Zoological Studies **65:**08 (2026)
doi:10.6620/ZS.2026.65-08

Zoological Studies

Open Access

Biodiversity and New Records of Subtidal Brachyuran Crabs (Crustacea, Decapoda) from Taiwan

Pan-Wen Hsueh[1,*] and You-Wei Tzeng[2]

[1]*Department of Life Sciences, National Chung Hsing University, Taichung 402, Taiwan. *Correspondence: E-mail: pwhsueh@dragon.nchu.edu.tw (Hsueh)*
[2]*Institute of Oceanography, National Taiwan University, Taipei 106, Taiwan. E-mail: ywtzeng@ntu.edu.tw (Tzeng)*

Received 12 February 2025 / Accepted 9 February 2026 / Published 17 March 2026
Communicated by Benny K.K. Chan

This study examines subtidal brachyuran crabs collected from the offshore sewage discharge site of the Bali wastewater treatment plant, which serves the great Taipei metropolitan areas in Taiwan. It reports seven taxa of brachyuran crabs from Taiwan: three newly recorded species and four others identified only to genus level as the specimens obtained were either adult but partially damaged or juveniles. These species belong to six families and seven genera, including three new genera recorded for the first time in Taiwan: *Ceratocarcinus* White, 1847, *Mariaplax* Rahayu and Ng, 2014, and *Xenophthalmus* White, 1846. The identified species are: *Paradorippe* sp. (family Dorippidae H. Milne Edwards, 1837), *Mariaplax chenae* Rahayu and Ng, 2014 (family Hexapodidae Miers, 1886), *Nursia* sp. (family Leucosiidae Samouelle, 1819, subfamily Ebaliinae Stimpson, 1871), *Seulocia* sp. (family Leucosiidae Samouelle, 1819, subfamily Leucosiinae Samouelle, 1819), *Pinnotheres* sp. (family Pinnotheridae De Haan, 1833), *Xenophthalmus pinnotheroides* White, 1846 (family Xenophthalmidae Stimpson, 1858), and *Ceratocarcinus frontodentata* (Shen, Dai and Chen, 1982) (family Pilumnidae Samouelle, 1819). *Ceratocarcinus frontodentata*, *M. chenae*, and *X. pinnotheroides* are reported in Taiwan for the first time.

Keywords: Brachyuran crab taxonomy, *Ceratocarcinus*, *Mariaplax*, *Nursia*, *Paradorippe*, *Pinnotheres*, *Seulocia*, *Xenophthalmus*

BACKGROUND

A long-term environmental monitoring project at the offshore sewage discharge site of the Bali wastewater treatment plant, serving the great Taipei metropolitan areas, offers a rare opportunity to survey the biodiversity of benthic macrofauna in this unique yet overlooked subtidal ecosystem. Results from this survey occasionally reveal macrofauna that are new to science. For example, Hsueh and Li (2017) described a new trichobranchid polychaete worm, *Terebellides baliensis* Hsueh and Li, 2017, collected from this subtidal area.

In the present study, the authors examine numerous subtidal brachyuran crabs collected from the survey site and seven taxa are identified, three to species (all new records) and four only to the genus level as they were represented by damaged adult or juveniles. These are distributed across seven genera and six families: *Paradorippe* Serène and Romimohtarto, 1969 (family Dorippidae H. Milne Edwards, 1837), *Mariaplax* Rahayu and Ng, 2014 (family Hexapodidae Miers, 1886), *Nursia* Leach, 1817, *Seulocia* Galil, 2005 (family Leucosiidae Samouelle, 1819, subfamily Leucosiinae Samouelle, 1819), *Pinnotheres* Bosc, 1801 (family Pinnotheridae De Haan, 1833), *Xenophthalmus* White, 1846 (family Xenophthalmidae Stimpson, 1858), and *Ceratocarcinus* White, 1847 (family Pilumnidae Samouelle, 1819). Among these genera, *Ceratocarcinus*,

Citation: Hsueh P-W, Tzeng Y-W. 2026. Biodiversity and new records of subtidal brachyuran crabs (Crustacea, Decapoda) from Taiwan. Zool Stud **65:**08. doi:10.6620/ZS.2026.65-08.

Mariaplax, *Randallia*, and *Xenophthalmus* are reported from Taiwan for the first time (cf. Ng et al. 2017). The four unnamed species are represented by mostly juvenile or incomplete adult female specimens, whose distinctive features are not observed in adult congeners. Because the degree of variation between sexes and ontogenetic changes is not known, it is not currently possible to identify these specimens to the species level. The newly recorded species from Taiwan are: *Ceratocarcinus frontodentata* (Shen, Dai and Chen, 1982), *Mariaplax chenae* Rahayu and Ng, 2014, and *X. pinnotheroides* White, 1846.

MATERIALS AND METHODS

Brachyuran crab specimens were collected over the past decade using a benthic sled towed by a local fishing boat at offshore subtidal stations near the sewage discharge site of the Bali wastewater treatment plant, New Taipei City. The specimens were preserved in 70% alcohol and subsequently examined under a stereo microscope (Leica MZ12.5) and a compound microscope (Leica DM2500). Photographic documentation of the specimens and their body parts was performed using digital cameras (Sony α 200, 10.2 megapixels, Canon EOS 6D Mark II, 26.2 megapixels, and Canon EOS 7D Mark II, 20 megapixels) and enhanced with software (Helicon Focus 8.2.2 and PhotoImpact 8). The terminology for brachyuran body parts followed Davie et al. (2015). The systematics of dorippoid crabs followed Guinot (2023), while those of other families essentially follow Ng et al. (2008). Measurements were taken for carapace width (CW) and carapace length (CL) in millimeter. Abbreviations in the descriptions used are: G1 = first gonopod of male; P1–P5 = first to fifth pereiopods, respectively (P1 also refers to chelipeds, and P2–P5 to ambulatory legs). Numbers in parenthesis indicate variations in a given morphological character. All specimens were deposited at the National Museum of Natural Science (NMNS), Republic of China.

TAXONOMY

Superfamily Dorippoidea H. Milne Edwards, 1837
Family Dorippidae H. Milne Edwards, 1837
Subfamily Paradorippinae Guinot, 2023
Genus *Paradorippe* Serène and Romimohtarto, 1969

Type species: *Dorippe granulata* De Haan, 1841 (type by original designation).

Paradorippe sp.
(Fig. 1A–K)

Material examined: 1 juvenile ♂ (5.5 × 4.9 mm), NMNS 8906-1, station C1 (25°9.34'N 121°20.67'E), Bali, New Taipei City, coll. P.-W. Hsueh, 11 April 2020.

Description: Incomplete, left P3, P4 missing, right eye damaged. Carapace (Fig. 1A–C) longitudinal rectangular, width to length ratio about 1.04; surface densely covered with fine granules and without pubescence, purple and brownish color in fresh and preserved conditions, respectively; regions and grooves well defined: cervical groove distinct, mesogastric region with 2 oblique submedian pits, posterolateral margins of mesogastric region with short, narrow, sharply defined grooves that end in cervical groove, branchial grooves shallow but distinct, urogastric region flanked by rounded, convex branchial lobes, branchiocardiac grooves shallow but distinct. Lateral margin of carapace granulate, without branchial spine, protogastric, mesogastric, cardiac and branchial regions convex.

Frontal margin granulate, with 2 bluntly triangular teeth directed anteriorly, divided by wide V-shaped notch. Supraorbital margin granulate with 1 notch medially; exorbital teeth directed anteriorly, slightly shorter than frontal teeth, infraorbital tooth small triangular. Eyes short and stout, tapering distally, cornea ventrolateral.

Third maxillipeds (Fig. 1D) subrhombic, length to width ratio about 2.67; palp tapering distally, articles subconical; merus subrhombic, length to width ratio about 1.33, anterolateral angle pointed, slightly projecting, anterolateral margin slightly concave, cristate and granulate, mesial margin, serrated proximally, lined with submarginal setae, external surface with patched granules; ischium subrhombic, about 1.09 times longer than merus, mesial margin cristate, serrated, lined with submarginal setae; exopod stout, margins almost straight, tapering slightly toward proximal end, distal end rounded.

Thoracic sternum (Fig. 1E) margins cristate; sternites 1, 2 fused, external surface covered with small granules, anterior area of sternite 1 with large granules; sternites 2, 3 separated by deep suture, external surface covered with small granules, margins lined with granules; sternites 3, 4 partially fused, with suture only at lateral edges continued mesially by oblique line; sutures 4/5, 5/6 joining toward median longitudinal axis of thoracic sternum; small, central, triangular, non-calcified area present between sternites 6, 7 within sternopleonal cavity; press-button on anterior half of sternite 5.

Chelipeds (Fig. 1F, G) subequal, moderately

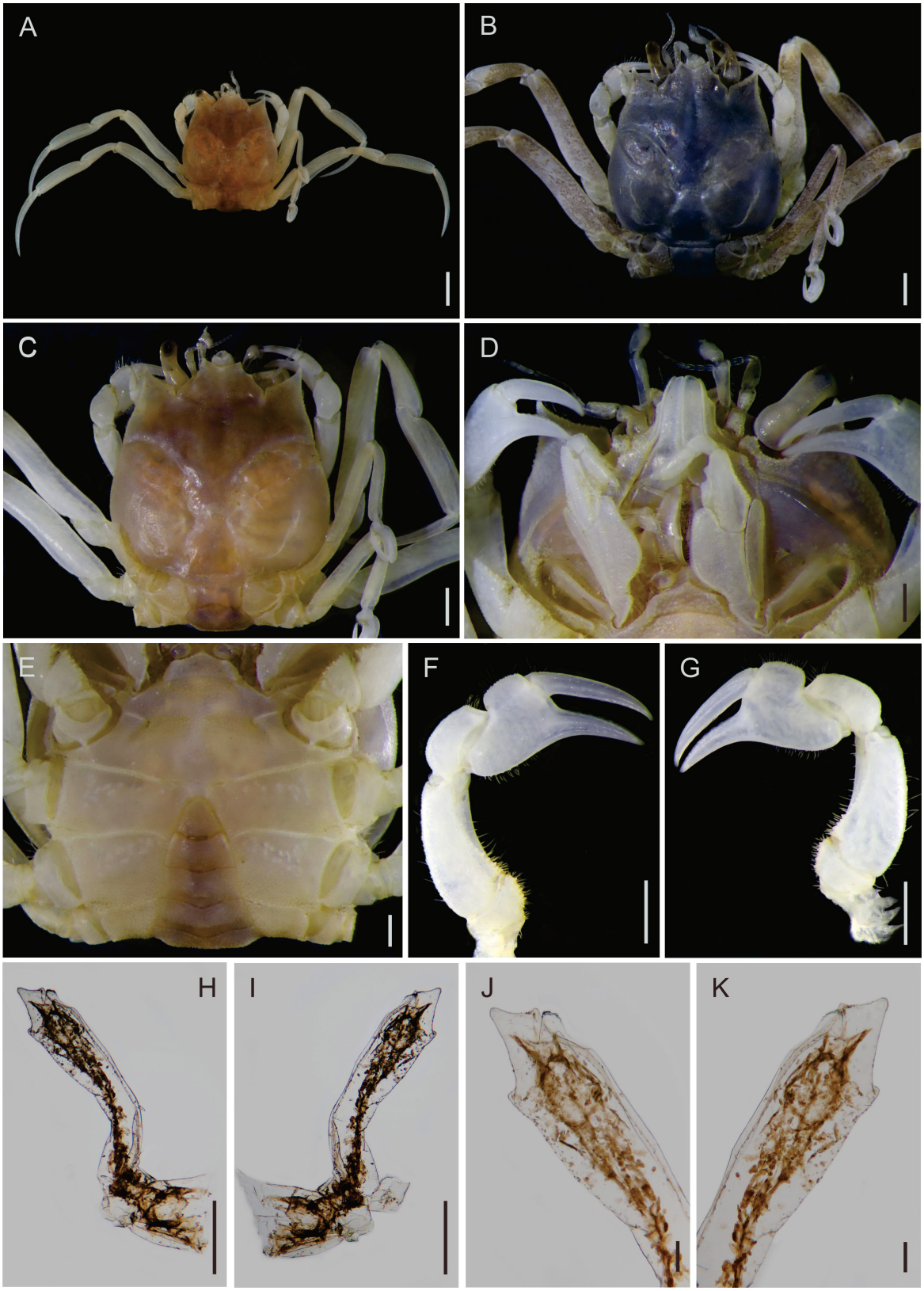

Fig. 1. *Paradorippe* sp.; juvenile male, CW 5.5 mm (NMNS 8906-1): A–C, habitus, dorsal view; D, third maxilliped; E, sternum and pleon; F, right chela, external view; G, left chela, external view; H, right G1, dorsal view; I, right G1, ventral view; J, distal area of right G1, dorsal view; K, distal area of right G1, ventral view. Scale bars: A = 2.0 mm; B–C = 1.0 mm; E–I = 0.5 mm; J, K = 0.02 mm.

robust, margins covered with long simple, light-colored and short, stout, brownish setae on inner proximal margins. Ischii subrectangular with denticles on lower margin. Meri moderate long, subrectangular, granulate on upper margin, with 1 row of denticles on lower margin. Carpi subrectangular, granulate on upper margin. Palm external surface smooth, upper margin granulate, lower margin with 1 row of small granules and short setae, lower submargin with groove extending toward subdistal area of pollex. Fingers elongate, slender, tips pointed; dactylus upper margin with few granules proximally, longitudinal shallow groove extending two-thirds of dactylus from proximal end, distal area moderately deflexed downward, cutting edge with 1 row of low, wide, blunt teeth; pollex external surface smooth, slightly deflexed downward, cutting edge with 1 row of low, wide, blunt teeth.

P2–P5 (Fig. 1A) longest, external surface smooth, meri shorter than carapace and slightly longer than frontorbital width, carpi weakly bicarinate, propodi flattened, dactyli slender, tapering distally, longer than respective propodus; P4, P5 short, meri less than half CW, external surface smooth.

Pleon (Fig. 1E) external surface granulate, moderate long relative to thoracic sternum, tip of telson slightly exceeding level median to sternal condyles of P2 coxae; somite 1 subrectangular, width 2.89 times length, somite 2 hexagonal, much wider than long; somite 3 widest, somite 4 shorter than somites 5 and 6; telson subtriangular, angles rounded, basal width about 1.28 times median length.

G1 (Fig. 1H–K) stout, S-shaped, distal tip with 2 short apical projections.

Distribution: Bali, New Taipei City, Northwestern Taiwan.

Remarks: Guinot (2023) attributed the authorship of the superfamily Dorippoidea and the family Dorippidae to H. Milne Edwards, 1837, and established Paradorippinae Guinot, 2023, as one of six newly erected subfamilies. We follow her classification scheme for dorippoid crabs.

The genus *Paradorippe* is currently the sole member of the subfamily Paradorippinae and includes four valid species: *Paradorippe australiensis* (Miers, 1884) (type locality: Port Denison, Australia), *P. cathayana* Manning and Holthuis, 1986 (type locality: Jimei, Fujian Province, China), *P. granulata* (De Haan, 1841) (type locality: Japan), and *P. polita* (Alcock and Anderson, 1894) (type locality: Madras Coast, India) (Holthuis and Manning 1990; Guinot 2023). *Paradorippe granulata* is the only species previously reported from Taiwan (Ng et al. 2017). Guinot (2023: 279) suggested that *P. polita* (and possibly *P. cathayana*) might belong to a new genus, as their G1 features shorter, equal-length processes and a smaller vulva compared to the other two congeners. However, further studies are required to confirm this hypothesis.

The present specimen has morphological characters consistent with the genus *Paradorippe* Serène and Romimohtarto, 1969, including: a much smaller inner suborbital tooth compared to the exorbital tooth; entirely naked ambulatory legs; a third pereiopod nearly 2.5 times as long as CW; a strongly swollen G1 shaft at the median length with distinct distal chitinous processes (Fig. 1A–C, H–K; Serène and Romimohtarto 1969: 15; Holthuis and Manning 1990: 108). Of the four known species, the morphology of the present species is somewhat similar to *P. cathayana* and *P. polita*, particularly in having relatively short distal processes on the G1 (Fig. 1H–K; Holthuis and Manning 1990: 115, 131, figs. 47g, 56e–g). However, it differs from *P. cathayana* in several key features: 1) presence of protogastric tubercles on the carapace (versus absent); 2) concave inner mesobranchial regions of the carapace (versus flat); 3) granulated antero- and posterolateral carapace margins (versus sparsely granulated posterolateral margin only); 4) a small triangular teeth on the inner supraorbital margin (versus a small notch); 5) a medial notch on the supraorbital margin (versus a fissure); 6) granulated upper and lower palm margins (versus smooth); 7) propodi of P2 and P3 approximately 5.3–5.5 times longer than high (versus less than 3.0 times); 8) granulated pleon surface (versus smooth with two rounded tubercles on the sixth somite); 9) telson width-to-length ratio of 1.28 (versus 1.57); and 10) distal G1 with two subtriangular apical projections (versus irregular, digitiform projections) (Fig. 1A–C, E–K; Holthuis and Manning 1990: 113–116, figs. 46, 47a–d, f, g). The new species differs from *P. polita* in the following ways: 1) presence of protogastric tubercles on the carapace (versus absent); 2) concave inner mesobranchial regions (versus flat); 3) granulated antero- and posterolateral carapace margins (versus sparsely granulated posterolateral margin only); 4) exorbital tooth apices not extending beyond frontal teeth (versus slightly extending); 5) granulated upper and lower palm margins (versus smooth); 6) propodi of P2 and P3 approximately 5.3–5.5 times longer than high (versus about 3.2–3.3 times); 7) surface (versus smooth and polished); and 8) distal G1 with two subtriangular apical projections (versus four irregular projections) (Fig. 1A–C, E–K; Holthuis and Manning 1990: 128–132, fig. 56a–d, f, g). Although the present species possesses a unique G1 and abovementioned characters not observed in congeners, it must be emphasized that the gonopods are poorly chitinized and of a form typical with juvenile males, and as such may not be indicative of the adult condition. Further studies are required to

examine a series of male and female specimens of *P. cathayana* and *P. polita* to confirm that the observed morphological differences are real.

Superfamily Hexapodoidea Miers, 1886
Family Hexapodidae Miers, 1886
Genus *Mariaplax* Rahayu and Ng, 2014

Type species: *Lambdophallus anfractus* Rathbun, 1909 (type by original description).

Mariaplax chenae Rahayu and Ng, 2014
(Fig. 2A–I)

Mariaplax chenae Rahayu and Ng 2014: 427–431, figs. 1H, 24–27 (for complete synonym).

Material examined: 1 juvenile ♂ (4.3 × 2.8 mm), NMNS 8906-2, station C2 (25°12.67'N 121°23.60'E), Bali, New Taipei City, coll. P-W Hsueh, 13 July 2023.

Distribution: East China Sea and Japan (Rahayu and Ng 2014).

Remarks: Rahayu and Ng (2014) described 11 new species and introduced two new combinations when establishing this genus within the family. Since then, five additional species have been described (Ng and Rahayu 2015; Rahayu and Widyastuti 2018; Ng and Wong 2019), bringing the total number of species in this genus to 18 worldwide.

This genus is recorded for the first time in Taiwan. The morphology of the present specimen matches the description of *Mariaplax chenae* Rahayu and Ng, 2014, whose type locality is the coastal waters of Zhejiang Province, East China Sea, China. Notably, the G1 of the current specimen is almost identical to that of a small individual (4.0 mm CW) illustrated in the original article (Fig. 2A–I; Rahayu and Ng 2014: 427–431, fig. 27A–F). This marks the first report of *M. chenae* from Taiwan. Given its known distribution across the coastal waters of East China Sea (Rahayu and Ng 2014), it is not surprising to encounter this species in nearshore subtidal habitats in northwestern Taiwan.

Superfamily Leucosioidea Samouelle, 1819
Family Leucosiidae Samouelle, 1819
Subfamily Ebaliinae Stimpson, 1871
Genus *Nursia* Leach, 1817

Type species: *Nursia hardwickii* Leach, 1817 (type by monotypy).

Nursia sp.
(Fig. 3A–D)

Material examined: 1 adult ♀ (4.4 × 3.6 mm), NMNS 8906-3, station C2 (25°12.67'N 121°23.60'E), Bali, New Taipei City, coll. P-W Hsueh, 15 April 2015.

Description: Incomplete, chelae, right P2 and merus of right third maxilliped missing; beige in alcohol. Carapace (Fig. 3A) hexagonal, about 1.24 times wider than long; dorsal surface depressed with frontal, hepatic, gastro-cardiac, anterior and posterior branchial regions, oblique and longitudinal ridges raised, Intestinal region prominently raised; entire dorsal surface well covered by mosaic of reticulated pattern with each polygon circle centered single minute granule. Front broad, nearly straight in dorsal view, slightly deflexed and protruded medially in frontal view, about 0.18 times wide as CW. Anterolateral margin slightly convex, with one small median notch. Posterolateral margin slightly longer than anterolateral margin, with 2 indentations.

Orbits (Fig. 3A, B) oval, orbital peduncle very short set-in orbital fossa, supraorbital margin with 2 short, shallow fissures; eyes well developed, eyestalks short, stout, corneas large. Antennular fossae transversely oval; antennules folding transversely. Basal article of antenna short, subrectangular; flagellum not freely entering orbital hiatus, short, tip slightly exceeding inner suborbital tooth.

Third maxillipeds (Fig. 3C) external surface well covered with rounded small and large granules, subtriangular, length to maximum width ratio about 1.88; merus subtriangular, length to width ratio about 1.7, blunt-tipped; ischium subrectangular, length to width ratio about 1.80, about 1.59 times longer than merus; exopod triangular, basal segment length to maximum width 3.17.

Thoracic sternum (Fig. 3C) margins strongly cristate.

Chelipeds not observed.

Female pleon (Fig. 4C) nearly rounded, external surface well covered by mosaic of reticulated pattern, each polygon circle centered single minute granule; formula of 2+ R+T; somite 1 completely concealed beneath the carapace; somite 2 short and transversely subrectangular; somites 3–6 fused with trace of sutures between somites, ovoid, convex ventrally mesially; telson subtriangular, anterior margin with setal tuft.

Ambulatory legs (Fig. 3A, D) similar in shape, gradually decreasing in length from P2–P5, entirely covered with small and large granules except dactylus; merus subcylindrical, slightly shorter than combination of carpus and propodus; carpi and propodi weakly compressed; dactylus subconical, with indistinct dactylo-propodal locks on proximal borders of dorsal surfaces.

Distribution: Bali, New Taipei City, Northwestern Taiwan.

Remarks: The genus *Nursia* is currently

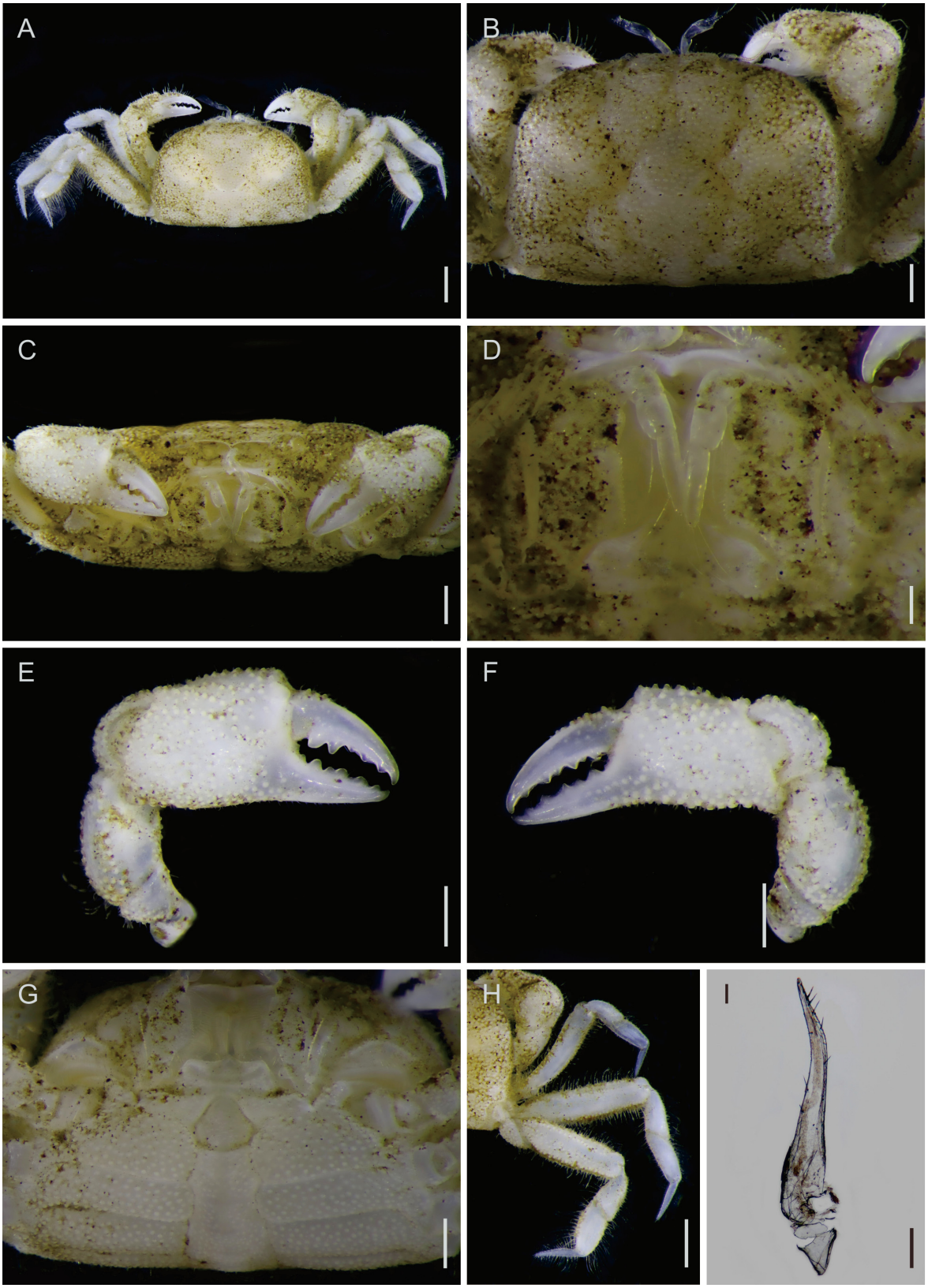

Fig. 2. *Mariaplax chenae* Rahayu and Ng, 2014; juvenile male, CW 4.3 mm (NMNS 8906-2): A, habitus, dorsal view; B, carapace, dorsal view; C, habitus, anterior view; D, third maxilliped; E, right chela, external view; F, left chela, external view; G, sternum and pleon; H, right pereiopods; dorsal view; I, left G1, dorsal view. Scale bars: A, C, H = 1.0 mm; B, D–G = 0.5 mm; I = 0.2 mm.

represented by 21 species (Ng and Komatsu 2016). Of these, only *N. plicata* (Herbst, 1803) and *N. rhomboidalis* (Miers, 1879) have been previously reported from Taiwan (Ng et al. 2017).

Among the 21 *Nursia* species, the present adult female specimen shows some resemblance to the adult female of *N. hamipleopoda* Chen and Fang, 1998, particularly in terms of body size and the shapes of the carapace and pleon (Fig. 3A–C; Chen and Fang 1998: 606, fig. 1I, K). However, the current specimen can be readily distinguished from *N. hamipleopoda* by the following characteristics: 1) a distinctive mosaic of reticulated patterns on both the dorsal surface of the carapace and the external surface of the pleon (versus absence of such pattern); a smaller length-to-width ratio of somite 2 of the pleon (0.13 versus 0.23); 3) a smooth surface on the dactyli of all ambulatory legs (versus granulated) (Fig. 3A, C, D; Chen and Fang 1998: 606, fig. 1I, K). Due to several characters not being observed in congeners, it is possible that this species is new to science. However, additional specimens, particularly an adult male with the necessary pleonal and gonopodal characters will be needed to determine the identity of this species.

Subfamily Leucosiinae Samouelle, 1819
Genus *Seulocia* Galil, 2005

Type species: *Leucosia rhomboidalis* De Haan, 1841 (type by original designation).

Seulocia sp.
(Fig. 4A–H)

Material Examined: 1 juvenile ♀ (2.8 × 4.0 mm), NMNS 8906-4, station D3 (25°13.33'N 121°21.40'E), Bali, New Taipei City, coll. P-W Hsueh, 31 July 2016; 1 juvenile ♀ (4.8 × 6.1 mm), NMNS 8906-5, station D13 (25°12.00'N 121°22.87'E), Bali, New Taipei City, coll. P-W Hsueh, 16 October 2024.

Description: Carapace (Fig. 4A–D) subrhomboidal, width to length ratio about 0.79; dorsal surface smooth, with 2 small spots on epibranchial region and 2 larger spots on mesobranchial region.

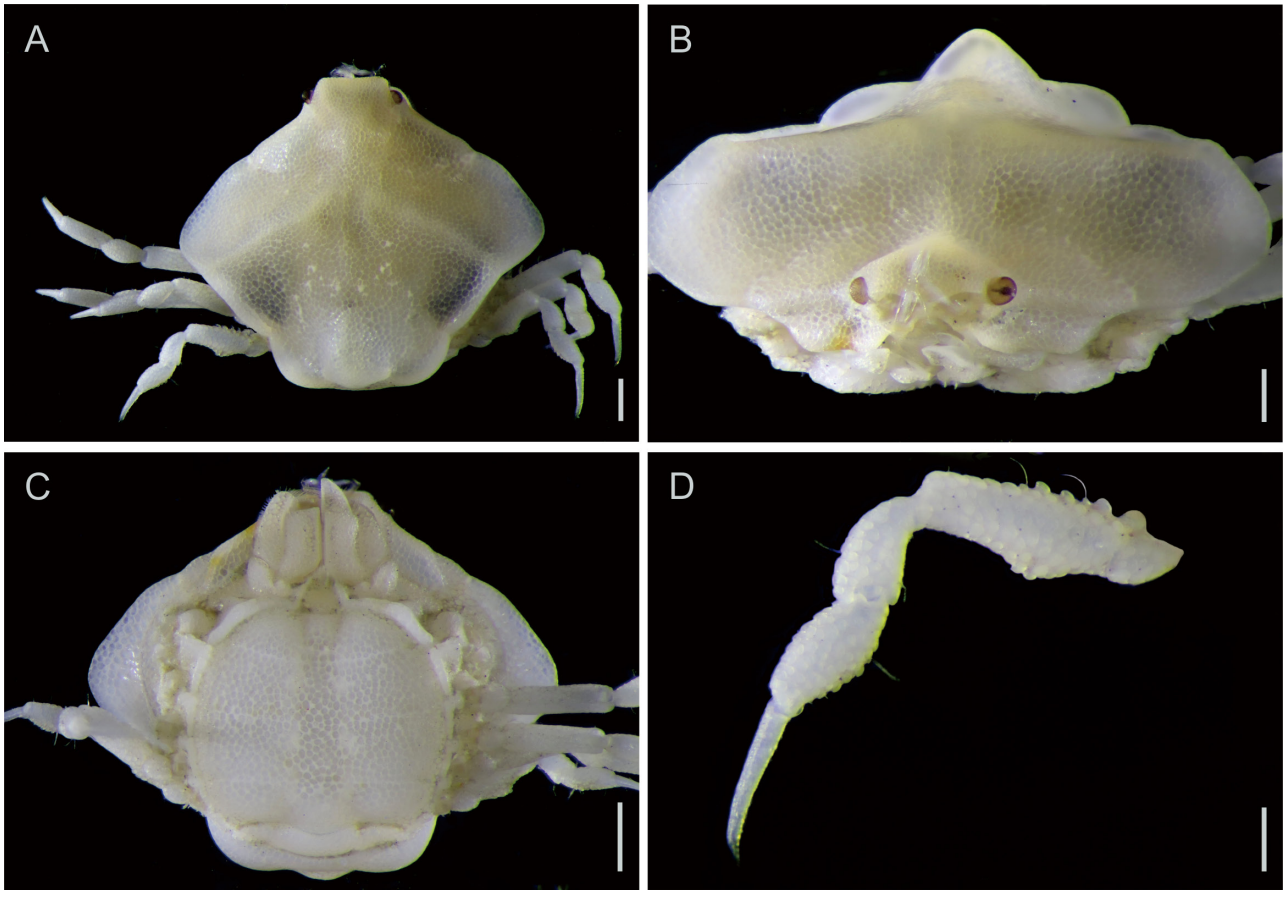

Fig. 3. *Nursia* sp.; adult female (CW 4.4 mm, NMNS 8906-3): A, habitus, dorsal view; B, habitus, anterior view; C, habitus, ventral view; D, right P5. Scale bars: A = 1.0 mm; B, C = 0.5 mm; D = 0.2 mm.

Frontal width about 0.26 times carapace width; margin slightly concave medially; tridenticulate, median denticle subequal to lateral denticles. Anterolateral margins slightly sinuous, with perliform granules, larger in size posteriorly; anterolateral margin separated from epibranchial angle by V-shaped notch. Epibranchial angle of carapace rounded, overhanging thoracic sinus, margin with perliform granules. Posterolateral margin slightly sinuous, granulate. Posterior margin straight, posterior surface strongly deflexed, granulate with prominent lateral lobes. Thoracic sinus shallow, floor smooth, ventral margin with row of small granules; anteriorly defined by convex margin of pterygostomian region sloping into sinus.

Orbits (Fig. 4A–C, E, F) oval, margins smooth; eyes well developed, eyestalks short, stout, corneas large. Antennular fossae transversely oval; antennules folding transversely. Basal article of antenna short, subrectangular; flagellum not freely entering orbital hiatus. Third maxillipeds (Fig. 4F) endopod triangular, length to maximum width ratio about 2.43; merus triangular, length to maximum width ratio about 2.10, anterior angle rounded; ischium subrectangular, about 0.87 times as long as merus; exopod stout, elongate.

Thoracic sternum (Fig. 4G) margins cristate; sternites 1–3 fused; sternites 3, 4 separated by deep suture; sternite 4 subrectangular, anterior angle round, lateral margins concave with deep, narrow V-shaped notch subposteriorly; sternites 5–8 separated by suture, gradually reduced in size.

Chelipeds (Fig. 4A) subequal; meri trigonal, surface smooth, margins with perliform granules, larger in size proximally, progressively smaller distally; carpi rhombic-shaped, with granules on upper distal margin; palm subrectangular, slightly longer than wide, surface smooth, margins granulate. Fingers laterally compressed, dactyli external surface smooth, dorsal margin with keeled proximally, distal area moderately deflexed downward, cutting edge with row of short setae and several small teeth subdistally; pollex external surface smooth, distal area moderately banded upward, cutting edge with row of short setae and several small teeth subdistally.

Ambulatory legs (Fig. 4A, H) P2 longest, gradually decreased in length; P2–P4 meri lower margin smooth, P5 meri lower margin with granules; P2–P4 propodi slightly carnate dorsally, P5 propodi slightly carnate dorsally and ventrally; P2–P5 dactyli longer than propodi.

Female pleon (Fig. 4G) moderate long, tip of telson reaching suture of sternites 3/4; somites 1, 2 trapezoidal, much wider than long, margins cristate, posterior angles with prominent projection; somites 3–5 fused, similar in width, margins convex, somites 3/4 with residual suture; somite 6 trapezoid, longer than wide, anterior margin slightly concave, lateral margins convex, posterior margin slightly concave medially; telson subtriangular, angles slightly rounded, basal width about 1.14 times median length.

Distribution: Bali, New Taipei City, Northwestern Taiwan.

Remarks: Galil (2005) erected the genus by transferring seven species formerly assigned to *Leucosia* Weber, 1795 and described three new species. Galil and Ng (2015) added a new species, *S. gagulae* Galil and Ng, 2015, to the genus and increased the total member of the genus to 11. Of these, only *S. latirostrata* and *S. rhomboidalis* have been previously reported from Taiwan (Ng et al. 2017).

The morphology of the present specimen (Fig. 4A–H) is largely consistent with the generic diagnosis provided by Galil (2005: 42). However, a notable difference is that that the juvenile female specimen in this present study has pleonal somites 3–5 fused, whereas in adult female *Seulocia*, somites 3–6 are fused. This may be due to ontogeny as the specimen on hand is a juvenile. Among the 11 known *Seulocia* species, only *S. vittata* exhibits a truncated posterior margin of the carapace with a granulate, deflexed surface, similar to that seen in the presence species (Fig. 4A, B; Chen and Sun 2002: 436–438, fig. 197, pl. XVI 8; Galil 2005: 53, 55, fig. 3B). According to Galil (2005: 55), juvenile *S. vittata* also shows a posterior margin of the carapace with prominent angles, which is likewise observed in the juvenile specimen in this study (Fig. 4A, B). Despites these similarities, the present species can be distinguished from *S. vittata* by several key features: 1) the median denticle at the front is subequal to the lateral denticles (versus larger than lateral denticles); 2) the lateral margins of the carapace are slightly sinuous and bear perliform granules anterior to the epibranchial angle (versus straight lateral margins without perliform granules); 3) the anterolateral margin is separated from the epibranchial angle by a V-shaped notch (versus no such separation); 4) the posterior margin of the carapaces is strongly deflexed, granulate, and exhibits prominent lateral lobes (versus slightly deflexed, granulate, and lacks prominent lateral lobes); 5) the meri of the fourth leg has smooth lateral surfaces (versus a single beaded line dorsally and two beaded lines ventrally); 6) the carpi of all walking legs are only indistinctly carnate dorsally (versus prominently carnate); 7) the propodi of all walking legs are also indistinctly carnate both dorsally and ventrally (versus prominently carnate on both surfaces); and 8) the fourth walking leg of the juvenile female in this study has a smaller length-to-maximum width ratio of the meri (2.23), but larger length-to-maximum width ratios of

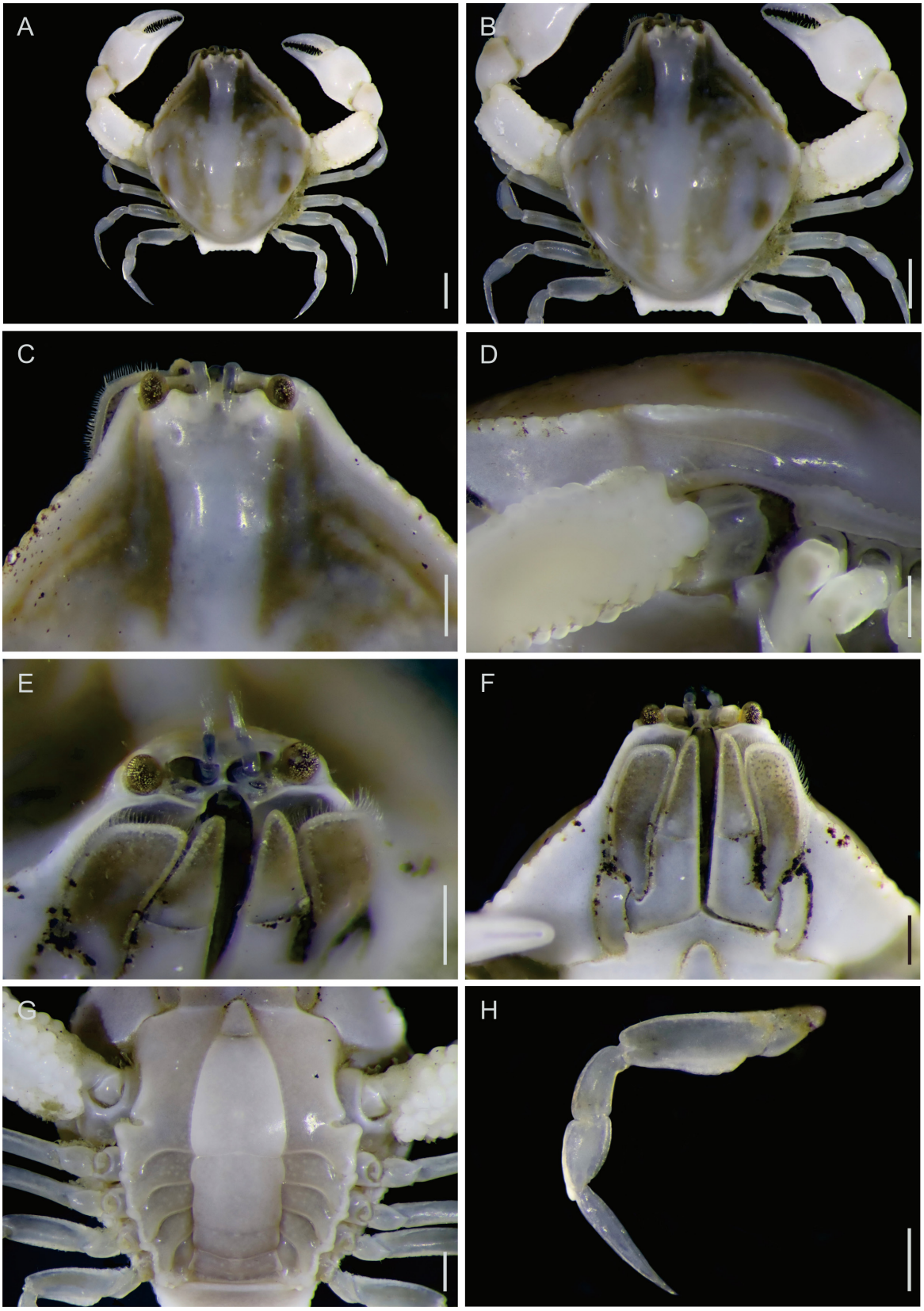

Fig. 4. *Seulocia* sp.; juvenile female, CW 4.8 (NMNS 8906-5): A, habitus, dorsal view; B, carapace, dorsal view; C, carapace, anterior view; D, thoracic sinus; E, habitus, frontal view; F, third maxilliped; G, thoracic sternum and pleon; H, left P5. Scale bars: A, B = 1.0 mm; C–H = 0.5 mm.

the carpi (1.92), propodi (1.65), and dactyli (8.0) (versus 2.79, 1.14, 1.40, and 3.14 in adult female, respectively; ratios based on measurements of the body parts from the figure 197-6 in Chen and Sun 2002) (Fig. 4A–C; Chen and Sun 2002: 436–438, fig. 197, pl. XVI-8; Galil 2005: 53, 55, fig. 3B). The present specimen is a juvenile, and additional adult male and female specimens will need to be collected to determine its identity. The G1 morphology is especially important for the determination of species in members of this genus.

Superfamily Pinnotheroidea De Haan, 1833
Family Pinnotheridae De Haan, 1833
Subfamily Pinnotherinae De Haan, 1833
Genus *Pinnotheres* Bosc, 1801

Type species: *Cancer pisum* Linnaeus, 1767 (type by subsequent designation).

Pinnotheres sp.
(Figs. 5A–H, 6A–F, 7A–K)

Material examined: 1 adult ♂ (3.5 × 2.9 mm), NMNS 8906-6, station B4 (25°12.00'N 121°23.60'E), Bali, New Taipei City, 26 October 2014; 1 adult ♂ (3.5 × 2.8 mm), NMNS 8906-7, station B3 (25°10.67'N 121°23.60'E), Bali, New Taipei City, 5 January 2016; 1 juvenile ♂ (2.4 × 2.1 mm), NMNS 8906-8, station C2 (25°12.67'N 121°23.60'E), Bali, New Taipei City, 15 April 2015.

Description: Based on two adult males (NMNS 8906-6 and NMNS 8906-7); carapace (Figs. 5A–C, 7A) subrectangular, width to length ratio about 1.17 (1.21); surface smooth, margins lined with dense long setae. Front slightly elevated with center concave, about 0.29 (0.28) times as long as carapace width, middle protrusion sharp triangular, strongly deflexed ventrally. Anterolateral margin smooth. Posterolateral margin shorter than anterolateral margin, straight posteriorly.

Orbits (Figs. 5A–D, 7B) suboval, margins smooth, continuous; pre-frontal supraorbital tooth weakly developed. Eyes well developed, eyestalks short, stout, corneas large. Antennular fossae transversely oval; antennules folding transversely. Basal article of antenna short, subrectangular; flagellum not freely entering orbital hiatus, short, tip slightly exceeding exorbital tooth.

Third maxillipeds (Figs. 6C, 7C) polygonal; ischium and merus fused, inner angle rounded, inner margin smooth with row of submargin long simple setae; palp 3-segmented with rows of short and long simple setae; propodus longer than carpus, dactylus digitiform, distal area with long simple setae, articulating underneath propodus, on one-third proximal of propodus, apex nearly reaching end of propodus.

Thoracic sternum (Figs. 6A, 7G) surface covered with numerous small pits margins cristate; sternites 1–3 fused, anterior area strongly concave, with short medial ridge near posterior margin.

Chelipeds (Figs. 5G–H, 7D, E) subequal, moderately robust, external surface smooth with scattered tubercles on proximal area of palms; upper and lower margins with rows of short to long setae. Meri short, distal end not extending beyond carapace anterolateral margin in dorsal view. Carpi rhomboidal. Palm external surface with scattered granules, lower margin with rows of short setae. Fingers thick, tips round; dactylus dorsal margin with 1 row of setae proximally, tip slightly deflexed, cutting edge with 1 large tooth and 1 small tooth, located 1/3 of total length from proximal end; pollex smooth, tip slightly bend upward, cutting edge with 1 row of 6 or 7 small to medium teeth proximally.

Ambulatory legs (Figs. 6B, 7F) subcylindrical, broad, moderate in length, upper and lower margins and/or submargins densely covered with rows of short and long setae. Length of P2–P5: P3 > P4 > P2 > P5. Dactylus of P2–P4 lower margin unarmed, dactylus of P5 lower margin with 1 row of 5 small spines proximally.

Pleon (Figs. 6A, 7G–I) moderate long relative to thoracic sternum, tip of telson reaching level median to sternal condyles of P1 coxae; somites 1, 2 subrectangular, much wider than long; base of somite 3 widest, lateral margins convex; somites 4, 5 progressively narrower, combined lateral margin gently concave; somite 6 subquadrate, distinctly wider than long, anterior margin slightly concave, lateral margins slightly convex medially and folded ventrally, posterior margin slightly convex; telson subrectangular, angles rounded, lateral margins slightly convex medially and folded ventrally, posterior margin slightly convex, basal width about 1.50 times median length.

G1 (Figs. 6D–F, 7J, K) moderate in length, stout, distal half curving laterally; distal tip with narrow, semi-fluted apical lobe, recurved ventrally.

Type locality: Bali, New Taipei City, Northwestern Taiwan.

Distribution: Known only from type locality.

Remarks: The number of valid *Pinnotheres* species has changed over the years. Ng et al. (2008) listed 72 species in the genus. Palacios Theil et al. (2016) listed 65 species, while Cuesta et al. (2019) recorded 52 species with Campos and Vargas-Castillo (2013) reporting 35 species. These changes are due to species being referred to other genera as revisions continuously take place. Of these *Pinnotheres* species, seven were originally described from East Asia: *Pinnotheres*

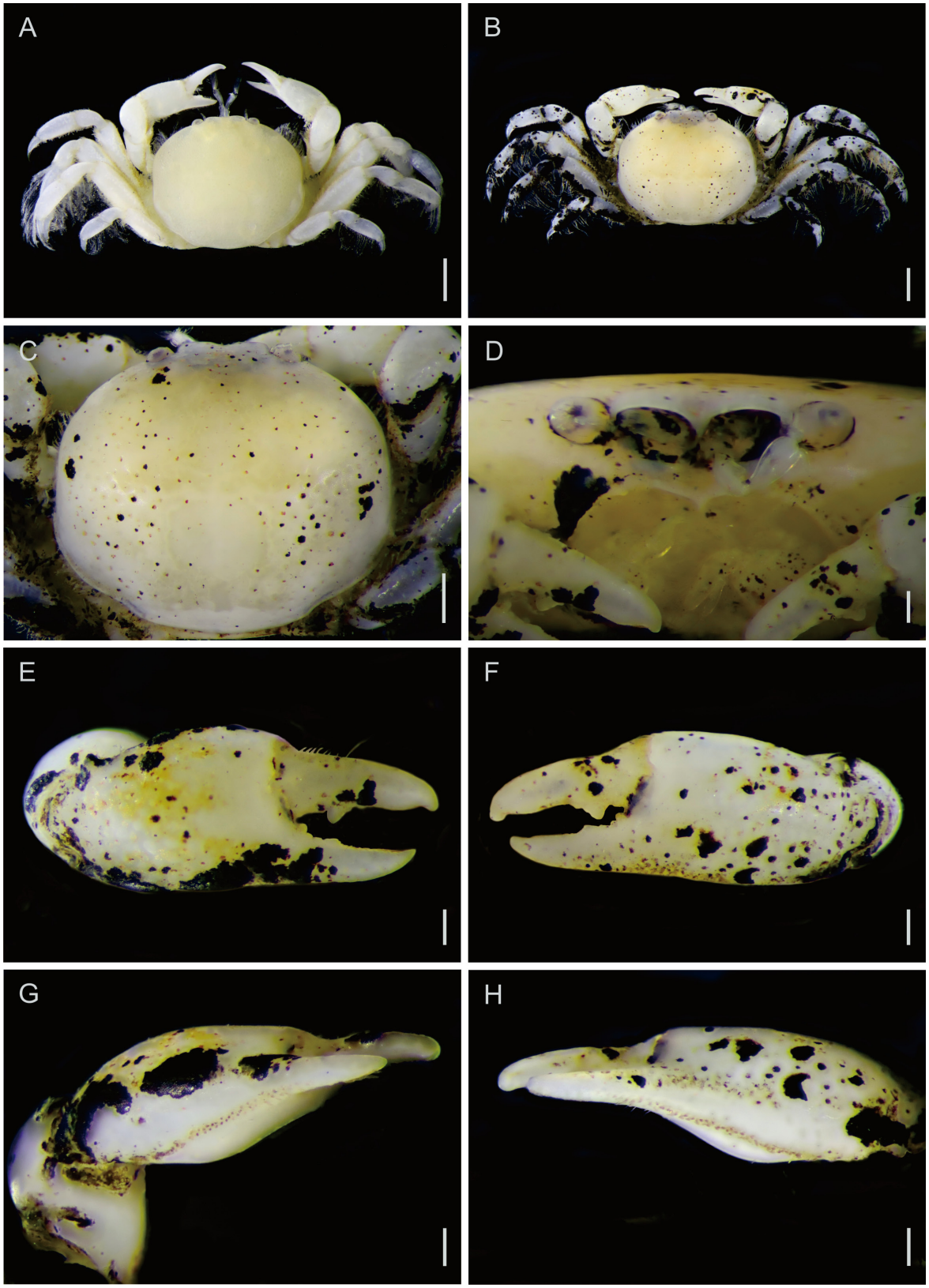

Fig. 5. *Pinnotheres* sp.; subadult male, CW 3.5 mm (NMNS 8906-6), A; subadult male, CW 3.5 mm (NMNS 8906-7), B–H: A, B, habitus, dorsal view; C, carapace, dorsal view; D, habitus, anterior view; E, right chela, external view; F, left chela, external view; G, right chela, ventral view; H, left chela, ventral view. Scale bars: A, B = 1.0 mm; C = 0.5 mm; D–H = 0.2 mm.

dilatatus Shen, 1932 (type locality: Huangdao [= Hwangtao], Jiaozhou [= Kiaochow] Bay, Shandong Province, China), *P. gordoni* Shen, 1932 (type locality: Qingdao [= Tsingtao], China), *P. haiyangensis* Shen, 1932 (type locality: Hsingtsun, Shandong Peninsula, China), *P. laquei* Sakai, 1961 (type locality: off the coast of Hayama, Sagami Bay, Japan), *P. obscurus* Stimpson, 1858 (type locality: Hong Kong Port, China), *P. ostrea* (Aikawa, 1933) (type locality: Misaki, Osaka, Japan), *P. parvulus* Stimpson, 1858 (type locality: the Chinese Sea, 23°N), and *P. serrignathus* Shen, 1932 (type locality: Chefoo, Shandong Peninsula, China) (Stimpson 1858; Shen 1932; Aikawa 1933; Sakai 1961). Among these species, *P. ostrea* was described based on protozoeal specimens collected from ovigerous crabs (Aikawa 1933: 247, fig. 57). Ng et al. (2017) reported four *Pinnotheres* species from Taiwan: *P. boninensis* Stimpson, 1858 (type locality: Bonin Island, Japan), *P. taichungae* Sakai, 2000 (type locality: Taichung, Taiwan), *P. parvulus*, and *P. tsingtaoensis* Shen, 1932 (type locality: Qingdao, China). However, recent taxonomic revisions have moved *P. boninensis* to *Arcotheres* Manning, 1993, and *P. taichungae* and *P. tsingtaoensis* to *Nepinnotheres* Manning, 1993 (cf. Ahyong and Ng 2020 2021; Ng and Ahyong 2022).

The morphology of the present specimens (Figs. 5A–H, 6A–H, 7A–K) aligns with the genus *Pinnotheres* as diagnosed by Poore and Ahyong (2023: 875). Of the seven *Pinnotheres* species reported from East Asia, the present species loosely resembles *P. haiyangensis* Shen, 1932, sharing the following features: 1) a small dactylus on the third maxilliped, attached at the basal third of the propodus and not extending beyond its extremity; 2) setose ambulatory legs with the second pair being the longest; and 3) the male pleonal somite 6 has convex lateral margins (Figs. 6B, C, 7C, F, G–I; Shen 1932: 145, text-figs. 89a, 90a, 91a). However, the new species differs from *P. haiyangensis* in several key aspects: 1) the front margin of the carapace is slightly sinuous (versus almost truncate); 2) the dactylus of the third

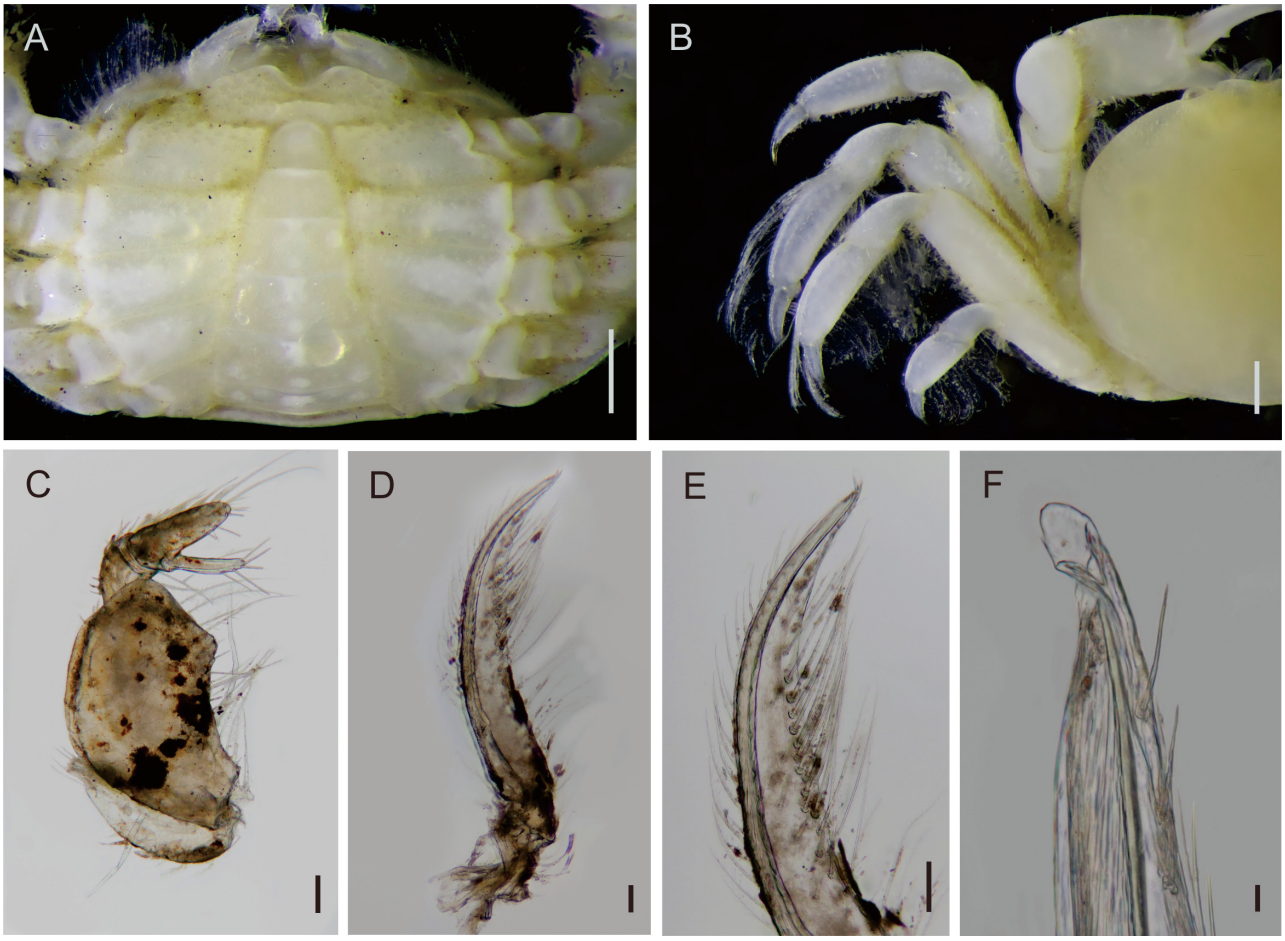

Fig. 6. *Pinnotheres* sp.; adult male, CW 3.5 mm (NMNS 8906-6), A, B; adult male, CW 3.5 mm (NMNS 8906-7), C–F: A, sternum and pleon; B, left pereiopods, dorsal view; C, third maxilliped, external view; D, right G1 of male, dorsal view; E, distal half of right G1, dorsal view, showing a translucent lobe on apex; F, distal area of right G1, dorsal view. Scale bars: A, B = 0.5 mm; C, D = 0.1 mm; E = 0.01 mm.

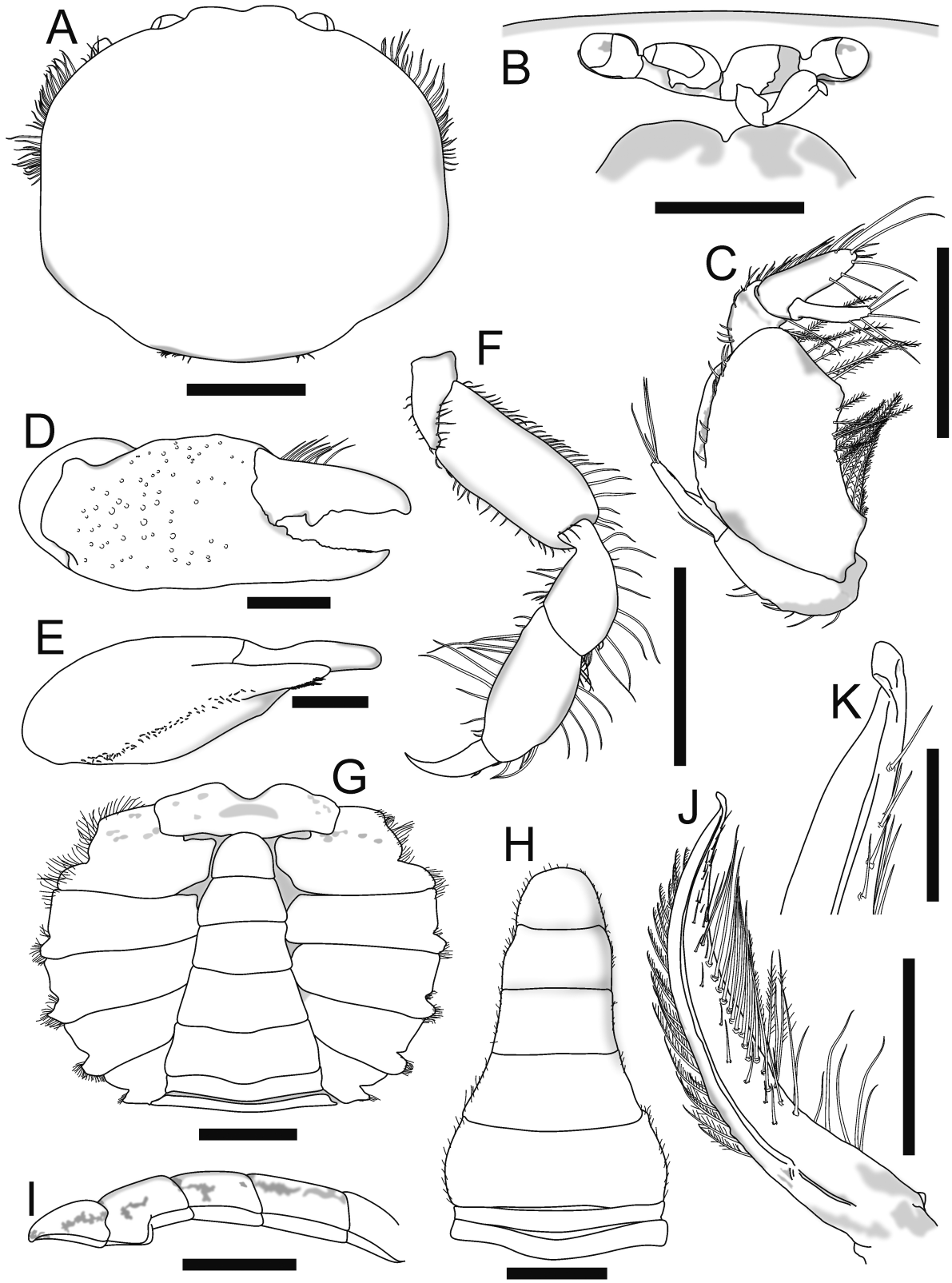

Fig. 7. *Pinnotheres* sp.; adult male, CW 3.5 mm (NMNS 8906-6), A, G; adult male, CW 3.5 mm (NMNS 8906-7), B–F, H–K: A, carapace, dorsal view; B, habitus, anterior view; C, third maxilliped, external view; D, right chela, external view; E, right chela, ventral view; F, right fifth pereiopod, dorsal view; G, sternum and pleon; H, pleon, ventral view; I, pleon, lateral view; J, right G1 of male, dorsal view; K, distal area of right G1, dorsal view. Scale bars: A, F = 1 mm; B–E, G–J = 0.5 mm; K = 0.1 mm.

maxilliped is long, nearly reaching the extremity of the propodus (versus short and far from the extremity); 3) the lower and sublower margins of the palm have rows of short setae (versus smooth margins); 4) the cutting edge of the pollex has four irregularly shaped teeth proximally (versus one small mesial tooth); 5) male pleonal somite 1 is shorter than somite 2 (versus longer); and 6) the tip of G1 bears a semi-fluted apical lobe (versus no lobe) (Figs. 5A–C, E–H, 6A–F, 7A–K; Shen 1932: 148, text-figs. 89a–c, 90a–c, 91a–c). While its possible these specimens belong to a new species, this course of action is not preferred, especially since many *Pinnotheres* species described from the western Pacific are based only on females (Peter KL Ng, pers comm). The lack of host data also makes the problem more difficult. Thus, the present study leaves the present species as an unnamed *Pinnotheres*, with the hope that when females are found with their hosts, the necessary characters can be found to ascertain its precise identity.

Superfamily Ocypodoidea Rafinesque, 1815
Family Xenophthalmidae Stimpson, 1858
Subfamily Xenophthalminae Stimpson, 1858
Genus *Xenophthalmus* White, 1846

Type species: *Xenophthalmus pinnotheroides* White, 1846 (type by monotypy).

Xenophthalmus pinnotheroides White, 1846
(Fig. 8A–G)

Xenophthalmus pinnotheroides White 1846: 178, pl. II, fig. 2.—Adams and White 1848: 63, pl. 12, fig. 3.—H. Milne Edwards 1853: 221.—Stimpson 1858: 107.—Sluiter 1881: 162.—Henderson 1893: 394.—Alcock 1900: 332.—Nobili 1900: 504.—1903: 19.—Rathbun 1910: 338, fig. 22.—Tesch 1918: 272.—Shen 1937a: 170.—1937b: 301, text-fig. 11.—1948: 113, text-fig. 4.—Miyake 1961:175.—Takeda and Miyake 1968: 514, fig. 10.—Griffin and Campbell 1969: 153–156, figs. 5, 6E.—Serène and Umali 1970: 87–89, text-figs. 96. 99. 102–109, pl. 9, figs. 1, 2.—1972: 86, text-figs. 96, 99, 102–109, pl. 9, figs. 1, 2.—Sakai 1976: 591, pl. 203, fig. 4.—Serène and Soh, 1976: 26.—Dai et al. 1986: 410, fig. 228A1.—Dai and Yang 1991: 446, fig. 228A1.—Ng et al. 2008: 245 [List].—Poore and Ahyong 2023: 860–861, fig. 14.201c, e, g.

Material examined: 1 ♂ (6.2 × 3.9 mm), NMNS 8906-9, station C2 (25°12.67'N 121°23.60'E), Bali, New Taipei City, 9 October 2013; 1 adult ♂ (6.8 × 5.1 mm), NMNS 8906-10, station B1 (25°8.67'N 121°20.67'E), Bali, New Taipei City, 26 October 2014; 1 adult ♀ (6.8 × 4.6 mm), NMNS 8906-11, station D1 (25°12.00'N 121°20.67'E), Bali, New Taipei City, 19 January 2015; 1 juvenile ♂ (4.3 × 3.4 mm), NMNS 8906-12, , station B4 (25°12.00'N 121°23.60'E), Bali, New Taipei City, 4 October 2015.

Distribution: Widely distributed in the Indo-Pacific region, from the Gulf of Iran to the Philippines, Hongkong, China, and Japan (Serène and Umali 1972).

Remarks: The genus is represented by two species: *Xenophthalmus pinnotheroides* White, 1846 (type locality: Philippines) and *X. wolffi* Takeda and Miyake, 1970 (type locality: Strait of Hormuz) (White 1946; Takeda and Miyake 1970: 17; Khot et al. 2019: 1340). This is the first record of this genus from Taiwan.

The morphology of the present specimens (Fig. 8A–G) aligns with diagnosis of *X. pinnotheroides* White, 1846 (White 1846: 178, pl. II, fig. 2; Serène and Umali 1970: 87–89, text-figs. 96. 99. 102–109, pl. 9, figs. 1, 2; Dai et al. 1986: 410, fig. 228A1; Dai and Yang 1991: 446, fig. 228A1; Poore and Ahyong 2023: 861, fig. 14.201c, e, g) This species is also reported for the first time from Taiwan.

Superfamily Pilumnoidea Samouelle, 1819
Family Pilumnidae Samouelle, 1819
Subfamily Eumedoninae Dana, 1852
Genus *Ceratocarcinus* White, 1847

Type species: *Ceratocarcinus longimanus* White, 1847 (type by monotypy).

Ceratocarcinus frontodentata (Shen, Dai and Chen, 1982)
(Fig. 9A–F)

Harrovia frontodentata Chen and Dai *in* Shen, Dai and Chen 1982: 146–147 [Chinese text], 149 [English text], text-figs. 12–14, pl. II, fig. 13.—Dai et al. 1986: 165, text-fig. 97, pl. 22, fig. 5.—Števčić et al. 1988: 1312 [list only].—Dai and Yang 1991: 183, text-fig. 97, pl. 22, fig. 5.—Ng et al. 2008: 138 [List].
Ceratocarcinus frontodentata Chia and Ng, 1998: 501–504, figs. 3–4.

Material examined: 1 adult ♀ (8.4 × 6.4 mm), NMNS 8906-13, station C2 (25°12.67'N 121°23.60'E), Bali, New Taipei City, 26 October 2014; 1 adult ♂ (6.4 × 5.7 mm), NMNS 8906-14, station C2 (25°12.67'N 121°23.60'E), Bali, New Taipei City, 27 October 2015.

Distribution: Known only from the type locality Haimen, Quandong Province, China and northwestern Taiwan.

Remarks: The genus has three valid species: *Ceratocarcinus frontodentata* (Chen and Dai *in* Shen, Dai and Chen, 1982) (type locality: Haimen, Guangdong Province, China), *C. longimanus* White, 1847 (type locality: the Eastern Seas), and *C. trilobatus* (Sakai, 1938) (type locality: Simoda, Japan) (Chia and Ng 1998). This is the first record of this genus from Taiwan.

The morphology of the present specimens (Fig. 9A–F) aligns with species description in Shen et al.

(1982) and Chia and Ng (1998). Chia and Ng (1988) noted that the authorship of this species had been cited by some workers as Shen and Dai, in Shen et al. (1982). However, they argued that the description of this species was a joint publication by Shen, Dai and Chen. Therefore, they recommended the correct authorship of this species as *C. frontodentata* (Shen, Dai and Chen 1982). This study follows the authorship suggestion of this species by Chia and Ng (1988).

The present two specimens of *C. frontodentata* were collected from offshore waters of northwestern Taiwan, less than 500 kilometers northeast of the type locality. This species represents a new record for Taiwan.

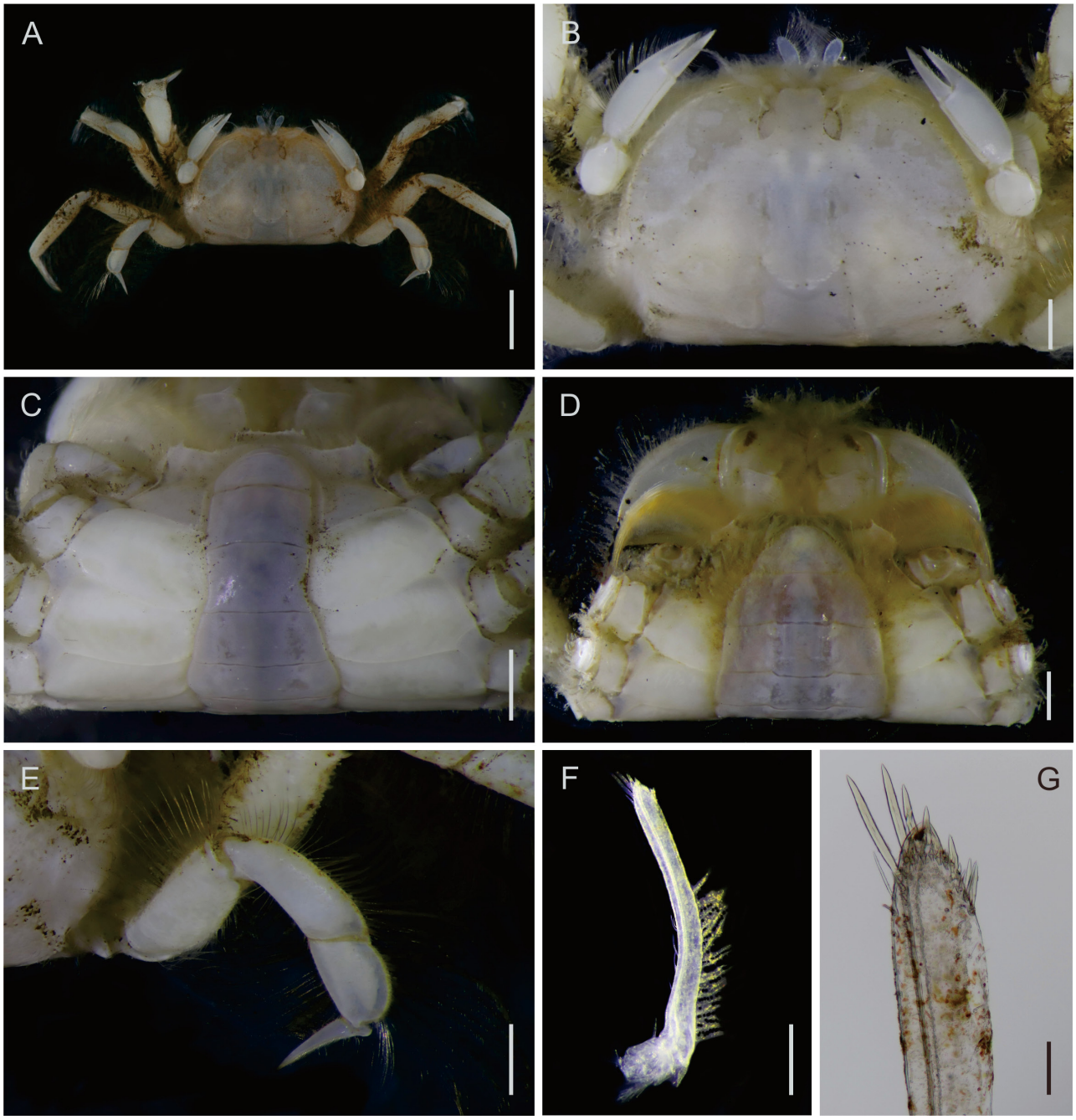

Fig. 8. *Xenophthalmus pinnotheroides* White, 1846; adult male, CW 6.8 mm (NMNS 8906-10), A, C, E–G; (adult female, CW 6.8 mm; NMNS 8906-12), B, D: A habitus, dorsal view; B, carapace, dorsal view; C, male sternum and pleon; D, female habitus, ventral view; E, right fourth pereiopod; F, left G1, dorsal view; G, left G1 distal area, dorsal view. Scale bars: A = 2.0 mm; B–D = 1.0 mm; E, F = 0.5 mm; G = 0.05 mm.

CONCLUSIONS

The present study reports seven species of subtidal brachyuran crabs collected from the offshore sewage discharge site of the Bali wastewater treatment plant. These species belong to six families and seven genera, including three new genera recorded for the first time in Taiwan: *Ceratocarcinus* White, 1847, *Mariaplax* Rahayu and Ng, 2014, and *Xenophthalmus* White, 1846. The seven species are *Paradorippe* sp. (family Dorippidae H. Milne Edwards, 1837), *Mariaplax chenae* Rahayu and Ng, 2014 (family Hexapodidae Miers, 1886), *Nursia* sp. (family Leucosiidae Samouelle, 1819, subfamily Ebaliinae Stimpson, 1871), *Seulocia* sp. (family Leucosiidae Samouelle, 1819, subfamily Leucosiinae Samouelle, 1819), *Pinnotheres* sp. (family Pinnotheridae

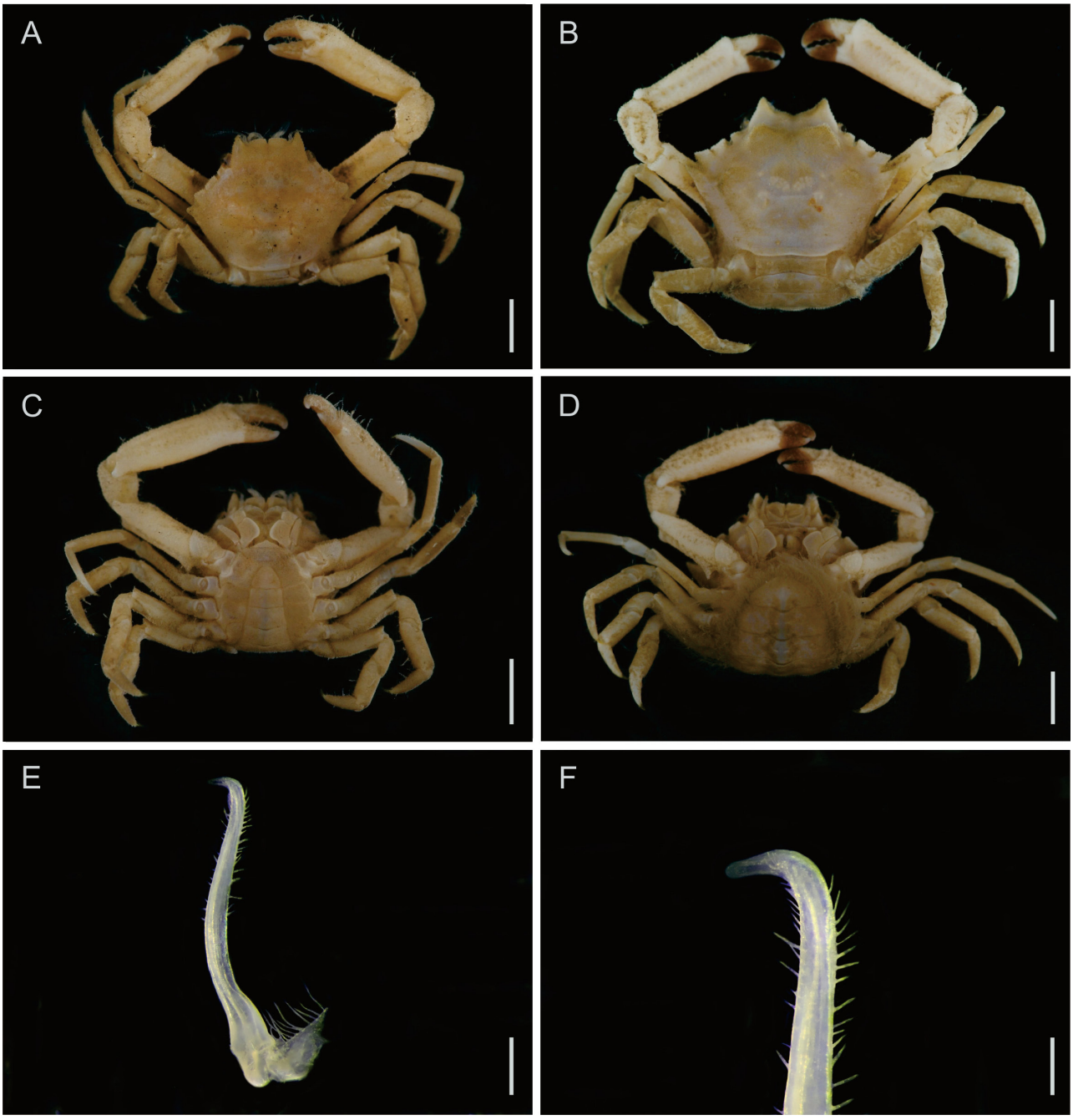

Fig. 9. *Ceratocarcinus frontodentata* (Shen, Dai and Chen, 1982); adult male, CW 6.4 mm (NMNS 8906-15), A, C, E, F; adult female, CW 8.4 mm (NMNS 8906-14), B, D: A, B, habitus, dorsal view; C, D, habitus, ventral view; E, left G1, dorsal view; F, distal area of left G1, dorsal view. Scale bars: A–D = 2.0 mm; E = 0.5 mm; F = 0.2 mm.

De Haan, 1833), *Xenophthalmus pinnotheroides* White, 1846 (family Xenophthalmidae Stimpson, 1858), and *Ceratocarcinus frontodentata* (Shen, Dai and Chen, 1982) (family Pilumnidae Samouelle, 1819). *Ceratocarcinus frontodentata*, *M. chenae*, and *X. pinnotheroides* are reported in Taiwan for the first time. The four unnamed species are represented by mostly juvenile or incomplete adult female specimens, whose distinctive features are not observed in adult congeners. Because the degree of variation between sexes and ontogenetic changes is not known, it is not currently possible to identify these specimens to the species level.

Acknowledgments: This study was partially supported by the Ministry of Science and Technology, Republic of China (MOST 108-2621-B-005-004-MY3) to PWH. We appreciate Dr PKL Ng for his valuable comments on this manuscript.

Authors' contributions: The first author was responsible for collecting and examining the specimens, writing the full text, and creating most of the figures and tables in this manuscript. The co-author contributed to the field collection and created all the line drawings for this manuscript. Both authors reviewed and approved the final draft of the manuscript prior to submission to Zoological Studies.

Competing interests: YWT and PWH declares that they have no conflict of interests.

Availability of data and materials: Not applicable.

Consent for publication: Not applicable.

Ethics approval consent to participate: Not applicable.

REFERENCES

Adams A, White A. 1848. Crustacea. *In*: Adams A (ed) The Zoology of the voyage of the HMS "Samarang" under the command of Captain Sir Edward Belcher, C.B., F.R.A.S., F.G.S., during the years 1843–1846. Benham and Leeve, London.

Ahyong ST, Ng PKL. 2020. New species of pinnotherid crabs from Southeast Asia and Papua New Guinea (Crustacea: Decapoda: Brachyura). Zootaxa **4816:**333–349. doi:10.11646/zootaxa.4816.3.4.

Ahyong ST, Ng PKL. 2021. The pinnotherid crabs from the Gulf of Siam described by Rathbun (1909) (Decapoda: Brachyura): revisited and revised. Raffles Bull Zool **69:**188–211.

Aikawa H. 1933. On larval forms of some Brachyura. Part II: A note on indeterminate zoeas. Rec Oceanogr Works Japan **5:**124–254.

Alcock A. 1900. Material for a carcinological Fauna of India. No. 6: the Brachyura Catometopa, or Grapsoidea. J Asiat Soc Bengal **69:**279–456.

Barnes RSK. 1967. The Macrophthalminae of Australasia; with a review of the evolution and morphological diversity of the type genus *Macrophthalmus* (Crustacea: Brachyura). Trans Zool Soc London **31:**195–261, pls. 1–4.

Bosc LAG. 1801. Histoire Naturelle des Crustacés, Contenant leur Description et leurs Moeurs; avec Figures Dessinées d'Après Nature. Tome premier. Suite à Boffon, Paris. Deterville, Paris, 258 pp., pls. 1–8.

Campos E, Vargas-Castillo R. 2013. *Pinnotheres orcutti* Rathbun, 1918, a new eastern tropical Pacific species of *Tumidotheres* Campos, 1989 (Crustacea: Brachyura: Pinnotheridae). Zootaxa **3666:**84–92. doi:10.11646/zootaxa.3666.1.8.

Castro P. 2005. Crabs of the subfamily Ethusinae Guinot, 1977 (Crustacea, Decapoda, Brachyura, Dorippidae) of the Indo-West Pacific region. Zoosystema **27:**499–600.

Castro P. 2013. Brachyuran crabs (Crustacea, Brachyura: Crossotonotidae, Ethusidae, Euryplacidae, Goneplacidae, Latreilliidae, Palicidae, Tetraliidae, Trapeziidae) of the MAINBAZA, MIRIKI, and ATIMO VATAE expeditions to the Mozambique Channel and Madagascar. *In*: Ahyong ST, Chan T-Y, Corbari L and Ng PKL (eds) Tropical Deep-Sea Benthos. Volume 27. Mémoires du Muséum national d'Histoire naturelle, Paris **204:**437–466.

Chen H-L, Fang S-H. 1998. On a new species of *Nursia* (Crustacea: Decapoda: Brachyura: Leucosiidae) from Fujian Province, China. Raffles Bull Zool **46:**605–608.

Chen H-L, Sun H. 2002. Arthropoda Crustacea. Brachyura. Marine primitive crabs. Fauna Sinica. Invertebrata. vol. 30. Science Press, Beijing, i–xiii, 597 pp., pls. I–XVI.

Chia DGB, Ng PKL. 1998. A revision of *Ceratocarcinus* White, 1847, and *Harrovia* Adams and White, 1849 (Crustacea: Decapoda: Brachyura: Eumedonidae), two genera of crabs symbiotic with crinoids. Raffles Bull Zool **46:**493–563.

Cuesta JA, Garcia Raso JE, Abelló P, Marco-Herrero E, Silva L et al. 2019. A new species of pea crab from south-western Europe (Crustacea, Decapoda, Brachyura): species description, geographic distribution and population structure with an identification key to European Pinnotheridae. J Mar Biol Assoc UK **99:**1141–1152. doi:10.1017/S0025315419000018.

Dai A-Y, Yang S-L. 1991. Crabs of the China Seas. China Ocean Press, Beijing and Springer-Verlag, Berlin, i–iv, 608 pp., figs. 1–295, pls. 1–74.

Dai A-Y, Yang S-L, Song Y, Chen G. 1986. Crabs of the China Seas. China Ocean Press, Beijing, 568 pp., pls. 1–74. (in Chinese)

Dana JD. 1851. Conspectus crustaceorum quae in orbis terrarum circumnavigatione, Carolo Wilkes e classe Reipublicae Faederate Duce, lexit et descripsit. Crustacea Grapsoidea (Cyclometopa, Edwardsii). Proc Acad Nat Sci **5:**247–254.

Dana JD. 1852. Crustacea. Part II. *In*: United States Exploring Expedition. During the years 1838, 1839, 1840, 1841, 1842. Under the command of Charles Wilkes. U. S. N., C. Sherman Printer, Philadelphia **14:**691–1618. [1855, folio atlas pls. 1–96.].

Davie PJF, Guinot D, Ng PKL. 2015. Systematics and classification of Brachyura. *In*: Castro P, Davie PJF, Guinot D, Schram F, von Vaupel Klein C (eds) Treatise on Zoology—Anatomy, Taxonomy, Biology – The Crustacea. Vol. 9. Part C. Brill, Leiden. doi:10.1163/9789004190832_021.

De Haan W. 1833–1850. Crustacea. *In*: von Siebold PF, Fauna Japonica sive Descriptio Animalium, quae in Itinere per Japoniam, Jussu et Auspiciis Superiorum, qui Summum in India Batava Imperium Tenent, Suspecto, Annis 1823-1830 Collegit, Notis, Observationibus et Adumbrationibus Illustravit. Lugduni-Batavorum, i–xxxi, ix–xvi, 243 pp., pls. A–J, L–Q, 1–55.

Galil BS. 2005. Contribution to the knowledge of Leucosiida IV. *Seucolia* gen. nov. (Crustacea: Brachyura). Zool Med Leiden **79:**41–59.

Griffin DJG, Campbell BM. 1969. The sub-1ittoral Goneplacidae and Pinnotherídae (Crustacea, Brachyura) of Moreton Bay. Mem Qd Mus **15:**141–164, text-figs. 1–8.

Guinot D. 1977. Proposition pour une nouvelle classification des crustacés décapodes brachyoures. Comptes Rendus de l'Académie des Sciences, sér D **285:**1049–1052.

Guinot D. 2023. A new subfamily classification of the highly diversified Dorippidae H. Milne Edwards, 1837 (Crustacea, Decapoda, Brachyura, Dorippoidea), using morphological, molecular and palaeotonlogical data, with special emphasis on its unique female reproductive system. Zoosystema **45:**225–372. doi:10.5252/zoosystema2023v45a9.

Guinot D, Tavares M, Castro P. 2013. Significances of the sexual opening and supplementary structures on the phylogeny of brachyuran crabs (Crustacea, Decapoda, Brachyura), with new nomina for higher-ranked podotreme taxa. Zootaxa **3665:**1–414. doi:10.11646/zootaxa.3665.1.1.

Henderson JR. 1893. A contribution to Indian carcinology. Trans Linn Soc London Zool, ser. 2 **5:**325–458, pls. 36–40.

Holthuis LB, Manning RB. 1990. Crabs of the subfamily Dorippinae MacLeay, 1838, from the Indo-West Pacific Region (Crustacea: Decapoda: Dorippidae). Res Crustacea, Spec No **3:**1–151.

Khot M, Jaiswar AK, Ng PKL. 2019. The taxonomy of two species of Xenophthalmidae from Maharashtra, India, and the generic placement of *Xenophthalmus garthii* Sankarankutty, 1969 (Decapoda, Brachyura). Crustaceana **92:**1337–1348.

Leach WE. 1817. Monograph on the genera and species of the Malacostracous family Leucosidea. *In*: Leach WE (ed) The Zoological Miscellany, being descriptions of new and interesting animals, illustrated with coloured figures engraved from original drawings by R.P. Nodder, Vol III, pp. 17–26.

Manning RB, Holthuis LB. 1986. Preliminary descriptions of four new species of dorippid crabs from the Indo-West Pacific region (Crustacea: Decapoda: Brachyura). Proc Biol Soc Washington **99:**363–365.

Miers EJ. 1886. Report on the Brachyura collected by H.M.S. Challenger during the years 1873–1876. Rep Sci Res Voyage H.M.S. Challenger during the years 1873–1876 **XVII(XLIX):**l [= 50] + 362 pp., pls. I–XXIX.

Milne Edwards H. 1834, 1837, 1840. Histoire Naturelle des Crustaces comprenant l'Anatomie, la Physiologie et la Classification de ces Animaux. Librairie Encyclopedique de Roret, Paris. Vol. 1 (1834), xxxv + 468 pp.; vol. 2 (1837), 1–531 pp.; Atlas (1834–1840), 42 pls.

Milne Edwards H. 1953. Observations sur les affinites zoologiques et la classification naturelle des Crustaces. Ann Sci Nat **20:**163–228, pls. 6–11.

Miyake S. 1961. A list of the decapod Crustacea of the Sea of Ariake Kyushu. Rec Sci Works (Spec No) **5:**165–178.

Ng PKL, Ahyong ST. 2022. The pea crab genus *Arcotheres* Manning, 1993 (Crustacea: Brachyura) from Singapore and Peninsular Malaysia, with a reappraisal of diagnostic characters and descriptions of two new genera. Raffles Bull Zool **70:**134–248.

Ng PKL, Guinot D, Davie PJF. 2008. Systema Brachyurorum: Part I. An annotated checklist of extant brachyuran crabs of the world. Raffles Bull Zool, Suppl **17:**1–286.

Ng PKL, Komatsu H. 2016. *Nursia tohae*, a new species of coral rubble mimic crab (Crustacea: Brachyura: Leucosiidae) from the Philippines and Singapore. Raffles Bull Zool, Suppl **34:**519–527.

Ng PKL, Rahayu DL. 2015. Notes on Hexapodidae (Crustacea, Brachyura) from Indonesia and Malaysia, with description of a new species of *Mariaplax* Rahayu and Ng, 2014, from Lombok, Indonesia. Zootaxa **3981:**125–137. doi:10.11646/zootaxa.3981.1.7.

Ng PKL, Shih H-T, Ho P-H, Wang C-H. 2017. An updated annotated checklist of brachyuran crabs from Taiwan (Crustacea: Decapoda). J Nat Taiwan Mus **70:**1010–1683.

Ng PKL, Wong KJH. 2019. The Hexapodidae (Decapoda, Brachyura) of Hong Kong, with description of a new species of *Mariaplax* Rahayu and Ng, 2014. Crustaceana **92:**233–245.

Nobili G. 1900. Contributioni della conocenza della fauna carcinologica dela Papuasia, delle Molluche e dell Australia. Ann Mus Civ Stor Nat Genova **20:**473–523.

Nobili G. 1903. Crostacei di Singapore. Bull Mus Zool Anat Comp RU, Torino **28:**1–39, pl. 1.

Palacios Theil E, Cuesta JA, Felder DL. 2016. Molecular evidence for non-monophyly of the pinnotheroid crabs (Crustacea: Brachyura: Pinnotheroidea), warranting taxonomic reappraisal. Invertebr Syst **30:**1–27. doi:10.1071/IS15023.

Poore GCB, Ahyong ST. 2023. Marine Decapod Crustacea: A Guide to Families and Genera of the World. CSIRO Publishing, Melbourne, and CRC Press, Boca Raton, xii + 916 pp.

Rafinesque CS. 1815. Analyse de la nature ou Tableau de l'univers et des corps organisés. (self-published) Palermo.

Rahayu DL, Ng PKL. 2014. New genera and new species of Hexapodidae (Crustacea, Brachyura) from the Indo-West Pacific and east Atlantic. Raffles Bull Zool **62:**396–483.

Rahayu DL, Widyastuti E. 2018. Additions to the Indonesian crab fauna of the genus *Mariaplax* Rahayu and Ng, 2014, and notes on *Hexapus timika* Rahayu and Ng, 2014 (Crustacea, Decapoda, Brachyura, Hexapodidae). Zootaxa **4379:**231–246. doi:10.11646/zootaxa.4379.2.

Rathbun MJ. 1910. The Danish Expedition to Siam 1899-1900. V. Brachyura. Mem. Acad. Roy Sc Danem Cop, 7c ser **5:**303–368, figs. 1–44, pls. 1–2.

Sakai T. 1961. New species of Japanese crabs from the collection of His Majesty the Emperor of Japan. Crustaceana **3:**31–150, pls. 3–4.

Sakai T. 1976. Crabs of Japan and the Adjacent Seas. Kodansha Ltd., Tokyo, In three volumes; English text, pp. xxix+773 pp., Japanese text, pp. 1–461, Plates volume, pp. 1–16, pls. 1–251.

Samouelle G. 1819. The entomologists' useful compendium; or an introduction to the knowledge of British Insects, comprising the best means of obtaining and preserving them, and a description of the apparatus generally used; together with the genera of Linné, and modern methods of arranging the Classes Crustacea, Myriapoda, spiders, mites and insects, from their affinities and structure, according to the views of Dr. Leach. Also an explanation of the terms used in entomology; a calendar of the times of appearance and usual situations of near 3,000 species of British Insects; with instructions for collecting and fitting up objects for the microscope. Thomas Boys, London, 496 pp., pls. 1–12.

Serène R, Romimohtarto K. 1969. Observations of the species of *Dorippe* from the Indo-Malayan Region. Mar Res Indonesia [= Penelitian Laut di Indonesia] **9:**1–35, pls. 1–6.

Serène R, Soh SL. 1976. Brachyura collected during the Thai-Danish expedition (1966). Phuket Mar Biol Cent Res **12:**1–37, pls. I–VIII.

Serène R, Umali AF. 1972. The family Raninidae and other new and rare species of brachyuran decapods from the Philippines and adjacent regions. Philippine Jour Sci **99:**21–105, pls. 1–9.

Shen CJ. 1932. The brachyuran Crustacea of North China. Zool Sinica, ser A (Invertebrates of China) **9:**1–321.

Shen CJ. 1937a. On some account of the Crabs on North China. Bull

Fan Memorial Inst Biol Peiping, Zool **7:**167–185.
Shen CJ. 1937b. Second addition to the fauna of Brachyuran Crustacea of North China, with a check list of the species recorded in this particular region. Contr Inst Zool Nat Acad Peiping **3:**277–312, text-figs. 1–11.
Shen CJ. 1948. On a collection of crabs from the Shantung Peninsula, with notes on some new and rare species. Contr Inst Zool Nat Acad Peiping **4:**105–118, figs. 1–5.
Shen C-L, Dai A-Y, Chen H-L. 1982. New and rare species of Parthenopidae (Crustacea: Brachyura) from China Seas. Acta Zoot Sin **7:**139–149, pls. 1–2. (in Chinese)
Sluiter CP. 1881. Bijdrage tot de kennis der Crustaceën Fauna van Java's noordkust. Nat Tijschr Ne Ind **40:**159–164, pl. 1
Števčić Z, Castro P, Gore RH. 1988. Re-establishment of the family Eumedonidae Dana, 1853 (Crustacea: Brachyura). J Nat Hist **22:**1301–1324.
Stimpson W. 1858. Prodromus descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. Pars V. Crustacea Ocypodoidea. Proc Acad Nat Sci Philadelphia **10:**93–110 [39–56 in separate].
Stimpson W. 1871. Preliminary report on the Crustacea dredged in the Gulf Stream in the Straits of Florida, by L. F. de Pourtales, Assist. U.S. Coast Survey. Part I. Brachyura. Bull Mus Comp Zoöl **2:**109–160.
Takeda M, Miyake S. 1968. Crabs from the East China Sea. I. Corystoidea and Brachygnatha Brachyrhyncha. Journ Fac Agri, Kyushu Univ **14:**541–582, pl. 1, figs. 1–11.
Takeda M, Miyake S. 1970. A new free-living pinnotherid crab (Crustacea, Brachyura) from the Iranian Gulf. OHMU, Occasional Papers of the Zoological Laboratory, Faculty of Agriculture, Kyushu University **3:**11–18.
Tesch JJ. 1918. The Decapod Brachyura of the Siboga-Expedition. II. Goneplacidae and Pinnotheridae. Siboga-Expeditie, Monogr **39c1:**149–295, pls. 1–12.
White A. 1846. Notes on four genera of Crustacea. Ann Mag Nat Hist, ser. 1 **18:**176–178, pl. 2.
White A. 1847. Descriptions of new Crustacea from the eastern seas. Proc Zool Soc London **15:**56–58.