13–15) movable spines. Carpus about twice as long as propodus, subdivided into 4–6 articles. Merus about 0.8 of carpal length, entire. Ischium about 0.6 of meral length.

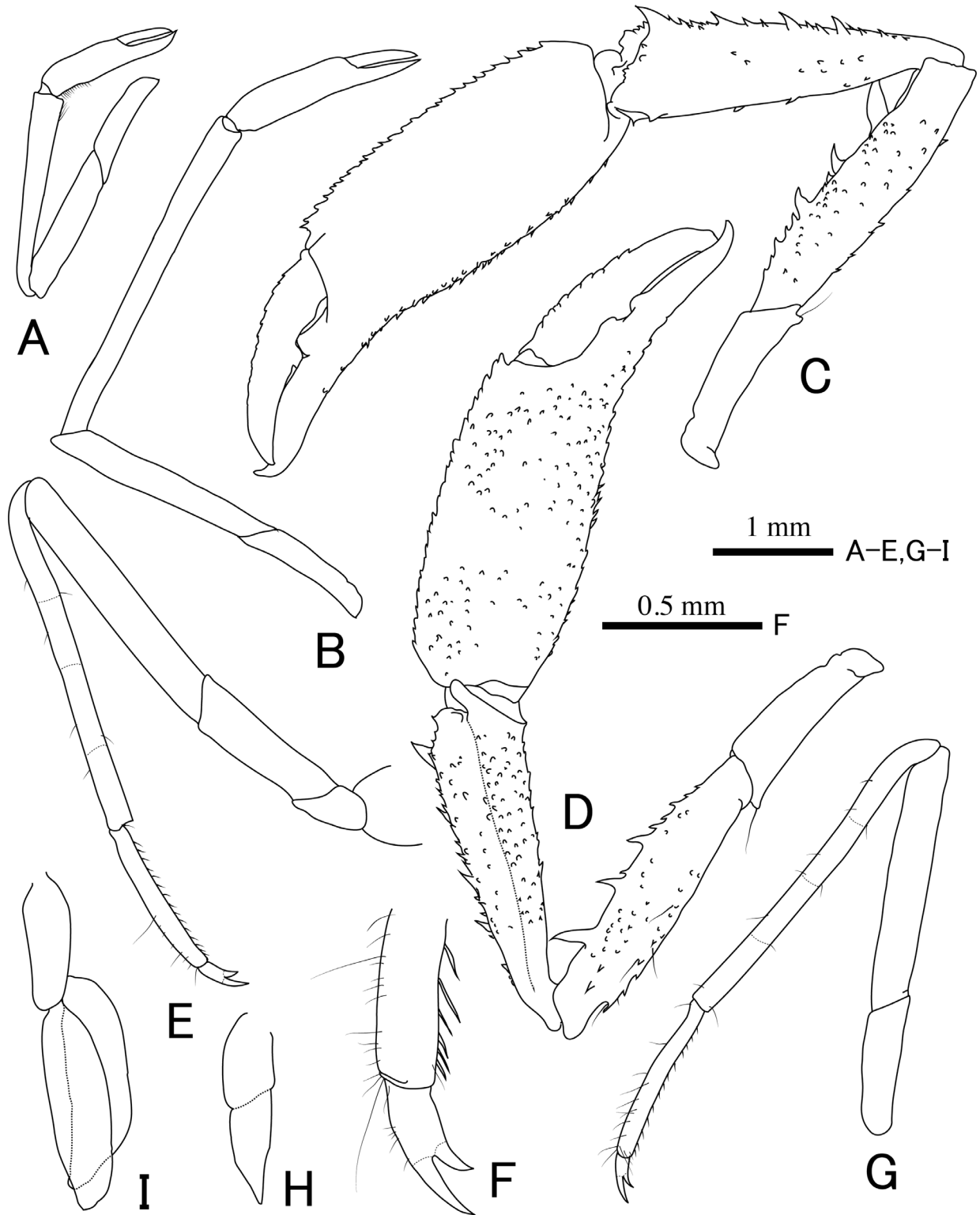


FIGURE 4. *Microprosthema ningaloo* sp. nov., holotype, female (cl 3.7 mm) from Ningaloo Reef, Western Australia (WAM C55835): A—right first pereiopod, lateral view; B—right second pereiopod, lateral view; C—left third pereiopod, lateral view; D—same, mesial view; E—left fourth pereiopod, lateral view; F—same, dactylus; G—left fifth pereiopod, lateral view, H—left first pleopod, dorsal view; I—left second pleopod, lateral view.

First pleopod (Fig. 4H) uniramous, shorter than other pleopods. Second to fifth pleopods biramous. Second pleopod (Fig. 4I) with protopod shorter than both rami, unarmed on mesial and lateral margins. Third to fifth pleopods generally similar, decreasing in size posteriorly.

Uropod (Fig. 2D) with stout protopod, its lateral margin terminating in blunt process. Exopod relatively broad, overreaching posterior margins of telson and endopod; lateral margin nearly straight, armed with row of 10–13 teeth; dorsal surface with 2 smooth longitudinal carinae, unarmed. Endopod tapering distally; lateral margin armed with 4–7 teeth, distal part unarmed; dorsal surface with longitudinal carina, unarmed.

Gill formula summarised in Table 2.

TABLE 2. Gill formulae of *Microprosthema ningaloo* sp. nov. and *M. pallidum* sp. nov.

<i>M. ningaloo</i> sp. nov.								
	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	-	-	1	1	1	1	1	1
Arthrobranchs	1	1	2	2	2	2	2	-
Podobranch	-	1	-	-	-	-	-	-
Epipods	1	1	1	1	1	1	1	-
Exopods	1	1	r	-	-	-	-	-

<i>M. pallidum</i> sp. nov.								
	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	-	-	1	1	1	1	1	1
Arthrobranchs	1	1	2	2	2	2	1	-
Podobranch	-	1	-	-	-	-	-	-
Epipods	1	1	1	1	r	-	-	-
Exopods	1	1	1	-	-	-	-	-

r: rudimentary

Number of eggs (holotype): 122, eggs subspherical, diameter 0.57 x 0.47 mm.

Males. Rostrum (Fig. 5A) about 0.6 carapace length, dorsal margin armed with 9 small, anteriorly directed teeth, latter subequal in size except for distinctly smaller, posterior-most tooth, proximal two teeth situated posterior to orbital margin; ventral margin with one small, subdistal tooth. Carapace armed with teeth on postorbital and anterolateral regions, teeth more numerous than in females.

Sixth thoracic sternite (Fig. 5B) with pair of slender, anteriorly directed lobes, their lateral and mesial margins unarmed, distolateral angles rounded; seventh sternite with pair of broad, triangular lobes, distolateral angles produced, lateral and anteromesial margins unarmed; eighth sternite with pair of trapezoid lobes, distolateral angles produced or rounded, lateral and anteromesial margins unarmed.

Chela of third pereiopod (Fig. 5C) about 1.7 times as long as carapace; dactylus about half-length of chela; palm subcylindrical, about 1.9 times as long as wide, mesial surface armed with scattered spinules or granules; carpus somewhat broadened distally, about 2.7 times as long as wide, about 1.7 times as long as chela; merus subequal to carpus in length.

Colour in life. Body and appendages with semitransparent-whitish background and pale golden-orange tinge, more intense in larger females; carapace and pleon with small red chromatophores forming diffuse, pale, shorter or longer, transverse bands on third pleonal somite; telson and uropods mostly semitransparent-whitish in males and pale to golden-yellowish in larger females; eyestalks and antennal scale whitish; antennular and antennal flagella pale orange to reddish; third maxilliped, first and second pereiopods semitransparent with reddish chromatophores; third pereiopod chelae varying from hyaline-white with pale-orange tinge (male, smaller female) to pale golden-orange (larger females), fingers darker reddish distally; palm, carpus and merus whitish with pale orange areas; fourth and fifth pereiopods semitransparent-whitish or yellowish, with reddish chromatophores typically forming longitudinal red line on carpus; eggs or maturing ovaries in females green (Fig. 6A–C).

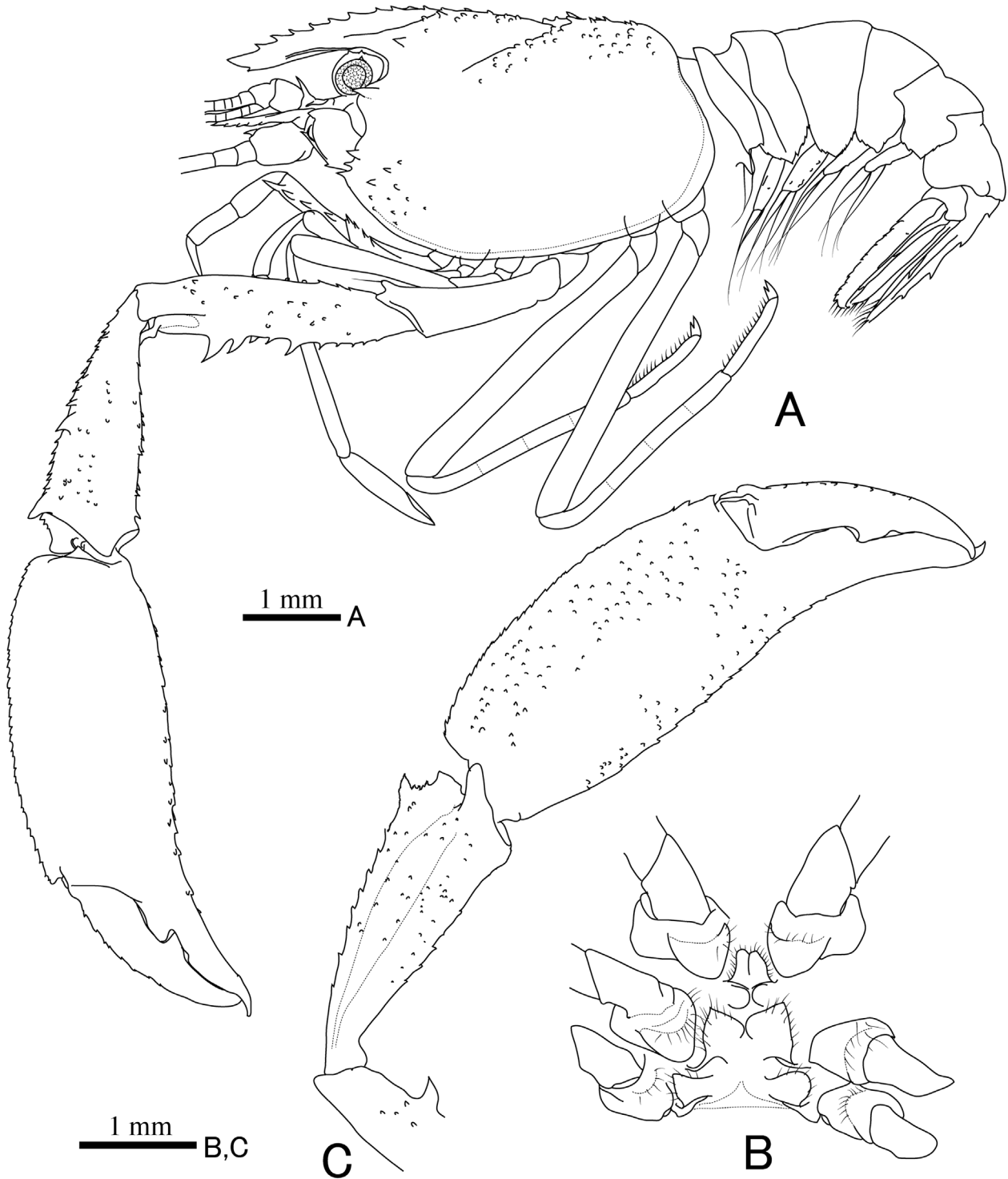


FIGURE 5. *Microprosthemina ningaloo* sp. nov., allotype, male (cl 2.9 mm) from Ningaloo Reef, Western Australia (WAM C55836): A—habitus, lateral view; B—sixth to eighth thoracic sternites, ventral view; C—left third pereiopod, chela and carpus, mesial view.

Etymology. The specific epithet refers to Ningaloo Reef in Western Australia, the type locality of the new species; used as a noun in apposition.

Common name. Ningaloo boxer shrimp.

Distribution. Presently known only from the type locality in Western Australia, Australia.

Ecology. Shallow coral reef, with large living coral heads (both branched and massive corals) and abundant coral rubble; in crevices of coral rubble and in growth on large reef oysters; depth range 2–7 m.



FIGURE 6. *Microprosthemina ningaloo* sp. nov. A—holotype, female (cl 3.7 mm) from Ningaloo Reef, Western Australia (WAM C55835); B—allotype, male (cl 2.9 mm) from Ningaloo Reef (WAM C55836); C—paratype, male (cl 2.6 mm) from Ningaloo Reef (FLMNH UF Arthropoda 27706). Photographs: A. Anker.

Remarks. *Microprosthemina ningaloo* sp. nov. appears to be unique within *Microprosthemina* in possessing a rudimentary exopod on the third maxilliped (Table 2). In all other members of the genus, the exopod flagellum is long, reaching past the distal margin of the merus. The new species is morphologically most similar to *M.*

personatum (Xisha Islands, South China Sea) and *M. takedai* (Ryukyu Islands, Japan to Society Islands, French Polynesia), sharing with them the following features: (1) carapace with only a few teeth or denticles, especially in the branchial region; (2) lateral surface of the sixth pleonal somite lacking a short transverse row of teeth; (3) antennal scale subsemicircular in shape; (4) first and second pereopods lacking dorsal teeth on their respective carpi; and (5) third pereopod chela armed with dorsal and ventral rows of teeth. However, *M. ningaloo* **sp. nov.** differs from these two species by the absence of a transverse groove on the third pleonal somite, which is rather conspicuous in *M. personatum* and *M. takedai* (cf. Saito & Anker 2012; Jiang & Li 2014). Other characters separating *M. ningaloo* **sp. nov.** from *M. personatum* are the narrower, slightly convex supraorbital eaves in the new species, which are very prominent and covering a large portion of the eyestalks in dorsal view in *M. personatum*, and more numerous small scattered tubercles and granules on the mesial surface of the third pereopod palm, especially in females (cf. Jiang & Li 2014).

A direct comparison between *M. ningaloo* **sp. nov.** and *M. takedai* (see comparative material) revealed several additional differences between these two species. For instance, *M. ningaloo* **sp. nov.** differs from *M. takedai* in the armature of the dorsal surface of the carapace: teeth or tubercles on the dorsal carapace are more numerous and weaker in the new species than in *M. takedai*. In *M. ningaloo* **sp. nov.**, the endopod of the first maxilliped is simple, whilst it is subdivided into two segments in *M. takedai*. Furthermore, *M. ningaloo* **sp. nov.** lacks a dorsal row of teeth on the merus of the third maxilliped, which is present in *M. takedai*. The two species can also be distinguished by the presence (in *M. ningaloo* **sp. nov.**) vs. absence (in *M. takedai*) of scattered small tubercles and granules on the groove on the dorsomesial surface of the third pereopod carpus. Finally, they differ in the colour of the third pereopod chela, with fingers being always dark reddish distally in *M. ningaloo* **sp. nov.** (Fig. 6) vs. always white in *M. takedai* (cf. Saito & Anker 2012: figs. 6, 7).

None of the other species of *Microprosthema* appears to be closely related to *M. ningaloo* **sp. nov.**, all being distinguishable by a series of morphological characters and (where known) colouration (cf. Richters 1880; Holthuis 1946; Goy 1987; Goy & Felder 1988; Manning & Chace 1990; Criales 1997; Martin 2002; Saito & Okuno 2011; Goy & Martin 2013).

***Microprosthema pallidum* sp. nov.**

(Figs. 7–11)

Microprosthema sp. 2—Minemizu 2013: 24.

Type material. Japan, Ryukyu Islands, Yaeyama Islands. Holotype: ov. female, cl 1.5 mm (NSMT-Cr 22937), west of Ishigaki Island, Osaki, depth 5 m, leg. R. Minemizu, 2 October 2011 [fcn MG2069]. Allotype: male, cl 1.7 mm (NSMT-Cr 22938), west of Ishigaki Island, Osaki, depth 5 m, leg. R. Minemizu, 4 October 2011 [fcn MG2332]. Paratype: 1 male, cl 1.8 mm (NSMT-Cr 22939), south of Taketomi Island, depth 10 m, leg. R. Minemizu, 5 October 2011 [fcn MG2794].

Description. Female. Rostrum (Figs. 7, 8A, B) slender, directed slightly downwards, reaching mid-length of antennal scale, 0.42 of carapace length, narrowly triangular in dorsal view; dorsal margin armed with 7 anteriorly directed teeth of similar size, all teeth situated anterior to orbital margin; ventral margin with 1 subdistal tooth; lateral margins unarmed.

Carapace (Fig. 8A, B) with postrostral median ridge extending to anterior part of gastric region; supraorbital tooth relatively small, pointing forwards; orbital margin concave, inferior orbital angle obsolete; antennal tooth minute; pterygostomial margin produced anteriorly, with several minute teeth; gastric region with 1 pair of submedian teeth; cervical groove feebly marked, posterior margin armed with 2 pairs of anteriorly directed, small teeth; hepatic tooth present; scattered anterolateral teeth and granules on pterygostomial region relatively small; postcervical region armed with 1 pair of anteriorly directed, stout teeth.

Sixth thoracic sternite (Fig. 8C) with medially jointed pair of slender, contiguous lobes; lateral and mesial margins unarmed; ventral surface concave, unarmed. Seventh sternite with paired, broad, subrectangular plates; each distolateral angle rounded; lateral and anteromesial margins unarmed; ventral surface concave, unarmed. Eighth sternite with pair of smaller trapezoid plates; each distolateral angle rounded; lateral and anteromesial margins unarmed; ventral surface concave, unarmed.

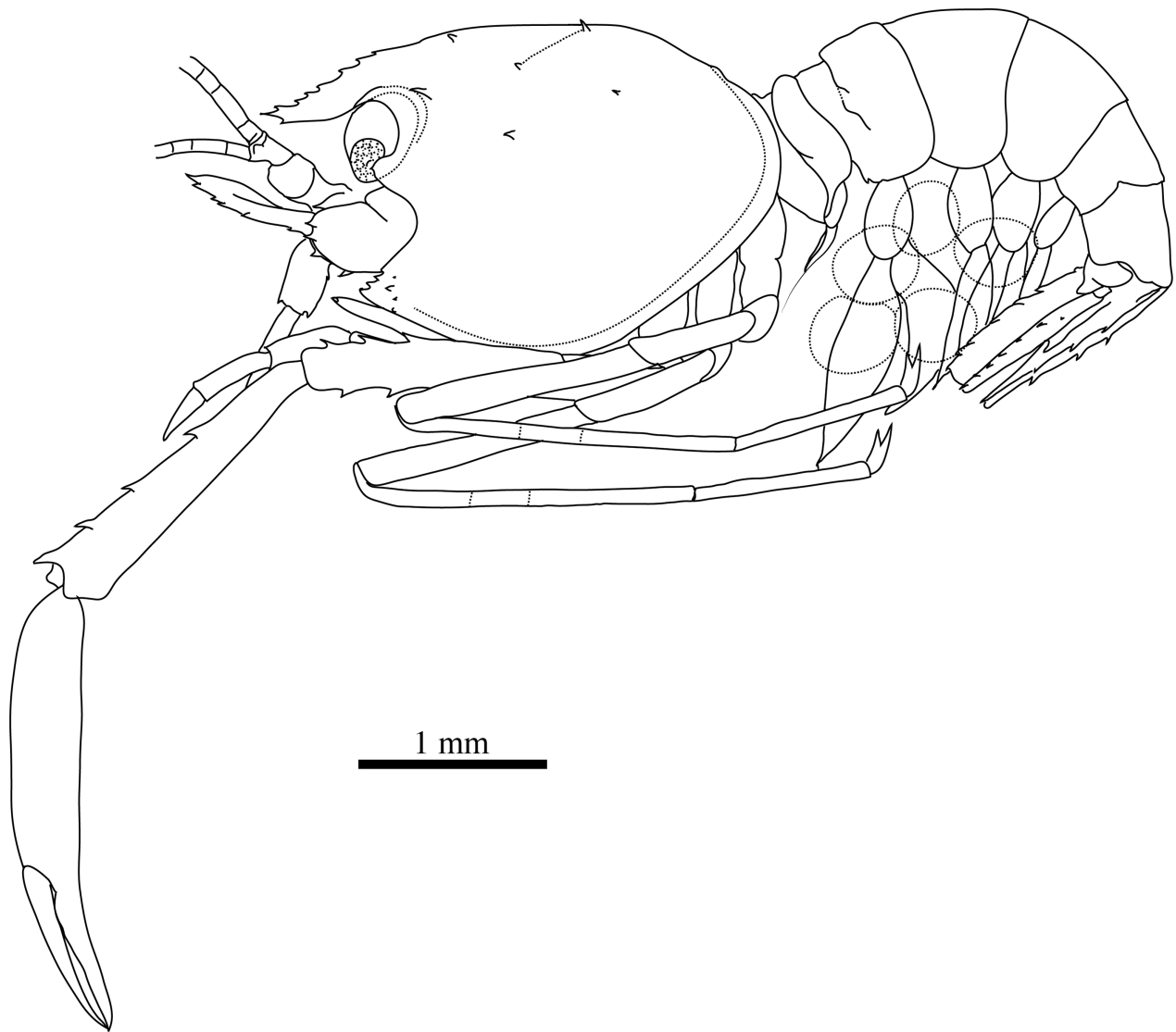


FIGURE 7. *Microprosthema pallidum* sp. nov., holotype, female (cl 1.5 mm) from Osaki, west of Ishigaki Island, Ryukyu Islands, Japan (NSMT-Cr 22937): habitus, lateral view.

Pleonal somites (Fig. 7) not sculptured. First pleonal somite short, divided into 2 sections by distinct transverse carina; anterior section with pleuron unarmed laterally, posteroventrally ending in elongate process supported by short transverse carina; posterior section with pleuron unarmed on lateral surfaces; posteroventral margin unarmed. Second to sixth pleura unarmed laterally; ventral margins rounded. Second pleonal somite with rather distinct transverse carina, ending at mid-height of pleuron; anteroventral margin armed with 1 minute tooth. Third pleonal somite longest. Sixth pleonal somite unarmed.

Telson (Fig. 8D) subrectangular-ovate, slightly constricted near base, gradually tapering distally, about 1.6 times as long as maximum width; dorsal surface with shallow median groove flanked by dorsolateral carinae each bearing 1 row of 3 strong, symmetrically situated teeth, and 2 submedian pairs of teeth, anterior pair near telson base, posterior pair at about 0.25 length of telson, anterior teeth stronger; lateral margins each armed with 1 submarginal tooth near base and 1 strong tooth at about mid-length; posterior margin generally convex, armed with 2 small lateral teeth, median tooth absent.

Eyes (Fig. 8A, B) with cornea narrower and shorter than peduncle, hemispherical, darkly pigmented; dorsal and anterior surfaces of eyestalk with several minute denticles.

Antennular peduncle (Fig. 8A, B) reaching mid-length of antennal scale. First article subequal to combined length of distal 2 articles, armed with 1 strong distal tooth on mesial surface; stylocerite strongly curved inwards, distally acute. Second article armed with several strong mesial teeth and 1 distolateral tooth. Third article unarmed. Flagellum slender, long, almost 5 times as long as carapace.

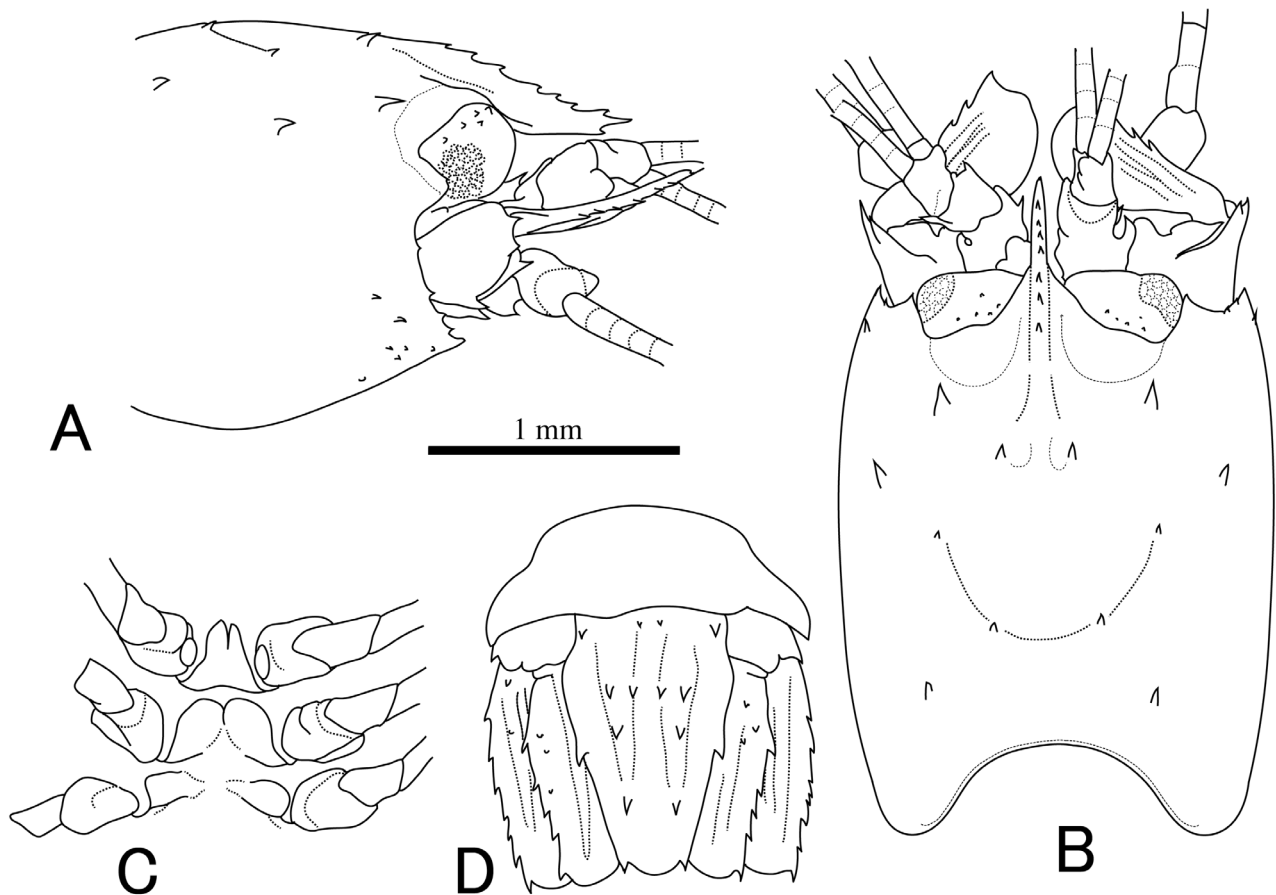


FIGURE 8. *Microprosthema pallidum* sp. nov., holotype, female (cl 1.5 mm) from Osaki, west of Ishigaki Island, Ryukyu Islands, Japan (NSMT-Cr 22937): A—carapace and cephalic appendages, lateral view; B—same, dorsal view; C—sixth to eighth thoracic sternites, ventral view; D—sixth pleonal somite, telson and uropods, dorsal view.

Antenna (Fig. 8A, B) with stout basicerite bearing 1 moderately large, distolateral tooth, and several additional teeth of various sizes on ventrolateral surface; mesial margin with laminate process. Antennal scale twice as long as broad, lateral margin nearly straight, armed with 6–7 teeth; dorsal surface with 2 longitudinal carinae. Carpocerite short, reaching level of third article of antennular peduncle, armed with few strong teeth on mesial and lateral margins. Flagellum slender, almost 8 times as long as carapace.

Mouthparts generally similar to those of *M. ningaloo* sp. nov. (see above). Third maxilliped (Fig. 9A) overreaching tip of antennal scale by length of dactylus. Dactylus tapering distally, lateral margins of dactylus and propodus furnished with long setae, distomesial surface with shallow depression densely furnished with grooming setae. Carpus subequal to propodus in length, armed with strong dorsolateral tooth, distoventral margin produced. Merus armed with row of 3 strong teeth dorsolaterally. Ischium compressed laterally, armed with row of several, equally spaced, minute teeth on ventromesial margin, and with row of several stronger teeth on dorsolateral margin, teeth decreasing in size from distal to proximal. Epipod elongate, rod-like. Exopod with well-developed, long, simple flagellum.

First pereiopod (Fig. 9B) slender, overreaching tip of antennal scale by length of chela, with well-developed carpo-propodal grooming apparatus; all articles unarmed; dactylus about half-length of chela; palm subcylindrical; carpus slender, about 1.3 length of chela; merus about 0.9 of carpal length; ischium about 0.6 of meral length.

Second pereiopod (Fig. 9C) longer than first pereiopod, overreaching tip of antennal scale by length of chela and half of carpus; all articles unarmed; dactylus about 0.4 of chela length; palm subcylindrical; carpus about 1.6 times as long as chela; merus about 0.7 of carpal length; ischium about half of meral length.

Third pereiopod (Fig. 9D) longest and strongest, overreaching tip of antennal scale by length of chela and half of carpus. Chela about 1.4 times as long as carapace. Dactylus about 0.4 of chela length, with hook-like tip; dorsal margin unarmed; cutting edge proximally with triangular tooth opposed to hiatus on fixed finger, otherwise

unarmed. Fixed finger generally similar to dactylus, gently curved distally, cutting edge unarmed. Palm subcylindrical, about 3.4 times as long as wide, unarmed. Carpus slightly widening distally, almost 5.0 times as long as wide, approximately 0.7 of chela length, dorsolateral surface armed with 6 widely spaced, strong teeth of various sizes, distal-most strongest, dorsomesial surface with longitudinal groove; ventrolateral and ventromesial margins unarmed. Merus about 0.9 of carpal length; dorsal margin with 3 strong teeth; ventral margin with 2 strong teeth, distal-most strongest; lateral and mesial surfaces unarmed. Ischium about 0.6 of meral length; distodorsal angle somewhat produced, with 1 stiff seta.

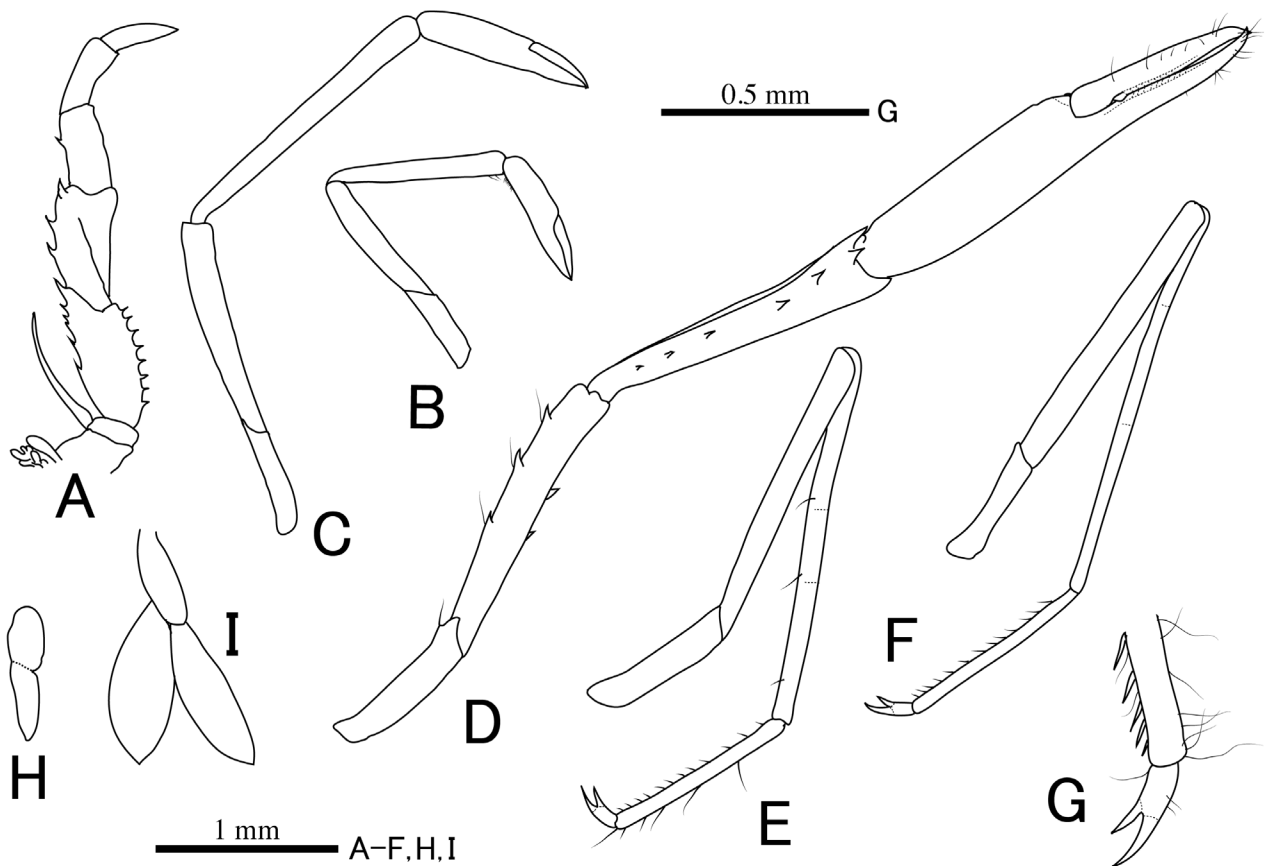


FIGURE 9. *Microprosthema pallidum* sp. nov., holotype, female (cl 1.5 mm) from Osaki, west of Ishigaki Island, Ryukyu Islands, Japan (NSMT-Cr 22937): A—right third maxilliped, ventral view; B—right first pereopod, lateral view; C—right second pereopod, lateral view; D—right third pereopod, lateral view; E—right fourth pereopod, lateral view; F—right fifth pereopod, lateral view, G—same, dactylus; H—right first pleopod, dorsal view; I—right second pleopod, lateral view.

Fourth and fifth pereopods (Fig. 9E–G) similar in shape and length. Dactylus compressed laterally, about 4.6 times as long as wide, biunguiculate. Propodus about 3.8 times as long as dactylus, not subdivided, ventral surfaces armed with 12–13 movable spines. Carpus about twice as long as propodus, subdivided into 3 articles. Merus about 0.8 of carpal length, entire. Ischium 0.4 of meral length.

First pleopod (Fig. 9H) uniramous, shorter than other pleopods. Second to fifth pleopods biramous. Second pleopod (Fig. 9I) with protopod shorter than both rami, unarmed on mesial and lateral margins. Third to fifth pleopods generally similar, decreasing in size posteriorly.

Uropod (Fig. 8D) with stout protopod, its lateral margin terminating in acute process. Exopod relatively broad, overreaching posterior margins of telson and endopod; lateral margin nearly straight, armed with row of 7–8 teeth; dorsal surface with 2 smooth longitudinal carinae, unarmed or armed with few blunt teeth. Endopod tapering distally; lateral margin armed with 5 teeth; dorsal surface with longitudinal carina, armed with several blunt teeth proximally.

Gill formula summarised in Table 2.

Number of eggs (holotype): 20, eggs subspherical, diameter 0.44 x 0.36 mm.

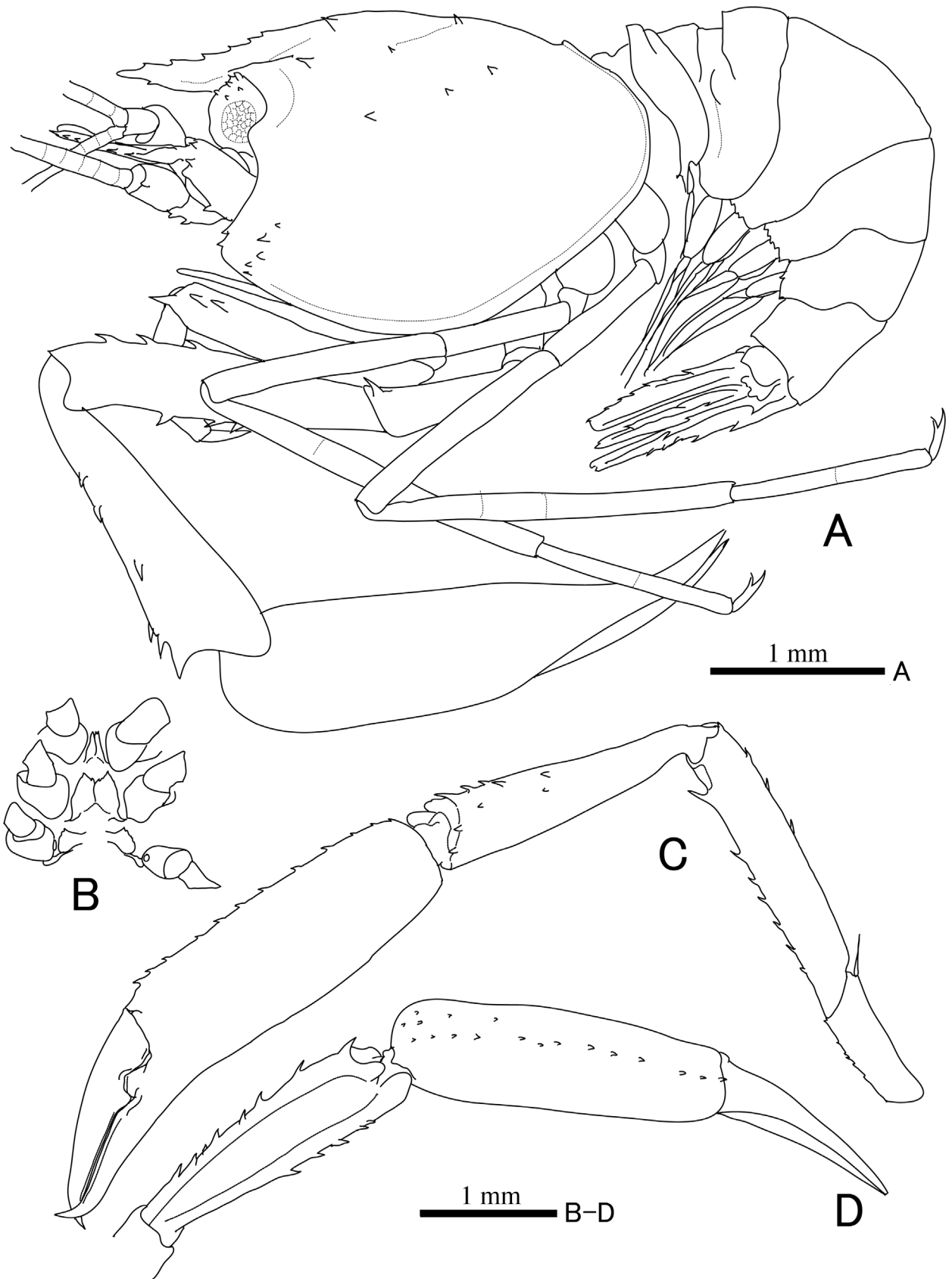


FIGURE 10. *Microprosthemella pallidum* sp. nov., allotype, male (cl 1.7 mm) from Osaki, west of Ishigaki Island, Ryukyu Islands, Japan (NSMT-Cr 22938): A—habitus, lateral view; B—sixth to eighth thoracic sternites, ventral view; C—left third pereiopod, chela, lateral view; D—same, chela and carpus, dorsal view.

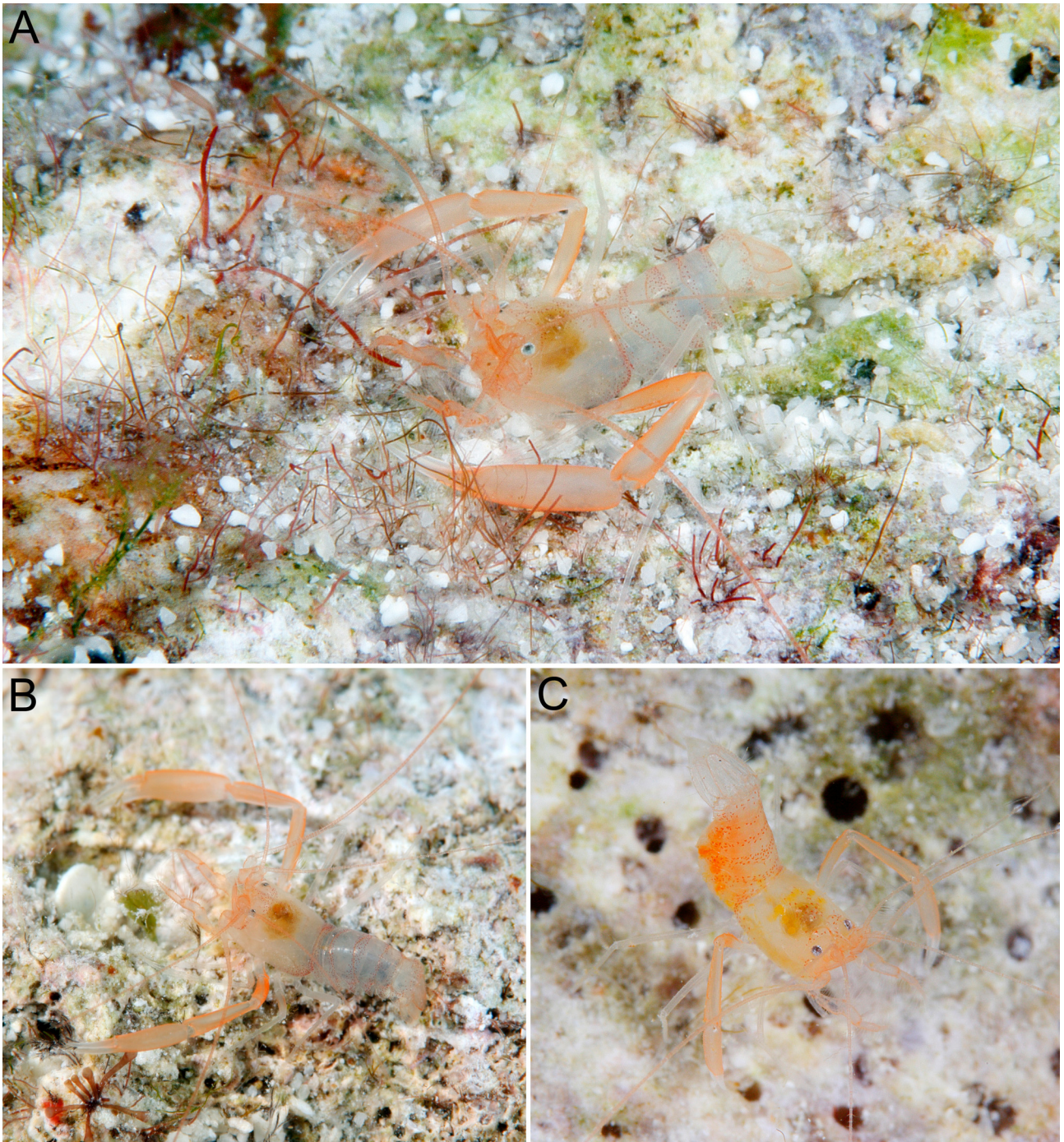


FIGURE 11. *Microprosthemella pallidum* sp. nov.: A—allotype, male (cl 1.7 mm) from Ishigaki Island, Ryukyu Islands, Japan (NSMT-Cr 22938); B—paratype, male (cl 1.8 mm) from Taketomi Island, Ryukyu Islands, Japan (NSMT-Cr 22939); C—holotype, female (cl 1.5 mm) from Ishigaki Island (NSMT-Cr 22937). Photographs: R. Minemizu.

Males. Rostrum (Fig. 10A) slightly less than half-length of carapace. Carapace armed with teeth on postorbital and anterolateral regions, teeth stronger than in females. Sixth thoracic sternite (Fig. 10B) with pair of slender, anteriorly directed lobes, their lateral and mesial margins unarmed, distolateral angles produced, sometimes bifid; seventh sternite with pair of broad, triangular lobes, distolateral angles produced, lateral and anteromesial margins armed with several minute teeth; eighth sternite with pair of trapezoid lobes, distolateral angles produced, lateral and anteromesial margins armed with minute teeth. Chela of third pereiopod (Fig. 10C, D) about 1.8 times as long as carapace; dactylus about 0.4 of chela length; palm subcylindrical, about 2.8 times as long as wide, mesial surface unarmed, dorsal margin armed with irregular rows of several, small, widely spaced teeth; carpus somewhat

broadened distally, about 3.8 times as long as wide, 0.6 of chela length, dorsomesial surface with longitudinal groove, dorsolateral and mesial margins armed with rows of several strong teeth; merus subequal to carpus in length, dorsal and ventral margins armed with row of strong teeth; ischium half as long as merus, ventral margin with row of small teeth, distodorsal angle slightly produced, furnished with 1 thick seta.

Colour in life. Body and appendages with semitransparent-whitish background and pale orange-reddish tinge; carapace and pleon covered with small red chromatophores, especially dense on anterior part of carapace and rostrum, and forming larger patches on posterolateral and epigastric regions of carapace and diffuse transverse bands on pleonal somites; telson and uropods mostly transparent-whitish; eyestalks greyish; antennal scale pale yellow; antennular and antennal flagella pale red-orange; third maxilliped and first and second pereopods semitransparent with reddish chromatophores; third pereopod chelae, carpus and merus light orange-pink, more intense on margins, chela fingers white distally; fourth and fifth pereopods transparent; eggs or maturing ovaries in females bright orange (Fig. 11).

Etymology. The specific epithet *pallidum* (neuter gender of *pallidus*, Latin for pale) refers to the pale orange-reddish body colour of the new species.

Common name. Pale boxer shrimp (English name), Benimatoi-Sangohimeebi (Japanese name suggested by the collector and photographer R. Minemizu, meaning “small coral reef shrimp wearing pink clothes”).

Distribution. Presently known only from the type locality (Osaki, Ishigaki Island) in the Ryukyu Islands, southern Japan.

Ecology. Coral reef, under large coral rocks; depth range 5–10 m.

Remarks. *Microprosthema pallidum* **sp. nov.** is the only species of *Microprosthema* with one arthrobranch on the fourth pereopod and lacking an epipod on the third pereopod (Table 2). The new species appears to be morphologically closest to *M. lubricum* (Japan and French Polynesia), sharing with it a reduced armature on the carapace and thoracic appendages and a subcylindrical, i.e. not particularly broadened, third pereopod chela. However, *M. pallidum* **sp. nov.** can be easily distinguished from *M. lubricum* by several morphological features, including (1) presence of a row of several teeth on the dorsal margin of the rostrum (vs. only one subdistal tooth in *M. lubricum*); (2) dorsal and dorsolateral surface of the carapace armed with teeth, e.g., near the rostral base and in the postorbital and hepatic regions, which are all absent in *M. lubricum*; (3) carpus and ischium of the third maxilliped with dorsolateral teeth, which are absent in *M. lubricum*; and (4) dorsal margin of the third pereopod merus armed with a row of stout teeth, which are also absent in *M. lubricum* (cf. Saito & Okuno 2011). The two species also differ from each other by their colour patterns: *M. pallidum* **sp. nov.** has pale-reddish transverse bands on the pleon and marginally pale orange-pink third pereopods (chela, carpus and merus) (Fig. 11), whereas *M. lubricum* is generally semitransparent with more opaque-white third pereopods (see colour photograph in Saito & Okuno 2011, fig. 11). None of the other species of *Microprosthema* appears to be closely related to *M. pallidum* **sp. nov.**

Discussion

The present study increases the total number of species in the genus *Microprosthema* to 16 (Table 1), with nine species being present in the Indo-West Pacific, one in the eastern Pacific, and six in the western-central Atlantic, after the recent synonymisation of *M. jareckii* Martin, 2002 with *M. manningi* Goy & Felder, 1988 (Goy & Martin 2013). Undoubtedly, more species of *Microprosthema* will be discovered in the future, as evidenced by recent underwater photographs (e.g., Minemizu 2013, *Microprosthema* sp. 1). Interestingly, no species of *Microprosthema* have so far been found in the tropical eastern Atlantic, but also in Hawaii.

Most Indo-West Pacific species of *Microprosthema* appear to have a relatively wide distribution. For instance, *M. plumicorne* (Richters, 1880) (Fig. 12A–C) was originally described from Mauritius and subsequently recorded only from a few other localities, mainly by underwater photographers (Coleman 1991; Minemizu 2013). However, recent collections (see comparative material and Table 1) show that *M. plumicorne* is actually fairly common in shallow-water reef habitats throughout the Indo-West Pacific, ranging from the Red Sea to Japan and French Polynesia (for new records see comparative material and Table 1). The relatively common *M. validum* Stimpson, 1860 (Fig. 13A, B) and *M. scabricaudatum* (Richters, 1880) (Fig. 13C) are two other widely distributed Indo-West Pacific species, both ranging from the Red Sea and southwestern Indian Ocean to Japan and French Polynesia (for

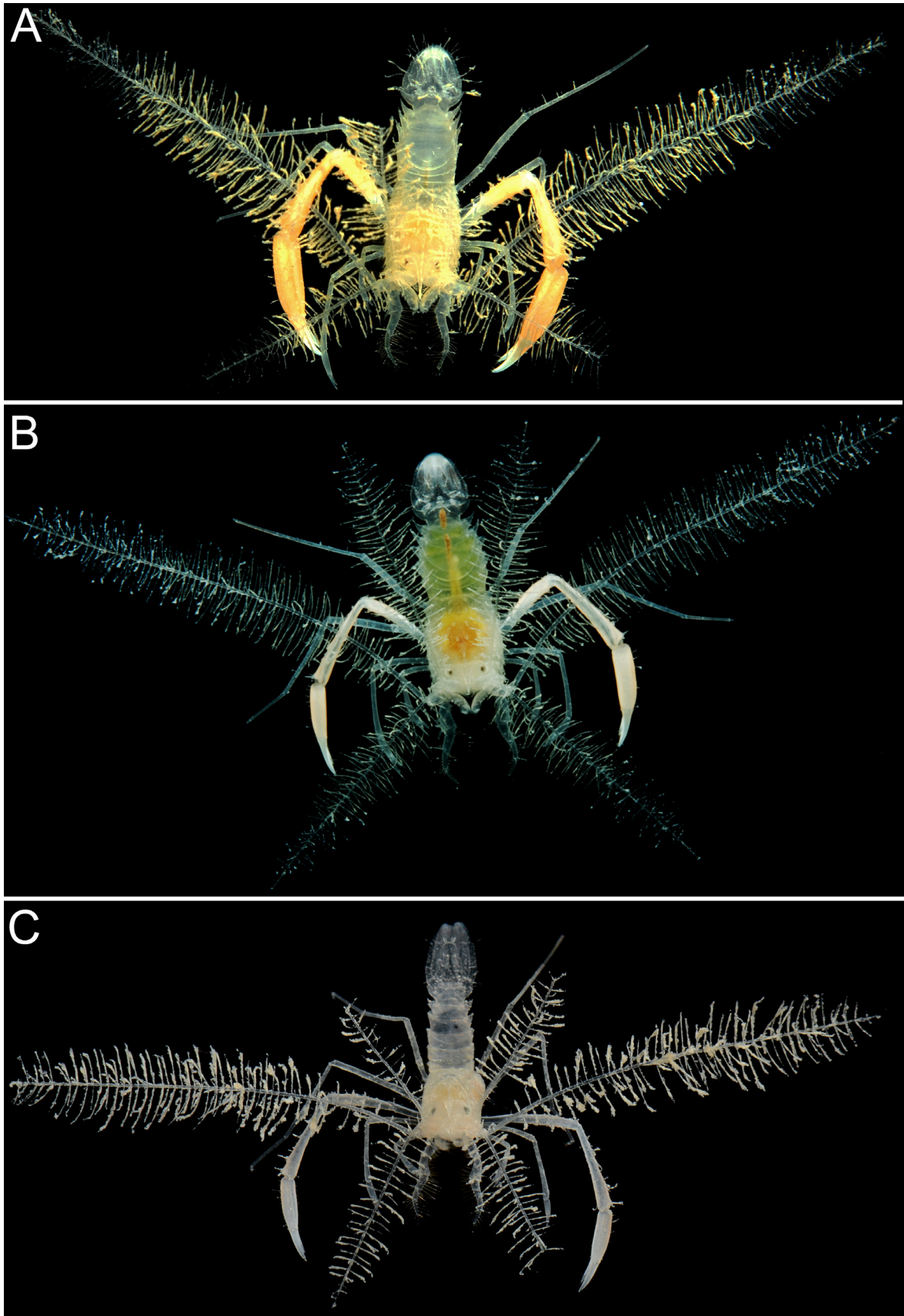


FIGURE 12. *Microprosthema plumicorne* (Richters, 1880): A—male (cl 2.6 mm) from Moorea, Society Islands, French Polynesia (FLMNH UF Arthropoda 23320); B—female (cl 2.6 mm) from Moorea (FLMNH UF Arthropoda 23325); C—juv. female (cl 1.3 mm) from Thuwal, Red Sea coast of Saudi Arabia (FLMNH UF Arthropoda 35989) [note parasitic isopod (Bopyridae)]. Photographs: A. Anker.

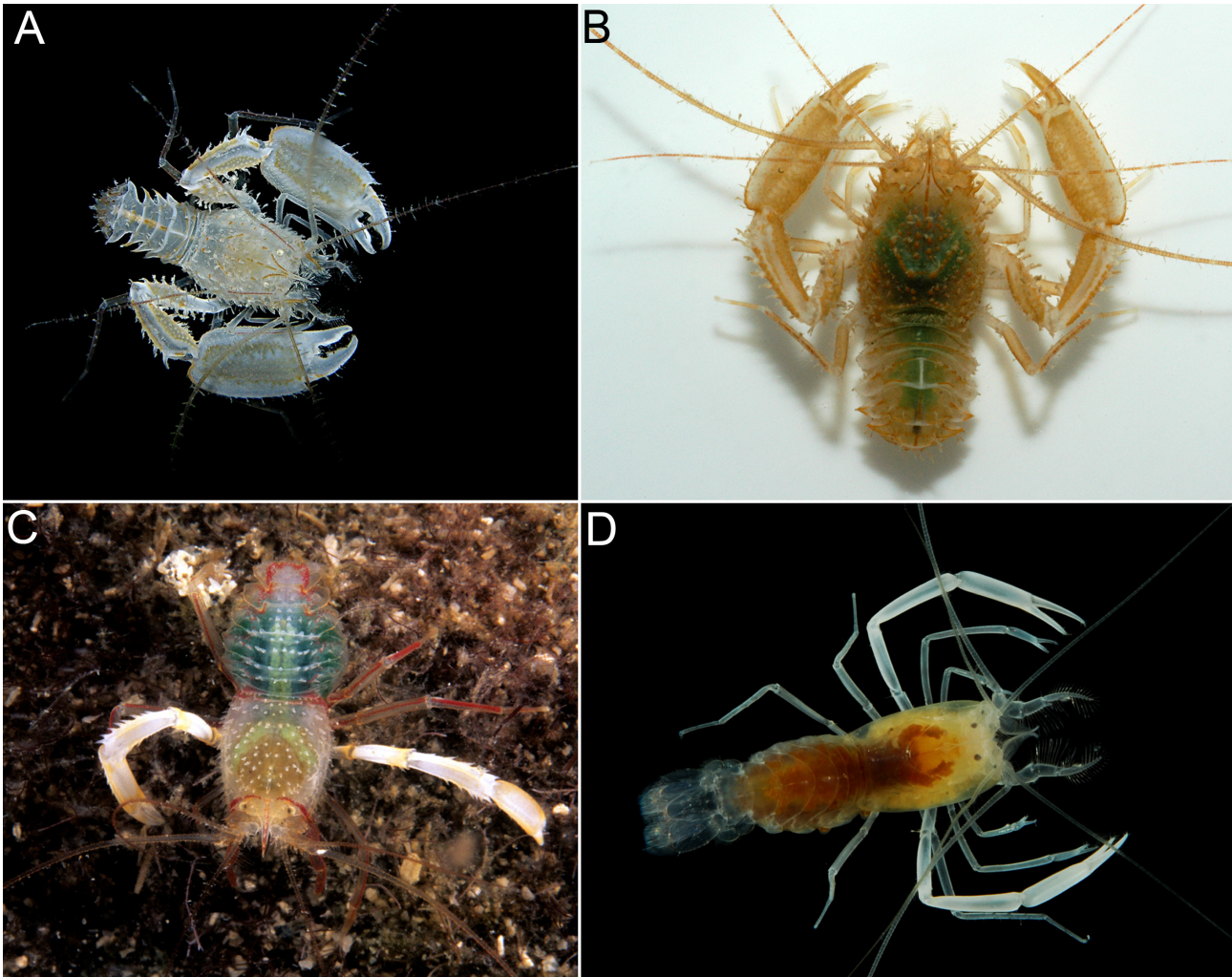


FIGURE 13. *Microprosthema validum* Stimpson, 1860 [A, B]: A—male (cl 3.4 mm) from Lizard Island, Queensland, Australia (FLMNH UF Arthropoda 17538); B—female from Raffles Lighthouse, Singapore (deposited in ZRC, not located). *Microprosthema scabricaudatum* (Richters, 1880) [C]: C—female from Moorea, Society Islands, French Polynesia, photographed in situ. *Microprosthema lubricum* Saito & Okuno, 2011 [D]: D—male (cl 2.5 mm) from Guam, Mariana Islands (FLMNH UF Arthropoda 28139). Photographs: A. Anker (A, D), H.H. Tan (B), P. Bacchet (C).

new records see comparative material and Table 1). Of particular interest are new records of *M. plumicorne*, *M. scabricaudatum* and *M. validum* from the Red Sea and French Polynesia. On the other hand, the recently described *M. lubricum* Saito & Okuno, 2011 (Fig. 13D) appears to be much less common and perhaps restricted to the tropical western Pacific; this species was hitherto known only from southern Japan and French Polynesia and is here recorded for the first time from Guam (see comparative material and Table 1). More sampling of cryptically living decapod crustaceans in the Indo-West Pacific will certainly further increase distribution ranges of these and other species of *Microprosthema*.

Although *M. plumicorne*, *M. scabricaudatum* and *M. validum* are relatively well-known and widely distributed species, their original descriptions (Stimpson 1860; Richters 1880) are taxonomically clearly not satisfying. Richters' illustrations of *M. plumicorne* and *M. scabricaudatum* are rather diagrammatic and therefore can hardly be used in precise species comparisons. Holthuis (1946) published detailed descriptions of the Snellius material of *M. scabricaudatum* and *M. validum*, but provided only a single figure of the scaphocerite for the former species and of the antennular peduncle for the latter species. Full redescriptions of all three species, although highly desirable, are beyond the scope of the present study.

Unlike other species of *Microprosthema*, *M. ningaloo* sp. nov. has a rudimentary exopod on the third maxilliped (Fig. 3K) and an entire (i.e. non-segmented) endopod on the first maxilliped (Fig. 3I). However, the non-segmented endopod is not unique to the new species for it was also found in six specimens of *M. semilaeve*

(von Martens, 1872), including the female lectotype (Goy & Martin 2013: fig. 2D), and also in some specimens of *M. validum* (J. Goy, pers. comm.). In the Spongicolidae, the segmentation of the endopod of the first maxilliped and the development of the exopods on the pereopods are considered as constant within a genus, thus providing important generic characters (e.g., Goy 2010). In addition to *Microprosthema*, the Spongicolidae presently includes six other genera: *Engystenopus* Alcock & Anderson, 1894, *Globospongicola* Komai & Saito, 2006, *Paraspongicola* de Saint Laurent & Cleva, 1981, *Spongicola* De Haan, 1844, *Spongicoloides* Hansen, 1908 and *Spongiocaris* Bruce & Baba, 1973. While *Engystenopus*, *Microprosthema* and *Paraspongicola* have a well-developed exopod on the third maxilliped (except for *M. ningaloo* **sp. nov.**), *Spongicola*, *Globospongicola* and *Spongicoloides* have a rudimentary exopod or no exopod at all. Thus, the variation in the segmentation of the endopod of the first maxilliped and the development of the exopod of the third maxilliped may compromise or at least make ambiguous some key characters presently used to define spongicolid genera.

Acknowledgements

We are indebted to Mr. Ryo Minemizu (Ryo Minemizu Photo Office) for providing us with material of the Japanese new species, as well as underwater photographs and valuable field data. The first author wishes to express his gratitude to Tomoyuki Komai (CBM) and Junji Okuno (CMNH) for their continuous guidance and encouragement, as well as loan of comparative material. The second author thanks Julian Caley and Shawn Smith (Australian Institute of Marine Science, Townsville, Queensland, Australia), the organisers of CReefs Australia Expedition to Ningaloo Reef in 2010. The CReefs Australia Project is a field program of the Census of Marine Life and was sponsored by BHP Billiton in partnership with The Great Barrier Reef Foundation, the Australian Institute of Marine Science (AIMS), the Australian Biological Resources Study and the Alfred P. Sloan Foundation. Viatcheslav Ivanenko (Moscow State University, Moscow, Russian Federation) helped collecting additional specimens of the Australian new species. Gustav Paulay (Florida Museum of Natural History, University of Florida, Gainesville, FL, USA) supported the second author's taxonomic studies on Decapoda and fieldwork in Australia, Madagascar and Saudi Arabia. Amanda Bemis (FLMNH) arranged loans of the Ningaloo specimens and transfer of some type material from FLMNH to WAM. The Nosy-Bé material was collected as part of BIOTAS project in 2008, organised jointly by FLMNH (coordinator Gustav Paulay) and Université de la Réunion, Saint-Denis, La Réunion, France (coordinator Henrich Bruggemann). The Moorea material was collected during the Biocode Moorea project in 2008–2010, based at the Richard B. Gump South Pacific research station of the University of California at Berkeley, and sponsored through the Gordon and Betty Moore Foundation. Seabird McKeon, Jenna Moore, and Sarah McPherson helped collecting specimens, while the Gump station staff provided excellent organisation and assistance in the laboratory. Research permits were issued by the Délégation à la Recherche of the Government of French Polynesia. The Saudi Arabian specimen of *M. plumicorne* was collected during a brief survey of Thuwal reefs in 2013, organised by Michael L. Berumen (King Abdullah University of Science and Technology, KAUST) and with logistical support of the crew of the MY "Dream Master". The Guam specimens of *M. plumicorne* were collected by Peter K.L. Ng (ZRC). Our cordial thanks are also extended to Hironori Komatsu, Masatsune Takeda (NSMT), Yoshihisa Fujita (University Education Center, University of the Ryukyus and Marine Learning Center), Michitaka Shimomura (KMNH), Masayuki Osawa (Research Center for Coastal Lagoon Environments, Shimane University), Janice C. Walker (USNM), Rudolf König (ZMK), and Gavin Dally (NTM) for arranging loans of additional comparative material and/or technical advice. Heok-Hui Tan (ZRC) and Philippe Bacchet (Papéete, Tahiti) provided additional colour photographs. The manuscript was thoroughly reviewed by Joseph Goy (Harding University), who also generously shared some unpublished data, and Tomoyuki Komai (CBM).

References

- Alcock, A. & Anderson, A.R. (1894) An account of a recent collection of deep sea Crustacea from the Bay of Bengal and Laccadive Sea. Natural History Notes from H.M. "Investigator", Commander C.F. Oldham, R.N., Commanding, (2) 14. *Journal of the Asiatic Society, Bengal*, 63, 141–185.
- Alves, M.L., Ramos-Porto, M. & Viana, G.F.S. (2008) Checklist of the decapods (Crustacea) from the Fernando de Noronha

- Archipelago, Brazil. *Zootaxa*, 1881, 43–68.
- Baba, K., Nakasone, Y. & Takeda, M. (1968) Two species of *Microprosthema* found on the coral reefs of the Ryukyu Islands (Stenopodidae, Crustacea). *Ohmu, Occasional Papers of Zoological Laboratory, Faculty of Agriculture, Kyushu University*, 1, 173–181.
- Bruce, A.J. & Baba, K. (1973) *Spongiocaris*, a new genus of stenopodidean shrimp from New Zealand and South African waters, with a description of two new species (Decapoda Natantia, Stenopodidea). *Crustaceana*, 25, 153–170.
<http://dx.doi.org/10.1163/156854073x00803>
- Coleman, N. (1991) *The nature of Norfolk Island*. Neville Coleman's Underwater Photographic, 64 pp.
- Criales, M.M. (1997) *Microprosthema granatense*, new species, from the southern Caribbean, with a key to shrimps of the genus *Microprosthema* from the western Atlantic and a new record of *Odontozona libertae* (Decapoda: Stenopodidea). *Journal of Crustacean Biology*, 17, 538–545.
<http://dx.doi.org/10.2307/1549446>
- De Haan, W. (1844) Crustacea, Fascicle 6–7. In: Siebold, P.F. von (Ed.), *Fauna Japonica sive Descriptio Animalium, quae in Itinere per Japoniam, Jussu et Auspiciis Superiorum, qui Summum in India Batava Imperium Tenent, Suscepto, Annis 1823-1830 Collegit, Notis, Observationibus et Adumbrationibus Illustravit*. J. Müller & Co., Amsterdam, pls. 38, 43–46, 48, 51–55, 1–N.
- De Man, J. (1888) Bericht über die von Herrn Dr. J. Brock in Indischen Archipel gesammelten Decapoden und Stomatopoden. *Archiv für Naturgeschichte*, 53, 215–600.
- Devaney, D.S. & Bruce, A.J. (1987) Crustacea Decapoda (Penaeidea, Stenopodidea, Caridea, and Palinura) of Enewetak Atoll. In: Devaney, D.M., Reese, E.S., Burch, B.L. & Helfrich, P. (Eds.), *The natural history of Enewetak Atoll. Vol. II. Biogeography and systematics*. U.S. Department of Energy, Oak Ridge, pp. 221–233.
- Ghory, F.S., Siddiqui, F.A. & Kazmi, Q.B. (2005) The complete larval development including juvenile stages of *Microprosthema validum* Stimpson, 1860 (Crustacea: Decapoda: Spongicolidae), reared under laboratory conditions. *Pakistan Journal of Marine Sciences*, 14, 33–64.
- Goy, J.W. (1987) *Microprosthema emmiltum*, new species, and other records of stenopodidean shrimps from the eastern Pacific (Crustacea: Decapoda). *Proceedings of the Biological Society of Washington*, 100, 717–725.
- Goy, J.W. (2010) Infraorder Stenopodidea Claus, 1872. In: Schram, F.R., von Vaupel Klein, J.C., Forest, J. & Charmantier-Daures, M. (Eds.), *Treatise on zoology – anatomy, taxonomy, biology. The Crustacea, Decapoda. Vol. 9. Part A: Eucarida: Euphausiacea, Amphionidacea, and Decapoda (partim)*. Koninklijke Brill NV, Leiden, pp. 215–265.
- Goy, J.W. & Felder, D.L. (1988) Two new species of *Microprosthema* from the western Atlantic (Crustacea: Decapoda: Stenopodidea). *Journal of Natural History*, 22, 1277–1292.
- Goy, J.W. & Martin, J.W. (2013) Redescription of *Microprosthema semilaeve* (von Martens, 1872) (Decapoda: Stenopodidea: Spongicolidae) and description of a new species of *Microprosthema* from Dry Tortugas, Florida. *Zootaxa*, 3630, 467–488.
- Hansen, H.J. (1908) Crustacea Malacostraca. I. *The Danish Ingolf-Expedition*, 3, 1–120, pls. 1–5.
- Holthuis, L.B. (1946) Biological results of the Snellius Expedition. XIV. The Decapoda Macrura of the Snellius Expedition. I. The Stenopodidae, Nephropsidae, Scyllaridae and Palinuridae. *Temminckia*, 7, 1–178, pls. 1–11.
- Jiang, Q. & Li, X. (2014) A new species of *Microprosthema* Stimpson, 1860 (Crustacea: Decapoda: Stenopodidea: Spongicolidae) from the South China Sea. *Zootaxa*, 3784 (5), 575–584.
<http://dx.doi.org/10.11646/zootaxa.3784.5.6>
- Johnson, D.S. (1976) Prawns of the Malacca Straits and Singapore waters. *Journal of the Marine Biological Association of India*, 18, 1–54.
- Komai, T. & Saito, T. (2006) A new genus and two new species of Spongicolidae from the southwestern Pacific. *Tropical Deep-Sea Benthos*, 24, 265–284.
- Kuiter, R. & Debelius, H. (2009) *World atlas of marine fauna*. IKAN, Frankfurt, 725 pp.
- Lanchester, W.F. (1901) On the Crustacea collected during the 'Skeat' Expedition to the Malay Peninsula, together with a note on the genus *Actaeopsis*. Part I. Brachyura, Stomatopoda and Macrura. *Proceedings of the Zoological Society of London*, 1901, 534–574.
- Manning, R.B. & Chace, F.A. (1990) Decapod and stomatopod Crustacea from Ascension Island, South Atlantic Ocean. *Smithsonian Contribution to Zoology*, 503, 1–91.
<http://dx.doi.org/10.5479/si.00810282.503>
- Martens, E. von (1872) Über cubanische Crustaceen nach den Sammlungen Dr. J. Gundlach's. *Archiv für Naturgeschichte*, 38, 77–147, pls. 4–5.
- McNeill, F. (1968) Crustacea, Decapoda & Stomatopoda. *Great Barrier Reef Expedition 1928-29 Scientific Reports*, VII (1), 1–98, pls. 1, 2.
- Minemizu, R. (2013) *Coral reef shrimps of Indo-West Pacific*. Bun-ichi Sogo Shuppan, Tokyo, 1–144. [in Japanese]
- Richters, F. (1880) Decapoda. In: Möbius, K. (Ed.), *Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen*, 3, 137–179, pls. 15–18.
- Saint Laurent, M. de & Cleve, R. (1981) Crustacés Décapodes: Stenopodidea. In: Crosnier, A. (Ed.), *Résultats des campagnes MUSORSTOM, 1. Philippines. Mémoires du Muséum National d'Histoire Naturelle*, 91, 151–188.
- Saito, T. & Anker, A. (2012) A new species of the genus *Microprosthema* Stimpson, 1860 (Stenopodidea, Spongicolidae) from the Society Islands, French Polynesia. In: Komatsu, H., Okuno, J. & Fukuoka, K. (Eds.), *Studies on Eumalacostraca: a*

homage to Masatsune Takeda. *Crustaceana Monographs*, 17, 285–301.

http://dx.doi.org/10.1163/9789004202894_024

- Saito, T. & Okuno, J. (2011) Two new species of the genus *Microprosthema* Stimpson, 1860 (Stenopodidea: Spongicolidae), from the Ryukyu Islands. *Bulletin of National Museum of Nature and Science*, Series A, Supplement 5, 83–99.
- Salvat, B. & Bacchet, P. (2011) *Guide des récifs coralliens de Tahiti et ses îles*. Au Vent des Iles, Papeete, 365 pp.
- Schram, F.R. (1986) *Crustacea*. Oxford University Press, New York, 606 pp.
- Stimpson, W. (1860) Prodromus descriptionis animalium evertibratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missam Cadwaladaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit. Pars VIII. Crustacea Macrura. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 1860, 22–48.