

THE FRESHWATER DECAPOD CRUSTACEANS OF HALMAHERA, INDONESIA

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ABSTRACT

Twenty-six species of freshwater shrimps and crabs, belonging to 14 genera of four families (Atyidae, Palaemonidae, Parathelphusidae, and Grapsidae) are reported from Halmahera, Indonesia. Of them, 10 are new records for the island while one species of *Macrobrachium* is here described as new. Description for new species, diagnoses for poorly known species, and taxonomic discussions for all species are provided.

The decapod crustacean fauna of Halmahera Island in the islands of Maluku (= Moluccas), Indonesia, is poorly known. To date, only De Man (1902, 1905), Holthuis (1950), and Ng (1990) have reported prawns and crabs from the island. Based on the specimens collected by W. Kükenthal from 1893 to 1894, De Man (1902) recorded five species of *Macrobrachium* (with two new species, *Palaemon (Eupalaemon) robustus* and *P. (Macrobrachium) oenone*, Palaemonidae) as well as six species of freshwater crabs (with two new species, *Sundathelphusa halmaherensis* and *S. cassiope* (Parathelphusidae). Holthuis (1950), in his synopsis of the Palaemoninae, examined material collected by H. A. Bernstein from the island in 1862. Ng (1990) subsequently reported a new genus and new species of freshwater crab (*Currothelphusa asserpes*) from Halmahera.

Between August and October, 1994, a University of Bristol expedition to Indonesia explored the freshwater fauna of Halmahera (Fig. 1). The present report deals with the decapod crustaceans collected by Mr. D. Robb during the expedition. Some previously reported specimens have also been re-examined. The fresh collection contains 15 species, 10 of which are new records for Halmahera and one (*Macrobrachium*) is new to science. An enumeration is given here of the 26 species of freshwater shrimps and crabs now known from Halmahera. They belong to 14 genera in four families (Atyidae, Palaemonidae, Parathelphusidae, and Grapsidae). De Man (1902: 536) reported on an unnamed new variety of *Parasesarma lenzii* from a

freshwater habitat in Halmahera, but as this is essentially a mangrove species, its presence in freshwater must be regarded as incidental at best. As such, it will not be treated in this paper.

Specimens examined in this study are deposited at the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC); Senckenberg Museum, Frankfurt am Main, Germany (SMF); Naturhistorisches Museum, Wien, Austria (NHMW); British Museum (Natural History), London, England (BMNH); National Museum of Natural History, Leiden, The Netherlands (RMNH); Zoological Museum of Amsterdam, Amsterdam, The Netherlands (ZMA); Beijing Natural History Museum, Beijing, China (BNHM); Museum Zoologicum Bogoriense, Bogor, Indonesia (MZB), and National Taiwan Ocean University, Keelung, Taiwan (NTOU). Notation for the rostral formula follows that of Chace and Bruce (1993). The abbreviation cl is used as carapace length (measured from the postorbital margin to the posterior margin of carapace). Diagnoses and/or descriptions are only appended for poorly described or new species.

TAXONOMIC ACCOUNT

Family Atyidae

Atyoida pilipes (Newport, 1847)

Atya pilipes Newport, 1847: 160 [type locality: Apia, Upolu, Navigator or Samoan Group].

Atya brevirostris De Man, 1892: 360, 520, pl. 21: figs. 21, 21 a–d [type locality: Flores and Timor, Indonesia].—De Man, 1902: 894.

Atyoida pilipes—Smith and Williams, 1982: 345.—Chace, 1983: 10, figs. 3–8.

Material Examined.—1 ♀, cl 4.1 mm (SMF 7975), Halmahera, leg. W. Kükenthal.

Remarks.—This species was not represented in the recent collection. De Man (1902) reported *Atya brevirostris* De Man, 1892, from Halmahera, which was synonymised with *Atyoida pilipes* (Newport, 1847) by Chace (1983). One of his specimens is in SMF and was re-examined by the first author when he visited SMF on June, 1999, and the synonymization is confirmed. *Atyoida pilipes* has been reported from the Philippines and eastern Lesser Sunda Islands (about 120°E) eastwards through the Pacific high islands (Chace, 1983).

Atyopsis spinipes (Newport, 1847)

Fig. 2A–D

Atya spinipes Newport, 1847: 159 [type locality: Philippine Islands].

Atya moluccensis—De Man, 1902: 893.

Atyopsis spinipes—Chace, 1983: 35, figs. 20–22.

Material Examined.—1 ♀, cl 9.2 mm, 1 ♀ (ovigerous), cl 13.0 mm (ZRC), Sungai Ifis (1°24'N, 128°13'E), Halmahera, Sep. 1994, leg. D. Robb; 1 ♀, cl 6.8 mm (SMF 7972), Halmahera, 1894, leg. W. Kükenthal; 1 ♀ (ovigerous), cl 12 mm, 2 ♂♂, cl 9.0–9.3 mm (SMF 7974), Halmahera, 1894, leg. W. Kükenthal.

Remarks.—As noted by Chace (1983: 36), the Halmahera specimens assigned to *Atya moluccensis* by De Man (1902: 893) are probably *Atyopsis spinipes* instead, as evident by the few (3–5) ventral rostral teeth. Examination of the original material and the recent collection confirms Chace's (1983) supposition.

Atyopsis spinipes occurs from the Philippines and eastern Lesser Sunda Islands (at about 120°00'E) northwards to Taiwan and as far as Tokuno-shima in the Ryukyus, and eastwards as far as Samoa (Chace, 1983).

Caridina weberi De Man, 1892

Fig. 3

Caridina Weberi De Man, 1892: 371, pl. 22: figs. 23–23g [type locality: Kotting, Flores, Indonesia].—Bouvier, 1925: 242, figs. 562–571.

Caridina Weberi—Edmondson, 1935: 8, figs. 3a–f, 4g, h.—Holthuis, 1978: 30.—Chace, 1997: 12.

Material Examined.—1 ♂, cl 3.0 mm, 1 ♀ (ovigerous), cl 5.0 mm (ZRC), Sungai Ifis, Halmahera, Sep. 1994, leg. D. Robb.

Description.—Rostrum straight, reaching to base or near middle of second segment of an-

tennular peduncle, dorsal margin nearly horizontal, elevated slightly above dorsal margin of carapace, rostral formula 0–2+13–14/2–3. Antennular peduncle 0.6 times as long as carapace. Suborbital angle acute, fused with antennal spine. Pterygostomian margin rounded. Telson with small posteromedian projection, sublateral pair of spines shorter than lateral pair, both shorter than intermediate setae-like pairs. First pereopod with fingers as long as palm. Carpus 0.7 times as long as chela, 1.3 times as long as high. Merus stout, 2.0 times as long as wide. Fifth pereopod slender, with propodus 5.0 times as long as dactylus. Dactylus with 55 spinules on flexor margin. Endopod of male first pleopod with distinctive appendix interna (Fig. 3J). Uropodal diaeresis with 19 spinules. Eggs 0.4 × 0.2 mm in diameter.

Remarks.—The Halmahera specimens most closely resemble *C. weberi* De Man, 1892 *sensu lato*. Currently, six subspecies of *C. weberi* have been proposed, viz. *C. w. weberi* De Man, 1892; *C. w. sumatrensis* De Man, 1892; *C. w. celebensis* Schenkel, 1902 (invalid name, see Holthuis, 1978); *C. w. papuana* Nobili, 1905; *C. w. keiensis* Roux, 1911; and *C. w. longicarpus* Roux, 1926. Some other species may also prove to be junior synonyms or subspecies of *C. weberi* as well, viz. *C. parvirostris* De Man, 1892 (*fide* Bouvier, 1925: 244); *C. vitiensis canacorum* Roux, 1926 (*fide* Holthuis, 1969: 103); and *C. laoagensis* Blanco, 1939 (*fide* Chace, 1997: 12).

When discussing the affinities of *C. w. weberi* and *C. w. sumatrensis*, De Man (1892) noted that with regards to the teeth on the rostrum, there are some "intermediate" specimens from Celebes (Sulawesi) possessing one or two postorbital teeth. Our Halmahera specimens seem to belong to this intermediate form. We believe that some of the subspecies mentioned above could be elevated to species while some others might fall into synonymy of others (unpublished data). Because the definitions of many of the subspecies are not very clear for the time being, we tentatively retain the nominal name for the Halmahera form.

Caridina cf. pareparensis De Man, 1892

Fig. 2E, F

Caridina pareparensis De Man, 1892: 379, pl. 22: fig. 25–25b [type locality: Pare Pare, Sulawesi (Celebes), Indonesia].—Bouvier, 1925: 236, figs. 538–543.—Chace, 1997: 18.

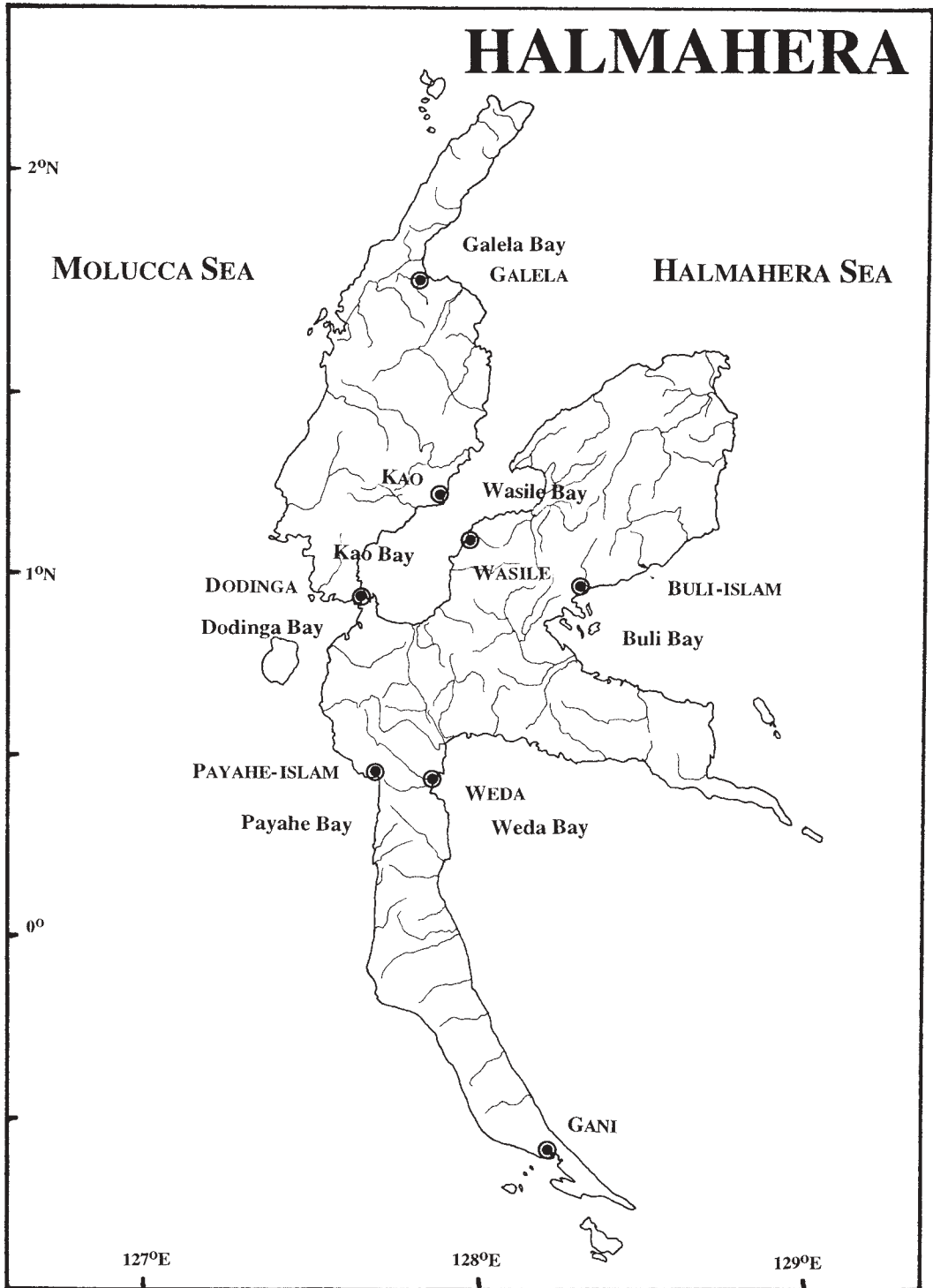


Fig. 1. Map of Halmahera, Indonesia.

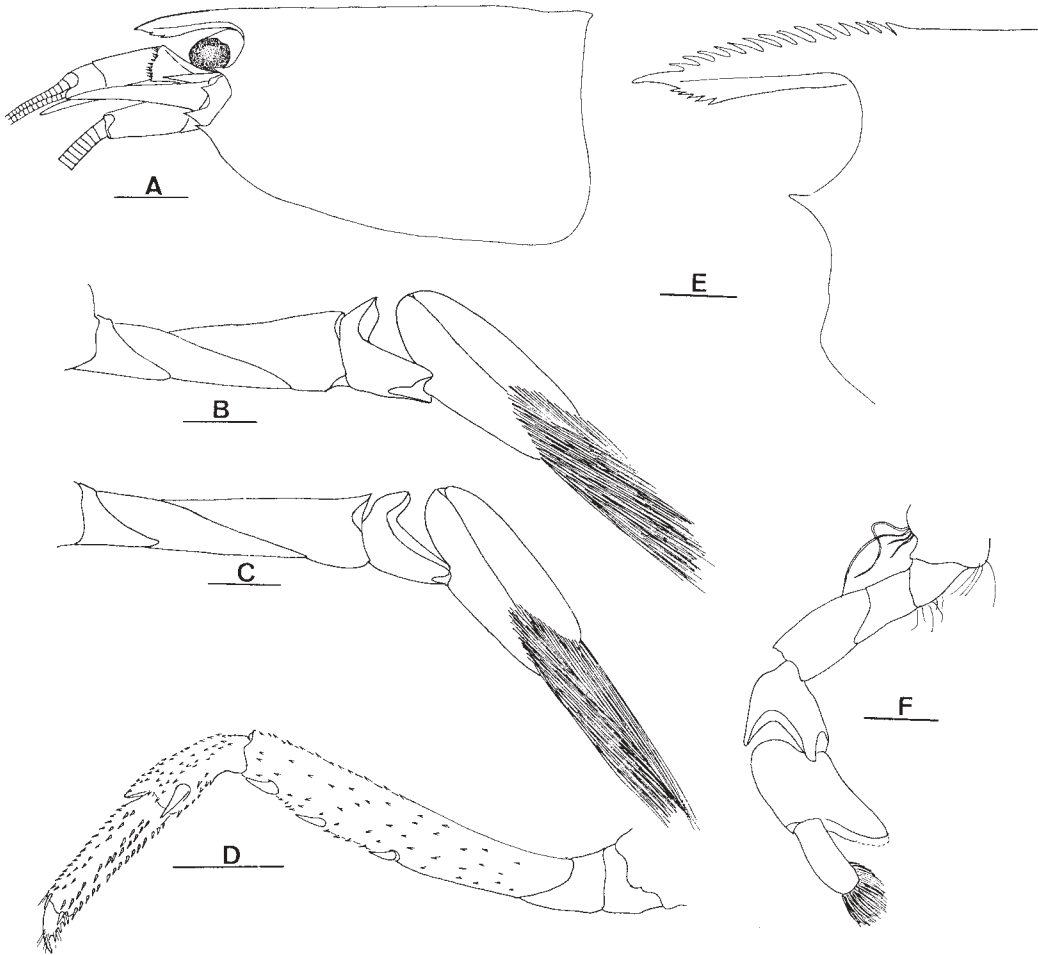


Fig. 2. *Atyopsis spinipes*, female, cl 9.2 mm (ZRC): A, cephalothorax; B, first pereopod; C, second pereopod; D, third pereopod. Scales: A, D = 2.0 mm; B, C = 1.0 mm. *Caridina* cf. *pareparensis*, female, cl 5.2 mm (ZRC): E, rostrum and anterior portion of carapace; F, first pereopod. Scales: E, F = 0.5 mm.

Material Examined.—1 ♀, cl 5.2 mm (damaged, ZRC), Sungai Ifis, Halmahera, Sep. 1994, leg. D. Robb.

Diagnosis.—Rostrum straight, reaching middle of second segment of antennular peduncle, rostral formula 4+10/5. Suborbital angle acute, fused with antennal spine. Pterygostomian margin rounded. First pereopod with fingers as long as palm. Carpus short, as long as high, deeply excavated in anterior margin. Merus stout, 1.2 times as long as wide.

Remarks.—The solitary damaged specimen cannot be identified with certainty. On the basis of the discernible characters, i.e., the form of rostrum and relatively stout first pereopod, we believe that it may be *C. pareparensis* De Man, 1892, a Sulawesi species known previously only from the original description.

Caridina villadolidi Blanco, 1939
Fig. 4A–E

Caridina typus var. *longirostris* De Man, 1892: 370, pl. 22: 22f–i [type locality: Palopo, Sulawesi (Celebes), Indonesia].

Caridina villadolidi Blanco, 1939: 389, pl. 1 [type locality: Laoag River, Luzon, Philippines].

Caridina typus—De Silva, 1982: 135, fig. 4a–h.

Caridina villadolidi—Hung *et al.*, 1993: 485, fig. 3.—Chace, 1997: 21, fig. 12.

Material Examined.—2 ♂♂, cl 4.5–7.5 mm (ZRC), Sungai Dodaga (1°10'N, 128°11'E), Halmahera, Aug. 1994, leg. D. Robb.

Remarks.—The Halmahera specimens agree well with description by Blanco (1939) and diagnoses given by Hung *et al.* (1993) and Chace (1997). Chace (1997: 22) stated that “This species is probably a synonym of *C. ty-*

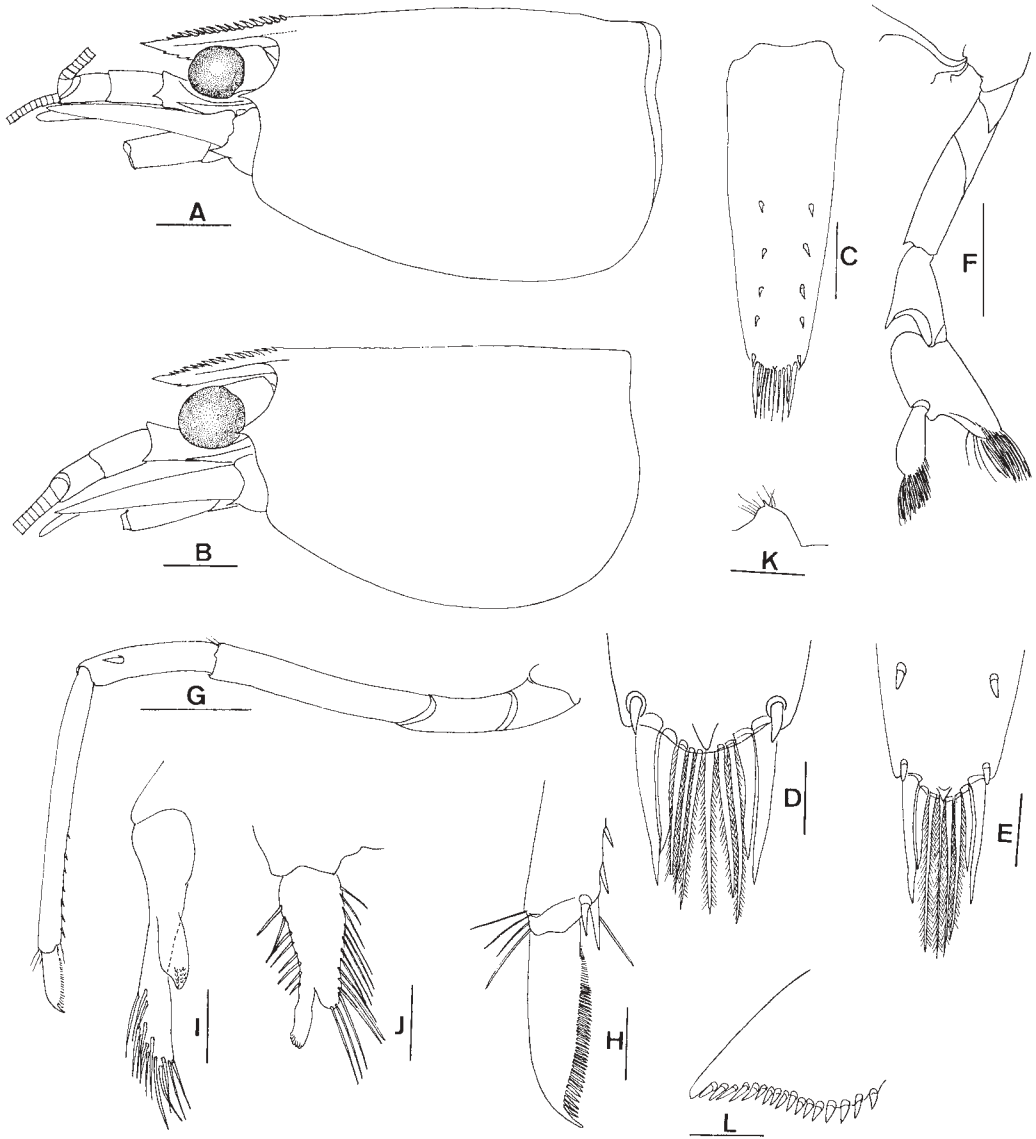


Fig. 3. *Caridina weberi*, female, cl 5.0 mm (ZRC): A, cephalothorax, ovigerous females; B, cephalothorax, male cl 3.0 mm (ZRC); C, telson, female, cl 5.0 mm; D, distal portion of same telson; E, distal portion of telson, cl 3.0 mm; F, first pereopod; G, fifth pereopod; H, dactylus of same leg; I, endopod of male first pleopod; J, appendix masculina and appendix interna of male second pleopod; K, preanal carina; L, uropodal diaeresis. Scales: A = 1.0 mm; B, D, K = 0.5 mm; C, E, H, I, J, L = 0.2 mm; F, G = 1.0 mm.

pus var. *longirostris* De Man, 1892: 369 from Sulawesi (Celebes) and Selajar, Indonesia, and possibly in turn, of *C. exilirostris* Stimpson, 1860." The description and figures of De Man (1892) and examination of fresh material from Sulawesi by present study (one female, cl 3.5 mm, ZRC, road from Sinjar to Sengkang, Sungai Buluat, Kec. Desa Ponra, Pampana, Kab. Bone, leg. M. Kottelat, 1992) show that *C. typus* var. *longirostris* (De Man,

1892) is actually identical to *C. villadolidi* Blanco, 1939. The name *Caridina typus* var. *longirostris* De Man, 1892, however, cannot be used as it is a junior homonym of *Caridina longirostris* H. Milne Edwards, 1837. The next available name for De Man's taxon is thus *C. villadolidi* Blanco, 1939.

The rostrum of *Caridina exilirostris* Stimpson (1860: 98) is ". . . valde gracile, compressum, angustum, acutum, medium articuli

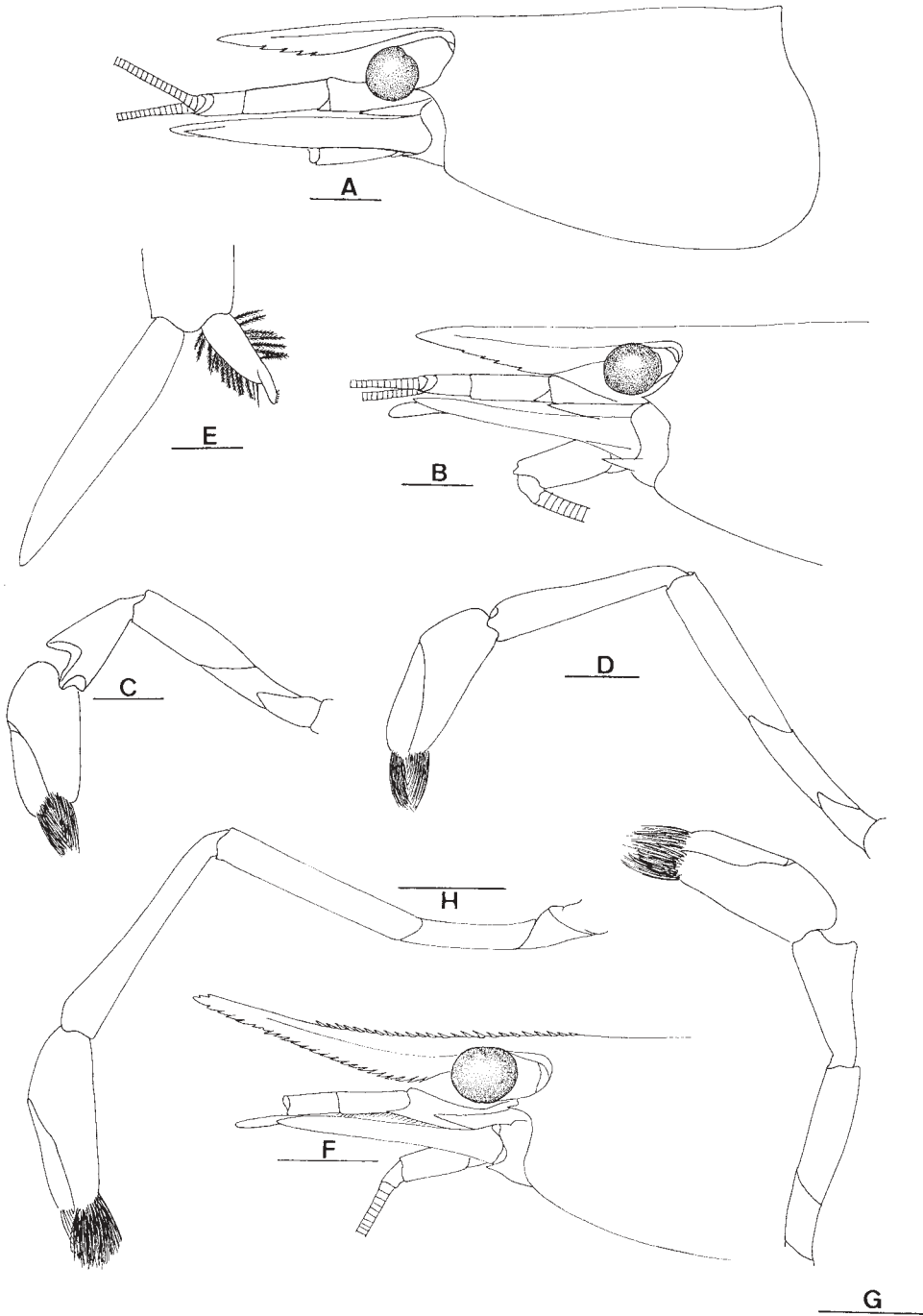


Fig. 4. *Caridina villadolodi*: A, cephalothorax, male, cl 4.5 mm (ZRC); B, anterior portion of cephalothorax, male, cl 7.0 mm (ZRC); C, first pereiopod; D, second pereiopod; E, male first pleopod. Scales: A, B = 1.0 mm, C, D, E = 0.5 mm. *Caridina brevidactyla*, ovigerous female, cl 6.2 mm (ZRC); F, anterior portion of cephalothorax; G, first pereiopod; H, second pereiopod. Scales: F, G, H = 1.0 mm.

penultimi antennularum pedunculi parce superans . . ." (slender, compressed, narrow, acute, reaching to the middle of second segment of antennular peduncle), while that of *C. villadolidi*, as a rule, reaches to or nearly to the end of the antennular peduncle. As such, we believe *C. exilirostris* and *C. villadolidi* are not synonymous. Also, *C. villadolidi* has never been reported from the Ryukyu islands, the type locality of *C. exilirostris*, thus far, we agree with Bouvier (1925) that *C. exilirostris* may only be a synonym of *C. typus*, a species which is quite common in the Ryukyus. The exact status of *C. exilirostris* may never be known because the type material was lost in the great Chicago fire in 1871 (Manning, 1993).

De Silva (1982: 135) reported *C. typus* from Sri Lanka and stated that ". . . the rostrum of my specimens differ markedly from those described by Bouvier (1925) and Tiwari and Pillai (1971) and from that of *C. typus* from the Seychelles and Reunion. In the latter, the rostrum extends to about the middle of the second antennular peduncle and not beyond and bears 0–3 teeth on the ventral border. In the specimens described here, the rostrum, more often than not, extends beyond the distal end of the second antennular segment and bear up to 7 teeth." On the basis of his description and figures, the Sri Lankan specimens should be referred to *C. villadolidi* instead.

Caridina villadolidi is distributed from Taiwan (Hung *et al.*, 1993), the Philippines (Blanco, 1939; Chace, 1997), Sulawesi and Halmahera in Indonesia, to Sri Lanka.

Caridina brevidactyla Roux, 1919
Figs. 4F–H, 5

Caridina nilotica brevidactyla Roux, 1919: 82 [type locality: Kepulauna Aru, Indonesia].—Roux, 1928: 198.

Material Examined.—1 ♀ (ovigerous), cl 5.2 mm (ZRC), Sungai Ifis, Sept. 1994, leg. D. Robb; 2 ♂♂, cl 3.0–4.2 mm, 2 ♀♀ (ovigerous), cl 5.8–6.2 mm (ZRC), Sungai Dodage, Halmahera, Aug. 1994, leg. D. Robb.

Diagnosis.—Rostrum slightly longer than carapace, reaching beyond end of scaphocerite, upturned anteriorly. Rostral formula: 2–3+17–22+1–2/18–23. Antennal spine placed below suborbital angle. Pterygostomian margin rounded. Telson with posteromedian projection, sublateral pair of posterior spines subequal to those of intermediate pairs. Carpus of first pereiopod 2.2 times as long as

high; chela 2.3 times as long as broad, with fingers 1.4 times as long as palm. Carpus of second pereiopod 5.8 times as long as high, fingers 1.4 times as long as palm. Dactylus of third pereiopod short, 0.16 of propodus, ending as large claw, with 4 or 5 accessory spines on flexor margin. Dactylus of fifth pereiopod short, 1/6 as long as propodus, with 57 spinules on flexor margin. Preanal carina without spines. Uropodal diaeresis with 12 movable denticles. Eggs 4.15 × 2.25 mm in diameter.

Remarks.—The Halmahera specimens fit well with the descriptions of the species by Roux (1919, 1928). With regards to the short dactylus of the last three pereiopods, *C. brevidactyla* most closely resembles *C. brachydactyla* De Man, 1908. *Caridina brevidactyla* can be distinguished by the rostrum having more ventral teeth, by the proportions of various joints of the pereiopods, and by the absence of an enlarged spine at the posterior margin of the propodus on each of the last three pereiopods. *Caridina brevidactyla* also differs from another close congener, *C. brachydactyla peninsularis* Kemp, 1918, by the rostral form. The latter has a rostrum completely armed with closely placed dorsal teeth.

Caridina brevidactyla has generally been regarded as a subspecies of *C. nilotica* (Roux), but in most of the characters discussed, it is in fact closer to *C. brachydactyla brachydactyla* and *C. brachydactyla peninsularis*. As such, *C. brevidactyla* should not be regarded as a subspecies of *C. nilotica* and is here regarded as a distinct species for the time being.

Caridina brachydactyla De Man, 1908
Fig. 6

Caridina wyckii—De Man, 1892: 386, fig. 29f, g, i, ii, k, cc, dd.

Caridina nilotica brachydactyla De Man, 1908: 269, pl. 20, figs. 8a–c [type locality: Sulawesi (Celebes), Saleyer and Flores, Indonesia].

Caridina brachydactyla—Bouvier, 1913: 463.—Holthuis, 1978: 37.

Caridina brachydactyla brachydactyla—Tiwari and Pillai, 1971: 80.

Material Examined.—2 ♂♂, both cl 5.0 mm (ZRC), Sungai Okitoi, near Wosile (1°04'N, 127°59'E), Halmahera, Aug. 1994, leg. D. Robb.

Diagnosis.—Rostrum horizontal, reaching end of scaphocerite, slightly shorter or as long as carapace. Rostral formula: 3–4+19–21+1–2/11–12. Antennal spine placed below

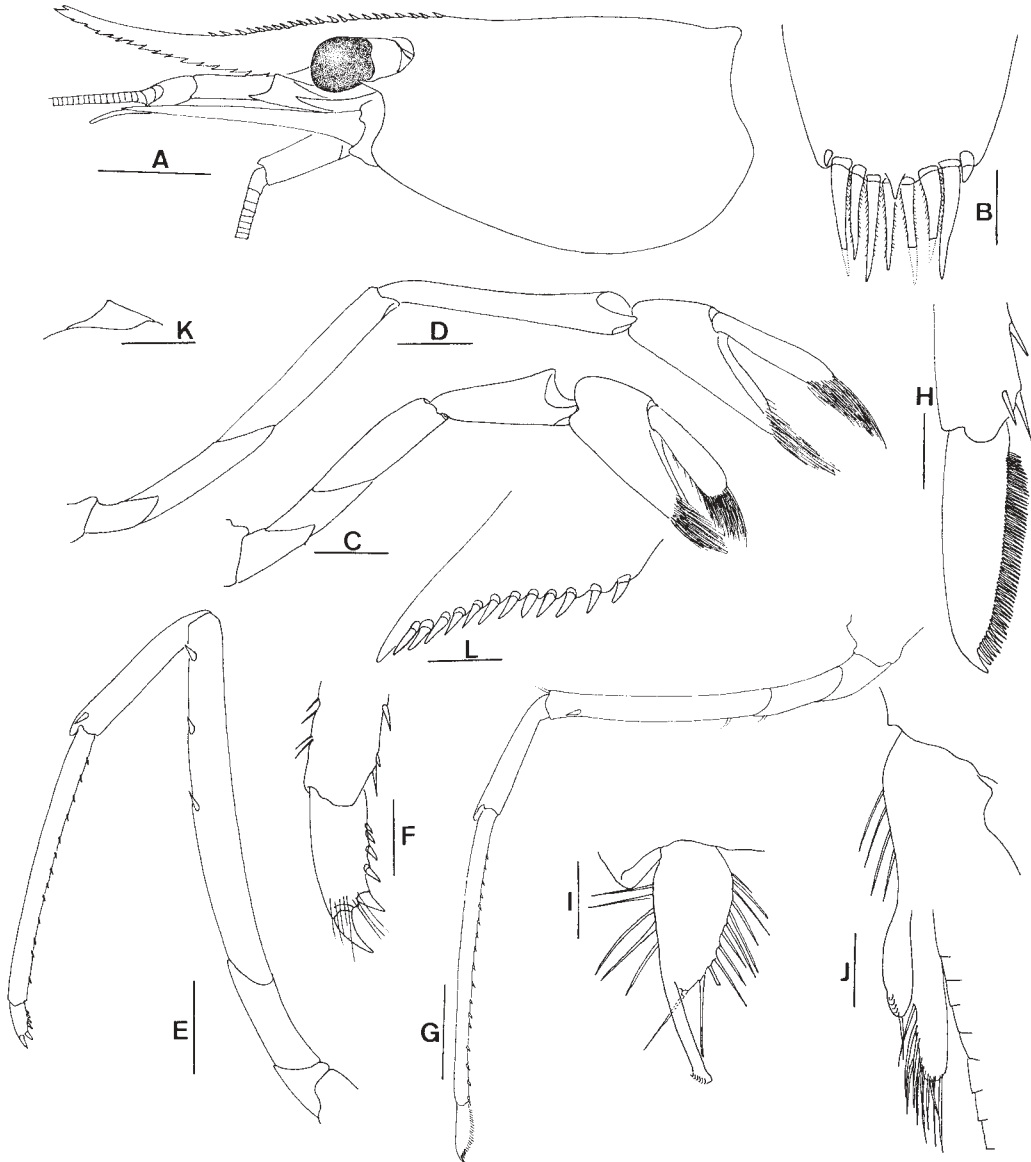


Fig. 5. *Caridina brevidactyla*: A, cephalothorax, ovigerous female, cl 5.2 mm (ZRC); B, telson, female, cl 6.2 mm (ZRC); C, first pereiopod; D, second pereiopod; E, third pereiopod; F, dactylus, same leg; G, fifth pereiopod; H, dactylus of same leg; I, endopod of male first pleopod; J, male second pleopod; K, preanal carina; L, uropodal diaeresis. Scales: A = 2.0 mm; B, F, H, I, J, L = 0.2 mm; C, D, K = 0.5 mm; E, G = 1.0 mm.

suborbital angle. Pterygostomian margin rounded. Telson without posteromedian projection, sublateral pair of posterior spines subequal to intermediate pairs. Carpus of first pereiopod 2.5 times as long as high; chela 2.5 times as long as broad, with fingers 2.0 times as long as palm. Carpus of second pereiopod 5.6 times as long as high, fingers 2.3 times as long as palm. Dactylus of third pereiopod

short, 0.17 of propodus, ending in large claw, with 4 or 5 accessory spines along flexor margin. Dactylus of fifth pereiopod short, 0.18 as long as propodus, ending in strong large claw, with 40 to 42 spinules along flexor margin. Endopod of male first pleopod triangular, with elongate appendix at distal end. Preanal carina unarmed. Uropodal diaeresis with 9 movable denticles.



Fig. 6. *Caridina brachydactyla*: A, cephalothorax, male, cl 5.0 mm (ZRC); B, rostrum and anterior portion of carapace, male, cl 5.0 mm (ZRC); C, distal portion of telson; D, first pereiopod; E, second pereiopod; F, third pereiopod; G, dactylus, same leg; H, fifth pereiopod; I, dactylus, same leg; J, male first pleopod; K, male second pleopod; L, preanal carina; M, uropodal diaeresis. Scales: A = 2.0 mm; B = 1.0 mm; C, G, I = 0.2 mm; D, E, F, H, J, K, L, M = 0.5 mm.

Remarks.—*Caridina brachydactyla* De Man, 1908, has generally been accepted as a valid taxon due to the distinctive features of its rostral form, short last three pereiopods, and the

structure of the dactylus of the last three pereiopods. The name, however, has been used in different combinations, viz. *C. nilotica* var. *brachydactyla* (De Man, 1908; Bou-

vier, 1925); *C. brachydactyla* (Bouvier, 1905; Holthuis, 1978); and *C. brachydactyla brachydactyla* (Kemp, 1918; Tiwari and Pillai, 1971).

The Halmahera material, however, differs slightly from the types of *C. brachydactyla* (*vide* De Man, 1892) in that the distal spine on the posterior margin of propodus of the third to fifth pereopods is not enlarged. The significance of this difference can only be resolved when more specimens become available for a detailed study.

Caridina gracilirostris De Man, 1892

Fig. 7

Caridina gracilirostris De Man, 1892: 399, pl. 25: fig. 31–31d [type locality: Balangnipa, Sulawesi (Celebes) Indonesia].—Bouvier, 1925: 142, figs. 305–307.—Holthuis, 1965: 23, fig. 7.—Tiwari and Pillai, 1971: 83, fig. 2a, b.—Chace, 1997: 10, fig. 4.

Material Examined.—1 ♂, cl 5.2 mm, 1 ♀, cl 6.3 mm (ZRC), Sungei Dodaga, Halmahera, Sep. 1994, leg. D. Robb.

Remarks.—The rostra of both specimens are broken off, but the remaining parts still suggest that they are almost certainly *C. gracilirostris*. While Holthuis (1965) and Chace (1997) showed that specimens from Madagascar and Philippines have a distinct appendix interna on the male first pleopod, the single male specimen from Halmahera lacks this structure. Unfortunately, De Man (1892) did not describe the structure of the sexual appendages.

De Man (1892) recorded different forms of carpus for this species, a short-carpus form from Celebes and a long-carpus form from Flores. Tiwari and Pillai (1971) also reported both forms from different parts of the Andaman islands. The Halmahera specimens belong to the short-carpus form. The significance of these two forms (and the supposed variation in the form of the appendix interna), as well as various taxonomic and nomenclatural problems involved is now being studied in detail and will form the basis of a revision of this species complex at a later date.

FAMILY PALAEMONIDAE

Macrobrachium rosenbergii rosenbergii
(De Man, 1879)

Palaemon Rosenbergii De Man, 1879: 167 [type locality: Andai, New Guinea (Irian Jaya), Indonesia].
Palamon carcinus rosenbergii Ortmann, 1891: 701.

Palaemon (Eupalaemon) carcinus—De Man, 1902: 763.
Macrobrachium rosenbergii—Holthuis, 1950: 111 (part).—Johnson, 1960: 260, fig. 1.—Lindenfelser, 1984: 195.

Macrobrachium rosenbergii rosenbergii—Johnson, 1973: 277.—Chace and Bruce, 1993: 36, fig. 15.—Holthuis, 1995: 148.

Remarks.—De Man (1879) described *Palaemon rosenbergii* on the basis of an adult female specimen from Andai, New Guinea (Irian Jaya, Indonesia), for which he had considered it to be very similar to, but different from, *Palaemon carcinus* Fabricius, 1798. The latter species had also been reported in the same paper, on the basis of specimens from Siam (Thailand), Java, and Minahassa of Celebes (Sulawesi). *Macrobrachium carcinus* was later shown to be restricted to the Americas, and the name *Macrobrachium rosenbergii* was used for the species from the Indo-Pacific (Holthuis, 1995). Johnson (1960) highlighted the differences between specimens from the western (Myanmar, Malay Peninsula, Java) and the eastern (New Guinea) parts of the region and recognised two subspecies, but he did not apply names to them for his material from Celebes and Moluccas was inadequate. Subsequently, Johnson (1973) provided a more detailed comparison and named the western subspecies *Macrobrachium rosenbergii schenkeli*, being unaware of *Palaemon dacqueti* Sunier, 1925. Chace and Bruce (1993) accepted this separation in their checklist. However, in the main text of their work in which they dealt with a single large male from the Zambanga River, Mindanao, Philippines, they included two synonyms for the western subspecies, viz. *Palaemon whitei* Sharp, 1893 (*nomen nudum*, *sensu* Holthuis, 1995) and *Palaemon dacqueti* Sunier, 1925, and stressed that their specimen seemed to represent the typical variety on the basis of the characters proposed by Johnson (1973) but that far more effort must be devoted to the problem before a satisfactory solution was possible. Schenkel (1902), however, had described *Palaemon spinipes* Schenkel, 1902, from Kema, Minahassa, northeastern Sulawesi, a name which has long been under the synonymy of *M. rosenbergii* (see Holthuis, 1950). Holthuis (1995) subsequently designated a lectotype for *P. dacqueti* Sunier, 1925, from specimens from Java and pointed out

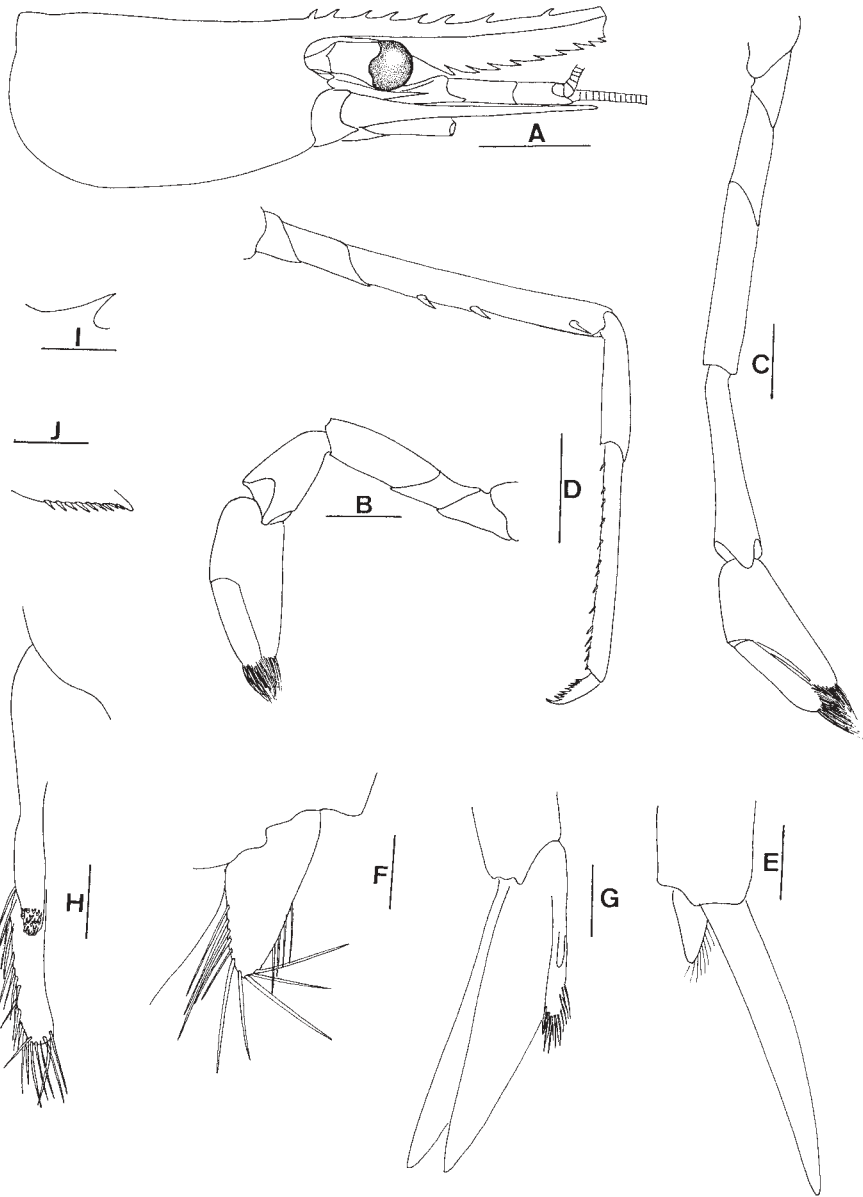


Fig. 7. *Caridina gracilirostris*, male, cl 5.2 mm (ZRC); A, cephalothorax; B, first pereiopod; C, second pereiopod; D, third pereiopod; E, male first pleopod; F, endopod of male first pleopod; G, male second pleopod; H, appendix masculina of male second pleopod; I, preanal carina; J, uropodal diaeresis. Scales: A = 2.0 mm; B, C, J = 0.5 mm; D = 1.0 mm; E-I = 0.2 mm.

that the name *Macrobrachium rosenbergii dacqueti* (Sunier, 1925) should be used for the western subspecies if it is recognised. This name is thus also a senior synonym of *Macrobrachium rosenbergii schenkeli* Johnson, 1973. Holthuis (1995) also commented that on the basis of Schenkel's (1902) description

and figures, it was likely that his Sulawesi material belongs to the typical, i.e., eastern subspecies, *M. rosenbergii rosenbergii*.

De Man (1902) recorded *P. carcinus* from Tobelo, Halmahera. The subspecific status cannot be ascertained on his description because it was based on specimens from several

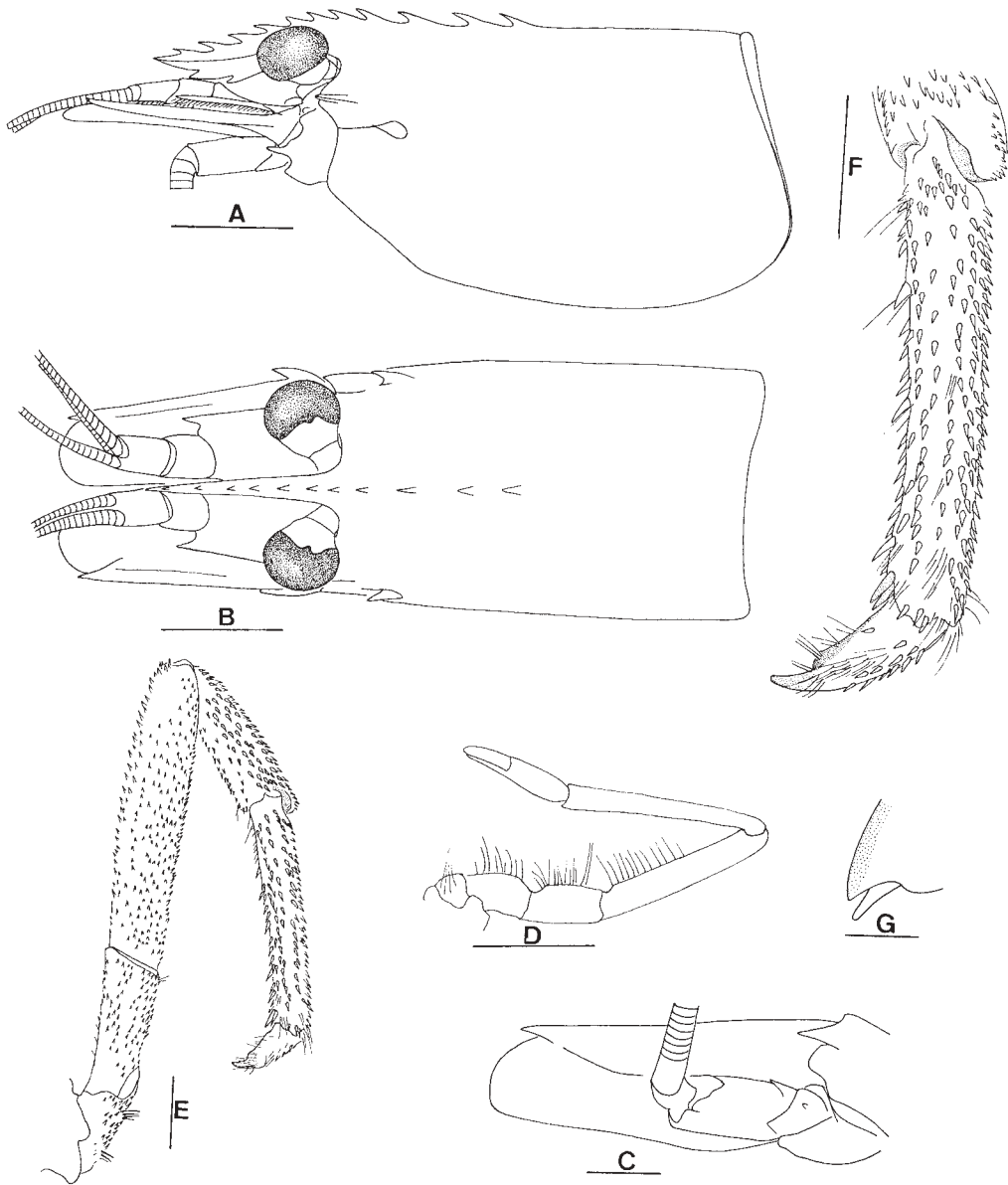


Fig. 8. *Macrobrachium spinosum*, new species, holotype, male, cl 17.5 mm (MZB): A, cephalothorax; B, cephalothorax, dorsal view; C, scaphocerite; D, first pereiopod; E, third pereiopod; F, dactylus, same leg; G, uropodal diaeresis. Scales: A, B, D = 5.0 mm; C = 2.0 mm; E, F = 1.0 mm; G = 0.5 mm.

localities in Indonesia. Because the Sulawesi form is likely the eastern subspecies (Holthuis, 1995) and the Mindanao is also represented by eastern subspecies, it is reasonable to assume that the Halmahera form is most probably the eastern subspecies as well.

***Macrobrachium spinosum*, new species**
Figs. 8, 9

Material Examined.—Holotype: 1 ♂, cl 21 mm (MZB 1441), Sungai Dadago, Halmahera, Aug. 1994, leg. J. Robb.

Paratypes: 3 ♂♂, cl 10.0–17.0 mm, 1 ♀, cl 13 mm (ZRC), same data as holotype.

Other specimens: 2 ♂♂, cl 13–17.5 mm (MZB 1442), 1 ♂, cl 16.5 mm (ZRC), Besitang, Sikundur, Kab. Langkat, Sumatra, Indonesia, 15 Oct. 1981, leg. D. Wowor; 1 ♂, cl 18 mm (ZRC), Bali, stream inland of Mediwī, 7–10 km from the sea, leg. A. J. Whitten *et al.*, 26 Mar. 1992.

Description.—Rostrum reaching middle of third segment of antennular peduncle, slightly elevated at base, rostral formula 4–6(mode 4)+6–10(mode 6–8)/2–3(mode 2),

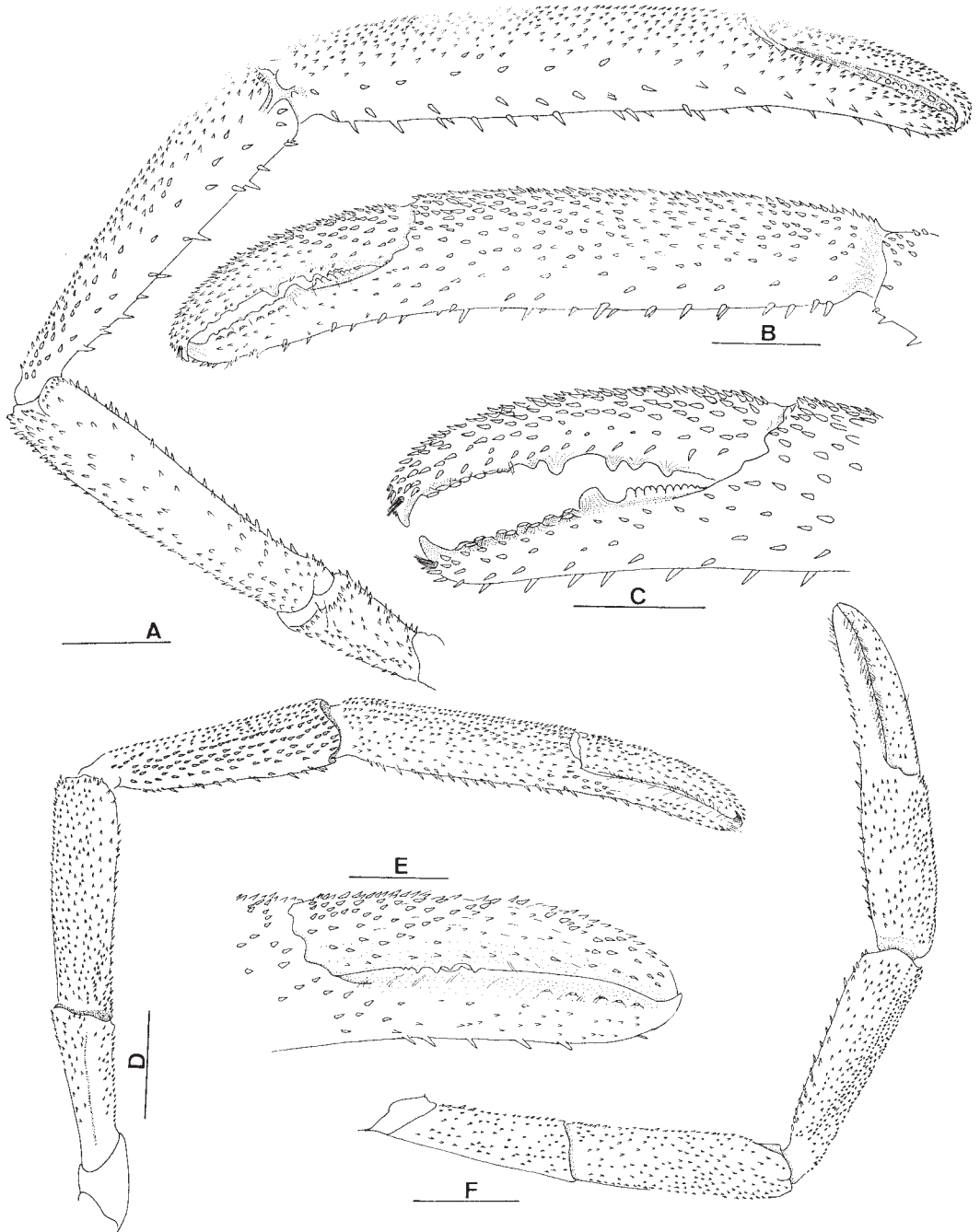


Fig. 9. *Macrobrachium spinosum*, new species, holotype, male, cl 17.5 mm (MZB): A, major second pereiopod; B, chela, same leg; C, fingers, same leg; D, minor second pereiopod; E, fingers, same leg; F, female major second pereiopod, cl 13 mm (ZRC). Scale: A, B, D, F = 5.0 mm; C = 4.0 mm; E = 2.0 mm.

first tooth placed almost at middle of carapace, teeth placed wider posteriorly than anteriorly. Distance between postorbital edge and first dorsal teeth as long as rostrum in young or subadults, longer than rostrum in

adults. Antennular peduncle half as long as carapace. Scaphocerite 2.7 times as long as wide. Third maxilliped reaching end of antennular peduncle, ultimate segment shorter than penultimate segment.

First pereopod reaching by $\frac{1}{4}$ of carpus beyond distal end of scaphocerite, fingers shorter than palm, chela 0.6 times as long as carpus. Second pereopods longer than body. In adult male, major leg reaching by $\frac{1}{3}$ of merus beyond scaphocerite; merus 4.2 times as long as wide, slightly shorter than carpus. Carpus slightly shorter than palm, 4.3 times as long as high; palm 1.4 times as long as fingers, 4 times as long as wide; fingers 0.6 times as long as palm, movable finger with 4 teeth at proximal half of cutting edge, size increasing distally, distance between last two equal to distance between first and third one; proximal $\frac{1}{3}$ cutting edge of immovable finger armed with ridge formed by row of 8–10 small teeth, 1 much larger tooth, positioned medially, fits gap between 2 distal teeth of movable finger when closed; with 5–9 round tubercles at distal half of cutting edges of each finger, outer surface of whole leg densely armed with small, rounded-to-sharp, anteriorly directed, scale-like spinules; inner surface sparsely armed with very strong short spines; suture running throughout outer surface of carpus and distal $\frac{1}{3}$ of palm. Minor leg of adult male similar to major one in shape with exception of carpus, which is as long as palm. Second pereopods of female similar in shape, subequal in size; merus slightly shorter than carpus; carpus longer than palm; fingers as long as palm, with several small teeth on proximal $\frac{1}{3}$ of cutting edges; surface armed with spinules, spine, and suture as in male. Third pereopods reaching by half of dactylus length beyond distal end of scaphocerite, merus stout, armed with small, rounded-to-sharp, anteriorly directed, scale-shaped spinules; 4.7 times as long as wide; carpus half as long as merus; propodus 6.5 times as long as wide; dactylus ending in hook-like spine, 0.3 times as long as propodus. Last two legs similar to third one in form.

Uropodal diaeresis with spine slightly longer than outer angle.

Remarks.—*Macrobrachium spinosum*, new species, is very similar to *M. horstii* (De Man, 1892) (Figs. 10, 11) (one male, cl 18 mm, ZRC, Leyte, Philippines; leg. M. Kottelat, 1993), especially in the form of the second pereopods. *Macrobrachium spinosum*, new species, however, can be separated from *M. horstii* by several characters, viz. the rela-

tively more slender second pereopods of the adult male, with a merus 4.2 times as long as wide (vs. 3.3 times in *M. horstii*), a carpus 4.3 times as long as high (vs. 2.9 times), a chela 5.9 times as long as wide (vs. 5.0 times), fingers 2.3 times the width of the chela (vs. 1.7 times); the suture on the outer surface of the second pereopods is indistinct (vs. distinct); the relatively more slender third pereopod, with a merus 4.7 times as long as wide (vs. 3.9 times) and a propodus 6.5 times as long as wide (vs. 6.0 times); the smaller uropodal spine (Fig. 8G vs. Fig. 10G); the shorter rostrum, which is 0.46 times length of carapace (vs. 0.55 times); and the larger eye, which is 0.30 times width of carapace (vs. 0.25 times).

Macrobrachium spinosum also resembles *M. jaroense* (Cowles, 1914) (one male, cl 23.5 mm, Lotung, Taiwan, leg. Shy and Lai, 12 Oct. 1985, NTOU), which has a similar rostral form and similarly shaped tubercles along the cutting edges of the fingers, but can be readily distinguished from the latter species by the form of the second pereopods, having the merus 4.2 times as long as wide (vs. 2.6 times), the carpus 4.3 times as long as high (vs. 2.3 times), the fingers 0.55 times as long as the palm, 2.3 times width of the chela (vs. 0.75 to 1.33 and 2.5 to 3.0 times respectively in *M. jaroense*); and the cutting edges of the fingers lined only with sparse setae (vs. concealed by dense pubescence).

Macrobrachium horstii is known from Sulawesi (Celebes, type locality), Bali (Roux, 1930; Holthuis, 1950), and the Philippines, while *M. spinosum* is found in Halmahera, Bali, and Sumatra.

Macrobrachium idae (Heller, 1862)

Figs. 12, 13

Palaemon Idae Heller, 1862: 416, pl. 2: figs. 40, 41 [type locality: Borneo].

Palaemon (Eupalaemon) ritsemae De Man, 1897: 774 [type locality: Atjeh, northwestern Sumatra].

Palaemon (Eupalaemon) robustus De Man, 1902: 771, pl. 24: fig. 48 [type locality: Halmahera, Indonesia].

Macrobrachium idae—Holthuis, 1950: 142, fig. 33.—Chace and Bruce, 1983: 27, fig. 6.—Yeo *et al.*, 1999: 226.

Macrobrachium palawanensis Johnson, 1962: 307, fig. 1 [type locality: Palawan, Philippines]; 1973: 274, 282.

? *Macrobrachium palawanense*—Chace and Bruce, 1983: 27.

Material Examined.—Lectotype of *Palaemon (Eupalaemon) robustus* (hereby designated), 1 ♂, cl 35 mm (SMF 8430), Tabolo, Halmahera, 1894, leg. W. Küenthal. Paralectotypes of *Palaemon (Eupalaemon) robustus*, 2 ♀♀ (1

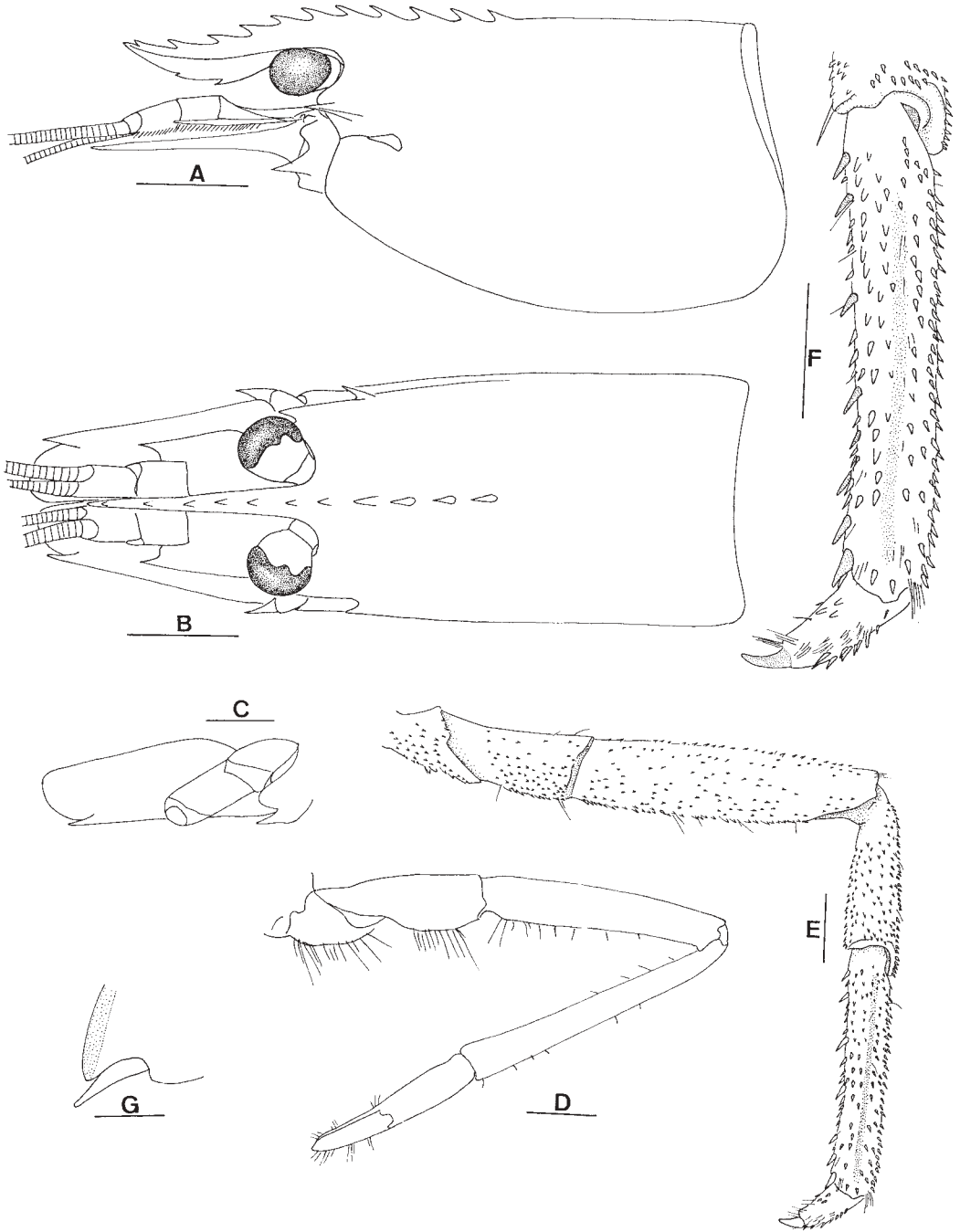


Fig. 10. *Macrobrachium horstii*, male, cl 18.0 mm (Leyte, Philippine, ZRC): A, cephalothorax; B, cephalothorax, dorsal view; C, scaphocerite; D, first pereiopod; E, third pereiopod; F, dactylus and propodus, same leg; G, uropodal diaeresis. Scales: A, B, C = 5.0 mm; D, E, F = 2.0 mm; G = 0.5 mm.

ovigerous), cl 23–27 mm (SMF 8429), Kau, Halmahera, 1894, leg. W. Kükenthal. Lectotype of *Palaemon idae*, 1 ♂, cl 22.5 mm (NHMW 7696), Borneo, leg. Ida Pfeiffer, Jan. 1854.

Comparative material: Holotype of *Macrobrachium palawanensis*, 1 ♂, cl 18 mm (BMNH 1958.9.29.1), Palawan, Philippines, leg. A. Everett, July 1894.

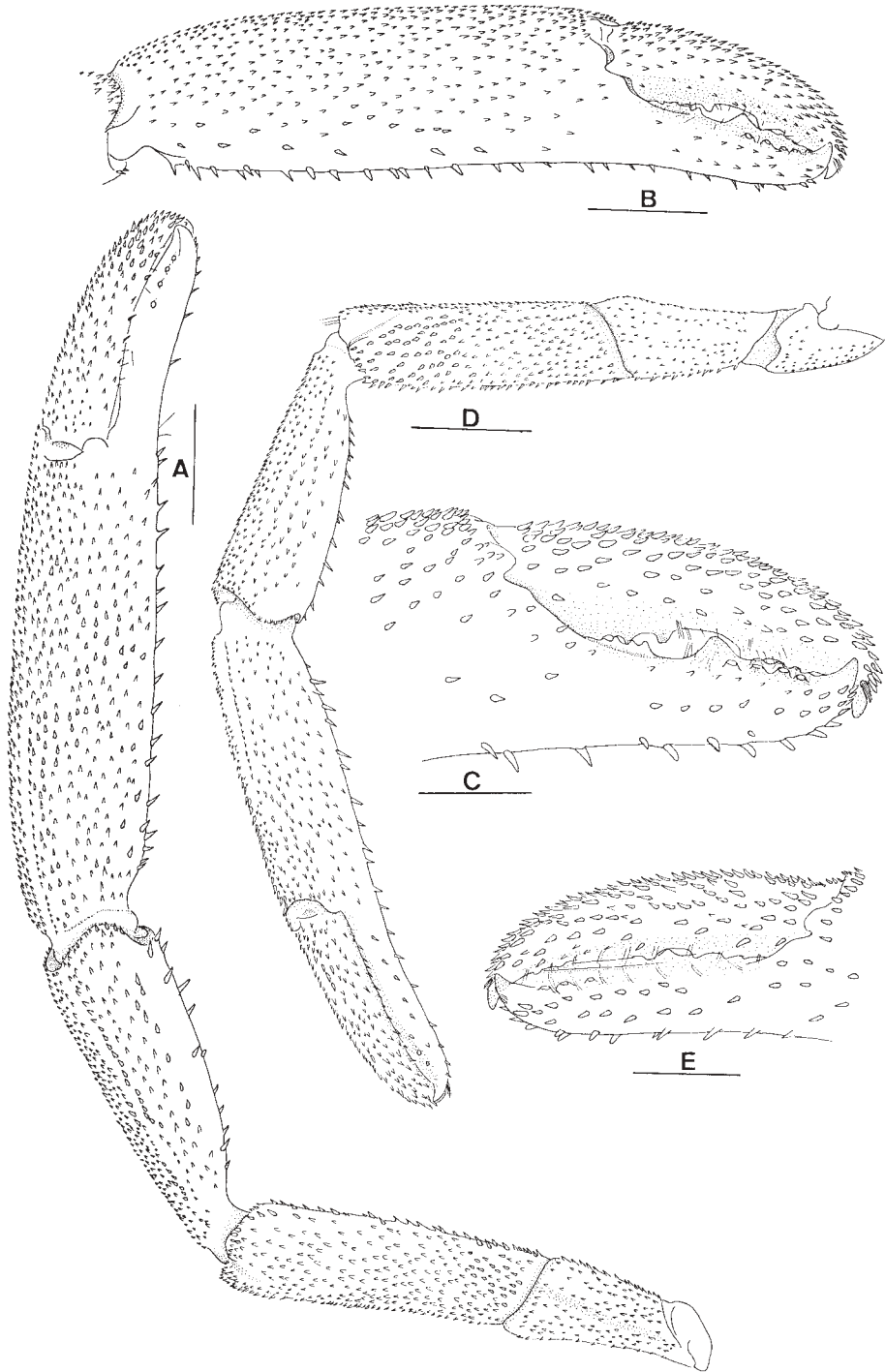


Fig. 11. *Macrobrachium horstii*, male, cl 18.0 mm (Leyte, Philippine, ZRC): A, major second pereiopod; B, chela, same leg; C, fingers, same leg; D, minor second pereiopod; E, fingers, same leg. Scales: A, B, D = 5.0 mm; C, E = 3.0 mm.

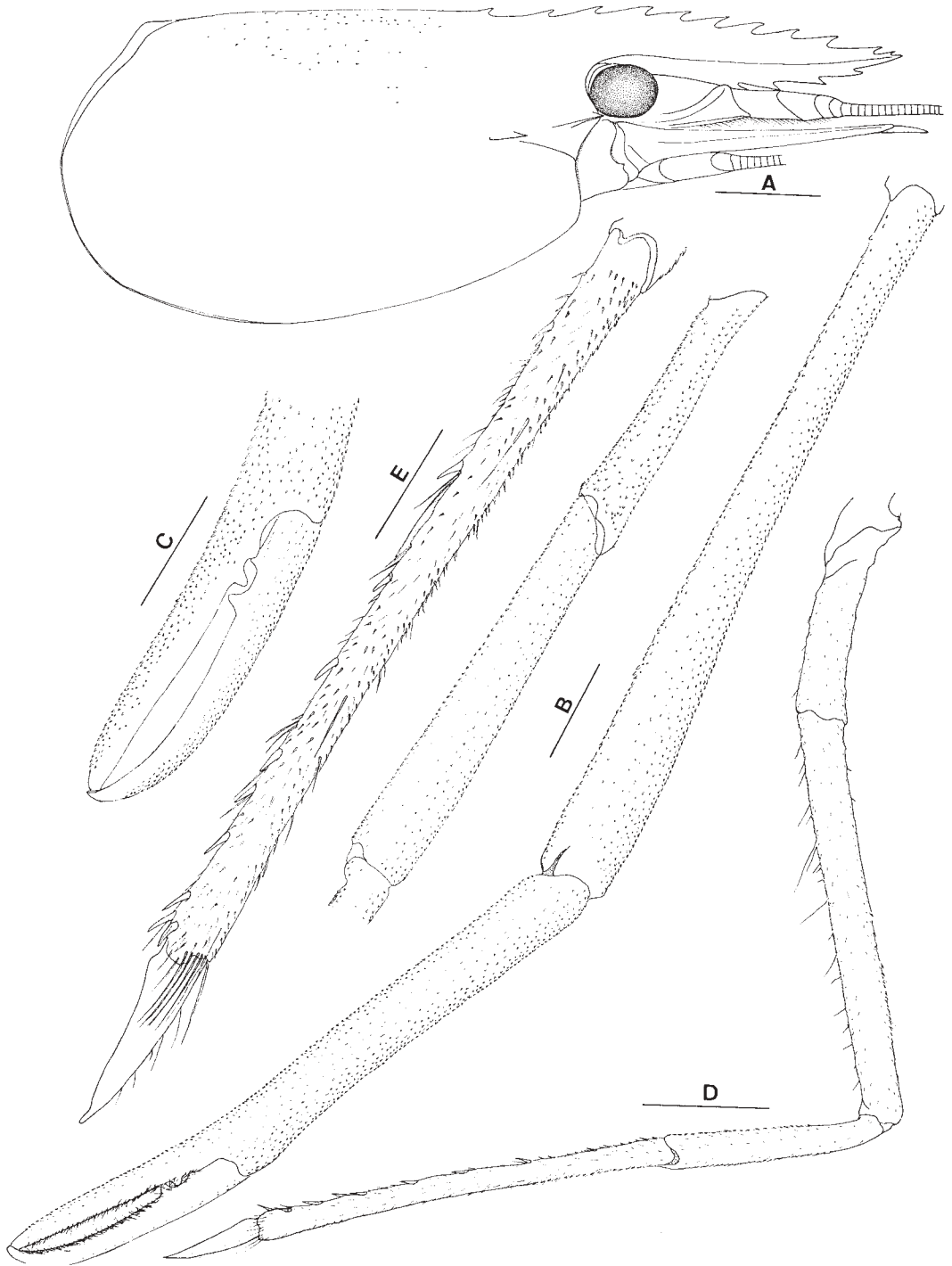


Fig. 12. *Macrobrachium idae*, lectotype male, cl 22.5 mm (Borneo, NHMW 7696): A, cephalothorax; B, second pereiopod; C, fingers of chela of major second pereiopod; D, third pereiopod; E, dactylus and propodus of third pereiopod. Scale: A, B = 5.0 mm; C, D = 4.0 mm; E = 2.0 mm.

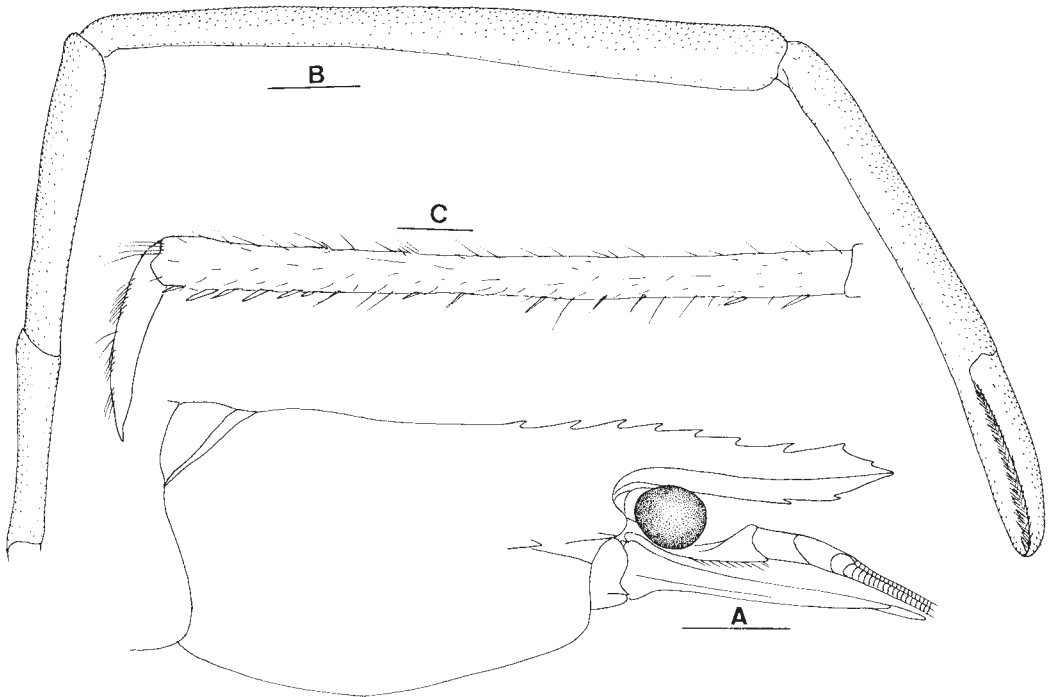


Fig. 13. *Macrobrachium idae*, holotype of *Macrobrachium palawanense*, male, cl 18 mm (Palawan, BMNH 1958.9.29.1): A, cephalothorax; B, second pereiopod; C, third pereiopod. Scales: A, B = 5 mm; C = 1 mm.

Remarks.—*Macrobrachium idae* was originally described from Borneo by Heller (1862). This species is characterized by its long carpus, which is distinctively longer than the chela. De Man (1902) reported it from Kau under the name *Palaemon (Eupalaemon) robustus*, a taxon which Holthuis (1950) stated was an undoubted synonym of *M. idae*, although he did not check the types. The present examination of the syntypes of *Palaemon robustus* confirms his identification. De Man (1902: 771) described and figured *Palaemon robustus* on the basis of one male and three female specimens. In addition to the male and two females re-examined by the first author in SMF, there is another syntype kept in ZMA (one ovigerous female cl 20.6 mm, ZMA De 102.663, D. Wowor, personal communication). The syntype male specimen (SMF 8430), which is the largest specimen in the type series and shows more characteristics of the species, is here designated the lectotype of *Palaemon robustus* De Man, 1902. The major leg of that male specimen, which was figured by De Man (1902), is no longer present in the syntype material.

Chace and Bruce (1993: 27) doubtfully synonymized *Macrobrachium palawanense* Johnson, 1962, with *M. idae*, but noted that “. . . *Macrobrachium palawanense* may be a valid species, but we have been unable to distinguish it from *M. idae* on the basis of the descriptions and illustrations published by Johnson (1962).” To resolve this problem, one syntype of *P. idae* Heller, 1862 (male, cl 22.5 mm, NHMW 7696) (Fig. 12) and the holotype of *M. palawanensis* (male, cl 18 mm, BMNH 1958.9.29.1) (Fig. 13) were compared directly. Both species are clearly conspecific, and we can find no major differences. This is supported by our re-examination of a series of Malayan specimens (1 male, cl 15.1 mm, 2 females, cl 9.5–10.5 mm, 14 juveniles, J220–242, semistagnant blackwater, tributary of Pahang River, at Pekan, Pahang, 3 Aug. 1956, leg. D. S. Johnson, ZRC), which had been referred to *M. palawanensis* by Johnson (1962), all of which are *M. idae* as presently defined. To stabilise the taxonomy of this species, we hereby designate the male syntype (cl 22.5 mm, NHMW 7696) as the lectotype of *Palaemon idae* Heller, 1862 (Fig. 12).

Macrobrachium idae has a wide distribution in the Indo-West Pacific from Madagascar to Admiralty Islands.

Macrobrachium australe
(Guérin-Méneville, 1838)

Fig. 14A–D

Palaemon australis Guérin-Méneville, 1838: 37 [type locality: Tahiti, French Polynesia].

Palaemon sondaicus Heller, 1862: 415, pl. 2: figs. 38, 39 [type locality: Java, Indonesia].

Palaemon dispar Von Martens, 1868: 41 [type locality: Pulau Adonara, east of Flores, Indonesia].

Palaemon (Eupalaemon) dispar—De Man, 1902: 766.

Macrobrachium australis—Holthuis, 1950: 124, figs. 27–30.—Chace and Bruce, 1993: 23, fig. 2.

Material Examined.—1 ♂, cl 10 mm, 2 ♀♀, cl 15–21 mm (ZRC), Sungai Dodago, Halmahera, Aug. 1994, leg. D. Robb; 1 ♀ (SMF 8423), Oba, northern Halmahera, 1894, leg. W. Kükenthal.

Remarks.—The species has a wide distribution range in the Indo-West Pacific, from Madagascar to Polynesia. It had been reported from Oba, North Halmahera (De Man, 1902) under the name *Palaemon (Eupalaemon) dispar*.

Macrobrachium lar (Fabricius, 1798)
Fig. 14E

Palaemon Lar Weber, 1795: 94 [*nomen nudum*].

Palaemon Lar Fabricius, 1798: 402 [type locality: Rin India Dom. Daldorf].

Palaemon (Eupalaemon) lar—De Man, 1902: 774; 1905: 205, pl. 15, fig. 5; 1915: 415.

Macrobrachium lar—Holthuis, 1950: 176, fig. 37.—Chace and Bruce, 1993: 30, fig. 9.—Yeo *et al.*, 1999: 236.

Material Examined.—1 ♀, cl 11 mm, Sungai Ifis, Halmahera, Sep. 1994, leg. D. Robb (ZRC); 12 ♀♀, cl 9–30 mm (4 ovigerous), 15 ♂♂, cl 10–31 mm (SMF 8457), Saluta, Tabeto, Halmahera, 1894, leg. W. Kükenthal; 14 ♀♀, cl 11–29 mm, 18 ♂♂, cl 12–43 mm (SMF 8148), Patani, Halmahera, 1894, Halmahera, leg. W. Kükenthal.

Remarks.—*Macrobrachium lar* has previously been reported from Oba, Saluta, and rivers near Tobelo, Halmahera (De Man, 1902, 1905), and Morotai, Halmahera (Holthuis, 1950). *Macrobrachium lar* is a well-known species, widely distributed throughout the Indo-West Pacific.

Macrobrachium latidactylus
(Thallwitz, 1891)

Fig. 15

Palaemon latidactylus Thallwitz, 1891: 97 [type locality: Sulawesi, Indonesia]; 1892: 17, fig. 3.

Palaemon (Macrobrachium) latidactylus—De Man, 1902: 805.

Macrobrachium latidactylus—Holthuis, 1950: 239, fig. 50.—Chace and Bruce, 1993: 31, fig. 10.—Yeo *et al.*, 1999: 236; Shokita, 1979: 275.

Material Examined.—1 ♂, cl 21 mm, 1 ♀ (ovigerous), cl 10 mm (ZRC), Sungai Dodago, Aug. 1994, leg. D. Robb; 1 ♀, cl 10.5 mm (ZRC), Sungai Dodago, Sep. 1994, leg. D. Robb; 1 ♂, cl 11 mm (ZRC), Sungai Ifis, Sep. 1994, leg. D. Robb; 4 ♂♂, cl 17–26.5 mm, 2 ♀♀ (ovigerous), cl 15–16 mm (SMF 8435), Kau, Halmahera, 1894, leg. Kükenthal.

Remarks.—This previously problematic species was revised by Holthuis (1950), who showed the great variation in the form of the male second pereopods and synonymised several species names. The species is widely distributed throughout Indonesia, Malaysia, Thailand, the Philippines, southern China, Taiwan, and Ryukyu Islands. *Macrobrachium latidactylus* has been reported from Kau, Halmahera, by De Man (1902).

Macrobrachium latimanus
(Von Martens, 1868)

Pal(aemon) latimanus Von Martens, 1868: 44 [type locality: Loquilocon, Samar, Philippines].

Palaemon singalangensis Nobili, 1900: 487 [type locality: R'ier Manticior, presso il Monte Singalang, Sumatra, Indonesia].

Palaemon (Macrobrachium) latimanus—De Man, 1902: 780.

Macrobrachium latimanus—Holthuis, 1950: 205, fig. 43.—Tiwari, 1961: 98.—Costa, 1979: 39.—Chace and Bruce, 1993: 31, fig. 11.—Short and Marquet, 1998: 406, fig. 3.

Material Examined.—1 ♂, cl 26 mm (SMF 8438), Apr. 1894, northern Halmahera, leg. W. Kükenthal.

Remarks.—This species had previously been reported by De Man (1902) and Holthuis (1950) from northern Halmahera. The high and short rostrum, short, cup-shaped carpus, and stout palm enables it to be easily distinguished from its congeners. *Macrobrachium latimanus* has been recorded from India, Sri Lanka, Indonesia, Philippines, Taiwan, Ryukyu Islands, and Marquesas (Short and Marquet, 1998).

Macrobrachium oenone (De Man, 1902)

Palaemon (Macrobrachium) oenone De Man, 1902: 784, pl. 25, fig. 49 [type locality: Halmahera, Indonesia].

Palaemon (Macrobrachium) sp.—De Man, 1902: 791.

Palaemon (Macrobrachium) oenone ? De Man, 1915: 439, pl. 29, fig. 15.

Palaemon (Macrobrachium) oenone papuana Roux, 1927: 324, fig. 2.

Macrobrachium oenone—Holthuis, 1950: 256; Chace and Bruce, 1993: 34.

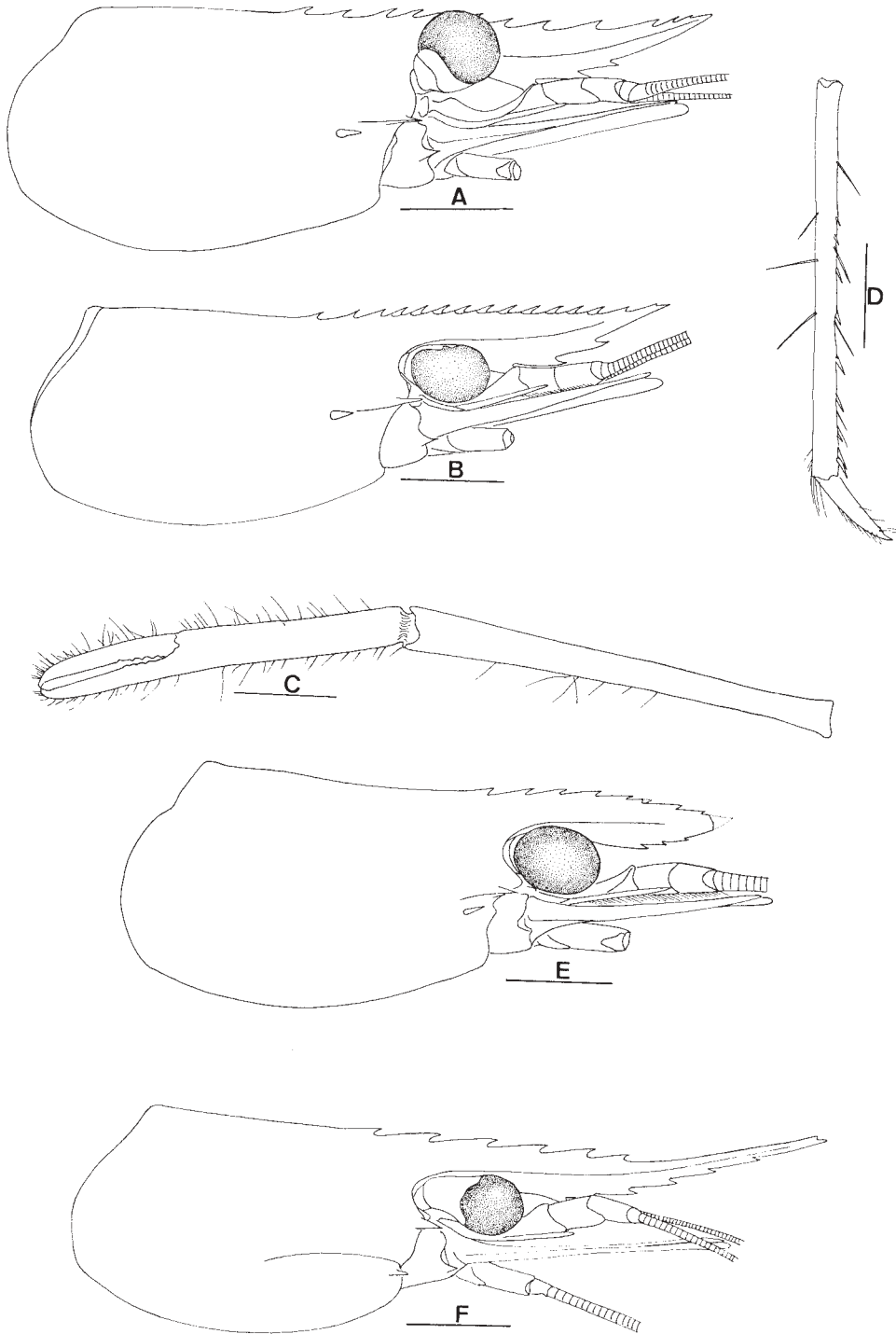


Fig. 14. *Macrobrachium australe*: A, cephalothorax, female, cl 15 mm (ZRC); B, cephalothorax, female, cl 10 mm; C, second pereiopod, cl 15 mm; D, third pereiopod, cl 15 mm. Scales: A, B = 5.0 mm; C, D = 3.0 mm. *Macrobrachium lar*: E, cephalothorax, female, cl 11 mm (ZRC). Scale = 3.0 mm. *Palaemon concinnus*, female: F, cephalothorax, cl 6.0 mm (ZRC). Scale = 3.0 mm.

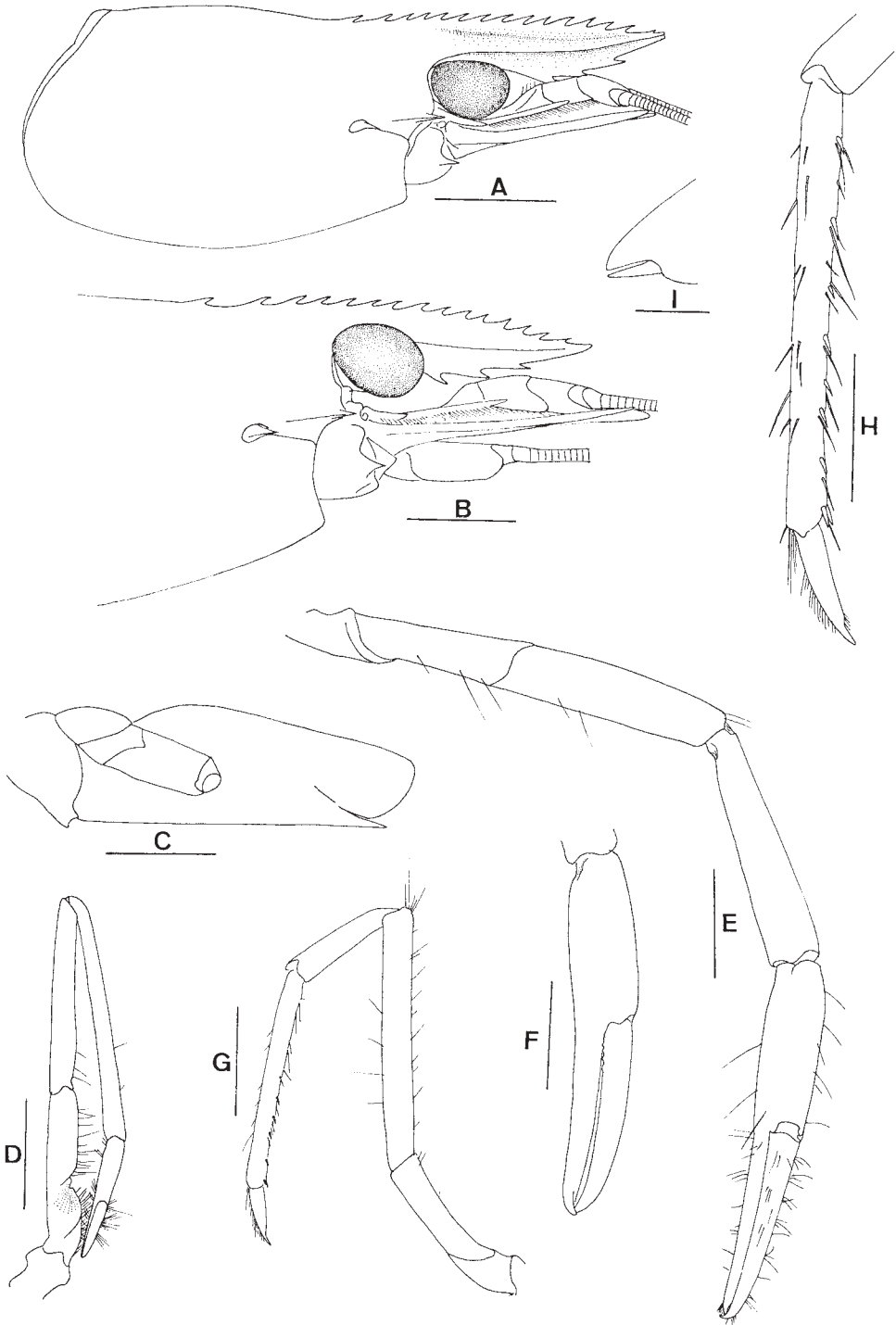


Fig. 15. *Macrobrachium latidactylus*: A, cephalothorax, female, cl 10.5 mm (ZRC); B, anterior portion of cephalothorax; C, scaphocerite; D, first pereiopod; E, second pereiopod; F, chela of same leg; G, third pereiopod; H, dactylus of same leg; I, uropodal diaeresis. Scales: A = 5.0 mm; B–G = 3.0 mm; H = 2.0 mm; I = 0.2 mm.

Material Examined.—1 ♂, syntype of *Palaemon oenone* (RMNH), 1893–1894, Kau, Halmahera, W. Kükenenthal.

Remarks.—This species was described by De Man (1902) on the basis of specimens from Kau River and Saluta, Halmahera. De Man (1915) doubtfully referred some Irian Jaya specimens from Mambramo River to this species. Roux (1927) described a variety, *Macrobrachium oenone* var. *papuana* also from Irian Jaya (Sermowai River), but Holthuis (1950), who examined some of De Man's specimens, considered all the Irian and Halmahera specimens as conspecific.

Palaemon concinnus Dana, 1852
Fig. 14F

Palaemon concinnus Dana, 1852: 587 [type locality: Fiji Islands].

Palaemon concinnus—Holthuis, 1950: 61, fig. 12.

Material Examined.—1 ♀, cl 6.0 mm, lower reach of Sungai Ifis, Halmahera, Sep. 1994, leg. D. Robb (ZRC).

Remarks.—*Palaemon concinnus* has a wide distribution in the Indo-West Pacific, from South Africa, Indonesia, Philippines to Marshall Islands and Tuamotu Archipelago. The species is commonly found in brackish to fresh water in the lower reaches of rivers.

FAMILY PARATHELPHUSIDAE

Sundathelphusa cassiope (De Man, 1902)

Potamon (Geothelphusa) cassiope De Man, 1902: 568, pl. 20: fig. 18 [type locality: Minahassa, Sulawesi (Celebes); Batjan Soah Konorah, Halmahera, Indonesia].

Potamon (Geothelphusa) minahassae—Rathbun, 1905: 211 (part).

Sundathelphusa cassiope cassiope—Bott, 1970: 76, pl. 11: figs. 24–29, pl. 28: fig. 47.

Remarks.—De Man (1902) described this species on the basis of specimens from Minahassa, Sulawesi (Celebes, seven males, seven females), Batjan, Molluccas (two males, two females) and Soah Konorah, Halmahera (one female). Schenkel (1902) reported another new species *Potamon (Geothelphusa) minahassae* also from Minahassa, Celebes; but Rathbun (1905) synonymised both taxa. The two species are very close and can only be separated by the form of their male first gonopods. They were regarded as distinct subspecies by Bott (1970), who examined the types of both taxa. We regard both as distinct species for the time being. The precise identity of the Halmahera form remains uncertain because only a female specimen

had been reported. No specimens were obtained during the present survey.

Sundathelphusa halmaherensis
(De Man, 1902)

Potamon halmaherensis De Man, 1902: 561, pl. 20: fig. 17 [type locality: Halmahera, Indonesia].

Potamon (Potamon) halmaherensis—Rathbun, 1904: 286.
Sundathelphusa halmaherensis—Bott, 1970: 78, pl. 14: figs. 67–69.

Remarks.—*Sundathelphusa halmaherensis* is known only from the original specimen. De Man (1902) described it on the basis of a young male specimen (cw 20 mm). Bott (1970) examined the specimen and transferred it to *Sundathelphusa*, noting that it was similar to another Halmahera species, *S. cassiope*, and when compared with similar-sized specimens of *S. cassiope*, the carapace of both species were equally flat. There is thus a possibility that *C. halmaherensis* is only the juvenile form of the Halmahera *S. cassiope*. This problem can only be resolved when the taxonomy of *S. cassiope* itself is revised, and male specimens from Sulawesi (type locality of *S. cassiope*) are directly compared with those from Halmahera when they become available. For the time being, *S. halmaherensis* is retained as a valid taxon.

Currothelphusa asserpes Ng, 1990

Currothelphusa asserpes Ng, 1990: 177, figs. 1–2, pls. 1–2 [type locality: Batu Lubang cave, near village of Sagea, Halmahera, Indonesia].

Material Examined.—Holotype, 1 ♂, 43.0 × 33.2 mm (MNHN B20991), paratype, 1 ♂, 30.1 × 24.0 mm (ZRC 1989.2156), Batu Lubang Cave, near Sagea, Halmahera, Indonesia.

Remarks.—The genus and species is known only from the original description. Compared to related genera like *Sundathelphusa* (= *Archipelothelphusa*, see Ng and Sket, 1996), *Currothelphusa* has a distinctly more convex carapace, longer ambulatory legs, better developed epigastric and postorbital cristae, and a distinctly T-shaped male abdominal segment (Ng, 1990).

FAMILY GRAPSIDAE

Ptychognathus riedelii
A. Milne Edwards, 1868
Fig. 16

Ptychognathus riedelii A. Milne Edwards, 1868 [type locality: Sulawesi (Celebes), Indonesia].

Ptychognathus riedelii riedelii—De Man, 1892: 323.—Holthuis, 1978: 17.

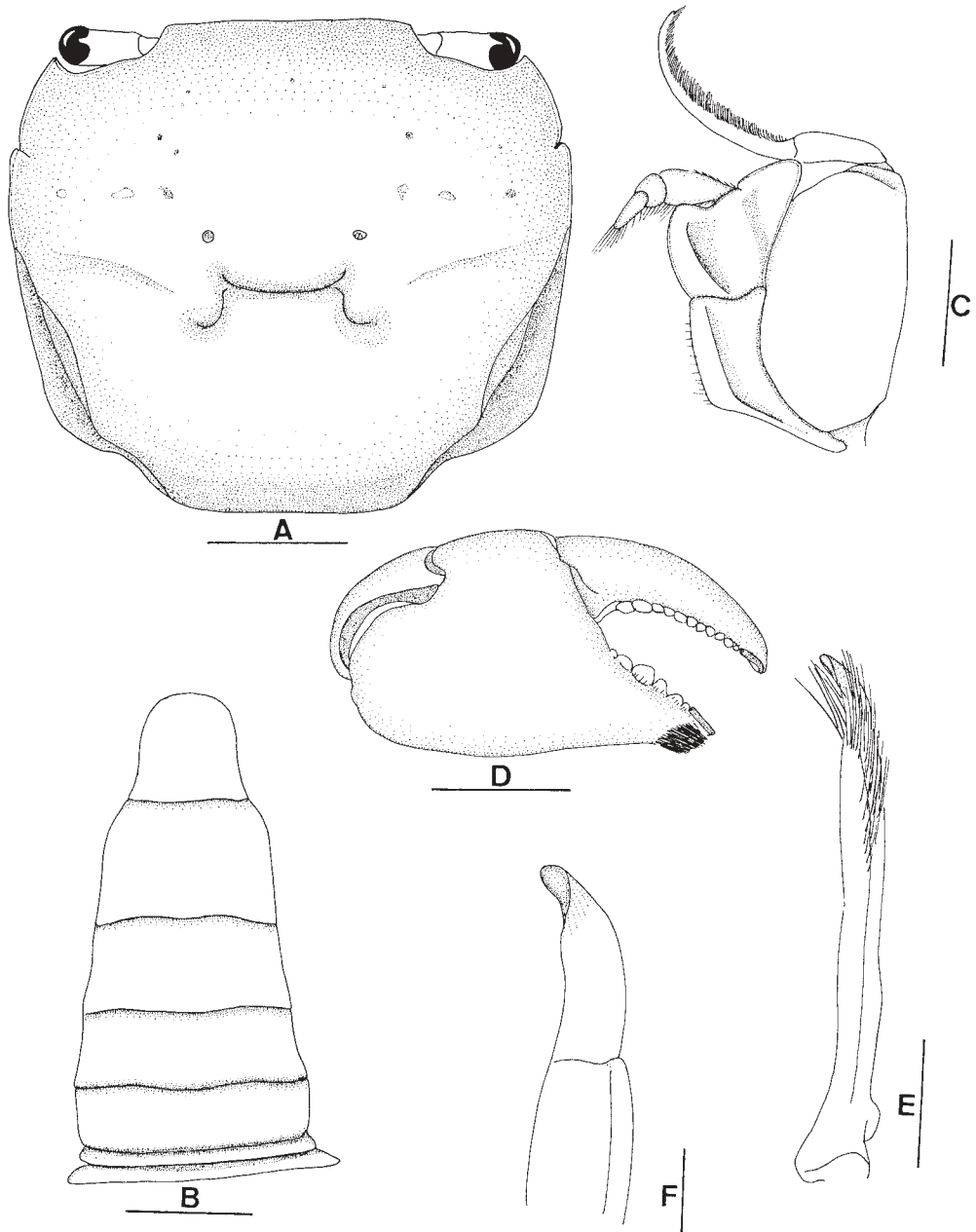


Fig. 16. *Ptychognathus riedelii*, male, 18.2 × 20.2 mm (ZRC): A, carapace; B, abdomen; C, third maxilliped; D, cheliped; E, first gonopod; F, distal portion of first gonopod. Scales: A, D = 5.0 mm; B, C, E = 3.0 mm; F = 1.0 mm.

Material Examined.—1 ♂, 18.2 × 20.2 mm; 1 ♀, 17.95 × 20.11 mm (ZRC), Sungai Ifis, Halmahera, Sep. 1994, leg. D. Robb.

Remarks.—Specimens of both sexes have a characteristic small tuft of short setae on the lower margin of the fixed finger just before the tip. Holthuis (1978) noted that *Ptychognathus riedelii pilosus* De Man, 1892, can

only be separated from the typical subspecies by the adult male having a distinct area of long setae on the proximal part of the outer surface of the finger. We believe that this character is sufficient to treat them as two separate species for the time being. *Ptychognathus riedelii* had previously been reported from Sulawesi (Celebes), Flores, Sumatra,

and Andaman Island. The present record extends its range eastward.

Varuna litterata (Fabricius, 1798)

Fig. 17A, C–H

Cancer litteratus Fabricius, 1798: 342 [type locality: probably east coast of India].

Trichopus litteratus—De Haan, 1835: 32.—Dana, 1852: 336, pl. 20: fig. 8.

Varuna litterata—H. Milne Edwards, 1837: 95.—Sakai, 1939: 665, pl. 76: fig. 2; pl. 108: fig. 1; 1976: 644, pl. 220.—Barnard, 1950: 122, figs. 22c, 23f, 24d.—Crosnier, 1965: 34, fig. 40–41a, b, pl. 6: fig. 1.—Dai and Yang, 1992: 519, fig. 265–4 (part).—Ng, 1988: 116 (part).

Material Examined.—2 ♂♂, 28.2 × 30 mm; 14.3 × 15 mm, 2 ♀♀, 11.7 × 11.8 mm; 20.5 × 12.5 mm (ZRC), Sungai Okita, Wosile, Halmahera, Aug. 1994, leg. D. Robb. 2 ♀♀, 18 × 21.5 mm; 12.4 × 12.5 mm (ZRC), Sungai Ifis, Sep. 1994, leg. D. Robb.

Taiwan: 2 ♂♂, 33.8 × 37.7 mm; 28.2 × 30.0 mm, Naniao fish port, Green island, Taitung County, 6 Jun. 1993. 1 ♀, 44.1 × 50.6 mm, Kengting National Park, Kangkou River, Pingtung County, 30 May 1997, leg. P. K. L. Ng. 1 ♂, 29.5 × 31.4 mm, Taipei County, 18 May 1991. 1 ♂, 35.5 × 39.8 mm; 1 ♀, 18.5 × 19.35 mm; 2 ♂♂, 15 × 15.5 mm; 12.6 × 13.25 mm, Toumen bridge, Hongtong village, Lanyu island. (All specimens in ZRC)

Comparative material: *Varuna yui* Hwang and Takeda, 1986—Taiwan: 1 ♂, 29.2 × 31.6; 1 ♀, 22.3 × 23.5 mm, Taipei County, 17 Oct. 1990. 1 ♂, 25.7 × 27.3 mm; 1 ♀, 27.7 × 29.5 mm, Da Taung village, I-Lan County, 27 Nov. 1983, sandy mud substratum, leg. J. J. Hwang. Thailand: 2 ♂♂, 16.6 × 17.9 mm; 7.5 × 7.5 mm; 1 ♀, 9.3 × 9.8 mm. Sud-est env. Ban. Pliu, Province of Chantaburi, 21 Mar. 1980, leg. M. Kottelat. Singapore: 1 ♂, 30.6 × 32.9 mm, Sungai Buloh, Singapore, leg. N. Sivasothi, 1996. 1 ♂, 19.1 × 21.5 mm; 1 ♀, 14.4 × 15.45 mm, Geylang canal, Singapore, 18 Aug. 1994, leg. reef eco-lab. (All specimens in ZRC). China: 1 ♂, 17.6 × 18.2 mm, 1 ♀, 18.2 × 19.4 mm (BNHM), April 3, 1992, muddy substratum, Qinjiang River near Qinjiang city, Guangxi, leg. S. L. Yang and Y. Cai.

Remarks.—*Varuna litterata* is a well-known species and has been reported from all over the Indo-West Pacific (Alcock, 1900; Sakai, 1939, 1976; Barnard, 1950; Crosnier, 1965; Holthuis, 1978; Dai and Yang, 1992; Ng, 1998). Pfeffer (1889) described *V. tomentosa* from Africa, but on the basis of his description, it is probably synonymous with *V. litterata*. Hwang and Takeda (1986) described *V. yui* (Fig. 17B) from Taiwan and the Philippines and provided a detailed comparison of the carapace, cheliped, abdomen, and first gonopods between *V. yui* and *V. litterata*. In addition to specimens from Halmahera, we have also examined some *Varuna* specimens from southern China, Taiwan, Thailand, and Singapore. We are confident that *V. yui* is different from *V. litterata* on the basis of the

form of the carapace and first gonopod, as stated by Hwang and Takeda (1986), despite the reservations expressed by Ng (1998) (see also Davie, 1992). The differences in the chelipeds and abdomen between the two species are less obvious, even when comparisons are between specimens of similar sizes. *Varuna litterata* is known to have a wide geographical range, while *V. yui* is, thus far, confined to Taiwan, southern China (Davie, 1992), Philippines (Hwang and Takeda, 1986), Thailand, and Singapore (see Ng, 1998). The specimens of *V. litterata* from Taiwan and Halmahera are identical. Comparing our specimens with those described and figured by Barnard (1950) from South Africa and by Crosnier (1965) from Madagascar, we find that the form of the third maxilliped appears to be somewhat different (Fig. 17D vs. fig. 46 in Crosnier, 1965: 36), and the distal part of the first gonopod is also more lobulated in the Madagascar and African specimens than in our specimens from the western Pacific area (see figs. 40, 41 in Crosnier, 1965: 35 vs. Fig. 17F–H). The significance of the differences, however, cannot be determined at the moment. As stated by Ng (1988), the types are most probably from the east coast of India, and the three extant syntypes are females. Direct comparisons between material from the type locality and other parts of its Indo-West Pacific range are needed before the taxonomy of *V. litterata* can be better understood.

Pseudograpsus crassus

A. Milne Edwards, 1868

Pseudograpsus crassus A. Milne Edwards, 1868: 176 [type locality: Celebes (Sulawesi), Indonesia (see Holthuis, 1978: 19)].—De Man, 1892: 317; 1902: 506.—Holthuis, 1978: 19.

Remarks.—De Man (1902: 506) reported a specimen of this interesting species from Halmahera, collected, surprisingly, from an altitude of 2,500 feet (800 m). No specimens of this species were obtained in the present study. The species has been reported with certainty only from several localities in Indonesia (Holthuis, 1978), all of which are freshwater habitats.

Geosesarma maculata (De Man, 1892)

Fig. 18A–C

Sesarma maculata De Man, 1892: 347, pl. 16: fig. 19 [type locality: Flores, Indonesia].

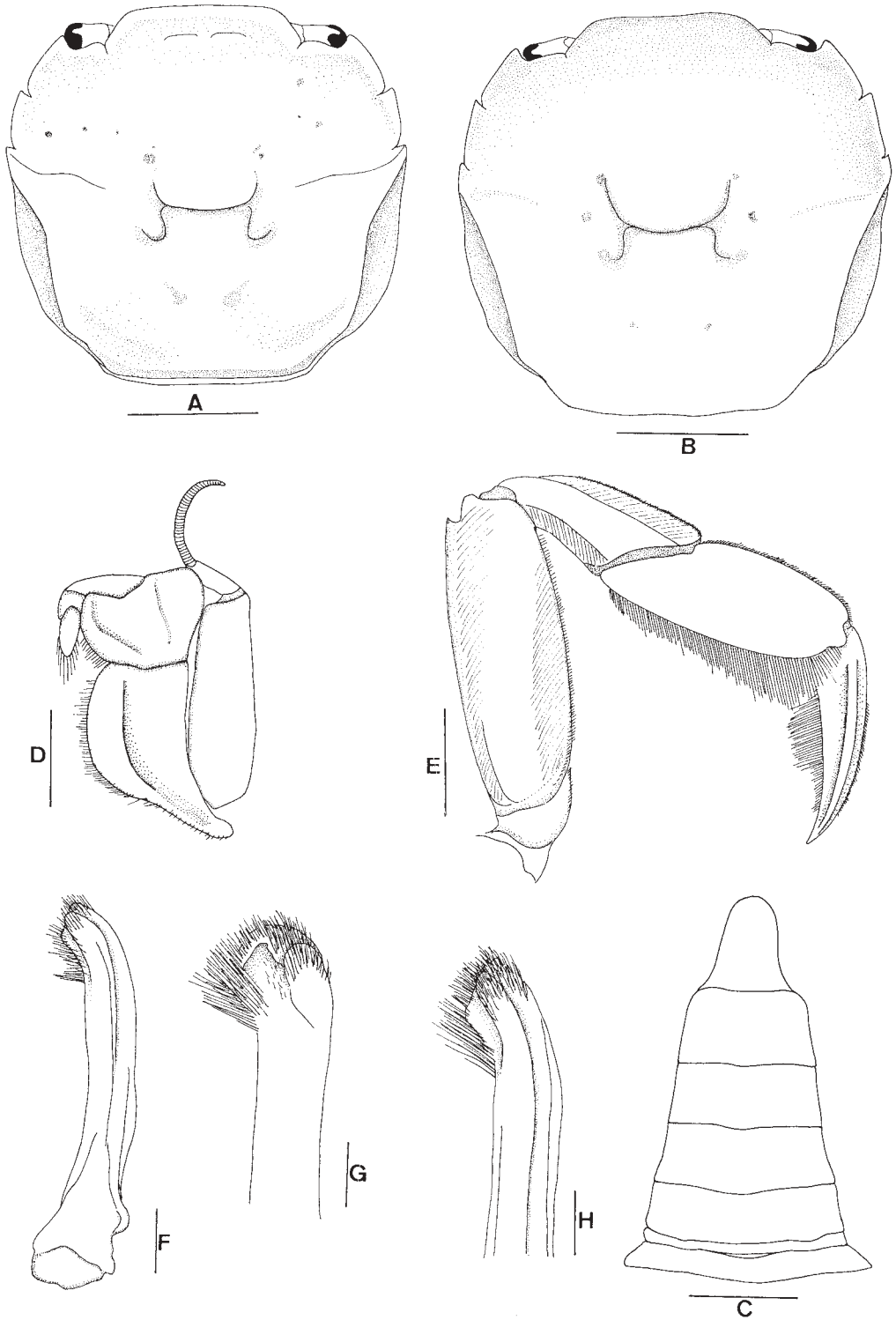


Fig. 17. *Varuna litterata*, male, 28.2 × 30 mm (ZRC): A, carapace; C, abdomen; D, third maxilliped; E, third ambulatory leg; F, G, H, first gonopod. *Varuna yui*, 29.2 × 30.6 mm, Taipei, Taiwan, (ZRC): B, carapace. Scales: A, B = 10.0 mm; C, E = 5.0 mm; D = 3.0 mm; F = 2.0 mm; G, H = 1.0 mm.

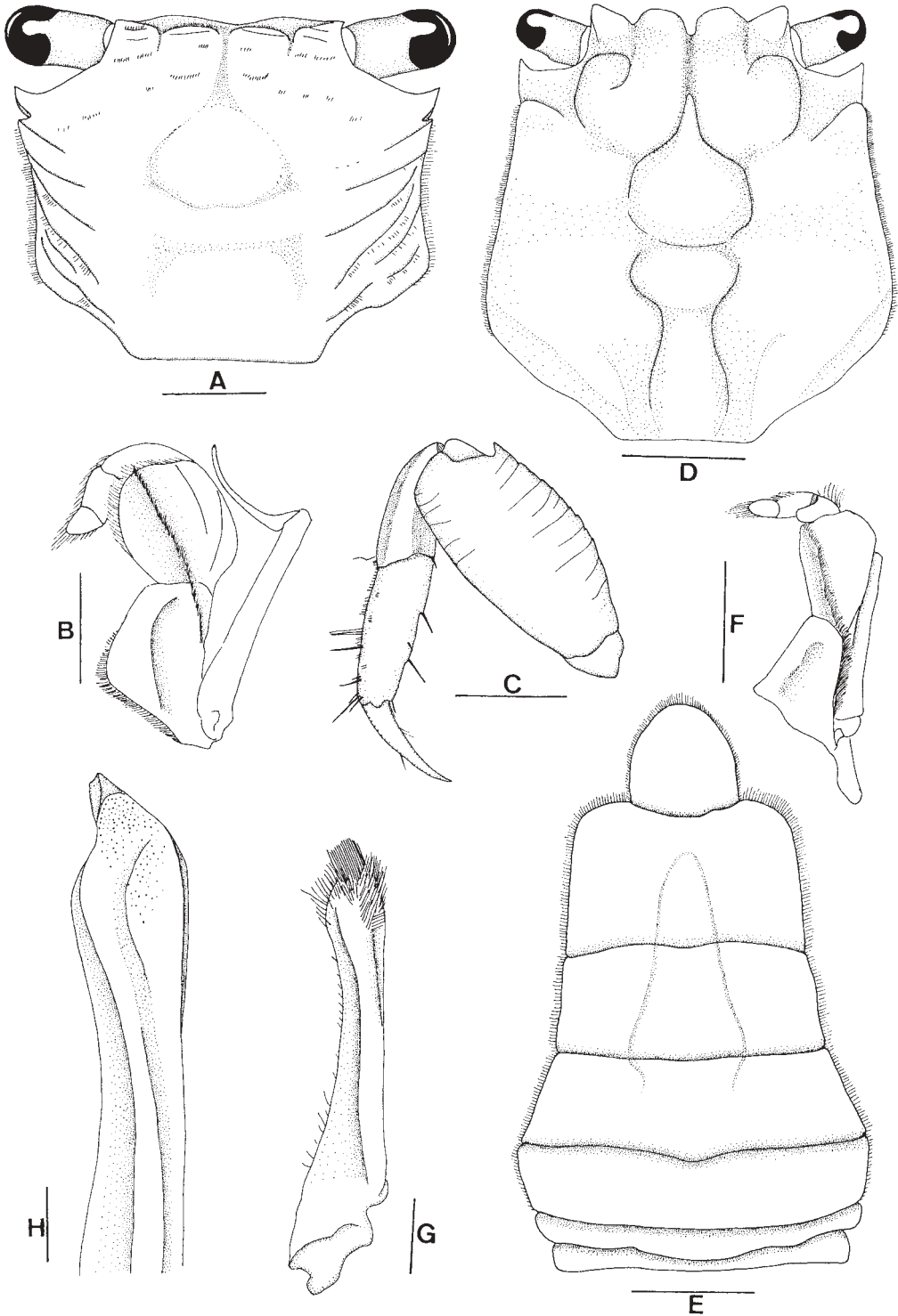


Fig. 18. *Geosesarma maculata*, female, cb 6 mm (ZRC): A, carapace; B, third maxilliped; C, third ambulatory leg. Scales: A = 2.0 mm; B, C = 1.0 mm. *Labuanium trapezoideum*, male, 32.3 × 35.1 mm (ZRC): D, carapace; E, abdomen; F, third maxilliped; G, H, first gonopod. Scales: D = 10.0 mm; E, F = 5.0 mm; G = 0.2 mm; H = 0.1 mm.

- Sesarma (Sesarma) maculata*—De Man, 1902: 517.—Gordon, 1937: 150, figs. 1, 2c, d, 3a–c.
Sesarma maculata—Holthuis, 1978: 28.
Geosesarma maculata—Serène and Soh, 1970: 402.—Ng, 1988: 119, fig. 53a–c.

Material Examined.—1 ♀, cb 6 mm, Sungai Ifis, Halmahera, Sep. 1994, leg. D. Robb (ZRC).

Remarks.—De Man (1902) reported *Sesarma (Sesarma) maculata* from several localities in Halmahera and in Ternate, with one female from Halmahera collected from an altitude of 2,000 feet. Gordon (1937), however, after examination of De Man's Ternate male specimen, showed that it was not *Sesarma maculata sensu stricto* and excluded De Man's (1902) specimens from *S. maculata*. The fact that Gordon did not check any of the Halmahera specimens, which were caught from several localities on the island and in different habitats, makes the identity of *Sesarma maculata* from Halmahera uncertain. The present specimen, being a juvenile, does not contribute to the solution. The species was moved to *Geosesarma* by Serène and Soh (1970), a genus which is now being revised by P. K. L. Ng and C. Schubart (ongoing).

Sesarmops impressum
(H. Milne Edwards, 1837)
Fig. 19

- Sesarma impressa* H. Milne Edwards, 1837: 74 [type locality: unknown].—De Man, 1887: 653.
Sesarma (Sesarma) impressa—Sakai, 1939: 685, pl. 110: fig. 1.
Sesarma (Sesarma) impressum—Crosnier, 1965: 63, figs. 82, 92, 104.
Sesarmops impressum—Serène and Soh, 1970: 400.
Sesarma impressum—Holthuis, 1978: 25.
Sesarma (Sesarmops) impressum—Dai and Yang, 1991: 540, fig. 278.

Material Examined.—2 ♂♂, 38.2 × 40.2 mm, 39.8 × 43.7 mm, Sungai Okita near Wosile, Halmahera, Aug. 1994, leg. D. Robb (ZRC).

Remarks.—There are actually several species that belong to what is now generally identified as "*Sesarmops impressum*" in the Indo-West Pacific, and this species complex is currently being revised by P. Davie and P. K. L. Ng. The Halmahera specimens represent one of these forms. Based on the carapace shape, it is difficult to distinguish the present population from Halmahera from the others of this species reported from Japan (cf. Sakai, 1976), Taiwan (cf. Dai and Yang, 1992), and Mada-

gascar (cf. Crosnier, 1965), but the chitinous process at the distal part of the first gonopod appears to be different (shorter and stouter vs. longer and more slender). Serène and Soh (1970) established *Sesarmops* and designated *Sesarma impressum* as its type species. Holthuis (1978), however, argued that the form of the first gonopod cannot separate *Sesarmops* from allied genera like *Pseudo-sesarma* Serène and Soh, 1970, and *Bresedium* Serène and Soh, 1970, and used *Sesarma, sensu lato*, for his material from Sumba. Apart from the structure of the first gonopod, we find that *Sesarmops* can easily be separated from other Indo-West Pacific sesarmine genera by a suite of characters, viz. carapace as long as (or longer than) extraorbital breadth, anterior frontal margin with marked median concavity, and postfrontal lobes remarkably salient. The authors thus follow Serène and Soh (1970) in regarding *Sesarmops* as a valid genus.

Labuanium trapezoideum
(H. Milne Edwards, 1837)
Fig. 18D–H

- Sesarma trapezoidea* H. Milne Edwards, 1837: 74. [type locality: unknown]
Sesarma trapezoideum—De Man, 1902: 532—Holthuis, 1978: 27.
Labuanium trapezoideum—Serène and Soh, 1970: 401.

Material Examined.—1 ♂, 32.3 × 35.1 mm; 1 ♀, 31.9 × 33.9 mm, Sungai Ifis, Halmahera, Sep. 1994, leg. D. Robb (ZRC).

Remarks.—Like specimens from Sumba reported by Holthuis (1978), the pair of Halmahera specimens agree well with De Man's (1887: 678; 1889: 19, fig. 7) description and figure of this species, especially with regards to the characteristic color pattern of the ambulatory legs.

Labuanium trapezoideum has a wide distribution and has been reported from Indonesia and the Philippines to Polynesia. It has been reported by De Man (1902) from an altitude of 2,500 feet (800 m) on Halmahera. We follow Serène and Soh (1970) in using *Labuanium* for this species, because the main characters, viz. postfrontal lobes anteriorly strongly acute, carapace with lateral border at least slightly convex and not diverging backward, easily distinguishes it from other sesarmine genera.

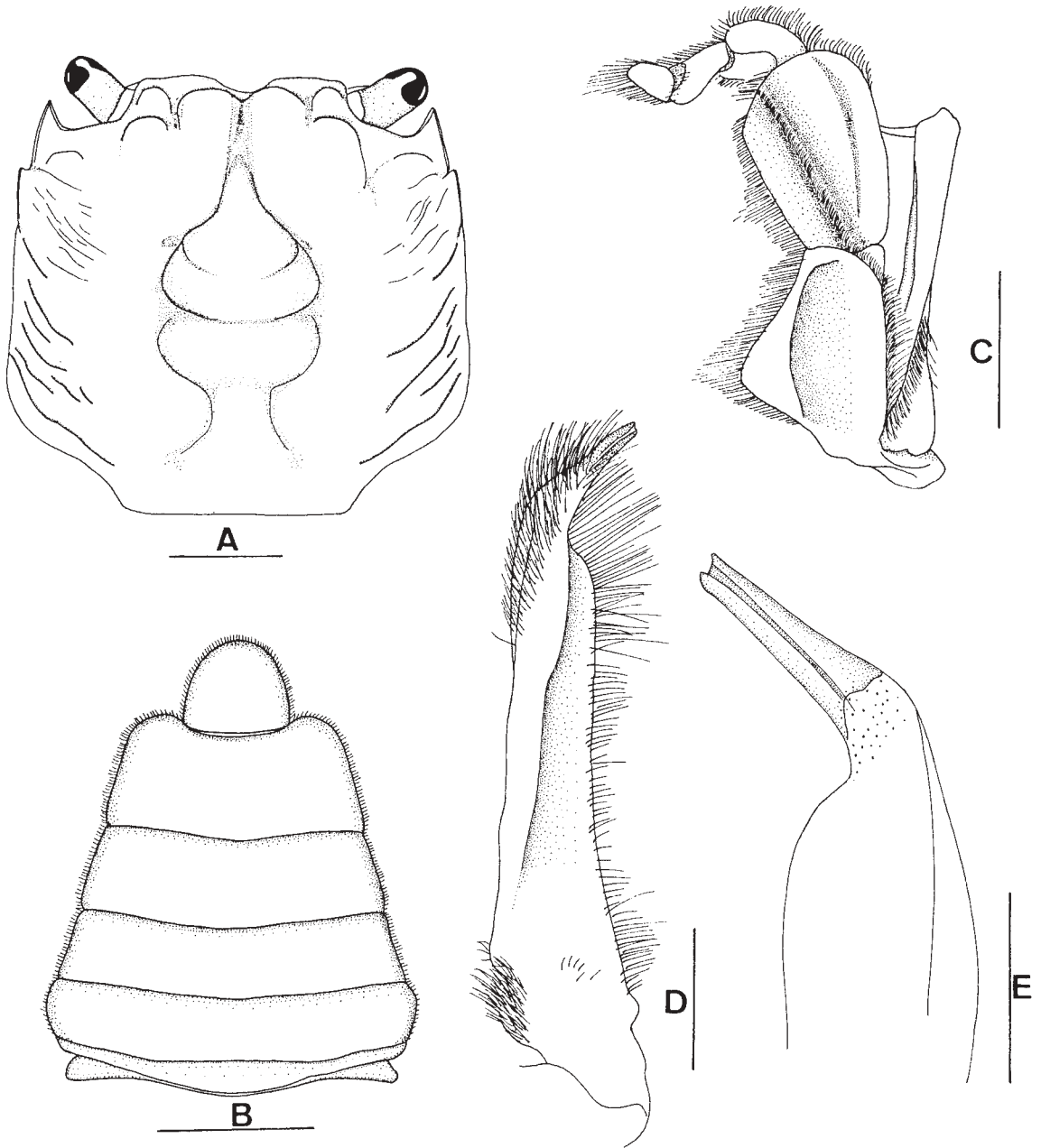


Fig. 19. *Sesarmops impressum*, male, 38.2 × 40.2 mm (ZRC): A, carapace; B, abdomen; C, third maxilliped; D, first gonopod; E, distal portion of first gonopod. Scales: A, B = 10.0 mm; C = 5.0 mm; D = 3.0 mm; E = 2.0 mm.

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