

Fig. 39. (*Hyastenus* species of group 1) *Hyastenus borradailei* (male, 35 mm, AM P.29891, in part) (a) left orbit, ventral view; *H. brockii* (male, 11.5 mm, S. Sulawesi, ZMA) (b) left orbit, ventral view; *H. uncifer* (male, 17 mm, Haingsisi, ZMA) (c) left orbit, ventral view; *H. ambonensis* (holotype, female) (d) carapace, dorsal view; (e) left fourth ambulatory leg; (f) left orbit, ventral view.

Branchial region with a lateral tubercle on anterior margin, a slightly larger tubercle centrally and a tubercle just dorsal to epibranchial spine.

Basal antennal article smooth, a ridge along medial edge; a longitudinal groove centrally (wider basally); anterolateral angle produced into a strong spine directed laterally and slightly forward; lateral edge sinuous, convex midway along. A small tubercle lateral to green gland.

Pterygostomian region smooth, margin with two blunt tubercles, anterior slightly larger.

Third maxilliped smooth, a low ridge on posterior margin of merus, anterolateral angle of merus produced and rounded.

Cheliped of ovigerous female slightly shorter (0.9) than postrostral carapace length; merus with three low tubercles and a long acute terminal spine dorsally; a low tubercle in

distal half ventrally on outer edge; carpus with a small lateral tubercle dorsally at about distal third; palm smooth, length about two and a half times height; fingers about two thirds (0.63) length of palm, hardly gaping in proximal third.

First ambulatory leg merus smooth with a blunt terminal tubercle; second ambulatory leg slightly longer (1.1) than postrostral carapace length; fourth ambulatory leg slightly less (0.96) than postrostral carapace length and about four fifths (0.86) of second leg; dactyl of fourth leg with about eight small spines ventrally along its length, proximal spines directed obliquely towards propod. (Only merus of the first leg is present on the holotype.)

Female abdomen of seven segments; a transverse medial tubercle in first to third segments a low medial ridge in remaining segments.

Female gonopore an oval aperture, narrower laterally, and opening anteriorly.

Remarks. — This species most closely resembles *H. trispinosus* Rathbun, but can be distinguished from it by the more strongly elevated gastric region, and the two strong mesogastric tubercles, rather than one or none as in *H. trispinosus*. It is distinguished from *H. hilgendorfi* by the presence of two mesogastric tubercles (rather than only one, or if two, a very low second), and from *H. pleione* by the absence of a transverse tubercle between the gastric and cardiac elevations. It differs from both these species in having no additional submarginal branchial tubercles between that on the anterior margin and the epibranchial spine, whereas the other two species have at least two such tubercles.

Distribution. — Known only from Ambon.

*Hyastenus aries* (Latreille, 1825)  
(Fig. 48h, i)

*Pisa aries* Latreille, 1825: 140-141.

*Chorinus aries*. — H. Milne Edwards, 1834: 315-316.

*Hyastenus aries*. — Alcock, 1895: 211-212. — McCulloch, 1913: 328-329, fig. 44. — Buitendijk, 1939: 239, text figs. 1-2; 1950: 64. — Serène & Lohavanijaya, 1973: 53-54, figs. 109-113, pl. 10A, B.

Material examined. — 32 ♂♂, 28 ♀♀ (3 ovig.), 12-78.5 mm, smallest ovig. ♀, 30 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 57, Savu Sea, near Sumba I. 10°29'S 121°28.7'E, 1419 m, Foraminifera ooze, 24 April 1899; 1 spec. — Stn. 80, Borneo Bank, 02°25'S 117°43'E, from 50-40 m, trawl, fine coral sand, 13 June 1899; 1 spec. — Ambon; 1 spec. (ZMA De.100.803, det. Ihle as *H. diacanthus*).

Aru Is., Jedan, 10 February 1907; 2 specs. — Java Sea, off Jakarta, otter trawl, 'Rambang', April-May 1907; 1 spec.

N. Sulawesi, Kuandang Bay, 36-81 m, coll. van Nouhuys, 17 April 1914; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Singapore, shallow water, 1906; 2 specs.

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, 36-45 m, dredge, sand, coral, 19 March 1914; 7 specs. — Sulu Archipelago, off Jolo, ca. 27 m, diving, 19 March 1914; 2 specs.

Danish Kei Islands Expedition: Ambon, Ambon Bay, 12-18 m, sand, 28 February 1922; 3 specs. — Ambon, Ambon Bay, ca. 90-45 m, dredge, stones, sand, 2 March 1922; 2 specs. — Ambon, Ambon reef, ca. 90 m, dredge, sand, stones, 3 March 1922; 1 spec. — Stn. 11, Kai Is., off Toeal, 20 m, trawl, fine sand, 9 April 1922; 1 spec. — Stn. 14, Kai Is., S. of Doe Roa, 40 m, trawl, sand, 10 April 1922; 4 specs. — Stn. 15, Kai Is., S. of Doe Roa, 20-5 m, trawl, sand, 10 April 1922; 1 spec. — Stn. 31, Kai Is., Doe Roa Bassin, 50 m, trawl, sand, 18 April 1922; 1 spec. — Kai Is., off Toeal, ca. 20 m, trawl, sand, 18 April 1922; 2 specs. — Stn. 36, Kai Is., Bay N. of Noehoe-Roa, 35 m, trawl, sand, 23 April 1922; 1 spec. — Kai Is., off Toeal, 20 m, trawl, sand, 12 May 1922; 2 specs. — Stn. 61, Kai Is., between Doe Roa and Kai Doelah, 50 m, trawl, Bryozoans, 14 May 1922; 1 spec. — Makassar, off Samalona, ca. 35 m, sand, shells, 28 June 1922; 1 spec. — Stn. 67, Java Sea, 05°48'S 106°12'E, 38 m, dredge, sand, 27 July 1922; 2 specs. — Stn. 71, Java Sea, 05°40'S 106°08'E, 54 m, trawl, sand, stones, 28 July 1922; 1 spec. — Stn. 72, Java Sea, 05°41'S 105°57'E, 35 m, trawl, stones, 28 July 1922; 2 specs. — Stn. 74, Sunda Strait, 06°03'S 105°54'E, 30 m, trawl, sand, shells, 29 July 1922; 1 spec. — Stn. 89, Java Sea, 05°57'S 105°32'E, 18 m, trawl, sandy mud with pumice, 31 July 1922; 1 spec. — Stn. 103, Sunda Strait, 06°05'S 105°42'E, 52 m, trawl, sand, shells, 4 August 1922; 3 specs. — Stn. 106, Java Sea, 05°30'S 106°16'E, 32 m, trawl, sand, 5 August 1922; 2 specs.

S. of Sumatra, 05°50'S 101°07'08"E, 48 m, sand, mud, 'Store Nordiske', 12 December 1935; 2 specs. — Strait of Malacca, 05°09'08"N 99°48'10"E, 57 m, sand, mud, 'Store Nordiske', 24 December 1935; 3 specs.

'Galathea' Expedition, 1950-52: Singapore, sea off Changi, ca. 10 m, fish trap, 26 June 1951; 1 spec.

5 Thai-Danish Expedition: Stn. 1178, West Malay Peninsula, 08°27'N 98°12'E, 35 m, trawl, 9 March 1966; 1 spec.

'Ostindien'; 1 spec.

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Mariel King Memorial Expedition-Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15'S 128°8'E, 54 m, dredge haul 15, grey sand, fine with shelly grit, 2 June 1970; 1 spec. — Stn. AW I, Aru Is., W. Wokam, off W. coast of Wasir I., 05°30'S 134°12'E, 39-72 m, dredge hauls 7-10, sand and shell rubble, 15 June 1970; 1 spec.

Remarks. — The rostral spines in these specimens vary from subparallel to divergent. They are less than, or equal to, half the postrostral carapace length, except among the largest males (45-78 mm) where six (out of nine in this size range) have rostral spines up to  $\frac{3}{4}$  postrostral carapace length.

The supraorbital eave is relatively wide and the preorbital angle is rounded, produced a little laterally and sometimes slightly forwards.

There is a tubercle on the summit of the elevated gastric region, and on the anterior slope there is usually a short spine but sometimes a second tubercle subequal in length to that on the summit. There is a low rounded protogastric tubercle. The branchial region is uniformly elevated (in *H. spinosus*, elevated anteriorly and just dorsal to the epibranchial spine), and the epibranchial spine is short, not more than  $\frac{1}{6}$  of the carapace width. There is sometimes a very small submarginal tubercle near the anterior border of the branchial region. There is a broad medial tubercle, not a spine as in *H. spinosus*, on the slightly elevated intestinal region.

The anterolateral angle of the basal antennal article is rounded and only slightly produced laterally. Behind it on the lateral edge there is a slight concavity, followed by a wide proximal lobe which is produced much further laterally than the anterolateral angle. The suborbital hiatus is a narrow slit in adults and V-shaped in younger specimens.

The palm of the chela is enlarged in males larger than approximately 40 mm.

The first pleopod of the young males is different from that of the adults. In larger specimens (36-78 mm) the distal half to two thirds of the pleopod is uniformly very slender, with long setae at the proximal third and the apex is turned outwards, as figured by Buitendijk (1939: figs. 1,2) and by Serène & Lohavanijaya (1973: figs. 110-112). In smaller specimens (16-39 mm), the pleopod tapers gradually, the two pleopods touch on the medial line just above their base, curve outward slightly and then curve back towards the medial line, sometimes meeting distally. (This is very similar to the first pleopod figured by Buitendijk (1939: fig. 8) for the smaller specimen of *H. diacanthus*.)

The presence of two large tubercles or a tubercle and a spine on the mesogastric region, distinguishes *H. aries* from the two other species where the male has a similar first pleopod, *H. diacanthus* (with one large and one very small tubercle) and *H. campbelli* (with no tubercles). The first pleopod of an immature male of *H. aries* is similar to that of *H. elatus* but in that species the curvature of the pleopod is different and on the gastric region there is one large and one very small tubercle.

There are some anomalies in relating pleopod development to the size of the animal alone. In one male of 56 mm from the Kai Islands, the first pleopod is the same as that described above for smaller (i.e. less than 40 mm) specimens. The palm of the chela is not inflated and there is only a very small proximal gape between the fingers. A smaller male, 45 mm, from the same area, has the adult form of first pleopod, the palm of the chela is inflated and there is a moderate proximal gape between the fingers.

This series includes records for this species from the new localities of Makassar, Kai Islands, Ambon, N. Sulawesi and the Sulu Archipelago. The specimens from N. Sulawesi and Sulu Archipelago (3 ♂♂, 7 ♀♀, cl. 23-78 mm) all have a strongly developed tubercle or a short spine on the intestinal region, and the preorbital angle of the supraorbital cave is produced slightly forwards.

*Hyastenus spinosus* A. Milne Edwards is closely related to *H. aries*, *H. diacanthus*, *H. elatus*, and *H. campbelli* and because of the presence of two spines on the mesogastric region, is usually considered to be closest to *H. aries*. There were no specimens of *H. spinosus* in the collections studied but an adult male of *H. spinosus* (AM P.2739, 46.5 mm) from the Arabian Sea was compared with the adult males in this series of *H. aries*, and it differed from them in the following respects:

(1) The intestinal and epibranchial spines are longer. The latter are approximately  $\frac{1}{4}$  carapace width, and the intestinal spine is about half their length.

(2) The first pleopods are gradually tapering (not very slender in the distal half) and meet in the midline only in the distal (not the proximal) half.

(3) The basal antennal article is not so broad proximally, and there is a U-shaped suborbital hiatus.

(4) The segmental ridges on the sternites are more strongly developed.

Laurie (1906) considered *H. consobrinus* A. Milne Edwards, 1895 to be a synonym of *H. spinosus*, but as *H. consobrinus*, which has not been found since, was collected from off the coast of Chile ('Challenger' Expedition, Stn. 306A) and *H. spinosus* is an Indo-West Pacific species it seems unlikely that they are conspecific.

Calman (1913) pointed out that Rathbun (1897) has confused *Pisa aries* Latreille with *Halimus aries* Guérin, an entirely different species. This was discussed in detail by Griffin (1966d).

Distribution. — South India, Singapore, Sulu Archipelago, Sulawesi, Kai Islands, Ambon and north Australia.

*Hyastenus auctus* Rathbun, 1916  
(Figs. 40e, f, 41a, b)

*Hyastenus auctus* Rathbun, 1916: 543. — Ward, 1941: 1. — Griffin, 1966b: 281, pl. 15 fig. (a); 1976: 190-191.

Material examined. — 4 ♂♂, 5 ♀♀ (2 ovig.), 5.5-31 mm, smaller ovig. ♀, 22.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN  
Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, ca. 54 m, dredge, sand, coral, 19 March 1914; 7 specs.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA  
Mariel King Memorial Expedition-Moluccas: Stn. KN IV, Kai Is., W. coast of Nuhu Tjut, E. side of Mitduan Reef, 05°32'S 133°E, 36-56 m, (?dredge hauls 3-4), 31 June 1970; 2 specs.

Remarks. — This species is distinguished by the very narrow supraorbital and suborbital hiatuses.

The rostral spines are straight, divergent and slightly greater than half the postrostral length.

The gastric region is elevated, with a single medial tubercle and there is a low rounded protogastric tubercle near the orbit. There is a medial tubercle, or short spine, on the intestinal region and a tubercle just above the small epibranchial spine. These tubercles are well developed and acute in adults, but low and rounded in smaller specimens (cl. 9-15 mm).

The basal antennal article is produced slightly forward at the anterolateral angle. The lateral edge is broadly convex in the proximal half, and separated from the postorbital lobe only by a narrow slit.

The first pleopod of the male is produced laterally into a rounded lobe at the base of the tip. It tapers evenly to the apex, or is weakly curved on the medial edge. This type of pleopod is common to several other species of *Hyastenus*, e.g. *H. hilgendorfi*, *H. sebae*, *H. trispinosus*.

In the smallest male (5.5 mm) in the series of specimens from Sulu Archipelago there is a small accessory spine on the

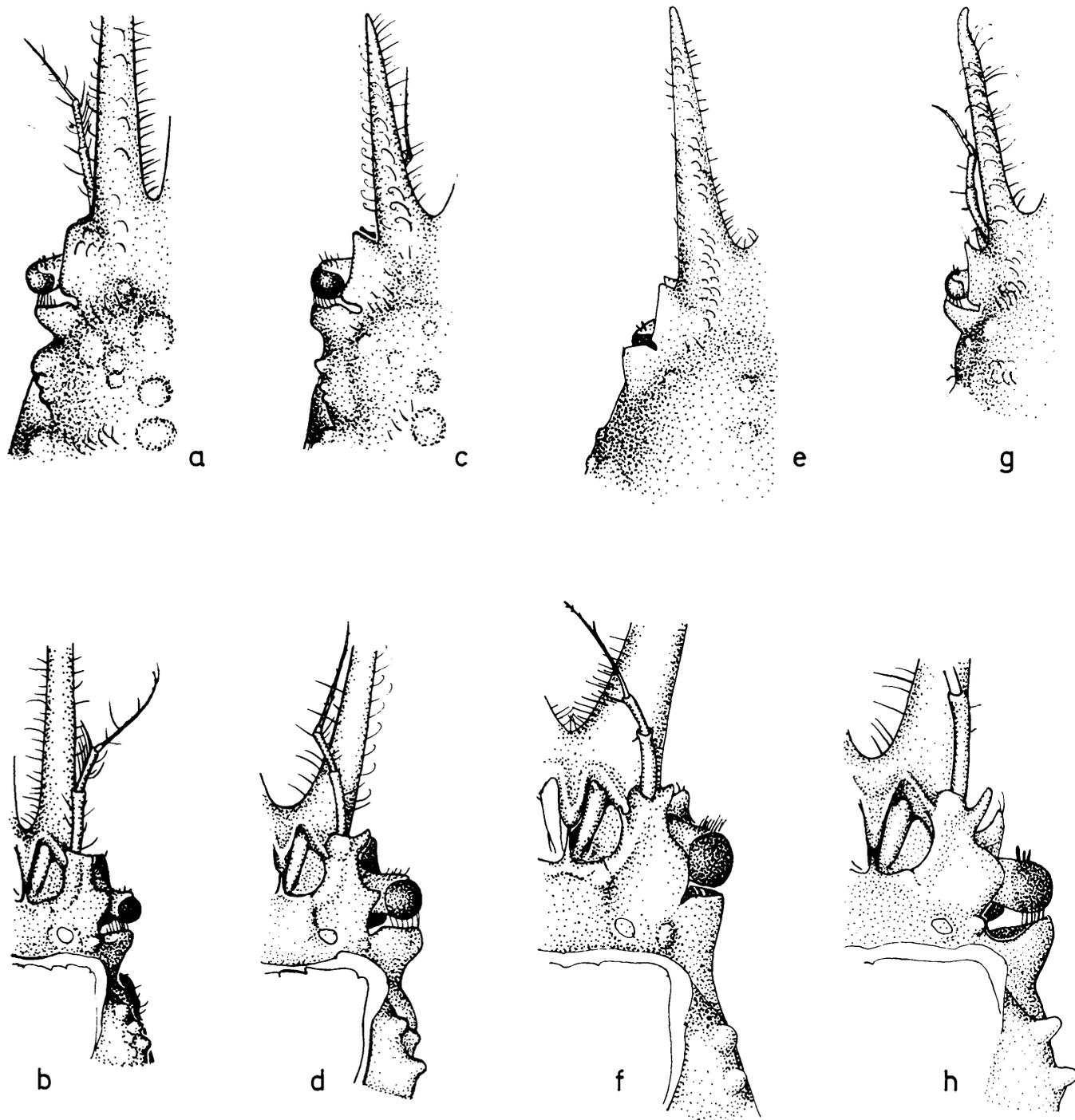


Fig. 40. (*Hyastenus* species of group 1) *Hyastenus whitei* (male, 34.5 mm, Singapore, ZMC) (a) left orbit, dorsal view, (b) ventral view of same; *H. sebae* (male, 22.5 mm, Sulu Archipelago, ZMC) (c) left orbit, dorsal view, (d) ventral view of same; *H. auctus* (male, 28 mm, Sulu Archipelago, ZMC) (e) left orbit, dorsal view, (f) ventral view of same; *H. trispinosus* (male, 12.5 mm, Ambon, ZMA) (g) left orbit, dorsal view, (h) ventral view of same.

anterolateral spine of the basal antennal article and there is a very broad U-shaped hiatus between the basal antennal article and the postorbital lobe. In these features this specimen is similar to *H. minutus* Buitendijk but it differs from the holotype of *H. minutus* ( $\sigma$ , 4.0 mm, Ternate, RML 4309) in having slightly longer, more slender rostral spines and a smaller epibranchial spine. A male of 9 mm from Sulu Archipelago has a small accessory spine on the anterolateral

spine of the basal antennal article on the right hand side but not on the left hand side and there is a broad V-shaped lower orbit hiatus; in a small immature female (12.5 mm, Kai Is.) the basal antennal article is similar to the adult and the hiatus of the lower orbit is a narrow V-shaped slit. It is possible that the accessory spine on the anterolateral spine of the basal antennal article in *H. minutus* may also be a juvenile character.

Distribution. — Philippine Islands, Kai Islands, north Western Australia (Cape Jaubert).

*Hyastenus biformis* Rathbun, 1916  
(Figs. 50e, f, 51a, b)

*Hyastenus biformis* Rathbun, 1916: 545-546. — Griffin, 1976: 191.

Material examined. — 5 ♂♂, 5 ♀♀ (1 ovig.), 5-14 mm, ovig. ♀, 7.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 64, Flores Sea, Tanahdjampea, Kamaragi Bay, up to 32 m, trawl, dredge and shore exploration, coral, coral sand, 4/5 May 1899; 1 spec. — Stn. 253, Kai Is., 05°48.2'S 132°13'E, 304 m, trawl, grey clay, hard and crumbly, 10 December 1899; 3 specs. — Stn. 313, Sumbawa, anchorage E. of Dangar Besar, Saleh Bay, up to 36 m, dredge, trawl and reef exploration, sand, coral and mud, 14/16 February 1900; 5 specs.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Natural Science Foundation Expedition: Stn. 465-4, Irian Jaya, Padaido I., 1/2 mile (~ 0.8 km) E. of Oerif I., Mios Woendi Lagoon, 6-9 m, coll. Ostheimer, Orr, Powell, 1956; 1 spec.

Remarks. — The two males and four females in this series from Sumbawa and Flores Sea, Indonesia, agree well with the holotype (♂, cl. 13 mm, USNM 48217) from the Sulu Archipelago. The rostral spines are a quarter to a third the postrostral carapace length. The preorbital angle of the supraorbital eave has only a small tubercle and the two lobes on the anterior margin of the postorbital lobe are subequal.

The cardiac region is as strongly elevated as the gastric region. There is a low tubercle on its anterior margin, two submedial tubercles centrally and a medial posterior tubercle.

There are three mesogastric tubercles, not two as in the holotype, and the protogastric tubercle is in line with the anterior of these. On the branchial region there are three to four small tubercles on the margin.

There is a small tubercle low on the margin of the hepatic region. On the branchial submargin there is one small tubercle anteriorly, and in the larger male, another posteriorly.

There are two tubercles on the pterygostomial margin and a small tubercle just dorsal to them.

The tubercles are less pronounced on the female specimens.

The basal antennal article is broad with two blunt subequal lobes on the lateral margin.

On the palm of the male cheliped there is a longitudinal row of sharp granules midway on the inner face, and scattered granules above it and on the dorsal margin.

The specimens from Irian Jaya and Kai Islands (3 ♂♂, 1 ovig. ♀, cl. 5-14 mm) have more tubercles on the carapace. As well as those mentioned, there is an inner pair of protogastric tubercles, there are two or three small tubercles dorsally on the hepatic region and an arc of three or four tubercles on the branchial submargin. The rostral spines are longer (half to two thirds postrostral carapace length) in the two large males (12, 14 mm), and the anterior margin of the postorbital lobe is straighter distally. The lobes on the lateral

margin of the basal antennal article are slightly shorter and the anterior one directed more laterally. The first pleopod of the male is not so narrow distally as it is in the holotype and the males from Sumbawa.

*H. biformis* is similar to *H. fraterculus* but that species has a much shorter rostrum (only about a sixth postrostral carapace length), the preorbital angle is more acute and there are eight to nine tubercles on the branchial margin. *H. scrobiculatus* is distinguished from *H. biformis* by the sharper projections on the lateral margin of the basal antennal article and the presence of only one tubercle on the cardiac region.

This species was previously known only from the Sulu Archipelago, Philippine Islands.

Distribution. — Sumbawa, Flores Sea, Kai Islands, Irian Jaya, Sulu Archipelago.

*Hyastenus bispinosus* Buitendijk, 1939  
(Fig. 41c, d)

*Hyastenus bispinosus* Buitendijk, 1939: 241, fig. 4, pl. 9 figs. 4, 5.

Material examined. — 3 ♂♂, 1 ovig. ♀, 6-12.5 mm, ovig. ♀, 10.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 282, anchorage between Nusa Besi and NE. point of Timor, 08°25.2'S 127°18.4'E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. — Ambon, Ambon reef; 2 specs.

Banda, on the shore; 1 spec.

Remarks. — These specimens agree well with the type material at the Rijksmuseum van Natuurlijke Historie, Leiden (RML 4301, 1 (juv.) ♀, 7.5 mm (holotype), 2 ♂♂, 5.5, 6.0 mm (paratypes)).

The preorbital angle of the supraorbital eave is produced obliquely forward, while the antorbital angle is only rounded and not produced. The hiatus between this and the postorbital lobe is narrow and U-shaped.

The gastric regions are strongly elevated with one low rounded protogastric tubercle but no mesogastric tubercles. The cardiac region of the ovigerous female is rounded and slightly elevated.

Most of these specimens are larger than those described by Buitendijk, and in all of them, there is a tubercle just dorsal to the epibranchial spine, which is larger than in the type material.

The basal antennal article has a very short blunt tooth directed forwards on the anterolateral angle, and the proximal part of the lateral margin is broadly convex.

The palm of the chela of the larger males is slightly inflated, its length is approximately twice the width, and there is a small proximal gap between the dactyl and the fixed finger.

The first pleopod of the male is similar to that of *H. sebae*, the tip being produced into a broad lobe on the lateral edge.

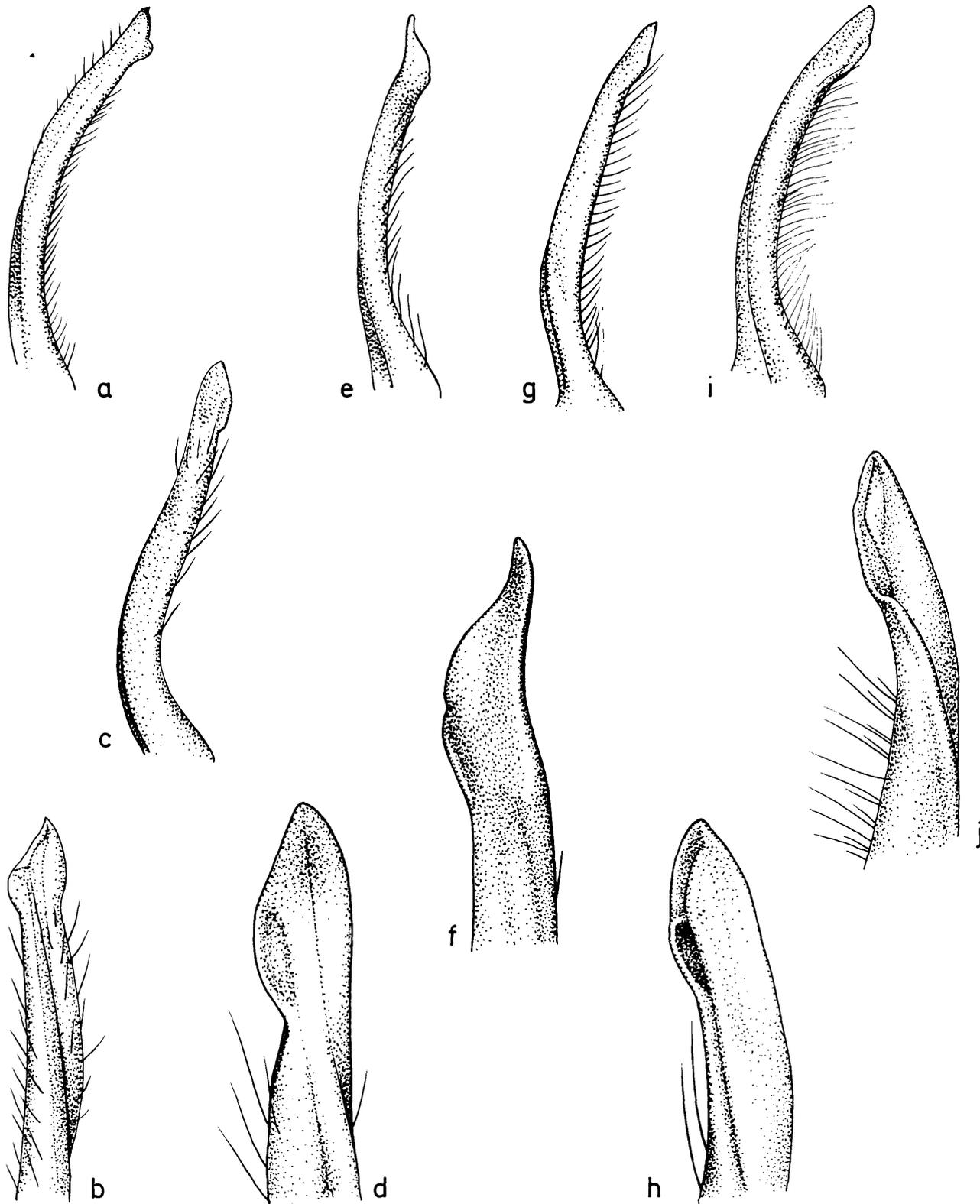


Fig. 41. (*Hyastenus* species of group 1) Left first pleopod of male of *Hyastenus auctus* (28 mm, Sulu Archipelago, ZMC) (a) abdominal view of pleopod, (b) sternal tip of same; *H. bispinosus* (12.5 mm, Ambon Reef, ZMA) (c) abdominal view of pleopod, (d) sternal tip of same; *H. trispinosus* (12.5 mm, Ambon, ZMA) (e) abdominal view of pleopod, (f) sternal tip of same; *H. sebae* (22.5 mm, Jolo, ZMC) (g) abdominal view of pleopod, (h) sternal tip of same; *H. whitei* (34.5 mm, Singapore, ZMC) (i) abdominal view of pleopod, (j) sternal tip of same.

The small male (cl. 6 mm) of which Buitendijk figured the pleopod (text fig. 4) is perhaps an immature animal.

Distribution. — Ambon, Banda, Timor, Lembah Strait.

*Hyastenus borradailei* (Rathbun, 1907)  
(Figs. 38a, b, g, 39a, 42a, b)

*Halimus borradailei* Rathbun, 1907: 64; 1911: 251-252, pl. 20 fig. 5.

*Hyastenus borradailei*. — Rathbun, 1924: 4.

*Hyastenus brockii*. — Campbell & Stephenson, 1970: 256, 258, fig. 24. — Takeda, 1973a: 103-104, fig. 2C, F, pl. 3 fig. A. (Not *Hyastenus brockii* De Man, 1888.)

Material examined. — 14 ♂♂, 17 ♀♀ (6 ovig.), 8-35 mm, smallest ovig. ♀, 14.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 282, anchorage between Nusa Besi and NE. point of Timor, 08°25.2'S 127°18.4'E, 27-54 m, trawl and dredge, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. — Stn. 315, Flores Sea, anchorage E. of Sailus Besar, Paternoster Is., up to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Banda Sea, Banda, off Neira, 5 m, sand, 9 June 1922; 1 spec. — Banda Sea, Banda, off Neira, 13 m, dive, sand, 12 June 1922; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Moreton Bay, Stradbroke I., subtidal, coll. K. Deacon, September-October 1968; 1 spec. (AM P.16789). — Wistari Reef, from 6 month algal panels, coll. R. Day, 2 July 1974; 1 spec. (AM P.29892). — Heron I., reef, 11 m, off gorgonid coral *Mopsella ellesi*, coll. K. Gillet, December 1961; 1 spec. (AM P.29888). — Heron I., channel, 7.5 m, in cave, at night, coll. R. Day, January 1975; 4 specs. (AM P.29891). — Heron I., reef, 10 m, at night, coll. N. Coleman, July 1976; 1 spec. (AM P.29894). — Heron I., 10 m, reef, coll. N. Coleman, 3 August 1977; 1 spec. (AM P.29893). — Townsville, Broadhurst Reef, 10.5 m, on coral behind SW. face, at night, coll. I. Loch, 11 October 1975; 2 specs. (AM P.24104). — Lizard I., reef, coll. G. Anderson; 1 spec. (AM P.29885). — Lizard I., outside reef between Bird I. and South I., 10.5 m, in blocks of dead *Porites lutea*, coll. P. Hutchings and P. Weate, June 1977; 2 specs. (AM P.29889). — Lizard I., outside reef between Bird I. and South I., 10.5 m, in blocks of dead *Porites lutea*, coll. P. Hutchings and P. Weate, April 1978; 1 spec. (AM P.29890). — Torres Strait, Murray I., coll. M. Ward, 10 November 1930; 2 specs (AM P.29887, dry).

Western Australia: Ninety Mile Beach between Broome and Wallal, about 14 m, dredge, coll. R. Bourne, 1930; 1 spec. (AM P.9916). — Ninety Mile Beach, between Cape Jaubert and Wallal, 9 m, dredge, coll. A. A. Livingstone, September 1929; 2 specs. (AM P.13893). — Ninety Mile Beach, 25 m, from pearl shells, coll. B. E. Bardwell; 7 specs. (AM P.29886, dry, det. M. Ward).

Remarks. — This species was originally figured as *Hyastenus elegans* var. *tenuicornis* by Borradaile (1900: 574, pl. 40 fig. 2) with only a few remarks; Rathbun (1907, 1911) added only a few descriptive notes. The specimen recorded by Rathbun (1907) from the Ellice Is. (Tuvalu) (♀, 9.9 mm, USNM 33391) and the specimen from Amirante figured by Rathbun (1911) (ovig. ♀, 13 mm, USNM 41407) have been examined by one of us (D.J.G.G.).

In the three very similar species *H. borradailei*, *H. brockii* De Man and *H. uncifer* Calman the first pleopod of the male is straight or weakly curved outwards, broad, tapering only near

the apex; one of the edges (lateral, medial or sternal) of the tip is straight or weakly convex, the other edge being produced into a broad, rounded lobe. The aperture is on the surface on, or near, the anterior part of this lobe. In *H. brockii* the aperture is on the sternal surface, in *H. uncifer* it is almost lateral, while in *H. borradailei* and *H. 'uncifer'* (as figured by Guinot) the aperture is on the abdominal surface.

The first pleopod of the male in this series of specimens is broad and straight with a sharp or subacute apex on the lateral edge and behind it, on the medial edge, a broad lobe; the aperture is midway along the lobe on the abdominal surface. The first pleopod of the male specimens figured as *H. brockii* by Campbell & Stephenson (1970) and by Takeda (1973a) differ from the pleopod figured by Buitendijk (1939: text fig. 3) for that species. However, the pleopods do agree with the pleopod described above for *H. borradailei* (discussed under *H. brockii*). Therefore we consider Campbell & Stephenson's specimen and Takeda's specimen to be properly referable to *H. borradailei*.

In this series the rostral spines are equal to, or slightly greater than, (1.0 to 1.3) the postrostral carapace length. The preorbital spine is sharp, directed forwards and horizontal; the antorbital angle is only very weakly produced; the anterior margin of the postorbital lobe is slightly sinuous. The eyestalks are only moderately stout and the cornea is not noticeably large. There is a tubercle on the hepatic region and a small tubercle on the branchial submargin anteriorly, which is only about half the size of the anterior pterygostomial tubercle. The six tubercles on the gastric regions are not always all distinct: sometimes the two mesogastric tubercles are low and the inner protogastric tubercle is small. As well as the two anterior tubercles on the dorsal branchial region, there is a tubercle medial to the short epibranchial spine. On the basal antennal article the anterolateral spine is short and directed forwards; the proximal lobe on the lateral margin is weakly convex but extends laterally beyond the anterolateral spine; the postorbital lobe is separated by a shallow U-shaped hiatus. The first ambulatory leg is about twice (1.9 to 2.2) the postrostral carapace length, the merus has a large blunt tubercle; the dactyl is slender (length about ten times height) and armed with eight to ten small spines, all except the most distal being directed obliquely backwards towards the propod. On the dactyl of the fourth ambulatory leg there are five to six long spines, the proximal three to four of which are sloped towards the propod, but not as strongly as those in *H. uncifer*. In three male specimens (16 mm, Sumbawa; 17 mm, Ninety Mile Beach; 35 mm, Heron I.) there is a blunt proximal tubercle dorsally on the palm of the chela.

This species is similar to *H. brockii* but can be distinguished from it by the preorbital spine which is horizontal, rather than upturned; by the sinuous anterior margin of the postorbital lobe (nearly straight in *H. brockii*); and by the first pleopod of the male with a broad medial, rather than a lateral lobe. As well, the eyes are not so large as are those of *H. brockii* and the dactyl of the first ambulatory leg is more slender.

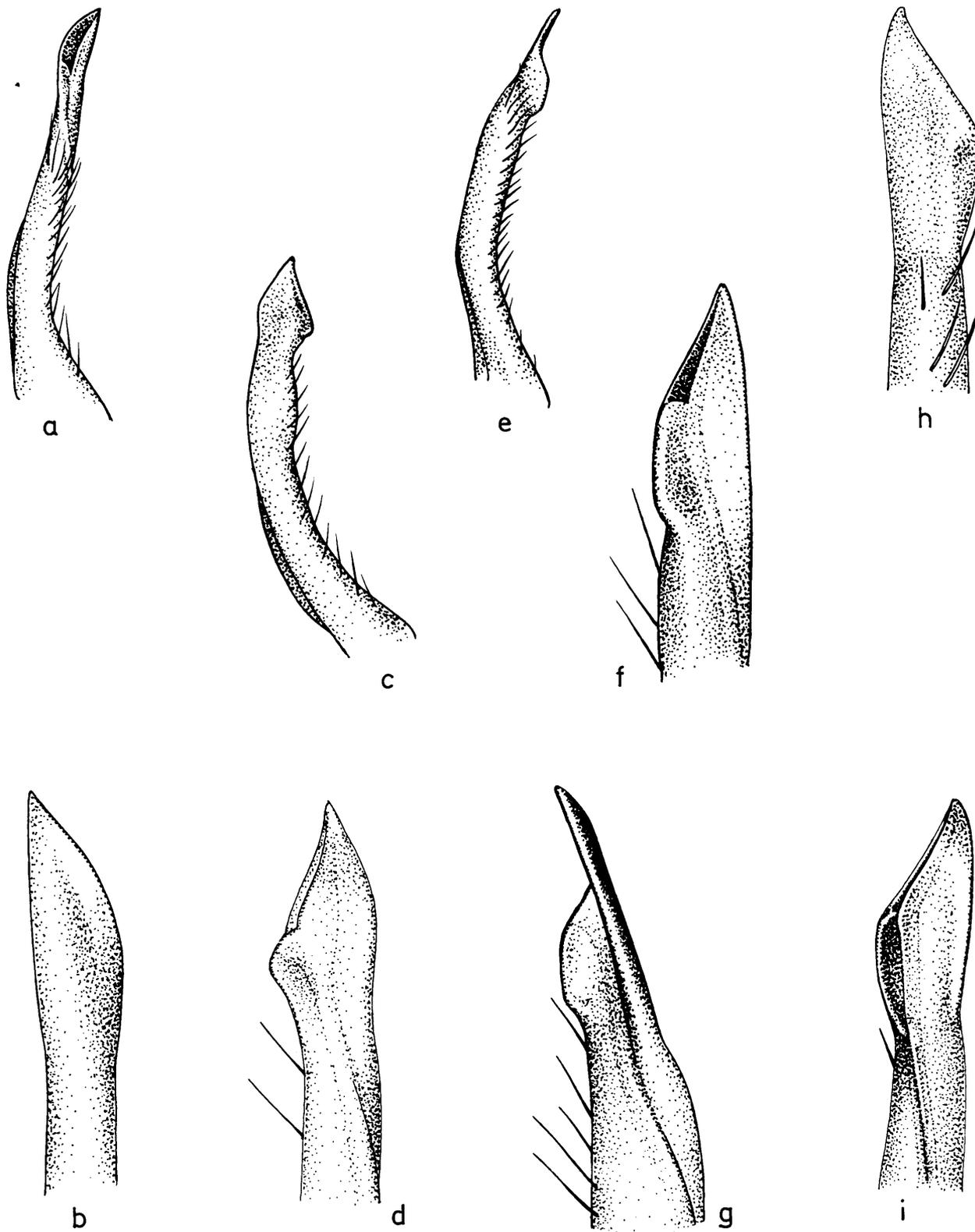


Fig. 42. (*Hyastenus* species of group 1) Left first pleopod of male of *Hyastenus borradalei* (35 mm, AM P.29891, in part) (a) abdominal view of pleopod, (b) sternal tip of same; *H. brockii* (11.5 mm, S. Sulawesi, ZMA) (c) abdominal view of pleopod, (d) sternal tip of same; *H. uncifer* (17 mm, Haingsisi Reef, ZMA) (e) abdominal view of pleopod, (f) tip of pleopod, lateral view, (g) sternal tip of same; *H. hilgendorfi* (28 mm, Jolo, ZMC) (h) abdominal tip of pleopod, (i) sternal tip of same.

The differences which distinguish this species and *H. brockii* from *H. uncifer* are discussed under *H. brockii*.

Distribution. — Amirante, Cargados Carajos, northern Australia from Ninety Mile Beach (Western Australia) to Moreton Bay (Queensland), Indonesia, Tuvalu (Ellice Is.), Japan.

*Hyastenus brockii* De Man, 1888  
(Figs. 38c, d, h, 39b, 42c, d)

*Hyastenus Brockii* De Man, 1888: 221-223, pl. 7 fig. 1. — Calman, 1900: 36.  
*Hyastenus brockii*. — Buitendijk, 1939: 239-241, text fig. 3.

Material examined. — 3 ♂♂, 8 ♀♀ (2 ovig.), 8-19 mm, smaller ovig. ♀, 15 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 66, S. Sulawesi, S. of Saleyer, bank between islands of Bahuluwang and Tambulungen, 8-10 m, dredge, dead coral, *Halimeda*, *Lithothamnion*, 7/8 May 1899; 2 specs. — Stn. 282, anchorage between Nusa Besi and NE. point of Timor, 08°25.2'S 127°18.4'E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. — Ambon, Ambon reef; 3 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Banda Islands, off Waling, ca. 15 m, sand, 15 May 1922; 2 specs. — Banda, off Neira, ca. 10 m, dive, sand, 5 June 1922; 1 spec. — Banda, off Neira, ca. 15 m, dive, sand, 9 June 1922; 1 spec.

WESTERN AUSTRALIAN MUSEUM, PERTH

Sulu Archipelago, Basilan Straits, W. of Malanipa I., 23 m, sand and rubble, coll. B. R. Wilson, 'Pele', 12 February 1964; 1 spec. (WAM 92-71, in part).

Remarks. — This species is very similar to *Hyastenus borradailei* (Rathbun): unfortunately the original descriptions and figures for both species are inadequate. Buitendijk (1939) identified two specimens (♂, 16 mm, Ternate; ovig. ♀, 16.5 mm, Ambon, RML) as *H. brockii*, and figured the abdominal view of the tip of the left first pleopod of the male. One of us (D.J.G.G.) has examined these specimens. We accept the identification by Buitendijk as valid and regard the male specimens in our series with a similar pleopod (a sharp medial apex, a broad lateral lobe and the aperture on the sternal surface) as belonging to *H. brockii*.

The specimens described and figured as *H. brockii* by Campbell & Stephenson (1970: 256, 258, fig. 24) and by Takeda (1973a: 103-104, fig. 2C, F, pl. 3 fig. A) have a first pleopod in the male with a narrow lateral apex, a broad medial lobe and the aperture is on the abdominal surface. These specimens are included by us in *H. borradailei* and are discussed under that species. The differences and similarities of the male pleopods of these two species and *H. uncifer* are discussed under *H. borradailei*.

*H. brockii* and *H. borradailei* are similar to *H. uncifer* Calman but are distinguished from that species by having a tubercle, rather than a spine, on the hepatic and intestinal regions; the

presence of two tubercles, rather than one, on the anterior part of the dorsal branchial region; and the proximal lobe on the basal antennal article is produced further laterally than the anterolateral spine.

The differences which distinguish *H. brockii* from *H. borradailei* are discussed under *H. borradailei*.

In this series the rostral spines are usually shorter (0.66 to 0.75) than the postrostral carapace length but in three specimens they are subequal to the postrostral carapace length. The preorbital spine is sharp, directed forwards and slightly upwards; the anterior margin of the postorbital lobe is nearly straight. The eyestalk is stout and the cornea is conspicuously large as in *H. uncifer*.

On the gastric region of these specimens the protogastric tubercle near the orbit is quite distinct, the inner protogastric tubercle is sometimes absent, and the two mesogastric tubercles are low. The first ambulatory leg is usually less than twice (1.6 to 2.1) the postrostral carapace length, there is a short terminal spine and, in most specimens, a low proximal tubercle on the merus; the dactyl is moderately slender (length about seven times height), with seven to eight straight, or slightly oblique, spines ventrally. On the dactyl of the fourth ambulatory leg there are five to seven long spines of which only some of the proximal ones are directed backwards toward the propod.

Distribution. — Sulu Archipelago, Ternate, Ambon, Banda, Timor, Torres Strait, S. Sulawesi.

*Hyastenus campbelli* new species  
(Figs. 43, 46b, 47h-j)

*Hyastenus* sp. — Campbell & Stephenson, 1970: 258-259, fig. 27.

Material examined. — 45 ♂♂, 54 ♀♀ (11 ovig.), 9-52 mm, smallest ovig. ♀, 22 mm.

Holotype. — Male, cl. 47.5 mm, Queensland, SE. corner Gulf of Carpentaria, 22 m, coll. D. F. McMichael and J. C. Yaldwyn, December 1963, CSIRO Prawn Survey; The Australian Museum, Sydney, AM P.29906.  
Paratypes. — As listed below.

ZOOLOGICAL MUSEUM, AMSTERDAM

Aru Is., Jedan, 10 February 1907; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 66, Java, Pula Balu, 05°54'S 106°12'E, 24 m, trawl, sandy mud, shells, 27 July 1922; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, S. of Merauke, 'De Goede Hoop', March-April 1955; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition-Moluccas: Stn. AW I, Aru, Wokam, off W. coast of Wasir I., 05°30'S 139°12'E, 54-57 m, dredge haul 5, mud, 15 June 1970; 2 specs. — Stn. AN I, Aru, S. Trangan I., SW. of Tg. Ngabordamlu, centred near 06°58'S 134°05'E, 26-29 m, dredge haul 1, coral and sponge, 20 June 1970; 1 spec. — Stn. A III, Aru, Trangan, 3-4 miles (~ 5-6.5 km) W. of Tg. Lelar, 06°46'S 133°58'E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 1 spec.

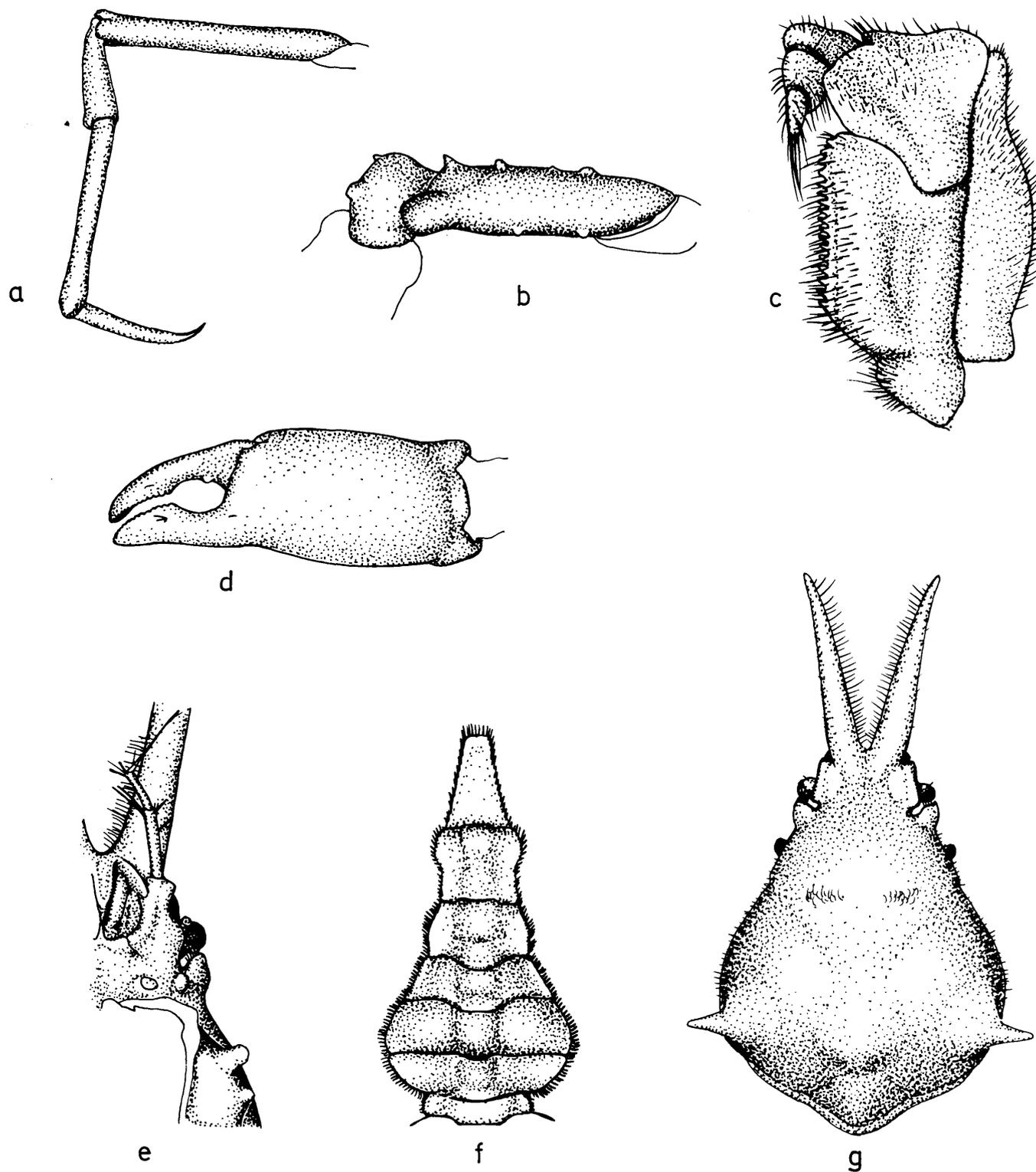


Fig. 43. (*Hyastenus* species of group 2) *Hyastenus campbelli* (holotype) (a) left first ambulatory leg; (b) left cheliped, merus and carpus; (c) left third maxilliped; (d) left chela; (e) left orbit, ventral view; (f) male abdomen; (g) carapace, dorsal view.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: mouth of Mary River, 4 m, 6 June 1946; 3 specs. (AM P.11906). — Off Bundaberg, 14-45 m, coll. A. Carter, December 1963; 1 spec. (AM P.18545). — Port Curtis, 7 m, coll. A. R. McCulloch and E. Troughton, August 1912; 1 spec. (AM P.3150). — Port Curtis, 11 m; 1 spec. (AM P.1960). — Port Curtis, 7 m, coll. A. R. McCulloch and E. Troughton, August 1912; 1 spec. (AM P.3151). — Port Curtis, Facing I., off Gatcombe Head, 16-22 m, dredge, coll. M. Ward, December 1929; 15

specs. (AM P.29908). — Port Curtis, dredged off Gatcombe Head, 16-21 m, coll. M. Ward and W. Boardman, July 1929; 12 specs. (AM P.29904). — Curtis I., northwest Channel, 5.4 m, dredge, coll. M. Ward, 1928; 1 spec. (AM P.29910). — Keppel I., 1½ miles (~ 2.5 km) NW., 12-20 m, coll. W. F. Ponder and T. Nielson, 4 July 1969; 2 specs. (AM P.29909). — Great Keppel I., 8 m, sand and rubble, coll. N. Coleman, 12 September 1974; 2 specs. (AM P.20477). — Swain Reefs, dredged off Gillett Cay, 54-72 m, October 1962; 4 specs. (AM P.29903). — N. of Mackay, Repulse

Bay, 14 m, trawl, October 1954; 1 spec. (AM P.12953). — Whitsunday Group, Black I., near Langford Reef, shallow water, coll. N. Coleman, November 1969; 1 spec. (AM P.19505). — Port Denison, intertidal, among stones and dead coral; 1 spec. (AM P.6954). — Port Denison; 1 spec. (AM P.170). — Port Denison; 3 specs. (AM P.1910). — S. of Townsville, Chunda Bay, 9 m, prawn trawl, coll. C. Wilson, April 1967; 1 spec. (AM P.29907). — Albany Passage, coll. M. Ward, August/September 1928; 21 specs. (AM P.15236). — SE. corner Gulf of Carpentaria, 16°57.3'S 139°40.4'E, 12 m, CSIRO Prawn Survey, Stn. 51, 13 August 1963; 1 spec. (AM P.18593). — SE. corner Gulf of Carpentaria, 17°18.7'S 139°37.8'E, 4 m, CSIRO Prawn Survey, Stn. 449, 8 December 1963; 1 spec. (AM P.18562). — SE. corner Gulf of Carpentaria, CSIRO Prawn Survey, 1963-64; 1 spec. (AM P.18570). — SE. corner Gulf of Carpentaria, data as for holotype; 7 specs. (AM P.29905).

Northern Territory: entrance to Port Darwin, intertidal on rocky reef shore, coll. A. A. Livingstone, June-October 1929; 2 specs. (AM P.13879).

Western Australia: Broome, June 1932; 2 specs. (AM P.10240). — Broome, dredge, coll. R. Bourne; 1 spec. (AM P.10194). — Near entrance to Roebuck Bay, 9-14 m, *Lithothamnion* reef bottom, coll. A. A. Livingstone, 26 September 1929; 1 spec. (AM P.13884). — Between Cape Bossut and Broome, 9 m, coll. A. A. Livingstone, 11 September 1929; 1 spec. (AM P.13885). — Between Broome and Wallal, (off Ninety Mile Beach), 12 m, dredge, coll. R. Bourne, 1931; 1 spec. (AM P.10022).

#### WESTERN AUSTRALIAN MUSEUM, PERTH

SE. Gulf of Carpentaria, 16°52'S 140°09'25"E, 4 m, 'Rama', CSIRO Gulf of Carpentaria Prawn Survey, 29 November 1964; 1 spec. (WAM 91-71).

Description. — Carapace pyriform, widening posteriorly, width about three quarters (0.76) postrostral carapace length, surface smooth, covered by a short tomentum; a strong epibranchial spine, no tubercles.

Rostral spines straight, short, less than half (0.4 to 0.47) postrostral carapace length, divergent, cylindrical, tapering to blunt apices.

Orbital eave moderately expanded, preorbital angle not or only weakly produced; margin of eave straight; antorbital angle not produced, rounded; postorbital lobe separated from eave by a narrow U-shaped hiatus; postorbital lobe moderately produced, anterior margin weakly convex. Eyestalks short, moderately slender; cornea terminal.

Hepatic region flat, smooth. Branchial submargin without tubercles; a strong epibranchial spine directed laterally.

Gastric regions hardly elevated, smooth, without tubercles, a transverse row of curled hairs on posterior protogastric region.

Cardiac region smooth, flat, hardly elevated. Intestinal region with a weak central elevation.

Branchial regions smooth, flat.

Basal antennal article narrow, smooth, anterolateral angle only weakly produced laterally, rounded; lateral margin sinuous, weakly concave behind anterolateral angle, proximal two-thirds produced into a broad convex lobe, greatest width at about proximal third; lower orbit hiatus broad, U-shaped. A blunt tubercle lateral to green gland.

Pterygostomian region smooth, margin with two tubercles, anterior about twice as high as posterior.

Third maxilliped smooth, ischium with central groove; anterolateral angle of merus moderately produced and rounded. Anterolateral angle of mouthfield moderately produced, oblique.

Cheliped of male about as long (1.2) as postrostral carapace length; merus with three small tubercles dorsally and a small terminal spine, two small tubercles ventrally on outer face; carpus with two dorsal tubercles; length of palm about one and a half (1.7) times height; fingers about two thirds (0.68) palm, strongly gaping in proximal half, a proximal tooth on dactyl in gape, uniform small teeth on both fingers in distal half.

Ambulatory legs slender, smooth; first leg about twice (2.1) postrostral carapace length, merus with a low terminal tubercle; fourth leg about equal to postrostral carapace length and about half as long as first leg, dactyl smooth.

Sternum of male smooth, first sternite with strong lateral ridge, a ridge around anterior margin of abdominal fossa to posteromedial angle of sternite.

Male abdomen of seven segments, third segment with rounded elevations laterally, width about twice (2.1) that of sixth segment; sixth segment about as wide as long, lateral margin convex in distal half; length of seventh segment about one and a half (1.6) times basal width, tip truncate.

First pleopod of adult male broad in proximal half with many long setae, curved toward midline; distal half filiform, straight. First pleopod of juvenile male tapering gradually, distally slender but not filiform; left and right pleopods meeting on midline not far above their base, curving slightly outwards, and then curving inwards distally, sometimes meeting at apex.

Female abdomen smooth, with a low, broad medial ridge, segments four to six fused, suture visible in midline only, a broad, low tubercle near posterolateral angle of fourth and fifth segments.

Female gonopore a suboval aperture, narrower laterally, margins high and rounded, lateral half of aperture almost covered by a lobe extending forward from posterior margin.

Remarks. — This species is similar to *H. diacanthus* (De Haan), *H. elatus* n.sp. and *H. cracentis* n.sp. but is distinguished from them by the absence of tubercles from both protogastric and mesogastric regions. The other differences which distinguish this species from *H. cracentis* are discussed under that species.

Campbell & Stephenson (1970) have listed the points that distinguish this species from *H. elatus*, which occurs over a similar geographic range, including the U-shaped hiatus on the lower orbit (rather than a slit or narrow V-shaped); and the seventh segment of the male abdomen which is about one and a half times longer than the basal width (rather than wide as long). Campbell & Stephenson also noted that the rostral spines are shorter in this species than in *H. elatus*: whilst this is usually so it is not true for all the specimens in our series. The first pleopod of the adult male of both this species and *H. elatus* are figured by Campbell & Stephenson, and are quite clearly different from each other. As well, it can be pointed out that the margins of the female gonopore are strongly elevated and rounded, not low as in *H. elatus* and *H. diacanthus*.

In this species, as in *H. aries* and *H. diacanthus*, the adult male has a different form of pleopod from that of the young male. The first pleopod of the adult male (cl. 20.5 mm), described by Campbell & Stephenson, is broad proximally and filiform distally. A male (28 mm) from Irian Jaya has a similar pleopod and so do 14 adult males (cl. 30-50 mm) in the Australian Museum's collection. The distal two thirds of the pleopod is even more filiform than that of *H. diacanthus*. The juvenile males from Java (cl. 16.5 mm) and the Gulf of Carpentaria (32 mm), together with others in the Australian Museum (cl. 9-33 mm) have a pleopod which tapers more gradually over the whole length and is slender but not filiform distally; the two pleopods meet on the midline not far above their base, curve slightly outwards at first and then inwards distally, sometimes meeting at their apex.

The new species is named for Mr Bruce Campbell, Queensland Museum, who has made numerous contributions to the knowledge of Moreton Bay and other Queensland species of Brachyura.

Distribution. — Irian Jaya, Aru Islands, Java, northern Australia from Moreton Bay (Queensland) to Ninety Mile Beach (Western Australia).

*Hyastenus convexus* Miers, 1884  
(Fig. 48d, e)

*Hyastenus (Chorilia) convexus* Miers, 1884: 196, pl. 18 figs. B, b.  
*Hyastenus convexus*. — De Man, 1902: 664-666, pl. 22 fig. 32. — Balss, 1935a: 123, 124. — Griffin, 1974: 14; 1976: 191-192.  
*Hyastenus tuberculosus* Rathbun, 1916: 543-544.

Material examined. — 24 ♂♂, 24 ♀♀ (10 ovig.), 4-24.5 mm, smallest ovig. ♀, 10.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Sumbawa, Sapeh Strait, 08°23.5'S 119°4.6'E, 69 m, dredge, coral and shells, 14 April 1899; 2 specs. — Stn. 80, Borneo Bank, 02°25'S 117°43'E, from 50-40 m, trawl, fine coral sand, 13 June 1899; 1 spec. (ZMA De.100.629 — in part). — Stn. 204, S. Sulawesi, between islands of Wowoni and Butung, N. entrance of Butung Strait, 04°20'S 122°58'E, 75-94 m, dredge and trownet, sand with dead shells, 20 September 1899; 1 spec. — Stn. 274, Aru Is., 05°28.2'S 134°53.9'E, 57 m, Blake dredge, sand and shells, stones, 26 December 1899; 1 spec. — Stn. 299, Timor, S. coast of Roti I., Boeka Bay or Cyrus Bay, 10°52.4'S 123°1.1'E, 34 m, dredge, reef exploration, diving, mud, coral and *Lithothamnion*, 27/29 January 1900; 1 spec.

N. Sulawesi, Kuandang Bay, 540-720 m, coll. van Nouhuys, 20 April 1914; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Japan, off Goto, 33°10'N 129°18'E, 72 m, 7 January 1897; 2 specs. — Formosa Strait, 45 m, 23 May 1897; 2 specs. — off Fuchou, 26°10'N 121°E, 79 m, coll. Capt. Christiansen, 'Store Nordiske', 5 August 1912; 1 spec.

South India, Pamban, 3-5 m, April 1889; 1 spec.

Mortensen Pacific Expedition: Mindanao, 6 miles (~ 10 km) NNE. of Sacol, ca. 63 m, trawl, 6 March 1914; 1 spec. — Sulu Archipelago, off Jolo, ca. 36 m, dredge, *Lithothamnion*, 17 March 1914; 1 spec. — Sulu Archipelago, off Jolo, 54 m, dredge, sand, coral, 19 March 1914; 3 specs.

Danish Kei Islands Expedition: Ambon, Ambon Bay, ca. 126 m, dredge, sand, stone, 21 February 1922; 4 specs. — Ambon, Ambon Bay, ca. 126 m,

dredge, stones, sand, 22 February 1922; 2 specs. — Ambon, Ambon Bay, ca. 126 m, dredge, stones, gravel, 23 February 1922; 1 spec. — Ambon, Ambon Bay, 90 m, dredge, stones, sand, 2 March 1922; 6 specs. — Ambon, Ambon Bay, 90 m, dredge, stones, sand, 3 March 1922; 3 specs. — Stn. 15, Kai Is., S. of Doe Roa, ca. 20-5 m, trawl, sand, 10 April 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AH I, Haruku I., (E. of Ambon) near Tg. Bt. Kapal, 03°36'S 128°24'E, 119-126 m, dredge haul 6, 31 May 1970; 1 spec. — Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15'S 128°08'E, 36-47 m, dredge hauls 7-9, coral, sponge, coarse sand, *Lithothamnion* and rubble, 1-2 June 1970; 1 spec. — Stn. KR VII, Kai Is., between Du Rowa and Kai Dulah Is., 05°32'S 132°46'E, 32-36 m, dredge haul 3, muddy sand and sponge, 11 June 1970; 1 spec. — Stn. KN II, Kai Is., W. coast of Nuhu Tjut, off Elat Bay, 05°40'S 132°59'E, 48-63 m, dredge hauls 3-4, rubble, fan coral, green algae and sand, 13 June 1970; 1 spec. — Stn. KN II (as above), 81-83 m, dredge haul 5, coarse sand and rubble, barren, 13 June 1970; 1 spec. — Stn. KN II (as above), 48-54 m, dredge haul 6, rubble, algae and sand, 13 June 1970; 3 specs. — Stn. AW I, Aru Is., W. Wokam, off W. coast of Wasir I., 05°30'S 134°12'E, 54-57 m, dredge haul 5, mud, 15 June 1970; 1 spec. — Stn. AW I (as above) 32-39 m, dredge haul 6, sand and shell rubble, 15 June 1970; 1 spec. — Stn. AW IV, Aru Is., Wokam, off W. end Udjir I., 05°37'S 134°10'E, 68-93 m, dredge hauls 4-7, mud and rubble, 16 June 1970; 1 spec. — Stn. AM II, Aru Is., Maikoor, approx. 8 miles (~ 13 km) SW. of Tg. Ratoe, centred at 06°07'S 133°57'E, 45-75 m, dredge hauls 1-4, sand and rubble, 18 June 1970; 1 spec. — Stn. B, Northern Territory, Clarence Straits, 27-57 m, dredge, mud, 30 June 1970; 1 spec.

Remarks. — In these specimens the rostral spines are slender and divergent, and vary from less than half to just greater than half the postrostral carapace length. The supraorbital eave is expanded, but the preorbital angle is not produced forward except in four specimens (16.5-20 mm) from off southern Japan and the Formosa Straits. The hiatus between the supraorbital eave and the postorbital lobe is keyhole-shaped. The medial part of the 'hole' is circular, or is longer on the anteroposterior axis (not transversely).

The carapace is covered with swollen setae which are longer on the tubercles and angles of the upper orbit. These setae are present in longitudinal rows on the ambulatory legs and cheliped, including the cheliped palm.

There are two mesogastric tubercles and one protogastric tubercle near the orbit. There is a small dorsal tubercle on the rounded hepatic region.

There is a row of three tubercles on the branchial margin, two on the anterior half and the third on the posterior half. This posterior tubercle is never in any way produced to form an epibranchial spine. On the branchial submargin there is only one very small tubercle near the anterior border.

The anterolateral spine of the basal antennal article is blunt, narrow, directed almost laterally and slightly ventrally. The broad proximal lobe on the lateral margin is flat. The suborbital tooth is laterally compressed.

The length of the palm of the cheliped of the adult male is about one and a half times its height and only slightly longer than the fingers. There is a strong gape with a single large tooth close to the base of the dactyl and small teeth distally where the fingers meet. There is a small tubercle on the dorsal edge of the palm in most specimens.

The first pleopod of the male narrows only slightly at the tip and there are a few long setae on the medial edge. This pleopod is similar to that of *Thusaenys calvarius*. That species also has a strong lobe on the anterior margin of the postorbital lobe and there are similarities in the shape of the basal antennal article.

The variation in this species has been previously discussed (Griffin, 1974; 1976). *H. hendersoni*, originally described as a 'variety' of *H. convexus*, is a distinct species not identifiable with *H. convexus*.

Distribution. — Indo-West Pacific from eastern Africa through Indonesia to Australia and E. China Sea.

*Hyastenus cracentis* new species  
(Figs. 44, 47c, d)

*Hyastenus diacanthus*. — Griffin & Tranter, 1974: 170. (Not *Pisa (Naxia) diacantha* De Haan, 1839.)

Material examined. — 5 ♂♂, 1 ovig. ♀, 18-36.5 mm, ovig. ♀, 34 mm.

Holotype. — Male, cl. 31.5 mm, Java Sea, Gasper Straits, coll. T. S. Gardner; Zoological Survey of India, Calcutta, ZSC 1377-8/7 (one specimen of two).

Paratypes. — As listed below.

ZOOLOGICAL SURVEY OF INDIA, CALCUTTA

Java Sea, Gasper Straits, coll. T. S. Gardner; 1 ♂, (ZSC. 1377-8/7, one specimen of two). — NE. India, Ganjam coast, 8 miles (~ 13 km) SE. of Bawanapadu Beacon, 50 m, sand, 'Investigator', Stn. 91, 20 February 1890; 1 ♂, 1 ovig. ♀ (ZSC 4494/10).

ZOOLOGICAL MUSEUM, AMSTERDAM

N. coast of Sumatra, telegraph cable; 1 ♂ (ZMA De.100.715); 1 ♂ (ZMA De.100.802, in part).

Description. — Carapace pyriform, widening posteriorly, width up to three quarters (0.7 to 0.75) postrostral carapace length, surface mostly smooth, a few tubercles near margins covered by a short tomentum, an epibranchial spine.

Rostral spines long, more than three quarters (0.8) postrostral carapace length in male, (0.6 in female), divergent, cylindrical, acuminate.

Orbital eave moderately expanded, preorbital angle hardly produced, almost a right angle; antorbital angle weakly produced, rounded; postorbital lobe separated from eave by a narrow 'keyhole'-shaped hiatus; postorbital lobe only moderately produced, anterior margin weakly convex.

Eyestalks short, moderately slender; cornea terminal and ventral.

Hepatic margin weakly expanded, a low tubercle on margin.

Branchial submargin with one tubercle anteriorly; a strong epibranchial spine directed laterally.

Gastric regions elevated, no mesogastric tubercles; a low protogastric tubercle laterally near postorbital lobe. Cardiac region elevated, rounded, smooth. Intestinal region with a

medial tubercle or short spine near posterior carapace margin.

Branchial region smooth except for a rounded tubercle just dorsal to epibranchial spine.

Basal antennal article smooth, a ridge along medial margin; anterolateral angle produced forward and slightly outwards as a short spine; lateral margin sinuous, concave behind spine, proximal half of margin produced as a broad convex lobe; lower orbital hiatus narrow, U-shaped. A rounded tubercle lateral to green gland.

Pterygostomian region smooth, margin with two tubercles, anterior larger.

Third maxilliped smooth, ischium with a narrow central groove; merus with a ridge along posterior margin, anterolateral angle moderately produced and rounded.

Cheliped of male about as long (0.97 to 1.03) as postrostral carapace length; merus with three groups of stout setae dorsally and a strong terminal spine; carpus with a sharp dorsal tubercle at about distal third; palm elongate, length about three times (3.4 to 2.8) height; fingers about half as long as palm, weakly gaping in proximal third, two small teeth on each finger in gape, uniform small teeth on distal two thirds of both fingers.

Ambulatory legs slender, smooth, first leg about twice (1.9 to 2.0) postrostral carapace length, merus with a terminal tubercle; fourth leg about equal to postrostral carapace length and about half as long as first leg, dactyl with seven small spines ventrally along its length.

Sternum smooth, a transverse ridge anteriorly near base of third maxillipeds; a low ridge on anterior border of abdominal fossa.

Male abdomen of seven segments, smooth, a low medial tubercle anteriorly, in all except seventh segment; third segment with rounded elevations laterally, nearly twice (1.9) as wide as sixth segment; sixth segment about one and a half (1.4) times as wide as long, lateral margin convex distally; seventh segment about as wide as long.

First pleopod of male broad, narrower in distal fifth; apex truncate, lateral angle produced forward, subacute, medial angle obtuse.

Female abdomen of seven segments, a medial tubercle in segments one to three, a low medial ridge in remainder.

Female gonopore a pear-shaped aperture narrower laterally, opening ventrally and medially.

Remarks. — This species is similar to *H. campbelli* n.sp. in general appearance and in the absence of any mesogastric tubercles, but it can be distinguished from that species by the following points:

- (1) there is a low tubercle on the hepatic region (none in *H. campbelli*);
- (2) there is a rounded tubercle just dorsal to the epibranchial spine (none in *H. campbelli*);
- (3) there is a tubercle or short spine on the intestinal region (smooth in *H. campbelli*);

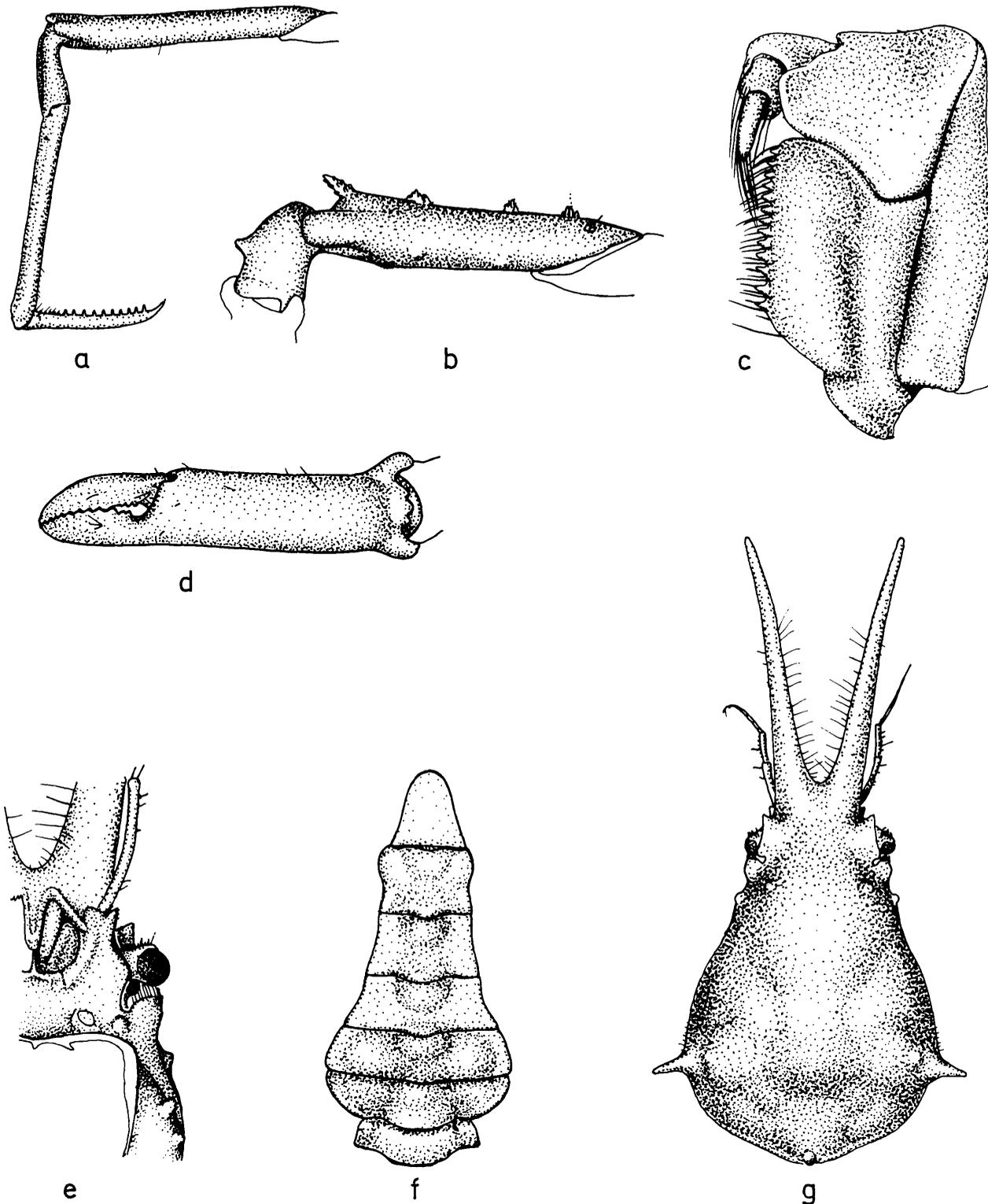


Fig. 44. (*Hyastenus* species of group 2) *Hyastenus cracentis* (holotype) (a) left first ambulatory leg; (male, 36.5 mm, Java Sea, ZSC) (b) left cheliped, merus and carpus; (holotype) (c) left third maxilliped; (male, 36.5 mm, as above) (d) left chela; (holotype) (e) left orbit, ventral view; (f) male abdomen; (g) carapace, dorsal view.

- (4) the seventh segment of the male abdomen is about as long as its basal width and rounded apically (one and a half times longer in *H. campbelli* and truncate apically); and  
 (5) the first pleopod of the adult male tapers gradually and the apex is truncate (the distal half of the adult male first pleopod is filiform in *H. campbelli*).

This species is distinguished from *H. diacanthus* and *H.*

*elatus* by the absence of mesogastric tubercles and the presence of a hepatic tubercle.

The specific name is derived from the Latin *cracentis* — graceful, in reference to the neat form of the carapace of this species.

Distribution. — Java Sea, India, Red Sea.

*Hyastenus diacanthus* (De Haan, 1839)  
(Figs. 46c, 48a-c)

*Pisa (Naxia) diacantha* De Haan, 1839: 96-97, pl. 24 fig. 1.  
*Hyastenus diacanthus*. — Sakai, 1938: 279-281, text fig. 36, pl. 29 fig. 2;  
1965a: 81, pl. 36 fig. 1; 1976: 225-226, pl. 77 fig. 1. — Buitendijk, 1939:  
241-242, text figs 5-8. — Takeda & Miyake, 1969: 508-509.

Material examined. — 17 ♂♂, 20 ♀♀ (6 ovig.), 11-70.5 mm, smallest ovig. ♀, 30.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 273, E. coast of Aru Is. (Pearl banks), anchorage off Pulu Jedan, 13 m, trawl, dredge and divers, sand and shells, 23/26 December 1899; 1 spec.

N. Sulawesi, Kuandang Bay, 36-81 m, coll. van Nouhuys, 18 April 1914; 1 spec.

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Japan, Nagasaki, coll. J. Jordan; 1 spec.

E. China Sea, 32°12'N 128°10'E, 180 m, 20 October 1897; 1 spec.

Formosa Strait and S. China Sea: 26°42'N 121°10'E, 77 m, 2 specs. — 63 m, 1 spec. — Namoa I.; 4 specs. — 21°30'N 113°08'E, 36 m, 6 April 1890; 2 specs. — 23°57'N 118°33'E, 50 m, April 1897; 2 specs. — 41-45 m, 23 May 1897; 1 spec. — 45 m, 23 May 1897; 4 specs. — 23°15'N 117°40'E, coll. Capt. Christiansen, 'Store Nordiske', 26 July 1912; 6 specs. — 24°06'N 118°25'E, 36 m, coll. Capt. Christiansen, 'Store Nordiske', 10 August 1912; 8 specs. — 23°34'42"N 119°49'04"E, 108 m, 'Store Nordiske', 26 August 1929; 1 spec.

Danish Kei Islands Expedition: Ambon I., Ambon Bay, 12-18 m, sand, 28 February 1922; 1 spec. — Stn. 108, Java Sea, 05°44'S 105°56'E, 54 m, trawl, sand, stones, 5 August 1922; 1 spec.

Remarks. — This large species has been recorded on many occasions from Japan, China Sea, north Australia, Singapore, Gulf of Thailand and India by many authors. However, several accounts (Sakai, 1934; Buitendijk, 1939; Campbell & Stephenson, 1970; Serène & Lohavanijaya, 1973) over the last 40 years describe and figure, under the same specific name, forms with three quite different male first pleopods.

Buitendijk (1939) has figured and commented on the first pleopod of males from De Haan's type material of this species (RML 742, 6 ♂♂, cl. 20.9-67.1 mm). She found that the first pleopod of a large specimen (35 mm) had a filiform distal half (figs. 5-7); the specimen of 34 mm had a gradually tapering pleopod (fig. 8), and the smallest males are like those figured by Sakai' (i.e. Sakai, 1934: text fig. 9c).

Specimens of *H. diacanthus* in our series, from Japan, Formosa Strait, S. China Sea, N. Sulawesi, Ambon and Java Sea, of less than 32 mm, have (with one exception) a curved pleopod of the kind shown by Sakai and by Buitendijk, i.e. they curve towards the medial line in the distal quarter. In the adult males from these localities the distal half of the first pleopod is filiform. These specimens of *H. diacanthus* s.s. agree in carapace shape and general features with those figured by De Haan and Sakai under that specific name.

Campbell & Stephenson (1970: fig. 26) have figured the first pleopod of a male of *H. diacanthus* from Moreton Bay, in which the distal third is slender but not filiform, and have stated that all 10 males found (cl. 20-70 mm) had this kind of pleopod. Serène & Lohavanijaya (1973: figs. 115-117) have

figured the first pleopod of a specimen of *H. diacanthus* from the National Museum of Singapore (cl. 36 mm, no locality given) which is of the same kind as that figured by Campbell & Stephenson, i.e. it tapers fairly evenly, and curves outward in the slender distal third. This kind of pleopod is present in specimens in our series from Aru Islands and Irian Jaya and also in Australian specimens (18-88 mm) in the collection at the Australian Museum. These specimens in which the distal third of the pleopod is slender but not filiform are now considered to be a new species, *Hyastenus elatus* and are discussed further under that name.

The shape of the basal antennal article and the suborbital hiatus also distinguish *H. diacanthus* from *H. elatus*. On the lateral margin of the basal antennal article there is a short blunt anterior tooth which is produced laterally. Between this tooth and the broad proximal lobe there is a distinct concavity. The postorbital lobe is separated from the basal antennal article by a U-shaped hiatus. On the lateral margin of the basal antennal article of *H. elatus* the anterior tooth, if present, is small and not produced laterally. The anterior part of the lateral margin appears nearly straight as there is no concavity between the anterolateral angle and the broad proximal lobe. The proximal lobe extends further laterally than that in *H. diacanthus* and the hiatus separating it from the postorbital lobe is a narrow slit (or V-shaped in young specimens).

The rostral spines are generally less than half or equal to half the postrostral carapace length, though in a few individuals they are  $\frac{2}{3}$  the postrostral carapace length.

The preorbital angle of the supraorbital cave is usually produced slightly forwards, especially in adult males.

The gastric region is moderately elevated, there is a tubercle on the summit and often a very much smaller rounded tubercle on the anterior slope. The protogastric tubercles, if present, are very low. The cardiac region is moderately elevated and there is a short epibranchial spine.

The first sternite is separated from the anterior abdominal cavity by a pronounced slender ridge. In *H. elatus* this ridge is low and almost disappears at the apex of the abdominal cavity.

The palm of the male chela is enlarged in our three specimens of carapace length greater than 60 mm.

The first pleopod of the immature male differs from that of the adult just as it does in *H. aries*. In the younger specimens (11.5-32 mm, one exception 45 mm), the two pleopods touch on the medial line not far above their base, curve outward slightly, and then curve back toward the medial line often meeting distally. In larger specimens (33.5-70.5 mm) the distal half of the pleopod is filiform with long setae at the base of the filiform extension, and the apex is turned outwards.

The shape of the female gonopore though variable, is usually pyriform, narrowing evenly in the lateral half. The female gonopore in *H. elatus* is more nearly oval.

Distribution. — Japan, Formosa Strait, South China Sea, N. Sulawesi, Ambon, Aru Islands, Java Sea.

*Hyastenus elatus* new species  
(Figs. 45, 46a, 47e-g)

*Hyastenus diacanthus*. — Campbell & Stephenson, 1970: 258, fig. 26. — Serène & Lohavanijaya, 1973: figs. 114-118, pl. 10 C. (Not *Pisa (Naxia) diacantha* De Haan, 1839.)

Material examined. — 75 ♂♂, 72 ♀♀ (34 ovig.), 10-88 mm, smallest ovig. ♀, 25 mm.

Holotype. — Male, cl. 66.5 mm, Sydney Harbour, Nelsons Beach, on rocks at low tide, coll. H. Hughes, November 1975; The Australian Museum, Sydney, AM P.29917.

Paratypes. As listed below:

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

S. Irian Jaya, S. coast Dolak (Frederik Hendrik I.), coll. D. Zwollo, 10 February 1955; 1 spec. — SW. Irian Jaya, 8 miles (~ 13 km) S. of Merauke, Gov't trawler, 'De Goede Hoop', coll. L. B. Holthuis, 24 March 1955; 1 spec. — Irian Jaya, S. of Merauke, 'De Goede Hoop', March-April 1955; 1 spec. — Southern Irian Jaya, off Merauke, 1954-1955, donated by Fisheries Station of Jayapura; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. KR VI, Kai Is., N. of Nuha Rowa, N. of Du Rowa I., 05°32'S 132°41'E, 32-36 m, dredge haul 1, sand, 10 June 1970; 1 spec. — Stn. AN I, Aru Is., S. Trangan I., SW. of Tg. Ngabordamlu, centred near 06°58'S 134°5'E, 26-29 m, dredge haul 1, coral and sponge, 20 June 1970; 8 specs. — Stn. A III, Aru, Trangan, 3-4 miles (~ 5-6.5 km) W. of Tg. Lelar, 06°46'S 133°58'E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 3 specs. — Stn. B, Northern Territory, Clarence Straits, 27-57 m, dredge, mud, 30 June 1970; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

New South Wales: Sydney, Georges River; 1 spec. (AM P. 5748). — Botany Bay, 36-41 m, 'Thetis' Expedition; 1 spec. (AM P. 1100). — Sydney, Port Jackson; 1 spec. (AM G. 1223); 1 spec. (AM G. 4147); 1 spec. (AM G. 4148); 1 spec. (AM G. 5074); 1 spec. (AM P. 141); 1 spec. (AM P. 142); 1 spec. (AM P. 147); 14 specs. (AM P. 179); 1 spec. (AM P. 1352); 1 spec. (AM P. 1353); 1 spec. (AM P. 1354); 1 spec. (AM P. 1356); 1 spec. (AM P. 1358); 1 spec. (AM P. 1359); 1 spec. (AM P. 1360); 1 spec. (AM P. 1361); 1 spec. (AM P. 1362); 1 spec. (AM P. 1476); 1 spec. (AM P. 1477); 1 spec. (AM P. 1478); 1 spec. (AM P. 4725); 1 spec. (AM P. 6746). — Port Jackson, dredge; 1 spec. (AM G. 1140). — Port Jackson, Lane Cove; 1 spec. (AM G. 5019). — Port Jackson, off Fort Denison, coll. C. K. Hills, 8 January 1979; 1 spec. (AM P. 29918). — Port Jackson, Cockatoo I.; 1 spec. (AM P. 2118); 1 spec. (AM P. 2119); 1 spec. (AM P. 3073). — Port Jackson, Lavender Bay Wharf, 19 November 1928; 1 spec. (AM P. 9268). — Port Jackson, Walsh Bay Wharf, 28 January 1934; 1 spec. (AM P. 10456). — Sydney, Parramatta River, entrance of Torban Creek, in fish trap; 1 spec. (AM P. 5176). — Sydney, Parramatta River; 1 spec. (AM P. 5339). — Sydney, Parramatta River, near Hunters Hill, January 1924; 1 spec. (AM P. 6918). — near Grafton, Minnie Waters, intertidal, coll. G. Biddle, February 1964; 1 spec. (AM P. 18516). — Lake Macquarie; 1 spec. (AM G. 5592). — Port Stephens, dredge, January 1920; 1 spec. (AM P. 4851); 1 spec. (AM P. 4852); 1 spec. (AM P. 4853); 1 spec. (AM P. 4855); 2 specs (AM P. 4856). — Port Stephens, Nelson's Bay; 1 spec. (AM P. 4875); 2 specs (AM P. 29916).

Queensland: Moreton Bay, dredged, coll. L. Juesue, 17 August 1966; 1 spec. (AM P. 16561). — Port Curtis, 11 m; 1 spec. (AM P. 1959); 3 specs (AM P. 1961). — Curtis I., Northwest Channel, 5-7 m, dredge, coll. M. Ward, 1928; 1 spec. (AM P. 13880). — Port Curtis, dredged off Gatcombe Head, 16-21 m, coll. M. Ward and W. Boardman, July 1929; 17 specs. (AM P. 29911). — Emu Park, Yeppoon, 14-18 m, trawl, coll. K. McDougall, May-July 1966; 1 spec. (AM P. 16545). — Keppel I., 1½ miles (~ 2.4 km) NW., 12-20 m, coll. W. F. Ponder and T. Nielsen, 4 July 1969; 2 specs (AM P. 17444). — Between North and South Keppel Islands, 22-26 m, coll. W. F. Ponder and T. Nielsen, 25 July 1969; 1 spec. (AM P. 29914). — 1½ miles (~ 2.4 km) NW. of South Keppel I., 13-20 m, coll. W. F. Ponder and T. Nielsen, 25 July 1969; 1 spec. (AM P. 29915). — Swain

Reefs, dredged off Gillēt Cay, 54-72 m, October 1962; 2 specs. (AM P. 14018). — Lindeman I., dredged, coll. M. Ward, December 1928; 1 spec. (AM P. 13882). — Cumberland Group, between Hayman I. and Eshelby I., 36-45 m, trawl, 14 September 1957; 1 spec. (AM P. 12982). — Magnetic I., Horseshoe Bay 12-21 m, prawn trawl, coll. C. Wilson, April 1967; 1 spec. (AM P. 16676). — Townsville, sandbank off Bohle River, coll. M. Parker, 21-23 October 1965; 1 spec. (AM P. 29913). — N. of Townsville, 9 m, trawl, coll. C. Wilson, April 1967; 1 spec. (AM P. 16677). — Torres Strait, ½ mile (~ 0.8 km) north of Horn I.; 1 spec. (AM P. 11348). — Torres Strait, Albany Passage, coll. M. Ward, August-September 1928; 1 spec. (AM P. 29912). — SE. corner Gulf of Carpentaria, 17°26.2'S 139°59.5'E, 7 m, CSIRO Prawn Survey, Stn.39, 9 August 1963; 2 specs (AM P. 18568). — SE. corner Gulf of Carpentaria, 16°52.5'S 140°34.7'E, 18 m, CSIRO Prawn Survey, Stn.60, 16 August 1963; 1 spec. (AM P. 18574). — SE. corner Gulf of Carpentaria, 17°22.7'S 139°40.4'E, 5 m, CSIRO Prawn Survey, Stn.76, 20 August 1963; 1 spec. (AM P. 18569). — SE. corner Gulf of Carpentaria, 16°24.8'S 140°58'E, 12 m, CSIRO Prawn Survey, Stn.96, 24 August 1963; 1 spec. (AM P. 18571). — SE. corner Gulf of Carpentaria, 17°24.5'S 139°42'E, 5 m, CSIRO Prawn Survey, Stn.547, 10 January 1964; 6 specs. (AM P. 18563). — SE. corner of Gulf of Carpentaria, about 22 m, coll. D. F. McMichael and J. C. Yaldwyn, CSIRO Prawn Survey, December 1963; 5 specs. (AM P. 18572). — Gulf of Carpentaria, off Karumba, 25 m, from hollows in massive sponge, coll. J. C. Yaldwyn and D. F. McMichael, CSIRO Prawn Survey, December 1963; 1 spec. (AM P. 18591).

Western Australia: Broome, June 1932; 1 spec. (AM P. 10261); 1 spec. (AM P. 10262); 1 spec. (AM P. 10263); 1 spec. (AM P. 10264). — Off Cape Bossut, 7 m, dredged, coll. A. A. Livingstone, 9 September 1929; 1 spec. (AM P. 13887). — Ninety Mile Beach, between Broome and Wallal, about 14 m, dredged, coll. R. Bourne, 1930; 3 specs. (AM P. 9917). — Ninety Mile Beach, between Cape Jaubert and Wallal, 5 miles (~ 8 km) offshore, 9 m, dredged, coll. A. A. Livingstone, September 1929; 1 spec. (AM P. 13886). — 30 miles (~ 48 km) south of Carnarvon, 14-18 m, sandy mud with *Posidonia* and *Cymadosia* banks, coll. N. Coleman, 3 June 1972; 4 specs. (AM P. 18844). — Shark Bay, with prawns, 1969; 1 spec. (AM P. 17404). — N. of Perth, CSIRO prawn trawl, coll. K. Godfrey, M. V. 'Lancelin', September 1955 — February 1956; 2 specs. (AM P. 13881).

Description. — Carapace pyriform, widening posteriorly, width about three quarters (0.72 to 0.8) postrostral carapace length; surface smooth, covered with a short dense tomentum; a strong epibranchial spine and a prominent gastric tubercle.

Rostral spines horizontal or weakly curved downward distally; straight or sometimes sinuous distally; divergent to almost subparallel; cylindrical, tapering to an acuminate apex; length ranging from a half to more than two thirds (0.5 to 0.7) postrostral carapace length.

Orbital eave moderately expanded; preorbital angle a blunt right angle, not produced forward even in adult males; antorbital angle weakly produced, rounded; postorbital lobe separated from eave by a narrow U-shaped hiatus; postorbital lobe short, anterior margin weakly convex proximally. Eyestalks short, moderately slender, a thick row of setae distally above cornea; cornea terminal, ventral.

Hepatic region flat, smooth. Branchial submargin smooth, no tubercles; a strong epibranchial spine directed laterally and sometimes weakly curved forwards.

Gastric regions very steeply elevated, a strong mesogastric tubercle at summit of elevation and sometimes a very low tubercle on anterior slope; a low, broad protogastric tubercle near orbit.

Cardiac region only weakly elevated, smooth.

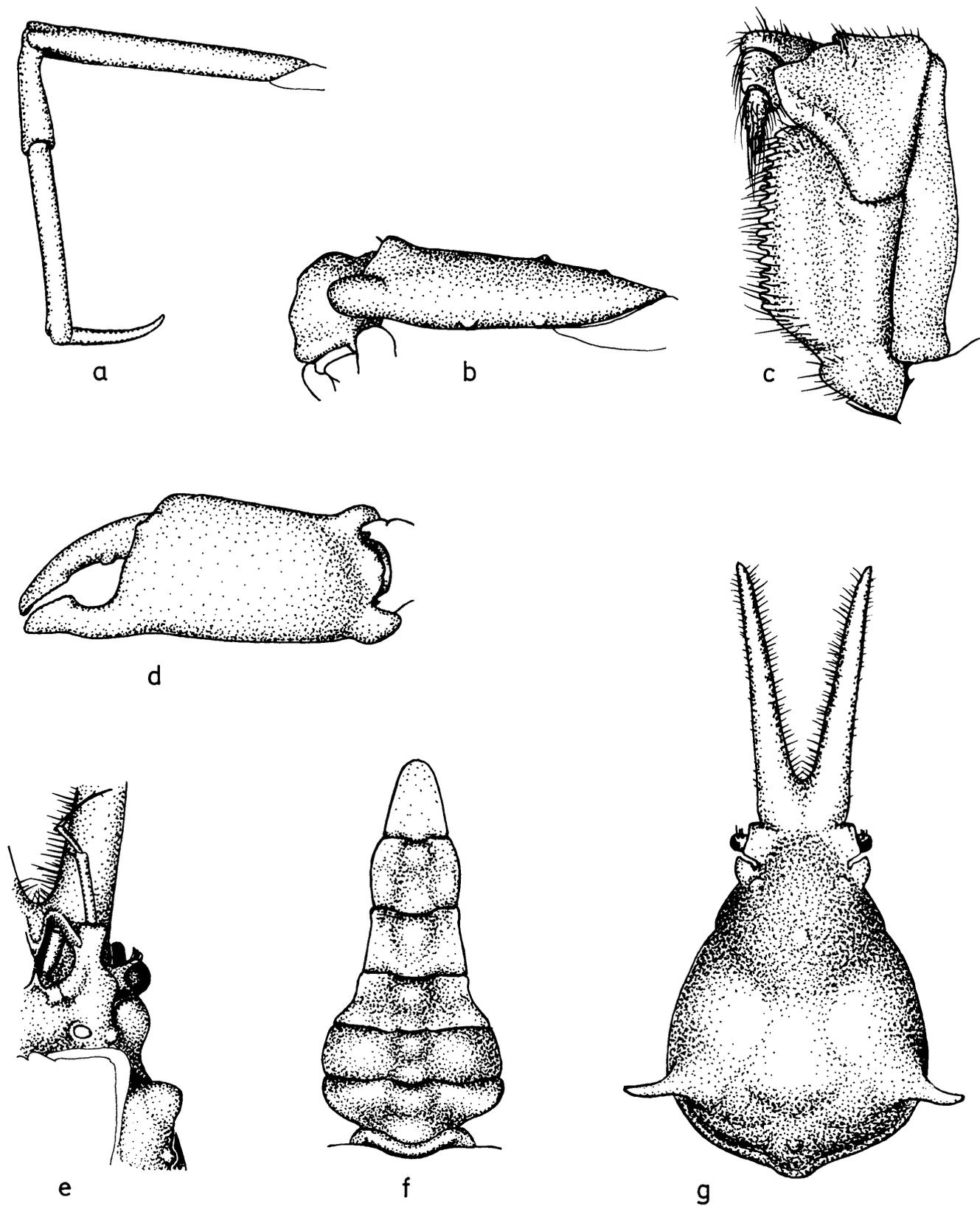


Fig. 45. (*Hyastenus* species of group 2) *Hyastenus elatus* (holotype). (a) left first ambulatory leg; (b) left cheliped, merus and carpus; (c) left third maxilliped; (d) left chela; (e) left orbit, ventral view; (f) male abdomen; (g) carapace, dorsal view.

Intestinal region weakly elevated, smooth or with small central tubercle.

Branchial regions smooth, abruptly convex in front of epibranchial spine.

Basal antennal article narrow, smooth, anterolateral angle blunt, sometimes produced weakly laterally but not forward; lateral margin sinuous, behind angle almost straight, proximal two thirds produced as a broad convex lobe; lower orbit hiatus a slit or, in small specimens, V-shaped and narrow. A blunt tubercle lateral to green gland.

Pterygostomian region smooth, margin with two tubercles, anterior much the larger.

Third maxilliped smooth, ischium with a shallow central groove; merus with a narrow ridge along posterior margin, a broad diagonal ridge forward from posterolateral angle; anterolateral angle only moderately produced and rounded.

Cheliped of adult male about one and a third (1.3) times postrostral carapace length; merus with two small tubercles in proximal half dorsally and a low terminal tubercle; one or two small tubercles ventrally on outer face; carpus with a tubercle on inner face and two to four small tubercles dorsally; length of palm about one and half (1.6) times height; fingers about two thirds (0.62 to 0.67) length of palm, strongly gaping in proximal half, a proximal tooth on dactyl in gape, fixed finger excavate, both fingers with only low teeth distally.

Ambulatory legs slender, smooth; first leg about twice postrostral carapace length, merus with a blunt terminal tubercle; fourth leg equal to or slightly longer (1.2) than postrostral carapace length, about half as long (0.5 to 0.6) as first leg.

Sternum smooth, first sternite with high, narrow lateral ridge, a ridge around anterior margin of abdominal fossa (low at apex of fossa), continuing to posterior edge of sternite.

Male abdomen of seven segments, smooth, segments two to six with a low medial tubercle anteriorly; third segment with rounded elevations laterally, width about twice (2.1) that of sixth segment; sixth segment about one and a third (1.3) times wide as long, lateral margin elevated midway along; length of seventh segment slightly exceeding (1.1 to 1.3) basal width.

First pleopod of male broad, narrower in distal quarter, aperture apical; pleopods curve gradually inward in proximal half, meeting on medial line in third quarter, slightly divergent in distal quarter. First pleopod of young male similar to that of adult male.

Female abdomen with segments four to six fused, suture visible only near midline; a low, broad medial ridge in all segments; a pair of low rounded tubercles laterally near posterior edge of both fourth and fifth segments.

Female gonopore a suboval aperture, laterally narrower and bridged by a narrow lobe; margins flat except at lateral extremity.

Remarks. — This species is very similar to *Hyastenus diacanthus* (De Haan) but is distinguished from that species by the degree of elevation of the gastric regions, the shape of the

basal antennal article and form of the male first pleopod. The gastric region is more steeply elevated than in *H. diacanthus* and the cardiac region less elevated than in that species; the branchial region is more convex in front of the epibranchial spine than it is in *H. diacanthus*. The anterolateral angle of the basal antennal article is hardly produced, and, as there is no concavity between this and the broad proximal lobe, the distal half of the lateral margin is nearly straight (not concave as it is in *H. diacanthus*). The proximal lobe extends further laterally than that in *H. diacanthus* and the hiatus between it and the postorbital lobe is only a narrow slit, or in young specimens V-shaped (not U-shaped as in *H. diacanthus*). The first pleopod of the adult male is similar to that of a young male, not markedly different as in *H. diacanthus*; the distal quarter of the pleopod is slender in *H. elatus*, while in adult males of *H. diacanthus* the distal half or more is filiform. The pleopod of the young male of *H. diacanthus* is similar to that of *H. elatus* but they can be distinguished by their different curvature; the two first pleopods of *H. elatus* meet on the midline at about the distal third and beyond this point are straight or weakly divergent; the pleopods of young males of *H. diacanthus* meet at about the proximal third and beyond that point curve laterally and then medially again near the apex.

This species is distinguished from *H. campbelli* n.sp. and *H. cracentis* n.sp. by the presence of a mesogastric tubercle, absent in both those species.

The name of the new species is derived from the Latin word *elatus* meaning high or lofty and refers to the elevated gastric region.

Distribution. — Irian Jaya, Arafura Sea, and northern Australia from north of Perth (W.A.) to Botany Bay (N.S.W.).

*Hyastenus elongatus* Ortmann, 1893  
(Figs. 46e,f, 47a,b)

*Hyastenus diacanthus* var. *elongata* Ortmann, 1893: 55.

*Halimus elongatus*. — Rathbun, 1911: 251.

*Hyastenus elongatus*. — Buitendijk, 1939: 242. — Sakai, 1965a: 81, pl. 36 fig. 2; 1976: 226, pl. 77 fig. 2. — Griffin & Tranter, 1974: 170.

Material examined. — 4 ♂♂, 5 ♀♀ (4 ovig.), 13.5-46.5 mm, smallest ovig. ♀, 26 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

South China Sea: between Amoy and Hong Kong, 23°16'N 117°43'E, 122 m, November 1889; 1 spec. — 23°15'N 117°40'E, coll. Capt. Christiansen, 'Store Nordiske', 26 July 1912; 2 specs. — E. China Sea, 32°12'N 128°10'E, 180 m, 20 October 1897; 1 spec. — S. Japan, off Goto, 33°10'N 129°18'E, 72 m, 7 September 1897; 4 specs. — S. Japan, off Nagasaki, 32°42'54"N 129°44'20"E, 56 m, rocks and sand, 'Store Nordiske', 31 August 1931; 1 spec.

Remarks. — These specimens agree well in the long straight rostral spines, blunt preorbital angle and anterolateral angle of the basal antennal article with a specimen, presumed to be

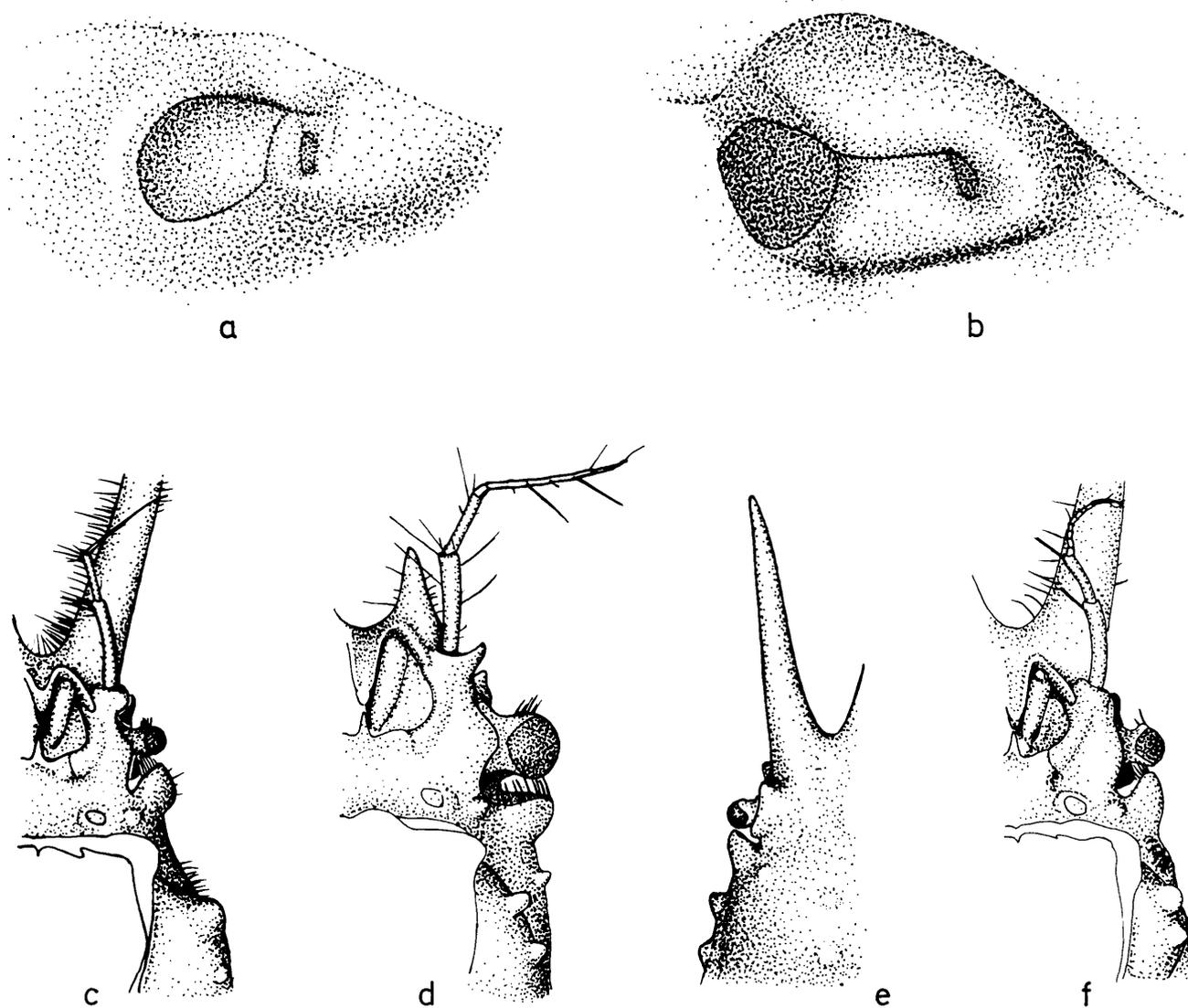


Fig. 46. (*Hyastenus* species of group 2) *Hyastenus elatus* (female, ovig. 55 mm, AM P.18572, in part) (a) left gonopore; *H. campbelli* (female, ovig., 52 mm, AM P.29908, in part) (b) left gonopore; *H. diacanthus* (male, 70.5 mm, N. of Formosa Strait, ZMC) (c) left orbit, ventral view; *H. planasius* (female, ovig., 10 mm, Java, ZMC) (d) left orbit, ventral view; *H. elongatus* (male, 30 mm, S. China Sea, ZMC) (e) left orbit, dorsal view; (f) ventral view of same.

a syntype (ad. ♀, 33.1 mm, Sagami Bay, Strasbourg Museum), which one of us (D.J.G.G.) has examined. Neither the syntype, nor the specimens described by Sakai (1934; 1938) have an epibranchial spine; however, in all except the smallest of our specimens there is a small epibranchial tubercle often covered by the tomentum.

The rostral spines are either parallel or weakly divergent. The length varies from half the postrostral carapace length in smaller individuals (17-30 mm), to nearly equal to the postrostral carapace length in the largest male (46.5 mm).

The supraorbital cave is narrow and the preorbital angle is rounded and not produced. The postorbital lobe is short and broad and not produced far laterally.

The mesogastric region is elevated. There is a low rounded tubercle on the summit, and the anterior slope is smooth or has a low tubercle. There is a low rounded protogastric

tubercle. There is a submarginal tubercle on the anterior border of the branchial region, subequal to the posterior tubercle on the pterygostomian margin. There is a low medial tubercle on the intestinal region.

The anterolateral angle of the basal antennal article is not produced, but there is a broad lateral lobe on the proximal half. The greatest width of the basal antennal article does not exceed  $1\frac{1}{2}$  times its anterior width. There is a wide U-shaped suborbital hiatus.

We have figured the first pleopod of the male which agrees with that figured by Sakai (1934: fig. 9b) but the apex is more slender and the setae are longer and reach the apex or exceed it. The female abdomen has seven segments.

A specimen collected by the 'Albatross' expedition off Honshu (♂, 33.75 mm, USNM 49920) previously identified by Rathbun as *H. diacanthus*, appears to be conspecific with these

specimens. An adult male from Amirante (13.4 mm, USNM 41405) identified as *H. elongatus* by Rathbun, has the same type of pleopod as specimens from China and Japan. However, both this specimen and an ovigerous female (14.5 mm) from the Red Sea (Griffin & Tranter, 1974), have an acute, produced preorbital lobe and a definite anterolateral spine on the basal antennal article.

This species can be distinguished from *H. diacanthus*, *H. elatus* and *H. campbelli* by its very narrow supraorbital cave, by the tubercle on the branchial submargin, and by the epibranchial tubercle which is barely visible in this species while the other three species have a quite robust epibranchial spine.

Distribution. — Japan, S. China Sea, Maldives, Amirante, Red Sea.

*Hyastenus fraterculus* Rathbun, 1916  
(Figs. 50a,b, 51c,d)

*Hyastenus fraterculus*, Rathbun, 1916: 546. — Griffin, 1976: 192, fig. 1 (b).

Material examined. — 2 ♂♂, 4 ♀♀ (2 ovig.), 4.5-8.5 mm, ovig. ♀, 8.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 172, Ceram Sea, Geser, anchorage between this island and Seram-laut, 18 m, townet, reef exploration, coral and *Lithothamnion* bottom, 26/28 August 1899; 1 spec. — Stn. 315, Flores Sea, Paternoster Islands, anchorage E. of Sailus Besar, up to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 15, Kai Is., S. of Doe Roa, 20-5 m, trawl, sand, 10 April 1922; 1 spec. — Stn. 39 Kai Is., N. of Doe Roa, 60 m, trawl, sand, *Lithothamnion*, 24 April 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition-Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15'S 128°8'E, 54 m, dredge haul 15, grey sand, fine with shelly grit, 2 June 1970; 1 spec. — Stn. KR VI, Kai Is., N. of Nuhu Rowa, N. of Du Rowa I., 05°32'S 132°41'E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 1 spec.

Remarks. — These specimens agree well with the holotype (♂, 7.5 mm, Sulu Archipelago, USNM 48291), but the smallest female has only four marginal branchial tubercles and the urogastric and cardiac regions are smooth.

The rostrum is very short, less than a sixth postrostral carapace length. There are granules on the rostral ridges.

The postorbital lobe is small and there is a small process on the anterior margin.

There are three mesogastric tubercles and two pairs of proto-gastric tubercles. There are two to four tubercles on the hepatic region.

There are three tubercles in a triangle on the urogastric region of the females, but in the two males only the posterior medial tubercle is present.

On the cardiac region there are two submedial tubercles and one posterior tubercle. In three of the specimens there are two very small tubercles on the anterior slope.

On the branchial region there is a row of six to nine irregular tubercles on the margin, many small submarginal tubercles and one larger anterior submarginal tubercle in line with the pterygostomial tubercles.

On the intestinal region there is a rounded medial tubercle, and parallel with the posterior margin there is a row of granules or a low ridge.

On the merus of the male cheliped there are four tubercles ventrally on both the inner and outer face, there are two or three tubercles dorsally in the proximal half and a short acute terminal spine; on the palm there is a longitudinal row of sharp tubercles midway on the inner face, some scattered sharp tubercles and granules above them on the upper half and on the dorsal margin; there is a large gap between the fingers with a large double tooth on the dactyl. There are three proximal tubercles on the merus of the first ambulatory leg.

This species is very similar to *H. biformis*, *H. scrobiculatus* and *H. mindoro* but can be distinguished from them by the very short rostral spines and the greater number of tubercles, especially on the branchial margin.

Previously known only from the Sulu Archipelago.

Distribution. — Sumbawa, Kai Islands, Ceram Sea, Sulu Archipelago.

*Hyastenus hendersoni* Laurie, 1906, new status

*Halimus convexus* (Miers) var. *hendersoni* Laurie, 1906: 377.

Type material. — Syntypes: 1 ♂, 1 ♀, W. of Cheval Paar; 1 ♂, 1 ovig. ♀, Gulf of Manaar; 2 ♀♀ (juv.), Cheval Paar; BMNH. 1907. 5.22.116-120. Cotype: 1 ♀ (juv.), Sri Lanka; ZSC 7249/10.

Material examined. — No new material examined.

Remarks. — This species can be distinguished from *H. convexus* Miers by the absence of any mesogastric tubercles (two in *H. convexus*) and the presence of an epibranchial spine rather than a low tubercle. The spines on the dactyl of the fourth ambulatory leg are quite robust in this species, while in *H. convexus* there are only a few small spines distally.

One of us (D.J.G.G.) has examined the syntypes (2 ♂♂, 3 ♀♀, BMNH. 1907.5.22. 116-120). The first pleopod of the male tapers to a point on the medial edge and is expanded to a rounded lobe on the lateral edge just below the apex whereas the first pleopod in *H. convexus* is not expanded distally, the apex is truncate, and there are long setae on the medial edge which exceed the apex. It is our opinion that *H. convexus* var. *hendersoni* is a distinct species, *H. hendersoni*, and not just a variety of *H. convexus*.

The pleopod of a male figured by Monod (1938: fig. 4, H, I) as *H. convexus* var. *hendersoni* does not agree with that of the male syntypes, but does agree with the pleopod of the holotype of *H. inermis* and is discussed further under that species.

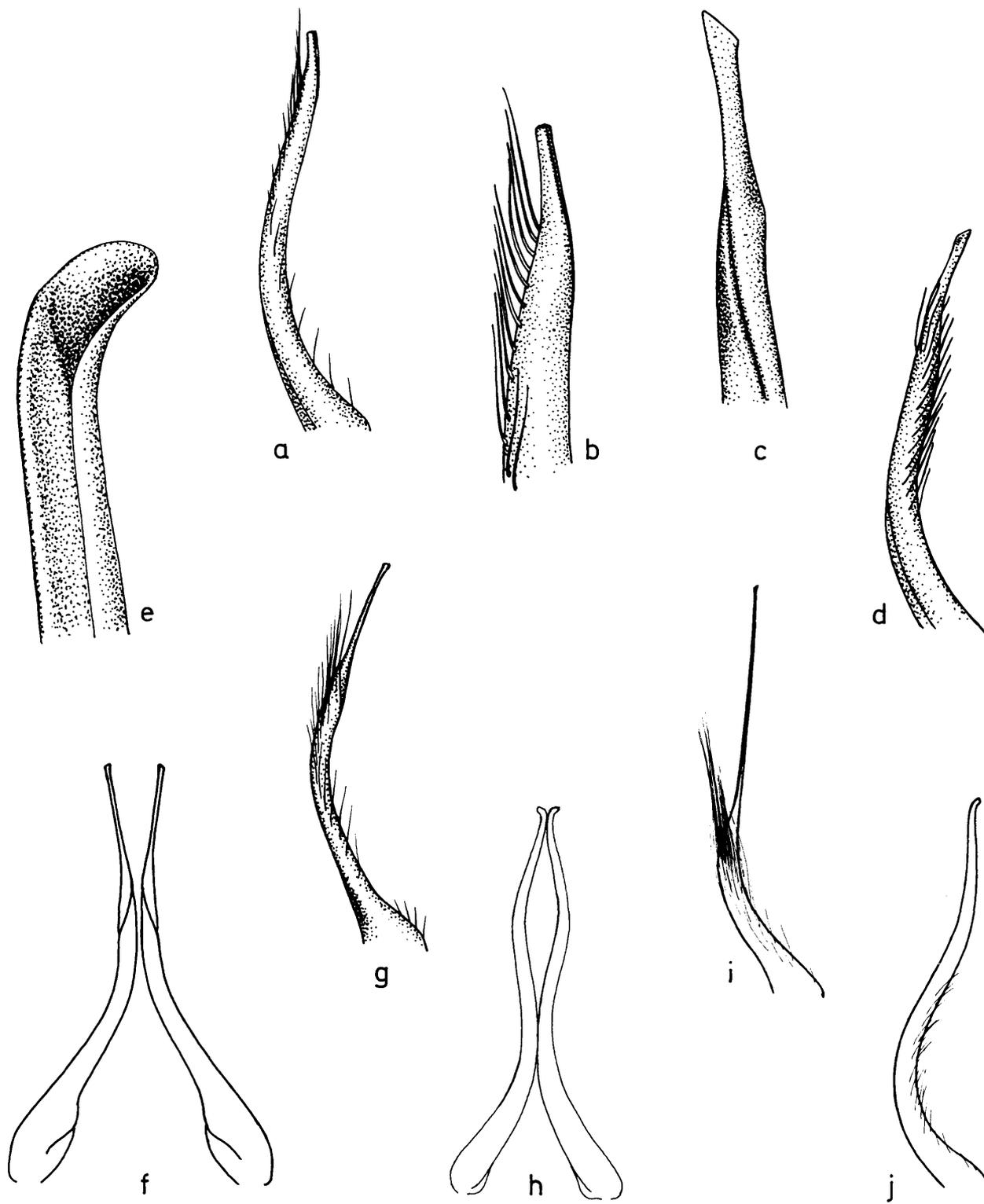


Fig. 47. (*Hyastenus* species of group 2) First pleopod of male of *Hyastenus elongatus* (39 mm, Hong Kong, ZMC) (a) abdominal view of left pleopod, (b) abdominal tip of same; *H. cracentis* (holotype) (c) sternal tip of left pleopod, (d) abdominal view of same; *H. elatus* (holotype) (e) abdominal tip of left pleopod, (f) diagrammatic view of left and right pleopods *in situ*, (g) abdominal view of left pleopod; *H. campbelli* (21 mm, AM P.1910, in part) (h) diagrammatic view of left and right pleopods of immature male *in situ*; (holotype) (i) abdominal view of left pleopod; (AM P.1910, as above) (j) abdominal view of left pleopod.

Laurie has remarked on the similarity of this species to *Hyastenus subinermis* Zehntner, 1894, and to *Halimus espinosus* Borradaile, 1903. However, *H. subinermis* as figured by De Man (1902: pl. 22 fig. 31) has an acuminate preorbital spine and on the basal antennal article there is a strong acuminate anterolateral spine which is visible dorsally. In *H. hendersoni* the preorbital angle of the eave is weakly produced and blunt, and the anterolateral angle of the basal antennal article is produced laterally in a blunt triangular lobe. *H. convexus* is also figured by De Man (1902: pl. 22 fig. 32) on the same plate and the differences from *H. subinermis* in the upper orbit are clearly shown.

We have not examined the type of *Hyastenus espinosus* but from the original description and figure given by Borradaile (1903: 688, pl. 47 figs. a-d) we consider that it differs from *H. hendersoni* in the presence of a tubercle on the summit of the mesogastric region and in the much less divergent rostral spines (the latter noted by Laurie also).

Distribution. — Known only from Sri Lanka: Gulf of Manaar, Cheval Paar.

*Hyastenus hilgendorfi* De Man, 1887  
(Fig. 42 h,i)

*Hyastenus hilgendorfi* De Man, 1887: 14-18, pl. 1 figs. 3, 4. — Stephensen, 1945: 107, fig. 20 D,E. — Griffin, 1968b: 103-105, fig. 1, pl. 1; 1974: 15; 1976: 192. — Tirmizi & Serène, 1971: 25-27 (in discussion), pl. 2 fig. B. *Halimus hilgendorfi*. — Rathbun, 1906: 881.

Material examined. — 31 ♂♂, 24 ♀♀ (13 ovig.), 6.5-35 mm, smallest ovig. ♀, 12 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Makassar, 27-32 m; 5 specs. — Aru Is., Pulu Jedan, 10 December 1907; 1 spec. — N. Sulawesi, Kuan-dang, coll. Van Nouhuys, 20 April 1914; 1 spec. — Indonesia, Belitung I., marine growths on buoy, S.S. 'Pharus'; 1 spec. — Borneo, marine growth on buoy, S.S. 'Pharus'; 1 spec. — Sumatra, S.S. 'Pharus'; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Siam Expedition: Gulf of Thailand, dredging in the sound between Koh Mesan and Cap Liant, 16 m, shells and sand, 4 February 1900; 1 spec. — Gulf of Thailand, Koh Kram, 54 m, March 1900; 1 spec.

Mortensen Pacific Expedition: Sulu Archipelago, 15 miles (24 km) W. 1/2 S of Jolo, 27 March 1914; 1 spec.

Danish Kei Islands Expedition: Kai Is., Vatek opposite Toeal, ca. 2 m, rocky shore, 23 March 1922; 1 spec. — Toeal, 2 m, coral, 26 March 1922; 1 spec. — Vatek, opposite Toeal, ca. 2 m, rocky shore, 28 March 1922; 2 specs. — Stn. 11, off Toeal, 20 m, trawl, 9 April 1922; 4 specs. — Stn. 72, Java Sea, 05°41'S 105°57'E, 35 m, trawl, stones, 28 July 1922; 1 spec. — Stn. 90, Sunda Strait, 05°55'S 105°30'E, 36 m, trawl, dredge hard bottom, coll. Th. Mortensen, 1 August 1922; 1 spec.

'Galathea' Expedition: Stn. 332, E. of Singapore, 10 m, fish trap, 15 May 1951; 1 spec.

Formosa Strait, 15 miles (24 km) off Amoy, 14-45 m, stony bottom, 1882; 1 spec. — Strait of Malacca, 05°9'8"N 99°48'10"E, 57 m, sand, mud, 'Store Nordiske', 24 December 1935; 5 specs. — Singapore, shallow water, 27 November 1907; 1 spec. — Singapore, shallow water, 24 January 1910; 3 specs. — Sri Lanka, Trincomalee, 11 m, March 1889; 2 specs. — India, Pamban, 4 m, April 1889; 2 specs. — Gulf of Manaar, Pamban Channel, 5 m, coll. H. Lemche, 8 October 1951; 2 specs. — Gulf of Manaar, Pamban Channel, 5 m, coll. H. Lemche, 9 October 1951; 1 spec.

5 Thai-Danish Expedition: Stn. 1009, E. coast Gulf of Thailand 08°43'38"N 98°10'50"E to 08°45'24"N 98°07'48"E, 20-30 m, otter trawl, 8 January 1966; 1 spec.

WESTERN AUSTRALIAN MUSEUM, PERTH

Hawaiian Islands, off Oahu I., 36-108 m, coll. T. Richert, late 1962; 1 spec. (WAM. 79-71). — Sulu Sea, off Sandakan, Berhala Channel, 5-36 m, coll. B. R. Wilson on 'Pele', 3 March 1964; 9 specs. (WAM. 94-71).

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

SE. Thailand, shallow water between Koh Chang and the coast, among growths of mussels and sponges on stakes on the bottom, coll. van Beusekom, 12 March 1970; 2 specs.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AW IV, Aru Is., Wokam, off W. end Udjir I., 05°37'S 134°10'E, 68-93 m, dredge hauls 4-7, mud and rubble, 16 June 1970; 1 spec.

Remarks. — As well as this large series of specimens, others collected by the Danish Expedition to Iran (Stephensen, 1945) and from the Zoological Survey, Calcutta, were examined.

In the series variation was found in rostral length (from less than half to almost 2/3 postrostral carapace length), thickness of rostral spines, how much the preorbital and antorbital angles of the eave are produced, sharpness of the anterolateral angle of the basal antennal article and number of submarginal tubercles on the branchial region. The carapace width varied from 0.69 to 0.8 postrostral carapace length.

There is a tubercle on the summit of the elevated gastric region and sometimes a very low anterior mesogastric tubercle. There is a rounded protogastric tubercle near the orbit and a small tubercle on the hepatic region. On the branchial region there are three to four marginal tubercles and a short epibranchial spine. Between the epibranchial spine and the anterior margin of the branchial region there are three to six submarginal tubercles. The cardiac region is elevated without a tubercle and there is a low tubercle on the intestinal region.

The basal antennal article has, at most, only a small tooth on the anterolateral angle, and proximally it is broadened laterally to form a rounded lobe, the apex of which is at the level of the posterior margin of the antennal fossa.

On the ridge dorsal to the two pterygostomian tubercles, there is sometimes a small tubercle.

In the adult males the cheliped is, with one exception, as figured by Griffin (1968b: fig. 1e), that is, the length of the palm is twice the height and there is only a small gape between the fingers. In one large male (ZMC, cl. 35 mm, off Amoy) the palm is inflated (length is only one and a half times height), there is a definite gape between the fingers and a low swelling proximally on the dactyl, this may be a senescent animal.

The first pleopod of the male has been figured by Monod (1938: fig. 4J), by Stephensen (1945: fig. 20D) and by Griffin (1968b: fig. 1a). The pleopod figured by Buitendijk (1939: figs. 9, 10) as *H. hilgendorfi* and referred to by Tirmizi & Serène (1971) is that of the closely related species *H. trispinosus*. The distal lateral lobe on the first pleopod of *H.*

*trispinosus* is not as large as that of *H. hilgendorfi*, and beyond it the tip is narrower and curves inward quite strongly. Usually the apex is curved slightly laterally. The specimens from Timor, near Koepang (1♂, cl. 17 mm, 1♀, cl. 15 mm, RML 4304), identified by Buitendijk as *H. hilgendorfi* have been examined and they agree with our specimens of *H. trispinosus*. It is the anterior mesogastric tubercle that is present (not the posterior as in *H. hilgendorfi*) and there is a strong intestinal spine.

There is some variation in the size at which animals reach maturity. Ovigerous females occurred in the size range 12 to 36 mm but there are immature females up to 26 mm in the series. The specimens from Iran have thicker rostral spines, the preorbital lobe is more produced and the anterolateral angle of the basal antennal article is less produced than in those from Singapore. The specimens from the Pearl Banks have moderately thick rostral spines and both the preorbital angle of the eave and the anterolateral angle of the basal antennal article are slightly produced.

The ovigerous female from Oahu Island (WAM 79-71) has been compared with two other female specimens (USNM 29746-7) from Hawaii collected by the 'Albatross' and reported on by Rathbun (1906). The most striking difference that these three specimens show from other specimens of *H. hilgendorfi* are the sharp hepatic spine and the larger protogastric tubercle near the orbit. Also there is only one submarginal tubercle on the branchial region and that is near the anterior border. With so few specimens, none of them male, we continue to regard them, for the present, as a geographical variation of *H. hilgendorfi*.

This species is very close to *H. pleione* and Tirmizi & Serène (1971) have listed several characters which distinguish the species. In *H. hilgendorfi* there is no transverse tubercle between the gastric and cardiac elevations as there is in *H. pleione*, and there are only three (not six) strong tubercles on the gastric region. The variation shown by this large series, indicates however, that the length of the rostral spines is not a reliable character to use. It can be added that the maximum width of the basal antennal article lies further forward in *H. pleione* than in *H. hilgendorfi*, at about the level of the proximal third of the antennal fossa. The first pleopod of the male of *H. pleione* has a constriction below the lateral lobe of the tip; the apex is more slender than that in *H. hilgendorfi* and it is curved laterally.

*H. hilgendorfi* is also similar to *H. trispinosus*, but in that species there is a strong intestinal spine and if a mesogastric tubercle is present it is the anterior one, level with the protogastric tubercle. Finally, in *H. trispinosus* there is only one submarginal tubercle on the branchial region and that is near the anterior border.

Distribution. — Widespread Indo-West Pacific: E. Africa, Red Sea, Iranian Gulf, S. India, Indonesia, Philippine Islands, Australia, Hawaii.

### *Hyastenus inermis* (Rathbun, 1911)

*Halimus inermis* Rathbun, 1911: 250-251, pl. 20 fig. 6.

*Hyastenus inermis*. — Griffin, 1974: 15. — Griffin & Tranter, 1974: 171.

Material examined. — No new material.

Remarks. — This species has a smooth carapace, there is only a low protogastric tubercle near the orbit and sometimes a very small epibranchial spine. It can be distinguished from *H. elongatus* Ortmann by the absence of any mesogastric tubercles (one in that species) and by the much wider supraorbital eave. It is distinguished from *H. hendersoni* Laurie, *H. cracentis* n.sp. and *H. campbelli* n.sp. which also lack mesogastric tubercles, by the lack of an epibranchial spine, while there is a well developed epibranchial spine in those three species.

The first pleopod of the male is distinctive. There is a large distal flap on the medial edge which extends round to the abdominal surface. A similar male pleopod has been figured as *Hyastenus convexus* var. *hendersoni* 'adult form' by Monod (1938: fig. 4, H,I). One of us (D.J.G.G.) has examined the syntypes of *H. hendersoni* (2♂♂, 3♀♀ BMNH. 1907.5.22.116-120) and the first pleopod in the two male specimens is only expanded to a moderate, rounded lobe on the lateral edge. It seems probable that the larger male, of which Monod figured the pleopod, is in fact *H. inermis*.

The palm of the male chela in *H. inermis* has two low tubercles proximally on the dorsal margin. The dactyl of the fourth ambulatory leg has only three or four very small distal spines (the same dactyl in *H. hendersoni* has quite robust proximal and distal spines).

Distribution. — Western Indian Ocean: E. of Mombasa, Seychelles, Amirante, Red Sea.

### *Hyastenus mindoro* new species (Figs. 49, 51e,f)

Material examined. — 5♂♂, 4♀♀ (4 ovig.), 6-11 mm, smallest ovig. ♀, 6 mm.

Holotype. — Male, 11 mm, Philippine Islands, Mindoro, Puerto Galero, ca. 9 m, 3 February 1914, Mortensen Pacific Expedition; Zoological Museum, University of Copenhagen.

Paratypes. — As listed below:

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'Siboga' Expedition: Banda Sea, Banda; 2♂♂, 6.5 mm. — Banda Sea, Banda, 9-36 m; 2♀♀ (ovig.), 6.0, 6.5 mm.

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Mortensen Pacific Expedition: data as for holotype; 2♂♂, 7.0, 8.5 mm, 2♀♀ (ovig.), 8.0, 8.5 mm.

Description. — Carapace pyriform, narrow behind orbits widened posteriorly across branchial regions, greatest width 0.8 postrostral carapace length, surface smooth with a few tubercles, a strong posterior intestinal spine.

Rostral spines short, about a sixth to a quarter postrostral

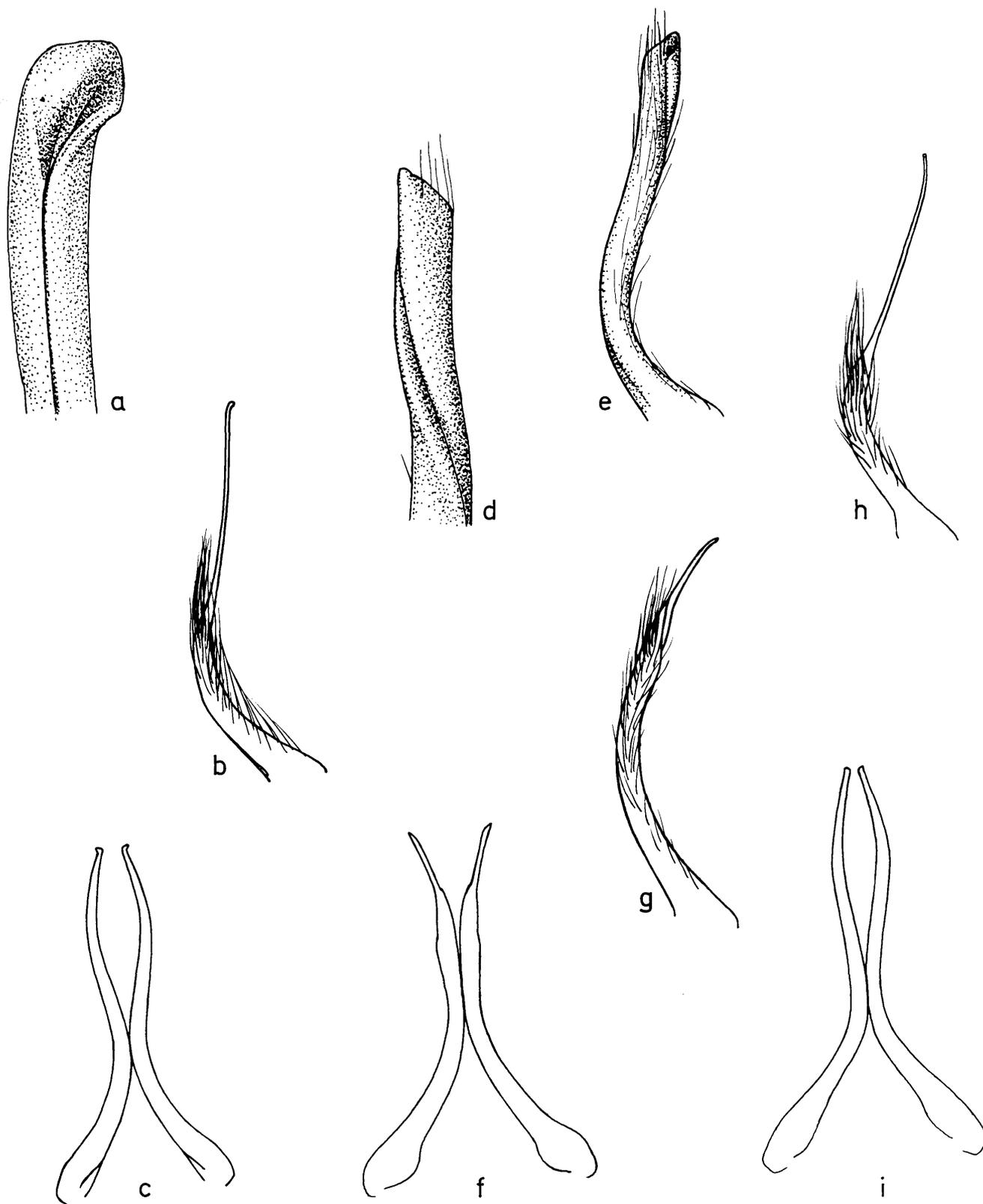


Fig. 48. (*Hyastenus* species of group 2) First pleopod of male of *Hyastenus diacanthus* (70.5 mm, N. of Formosa Strait, ZMC) (a) abdominal tip of left pleopod, (b) abdominal view of same; (20 mm, S. China Sea, ZMC) (c) diagrammatic view of left and right pleopods of an immature male *in situ*; *H. convexus* (20 mm, N. of Formosa Strait, ZMC) (d) sternal tip of left pleopod, (e) abdominal view of same; *H. spinosus* (46.5 mm, AM P.2739) (f) diagrammatic view of left and right pleopods *in situ*, (g) abdominal view of left pleopod; *H. aries* (55.5 mm, Singapore, ZMC) (h) abdominal view of left pleopod; (25.5 mm, Java Sea, ZMC) (i) diagrammatic view of left and right pleopods of an immature male *in situ*.

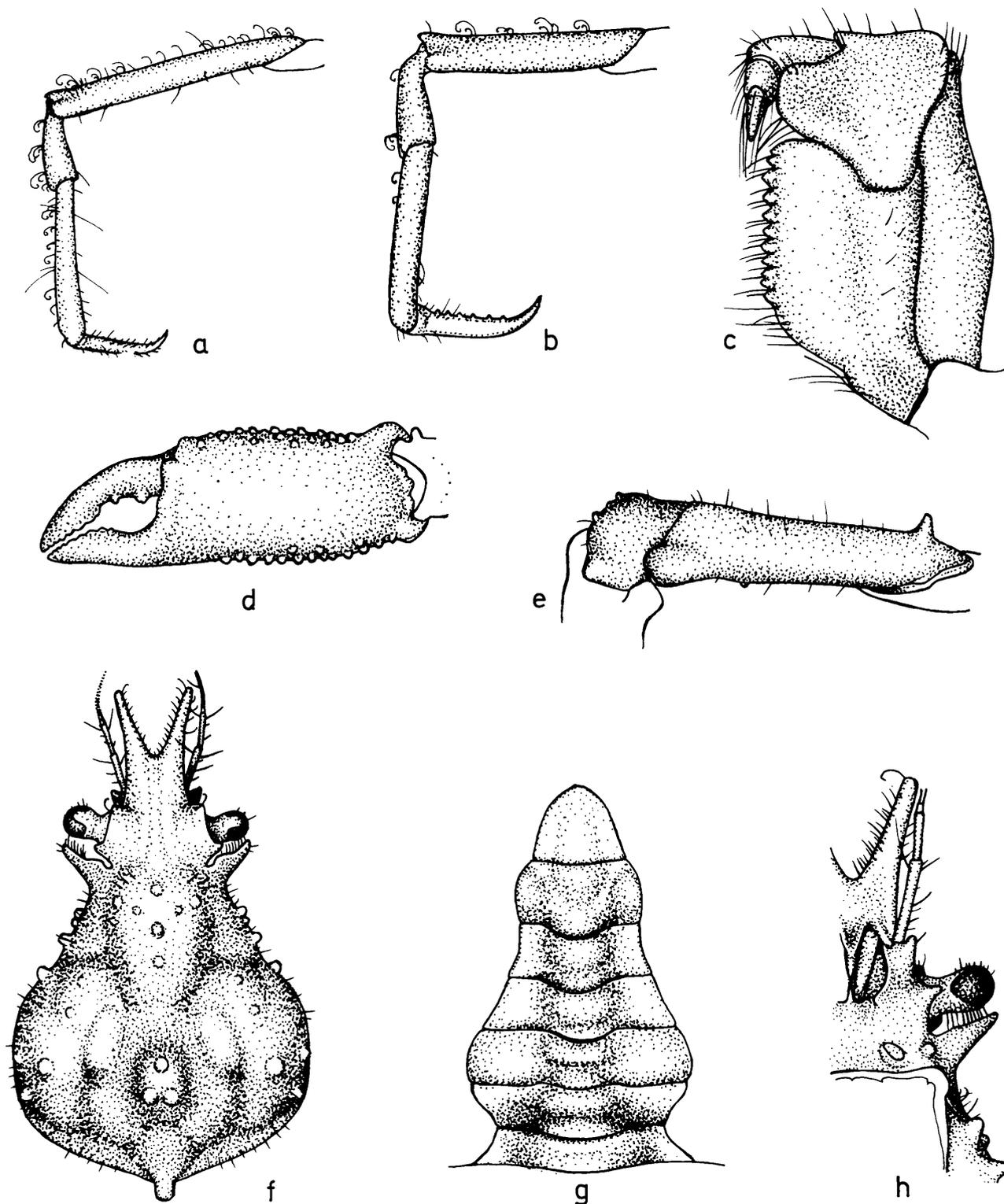


Fig. 49. (*Hyastenus* species of group 3) *Hyastenus mindoro* (female, 8 mm, Mindoro, ZMC) (a) left first ambulatory leg; (b) left fourth ambulatory leg; (holotype) (c) left third maxilliped; (d) left chela; (e) left cheliped, merus and carpus; (f) carapace, dorsal view; (g) male abdomen; (h) left orbit, ventral view.

carapace length, fused for basal third, weakly upcurved; tubercles on rostral ridges.

Orbital eave moderately expanded, preorbital angle only weakly produced not upturned, with a very small lobe or tubercle; antorbital angle a rounded lobe, produced more laterally than preorbital angle; postorbital lobe separated

from eave by a narrow U-shaped or keyhole-shaped hiatus; postorbital lobe long, apically narrow, anterior margin with a small proximal lobe, posterior margin straight, apex level with or exceeding antorbital lobe. Eyestalks short, moderately slender; cornea terminal, ventral.

Hepatic region not expanded, smooth, Branchial sub-

margin with a sharp tubercle anteriorly; two short spines one above the other near posterolateral angle, a small tubercle in front of more ventral spine.

Gastric regions weakly elevated; mesogastric region with three medial tubercles; a small protogastric tubercle at a level halfway between first and second mesogastric tubercles and a larger tubercle anterolateral to it.

Cardiac region elevated, higher than gastric region, with a triangle of three strong tubercles, one in front and two behind; sometimes a pair of much smaller submedial tubercles on anterior slope.

Intestinal region with a blunt medial spine, longest carapace spine, just in front of posterior carapace margin.

Anterior branchial region with two small tubercles one behind the other.

Basal antennal article narrow, smooth, medial margin elevated, sharp; anterolateral angle produced into a blunt, triangular spine directed forward and slightly ventrally; a similar spine, directed laterally, on lateral edge about halfway along. A large sharp tubercle lateral to green gland.

Pterygostomian region smooth, margin with two high tubercles, anterior larger, and one or two tubercles just dorsal to them.

Third maxilliped smooth, anterolateral angle of merus moderately produced and rounded. Anterolateral angle of mouthfield produced.

Cheliped of adult male about one and a half (1.4) times postrostral carapace length, merus with a short proximal spine dorsally but no terminal spine, a small tubercle ventrally at about distal third; a longitudinal row of about eight sharp tubercles midway along inner face of merus; carpus with about five well separated tubercles dorsally and a crest of five or six tubercles on inner edge; palm about one and a half (1.7) times as long as high with numerous sharp granules on inner face and on dorsal and ventral margins and a longitudinal row of five or six sharp tubercles midway along inner face; outer face smooth; fingers two thirds length of palm, a large gape between them in proximal half, a large proximal tooth and a smaller distal tooth on dactyl in gape, both fingers with small, uniform teeth on distal half of cutting edge.

Ambulatory legs slender, smooth, first ambulatory leg about one and a half times postrostral carapace length, merus without a terminal spine; fourth leg about two thirds length of first leg, dactyl with about six very small spines ventrally along its length.

Sternum smooth, a low shallow depression on each side in front of abdominal fossa.

Male abdomen of seven segments, smooth; third segment nearly twice (1.8) as wide as sixth segment; sixth segment about one and a half times wide as long; seventh segment as wide as long.

Female abdomen with segments four to six fused; second and third segments with a transverse medial tubercle. Female gonopore a suboval aperture, opening medially.

First pleopod of male broad, curved outwards at about distal third, tapering only just before blunt apex.

Remarks. — This species is similar to *H. biformis*, *H. scrobiculatis* and *H. fraterculus* in the presence of two subequal lateral lobes on the basal antennal article; the presence of tubercles and granules on the inner face of the cheliped palm; and the weakly produced preorbital angle of the eave. It is distinguished from these three species by the rostral spines which are fused for the basal third; the strong posterior intestinal spine, and the longer postorbital lobe which is directed slightly forward.

Distribution. — Philippine Islands, Banda.

*Hyastenus planasius* (Adams & White, 1848)  
(Fig. 46d)

*Pisa planasia* Adams & White, 1848: 9-10, pl. 2 figs. 4, 5.

*Hyastenus planasius*. — Alcock, 1895: 212. — Buitendijk, 1939: 245, 247, text fig. 13. — Griffin, 1976: 194. (Not *Hyastenus planasius*. — Chhappgar, 1957: 411-412, pl. 3 figs. 1-n.)

Material examined. — 9 ♂♂, 16 ♀♀ (11 ovig.), 5.5-15 mm, smallest ovig. ♀, 8 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn.47, Sumbawa, Bay of Bima, near south fort, Bima anchorage, shore exploration, 8/12 April 1899; 1 spec. — Stn.57, Timor Sea, 10°29'S 121°28.7'E, 1419 m, foraminiferan ooze, 24 April 1899; 1 spec. — Stn. 310, Flores Sea, 08°30'S 119°7'E, 73 m, dredge, sand with few pieces of dead coral, 12 February 1900; 1 spec.

Java Sea, off Jakarta, otter-trawl, 'Rambang', April-May 1907; 5 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, ca. 21-40 m, dredge, 17 March 1914; 2 specs. — Sulu Archipelago, off Jolo, off Marongas, ca. 54 m, dredge, 19 March 1914; 6 specs.

Danish Kei Islands Expedition: Stn.67, Java 05°48'S 106°12'E, 38 m, trawl, sand, 27 July 1922; 1 spec. — Stn. 72, Java, 05°41'S 105°57'E, 35 m, trawl, stones, 28 July 1922; 2 specs. — Stn. 106, Java Sea, 05°50'S 106°16'E, 32 m, trawl, sand, 5 August 1922; 2 specs.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn.CP I, Ceram, Piru Bay, off Tg Tutuhuhur, 03°15'S 128°8'E, 25-54 m, dredge hauls 8-19, coarse sand, grey sand or foraminiferal sand, 1 June 1970; 1 spec. — Stn.CP I (as above), 54 m, dredge haul 15, grey sand, fine with shelly grit, 2 June 1970; 1 spec. — Stn.AN I, Aru, S. Trangan I., SW. of Tg. Ngabordamlu, centred near 06°58'S 134°5'E, 25-29 m, dredge hauls 1-3, coral and sponge, mud and broken shell, 20 June 1970; 1 spec. — Stn.AN I (as above), 25-29 m, dredge haul 2, mud and broken shell, 20 June 1970; 1 spec. — Stn.A III, Aru, Trangan, 3-4 miles (~ 5-6.5 km) W. of Tg.Lelar, 06°46'S 133°58'E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 1 spec.

Remarks. — These specimens agree well with those figured by Adams & White (1848: pl. 2 figs. 4, 5). The carapace surface is smooth without a dense tomentum, but there are lines of curled hairs on the interorbital region, on the gastric region and along the branchial margin. As well, there are scattered pairs of long setae.

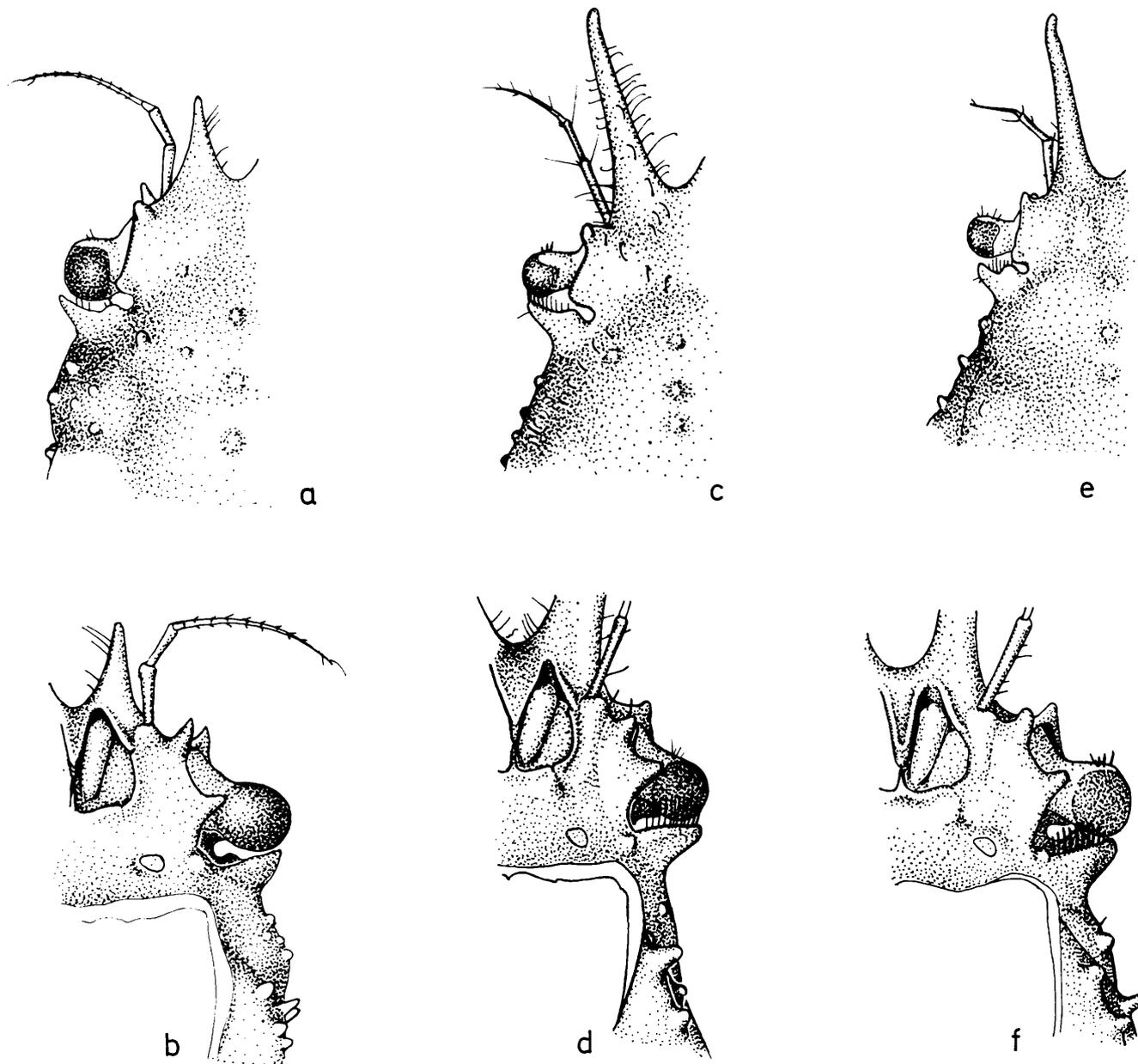


Fig. 50. (*Hyastenus* species of group 3) *Hyastenus fraterculus* (male, 8.5 mm, Kai Is., NIO Jakarta) (a) left orbit, dorsal view, (b) ventral view of same; *H. scrobiculatus* (male, 9.5 mm, Kai Is., NIO Jakarta) (c) left orbit, dorsal view, (d) ventral view of same; *H. biformis* (male, 14 mm, Sumbawa, ZMA) (e) left orbit, dorsal view, (f) ventral view of same.

The rostral spines are very short (a quarter to a third postrostral carapace length) and parallel. The outer margin of the supraorbital eave is slightly concave and the upper orbital hiatus is U-shaped.

There is a small spine on the hepatic region and there is a very small epibranchial spine.

The gastric region is only slightly elevated and the number of mesogastric tubercles varies. Some of these specimens have two very low mesogastric tubercles, some only the posterior one, and some have no mesogastric tubercles. Specimens from the Sulu Archipelago collected by the 'Albatross' expedition (6♂♂, 3♀♀, cl. 10-15 mm, USNM 49899) have two low mesogastric and two pairs of low protogastric tubercles. Buitendijk (1939) has described specimens from Timor with

three faint mesogastric tubercles and one low lateral tubercle on each side.

The cardiac region is smooth and barely elevated, there is a very low tubercle in only four specimens. The intestinal region is flat and without a tubercle.

The anterolateral angle of the basal antennal article has a well developed spine directed obliquely forwards. On the lateral margin there is a broad proximal lobe which is produced as far laterally as is the anterior spine. The orbit is completely open below.

The first pleopod of the male is similar to that figured by Buitendijk, but narrows more gradually toward the tip, and sometimes there is one long seta extending beyond the apex.

The abdomen of the female has segments four to six fused.

The specimens figured by Chhapgar (1957: pl. 3 figs. l,m,n) are dissimilar from our series in carapace shape, form of rostrum and first pleopod of the male and we cannot consider them conspecific, but we are unable to say what species they are.

Distribution. — Northern Indo-West Pacific: Sulu Archipelago, Ceram, Aru Is., Timor Sea, Flores Sea, Java Sea, Gulf of Thailand, Singapore, Mergui, Sri Lanka and South India.

*Hyastenus pleione* (Herbst, 1803)

*Cancer pleione* Herbst, 1803: 52-53, pl. 58 fig. 5.

*Hyastenus pleione*. — De Man, 1888: 225-226, pl. 7 figs. 3, 3a. — Alcock, 1895: 208-209. — Buitendijk, 1939: 247-248, text fig. 14. — Tirmizi & Serène, 1971: 24-27, text fig. 2, pl. 2 fig. 4.

Material examined. — 1♂, 2♀♀, 20-32 mm.

ZOOLOGICAL SURVEY, CALCUTTA

Sri Lanka, Galle, coll. J. A. Anderson; 2 specs. (ZSC.2719/3). — Sri Lanka, Pearl Banks, coll. T. Southwell, 1911; 1 spec.

Remarks. — This species is distinguished from *H. hilgendorfi* as follows: there is a transverse tubercle between the gastric and cardiac elevations (not present in *H. hilgendorfi*), and on the gastric region there are six (not three) strong tubercles arranged in a 'Y'; the two large tubercles on the pterygostomial margin have one or two tubercles medial to them (absent in *H. hilgendorfi* but a small tubercle is sometimes found on the ridge dorsal and lateral to the two large pterygostomial tubercles).

Differences from *H. hilgendorfi* in the shape of the basal antennal article and first pleopod of the male are discussed under that species.

This species has been recently discussed and figured by Tirmizi & Serène (1971) and a detailed synonymy given.

Distribution. — South India, Sri Lanka, Gulf of Manar, Singapore, Timor, Ambon.

*Hyastenus scrobiculatus* Rathbun, 1916  
(Figs. 50c,d, 51g,h)

*Hyastenus scrobiculatus* Rathbun, 1916: 547. — Griffin, 1976: 194, fig. 4 (b).

Material examined. — 11♂♂, 10♀♀ (7 ovig.), 6.5-11.5 mm, smallest ovig. ♀, 7.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn.14, Kai Is., S. of Doe Roa, 40 m, trawl, sand, 10 April 1922; 5 specs. — Stn.30, Kai Is., between Doe Roa and Kei Doelah, 40 m, trawl, sand, shells, 18 April 1922; 1 spec. — Stn.38, Kai Is., NE. of Doe Roa, 35 m, trawl, sand, coll. Th. Mortensen, 24 April 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn.CP I, Ceram, Piru Bay, off Tg.Tutuhuhur, 03°15'S 128°8'E, 25-63 m, dredge hauls 8-19, 2

June 1970; 1 spec. — KR VI, Kai Is., N. of Nuhu Rowa, N. of Du Rowa I., 05°32'S 132°41'E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 6 specs. — Stn. KR VII, Kai Is., between Du Rowa and Kai Dulah Is., 05°32'S 132°46'E, 32-36 m, dredge haul 3, muddy sand and sponge, 11 June 1970; 5 specs. — Stn.KR IX, Kai Is., N. end of Kai Dulah, 05°31'S 132°48'E, 18-22 m, dredge, sand, 12 June 1970; 1 spec. — Stn. TS VI, Kai Is., Tanimbar, Selaru, Tg. Tuwau, 08°11'S 130°49'E, snorkeled and hand dredged, 27 June 1970; 1 spec.

Remarks. — These specimens agree well with the holotype (♂, 9.6 mm, Sulu Archipelago, USNM 48218) but the rostral spines in most specimens are weakly divergent, not parallel. In some of the females of this series the urogastric region is less depressed and the dorsal carapace tubercles, especially on the branchial region, are less pronounced.

The rostral spines are about a quarter postrostral carapace length in the females and up to half the postrostral carapace length in the males.

On the preorbital angle of the eave there is a small sharp upturned tubercle, and the antorbital angle is rounded and produced. On the anterior margin of the postorbital lobe there is a small process, which varies in size, more pronounced than in the type material but not as large as in *H. biformis*.

There are three mesogastric tubercles (not four) and a proto-gastric tubercle level with the space between the first and second tubercle.

The cardiac region is more elevated than the gastric region, there is a tubercle on the summit and in most specimens a low tubercle on the posterior slope.

There are four tubercles, the last sharp, on the branchial margin, but in several specimens only the last two of these are present. Anteriorly, there is a single submarginal tubercle in line with the pterygostomial tubercles.

On the lateral margin of the basal antennal article there are two sharp subequal processes, the anterior is more slender and directed obliquely downwards.

As well as the two usual tubercles on the pterygostomial margin, there is often a third tubercle, level or slightly dorsal, between them.

There is a submarginal tubercle on the hepatic region and in three females there is also a dorsal tubercle. There is a single tubercle on the intestinal region.

There are three or four tubercles ventrally on the inner face of the merus of the cheliped, dorsally there are two proximal tubercles and a short acute terminal spine; midway on the inner face of the palm of the male there is a longitudinal row of two or three tubercles, granules above it, and also along the dorsal edge.

This species is similar to *H. biformis*, *H. fraterculus* and *H. mindoro* but each of these three species has two submedial tubercles on the cardiac region.

This species has been known previously only from the Sulu Archipelago, Philippine Islands.

Distribution. — Kai Islands, Ceram, Sulu Archipelago.

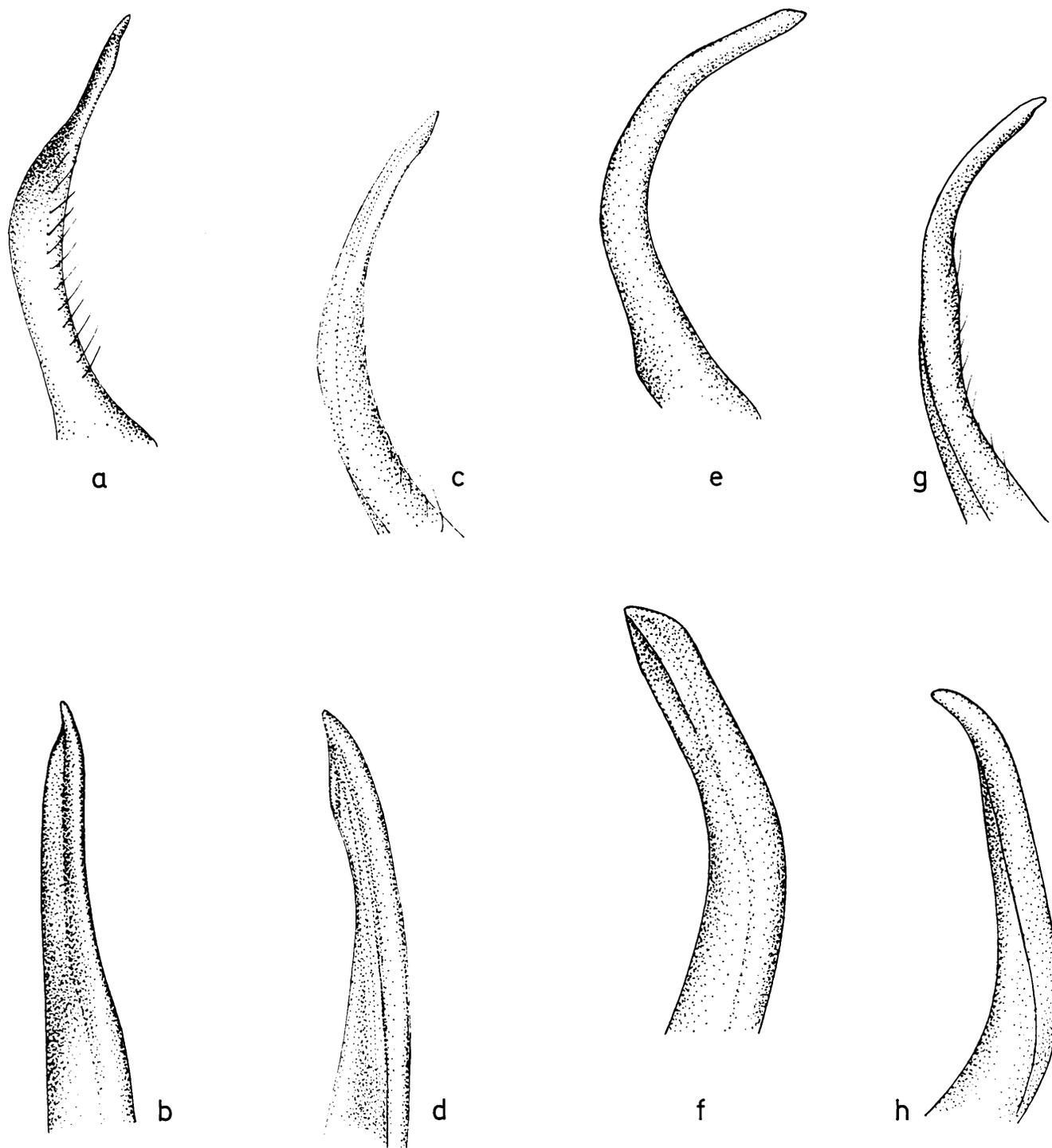


Fig. 51. (*Hyastenus* species of group 3) Left first pleopod of male of *Hyastenus biformis* (14 mm, Sumbawa, ZMA) (a) abdominal view of pleopod, (b) sternal tip of same; *H. fraterculus* (8.5 mm, Kai Is., NIO Jakarta) (c) abdominal view of pleopod, (d) sternal tip of same; *H. mindoro* (holotype) (e) abdominal view of pleopod, (f) sternal tip of same; *H. scrobiculatus* (11.5 mm, Kai Is., ZMC) (g) abdominal view of pleopod, (h) sternal tip of same.

*Hyastenus sebae* White, 1847  
(Figs. 40c,d, 41g,h)

*Hyastenus sebae* White, 1847b: 57 (in part). — Griffin, 1976: 194, 196, fig. 6(a).

*Hyastenus oryx* A. Milne Edwards, 1872: 250-252, pl. 14 fig. 1, 1a-d. — Takeda, 1973a: 104-105, fig. 2 G,H.

Material examined. — 77 ♂♂, 102 ♀♀ (42 ovig.), 5.5-33 mm, smallest ovig. ♀, 11 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn.33, Lombok, Bay of Pidjot, 22 m or less, trawl, dredge and shore exploration, mud, coral and coral sand, 24/26 March 1899; 1 spec. — Stn. 50, W. coast of Flores, Bay of Badjo, up to 40 m, dredge, trawl and shore exploration, mud, sand and shells, 16/18 April 1899; 1 spec. (ZMA De. 100.716). — Stn.64, Flores Sea, Tanahdjampea, Kambaragi Bay, up to 32 m, trawl, dredge and shore exploration, coral, coral sand, 4/5 May 1899; 6 specs. — Stn.65a, S. Sulawesi (Celebes), near 07°S 120°34.5'E, from 400-120 m, dredge, pale grey mud changing to cor-

al, 6 May 1899; 1 spec. — Stn.71 Sulawesi (Celebes), near Makassar, Pulu Barang, shore exploration, 24 May 1899; 1 spec. — Stn.80, Borneo Bank, 02°25'S 117°43'E, from 50-40 m, trawl, fine coral sand, 13 June 1899; 1 spec. (ZMA De. 100.629 (in part)). — Stn.96, Sulu Archipelago, SE. side of Pearl Bank, 15 m, dredge, trowl, *Lithothamnion*, 27 June 1899; 1 spec. — Stn.154, Irian Jaya, Straat Bougainville, 00°7.2'N 130°25.5'E, 83 m, decreased to 59 m during haul, dredge, grey muddy sand, shells and *Lithothamnion*, 14 August 1899; 2 specs. — Stn.164, Irian Jaya, between Salawati and Misool, 01°42.5'S 130°47.5'E, 32 m, dredge, sand, small stones and shells, 20 August 1899; 4 specs. — Stn. 172, Ceram, Geser, anchorage between this island and Seram — Laut, reef exploration, coral and *Lithothamnion*, 26/28 August 1899; 1 spec. (ZMA De. 100.725, det. Ihle as *H. oryx*). — Stn.174, N. coast of Ceram, Waru Bay, 18 m, dredge, trowl, reef exploration, mud, 28/29 August 1899; 1 spec. — Stn.209, S. Sulawesi, anchorage off S. point of Kabaena I., 22 m, dredge, reef exploration, coarse sand, 23 September 1899; 1 spec. — Stn.253, Kai Is., 05°48.2'S 132°13'E, 304 m, trawl, grey clay, hard and crumbly, 10 December 1899; 3 specs. — Stn.282, Timor, anchorage between Nusa Besi and NE. point of Timor, 08°25.2'S 127°18.4'E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. — Stn.299, Timor, S. coast of Roti I., Boeka or Cyrus Bay, 34 m, dredge, reef exploration, diving, mud, coral and *Lithothamnion*, 27/29 January 1900; 1 spec. — Stn.315, Flores Sea, anchorage E. of Sailus Besar, Paternoster Is., up to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 2 specs. — Stn.316, Java Sea, 07°19.4'S 116°49.5'E, 538 m, trawl, fine, dark brown, sandy mud, 19 February 1900; 1 spec. — Stn.322, Java Sea, S. coast of Bawean I., 1½ miles (~ 2½ km) S. of Tandjong Lajar, 32 m, dredge, coral 24 February 1900; 1 spec. (ZMA De. 100.655 (in part)). — Kai Is., Kur I.; 1 spec. — Banda; 1 spec. — Banda, 9-36 m; 2 specs. — Sulawesi, Makassar; 3 specs. — Sulawesi, Makassar, 27-32 m; 1 spec. — Ambon Reef; 1 spec. — Sulu Archipelago; 1 spec.

Banda, on the shore; 1 spec. — Java Sea by Jakarta, trawl, 'Rambang', April-May 1907; 3 specs.

#### ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Singapore, 16 April 1907; 1 spec. — Singapore, shallow water, 24 January 1910; 1 spec.

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, ca. 36 m, dredge, *Lithothamnion*, 17 March 1914; 5 specs. — Sulu Archipelago, off Jolo, ca. 54 m, dredge, coral sand, 19 March 1914; 18 specs.

Danish Kei Islands Expedition: Banda, off Neira, 13 m, dive, sand, 12 February 1922; 2 specs. — Ambon, Ambon Bay, 13-18 m, sand, 28 February 1922; 1 spec. — Kai Is., Toeal, ca. 2 m, sand, 21 March 1922; 6 specs. — Kai Is., off Toeal, ca. 1-2 m, 31 March 1922; 1 spec. — Stn.10 Kai Is., off Doelah, 50 m, dredge, fine sand, 6 April 1922; 1 spec. — Stn.11, Kai Is., off Toeal, 20 m, trawl, fine sand, 9 April 1922; 1 spec. — Stn.14, Kai Is., S. of Doe Roa, 40 m, sand, 10 April 1922; 1 spec. — Stn.15, Kai Is., S. of Doe Roa, 5-20 m, sand, 10 April 1922; 2 specs. — Stn.19, Kai Is., off Toeal, 20 m, trawl, sand, 14 April 1922; 3 specs. — Kai Is., Doe Roa Bassin, 50 m, sand, 14 April 1922; 1 spec. — Stn. 30, Kai Is., between Doe Roa and Kei Doelah, 40 m, trawl, sand, shells, 18 April 1922; 7 specs. — Stn. 59, Kai Is., 05°28'S 132°36'E, 385 m, trawl, coral, sponges, 12 May 1922; 1 spec. — Stn. 60, Kai Is., S. of Doe Roa, ca. 25 m, dredge, sand, shells, 14 May 1922; 4 specs. — Stn. pt. 61, Kai Is., between Doe Roa and Kai Doelah, ca. 50 m, trawl, bryozoans, 14 May 1922; 1 spec. — Banda, off Waling, ca. 15 m, sand, 15 May 1922; 1 spec. — Banda, off Neira, ca. 20 m, dive, sand, 1 June 1922; 9 specs. — Banda, off Neira, ca. 10 m, dive, sand, 5 June 1922; 3 specs. — Banda, off Kombir, ca. 70-90 m, dredge, sand, 7 June 1922; 1 spec. — Banda, ca. 20 m, dive, sand, 8 June 1922; 1 spec. — Banda, off Neira, ca. 15 m, dive, sand, 9 June 1922; 1 spec. — Banda, off Neira, ca. 20 m, dive, sand, 10 June 1922; 1 spec. — Banda, off Neira, 13 m, dive, sand, coral, 12 June 1922; 1 spec. — Banda Is., off Waling, 10 m, sand, 15 June 1922; 6 specs. — Sulawesi, Makassar, off Samaloma, ca. 35 m, dredge, sand, mud, 28 June 1922; 1 spec. — Kai Is., Toeal, 0-1 m, 21 July 1922; 1 spec. — Stn. 65, Java Sea, 05°52'05"S 106°17'E, 25 m, sand, 27 July 1922; 1 spec. — Stn.66, Java Sea, 05°54'S 106°12'E, 24 m, trawl, sandy mud, shells 27 July 1922; 2 specs. — Stn.69, Java Sea, 05°47'S 106°17'E, 50 m, sand, 27 July 1922; 1 spec. — Stn.106, Java Sea, 05°50'S 106°6'E, 32 m, sand, 5 August 1922; 3 specs.

'Dana' Expedition: Stn.3617, New Caledonia, Noumea Harbour, 0.2 m, coral, sand, stones, 3 December 1928; 1 spec.

Mortensen Java-S. Africa Expedition: Java Sea, Hoorn, I., shore collecting, 19 April 1929; 1 spec.

#### WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: Dampier Archipelago, between Manus and Gidley Is., coll. B. Royce on 'Davena', 1 June 1960; 1 spec. (WAM 83-71). — Dampier Archipelago, Gidley I., 29 m, Honolulu dredge, coral rubble, coll. B. Royce on 'Davena', June 1960; 1 spec. (WAM. 76-71). — Shark Bay, SE. corner of Dirk Hartog I., 3-7 m, dredge, coll. B. R. Wilson and G. W. Kendrick, 5 March 1966; 2 specs. (WAM. 84-71). — Shark Bay, South Passage, mainland side, 3-5 m, sand, 5 March 1966; 1 spec. (WAM 86-71). — Careening Bay, *Posidonia* bank, south sand flat, coll. Marine Science Camp, 29 November 1967; 1 spec. (WAM 75-71). — Bay N. of Pt. Cloates, 22°37'S 113°38.5'E to 22°39'S, 113°40'E, 2-6 m, box dredge, sand, sponge and dead shells, 'Ningaloo', 30 August 1968; 3 specs.

Sulu Archipelago, Basilan Straits, W. of Malanipa I., 23 m, sand and rubble. coll. B. R. Wilson on 'Pele', 12 February 1964; 1 spec. (WAM. 92-71 (in part)).

#### RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Sydney, Museum Godeffroy; 1 spec.

#### NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn.CP I, Ceram, Piru Bay, off Tg.Tutuhuhur, 03°15'S 128°8'E, 41-48 m, dredge haul 4, coarse foraminiferal and shell sand, 1 June 1970; 1 spec. — Stn.CP I (as above), 36-47 m, dredge hauls 7-9, coral, sponge, coarse sand, *Lithothamnion* and rubble, 1-2 June 1970; 1 spec. — Stn.KR VI, Kai Is., N. of Nuhu Rowa, N. of Du Rowa I., 05°32'S 132°41'E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 4 specs. — Stn.KR IX, Kai Is., N. end of Kai Dulah, 05°31'S 132°48'E, 18-21 m, dredge, sand, 12 June 1970; 2 specs. — Stn.KN IV, Kai Is., W. coast of Nuhu Tjut, E. side of Mitduan Reef, 05°32'S 133°E, 36-56 m, dredge hauls 3-4, sand, coral, rubble and sponge, 13 June 1970; 1 spec. — Stn.AW I, Aru Is., W. Wokam, off W. coast of Wasir I., 05°30'S 134°12'E, 32-39 m, dredge haul 6, sand and shell rubble, 15 June 1970; 6 specs. — Stn.AN I, Aru, S. Trangan I., SW. of Tg.Ngabordamlu, centred near 06°58'S 134°05'E, 26-29 m, dredge haul 1, coral and sponge, 20 June 1970; 4 specs. — Stn.AN I (as above), 25-29 m, dredge hauls 1-3, coral, sponge, mud and broken shell, 20 June 1970; 5 specs. — Stn. A III, Aru, Trangan, 3-4 miles (~ 5-6½ km) W. of Tg.Lelar, 06°46'S 133°58'E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 7 specs. — Stn. TS VI, Tanimbar, Selaru, Tg.Tuwau, 08°11'S 130°49'E, snorkeled and hand dredged, 27 June 1970; 1 spec.

Remarks. — This species, like *H. whitei* and *H. cornigerus* is distinguished from other species of *Hyastenus* by a very tuberculate carapace. The characters which separate *H. sebae* and *H. whitei* have been listed previously (Griffin, 1976), but are reiterated briefly here.

This large series of *H. sebae* shows considerable variation in several characters. The rostral spines vary from a third to two thirds the postrostral carapace length. They are usually divergent, but in some specimens with short rostral spines they are subparallel.

The preorbital angle of the supraorbital eave is sharp, slightly produced, and is sometimes a short spine (in *H. whitei* it is rounded and not produced). Opposite the rounded antorbital lobe there is a small process on the anterior margin of the postorbital lobe.

There is a row of three to four tubercles on the branchial margin and a much larger epibranchial tubercle or short spine (in *H. whitei* only a subequal tubercle). Between the epibranchial spine and the anterior margin of the branchial region,

there are three to five small submarginal tubercles (in *H. whitei* only two). On the dorsal part of the hepatic region there is a row of two to three small tubercles, which in nearly all the specimens are smaller than the posterior tubercles of the branchial region. (In *H. whitei* the hepatic and posterior branchial tubercles are subequal.) In this series, a few specimens (from Sulawesi and Western Australia) have hepatic tubercles as large as those of *H. whitei*; however, these specimens also have a strong epibranchial spine. On the intestinal region there is a medial tubercle, low and rounded in most specimens, but in a few almost spine-like.

The anterolateral angle of the basal antennal article is produced as a blunt lobe, small tooth or well developed spine (not produced at all in *H. whitei*). This feature and the shape of the lobe on the lateral margin of the article are very variable.

In some specimens there is a small proximal tubercle on the merus of both the cheliped and the first ambulatory leg.

The first pleopod of the male has been figured by Takeda (1973a).

Both *H. sebae* and *H. whitei* have been found in the Sulu Archipelago but neither have been recorded from Japan. *H. cornigerus* Sakai, from Japan, as described and figured by Sakai (1938: 283-284, fig. 37; 1976: 227-228, fig. 123) is very similar to our specimens of *H. sebae* in general appearance and in number and pattern of carapace tubercles, including the triangle of three tubercles on the urogastric region. We are not able to say, from the description given for *H. cornigerus*, and with the wide variability we have noted among our specimens of *H. sebae*, what the characters are which would separate the two species. Only by examining the two species together could the difference be determined.

Takeda (1973a) recorded *H. sebae* (under the name *H. oryx*) from Palau. In the collections of the Smithsonian Institution is a specimen (1 ovig. ♀, cl. 19.5 mm, acc. no. 206 221) from Palau of *H. sebae* identified by Sakai as *H. cornigerus*.

However, the specimen reported and figured as *H. cornigerus* by Takeda & Kurata (1976: 24-25, fig. 3 E,F, pl. 2 fig. 2) clearly differs from our specimens of *H. sebae* (and, therefore, the material discussed under the name *H. cornigerus* by Sakai) in the large hepatic spine, broad intestinal spine and bilobed orbital eave and, as remarked by Takeda, it resembles species of *Naxioides* especially in the pleopod of the male. Takeda's specimens are similar to the specimen described and figured as *Hyastenus elegans* by Miers (1886: 58-59, pl. 6 fig. 3) and which Miers compared to *H. oryx* (now *H. sebae*). In the holotype of *H. elegans* (imm, female, cl. 32.7 mm, Kai Is., 252 m, BMNH 84.31) which one of us (D.J.G.G.) has examined, there is an intercalated spine separated from the postorbital lobe only by a narrow slit. In addition a specimen examined at the Zoological Museum, University of Copenhagen (♂, 59.6 mm, E. of Tsu Shima, 113 m, 16 December 1956), which appears to be conspecific with the holotype of *H. elegans* has a pleopod very similar to that figured by Takeda for *H. cornigerus*. The presence of an intercalated spine would mean these specimens do not belong to *Hyastenus*.

Distribution. — Palau, Philippine Islands, Indonesia, North and Western Australia, northern Indian Ocean.

*Hyastenus trispinosus* Rathbun, 1916

(Figs. 40g,h, 41e,f)

*Hyastenus trispinosus* Rathbun, 1916: 542-543. — Griffin, 1976: 198, fig. 5(b).

Material examined. — 6 ♂♂, 6 ♀♀ (3 ovig.), 7.5-16 mm, smallest ovig. ♀, postrostral carapace length 8.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn.299, Timor, S. coast of Roti I., Boeka or Cyrus Bay, 10°52.4'S 123°1.1'E, 34 m, dredge, reef exploration, diving to 34 m, mud, coral and *Lithothamnion*, 27/29 January 1900; 2 specs.— Ambon, Ambon reef; 7 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Dana' Expedition: Stn.3760, Irian Jaya, Manokwari, 16 July 1929; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, Pacific coast N. of Jayapura, reef near base G, coll. G. van Hout, April 1955; 2 specs.

Remarks. — This species is similar to *H. hilgendorfi*. Like that species it has divergent rostral spines, a protogastric tubercle near the orbit, a row of three tubercles on the branchial region and an epibranchial spine. It is distinguished from *H. hilgendorfi*, by the presence of a strong spine on the intestinal region and the absence of any additional submarginal tubercles between the tubercle on the anterior margin of the branchial region and the epibranchial spine; the mesogastric tubercle, when present is located anteriorly, level with the protogastric tubercle.

On the anterior margin of the postorbital lobe, there is a notch in some specimens which is almost as pronounced as that in *Thusaenys calvarius*, a species which also has a well developed intestinal spine. In *H. trispinosus*, however, the supraorbital eave is longer, the small preorbital spine is directed forward rather than laterally, and the lateral margin of the eave, although slightly concave, is not notched. As well, the branchial regions are elevated, with a strong epibranchial spine, and the gastric and cardiac regions are separated by a depressed urogastric region not present in *T. calvarius*.

The first pleopod of the male is similar to that of *H. hilgendorfi*, but the tip is narrower towards the apex and concave on the medial edge opposite the lateral lobe.

Distribution. — Sulu Archipelago, Ambon, Irian Jaya, Timor, Singapore.

*Hyastenus uncifer* Calman, 1909

(Figs. 38e,f,i, 39c, 42e-g)

*Hyastenus uncifer* Calman, 1909: 712, pl. 72 figs. 8, 9.

Material examined. — 3 ♂♂, 2 ♀♀ (1 ovig.) 12-18.5 mm, ovig. ♀, 15 mm.

## ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: South Timor, Haingsisi Reef; 1 spec.  
Sumatra, S.S. 'Pharus'; 1 spec.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Banda Is., Waling, ca. 15 m, sand, 15 May 1922; 1 spec. — Banda Is., off Waling, ca. 15 m, dive, sand, coral, 2 June 1922; 1 spec. — Banda, off Neira, 13 m, dive, sand, 12 June 1922; 1 spec.

Remarks. — These specimens agree well with type material (imm. ♀, 11.4 mm, Christmas I., Indian Ocean, ZSC 7250/10) examined by one of us (D.J.G.G.) and with the description given by Calman, in the long slender rostral spines, distinct hepatic and intestinal spine, one dorsal tubercle on the anterior branchial region, and the spines on the dactyls of the ambulatory legs directed backwards towards the propod. The cardiac region is incorrectly shown in Calman's figure of the holotype (pl. 72 fig.8); in his figure there is a strong medial elevation ahead of the level of the epibranchial spine and another behind it, but in fact the urogastric region is smooth and the cardiac elevation is level with the epibranchial spine. As there is no male in the type material the first pleopod of the male must be described from other specimens. In our series there are three males, one from south Timor and two from Banda and we have figured the first pleopod of one of these. The first pleopod is broad and straight, the distal quarter is twisted through 90° to lie in a dorsoventral plane, the narrow apex is sternal and there is a broad lobe behind it on the abdominal surface. Therefore we base our understanding of the male of *H. uncifer* on these specimens.

*H. uncifer* is similar to *H. brockii* De Man and *H. borradailei* (Rathbun) in the long rostral spines, weakly expanded orbital eave, shallow postorbital lobe and weakly produced proximal margin of the basal antennal article. It differs from those two species by the presence of distinct hepatic and intestinal spines, rather than tubercles; the presence of only one, not two, tubercles on the anterior dorsal branchial region; the tubercle anteriorly on the branchial submargin is as large as the anterior pterygostomian tubercle (not half as large) and is visible dorsally; and the proximal lobe on the lateral margin of the basal antennal article is not produced as far laterally as the strong anterolateral spine (produced further than the spine in the other two species). The differences and similarities of the male pleopods of these three species are discussed under *H. borradailei*.

In this series of specimens the rostral spines are long, about one and a third times (1.2 to 1.4) the postrostral carapace length. The preorbital lobe is directed forwards and obliquely upwards; the antorbital angle is weakly produced; the anterior margin of the postorbital lobe is straight and the orbit below is completely open. The eyestalks are stout and the cornea conspicuously large. There are six distinct tubercles on the gastric region — two mesogastric and two pairs of protogastric tubercles; there is an epibranchial spine and a tubercle above it; none of the specimens have a tubercle in front of

the intestinal spine as figured by Calman. The first ambulatory leg is about two and a half (2.4 to 2.6) times the postrostral carapace length, the merus has a slender terminal spine; the dactyl is slender (length about ten times height) with eight to twelve short spines ventrally, the proximal ones directed backwards towards the propod. The dactyl of the fourth ambulatory leg has six to seven long spines of which only the subterminal spine is vertical, all the others are directed backwards towards the propod.

One of us (D.J.G.G.) has examined the specimen (♂, 20.5 mm, USNM 41408) from Diego Garcia, identified as *H. uncifer* by Rathbun (1911: 252, pl. 20 fig. 7) and although we are unable to distinguish it from the males in our series in any other respects, the first pleopods of the males are different. It does agree with that of a male specimen from Aldabra, which we have also examined, and which was figured by Guinot (1962b: fig. 16a, b) as *H. uncifer*. The sharp apex is on the lateral edge of the pleopod and behind it on the medial edge there is a broad lobe which is recurved ventrally; the aperture is subterminal on the medial half of the abdominal surface, while the lateral half of the abdominal surface beside the aperture is elevated. This pleopod is similar to that of *H. borradailei*, but in that species the medial lobe is nearer the apex and the abdominal surface is nearly flat. It seems possible then, that there is another species, very similar to *H. uncifer*, in the western Indian Ocean but more specimens would be necessary to confirm this. We have examined two ovigerous females, one from Aldabra (cl. 23 mm, 23 May 1954; Paris Museum) and one from the Red Sea (cl. 21 mm, Abulat; Paris Museum). The gonopore in these specimens does not differ substantially from the gonopore of the ovigerous female from Sumatra, that is, it is an oval aperture, opening anteromedially with a moderately elevated posterolateral margin. In the specimens from Aldabra and the Red Sea this elevated margin is nearly straight while in the specimen from Sumatra there is an obtuse angle midway along.

Distribution. — Banda, South Timor, Sumatra, Christmas I. (Indian Ocean).

*Hyastenus whitei* Griffin, 1976  
(Figs. 40a,b, 41i,j)

*Hyastenus sebae* White, 1847b: 57 (in part).

*Hyastenus whitei* Griffin, 1976: 198-199, fig. 6(b).

Material examined. — 7 ♂♂, 10 ♀♀ (7 ovig.), 12-34.5 mm, smallest ovig. ♀, 18 mm.

## ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 47, Indonesia, Sumbawa, Bay of Bima, near south fort, shore exploration, 8/12 April 1899; 5 specs.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Singapore, shallow water, 1903-1907; 12 specs.

Remarks. — This species has been previously known as *Hyastenus sebae*. That name belongs now to the species previously known as *Hyastenus oryx* A. Milne Edwards 1872. The reason for the change of name has been explained in detail by Griffin (1976). Both species have a tuberculate carapace, but *H. whitei* may be distinguished by the following combination of characters. There is no preorbital spine, and there is no anterolateral spine on the basal antennal article. The epibranchial tubercle is no larger than the dorsal branchial tubercle above it and the three tubercles on the dorsal part of the hepatic region are as large as the dorsal branchial tubercles. There are only two small submarginal tubercles on the branchial region, both on the anterior half.

The length of the palm of the chela of the largest male (34.5 mm) is four to five times the distal height. There is a small gape between the fingers, and a large proximal tooth on the dactyl.

Distribution. — Indo-West Pacific: Mauritius, Singapore, Indonesia, Philippine Islands.

*Lahaina* Dana, 1851

Type species. — *Lahaina ovata* Dana, 1851, by monotypy.

Description. — Carapace pyriform. Surface with a few tubercles and small spines including an epibranchial and posterior intestinal spine. Rostrum about as long as carapace, of two distinct, slightly sinuous acuminate spines. Orbit comprising above an eave separated by a U-shaped hiatus from postorbital lobe, a small intercalated spine sometimes present. Supraorbital eave at most only moderately expanded with a slender, acute preorbital spine and a blunt antorbital spine. Postorbital lobe small, laterally flattened, sometimes with a tubercle. Basal antennal article narrow with a strong anterolateral spine, lateral margin at base sometimes produced as a dorsally extending lobe, separated from postorbital lobe by a broad hiatus; a small suborbital tubercle present.

Abdomen of seven distinct segments in male.

First pleopod of male simple, slender distally.

Remarks. — The four species now placed in this genus are distinguished by the relatively narrow orbital eave armed with both preorbital and antorbital spine and the relatively narrow basal antennal article, all have very long rostral spines. Whilst one of the other species groups formerly included in *Hyastenus* (*Giranauria* species) has strong preorbital and antorbital lobes, the orbit (and basal antennal article) is much broader. In most other groups the preorbital and antorbital lobes are small indeed.

*Pseudomicippe incerta* Balss, 1938, from the Pacific is here shown to be a species related to *Lahaina ovata* of which *Hyastenus tenuicornis* Pocock, 1890, has already been shown to be a synonym (Griffin, 1974). *Naxioides rombloni* Rathbun, 1916, is here considered to be a synonym of *Halimus agassizii*

Rathbun, 1902a, and is removed to this genus. A new species of this genus is described from Mauritius.

As now understood *Lahaina* ranges from the Red Sea, Seychelles and Mauritius in the west through the tropical Pacific — Indonesia, the Philippines and nearby areas to the Marshall Islands and Hawaii in the West Pacific.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *LAHAINA*

- 1 Rostral spines strongly divergent from base; preorbital spine strongly produced, directed obliquely forward or upward; postorbital lobe basally narrow ..... 2
- Rostral spines only moderately divergent in basal half; preorbital spine small or moderately produced and directed forward; postorbital lobe not basally narrow ..... 3
- 2( 1) Postorbital lobe strongly produced, apex remote from antorbital lobe, upper orbital hiatus oval; cardiac region weakly elevated with a slender spine; anterior pterygostomian spine slender, straight, spinulose; posterior carapace margin spinulose ..... *L. incerta*
- Postorbital lobe not strongly produced, apex close to antorbital lobe, upper orbital hiatus subcircular; cardiac region inflated with a strong tubercle at summit; anterior pterygostomian spine robust, strongly curved forwards, smooth; posterior carapace margin smooth ..... *L. ovata*
- 3( 1) Preorbital spine longer than antorbital lobe; cardiac region with two short medial spines; posterior carapace margin with a row of granules and another row just in from the edge; carapace surface with granules between spines but without a thick tomentum ..... *L. agassizii*
- Preorbital spine equal to or shorter than antorbital lobe; cardiac region smooth or with a blunt tubercle; posterior carapace margin smooth; carapace surface smooth below a thick tomentum ..... *L. mauritiana*

*Lahaina agassizii* (Rathbun, 1902) new combination  
(Figs. 37b, 52b,e)

*Halimus agassizii* Rathbun, 1902a: 133-134, pl.1 fig. 6. — Laurie, 1906: 377-378.

*Naxioides rombloni* Rathbun, 1916: 549-551. — Griffin, 1976: 202, fig. 8; new synonymy.

Material examined. — 16 ♂♂, 19 ♀♀ (13 ovig.), 7.5-14.5 mm, smallest ovig. ♀, 9.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 133, N. Sulawesi, anchorage off Lirung, Salibabu I., to 36 m, trawl, dredge and reef exploration, mud and hard sand, 25/27 July 1899; 2 specs. — Stn. 144, Moluccas, anchorage N. of Damar I., 45 m, dredge, tow net and reef exploration, coral bottom and *Lithothamnion*, 7/9 August 1899; 5 specs. — Stn. 154, Irian Jaya, Bougainville Strait, 00°7.2'N 130°25.5'E, 83 m (depth decreased to 59 m), dredge, grey muddy sand, shells and *Lithothamnion*, 14 August 1899; 1 spec. — Stn. 282, anchorage between Nusa Besi and NE. point of Timor, 08°25.2'S 127°18.4'E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 2 specs. — Stn. 315, Bali Sea, anchorage E. of Sailus Besar, Paternoster Is., to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 5 specs. — ?Haingsisi; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: off Neira Banda, ca. 15 m, sand, dive, 9 June 1922; 2 specs. — Banda, 20 m, coll. Th. Mortensen, June 1922; 1 spec. — Java Sea, 05°41'S 105°57'E, 35 m, coll. Th. Mortensen, 28 July 1922; 1 spec.

## THE AUSTRALIAN MUSEUM, SYDNEY

New Caledonia: off Noumea, near Îlot Amédée, on outside of main reef, 30-35 m, coll. B. Conseil and G. Bargibant, 12 September 1969; 1 spec. (AM P. 29901).

Queensland: Lizard I., outer Yonge Reef, 36 m, dead reef rock covered in *Halimeda* and coralline algae, coll. P. Weate, 9 January 1975; 1 spec. (AM P. 29900). — Lizard Island, outer Yonge Reef, 24 m, reef rock, coll. P. Weate, 13 April 1978; 1 spec. (AM P. 29902).

## WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: Shark Bay, Dorre I., 4 miles (~6 km) W. of C.St.Cricq, 80 m, Honolulu dredge, coll. R. W. George, 'Dorothea', 16 May 1960; 2 specs. (WAM 295-67). — Geraldton, NW. of Bluff Pt., 27°40'S 113°03'E, 140 m, dredge or midwater trawl, sponge and Bryozoa, CSIRO 'Diamantina', 22 August 1963; 1 spec. (WAM 57-67). — NW. of Bluff Pt., 27°18'S 113°16'E, 108 m, triangle dredge, sponges, starfish, Oxystomata, CSIRO 'Diamantina', 9 October 1963; 1 spec. (WAM 127-67). — SW. Geraldton, 29°49'S 114°24'E, 142 m, triangle dredge, sponge and Crustacea, CSIRO 'Diamantina', 1 October 1963; 1 spec. (WAM 72-71). — N. of Cape Leschenault, 31°22'S 115°03'E, 48 m, triangle dredge, huge catch of sponges, CSIRO 'Diamantina', 11 October 1963; 3 specs. (WAM 139-67). — NW. of Jurien Bay, 30°S 114°22'E, 140-150 m, beam trawl, sponge and Bryozoa, CSIRO 'Diamantina', 28 January 1964; 2 specs. (WAM 102-67). — Abrolhos, W. of North I., 108 m, triangle dredge, coll. B. Wilson, CSIRO 'Diamantina', 5 December 1970; 2 specs. (WAM 95-71, in part).

Remarks. — These specimens agree well with the holotype of *Naxioides rombloni* (USNM 48201, ♂, 14.6 mm). They also agree very closely with the holotype of *Halimus agassizii* (MCZ 6714, ♂, 6.7 mm). In these specimens the rostral spines range in length from two thirds of the postrostral carapace to as long as the postrostral carapace. The rostral spines are shorter (half postrostral carapace length) in the small holotype of *H. agassizii* than they are in most of our specimens. Both holotypes have a small intercalated tooth in the upper orbital hiatus.

The antorbital angle of the supraorbital eave is often narrow, acute (down to 45°) and directed posteriorly. The small tooth on the border of the hiatus between the eave and postorbital lobe varies in size; it is absent in two specimens and very small in about 10 specimens. It is more usually midway along the hiatus than close to the postorbital lobe.

The hepatic spine varies in shape, being often quite slender and usually directed posteriorly.

There is a row of granules on the posterior margin of the carapace and a similar row parallel to it commencing at the intestinal spine.

There is a spinule or granules on the dorsal edge of the strong anterolateral spine on the basal antennal article.

The anterolateral angle of the buccal cavity is strongly produced, and so is the anterolateral angle of the merus of the third maxilliped.

The palm of the cheliped of the larger males (11.5-13.5 mm) is inflated, 2 to 2½ times as long as high, the fingers half as long as the palm; there are two shallow longitudinal grooves, one dorsal and one ventral, on the outer surface; there is a moderate gape between the fingers, two large adjacent teeth proximally on the dactyl, and the fixed finger is arched and excavate proximally.

The first pleopod of the male is very slender in the distal half.

The specimens from Western Australia have a more granular carapace and there are two or three pairs of granules on the urogastric region, which is smooth in all other specimens.

This species has several characters in common with *L. ovata*.

- a. The postorbital lobe is flattened laterally.
- b. There is often a small tooth in the hiatus of the upper orbit.
- c. The basal antennal article has a strong longitudinal groove, a strong anterolateral spine with an accessory spinule, and two lateral lobes extending dorsally into the orbit.
- d. The sternites of the male have a central row of granules with swollen setae.
- e. The first ambulatory leg has a strong terminal spine on the merus.
- f. There are longitudinal grooves on the palm of the cheliped and the fixed finger of the adult male is arched and excavate.

Also the suborbital tooth is very small and there is a similar pattern of spines and tubercles on the carapace.

This species can be distinguished from *L. ovata* by the following characters.

- a. The rostral spines are less divergent.
- b. The proximal lobe on the lateral margin of the basal antennal article is broad and produced laterally (small and directed dorsally in *L. ovata*).
- c. The cardiac elevation has two spines rather than one tubercle.
- d. There is a strong row of granules on the posterior margin of the carapace.
- e. The merus of the first ambulatory leg has a long spine as well as the terminal spine, and there are two spines on the carpus.
- f. The merus of the fourth ambulatory leg has a spine dorsally midway along and three spines or tubercles ventrally (only setae in *L. ovata*).
- g. The first pleopod of the male of this species is distally very slender while that of *L. ovata* is only slightly narrowed.

This species has been recorded from the Maldives Islands (Rathbun; Garth (unpubl.)) and from the Gulf of Manaar (Laurie). As *Naxioides rombloni* it has been previously known from the Philippine Islands.

Distribution. — Gulf of Manaar, Maldives Islands, Western Australia, Java Sea, Sumbawa, Timor, Queensland, New Caledonia, Banda, Moluccas, Philippine Islands.

*Lahaina incerta* (Balss, 1938), new combination  
(Figs. 52a, d)

*Pseudomicippe incerta* Balss, 1938: 15-17, pl. 1 fig. 2. — Buitendijk, 1939: 245 (in discussion). — Griffin, 1974: 16 (in discussion).

Material examined. — 1 juv. ♂, 3.0 mm, 2 ♀♀ (1 ovig.) 9.5, 11.5 mm, ovig. ♀, 9.5 mm.

## ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 144, Moluccas, anchorage north of Damar I., 45 m, dredge, tordnet and reef exploration, coral and *Lithothamnion*, 7/9 August 1899; 1 spec.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Off Neira Banda, 18 m, sand, 12 June 1922; 1 spec. — Banda Is., 10 m, sand, 15 June 1922; 1 spec.

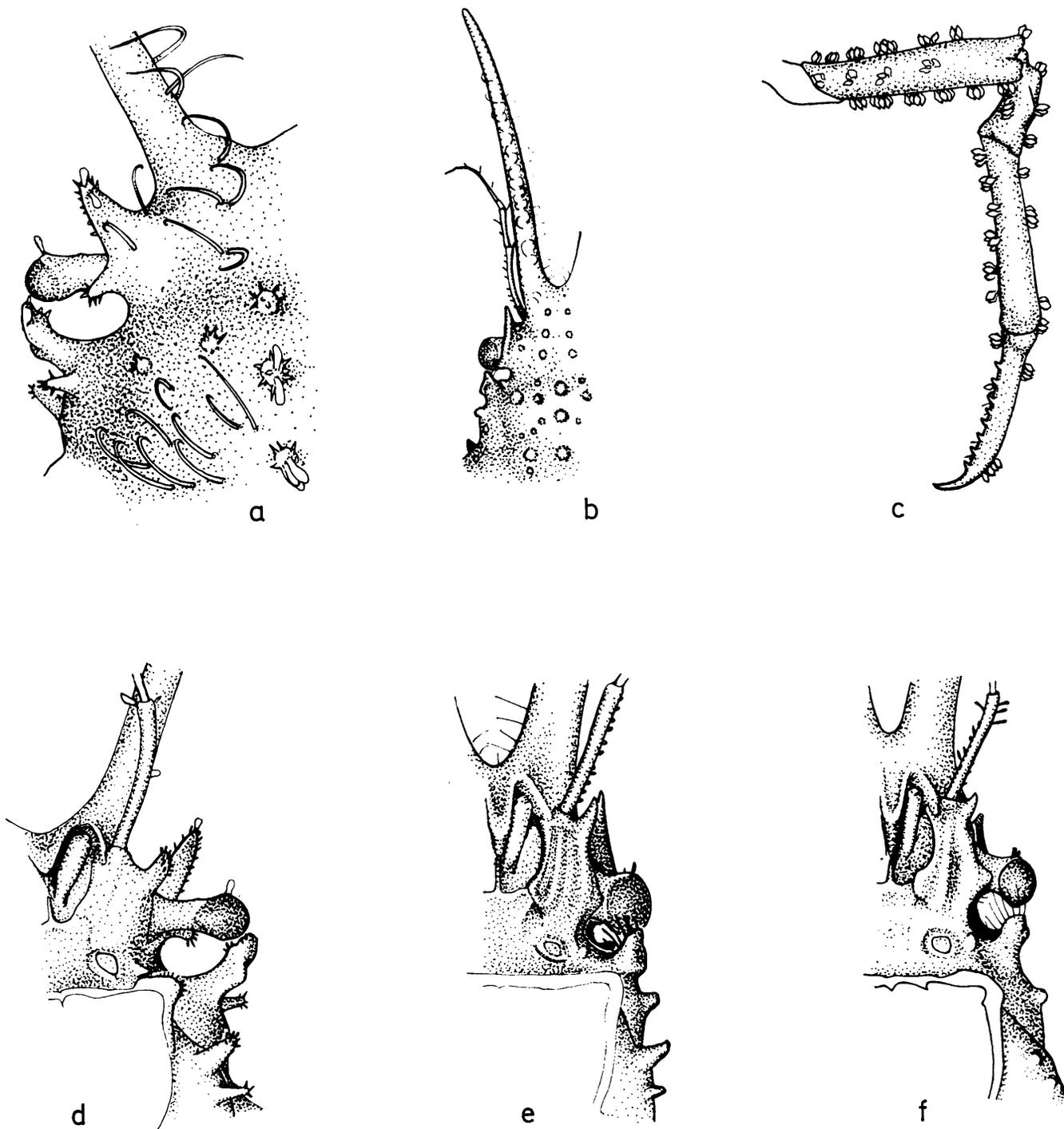


Fig. 52. *Lahaina incerta* (female, 11.5 mm, Damar I., ZMA) (a) left orbit, dorsal view; *L. agassizii* (male, 13.5 mm, Banda, ZMC) (b) left orbit, dorsal view; *L. mauritiana* (holotype) (c) right fourth ambulatory leg; *L. incerta* (as above) (d) left orbit, ventral view; *L. agassizii* (as above) (e) left orbit, ventral view; *L. mauritiana* (as above) (f) left orbit, ventral view.

Remarks. — These specimens have the small spinules distally on the carapace spines, including the small spines on the posterior margin of the carapace, described by Balss as distinguishing this species.

This species is very similar to *L. ovata* but the postorbital lobe is more slender than in that species and produced further laterally, so that the hiatus of the upper orbit is oval rather than round; distally the postorbital lobe is produced dorsally and appears L-shaped in lateral view, rather than subrec-

tangular as in *L. ovata*. Our specimens, like the holotype, lack the small tooth on the margin of the upper hiatus, present in most specimens of *L. ovata*.

There is a slender hepatic spine, armed with spinules, and directed laterally and upward. There are three small spines on the branchial submargin, while in *L. ovata*, though there are sometimes granules, there are no tubercles or spines. On the cardiac region there is a slender spine not a tubercle as in *L. ovata*.

The anterolateral spine of the basal antennal article is directed ventrally and there are several sharp spinules on its dorsal edge. The lateral margin is straight and lacks the two rounded lobes which extend dorsally towards the orbit and the abrupt basal concavity behind the proximal lobe, present in *L. ovata*.

The anterior spine on the pterygostomian margin is straight, slender and armed with spinules, the second spine is similar but smaller; the anterior spine in *L. ovata* is broad, blunt and often curved forward and there is a small tubercle behind it. There is a short spine or tubercle midway on the posterior margin of the merus of the third maxilliped in *L. incerta*.

There is a very long terminal spine on the merus of the first ambulatory leg and another long dorsal spine about midway along. There are also two spines on the carpus. (The first ambulatory leg of the type of *Naxioides rombloni* is similarly armed but in the type of *L. ovata* and *L. mauritiana* there is only a terminal spine on the merus.) The second to fourth ambulatory legs also have a long terminal spine on the merus.

Previously known only from the Marshall Islands.

Distribution. — Banda Islands, Damar I., Marshall Islands.

*Lahaina mauritiana* new species  
(Figs. 37c,d, 52c,f,53)

Material examined. — 2♂♂, 3♀♀ (2 ovig.), postrostral cl. 6.5 mm, cl. 19-26.5 mm, smaller ovig. ♀, 20 mm.

Holotype. — Male, 26.5 mm, Mauritius, Tombeau Bay, 360 m, Sigsbee trawl, hard bottom with sand, 26 September 1929, Mortensen Java-S. Africa Expedition, Stn. 34; Zoological Museum, University of Copenhagen.

Paratypes. Female, 19 mm; ovig. female, 20 mm, data as for holotype. — Male, postrostral cl. 6.5 mm, ovig. female 21 mm, Mauritius, N. of Port Louis, about 234 m, Sigsbee trawl, 6 November 1929, Mortensen Java-S. Africa Expedition. Stn. 47; Zoological Museum, University of Copenhagen.

Description. — Carapace pyriform, widening posteriorly, width about three quarters (0.7 to 0.75) postrostral carapace length; carapace regions clearly defined and elevated; surface covered with a tomentum of club setae, a few tubercles and short spines.

Rostral spines very long, in adult male slightly greater (1.2) than, or in adult female equal to, postrostral carapace length; slender, divergent; two pairs of submedial tubercles on the rostral ridges.

Orbital cave weakly expanded, preorbital angle produced forward and slightly upward as a small spine; antorbital angle a short, blunt lobe, produced further laterally than preorbital spine; postorbital lobe short, truncate, with a small tubercle laterally, separated from cave by a wide, subcircular hiatus which lacks tooth or spine. Eyestalks short, moderately stout, a row of setae distally above cornea; cornea terminal.

Hepatic region not elevated, a tubercle on margin, subhepatic region smooth.

Branchial submargin with a small tubercle anteriorly; epibranchial spine short, blunt.

Gastric regions elevated; three evenly spaced mesogastric tubercles; a lateral protogastric tubercle at a level halfway between first and second mesogastric tubercles; a more medial protogastric tubercle level with second mesogastric tubercle; urogastric region smooth, depressed.

Cardiac region elevated, rounded, smooth except for a very small tubercle at summit.

Branchial region elevated anteromedially with two small tubercles on lateral part of elevation; a tubercle between epibranchial spine and cardiac region; a weakly elevated, subtriangular area just posterolateral to cardiac region.

Intestinal region elevated, conical with a short, upwardly directed spine at summit.

Basal antennal article narrow, smooth; a longitudinal ridge just in from medial edge and a well marked longitudinal groove centrally; medial edge produced basally over epistome; anterolateral angle produced as a short spine directed obliquely forward; lateral edge with a short, blunt, dorsally directed lobe just behind spine, proximal half produced laterally as a broad lobe with a small flat lobe at its apex. A small tubercle just lateral to green gland.

Pterygostomian region smooth, two tubercles on margin, anterior the larger.

Third maxilliped smooth; ischium with an elongate, central depression, marginal ridges with large club setae, medial half of anterior margin flat, without setae, merus with ridge on posterior margin and diagonal ridge from posterolateral angle, anterolateral angle strongly produced and rounded.

Cheliped of adult male long, twice postrostral carapace length (in adult female about one and a quarter times postrostral carapace length); merus slender, smooth, with scattered groups of club setae, a blunt tubercle on ventral outer edge distally and a small, sharp terminal spine; carpus with a sharp dorsal tubercle in the distal half and a sharp terminal tubercle; palm elongate, slightly higher distally, dorsal and ventral margins broad, length about three and a half (3.4) times distal height, a longitudinal ridge midway along inner and outer face; fingers about one third length of palm, strongly gaping in proximal half, dactyl with two large teeth in gape, fixed finger excavate and unarmed; both fingers with small teeth on cutting edge in distal half, dorsal edge of dactyl and ventral edge of fixed finger broad and weakly grooved.

Ambulatory legs slender, first leg of male about three and a half (3.6) times postrostral carapace length (about two and a half times in female), merus smooth with scattered groups of club setae, a long terminal spine; dactyl long, straight, curved only at tip, unarmed; fourth leg slightly longer (1.3) than postrostral carapace length, about two fifths (0.37) of first leg, dactyl with nine small teeth ventrally along its length.

Sternum smooth, first sternite centrally depressed, a well developed narrow ridge on anterior margin of abdominal fossa.

Male abdomen of seven segments, first segment with a

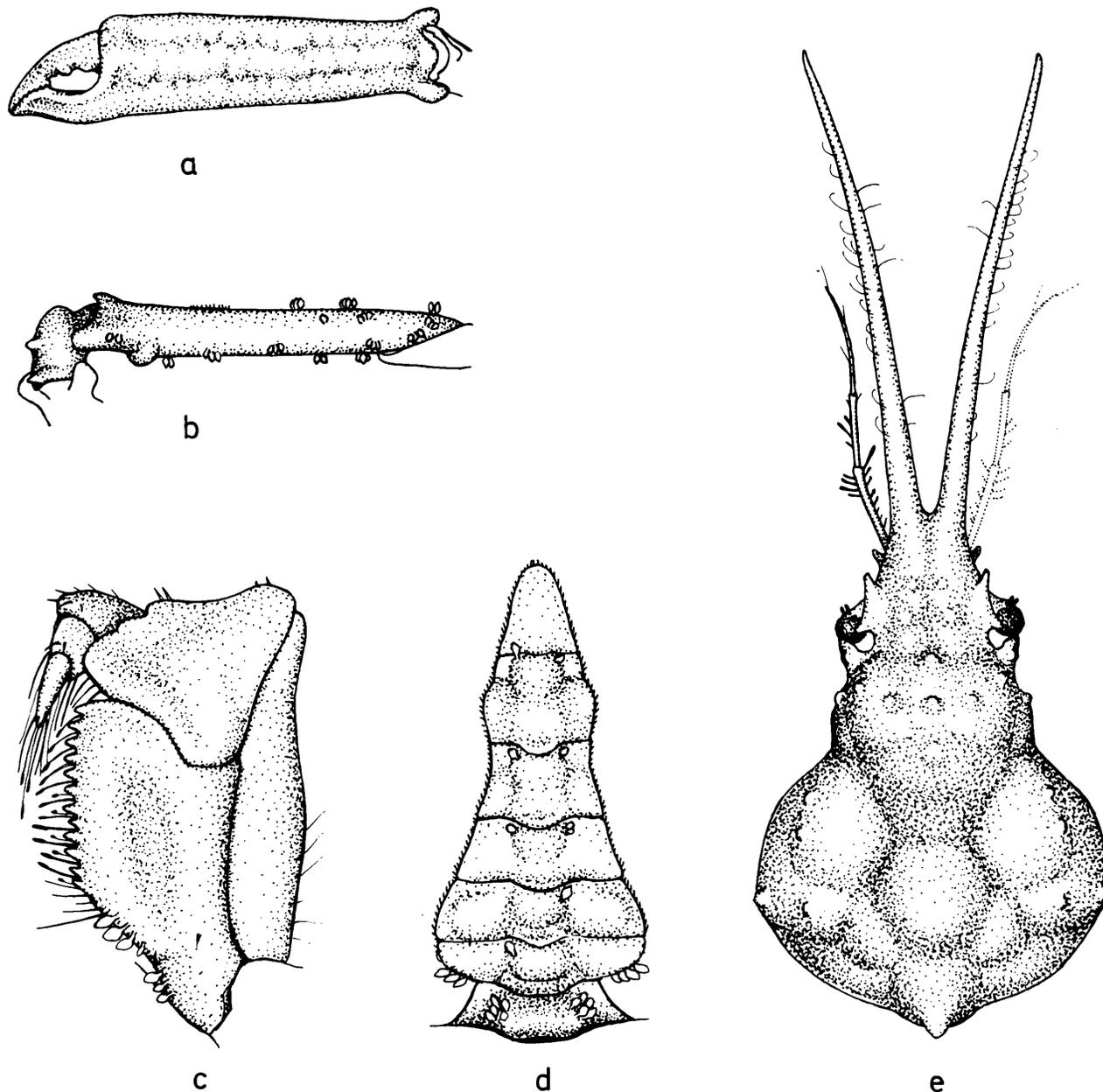


Fig. 53. *Lahaina mauritiana* (holotype) (a) left chela, (b) left cheliped, merus and carpus; (c) left third maxilliped; (d) male abdomen; (e) carapace, dorsal view.

transverse, elongate ridge, second to sixth segments with a rounded, anterior medial tubercle, third segment rounded laterally, sixth segment rounded on lateral margins; third segment less than twice (1.8) as wide as sixth segment, sixth segment only slightly wider (1.1) than long, seventh segment slightly longer (1.2) than wide.

Female abdomen of seven segments, smooth except for a low medial ridge.

First pleopod of male almost straight, narrower in distal quarter, apically blunt.

Female gonopore a keyhole shaped aperture, narrower medially, opening anteriorly and ventrally from a low swelling.

Remarks. — This species shares with *Lahaina ovata* long rostral spines, broad upper orbital sinus, grooved basal antennal article with a spine and two lateral lobes; male chela with elongate palm and a simple, straight pleopod in the male.

This species can be distinguished from *L. ovata* by the moderately divergent rostral spines (strongly divergent in *L. ovata*), the short preorbital spine and anterolateral spine of the basal antennal article (both long spines in *L. ovata*), only moderately produced postorbital lobe (strongly produced laterally and basally narrow in *L. ovata*) and a short blunt anterior pterygostomian tubercle (a long curved lobe in *L. ovata*).

Distribution. — Known only from Mauritius.

*Lahaina ovata* Dana, 1851

- Lahaina ovata* Dana, 1851a: 269; 1852: 93-94; 1855; pl. 2 figs. 1a-f.  
*Hyastenus (Chorilia) ovatus*. — Miers, 1884: 522-523.  
*Hyastenus (Chorilia) ovatus* var. *tenuirostris* Miers, 1884: 523.  
*Hyastenus (Chorilia) tenuicornis* Pocock, 1890: 76-77.  
*Hyastenus tenuicornis*. — Alcock, 1895: 215-216. — Alcock & Anderson, 1898: pl. 33 figs. 4,4a. — Takeda, 1977: 122-124, pl. 13 figs. C, D.  
*Hyastenus ovatus*. — Buitendijk, 1939: 244-245. — Griffin, 1974: 15-16, figs. 3a, b, g.

Material examined. — 26 ♂♂, 27 ♀♀ (18 ovig.), 6-17.5 mm, smallest ovig. ♀, 7.5 mm.

## ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 65a, Flores Sea, very near 07°0'S 120°34.5'E (Stn. 65), from 400 m and pale grey mud, rapidly reducing to 120 m and coral bottom, dredge, 6 May 1899; 1 spec. — Stn. 80, Borneo Bank, 02°25'S 117°43'E, from 50-40 m, trawl, fine coral sand, 13 June 1899; 1 spec. — Stn. 282, anchorage between Nusa Besi and NE. point of Timor, 08°25.2'S 127°18.4'E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. — Stn. 310, Flores Sea, 08°30'S 119°7.5'E, 73 m, dredge, sand with fine pieces of dead coral, 12 February 1900; 1 spec.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Honolulu, 18-72 m, coral, 5 May 1915; 47 specs.  
 Danish Kei Islands Expedition: Stn. 71, Java Sea, 05°40'S 106°08'E, 54 m, sand, stones, 28 July 1922; 1 spec.

## WESTERN AUSTRALIAN MUSEUM, PERTH

Hawaii, coll. T. Richert, May 1963; 1 spec. (WAM 80-71).

Remarks. — These specimens agree with those described and discussed fully by Griffin (1974). The triangular preorbital lobe, which is directed obliquely upward and forward, is broad in the specimens from Hawaii and slender in the three females from Borneo Bank, Flores and Java Sea. Also in these three specimens the hepatic spine is longer than in those from Hawaii, and is directed upwards and backwards.

The characters which distinguish this species from *L. incerta*, *L. agassizii* and *L. mauritiana* are discussed under those species.

Distribution. — Widespread Indo-West Pacific: Red Sea and Seychelles area to the Western Pacific and Hawaii.

*Leptomaia* new genus

Type species. — *Leptomaia tuberculata* new species.

Description. — Carapace narrow pyriform with many low tubercles. Rostrum of two slender divergent spines, about one third postrostral carapace length. Orbit comprising above an eave adjacent to a postorbital lobe, no intercalated spine. Supraorbital eave moderately expanded, preorbital and antorbital angles both produced. Postorbital lobe moderately produced, narrowing distally. Basal antennal article narrow with a strong anterolateral spine and a broad proximal lobe on lateral margin adjacent basally to postorbital lobe.

Cheliped merus of male smooth with a terminal spine. Abdomen of seven segments in both sexes.

First pleopod of male simple, broad, curving outward distally, aperture subterminal.

Remarks. — This genus is similar to *Tylocarcinus* in the tuberculate carapace, the basal antennal article with a strong anterolateral spine and a broad proximal lobe adjacent basally to the postorbital lobe; and a slit-like hiatus in the orbit above, but *Leptomaia* lacks the intercalated spine present in *Tylocarcinus*.

*L. tuberculata* is distinguished from species of *Hyastenus* by the presence of a curved interantennular spine, by the merus of the third maxilliped which is narrow in the medial half and by the almost uniformly narrow abdomen in the male.

The name for the new genus is derived from *leptos* (Greek), meaning thin, delicate, in reference to the narrow carapace of this small animal.

Distribution. — Southwestern Pacific.

*Leptomaia tuberculata* new species  
(Figs. 32d-f, 54)

Material examined. — 3 ♂♂, 3 ♀♀ (1 ovig.), 7.5-15 mm, ovig. ♀, 15 mm. Holotype. — Female, ovigerous, cl. 15.0 mm, Tasman Sea, Middleton Reef, 54-72 m, triangle dredge, coll. R. J. MacIntyre, 26 November 1960, CSIRO Stn. G3/280/60; The Australian Museum, Sydney, AM P. 29923. Paratypes. As listed below:

## THE AUSTRALIAN MUSEUM, SYDNEY

Lord Howe I., Tenth of June, 25 m, coll. N. Coleman, 23 February 1979; 1 spec. (AM P. 29924).

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Galathea' Expedition: Stn. 674, Kermadec Is., Raoul Islet, 29°13'S 177°57'W, 75-85 m, dredge, gravel and stones, 3 March 1952; 1 male, 11 mm, 1 female (imm.) 11.5 mm. — Stn. 675, Kermadec Is., Raoul Islet, 29°13'S 177°57'W, 60 m, trawl, stones, 3 March 1952; 1 male, 7.5 mm.

## NATIONAL MUSEUM OF NEW ZEALAND, WELLINGTON

New Zealand, W. of Meyer I., dredged, 21.5 m, rocky bottom, coll. W. R. B. Oliver, 19 May 1908; 1 spec.

Description. — Carapace narrow, not widened posteriorly, width less than two thirds (0.56-0.63) postrostral carapace length; surface with scattered low tubercles.

Rostral spines slender, straight, divergent, widely separate from base; length about a third (0.3-0.37) postrostral carapace length; rostral ridges with low tubercles.

Orbital eave moderately expanded, preorbital angle produced into a broad spine, directed obliquely forward and slightly upward (preorbital spine much smaller in small specimens); antorbital angle produced more laterally than preorbital, antorbital lobe short and blunt; postorbital lobe separated from eave by only a narrow slit; postorbital lobe basally broad, narrowing distally laterally keeled, apex subacute.

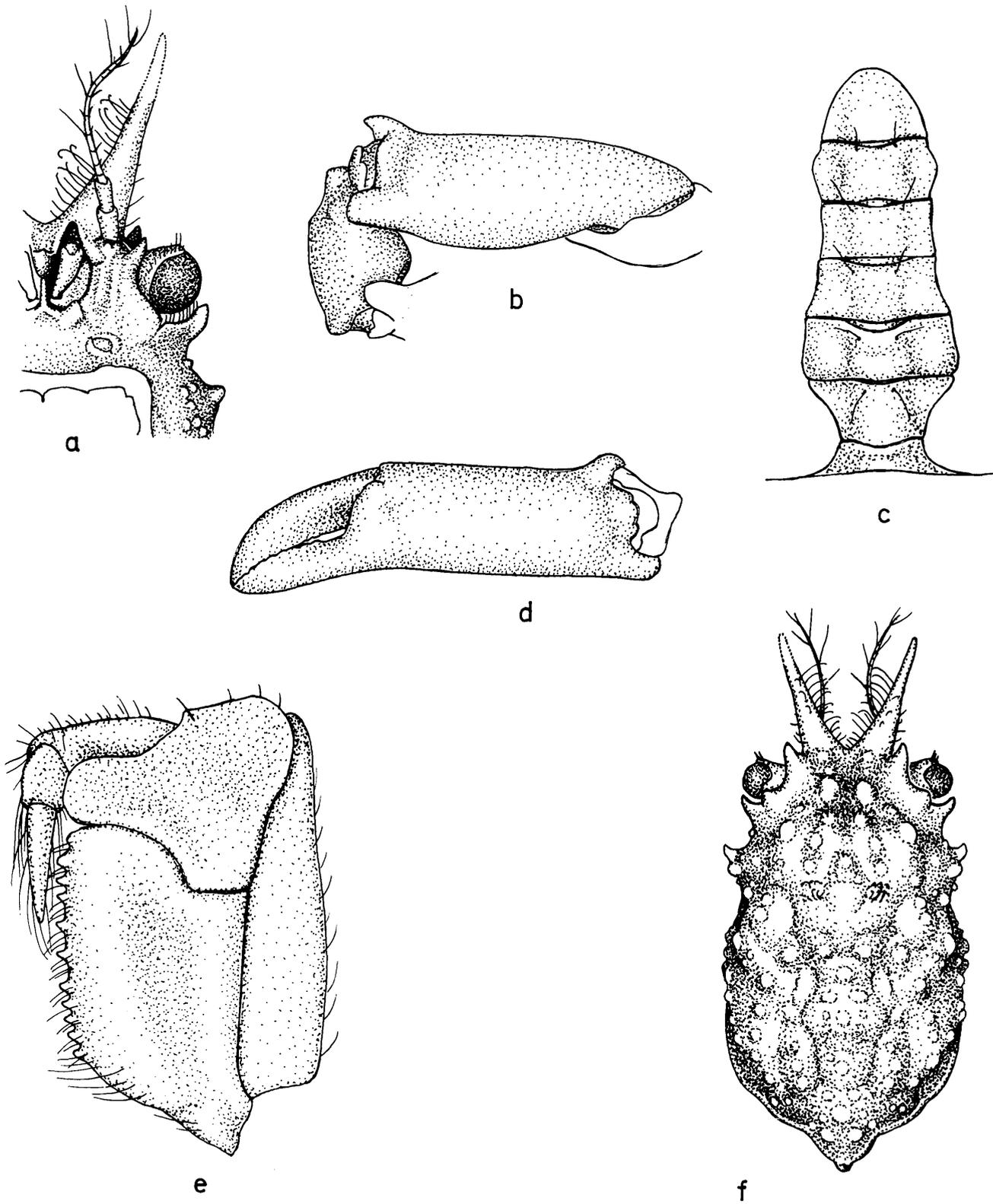


Fig. 54. *Leptomaia tuberculata* (holotype) (a) left orbit, ventral view; (b) left cheliped, merus and carpus; (male 11 mm, Kermadec Is., ZMC) (c) male abdomen; (holotype) (d) left chela; (e) left third maxilliped; (f) carapace, dorsal view.

Eyestalks short, stout, a row of club setae distally above cornea; cornea large, terminal.

Hepatic region weakly elevated, a low tubercle dorsally; a short spine and two tubercles on margin; about seven small subhepatic tubercles (only four in smaller specimens).

Branchial margin with a tubercle on anterior border and a second tubercle behind it; more ventrally an irregular row of about twelve small tubercles extending to posterolateral margin.

Gastric regions elevated, two pairs of protogastric tubercles

anteriorly, forming a transverse row of four tubercles; one tubercle behind lateral tubercle of this row and two tubercles behind medial tubercle; a posterior protogastric tubercle lateral to metagastric region; mesogastric region with two posterior tubercles. Urogastric region with a pair of submedial tubercles anteriorly and a central tubercle.

Cardiac region only weakly elevated, a pair of submedial tubercles anteriorly, just behind them a medial tubercle with two small tubercles on either side; cardiac region centrally smooth; posteriorly a pair of submedial tubercles just in front of a medial tubercle.

Intestinal region weakly elevated, an anterior and posterior pair of submedial tubercles and a central tubercle between them; region produced backward as a broad triangular lobe, a short, blunt spine at its apex.

Dorsal branchial region with a medial and lateral tubercle on anterior border; a central tubercle and behind it an oblique row of three smaller tubercles; a low longitudinal ridge of three small tubercles near cardiac region.

Basal antennal article smooth, a ridge along medial margin and a shallow longitudinal groove centrally; a small anteromedial tubercle; anterolateral angle produced into a strong spine directed obliquely forward and somewhat ventrally; lateral margin concave behind spine, proximal half of margin convex, strongly produced laterally, meeting medial edge of postorbital lobe basally and separated from it on orbital border only by a small V-shaped notch. A low, round tubercle just lateral to green gland.

Pterygostomian region smooth, margin only indistinctly tuberculate.

Third maxilliped smooth, anterolateral angle of merus strongly produced and rounded, broad notch on anteromedial angle.

Cheliped of male (cl. 13 mm) slightly shorter (0.9) than postrostral carapace length; merus smooth with a short, blunt terminal spine; carpus with a small proximal tubercle and a terminal tubercle; palm smooth, length more than one and a half times (1.7) height; fingers about two thirds (0.65) length of palm, a narrow gape between fingers in proximal half, a few low teeth on both fingers in gape and along remainder of cutting edge. Cheliped of holotype (ovig. female) similar but shorter (0.8 postrostral carapace length) and palm more slender (length equal to twice height).

First ambulatory leg slightly longer (1.16) than postrostral carapace length, merus with a low terminal tubercle. Fourth ambulatory leg about three quarters length of first leg, dactyl of fourth leg with about five very small teeth ventrally on distal half.

Male sternum smooth, a narrow ridge on anterior margin of abdominal fossa, a shallow depression lateral to ridge, a ridge on edge of abdominal fossa in third and fourth sternal segments.

Male abdomen of seven segments, smooth, a small anterior tubercle laterally on third segment; third segment one and a quarter times as wide as sixth segment; sixth segment twice as wide as long; seventh segment as wide as long.

Female abdomen of seven segments, smooth except for a low medial ridge.

First pleopod of male broad, curving outward distally but not tapered, apex blunt; aperture subterminal on abdominal surface.

Female gonopore a crescent shaped slit, opening medially and covered by a semicircular lobe.

Remarks. — In some points of general appearance *L. tuberculata* is similar to species of the genus *Eurynome* — the general shape of the orbit, the expanded hepatic lobe and tuberculate carapace, narrowing posteriorly. However, this species differs from known species of *Eurynome* in the presence of a preorbital spine, absence of both an intercalated and a suborbital spine; the presence of a strong anterolateral spine on the basal antennal article; in the adult female the anterior part of the first sternite is not covered by the abdomen; and the fingers of the cheliped are not angled towards the fixed finger.

*L. tuberculata* is distinguished from *Hyastenus auctus* which also has slit-like hiatuses by the narrow tuberculate carapace and by the postorbital lobe which is narrow distally and laterally keeled.

Distribution. — North of New Zealand and Tasman Sea.

#### *Lyramaia* new genus

Type species. — *Tiarinia elegans* Haswell, 1882.

Description. — Carapace pyriform with some tubercles and a few short spines. Rostrum of two broad spines of moderate length. Orbit comprising above an eave separated by a hiatus from postorbital lobe, no intercalated spine. Supraorbital eave moderately expanded, preorbital and antorbital angles weakly produced. Postorbital lobe hardly produced, only weakly excavate. Basal antennal article moderately broad with an anterolateral spine, lateral margin produced and directed dorsally, separated from postorbital lobe by a hiatus. Cheliped merus of male tuberculate, carpus smooth, Male abdomen of seven segments, female abdomen of five segments.

First pleopod of male simple, slender, curved outwards distally.

Remarks. — The orbit in this monotypic genus resembles that in species of *Hyastenus* but the basal antennal article and carapace ornamentation show similarities to species of *Acanthophrys* and *Giranauria*. *Lyramaia elegans* is distinguished from species of *Acanthophrys* and *Giranauria* by the basally fused and broadened rostral spines which conceal the antennae in dorsal view.

The name of the new genus is derived from the Greek *lyra*, a lyre, in reference to the shape of the rostrum.

Distribution. — Known only from the east Australian coast.

*Lyrarmaia elegans* (Haswell, 1882) new combination  
(Figs. 32c, 55)

*Tiarinia elegans* Haswell, 1882: 29. — Griffin, 1966b: 288 (in key), pl. 17 fig. b.

Material examined. — 4 ♂♂, 4 ♀♀ (3 ovig.), 8.5-13.5 mm, smallest ovig. ♀, 8.5 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Off Moreton Bay, 27°31'S 153°40'E, 75-79 m, HMAS 'Kimbla' Stn. 1, coll. W. F. Ponder, 29 March 1969; 2 specs. (AM P. 29948). — Off Moreton Bay, 27°27'22"S 153°39'E, 75 m, HMAS 'Kimbla' Stn. 2, coll. W. F. Ponder, 29 March 1969; 5 specs. (AM P. 29950), 1 spec. (AM P. 29949).

Description. — Carapace surface pitted, carapace width two thirds to three quarters postrostral carapace length.

Rostral spines in female about one third and in male about half postrostral carapace length; proximal third broad, fused, surface tuberculate; spines contiguous or separate and parallel, divergent distally with some spinules on medial surface of each spine at divergence; rostral ridges tuberculate.

Supraorbital eave only moderately expanded; preorbital angle weakly produced forward and upturned; antorbital angle is hardly produced, slightly rounded, horizontal; postorbital lobe is separated from eave by a narrow U-shaped hiatus; postorbital lobe slender in male, broader in female with a process on anterior margin. Eystalks short, moderately slender, smooth; cornea is small, terminal and ventral.

Hepatic region smooth or with one or two small tubercles.

Branchial submargin with a small tubercle anteriorly and, more dorsally, an irregular row of about six to eight small tubercles each surmounted by curled hairs.

Protogastric region with a longitudinal row of three small tubercles near its medial border and a more lateral longitudinal row of four or five tubercles, of which the largest is posterolateral to the anterior mesogastric tubercle; two mesogastric tubercles, longitudinally elongate, posterior usually larger.

Cardiac region with a broad, high, conical spine, directed slightly backwards.

Intestinal region with a central spine or tubercle, posterior carapace margin smooth or weakly crenulate; posterior medial lobe of carapace broader in female than male.

Branchial region elevated, centrally smooth, two strong spines near lateral margin; two to three small tubercles in front of anterior spine.

Basal antennal article not as broad as in *Tiarinia* and separated from postorbital lobe by a U-shaped hiatus; a short, acute anterolateral spine directed forward and separated from base of peduncle by a U-shaped hiatus; a lateral longitudinal ridge behind anterolateral spine and another near medial edge with a deep groove between them; lateral margin convex and directed dorsally beyond lateral ridge.

Third maxilliped ischium with marginal ridges, longitudinally excavate; granules on longitudinal ridges and lateral edge; merus with ridge on posterior edge and a short

ridge running forward from posterolateral angle; a granule proximally on lateral edge; anterolateral angle only moderately produced.

Pterygostomian margin with three small tubercles or else two anterior tubercles fused to form one compressed tubercle.

Merus of male cheliped with three low tubercles dorsally and a terminal tubercle, ventrally two rows each of four small tubercles; carpus smooth; palm smooth, length about two and a half (2.5) times height; fixed finger excavate, moderate gape between fingers, three small teeth on dactyl in gape.

Ambulatory legs cylindrical, slender, dorsal surfaces with groups of curled hairs, swollen setae laterally, each arising from a small tubercle; merus with terminal tubercle; dactyl of fourth leg with about seven small teeth ventrally along its length.

Male sternum with first sternite excavate on either side of midline; segments two to five with well marked intersegmental rimmed pits, ridges bordering pits high.

Male abdomen of seven segments, segments two to six with a medial tubercle anteriorly; third segment with a strong lateral tubercle; sixth segment slightly wider (1.2) than long; seventh segment as wide as long.

First pleopod of male simple, slender, curved outwards at tip.

Female abdomen strongly convex, segments four to six fused; surface pitted.

Female gonopore a simple subcircular aperture; eggs large (1 mm diameter).

Remarks. — This species, described briefly by Haswell (1882) and figured by Griffin (1966b) has been known from only one specimen. The holotype (male, 14 mm, AM G. 5140, Broughton I., off Port Stephens, N.S.W.), a dried specimen, mounted on glass, has been detached for further examination and comparison with the new material.

The recently collected specimens and the type of *Tiarinia elegans* differ from other species of *Tiarinia* in having the orbit open above and below; the rostral spines less closely contiguous and segments four to six of the female abdomen fused.

*Lyrarmaia elegans* is similar to *Paranaxia serpulifera* (Guérin) in general body shape; in the slender legs; in the rostral spines broadened basally and divergent at the tip; grooved basal antennal article and pitted male sternum. However, in that species there is a strong distal accessory spine on the rostrum; the orbit is closed above and below; there is a long acuminate preorbital spine and a similar single long spine on the pterygostomian margin.

*L. elegans* is similar to species of *Giranauria* and *Acanthophrys* in general carapace appearance and on the basal antennal article having a U-shaped concavity between the anterolateral spine and the base of the antennal peduncle. In both *L. elegans* and species of *Giranauria* the lateral margin of the basal antennal article is strongly produced and conceals at least the proximal half of the eystalk, but the anterolateral spine is at the anterior angle of this dorsally produced margin in *L. elegans*

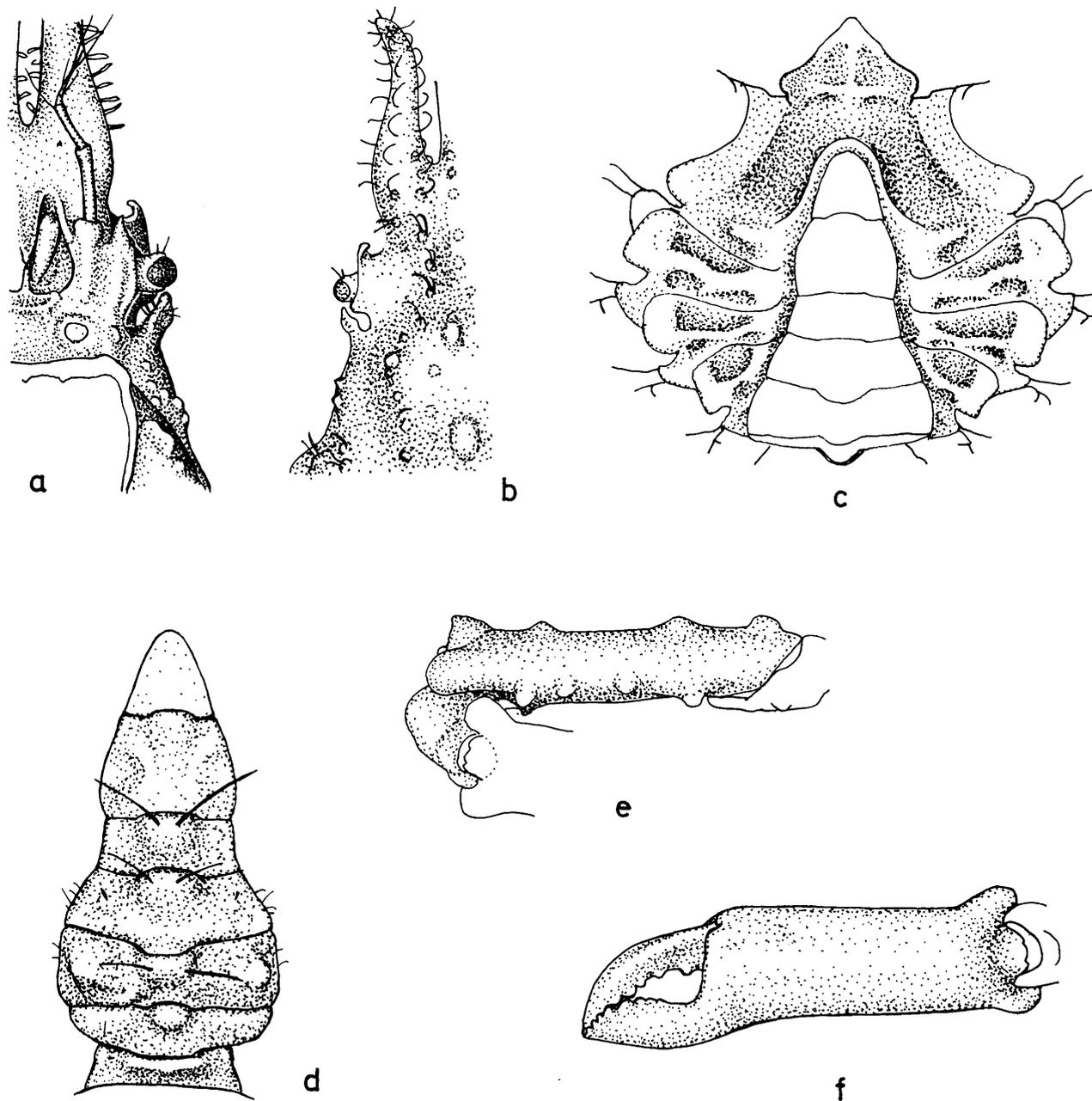


Fig. 55. *Lyramaia elegans* (male, 13.5 mm, off Moreton Bay, AM P.29949) (a) left orbit, ventral view, (b) dorsal view of same; (c) male sternum; (d) male abdomen; (e) left cheliped, merus and carpus; (f) left chela.

while in species of *Giranauria* it is on the ridge parallel to and in from the lateral margin. *L. elegans* is distinguished from species of *Acanthophrys* by the postorbital lobe which is short and excavate (elongate and not ventrally excavate in *Acanthophrys*) and distinguished from species of *Acanthophrys* and *Giranauria* by the basally fused and broadened rostral spines which conceal the antennae in dorsal view.

Distribution. — East Australian coast: off Moreton Bay, Broughton Island.

*Micippoides* A. Milne Edwards, 1873

Type species. — *Micippoides angustifrons* A. Milne Edwards, 1873, by monotypy.

Remarks. — In this monotypic genus the supraorbital eave is only weakly produced and the preorbital angle not produced at all. There is a narrow slit between the eave and the postorbital lobe. The basal antennal article is broad proximally and narrow and unarmed anteriorly but there is variation in the shape of the lateral margin as Calman (1913) noted. In some specimens the lateral margin is weakly concave just behind the anterolateral angle and very strongly convex at about the proximal third, with only a narrow hiatus between the article and the postorbital lobe. In Calman's specimen from Christmas Island the basal antennal article is subtriangular with hardly any proximal convexity and separated by a U-shaped hiatus from the postorbital lobe. This is more variation than would be expected within a species but few

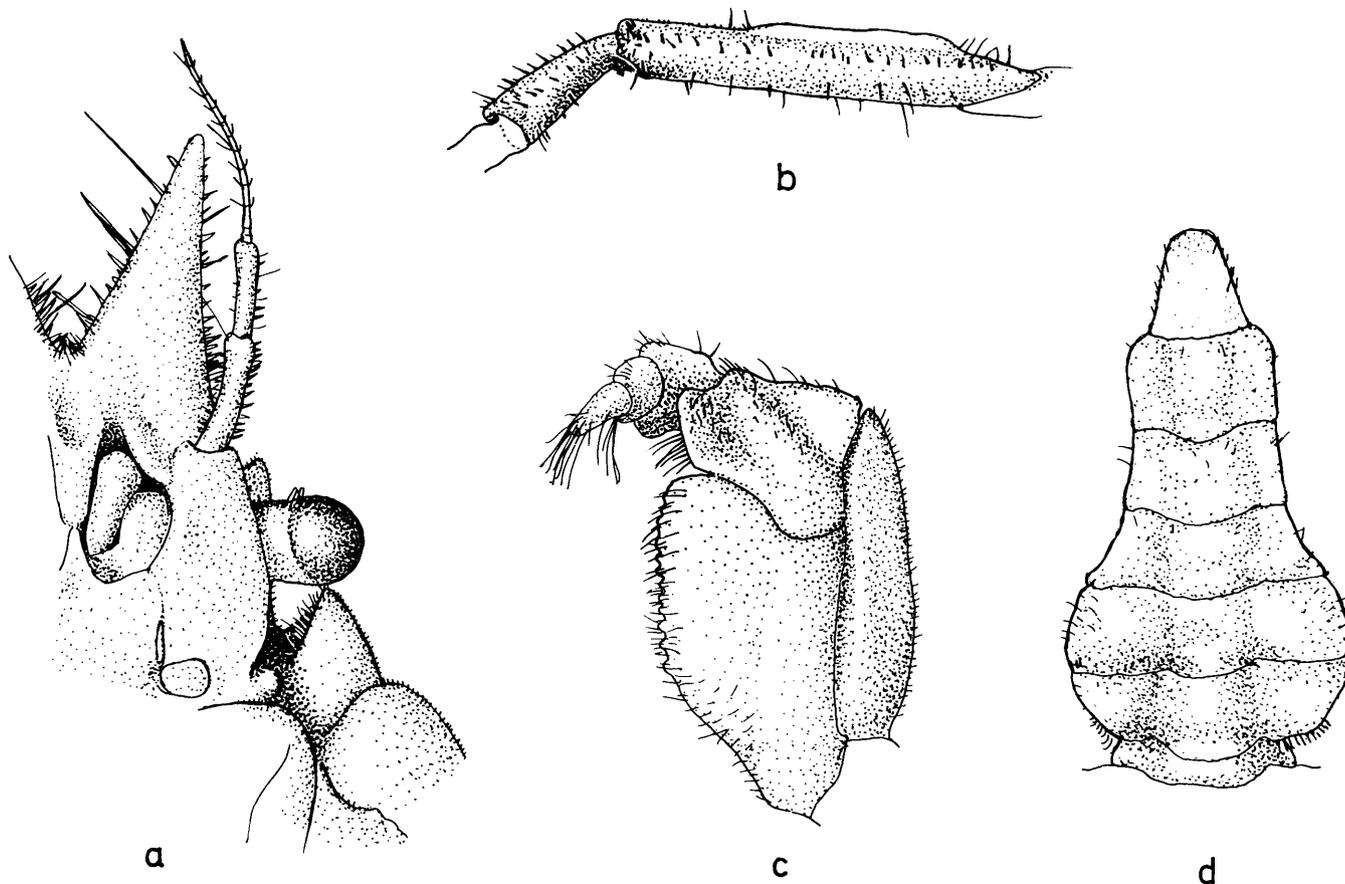


Fig. 56. *Rochinia carinata* (holotype) (a) left orbit, ventral view; (b) merus and carpus of first ambulatory leg; (c) left third maxilliped; (d) male abdomen.

specimens of *M. angustifrons* have been reported and more material from several localities would need to be examined to decide whether or not there are two species in this genus.

The rostral spines are short, deflexed and the apex is upturned. The first pleopod of the male is straight, tapering only near the apex and with a flap from the lateral margin folded across the abdominal surface.

The form of the orbit and the pleopod of the male suggest that this genus is correctly placed in the Pisinae.

Distribution. — Indo-West Pacific.

*Naxioides* A. Milne Edwards, 1865

Type species. — *Naxioides hirta* A. Milne Edwards, 1865, by monotypy.

Remarks. — The species of this genus are distinguished by the presence, in the upper orbit, of a lobe, either on the inner margin of the hiatus between the eave and the postorbital lobe or at the base of the anterior margin of the postorbital lobe, and referred to as an intercalated spine. In all the known species of this genus there is a small accessory spine on the distal half of the rostral spines. The first pleopod of the male of species of *Naxioides* tapers gradually to an outwardly curved subacute apex. There is usually a subterminal flap near the aperture.

*Chlorinoides tenuirostris* Haswell (1880b), the type species of the genus *Chlorinoides* Haswell, is now included in the Pisinae. It has in common with species of *Naxioides* an intercalated spine, a small dorsal accessory spine on the rostrum and a first pleopod in the male which is simple and tapers to a sharp apex. The differences between *C. tenuirostris* and *N. hirta* are no greater than those between species already in the genus and therefore we propose to include this species in *Naxioides*. *Naxia cerastes* Ortmann is here shown to be a synonym of *N. tenuirostris*.

*N. rombloni* Rathbun is here considered to be a synonym of *Lahaina agassizii* and is discussed under that species. A new species of *Naxioides* is described from Western Australia. *N. spinigera* Borradaile is here considered a synonym of *N. taurus* (Pocock).

The holotype of *Hyastenus elegans* Miers (1 ♀, cl. 32.7 mm, Kai Is., BM(NH) 84.31) has been examined by one of us (D.J.G.G.). There is a small accessory spine on the rostral spines and an intercalated spine in the upper orbit. These features, together with the shape of the supraorbital eave and basal antennal article and a general appearance similar to *N. robillardi* indicate that this species would be more correctly placed in the genus *Naxioides*.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *NAXIOIDES*

- 1 Preorbital angle of eave hardly produced, blunt; basal antennal article moderately broad, anterior margin with a spine near base of antennal peduncle as well as a blunt lobe, slightly more dorsally, at the anterolateral angle ..... *N. hirta*
- Supraorbital eave with an upright preorbital spine, usually long; basal antennal article narrow, anterior margin with a spine or a blunt tooth only at anterolateral angle ..... 2
- 2( 1) Carapace with long spines (14 to 20 or more); cardiac region with a single medial spine ..... 3
- Carapace with short spines (14 or less); cardiac region with two medial spines ..... 4
- 3( 2) Antorbital lobe of eave directed obliquely backwards (toward intercalated spine); hepatic margin with two long spines, one above the other; lateral margin of basal antennal article with a long proximal spine directed ventrally ..... *N. tenuirostris*
- Antorbital lobe of eave directed laterally; hepatic margin with one long spine; lateral margin of basal antennal article with a short proximal spine or lobe directed laterally ..... *N. robillardii*
- 4( 2) Apex of postorbital lobe reaching at least as far forward as antorbital lobe; hepatic margin with a slender spine; intestinal region not elevated, with a spine posteriorly and a submedial pair of minute tubercles anteriorly ..... *N. carnarvon*
- Apex of postorbital lobe not reaching as far as antorbital lobe; hepatic margin with blunt tubercles; intestinal region elevated with a medial spine posteriorly and a submedial pair of high tubercles anteriorly ..... 5
- 5( 4) Rostral spines usually  $\frac{1}{2}$  to  $\frac{7}{8}$  (rarely less than  $\frac{1}{2}$ ) postrostral carapace length; supraorbital spine usually well developed (height = 1-2 times basal width) ..... *N. taurus*
- Rostral spines about  $\frac{1}{3}$  postrostral carapace length; supraorbital spine short (height = basal width) ..... *N. investigatoris*<sup>27</sup>

*Naxioides carnarvon* new species  
(Fig. 67c)

*Chlorinoides tenuirostris*. — Griffin, 1970a: 76. (Not *Chlorinoides tenuirostris* Haswell, 1880 = *Naxioides tenuirostris* (Haswell).)

Material examined. — 2 ♀♀, 20-31.8 mm.

Holotype. — Female, immature, cl. 20 mm, Western Australia, NW. of Carnarvon, 24°59'S 112°27'E, 128 m, beam trawl, CSIRO, HMAS 'Diamantina' 8 October 1963, Western Australian Museum, Perth, (WAM 147-67).

Paratype. Female, ovigerous, cl. 31.8 mm, Western Australia, SW. of Point Cloates, 23°05'S 113°23'E, 131 m, triangle dredge, CSIRO, HMAS 'Diamantina', 7 October 1963; Western Australian Museum, Perth, (WAM 99-67).

Description. — Carapace narrowly pyriform, width about two thirds (0.65) postrostral carapace length; margins and dorsal surface with tubercles and short spines.

Rostrum of two long spines nearly three quarters (0.74) postrostral carapace length; divergent, with an accessory spine on dorsal surface about halfway between base and tip. Rostral ridges between orbits each with four tubercles.

Orbit above comprising a supraorbital eave, intercalated spine and postorbital lobe. Eave with a long, upright preorbital spine and a narrow, subacute antorbital lobe directed obliquely backwards.

Intercalated spine apically acute, separated from eave by a broad U-shaped hiatus and from postorbital lobe by a narrow

V-shaped hiatus. Postorbital lobe strongly produced obliquely forward, apex reaching level of antorbital lobe, anterior margin with a very low process, posterior margin with a large lobe near tip, apically subtruncate.

Eyestalks short, moderately slender, cornea large, terminal and ventral.

Hepatic region moderately elevated, a small tubercle dorsally and a slender spine on margin: subhepatic region with, in a row, a low tubercle anteriorly, a short spine behind it and a high tubercle posteriorly.

Branchial submargin with a row of three well spaced tubercles, third near epibranchial spine, three to four granules above this row; another row of three small tubercles near posterolateral carapace margin.

Gastric regions elevated, mesogastric region with an anterior tubercle and three short spines in a row; protogastric regions with two tubercles side by side just behind level of first mesogastric spine and two tubercles behind them a little ahead of level of last mesogastric spine; a small tubercle laterally near margin with branchial region and a pair of submedial tubercles behind last mesogastric spine. Urogastric region with a medial tubercle.

Cardiac region elevated with two short medial spines one behind the other, and two pairs of submedial granules on anterior slope. Intestinal region not elevated, a pair of submedial granules anteriorly, a tubercle near lateral margin and a large conical spine directed backward and upward on posterior carapace margin.

Branchial region with three short spines on lateral dorsal margin, epibranchial longest; a short spine just medial to epibranchial spine and a tubercle between spine and cardiac region; an arc of three tubercles close together centrally on branchial region.

Basal antennal article narrow, smooth, a shallow longitudinal groove centrally; anterolateral angle produced as a long spine directed laterally and somewhat ventrally; lateral margin behind spine straight with a short lobe midway along, lobe anteroposteriorly compressed and apically subtruncate. Postorbital lobe separated from article by a broad U-shaped hiatus; anterior margin of postorbital lobe with a prominent tubercle. A small tubercle lateral to green gland.

Pterygostomian region smooth, margin with two high tubercles.

Third maxilliped ischium smooth with a shallow longitudinal groove; anterolateral angle of merus moderately produced and rounded.

Cheliped of immature female nearly as long as postorbital carapace length, merus with a short proximal spine, a long acuminate terminal spine and two tubercles between them on dorsal margin, two tubercles on ventral margin; carpus with a small anterior tubercle; palm smooth, length three and a half times height, fingers nearly half (0.45) as long as palm, a narrow gape between fingers and low uniform teeth along whole cutting edge of both fingers (tip of dactyl broken).

(Ambulatory legs not with specimen.)

<sup>27)</sup> Not clearly distinguished, see *N. taurus* species account.

Remarks. — A single specimen examined from Western Australia (WAM 99-67), agreeing with *N. tenuirostris* in many features, was previously considered as a variation of that species (Griffin, 1970a). We have since examined a second specimen (WAM 147-67) also from Western Australia, which closely resembles the first; we now consider these two specimens to represent a distinct species. Unfortunately the specimens are not complete. We have figured the carapace of the immature female.

This species is distinguished from *N. tenuirostris* by the shorter carapace spines and the presence of three spines rather than two on the mesogastric region and two spines rather than one on the cardiac region. Also, in *N. carnarvon* the intercalated spine is narrow and apically acute (broad and apically rounded in *N. tenuirostris*); the postorbital lobe is strongly produced, apically subtruncate and has a prominent tubercle on the anterior margin ventrally (moderately produced, apically narrow and without a tubercle ventrally in *N. tenuirostris*); and the anterolateral angle of the mouthfield is smooth (with a blunt spine in *N. tenuirostris*).

*N. carnarvon* is distinguished from *N. taurus* by the upper orbit which has a narrow intercalated spine and an oblique postorbital lobe which reaches to the level of the backwardly directed antorbital lobe; in *N. taurus* the intercalated spine is moderately broad and both postorbital and antorbital lobes are directed laterally, and not convergent. The anterolateral spine of the basal antennal article in *N. carnarvon* is long, laterally and slightly ventrally directed but not directed forward, while the anterolateral spine in *N. taurus* is usually short and directed forward and only slightly laterally. This species also has a slender spine rather a tubercle on the hepatic margin and lacks the two high tubercles present on the anterior intestinal region in *N. taurus*.

Distribution. — Western Australia, between Point Cloates and Carnarvon.

*Naxioides hirta* A. Milne Edwards, 1865

(Fig. 37g,h)

*Naxioides hirta* A. Milne Edwards, 1865: 143, pl. 4 fig. 1 — Sakai, 1938: 270-271, text-fig. 33; 1976: 218, pl. 74 fig. 2. — Barnard, 1950: 52-53, fig. 11d.

Material examined. — 2 ♂♂, 26, 34 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 285, southern coast of Timor, 08°39' 1'S 127°44'E, 34 m, dredge, on the limit between mud and coral, *Lithothamnion*, 18 January 1900; 1 spec. (ZMA De. 100.630, det. Ihle).

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. KR VI, Kai Is., N. of Nuhu Rowa, N. of Du Rowa I., 05°32'S 132°41'E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 1 spec.

Remarks. — These specimens agree well with the figure and description given by Sakai (1938). The supraorbital eave has

an anterior tubercle but no spine. The intercalated spine is small and close to the postorbital lobe. The sternal plate is strongly ridged on the margins. The first pleopod is broad and narrows only gradually towards the acute tip as in other *Naxioides* species.

We have also examined the following specimen — 1 ♀, cl. 11 mm, Sulu Archipelago, anchorage off N. Ubian, 06°7.5'N 120°26'E, 16-23 m, dredge, tow net, *Lithothamnion* bottom, 29 June 1899, 'Siboga' Expedition, Stn. 99, ZMA. This specimen agrees well with the specimen (♀, cl. 8.6 mm, Ternate, Senckenberg Museum, Frankfurt 3830) described and figured as "*Naxia?* n.sp.?" (sic) (not "*Naxia* n.sp.?" by de Man (1902: 670-672, pl. 22 figs. 34, 34a-d) and examined by one of us (D.J.G.G.). Although De Man referred to his specimen as a male it is, like ours, an immature female.

Our specimen is similar to *N. hirta* in the rostral spines being parallel behind the accessory spine, the form of the supraorbital eave, the postorbital lobe and the basal antennal article. It differs from *N. hirta* in the rostral spines being shorter and not produced so far beyond the accessory spine; there are epibranchial tubercles rather than spines and there is a small rather than a large medial tubercle near the posterior carapace margin. It is possible that De Man's specimen and our specimen are juveniles of *N. hirta*.

Distribution. — Indo-West Pacific: east Africa to Philippine Islands and Japan.

*Naxioides investigatoris* (Alcock, 1895)

*Naxia investigatoris* Alcock, 1895: 218, pl. 4 fig. 3.

Material examined. — 1 ♂, 18.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Off Sri Lanka, 61 m, Indian Museum (ded. 9-1899 u. 23-9-1899); 1 spec. (ZMC unreg., prev. det. as *Naxia investigatoris*).

Remarks. — This specimen has short rostral spines, length about a third postrostral carapace length. The spines are divergent, unarched to the accessory spine and the tips are slightly incurved. The proximal lobe on the lateral margin of the basal antennal article is broad. The spine on the supraorbital eave is short, as high as its basal width, and blunt. The palm of the chela is granular and twice as long as the finger — not noticeably less than twice as long as the fingers, as Alcock described his specimen.

This specimen may be one of Alcock's series. There are two specimens in the BM(NH) (1 ♂, 1 ovig. ♀, cl. 16.1 mm, ? Syntypes, BM(NH) 96.5.14.4-5), examined by one of us (D.J.G.G.), which were also collected 'Off Ceylon, 34 fms' — as were Alcock's specimens — and donated by the Indian Museum.

In most specimens of *N. taurus* (Pocock) the rostral spines are longer than half the postrostral carapace length and the supraorbital spine is longer than its basal width but in our

specimens of *N. taurus* there is a lot of variation and in some specimens both the rostral spines and supraorbital spines are short. Such specimens are very similar to this specimen of *N. investigatoris* but we would not be justified, on the basis of this single specimen, in considering *N. investigatoris* as a synonym of *N. taurus*.

Distribution. — Off Sri Lanka, Andaman Islands.

*Naxioides robillardi* (Miers, 1882)

*Naxia* (*Naxioides*) *robillardi* Miers, 1882: 339-341, pl. 20 figs. 1, 1a-c.

*Naxia mammillata* Ortmann, 1893: 56-57, pl. 3 figs. 7, 7a, 7i.

*Naxioides mammillata*. — Sakai, 1965a: 78, pl. 35 fig. 1; 1976: 217-218, pl. 75 figs. 1, 2. — Serène & Lohavanijaya, 1973: 52, figs. 98-103, pl. 9 figs. C, D. — Takeda, 1973b: 41-42. — Takeda & Kurata, 1976: 27, figs. 3G, H.

*Naxioides robillardi*. — Griffin, 1974: 21-22.

Material examined. — 1♂, 22.5 mm, 1♀ 43 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java-S. Africa Expedition: Stn. 47, Mauritius, north of Port Louis, ca. 260 m, Sigsbee trawl, mud and coral, 6 November 1929; 1 spec.

WESTERN AUSTRALIAN MUSEUM, PERTH

Sulu Archipelago, SW. Pearl Bank, 9 miles (~ 14.5 km) and 242° from Zal Is., 135 m, sponges, coll. B. R. Wilson on 'Pele', 22 February 1964; 1 spec. (WAM 12-67).

Remarks. — The reasons for considering *Naxioides mammillata* (Ortmann) as a synonym of this species have been dealt with recently (Griffin, 1974).

These immature specimens have short spines almost entirely covered by a dense tomentum. There are two small tubercles on the anterior slope of the intestinal region rather than the two spines in adult specimens.

Distribution. — Indo-West Pacific; east Africa to Japan, Philippine Islands and southeast Australia.

*Naxioides taurus* (Pocock, 1890)  
(Fig. 37e-f, Pl. 11)

*Naxia taurus* Pocock, 1890: 77-78, 79. — Henderson, 1893: 346. — Alcock, 1895: 219-220. — Alcock & Anderson, 1898: pl. 33 figs. 5, 5a. — Calman, 1900: 37.

*Naxia cerastes*. — Alcock, 1895: 220. — Alcock & Anderson, 1898: pl. 33 figs. 2, 2a. (Not *Naxia cerastes* Ortmann, 1894 = *Naxioides tenuirostris* (Haswell, 1880).)

*Naxioides spinigera* Borradaile, 1903: 687, pl. 47 figs. 3a-c. — Rathbun, 1911: 253, pl. 20 fig. 8. — Monod, 1938: 107, fig. 5. — Buitendijk, 1939: 238. — Griffin, 1976: 203; new synonymy.

*Naxioides taurus*. — Griffin, 1966b: 270, 279 (in key). — Sakai, 1976: 218, pl. 74 fig. 1.

Material examined. — 11♂♂, 15♀♀ (4 ovig.), 12.5-32 mm, smallest ovig. ♀, postrostral cl. 13.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 50, west coast of Flores, Bay of Badjo, 40 m, dredge, trawl and shore exploration, mud, sand or shells, 16/18 April 1899;

2 specs. (ZMA De. 100.716 (in part), det. Ihle as *Hyastenus* sp.). — Stn. 80, Makassar Strait, Borneo Bank, 02°25'S 117°43'E, 40-50 m, trawl, fine coral sand, 13 June 1899; 1 spec. (ZMA De. 100.629, det. Ihle as *Naxia* sp.). — Stn. 99, Sulu Archipelago, anchorage off N. Ubian, 06°7.5'N 120°26'E, 16-23 m, dredge, *Lithothamnion*, 28/29 June 1899; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Mindanao, about 6 miles (~ 9.5 km) NNE. of Sacol, ca. 75 m, trawl, 6 March 1914; 2 specs. — Sulu Archipelago, off Jolo, 45-54 m, dredge, 19 March 1914; 4 specs.

Danish Kei Islands Expedition: Stn. 16, Kai Is., 05°32'20"S 132°37'E, 50 m, dredge, sand with *Lithothamnion*, 12 April 1922; 1 spec. — Stn. 31, Kai Is., Doe Roa Bassin, 50 m, trawl, sand, 18 April 1922; 1 spec. — Stn. 68, Sunda Strait, 05°47'S 106°14'E, 55 m, Sigsbee trawl, stones, 27 July 1922; 1 spec. — Stn. 72, Sunda Strait, 05°41'S 105°57'E, 35 m, trawl, stones, 28 July 1922; 1 spec.

ZOOLOGICAL SURVEY, CALCUTTA

'Investigator' Marine Survey: Stn. 175, NE. of Sri Lanka, 08°51'30"N 81°11'52"E, 56 m, 20 April 1894; 2 specs. (ZSC 1139/10).

WESTERN AUSTRALIAN MUSEUM, PERTH

Sulu Archipelago, Sibutu, S. Lagoon, 04°31'N 119°22'E, 18-26 m, dredge, sand and a few coral beds, coll. B. R. Wilson on 'Pele', 25/26 February 1964; 1 spec. (WAM 18-67).

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15'S 128°8'E, 25-63 m, dredge hauls 8-19, coarse sand, *Lithothamnion* and rubble, 2 June 1970; 1 spec. — Stn. CPI, (as above), 54 m, dredge haul 15, grey sand, fine with shelly grit, 2 June 1970; 1 spec. — Stn. KR VI, Kai Is., N. of Nuhu Rowa, N. of Du Rowa I., 05°32'S 132°41'E, 32-36 m, dredge haul 2, *Lithothamnion* rubble and sand, 10 June 1970; 1 spec. — Stn. KR VI, (as above), 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 3 specs. — Stn. KN II, Kai Is., west coast Nuhu Tjut, off Elat Bay, 05°40'S 132°59'E, 54-74 m, dredge hauls 3-4, rubble, fan coral, sand, green algae, 13 June 1970; 2 specs. — Stn. KN II, (as above), 48-54 m, dredge haul 6, rubble, algae and sand, 13 June 1970; 3 specs.

Remarks. — These specimens agree with those figured separately as *Naxia taurus* Pocock and *Naxia cerastes* Ortmann by Alcock & Anderson (1898: pl. 33 figs. 2, 2a, 5, 5a) from the Andaman Islands. These two species have been considered synonymous (Griffin 1966b: 270, 279) under the name *Naxioides taurus*. It must be emphasised that, whatever the animal is that Alcock & Anderson figured as *N. cerastes* it is not the same species as that described from Torres Strait under that name by Ortmann. The conclusion that *N. cerastes* is a synonym of *N. taurus* was based on the Andaman Island material (Alcock, 1895; Calman, 1900). The following discussion does not cover the identity of the true *N. cerastes* which is discussed under *Naxioides tenuirostris* (Haswell).

The present specimens were compared with specimens of *N. spinigera* Borradaile from the Seychelles (USNM 41416) collected by the 'Sealark' (Rathbun, 1911: 253, pl. 20 fig. 8). Borradaile (1903: 687, pl. 47 fig. 3a) described *N. spinigera* from the Maldivian Islands as allied to *N. cerastes* Ortmann. In Borradaile's specimens (cl. approx. 18 mm) the rostral spines are greater than half the postrostral carapace length, while large specimens from the Seychelles have the rostral spines

equal to, or less than half, the postrostral carapace length. In the present series the rostrum equals half the postrostral carapace length in the case of the two specimens from Sri Lanka (15, 17 mm) but up to 5/6 or 7/8 (nearly equal) postrostral carapace length on a large male specimen from the Kai Islands.

Comparing the relative size of the rostral spines in published figures and descriptions, the proportion of the rostrum to postrostral carapace length is the same in the figures for *N. cerastes* (Alcock & Anderson, 1898: figs. 2, 2a) and *N. spinigera* as figured by Borradaile, that is three fifths. *N. taurus* as figured by Alcock & Anderson has the rostrum equal to two thirds postrostral carapace length. The female specimen of *N. spinigera* from the Red Sea figured by Monod (1938) has the rostrum less than half the postrostral carapace length. Specimens of *N. taurus* described by Henderson (1893) have the rostrum less than half the postrostral carapace length whereas on the type, which he had seen, it was greater than half as it was also on the specimens described by Calman.

The considerable variation in the rostrum with age and locality, shown also in the present series, makes it an unreliable specific character. The rostrum is slightly arched on all specimens.

In Seychelles specimens the anterior margin of the orbit has a small tooth dorsal to the anterolateral spine of the basal antennal article.

The supraorbital spine, on the anterior half of the eave, varies in height from just greater than its basal width to twice its basal width; on some specimens the tip of the spine is curved forwards. In the specimens from the Seychelles the supraorbital spine is erect but not curved forward at the tip as described for *N. spinigera* (Buitendijk, 1939; Borradaile, 1903). Among the present collection are some from the Sunda Strait, Kai Islands and Mindanao in which the supraorbital spine bends forward slightly at the tip and one specimen (ovig. ♀, cl. 27 mm) from the Kai Islands on which it is bent strongly forward. On no specimen is the tip bent backwards as figured for *N. cerastes* by Ortmann.

The width of the intercalated spine and the angle (acute or subacute) of the tip is variable.

The basal antennal article has a blunt tooth at the anterolateral angle and a broader proximal lateral tooth which is dorsoventrally ridged in larger specimens. In the Seychelles specimens the proximal lateral tooth lies rather more dorsally than the anterolateral tooth.

The arrangement of the carapace spines is the same in all specimens. In the gastric region there is an anterior tubercle followed in the midline by three spines, the last of which is the largest. The cardiac region is elevated and surmounted by two medial tubercles or spines in all specimens. (See remarks of Buitendijk, 1939; none has the single large spine figured for *N. cerastes* by Ortmann.) There is a broad, blunt intestinal spine with two tubercles on the anterior slope.

On the branchial region there are two lateral spines; the posterior is the larger in the Seychelles specimens but the

anterior is the larger in most other specimens. There is a third small spine or tubercle lying dorsally and anteriorly from the posterior lateral spine.

The very small specimens from the Seychelles (8-11 mm) have narrow hepatic spines and all carapace spines more slender.

All specimens, except those from the Seychelles, have one or more tubercles proximally on the ischium of the third maxilliped. (One specimen from the Kai Islands (ovig. ♀, cl. 27 mm) has no teeth along the medial edge of the ischium. This is just an abnormal specimen.)

The chelipeds of the males vary with age and size. Specimens of about 22 mm and larger have tubercles on the palm of the chela but specimens of about 20 mm and smaller do not.

The presence of a spine distally on the merus of the ambulatory leg varies with age. All specimens have a spine on the merus of the first ambulatory leg; this is true of the Seychelles specimens, although as Bouvier (1915a) remarked this cannot be seen in the photograph published by Rathbun. Nearly all specimens have a smaller spine on the second ambulatory leg and the larger specimens also have a spine on the merus of the third leg. The dactyls of the ambulatory legs vary from  $\frac{3}{4}$  of the respective propod to equal to the propod. Bouvier distinguished his variety from Borradaile's species because there were no spines on the ambulatory meri and the dactyls of the ambulatory legs were only  $\frac{3}{4}$  of the propodi in length. Such distinctions are clearly invalid.

The first pleopod of the male is similar in all specimens: broad, outwardly curved and narrowing abruptly near the tip.

In conclusion it seems there is little reason to separate *N. spinigera* from *N. taurus*. The two names are here considered to apply to the one species, a species distinct from *N. cerastes* Ortmann.

The specimens described and figured by De Man (1902: 667-670, pl. 22 figs. 33, 33a, b) as "*Naxia* n.sp.?" (sic) (not "*Naxia?* n.sp.?") have been examined by one of us (D.J.G.G.) and they are both immature females. They agree with other specimens of *N. taurus* that we have examined in the form of the postorbital lobe and basal antennal article and ornamentation of the carapace, including two medial spines or tubercles on the cardiac region. There are spinules on the margin of the intercalated spine and one of the tubercles on the hepatic margin is much higher than the others but these features are present in other immature specimens of *N. taurus* we have examined. De Man suggested that these two specimens may simply be variations of *N. taurus* and in view of the wide variation we have observed in the series that we have examined we consider they are conspecific with *N. taurus*.

Distribution. — Indo-West Pacific: Red Sea, Mauritius, Seychelles, Sri Lanka, Maldivé Islands, Indonesia, North Australia, Philippine Islands and Japan.

*Naxioides tenuirostris* (Haswell, 1880) new combination

*Chlorinoides tenuirostris* Haswell, 1880b: 443, pl. 26 fig. 1; 1882: 18. — Griffin, 1966a: 4-9, 12, figs. 2-11. (Not *Chlorinoides tenuirostris*. — Griffin, 1970 = *Naxioides carnarvon*.)

*Naxia cerastes* Ortmann, 1894: 43, pl. 3 fig. 4; new synonymy. (Not *Naxia cerastes*. — Alcock & Anderson, 1898: pl. 33 figs. 2, 2a = *Naxioides taurus* (Pocock).)

Material examined. — 3 ♂♂, 2 ♀♀, 5.5-38.5 mm.

## NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition-Moluccas: Stn. AN I, Aru, S. Trangan I., SW. of Tg. Ngabordamlu, centred near 06°58'S 134°5'E, 26-29 m, dredge haul 1, coral and sponge, 20 June 1970; 1 spec. — Stn. B I, Northern Territory (Australia), Clarence Straits, S. of Bathurst I., 12°4'S 130°17'E, 52-57 m, dredge, mud and dead shells, 30 June 1970; 4 specs.

Remarks. — These specimens agree with those described and figured in detail by Griffin (1966a). The several species previously regarded as belonging to the genus *Chlorinoides* are discussed under the new generic name *Thacanophrys* in the Majinae.

*Naxia cerastes* Ortmann as described and figured by Ortmann (1894: 43, pl. 3 fig. 4) agrees in detail with specimens of *Naxioides tenuirostris* (3 ♂♂, 5 ♀♀ (1 ovig., 30 mm), 19-31.5 mm, AM P. 13941) we have examined from Torres Strait (the type locality of *N. cerastes*) and it is clear that they are conspecific. The upper spine on the pterygostomian region at the level of the eye referred to by Ortmann, is a ventral hepatic spine, and the five tubercles behind the spine on the angle of the buccal cavity include the one on the pterygostomian margin.

The specimen from off Western Australia previously included as a variation of this species (Griffin, 1970a) is, on the basis of a second specimen, now considered to be a distinct new species *N. carnarvon*.

Distribution. — Northern Australia from Cape York to Bathurst Island, Arafura Sea.

*Phalangipus* Latreille, 1825

Type species. — *Cancer longipes* Linnaeus, 1758, by later designation of Griffin, 1973.

Remarks. — This genus containing nine species has been dealt with recently in detail (Griffin, 1973) and material from the Zoological Museum, Amsterdam, the Zoological Museum, University of Copenhagen and other collections discussed. Species of this genus are distinguished by the broad carapace; the rostrum of two short spines fused for about the basal half; the orbit with an intercalated spine dorsally and a suborbital lobe ventrally; and by the extremely long slender ambulatory legs.

The first pleopod of the male is simple, tapering to a narrow apex. A similar kind of pleopod is found in species of *Naxioides* and *Austrolibinia*.

A small number of specimens identified recently are included here and the key to species of the genus, published previously, is reproduced.

Distribution. — Indo-West Pacific.

KEY TO THE SPECIES OF *PHALANGIPUS*

- 1 Branchial region with a subdorsal spine posteriorly in addition to three marginal branchial spines; protogastric region with four pairs of submedial tubercles and two pairs of spines distant from midline; chelipeds of male spinulose, a row of enlarged tubercles on outer surface of palm..... *P. hystrix*
- Branchial region with tubercles dorsally but without any spines except the three marginal ones; protogastric region usually with a pair of tubercles or spines near first mesogastric spine, sometimes with a second pair near third mesogastric spine and one pair distant from midline; chelipeds of male smooth except for terminal spine on merus ..... 2
- 2( 1) Supraorbital cave usually with antorbital lobe at posterolateral angle separated from intercalated spine by a narrow V- or U-shaped hiatus (rostral spines of at least moderate length, distance between tips only slightly exceeding depth of hiatus); suborbital lobe usually stout, separated from basal antennal article by narrow hiatus ..... 3
- Supraorbital cave without antorbital lobe (if lobe present, rostral spines short, distance between tips twice depth of hiatus); suborbital lobe usually small and slender, separated from basal antennal article by broad U..... 6
- 3( 2) Lateral margins of rostral spines weakly convergent distally or at most subparallel; males with numerous tubercles on sternites two to four..... *P. trachysternus*
- Lateral margins of rostral spines seldom sub-parallel, usually at least weakly divergent distally; males with no more than three tubercles on sternite two, sternites three and four usually smooth ..... 4
- 4( 3) Ischium of third maxilliped with lateral ridge elevated basally as a tubercle or lobe; suborbital lobe slender, apically subacute ..... *P. persicus*
- Ischium of third maxilliped without lateral basal lobe; suborbital lobe stout, apically blunt ..... 5
- 5( 4) Rostrum 0.2 postrostral length or more; major lobe on first sternite of male cylindrical, subacute..... *P. indicus*
- Rostrum no more than 0.1 postrostral length; major lobe on first sternite of male weakly flattened anteroposteriorly, apically rounded ..... *P. malakkensis*
- 6( 2) Rostral spines short, distance between tips twice depth of hiatus; suborbital lobe a slender spine; sternum of male naked in adults, major lobe of first sternite cylindrical, acuminate ..... 7
- Rostral spines not especially short, distance between tips equal to depth of hiatus; suborbital lobe a very blunt tubercle; sternum of males pubescent in adults, major lobe of first sternite anteroposteriorly flattened, rounded apically ..... 8
- 7( 6) Pterygostomian spine cylindrical, acuminate; spines of carapace generally sharp..... *P. filiformis*
- Pterygostomian spine dorsoventrally flattened, blunt apically; spines of carapace generally blunt..... *P. retusus*
- 8( 6) Ischium of third maxilliped generally with a strong lobe at base of lateral ridge; male first pleopod short, straight..... *P. australiensis*
- Ischium of third maxilliped generally without lobe at base of lateral ridge; male first pleopod long, distally outwardly curved *P. longipes*

*Phalangipus australiensis* Rathbun, 1918

*Phalangipus australiensis* Rathbun, 1918: 15-16, pl. 6. — Griffin, 1973: 168-172, figs. 1a, 3a,b, 6a, 7a, 8c,d.

Material examined. — 1 ♂, 6.5 mm.

## NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AW I, Aru, W. Wokam off W. coast of Wasir I., 05°30'S 134°12'E, 32-40 m, dredge haul 6, sand and shell rubble, 15 June 1970; 1 spec.

Remarks. — This small specimen agrees with those previously described (Griffin, 1973).

Distribution. — Aru and northern Australia from Broome (W.A.) through the Gulf of Carpentaria and Queensland to Port Stephens (N.S.W.).

*Phalangipus hystrix* (Miers, 1886)

*Naxia hystrix* Miers, 1886: 60-61, pl. 6 fig. 4.

*Phalangipus hystrix*. — Griffin, 1973: 175-179, figs. 5a-e, 6i, 7i. — Sakai, 1976: 219, pl. 76 fig. 3.

Material examined. — 10 ♂♂, 6 ♀♀, 7-15.5 mm.

## ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 289, S. coast of Timor, 09°0.3'S 126°24.5'E, 112 m, trawl, mud, sand and shells, 20 January 1900; 3 specs.

## NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AH I, Haruku I. (E. of Ambon), near Tg. Bt. Kapal, 03°36'S 128°24'E, 108-113 m, dredge haul 4, shell, sand and rubble, 31 May 1970; 2 specs. — Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15'S 128°8'E, 57-63 m, dredge haul 1, coarse foraminiferal and shell sand, 1 June 1970; 1 spec. — Stn. KT II, Kai Is., Tajandu Is., NW. of Walir Is., 05°35'S 132°15'E, 63-84 m, dredge hauls 1-4, coral and limestone rubble, 8 June 1970; 1 spec. — Stn. KN IV, Kai Is., W. coast of Nuhu Tjut, E. side of Mitduan Reef, 05°32'S 133°E, 36-56 m, dredge hauls 3-4, sand, coral rubble and sponge, 13 June 1970; 1 spec. — Stn. AW I, Aru, W. Wokam, off west coast of Wasir I., 05°30'S 134°12'E, 39-72 m, dredge hauls 7-10, sand and shell rubble, 15 June 1970; 2 specs. — Stn. AW I (as above), 72-90 m, dredge hauls 11-12, muddy sand and shell rubble, 15 June 1970; 3 specs. — Stn. AM II, Aru, Maikoor, approx. 8 miles (~13 km) SW. of Tg. Ratoe, 06°07'S 133°57'E, 63-54 m, dredge haul 3, sand and rubble, 18 June 1970; 2 specs. — Stn. TS I, Tanimbar, Selaru, approx. 5 miles (~8 km) N. of Labuan Olendir, 08°03'S 130°56'E, 50-57 m, dredge, sandy mud, 25 June 1970; 1 spec.

Remarks. — This species has been dealt with in detail previously (Griffin, 1973).

Distribution. — Widespread throughout the Indo-West Pacific.

*Phalangipus longipes* (Linnaeus, 1758)

*Cancer longipes* Linnaeus, 1758: 629; 1764: 446.

*Phalangipus longipes*. — Griffin, 1973: 182-186, figs. 1c, 3c,d, 6d, 7d, 8a,b.

Material examined. — 3 ♂♂, 2 ♀♀ (1 ovig.) 11-16.5 mm.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, 27 m, dive, 19 March 1914; 3 specs.

## NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AW I, Aru, W. Wokam, off W. coast of Wasir I., 05°30'S 134°12'E, 49-58 m, dredge

hauls 3-4, sand and mud, 15 June 1970; 1 spec. — Stn. AW I (as above), 54-58 m, dredge haul 5, mud, 15 June 1970; 1 spec.

Remarks. — These specimens agree with those previously described (Griffin, 1973).

Distribution. — East coast of India, Sri Lanka, Andaman Sea, Gulf of Thailand, China Sea, Philippine Islands, Moluccas, Irian Jaya, Papua New Guinea, northwestern and northeastern Australia.

*Pisoides* H. Milne Edwards & Lucas, 1843

Type species. — *Pisoides tuberculatus* H. Milne Edwards & Lucas, 1843 = *Hyas edwardsi* Bell, 1835, by monotypy.

Remarks. — This genus at present contains three species — *Pisoides edwardsi*, the type species, from the southern East Pacific (off Chile) and *P. ortmanni* (Balss) and *P. bidentatus* (A. Milne Edwards) both from the northern West Pacific (Japan). The first pleopod of the male is scyriiform in the two Japanese species but in the type species it is simple and produced to a narrow apex laterally. Two distinct genera may be warranted for these three species.

Distribution. — East and West Pacific.

*Rochinia* A. Milne Edwards, 1875

Type species. — *Rochinia gracilipes* A. Milne Edwards, 1875, by monotypy.

Description. — Carapace pyriform to elongate triangular, surface with tubercles, spines and/or flattened plates. Rostrum varying in length, rarely single, usually of two distinct spines, sometimes contiguous. Orbit above comprising an eave and postorbital lobe separated by a U-shaped hiatus (rarely adjacent). Supraorbital eave weakly expanded with a preorbital spine or a flattened plate, no antorbital lobe. Postorbital lobe hardly excavate, sometimes with a flattened plate which is adjacent or fused to another flattened plate on hepatic region. Eyestalk short, eyes retractile against postorbital lobe. Basal antennal article narrow to moderately broad, distally truncate or with a small anterolateral tooth, lateral margin otherwise entire; article separated from postorbital lobe by a narrow U-shaped hiatus. Cheliped of adult male usually enlarged, palm compressed, merus sometimes carinate. First pair of ambulatory legs longest. Abdomen of seven distinct segments in both sexes. First pleopod of male pisiform.

Remarks. — The genus *Sphenocarcinus* A. Milne Edwards, 1875 (type species: *Sphenocarcinus corrosus* A. Milne Edwards, 1875, by monotypy) is here regarded as synonymous with *Rochinia*. Alcock (1895) placed the genus *Sphenocarcinus* in the subfamily Acanthonychinae (now Epialtinae) and the genus *Scyramathia* (subsequently a synonym of *Rochinia*) in the subfamily Pisinae and this gross separation has been maintained.

Garth (1958) has given a detailed synonymy and diagnosis of both genera. The characters, of *Rochinia* s.l. and *Sphenocarcinus* respectively, which have been used to distinguish the genera are —

- 1) rostral spines distinct or contiguous;
- 2) preorbital angle produced or not;
- 3) flagellum of antenna visible from above or concealed;
- 4) male cheliped palm enlarged and compressed or small and slender.

These characters are not correlated with one another in many of the presently known species. In several Indo-West Pacific species of *Sphenocarcinus* the rostral spines are distinct, the cheliped of the adult male is enlarged and the palm compressed. In some of these species the preorbital angle is weakly produced — in others there is a flattened plate; in some species the flagellum of the antenna is concealed under the rostrum while in others it is visible from above. Also, some species of *Rochinia* s.l. have flattened plates while some species of *Sphenocarcinus* have no plates, and we do not find it possible to divide the species into two or more distinct groups on the basis of carapace shape.

We see no reason to retain these species in two distinct genera. The first pleopod of the male is pisiform in all the species of both genera (except *R. vesicularis*) we have examined or in which it has been described. *R. vesicularis*, which has a scyiform pleopod in the male, does not belong in this group, as Garth has suggested, and a new genus is required: its composition has yet to be determined. We do not know the form of the male pleopod of four species (*R. crassa*, *R. hystrix*, *R. umbonata*, *R. tanneri*) from the Atlantic nor of seven species (*R. aurita*, *R. bidens*, *R. crosnieri*, *R. cuneata*, *R. debilis*, *R. makassar*, *R. natalensis*) from the Indo-West Pacific.

*Doclea profunda* Rathbun is here shown to be synonymous with *Pugettia mosaica* Whitelegge and, on the basis of the apically truncate first pleopod of the male, included in *Rochinia*. *Pugettia brevirostris* (Doflein) and *Pugettia sagamiensis* Gordon with similar male pleopods are now included in *Rochinia* also. A species from Ile de la Réunion, reported and figured by Crosnier as *Hyastenus* sp., is here described as a new species of *Rochinia* and five other new species are also described. This genus as redefined now contains 29 known species. The following species, included in the key, were considered only from the literature — *R. bidens* (Sakai, 1969), *R. coralliophilus* (Takeda, 1980), *R. strangeri* Serène & Lohavanijaya, 1973, and *R. natalensis* Kensley, 1977.

Distribution. — Atlantic Ocean, Indo-West Pacific and East Pacific.

#### KEY TO INDO-WEST PACIFIC SPECIES OF *ROCHINIA*

- 1 Preorbital angle of cave not produced; carapace with plates which are usually large and dominate the surface, a plate on the hepatic margin..... 2
- Preorbital angle of cave weakly to strongly produced; carapace surface and/or margins sometimes with plates but not dominated by them..... 9

- 2( 1) Rostrum of two spines distinct from close to base ..... 3
- Rostrum single or, if double, spines fused in basal half, contiguous in distal half..... 7
- 3( 2) Branchial region with one or two large plates ..... 4
- Branchial region with three small plates ..... 5
- 4( 3) Branchial region with only one large plate which extends laterally over epibranchial region; meri of ambulatory legs carinate ..... *R. simpsoni*
- Branchial region with two plates; meri of ambulatory legs lacking a carina..... *R. luzonica*
- 5( 3) Hepatic plate produced laterally and slightly upward as an acuminate spine ..... *R. coralliophilus*<sup>28)</sup>
- Hepatic plate smooth, without a spine ..... 6
- 6( 5) Epibranchial plate projecting obliquely; cardiac plate pyriform, narrow posteriorly..... *R. bidens*<sup>28)</sup>
- Epibranchial plate convex not projecting outwards, rounded anteriorly; cardiac plate globular ..... *R. carbuncula*
- 7( 2) Rostrum of two lobes fused in proximal half, separated only by a slit distally, tip convex; cardiac and intestinal lobes fused into an inverted anchor shape ..... *R. aurita*
- Rostrum single, tip concave; cardiac and intestinal plates separate..... 8
- 8( 7) Rostrum one-third postrostral carapace length; cardiac plate hardly wider than long ..... *R. aurorae*
- Rostrum equal to postrostral carapace length; cardiac plate about three times as wide as long..... *R. cuneata*
- 9( 1) Hepatic margin with an oval or globular island or flattened plate or ear-like lobe ..... 10
- Hepatic margin with a broad triangular or a conical lobe laterally directed or else a narrow spine ..... 18
- 10( 9) Branchial regions somewhat swollen, closely approximated in the midline; carapace margin without hepatic or branchial plates ..... *R. beauchampi*
- Branchial regions not swollen, not approximated medially; carapace margin with an hepatic and/or a branchial plate ..... 11
- 11(10) Anterolateral margin of branchial region with a flattened plate; cardiac region with a tubercle or low, flat islet ..... 12
- Anterolateral margin of branchial region without a flattened plate; cardiac region smooth or with a spine or flat elevated plate ..... 15
- 12(11) Hepatic margin with an upturned flattened plate, apically subacute; epibranchial region with a pointed lobe or spine ..... 13
- Hepatic and epibranchial margins surmounted by globular lobes ..... 14
- 13(12) Hepatic plate globular ventrally; epibranchial spine slender, straight; intestinal region smooth except for a central tubercle ..... *R. globulifera*
- Hepatic plate flat throughout, margin thin; epibranchial spine stout, arched; intestinal region with a strong ridge parallel to posterior carapace margin on either side of medial tubercle ..... *R. velutina*
- 14(12) Carapace with three flattened islets in midline in posterior half of carapace — mesogastric, cardiac and intestinal; ambulatory meri each with a dorsal carina (fig. 56b) ..... *R. carinata*
- Carapace with tubercles in midline; ambulatory meri cylindrical, lacking carinae ..... *R. nodosa*
- 15(11) Epibranchial and cardiac regions each bearing a spine ..... 16
- Epibranchial and cardiac regions smooth or each with a flattened plate ..... 17
- 16(15) Epibranchial spine long to extremely long (0.4 to 0.8cw.); protogastric region with a single spine or tubercle on each side ..... *R. riversandersoni*
- Epibranchial spine of only moderate length (0.15 to 0.25cw.); protogastric region with two spines on each side..... *R. strangeri*<sup>28)</sup>
- 17(15) Carapace with eight small flattened plates dorsally; hepatic and postorbital lobes confluent ..... *R. hertwigi*
- Carapace smooth dorsally; hepatic and postorbital lobes separate (fig. 61b)..... *R. tomentosa*
- 18( 9) Epibranchial region with an apically pointed plate, directed laterally; cardiac and intestinal regions each with a flat plate ..... *R. sphenocarcinoides*

<sup>28)</sup> From the literature

- Epibranchial, cardiac and intestinal regions smooth or with tubercles or spines but not with flattened plates..... 19
- 19(18) Epibranchial region with a cylindrical spine, usually long; intestinal region with a spine..... 20
- Epibranchial region smooth or with a small tubercle or a blunt or broad conical lobe; intestinal region smooth or with a tubercle..... 24
- 20(19) Midline of carapace with four spines including posterior intestinal; protogastric and dorsal branchial regions with spines..... 21
- Midline of carapace with no more than two spines and a tubercle, including posterior intestinal; protogastric and dorsal branchial region with tubercles but no spines..... 22
- 21(20) Preorbital lobe upright; hepatic spine long, upright; one tubercle on branchial submargin..... *R. pulchra*
- Preorbital lobe short, anterolaterally directed; hepatic spine short, conical, laterally directed; three tubercles on branchial submargin anterolaterally..... *R. natalensis*<sup>28)</sup>
- 22(20) Mesogastric region smooth; cardiac region with a tubercle; intestinal region with a short spine..... *R. debilis*
- Mesogastric region with a tubercle; cardiac and intestinal region each with a prominent spine..... 23
- 23(22) Postorbital lobe laterally flattened; meri of ambulatory legs with dorsal carinae, at least in distal half..... *R. mosaica*
- Postorbital lobe laterally convex; meri of ambulatory legs without any carinae..... *R. fulloni*
- 24(19) Hepatic lobe with broad obtuse base and subacute to rounded apically (fig. 57c)..... 25
- Hepatic lobe narrow conical, acute or subacute apically (fig. 57a)..... 26
- 25(24) Postorbital and hepatic lobes separated by a broad concavity; branchial region with a high compound tubercle near anteromedial angle; anterior dorsolateral margin of branchial region not produced laterally; merus and propod of first ambulatory leg cylindrical..... *R. breviostris*
- Margin between postorbital and hepatic lobes nearly straight; branchial region lacking a high tubercle near anteromedial angle; anterior dorsolateral margin of branchial region produced laterally; merus of first ambulatory leg trigonal, propod compressed..... *R. sagamiensis*
- 26(24) Hepatic lobe longer than postorbital lobe; cardiac region elevated, dorsally flat, a similar but lower elevation on anterior half of branchial region..... 27
- Hepatic lobe subequal to postorbital lobe; cardiac region with a conical elevation, anterior half of branchial region not elevated, smooth..... 28
- 27(26) Preorbital angle of eave weakly produced, blunt (fig. 57e); epibranchial angle with a distinct tubercle directed outwards... *R. makassar*
- Preorbital angle of eave strongly produced, acute (fig. 57a); epibranchial angle smooth (or with a small, low tubercle)..... *R. crosnieri*
- 28(26) Postorbital lobe with a lateral keel which is confluent with anterior margin of hepatic lobe; cheliped merus lacking a terminal spine distinct from carina (fig. 59d)..... *R. moluccensis*
- Postorbital lobe laterally flat, separate from hepatic lobe; cheliped merus with a distinct terminal spine (fig. 60c)..... *R. suluensis*

*Rochinia aurorae* (Alcock, 1899) new combination

*Sphenocarcinus aurorae* Alcock, 1899: 84. — Kemp & Sewell, 1912: 30, pl. 1 fig. 10.

Material examined. — 1 ♂, 7.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java-S. Africa Expedition: Stn. 3, Bali Sea, 07°42'S 114°E 450 m, Sigsbee trawl, mud with corals, 4 April 1929; 1 spec.

Remarks. — This species has been recorded previously only from the south-west coast of India. It is only distinguished

<sup>28)</sup> From the literature.

from *R. cuneata* (Wood-Mason) by the shorter rostrum which is a third postrostral carapace length.

The carapace of this specimen closely resembles that of *R. stimpsoni* but comparison with the series of *R. stimpsoni* collected in the Kai Islands shows that the cardiac plate in that species is always strongly elongate transversely and not triangular as in *R. aurorae*.

There have been no previous records from the Indonesian area or Pacific Ocean of *Rochinia* species with fused rostral spines and, though the rostrum of this specimen is damaged, it is clearly different from that of *R. stimpsoni* which has the rostral spines separate from the base, and which is known from Japan to north Australia and also from Sri Lanka.

Distribution. — Southwest coast of India, Bali Sea.

*Rochinia breviostris* (Doflein, 1904) new combination  
(Figs. 57c,d, 62c,d)

*Hyastenus breviostris* Doflein, 1904: 85-86, pl. 27 figs. 13, 14.

*Pugettia breviostris*. — Gordon, 1931: 557-558 (in discussion), text fig. 36a,b.  
(Not *Pugettia breviostris* Parisi, 1915 = *P. sagamiensis* Gordon, 1931.)

Material examined. — 1 ♂, cl. 22.5 mm.

ZOOLOGICAL SURVEY OF INDIA, CALCUTTA

'Investigator' Expedition: Stn. 280, Bay of Bengal, 11°29'45"N 80°02'30"E, 803 m, Agassiz trawl, mud, sand, 19 March 1901; 1 spec. (ZSC 4047/10).

Remarks. — This specimen agrees with the holotype of *H. breviostris* (ovig. ♀, 25.3 mm, SW. of Sumatra, 614 m, ZMB 13647), examined by Griffin (1970), in having a blunt, conical hepatic lobe directed laterally and connected to the postorbital lobe; a large blunt, conical epibranchial lobe directed laterally; two mesogastric tubercles; and a large anterior dorsal branchial tubercle.

This specimen differs from the holotype in having the preorbital lobe broadly rounded, upturned and subequal with the broad, laterally flat, postorbital lobe.

In this specimen there is an elongate mesogastric tubercle at the level of the hepatic spine and a small protogastric tubercle just lateral to it posteriorly; there is a high posterior mesogastric tubercle and behind it a small metogastric tubercle. The high tubercle near the anterior margin of the branchial region is trilobed; the medial margin of the branchial region is elevated and slightly produced over the urogastric region; the cardiac tubercle and the intestinal tubercle are conical. On the branchial submargin there is a ridge of four tubercles (second and fourth small) anteriorly, almost in line with the tubercles on the pterygostomial margin.

The merus of the cheliped of this male is carinate ventrally on the inner face, with a distinct angle dorsally and ventrally on the outer face but not carinate; a blunt terminal tubercle; carpus with two sharp ridges, an outer ridge dorsally and a ridge ventrally on the inner face; the palm is dorsally sharp and ventrally blunt, less than twice as long (1.8) as high and

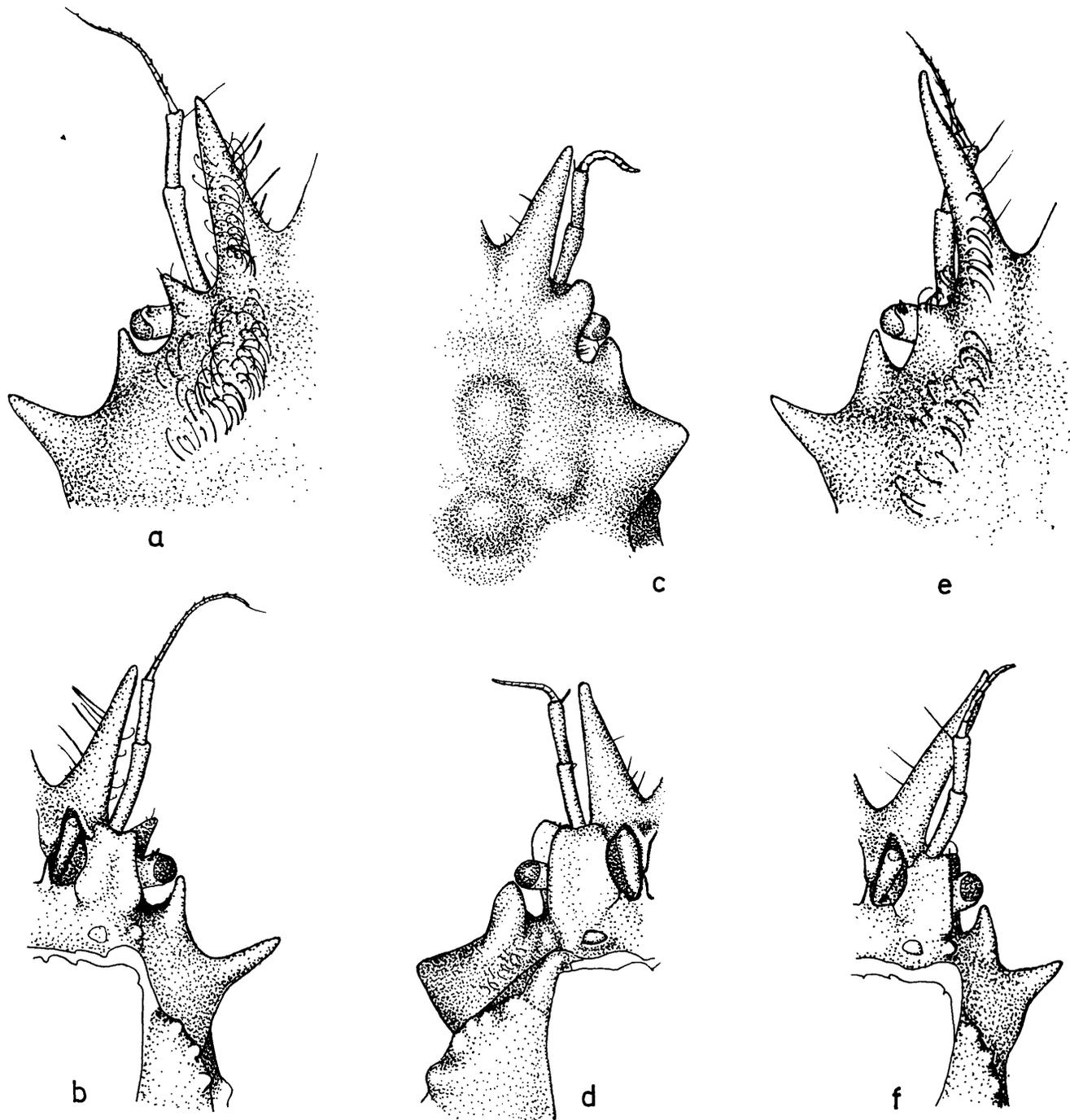


Fig. 57. *Rochinia crosnieri* (holotype) (a) left orbit, dorsal view, (b) ventral view of same; *R. breviostris* (male, 22.5 mm, ZSC 4047/10) (c) right orbit, dorsal view; (d) ventral view of same; *R. makassar* (holotype) (e) left orbit, dorsal view, (f) ventral view of same.

there is a narrow gape between the fingers in the proximal half.

The ambulatory legs are smooth, tomentose with longitudinal rows of longer setae; cylindrical, as noted in the holotype by Gordon (1931), not prismatic as described by Doflein. The first leg is slightly longer (1.2) than the postrostral carapace length, the merus has a blunt terminal tubercle; the fourth leg is not much shorter (0.86) than the first leg.

The sternum of this male is smooth with shallow intersegmental grooves. The abdomen is smooth except for a

medial anterior tubercle in segments three to six, the sixth segment is more than one and a half (1.7) times as wide as long; the seventh segment is as wide as long. The first pleopod of the male is straight, broad, narrowing slightly just before expanding to a truncate apex; lateral angle acute, produced laterally; medial angle blunt, produced slightly forward; the aperture is just below the anterior margin, laterally on the sternal surface.

*R. breviostris* is distinguished from the other known species of *Rochinia* (except *R. sagamiensis* and *R. beauchampi*) by the broad conical lobe, directed laterally, on the hepatic margin.

It is distinguished from *R. sagamiensis* by having the postorbital and hepatic lobes separated by a broad concavity while in *R. sagamiensis* the margin between the two lobes is nearly straight, forming a large wing-like lobe. *R. brevirostris* is distinguished from *R. beauchampi* by not having the branchial regions strongly elevated and adjacent on the midline as they are in that species.

Distribution. — Eastern Indian Ocean: Bay of Bengal and SW. of Sumatra.

*Rochinia carinata* new species  
(Figs. 56, 64 e,f, Pl. 12)

Material examined. — 4 ♂♂, 6 ♀♀ (3 ovig.) 13.5-25.5 mm, smallest ovig. ♀, 19 mm.

Holotype. — Male, cl. 25.5 mm, Kai Islands, 05°29'S 132°37'E, 290 m, trawl, mud, 12 May 1922; Danish Kei Islands Expedition, Stn. 58; Zoological Museum, University of Copenhagen.

Paratypes. As listed below:

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 251, Kai Is., 05°28.4'S 132°00.2'E, 204 m, trawl, hard coral sand, 8 December 1899; 1 spec. — Stn. 253, Kai Is., 05°48.2'S 132°13'E, 304 m, trawl, grey clay, hard and crumbly, 10 December 1899; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 12, Kai Is., 05°30'S 132°35'E, 325 m, trawl, sand, shells, corals, 9 April 1922; 1 spec. — Stn. 50, Kai Is., 05°34'S 132°25'40"E, 233 m, trawl, sand, 4 May 1922; 2 specs. — Stn. 58, data as for holotype; 4 specs.

Description. — Carapace broad, greatest width about 0.8 postrostral carapace length, surface covered by a fine tomentum and with seven large, flattened, circular or subcircular islets.

Rostral spines short, straight, tapering to a sharp apex, length about one quarter postrostral carapace length. Eyestalks short, covered with tomentum, cornea terminal.

Orbital eave moderately expanded, preorbital angle produced forward into a blunt spine, antorbital angle indistinct; postorbital lobe short, broad, separated from eave by a narrow U-shaped hiatus, lateral margin basally adjacent to, but distinct from, anterior edge of large hepatic islet.

Hepatic margin with a large, broadly oval islet. Branchial margin with a narrow suboval plate anteriorly, just above carapace margin, anterior and dorsal edges of plate carinate; a large circular islet, posterolaterally.

Mesogastric region with a large circular islet posteriorly and a small tubercle in front of it (centrally); a protogastric tubercle just lateral to anterior margin of large mesogastric islet.

Cardiac region with a large subcircular islet, a tubercle just lateral to posterior margin of cardiac islet. Intestinal region with a large, circular islet, extending almost to posterior carapace margin. Branchial region anteriorly with a group of one large and two small tubercles near medial angle.

Basal antennal article flat, tomentose; anterolateral angle blunt, not produced, lateral margin weakly convex with a small basal tubercle; article separated from postorbital lobe by a narrow U-shaped hiatus.

Pterygostomian region smooth, margin carinate or with three to four compressed tubercles.

Third maxilliped smooth, anterolateral angle of merus only moderately produced and rounded.

Merus of cheliped of adult male with two carinate ridges, one dorsally and one ventrally on inner face (ventral margin of outer face blunt); a short, acute terminal spine distinct from dorsal ridge; carpus with two very low smooth ridges dorsally and a convex, carinate lobe ventrally on inner face. Palm dorsally sharp in proximal half, ventral surface commencing with a short right-angled carina; palm one and a half times as long as high; fingers more than  $\frac{3}{4}$  length of palm (0.8) with a moderate gape for proximal two thirds; dactyl with a large low tubercle in gape, fixed finger with a few small irregular teeth in gape.

Meri of first three pairs of ambulatory legs dorsally carinate, carina extending along proximal two thirds of first pair and confined to central third of second and third pairs; no terminal spine. First ambulatory leg about one and a half (1.6) times postrostral carapace length, fourth leg about 0.62 length of first.

Male sternum smooth, low ridges on anterior and lateral edges of first sternite.

Male abdomen of seven segments, smooth, third segment twice as wide as sixth segment, sixth segment about one and a half (1.4) times as wide as long, seventh segment about two thirds (0.7) as wide as long. Female abdomen of seven segments, smooth.

First pleopod of male straight, broad, narrowing at about distal sixth, and widening again to truncate apex.

Female gonopore a simple circular aperture, opening ventrally.

Remarks. — The first pleopod of the male of this species is similar to that of other species of *Rochinia*. This species is similar to *R. nodosa* (Rathbun) in having a broad carapace, short, stout rostral spines, a distinct preorbital spine and islets on the carapace that are nearly circular. However, this species is distinguished from *R. nodosa* by having well developed islets in the midline (mesogastric, cardiac, and intestinal) which are represented by broad, blunt tubercles in *R. nodosa*; by the presence of a small central mesogastric tubercle, absent in *R. nodosa*; and by the dorsally carinate meri of the ambulatory legs and the cheliped of the male.

This species is distinguished from *R. carbuncula* (Rathbun) and *R. bidens* (Sakai) by having only one branchial islet, rather than three as in the other two species, and by the presence of a distinct preorbital spine which is absent in *R. carbuncula* and *R. bidens*.

Distribution. — Only known from the Kai Islands.

*Rochinia crosnieri* new species  
(Fig. 57a,b)

*Hyastenus* sp., Crosnier, 1976: 242, pl. 2 figs. 1, 2.

Holotype. — Female, ovigerous, cl. 24 mm, Ile de la Réunion, St. Paul, 580-680 m, trap, coll. Gueze, March 1973. Muséum National d'Histoire Naturelle, Paris.

Description. — Carapace pyriform, width three quarters (0.75) postrostral carapace length; carapace covered with a short, thick tomentum, regions not strongly defined; surface beneath tomentum smooth with broad, low elevations.

Rostral spines, slender, straight, weakly divergent, apically blunt; fused for less than proximal third (0.3), length more than a quarter (0.28) postrostral carapace length.

Orbital eave moderately expanded; preorbital spine short, about as large as postorbital lobe, directed upwards, outwards and slightly forwards, lateral edge concave, no antorbital angle; postorbital lobe separated from eave by a very broad U-shaped hiatus; postorbital lobe narrow, laterally flattened and smooth, length in lateral view about twice basal width, apex blunt. Eyestalks slender, short; cornea terminal.

Hepatic margin with a conical elevation surmounted by a large, blunt, cylindrical spine directed obliquely outwards and forwards; a low ridge connecting base of hepatic spine to base of postorbital lobe.

Branchial submargin anteriorly with a row of three tubercles, anterior largest; a small low epibranchial tubercle.

Gastric regions elevated, a very broad, low posterior mesogastric elevation and a small, rounded protogastric tubercle. Urogastric region weakly elevated.

Cardiac region with a smooth, broad elevation. Intestinal region smooth, weakly elevated medially near posterior carapace margin and with a low ridge laterally, parallel to margin.

Branchial region anteriorly with a broad, low subcircular elevation near medial angle.

Basal antennal article smooth, with a shallow longitudinal groove centrally; anterolateral angle produced into a small, blunt lobe; lateral margin weakly sinuous, concave in distal half and convex at proximal angle; medial margin of basal antennal article produced as a thin 'ledge' over antennal fossa. A small tubercle lateral to green gland.

Pterygostomian region smooth, margin with three small, well separated tubercles.

Third maxilliped smooth, covered with tomentum; anterolateral angle of merus moderately produced and rounded.

Cheliped of ovigerous female about equal (1.1) postrostral carapace length; merus smooth, subcylindrical, with a low terminal tubercle; carpus smooth; merus, carpus and outer face of palm covered in tomentum; length of palm about twice height, fingers about two thirds length of palm, each with about ten low teeth along cutting edge.

First ambulatory legs missing from specimen; merus of second ambulatory leg cylindrical, smooth, no terminal tuber-

cle, all leg segments covered in tomentum; dactyl of fourth leg with minute spines ventrally along its length; length of second leg about one and a half times postrostral carapace length; fourth leg about equal to postrostral carapace length and about three fifths (0.6) of second leg.

Female abdomen of seven segments, smooth with a low medial ridge. Female gonopore a subtriangular aperture, opening ventrally.

The male of this species is unknown.

Remarks. — Crosnier (1976) distinguished this species from the specimen described as *Hyastenus brevirostris* by Doflein (1904) (now *Rochinia brevirostris*) by the presence in that species of a large conical epibranchial tubercle, whereas in *R. crosnieri* there is only a very small epibranchial tubercle. One of us (D.J.G.G.) has examined the holotype of *R. brevirostris* (ovig. ♀, 25.3 mm, SW. of Sumatra, 614 m, ZMB 13647) and *R. crosnieri* can be distinguished from it by the following additional points:

- 1) the hepatic spine is cylindrical in this species; it is broad and conical in *R. brevirostris*;
- 2) the postorbital lobe is separated from the eave by a very broad U-shaped hiatus; the hiatus is narrow and U-shaped in *R. brevirostris*;
- 3) there is only a low posterior mesogastric elevation; two distinct mesogastric tubercles in *R. brevirostris*;
- 4) the lateral edge of the basal antennal article is concave distally; the lateral edge is convex in *R. brevirostris*;
- 5) the merus of the cheliped is subcylindrical; it is trigonal (prismatic) in *R. brevirostris*.

This species is distinguished from *R. makassar* n.sp. by the presence of a preorbital spine, absent in *R. makassar*; and by the weakly elevated cardiac and anteromedial branchial regions which are distinct and strongly elevated in *R. makassar*.

Distribution. — Known only from the type locality, Ile de la Réunion, St. Paul.

*Rochinia globulifera* (Wood-Mason, 1891)  
(Fig. 62a, b)

*Pugettia globulifera* Wood-Mason, in Wood-Mason & Alcock, 1891: 260-261.

*Scyramathia globulifera*. — Alcock, 1895: 205-206. — Alcock & Anderson, 1896: pl. 20 figs. 3, 3a. — Doflein, 1904: 85.

*Rochinia globulifera*. — Serène & Lohavanijaya, 1973: 56 (in key).

Material examined. — 2 ♂♂, 10.0, 11.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java-S.Africa Expedition: Stn. 7, Bali Sea, 08°29'S 114°40'E, 200 m, small fish trawl, mud, 5 April 1929; 2 specs.

Remarks. — These specimens agree well with that figured by Alcock & Anderson (1896). On the gastric region there is a posterior medial tubercle with a smaller more anterior tubercle on either side. There is a flat, oval plate laterally on the branchial submargin and the epibranchial spines are acuminate. This species is distinguished from other known

species of *Rochinia* by the distinct, smooth, rounded elevation at the base of the flattened hepatic spine.

This species has previously been recorded only from the Indian Ocean.

Distribution. — Andaman Sea, Nicobar Islands, Bali.

*Rochinia hertwigi* (Doflein, 1900)

*Scyramathia Hertwigi* Doflein in Chun, 1900: 497 (fig.). — Doflein, 1904: 81-84, pl. 27 figs. 1-7, pl. 28 fig. 1.

*Scyramathia hertwigi*. — Stebbing, 1902: 7-8, pl. 6. — Barnard, 1950: 50-51, figs. 11b, c.

*Rochinia hertwigi* — Serène & Lohavanijaya, 1973: 56 (in key).

Material examined. — 4 ♂♂, 25.5-57.5 mm.

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Mortensen Java-S.Africa Expedition: Stn. 57, South Africa, 34°21'S 17°57'E, off Cape Town, ca. 356 m, trawl, mud, 18 December 1929; 3 specs. — 34°21'S 17°7'E, off Cape Town, 350 m, 18 December 1929; 1 spec.

Remarks. — These specimens agree well with those previously described by other authors. This large species (up to 60 mm, cl.) has eight flattened islets well separated on the carapace as well as a flat islet on the hepatic margin. The hepatic islet is produced dorsally as a broad spine and is confluent anteriorly with the postorbital lobe. The cheliped of the adult male is long, about three and a half times the postrostral carapace length.

*R. hertwigi* is distinguished from other Indo-West Pacific species of *Rochinia* which have many flat islets, by the islets being more widely separated and by the presence of a sharp preorbital spine lacking in the other species.

The similarity between this species and *R. carpenteri* Norman from the North Atlantic has been noted by Barnard (1950).

Distribution. — Southern coast of South Africa.

*Rochinia luzonica* (Rathbun, 1916) new combination  
(Fig. 63c,d)

*Sphenocarcinus luzonicus* Rathbun, 1916: 539-540. — Griffin, 1976: 211-213, fig. 11a.

Material examined. — 6 ♂♂, 6 ♀♀ (2 ovig.), 10-37 mm, smaller ovig. ♀, 22 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 95, Sulu Archipelago, 05°43.5'N 119°40'E, 522 m, dredge, stony bottom, 26 June 1899; 1 spec. — Stn. 251, Kai Is., 05°28.4'S 132°0.2'E, 204 m, trawl, hard coral sand, 8 December 1899; 1 spec. — Stn. 254, Kai Is., 05°40'S 132°26'E, 310 m, trawl, fine grey mud, 10 December 1899; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 12, Kai Is., 05°30'S 132°35'E, 325 m, trawl, sand, shells, corals, 9 April 1922; 1 spec. — Stn. 49, Kai Is.,

05°37'10"S 132°23'E, 245 m, trawl, sand, 3 May 1922; 1 spec. — Stn. 59, Kai Is., 05°28'S 132°36'E, 385 m, trawl, corals, sponges, 12 May 1922; 4 specs.

Mortensen Java-S.Africa Expedition: Stn. 15, Bali, off Boeleleng, 07°29'S 114°49'E, ca. 240 m, Sigsbee trawl, sand and mud with concretions, 10 April 1929; 2 specs.

Sulawesi, off Manado, 01°31'N 124°47'E, 450 m, coll. Capt. Christiansen, 12 March 1913; 1 spec.

Remarks. — The rostral spines are straight and weakly divergent in all specimens except two adult males; in one specimen from the Kai Islands ('Siboga' Stn. 254) the rostrum is sinuous and in the other from Sulawesi the tips are upturned.

There is a small tubercle on either side of the gastric islet; this islet has a more rounded outline in younger animals than in the adult. The anterior branchial islet is only a round tubercle in young specimens, becoming more elongate and laterally pointed in adults, but in several specimens it is notched on either the anterior or posterior margin. On the posterior margin of the carapace in one ovigerous female, the central triangular part of the islet is clearly separated from the slender lateral parts, instead of being fused to them as it is in other specimens. The dorsal islets of younger animals are smaller and flatter, while in the adults the islets are more convex and constricted below so that they stand out from the carapace surface; the gastric and cardiac islets have a central tubercle. The meri of the ambulatory legs are not carinate.

*R. luzonica* is one of the four species of *Rochinia* with large islets and separate rostral spines. It is distinguished from *R. bidens* and *R. carbuncula* by the presence of a transversely elongate intestinal islet just above the posterior carapace margin and from *R. stimpsoni* by the presence of two islets rather than one on the dorsal branchial region.

Distribution. — Indonesia, Philippine Islands; previously known only from the Philippine Islands.

*Rochinia makassar* new species  
(Fig. 57e,f)

Material examined. — 2 ♀♀, 11.0, 16.5 mm.

Holotype. — Female, immature, cl. 16.5 mm, Makassar Strait, 00°32'S 119°39.8'E, 655 m, trawl, fine grey mud, 19 June 1899, 'Siboga' Expedition, Stn. 87; Zoological Museum, Amsterdam.

Paratype. Female, immature, cl. 11 mm, Ceram Sea, 03°27'S 131°0.5'E, 567 m, deep sea trawl, fine, yellow grey mud, 28 August 1899, 'Siboga' Expedition, Stn. 173; Zoological Museum, Amsterdam.

Description. — Carapace pyriform, width three quarters (0.75) postrostral carapace length; carapace covered with a short tomentum; surface smooth with a few broad elevations.

Rostral spines slender, apically sharp and weakly incurved; fused for about proximal fifth; length about a third (0.36) postrostral carapace length.

Orbital eave moderately expanded, preorbital angle only very weakly produced and rounded; no antorbital angle;

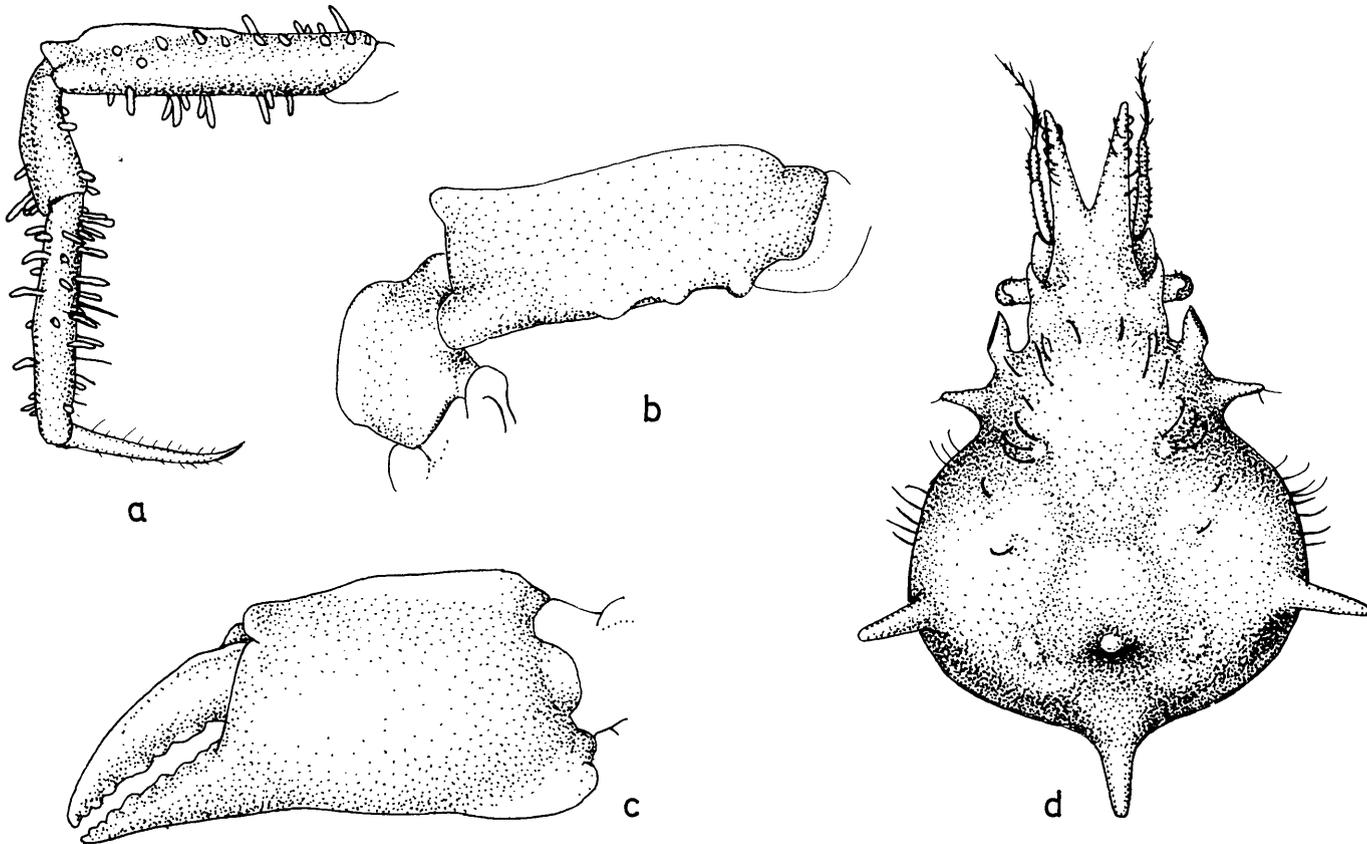


Fig. 58. *Rochinia mosaica* (male, 13 mm, AM P.11743) (a) left first ambulatory leg; (b) left cheliped, merus and carpus; (c) left chela; (d) carapace, dorsal view.

postorbital lobe separated from eave by a U-shaped hiatus; postorbital lobe narrow, laterally flattened but tomentose, length in lateral view about one and a half times basal width, apex blunt. Eyestalks slender, short; cornea terminal.

Hepatic margin with a small conical elevation surmounted by a cylindrical spine directed laterally and slightly forwards; base of hepatic spine connected with base of postorbital lobe by a low ridge.

Anterior branchial submargin with two small tubercles, anterior larger; a conical epibranchial tubercle directed laterally.

Gastric regions elevated, a small anterior mesogastric tubercle level with hepatic spine, a much larger posterior mesogastric tubercle and behind it, on posterior slope, a round tubercle; a very small posterior protogastric tubercle.

Cardiac region strongly elevated, smooth. A large circular tubercle on anterior border of the branchial region near medial angle; a small tubercle just lateral to cardiac region.

Intestinal region with a blunt tubercle centrally, carapace almost vertical below tubercle to posterior carapace margin; a low lateral ridge just in front of and almost parallel to margin.

Basal antennal article smooth, flat, anterolateral angle not produced or produced only to a very small triangular tooth; lateral margin straight; medial margin produced slightly over antennal fossa; a small tubercle lateral to green gland.

Pterygostomian region smooth, margin with three low, broad tubercles.

Third maxilliped smooth, covered with tomentum, anterolateral angle of merus produced and rounded.

Cheliped of immature female about equal to postrostral carapace length; merus smooth with a low terminal tubercle; carpus smooth; merus, carpus and palm covered with tomentum; length of palm about one and a half times height; fingers about four fifths (0.8) length of palm, a very narrow proximal unarmed gape between fingers, remainder of cutting edge of both fingers with low teeth.

Ambulatory legs smooth, merus of first leg with a small terminal tubercle; all segments of legs covered with tomentum; first leg about one and a half times (1.6) postrostral carapace length, fourth leg about two thirds length of first.

The male of this species is unknown.

Remarks. — The absence of a well developed preorbital spine distinguishes this species from *R. brevisrostris* Doflein and *R. crosnieri*. This species is similar to *R. crosnieri* in having a slender hepatic spine which is the longest carapace spine, but it is distinguished from that species by the strongly elevated cardiac and anterior branchial regions which are low and broad in *R. crosnieri*.

*R. sagamiensis* (Gordon) also lacks a well developed preorbital spine, but in that species the postorbital and hepatic lobes are connected by a wing-like ridge just below the apex.

Distribution. — Makassar Strait, Ceram Sea.

*Rochinia moluccensis* new species  
(Figs. 59, 64c,d)

Material examined. — 1♂, postrostral cl. 10.5 mm; 1♀, cl. 16.5 mm.

Holotype. — Female, adult, cl. 16.5 mm, Java Sea, 07°35'S 114°42'E, ca. 200 m, Sigsbee trawl, mud without concretions, 10 April 1929, Mortensen Java-S. Africa Expedition; Stn. 16, Zoological Museum, University of Copenhagen.

Paratype. Male, postrostral cl. 10.5 mm, Straat Bougainville, W. of Waigeo I., 00°29.2'S 130°5.3'E, 469 m, dredge, coarse sand and broken shells, 15 August 1899, 'Siboga' Expedition, Stn. 156; Zoological Museum, Amsterdam.

Description. — Carapace pyriform, width about two thirds (0.66-0.68) postrostral carapace length; surface smooth with a few low tubercles.

Rostral spines slender, straight, divergent; length about one third (0.36) postrostral carapace length, fused for about proximal quarter.

Orbital eave moderately expanded; a broad, subacute preorbital spine directed obliquely forwards and slightly upwards; a small convexity on edge of eave at antorbital level; postorbital lobe separated from eave by a narrow U-shaped hiatus; postorbital lobe short, laterally keeled, keel extending posteriorly to meet hepatic spine. Eyestalks short, slender; cornea terminal.

Hepatic margin elevated, a short spine dorsally on elevation directed outward and slightly upward, anterior margin of spine produced forward as a sharp keel to be continuous with keel of postorbital lobe.

Branchial submargin smooth or with a very small tubercle; a small epibranchial tubercle in the female, a smaller, almost indistinguishable tubercle in the male.

Gastric regions elevated, a small posterior mesogastric tubercle; a low posterior protogastric tubercle.

Cardiac region with a large conical tubercle; branchial region elevated near anterior border, smooth.

Intestinal region with a very low medial tubercle near posterior carapace margin; laterally a low ridge just in front of and parallel to carapace margin.

Basal antennal article smooth, a longitudinal groove centrally; anterolateral angle produced forward into a short, blunt, triangular spine; lateral margin almost straight, weakly concave midway along; medial edge concave, produced slightly over antennal fossa; a small tubercle lateral to green gland.

Pterygostomian region smooth, margin with four broad tubercles, united (in male) to form a tuberculate ridge.

Third maxilliped smooth, anterolateral angle of merus moderately produced and rounded.

Cheliped of male about one and a quarter (1.23) times postrostral carapace length; merus smooth, carinate on dorsal and inner ventral edges, outer ventral edge rounded, terminal spine not separate from carina; carpus smooth with two carinate ridges, one dorsally and one ventrally on inner face; palm about twice as long as high, dorsal and ventral margins carinate; fingers about two thirds (0.69) palm, weakly gaping proximally, low teeth along cutting edge of both fingers.

Ambulatory legs smooth, slender, merus of first leg with a small terminal tubercle; dactyl of fourth leg with about four very small teeth ventrally along its length; first leg about one and a half times (1.42) postrostral carapace length; fourth leg less than two thirds (0.6) first leg.

Male sternum smooth, first sternite with a shallow depression on either side of a narrow ridge in front of abdominal fossa; shallow intersegmental grooves between remaining segments.

Male abdomen smooth, third segment less than twice (1.8) width of sixth segment; sixth segment one and a half times as wide as long; seventh segment as wide as long.

Female abdomen of seven segments, smooth except for a low medial ridge.

First pleopod of male straight, broad, twisted through 90° at about the distal quarter so that lateral margin becomes ventral; apical margin truncate; pleopod divided into two terminally separate lobes on rounded medial-ventral angle of apex; abdominal (inner) surface recurved along anterior border and its medial-ventral angle is a broad, rounded lobe; sternal (outer) surface is simply rounded on medialventral angle; central anterior margin curved in towards abdominal surface; aperture terminal between lobes.

Female gonopore a simple subcircular aperture opening ventrally.

Remarks. — The presence of only a small epibranchial tubercle rather than a lobe, spine or prominent tubercle distinguishes *R. moluccensis* from most other species of *Rochinia*. Of the few species similarly lacking a strong epibranchial spine or lobe, *R. moluccensis* is distinguished from *R. crosnieri* and *R. makassar* by the hepatic spine which is short and directed upwards (long and directed laterally in *R. crosnieri* and *R. makassar*); from *R. suluensis* by the postorbital lobe which is keeled and confluent with the hepatic spine (laterally flat and separate from the hepatic spine in *R. suluensis*); and from *R. tomentosa* by the conical cardiac tubercle (cardiac region smooth in *R. tomentosa*). In *R. moluccensis* the subhepatic region is roundly elevated, but the elevation is not glabrous nor part of a hepatic plate as it is in *R. globulifera* and that species also has flattened plate laterally on the branchial submargin which is lacking in *R. moluccensis*.

Distribution. — Moluccas, Java Sea.

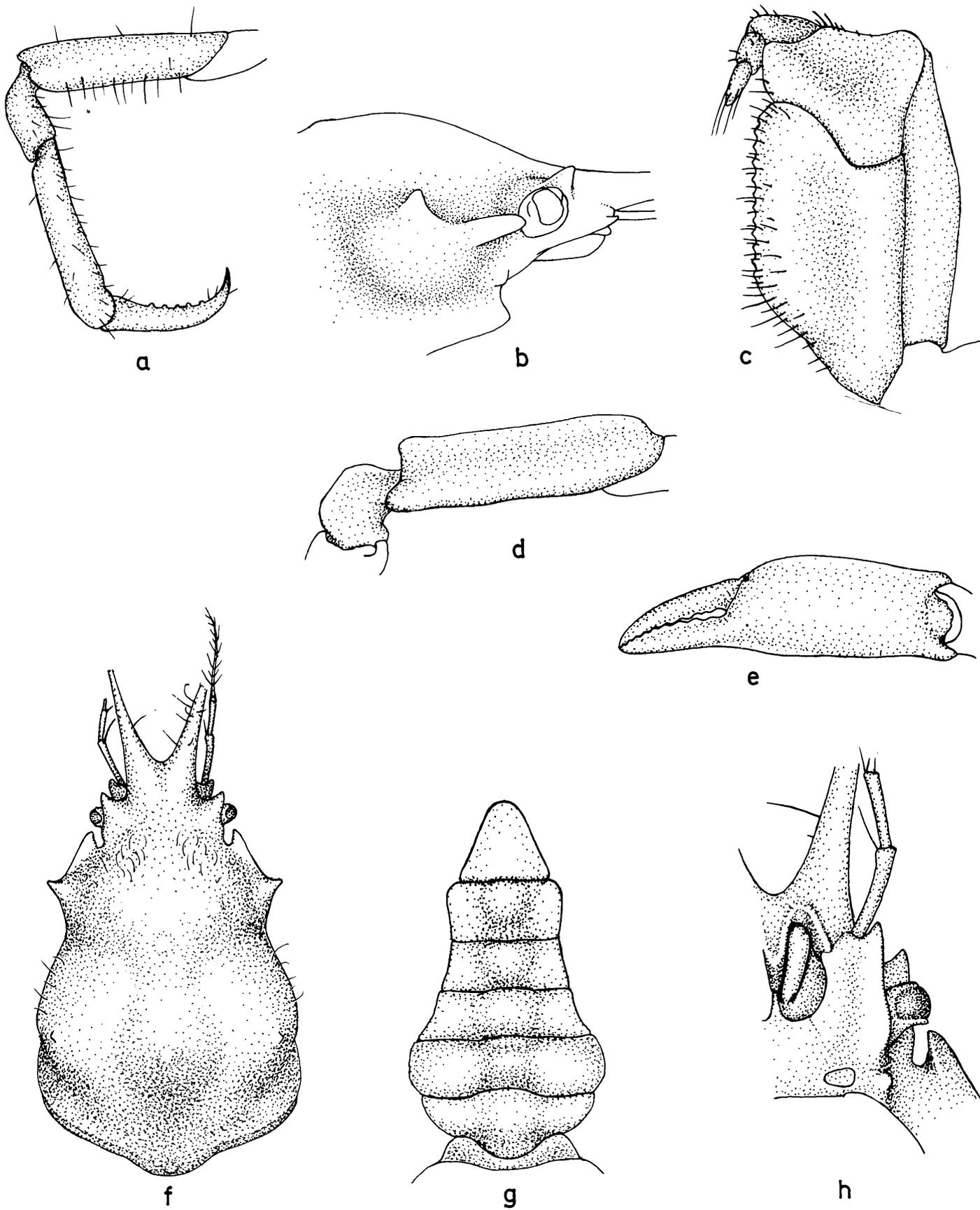


Fig. 59. *Rochinia moluccensis* (holotype, female) (a) left fourth ambulatory leg; (b) anterior region, lateral view (c) left third maxilliped; (paratype, male) (d) left cheliped, merus and carpus; (e) left chela; (holotype) (f) carapace, dorsal view; (paratype, male) (g) male abdomen; (holotype) (h) left orbit, ventral view.

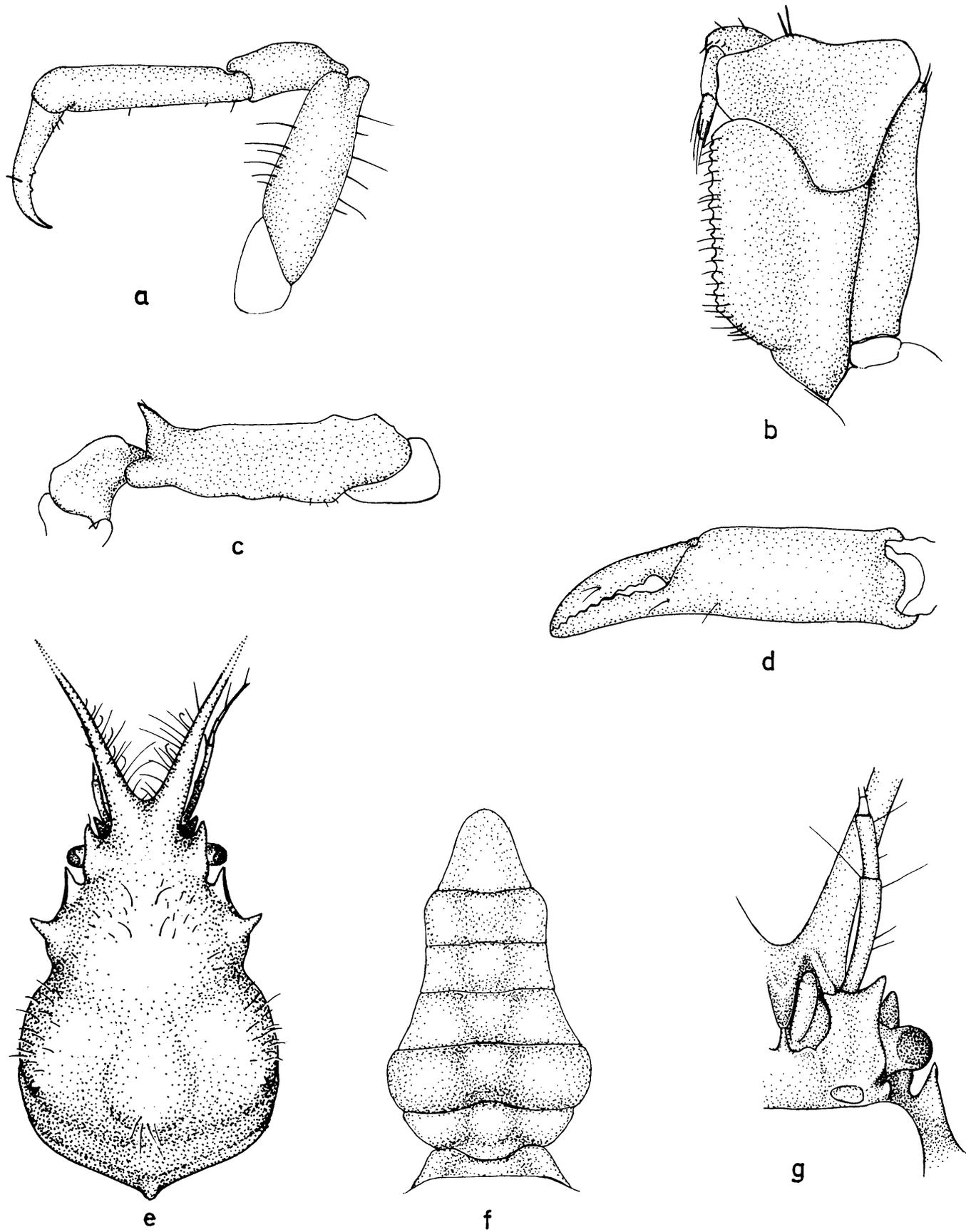


Fig. 60. *Rochinia suluensis* (female, 11.5 mm, Bougainville Strait, ZMA) (a) left fourth ambulatory leg; (holotype) (b) left third maxilliped; (c) left cheliped, merus and carpus; (d) left chela; (e) carapace, dorsal view; (f) male abdomen; (g) left orbit, ventral view.

*Rochinia mosaica* (Whitelegge, 1900) new combination  
(Figs. 58, 62 e,f)

*Pugettia mosaica* Whitelegge, 1900: 141-142, pl. 35 figs. 5, 6, 7. — Griffin, 1972: 70-71.

*Doclea profunda* Rathbun, 1918: 16-17, pl. 7 figs. 1, 2. — Hale, 1927: 134 fig. 134; new synonymy.

Material examined. — 3 ♂♂, 5 ♀♀ (4 ovig.), 7.5-11.0 mm, smallest ovig. ♀, 9 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

New South Wales: E. of Sydney, 33°46'S 151°43'E, 173 m, dredge, F. R. V. Kapala, 5 December 1977; 5 specs. (AM P.32091). — 2.3 km E. of Malabar, 33°59'27"S 150°16'48"E, dredge, 24 May 1973; 1 spec. (AM P. 20740). — E. of Cronulla, 34°05'S 151°19'E 1° to 34°11'S, 151°14'E, 130 m, demersal fish trawl, F. R. V. Kapala, 22 April 1975; 2 specs. (AM P.20600).

Material previously examined and discussed (Griffin, 1972). — 54 ♂♂, 58 ♀♀, cl. 4.5-14.3 mm, from 13 localities between Cape Moreton, Queensland and Cape Everard, Victoria.

Remarks. — *Doclea profunda* Rathbun is synonymous with *Pugettia mosaica* Whitelegge. We have examined a large series of specimens identified as *Pugettia mosaica* and the type material of both species. The type material of *Pugettia mosaica* consisting of a lectotype (male, 14.4 mm, AM P. 15175) and paralectotypes (14 males, 28 females, AM G. 2331 to G. 2336 inclusive, G. 2342, P. 1400) has been discussed previously (Griffin, 1972). *Doclea profunda* is known only from the holotype (ovig. female, 10.7 mm, Great Australian Bight, S. of Eucla, 450-810 m, AM E. 6279). The type material of the two species agrees in the laterally flattened and smooth postorbital lobe; the separate, laterally directed hepatic spine; the large epibranchial, cardiac and intestinal spines; the longitudinally grooved, subrectangular basal antennal article; and the fused fifth and sixth segments of the female abdomen.

Rathbun described several small tubercles on the carapace of *Doclea profunda*: a posterior protogastric, and dorsally on the branchial region a group of tubercles anteromedially and a tubercle posterolateral to the cardiac spine. These tubercles are usually covered by a thick tomentum, described by Whitelegge as 'bead-like granules', and their presence is only indicated by a group of curled hairs or long setae. This tomentum is absent from the greater part of the carapace of the holotype of *D. profunda*, though the bases of hairs can be seen.

In all the specimens the postorbital lobe is separated from the orbital cave by a narrow U-shaped hiatus; ventrally there is a small tubercle lateral to the green gland and on the pterygostomial margin there are two tubercles, the anterior one at least twice the size of the other.

The first pleopod of the male is straight, broad, only narrowing slightly before expanding again apically; the apex is truncate, medially rounded, laterally subacute; the aperture appears to be terminal. This pleopod differs from the scyiform pleopod of most Japanese species of *Pugettia* but is similar to that of Indo-west Pacific species of *Rochinia*.

Brief notes found with some specimens of this species collected (1930-1937) by Melbourne Ward indicate that he

thought then that *Doclea profunda* probably was synonymous with *Pugettia mosaica* although he never included this in any of his published work.

Distribution. — South-eastern and southern Australia from Cape Moreton (Queensland) to Great Australian Bight (South Australia).

*Rochinia nodosa* (Rathbun, 1916) new combination  
(Fig. 63g,h)

*Sphenocarcinus nodosus* Rathbun, 1916: 541-542. — Griffin, 1976: 213, fig. 10a. — Sakai, 1976: 204-205, pl. 72 fig. 2.

Material examined. — 1 ♂, 20 mm, 1 ♀ (ovig.), 20.5 mm.

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Mortensen Pacific Expedition: Japan, 21 miles (~33.5 km) W<sup>1</sup>/<sub>2</sub>S. of Bonomisaki, 440 m, trawl no. 3, 13 May 1914; 2 specs.

Remarks. — These specimens agree closely with specimens from the Philippine Islands reported on previously (Griffin, 1976).

Sakai (1976) suggests, but without discussion, that *Scyra tuberculata* Yokoya, 1933 may be a synonym of this species. Nothing in Yokoya's description and figure contradicts such a proposal, in our view, and we do not treat Yokoya's species as a separate taxon.

Distribution. — Philippine Islands and Japan.

*Rochinia pulchra* (Miers, 1886)

*Anamathia pulchra* Miers, 1886: 26-27, pl. 4 figs. 1, 1a-c.

*Scyramathia pulchra*. — Alcock, 1895: 202-203. — Doflein, 1904: 84, pl. 27 fig. 12.

*Rochinia pulchra*. — Sakai, 1938: 278-279, fig. 35, pl. 37 fig. 4; 1976: 223-224, pl. 79 fig. 1. — Serène & Lohavanijaya, 1973: 56-57, figs. 119-122, pl. 11A. — Takeda, 1975: 144-145, fig. 4a,b. — Griffin, 1976: 210.

Material examined. — 3 ♂♂, 3 ♀♀, 12.5-31.0 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 256, Kai Is., 05°26.6'S 132°32.5'E, 397 m, greyish green mud, 11 December 1899; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 52, Kai Is., 05°46'S 132°49'35"E, 352 m, trawl, mud, 7 May 1922; 1 spec.

Mortensen Java-S. Africa Expedition: Stn. 15, Bali, off Boelcleng, 07°29'S 114°49'E, ca. 240 m, Sigsbee trawl, sand and mud with concretions, 10 April 1929; 1 spec. — Stn. 16, off Bali, 07°35'S 114°42'E, ca. 200 m, Sigsbee trawl, mud without concretions, 10 April 1929; 2 specs.

Remarks. — The spines on the carapace of these specimens are all of a relatively similar length, except that the anterior protogastric spine is always slightly shorter than the posterior protogastric spine. Three of the specimens have two small additional spines between the mesogastric and metagastric spines, whereas the other three specimens have only two very

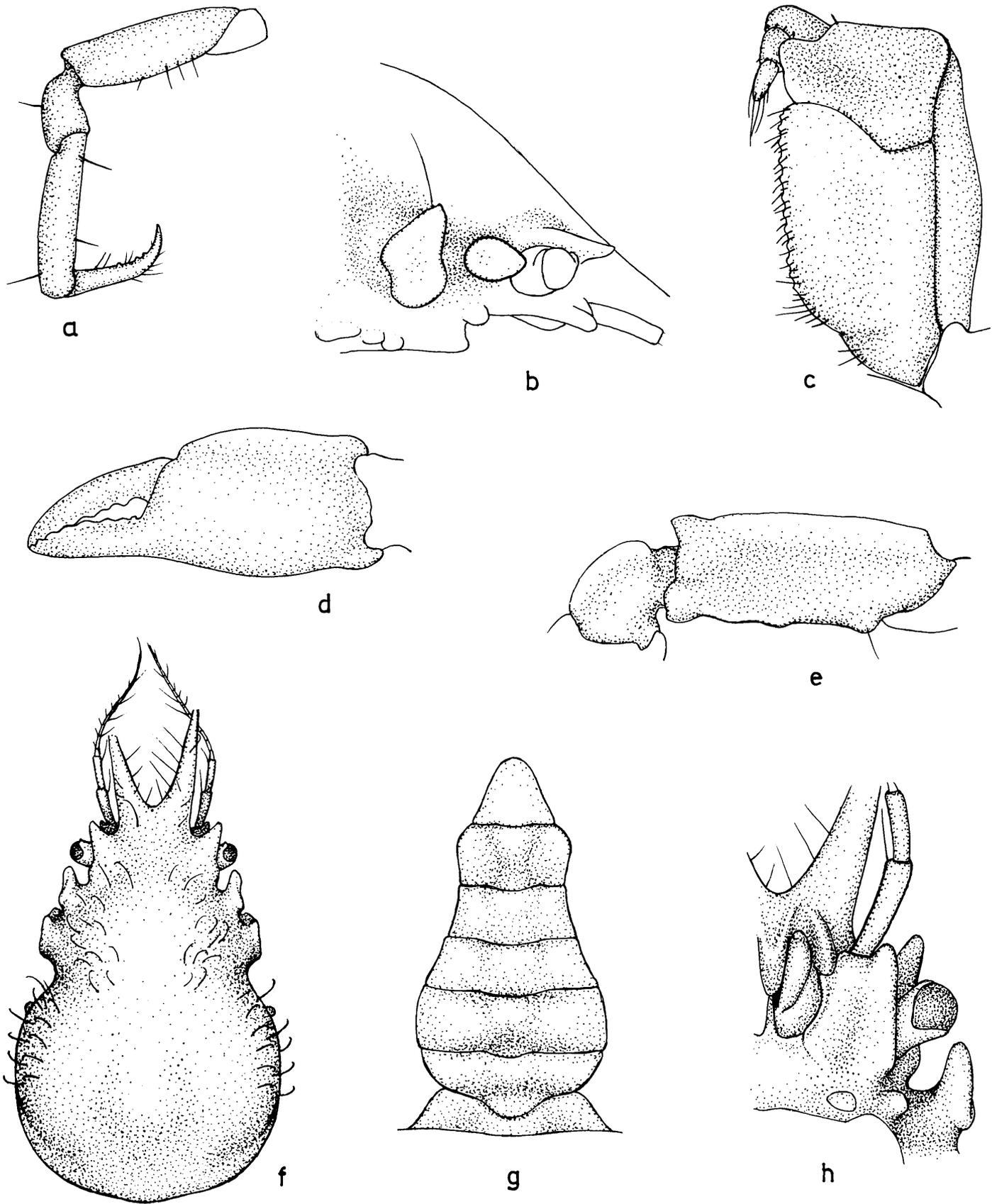


Fig. 61. *Rochinia tomentosa* (holotype) (a) left third ambulatory leg; (b) anterior region, lateral view; (c) left third maxilliped; (d) left chela; (e) left cheliped, merus and carpus; (f) carapace, dorsal view; (g) male abdomen; (h) left orbit, ventral view.

small tubercles. In some specimens the cardiac spine and some of the branchial spines are curved forward at the tip.

We have also examined a specimen (imm. ♀, cl. 42 mm, 540 m, FRV. 'Kapala', AM P. 32090) collected from off Point Danger, northern New South Wales, which is similar to *R. pulchra* in having many long carapace spines. As in *R. pulchra* the supraorbital spine, hepatic spine and protogastric spine are all long, slender and upright. However, this specimen differs from *R. pulchra* in having fewer carapace spines, there is only one protogastric spine on each side, not two; there is only one mesogastric spine; and one spine on the branchial margin, posterolaterally. While these differences are sufficient to justify considering this specimen a distinct species, we feel a detailed description should wait until more material is available.

Distribution. — Indo-West Pacific: East Africa to the Philippine Islands and Japan.

*Rochinia riversandersoni* (Alcock, 1895)

*Scyramathia riversandersoni* Alcock, 1895: 203-204. — Alcock & Anderson, 1896: pl. 22 figs. 2, 4, 4a. — Doflein, 1904: 84-85, pl. 27 figs. 8-11.

*Rochinia riversandersoni*. — Serène & Lohavanijaya, 1973: 58, figs. 129-132, pl. 12A. — Yaldwyn & Dawson, 1976: 98-101, figs. 6-9. — Griffin, 1976: 211.

Material examined. — 2 ♀♀ (1 ovig.), postrostral cl. 8.5 mm, ovig. ♀, postrostral cl. 11 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 170, Ceram, 03°37.7'S 131°26.4'E, 924 m, deep sea trawl, fine grey mud, 26 August 1899; 2 specs.

Remarks. — In these specimens the epibranchial spine is long and slender (equal to 7/8 carapace width) but on either side of the cardiac spine there are two tubercles, not two spines as in the specimens figured by other authors, or in the specimens examined from the Philippine Islands (Griffin, 1976).

The postorbital lobe is continuous with the hepatic spine; there is a medial metagastric tubercle rather than a spine, and on either side of it a smaller protogastric tubercle. The preorbital spine is apically blunt.

It is possible that all the specimens which have been reported by various authors under this name are not conspecific and that these specimens too may represent a new species.

Distribution. — East Africa, India, Ceram, South China Sea, Philippine Islands, Kermadec Islands, New Zealand.

*Rochinia sagamiensis* (Gordon, 1931) new combination  
(Fig. 62g,h)

*Pugettia brevirostris*. — Parisi, 1915: 287-289, text fig. 2, pl. 7 fig. 1. (Not *Hyastenus brevirostris* Doflein, 1904 = *Rochinia brevirostris* (Doflein).)

*Pugettia sagamiensis* Gordon, 1931: 557-558, figs. 35, 36c. — Sakai, 1938: 253-254, pl. 25 fig. 3; 1965a: 73-74, pl. 33 fig. 2; 1976: 195, pl. 69 fig. 2.

Material examined. — 1 ♂, 16.5 mm.

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Mortensen Pacific Expedition: Japan, Sagami Sea, 720 m, 1-4 June 1914; 1 spec.

Remarks. — Parisi (1915) considered a specimen of this species from Sagami Bay to be the same as *Hyastenus brevirostris* Doflein but placed it in *Pugettia*. In 1931 Gordon named the species and distinguished it from *Pugettia brevirostris*. Both species differ from most species of *Pugettia* in having large conical elevations on the carapace. The first pleopod of the male has not previously been described: it is not of the scyiform type present in species of *Pugettia*—the apex is truncate, laterally subacute and medially rounded without any medial lobes. There is a similar kind of pleopod in species of *Rochinia* and we have therefore removed this species from *Pugettia* and included it with other species having a similar pleopod in the pisine genus *Rochinia*.

This specimen agrees well with those previously described, but it is not as large as those recorded by Parisi or Sakai. The cheliped palm is not enlarged and the carapace tubercles are not so strongly developed.

This species is similar to *R. brevirostris*, *R. crosnieri* and *R. makassar*, but is distinguished from them by the merus of the first ambulatory leg which is trigonal rather than cylindrical and by the postorbital and hepatic lobes which are connected to form a single wing-like lobe, while in the other three species the postorbital and hepatic lobes are only connected basally and in *R. crosnieri* and *R. makassar* the hepatic lobe is narrow. It is further distinguished from *R. crosnieri* and *R. makassar* by the epibranchial angle having a broad conical lobe rather than being smooth or having a tubercle.

Distribution. — Endemic to Japan.

*Rochinia stimpsoni* (Miers, 1886) new combination  
(Fig. 63a,b)

*Oxypleurodon stimpsoni* Miers, 1886: 38-39, pl. 6 figs. 1, 1a-c.

*Sphenocarcinus stimpsoni*. — Sakai, 1938: 286-287, pl. 29 fig. 3; 1976: 203, pl. 72 fig. 1, pl. 73 fig. 1. — Griffin, 1976: 215.

Material examined. — 8 ♂♂, 11 ♀♀ (5 ovig.), 1 juv., 6.5-22.5 mm, smallest ovig. ♀, 15 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Mindanao, 07°30'N 123°30'E, 3 miles (~ 5 km) SW. of Tucaran, ca. 600 m, Sigsbee trawl, sand, 10 March 1914; 6 specs.

Danish Kei Islands Expedition: Stn. 4, Kai Is., 05°31'40"S 132°26'E, 250 m, trawl, sand, 3 April 1922; 1 spec. — Stn. 32, Kai Is., 05°32'20"S 132°34'E, 260 m, trawl, sand, 22 April 1922; 1 spec. — Stn. 45, Kai Is., 05°48'30"S 132°14'E, 300 m, trawl, sand, 1 May 1922; 1 spec. — Stn. 46, Kai Is., 05°47'20"S 132°13'E, 300 m, trawl, clay, mud, 2 May 1922; 3 specs — Stn. 49, Kai Is., 05°37'10"S 132°23'E, 245 m, trawl, sand, 3 May 1922; 2 specs. — Stn. 62, Kai Is., 05°29'25"S 132°50'E, 290 m, trawl, sand shells and concretions, 15 May 1922; 1 spec.

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Queensland, 1.6-3.2 km WNW. of Raine I., 250 m, prawn trawl, coll. J. Paxton, 12 February 1979; 5 specs. (AM P.29928).

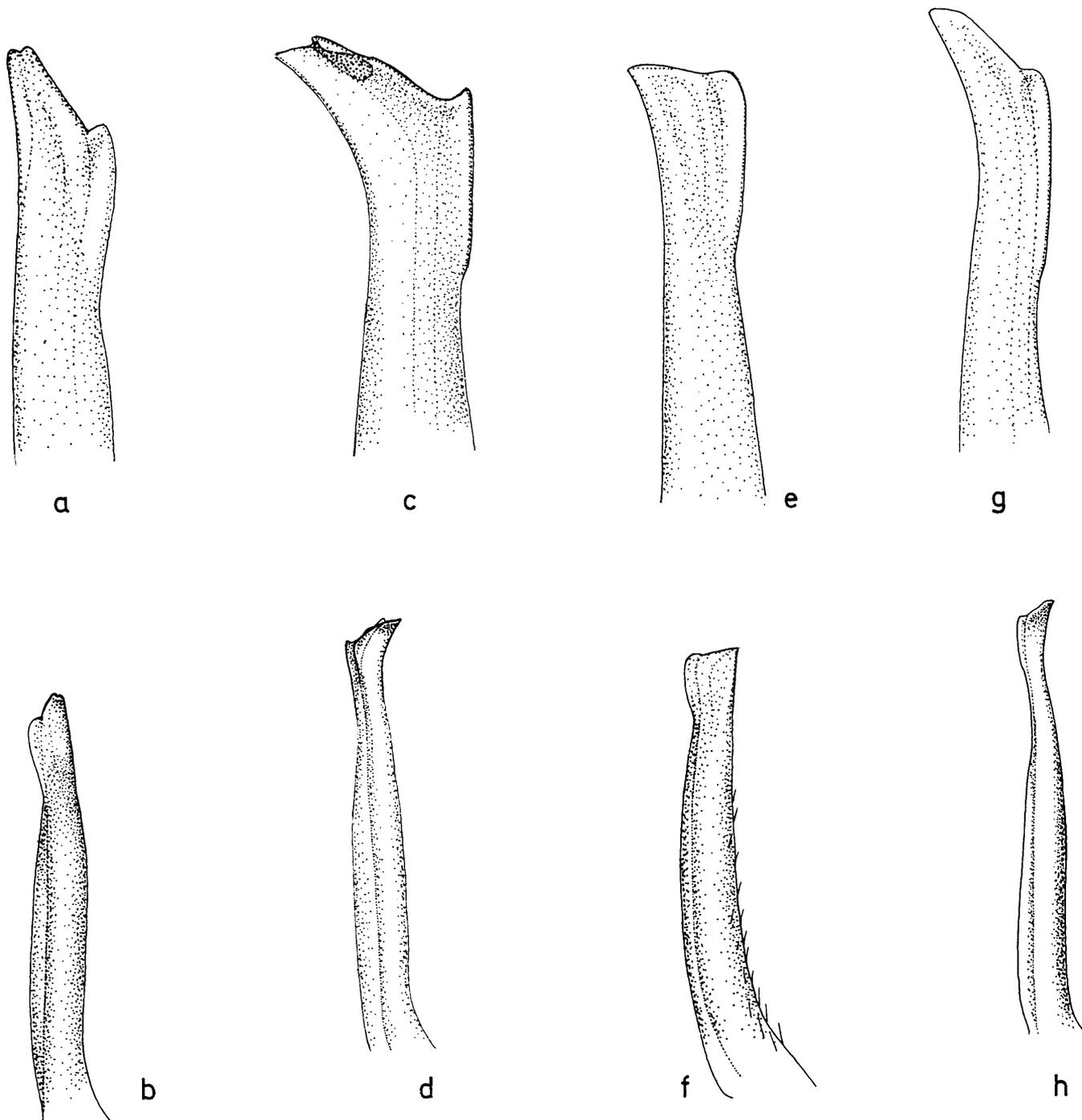


Fig. 62. Left first pleopod of male of *Rochinia globulifera* (11.5 mm, Java, ZMC) (a) sternal tip of pleopod, (b) abdominal view of same; *R. brevirostris* (22.5 mm, ZSC 4047/10) (c) sternal tip of pleopod, (d) abdominal view of same; *R. mosaica* (13 mm, AM P. 11743) (e) sternal tip of pleopod, (f) abdominal view of same; *R. sagamiensis* (16.5 mm, Sagami Sea, ZMC) (g) sternal tip of pleopod, (h) abdominal view of same.

Remarks. — In this series the rostral spines vary from barely half to nearly two thirds postrostral carapace length and are weakly divergent or subparallel; only in four specimens are they curved outwards as strongly as shown by Miers (1886).

The surface of the islets is granular; the elongate gastric islet reaches anteriorly to level with the postorbital lobe or may extend to the front of the eyestalk. The hepatic islet is not always confluent with the postorbital lobe even in adults. In juvenile specimens the islets are more widely separated but

they are the same shape and are just as clearly distinguished as in the adults.

The meri of the ambulatory legs are carinate as in *R. aurorae*, *R. cuneata* (Wood-Mason) and *R. carinata*. The carpus has two dorsal ridges the medial being the larger.

*R. stimpsoni* is distinguished from other species of *Rochinia* with large islets on the carapace by having the rostral spines separate and only one large islet on the dorsal branchial region. The rostrum is fused for the basal half or only apically

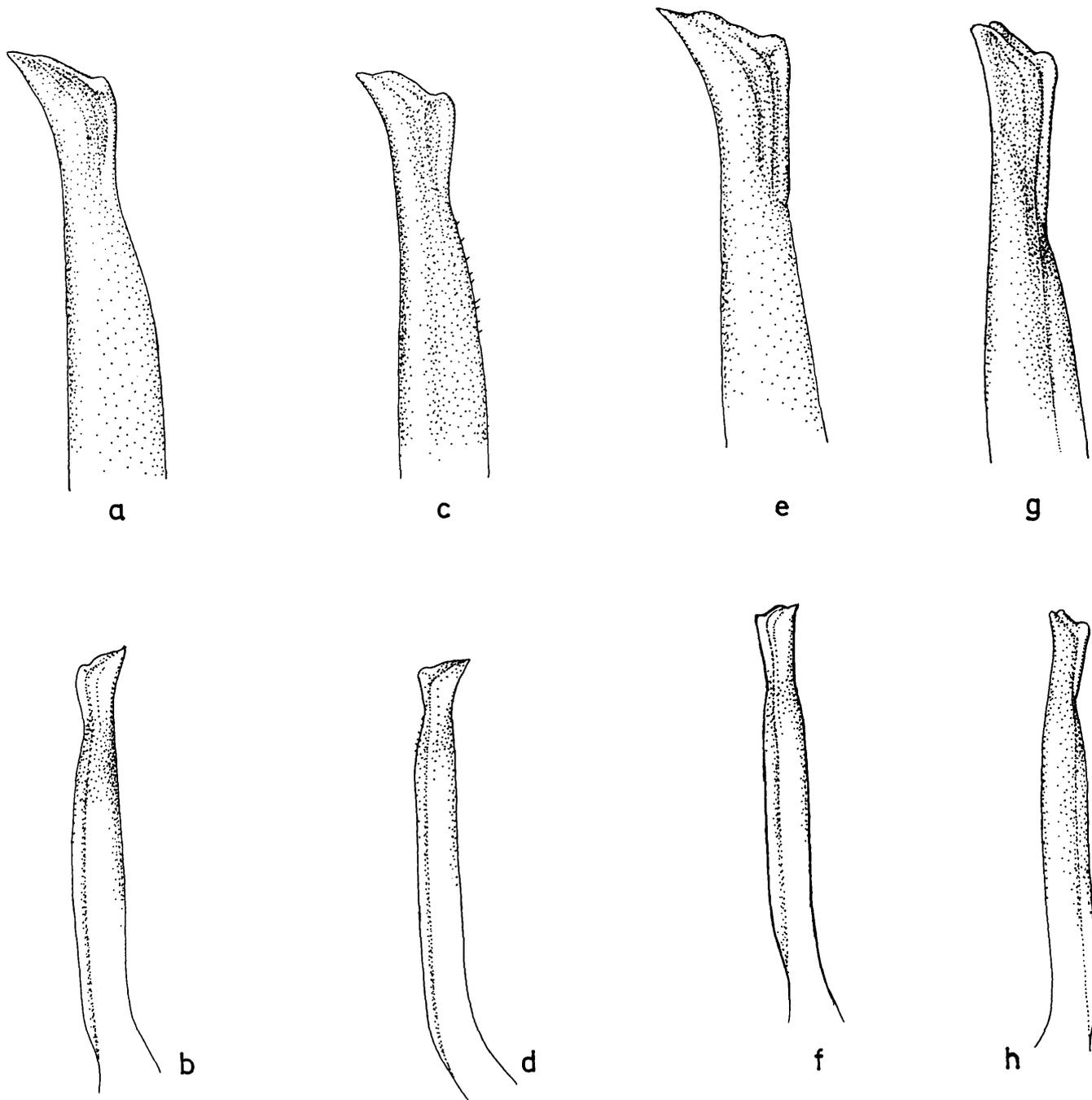


Fig. 63. First pleopod of male of *Rochinia stimpsoni* (21 mm, Kai Is., ZMC) (a) sternal tip of left pleopod, (b) abdominal view of same; *R. luzonica* (37 mm, off Manado, ZMC) (c) sternal tip of left pleopod, (d) abdominal view of same; *R. velutina* (22 mm, Kai Is., ZMC) (e) sternal view of left pleopod, (f) abdominal view of same; *R. nodosa* (20 mm, Japan, ZMC) (g) abdominal tip of right pleopod, (h) abdominal view of same.

bifid in the three other species with a single dorsal branchial islet (*R. aurorae*, *R. aurita* and *R. cuneata*) and in the three species with separate rostral spines (*R. bidens*, *R. carbuncula* and *R. luzonica*) there are at least two islets on the dorsal branchial region.

This is the first record of this species from Australian waters.

Distribution. — Sri Lanka, N. Australia, Kai Islands, Philippine Islands and Japan.

*Rochinia suluensis* new species  
(Figs. 60, 64a,b)

Material examined. — 2 ♂♂, 1 ♀, 10.5-11.5 mm.

Holotype. — Male, cl. 11 mm, Bougainville Strait, W. of Waigeo I., 00°29.2'S 130°5.3'E, 469 m, dredge, coarse sand and broken shells, 15 August 1899; 'Siboga' Expedition, Stn. 156; Zoological Museum, Amsterdam.

Paratypes as follows:

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'Siboga' Expedition: Stn. 105, Sulu Archipelago, 06°8'N 121°19'E, 275 m, dredge, coral bottom, 4 July 1899; 1 spec. — Stn. 156, data as for holotype; 1 spec.

Description. — Carapace pyriform, carapace width about three quarters (0.7-0.75) postrostral carapace length, surface smooth with a fine tomentum.

Rostral spines slender, divergent, length about half postrostral carapace length.

Orbital eave moderately expanded, preorbital angle produced forward into a subacute spine; lateral margin of eave nearly straight; a small weak antorbital angle; postorbital lobe narrow in lateral view (length about twice basal width), laterally flattened, separated from eave by a U-shaped hiatus. Eyestalks short; cornea terminal.

Hepatic margin elevated, adjacent to base of postorbital lobe anteriorly and surmounted dorsally by a sharp spine (largest carapace spine) directed outwards and slightly upwards. Branchial margin with a minute tubercle anteriorly, just above carapace margin, and a small epibranchial tubercle.

Gastric regions elevated, smooth. Cardiac region elevated but without a tubercle or spine. Dorsal branchial regions smooth. Intestinal region with a medial, backwardly produced tubercle on posterior carapace margin.

Basal antennal article smooth, surface with a shallow, central longitudinal groove; anterolateral angle produced obliquely forward as a sharp spine; lateral margin weakly concave, proximal angle rounded; a tubercle lateral to green gland.

Pterygostomian region smooth, margin with three or four blunt, compressed tubercles; anterolateral angle of mouthfield produced and rounded.

Third maxilliped smooth, anteromedial angle of ischium slightly overlapping posteromedial angle of merus; anterolateral angle of merus produced and rounded.

Cheliped merus of male trigonal; a strong sharp, terminal spine dorsally, separate from carina; carpus with two sharp ridges, one dorsally and one ventrally on inner face; palm dorsally sharp in proximal half, length two and a half times height; fingers slender, more than half (0.6) length of palm; a small proximal gape without teeth, then gape narrowing with a few irregular teeth on both fingers.

Ambulatory legs smooth, merus of first leg with a small acute terminal spine, merus of fourth leg with a blunt terminal tubercle; dactyl of fourth leg with two very small ventral teeth distally; first leg about one and a half times (1.4) postrostral carapace length, fourth leg less than three quarters (0.7) of first.

Male sternum smooth, a shallow depression on each side in front of abdominal fossa; shallow intersegmental grooves between remaining segments.

Male abdomen of seven segments, smooth, third segment about one and a half times as wide as sixth segment; sixth segment twice as wide as long; seventh segment as wide as long.

Female abdomen of seven segments, smooth.

First pleopod of male straight, broad, narrowing only slightly before widening to a truncate apex; apex medially rounded, laterally subacute; aperture terminal.

Female gonopore a simple circular aperture opening ventrally.

Remarks. — In the male from the Sulu Archipelago the hepatic margin below the spine is not so strongly elevated as in the holotype; there is a short epibranchial spine rather than a tubercle; and on the cheliped carpus there are two compressed tubercles on the inner side of the dorsal ridge.

This species is similar to *R. moluccensis* and both are distinguished from other species of *Rochinia* (except *R. tomentosa*) by the presence of a small hepatic spine and a small epibranchial tubercle. *R. suluensis* is distinguished from *R. moluccensis* by the postorbital lobe which is laterally flat and separate from the hepatic spine while in *R. moluccensis* the postorbital lobe is laterally keeled and confluent with the hepatic spine. *R. suluensis* is distinguished from *R. tomentosa* by the presence of a conical spine on the hepatic margin, rather than a flat, glabrous islet as in *R. tomentosa*.

Distribution. — Halmahera Sea (Bougainville Strait) and Sulu Archipelago.

*Rochinia tomentosa* new species  
(Figs. 61, 64g,h)

Material examined. — 1♂, 9 mm, 1♀, 7.5 mm.

Holotype. — Male, cl. 9 mm, Bougainville Strait, W. of Waigeo I., 00°29.2'S 130°5.3'E, 469 m, dredge, coarse sand and broken shells, 15 August 1899, 'Siboga' Expedition, Stn. 156; Zoological Museum, Amsterdam.

Paratype. Female, adult, cl. 7.5 mm, N. Makassar Strait, Pulu Kaniungan Ketjil, 11 m, shore exploration, coral, 21 June 1899, 'Siboga' Expedition, Stn. 89; Zoological Museum, Amsterdam.

Description. — Carapace pyriform, width about three quarters (0.7-0.8) postrostral carapace length; surface covered with a short dense tomentum of clubbed setae; surface beneath tomentum smooth, regions only weakly defined.

Rostral spines slender, weakly divergent, apically sharp, length about a quarter (0.28) postrostral carapace length.

Orbital eave moderately expanded; preorbital spine sharp, directed obliquely forwards; margin of eave weakly concave with a slight convexity at the antorbital level; postorbital lobe separated from eave by a U-shaped hiatus; postorbital lobe laterally flat, smooth, glabrous, Eyestalks short, slender, cornea terminal.

Hepatic margin with a smooth, glabrous 'islet' quite separate from postorbital lobe; 'islet' laterally flat or centrally depressed, ventral edge rounded, dorsal edge produced upward as a spine.

Branchial submargin with one or two small, glabrous tubercles anteriorly; no epibranchial tubercle.

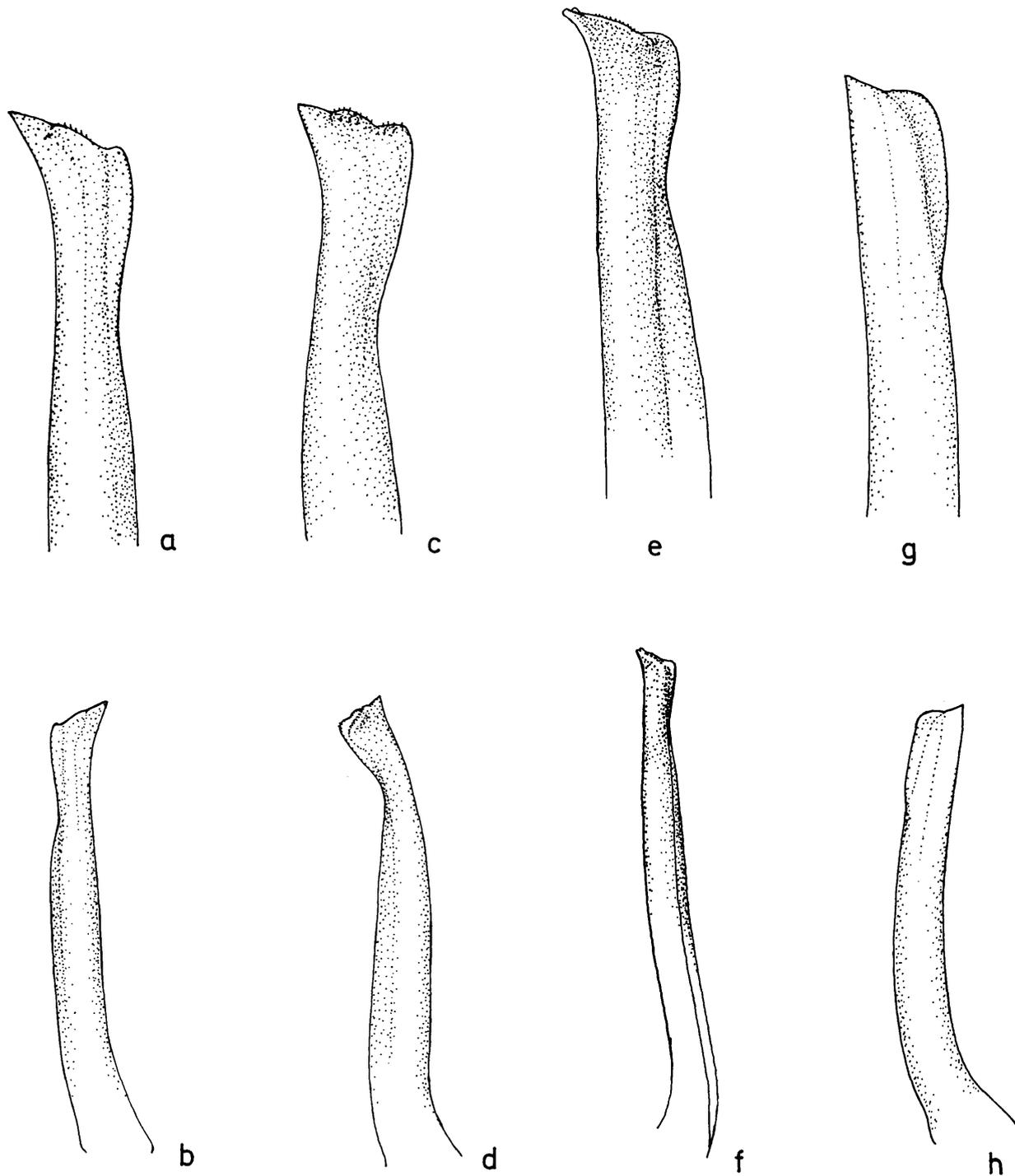


Fig. 64. First pleopod of male of *Rochinia suluensis* (holotype) (a) sternal tip of left pleopod, (b) abdominal view of same; *R. moluccensis* (paratype) (c) sternal tip of left pleopod, (d) abdominal view of same; *R. carinata* (holotype) (e) abdominal tip of right pleopod, (f) abdominal view of same; *R. tomentosa* (holotype) (g) sternal tip of left pleopod, (h) abdominal view of same.

Gastric regions elevated, smooth, only a weak cervical groove laterally. Cardiac region smooth, not elevated, weakly defined; dorsal branchial region and intestinal region smooth.

Basal antennal article smooth, a shallow longitudinal groove centrally; anterolateral angle produced forward as a short blunt (holotype) or sharp (paratype) spine; lateral margin straight, faintly crenulate, proximal angle rounded; medial margin produced slightly over antennal fossa; a blunt tubercle just lateral to green gland.

Pterygostomian region smooth, margin with three glabrous, blunt, compressed tubercles.

Third maxilliped smooth; anterolateral angle of merus only moderately produced and rounded.

Cheliped of male only slightly longer (1.2) than postrostral carapace length; merus with dorsal and ventral inner edges carinate, ventral outer edge sharp in distal third, a compressed tubercle at proximal third and at distal third; no terminal spine distinct from carina; carpus with two carinate ridges, an

outer dorsal ridge and a ventral ridge on inner face. Palm about one and a third (1.35) as long as high, dorsal margin carinate in proximal half, blunt distally, ventral margin rounded; fingers about two thirds (0.65) length of palm, a moderate gape between fingers in proximal half, two or three low teeth on both fingers in gape, and similar teeth on both fingers distally. Cheliped of adult female with merus dorsally blunt and a sharp terminal spine; inner ventral edge sharp, outer ventral edge blunt with two small tubercles.

Ambulatory legs slender, smooth, merus of first leg with a terminal tubercle surmounted by a spine; dactyl of third leg with two or three very small ventral teeth distally; first leg of male nearly one and a half (1.4) times postrostral carapace length, third leg about two thirds (0.6) length of first.

Sternum of male smooth, a shallow depression on either side of a narrow ridge in front of abdominal fossa.

Male abdomen of seven segments, smooth; third segment less than twice (1.8) as wide as sixth segment; sixth segment twice as wide as long; seventh segment as wide as long.

Female abdomen of seven segments, smooth.

First pleopod of male broad, straight, apically truncate; medial angle of anterior margin rounded, lateral angle subacute and produced slightly forward; aperture appears to be terminal.

Female gonopore a simple, circular aperture, opening ventrally.

Remarks. — This species is distinguished from all other known species of *Rochinia* by its smooth carapace with the regions only weakly defined. The gastric, cardiac and intestinal regions are smooth and there is no epibranchial spine or tubercle.

Distribution. — Halmahera Sea (Bougainville Strait), Makassar Strait.

*Rochinia velutina* (Miers, 1886)  
(Fig. 63e,f)

*Pugettia velutina* Miers, 1886: 41-42, pl. 6 figs. 2, 2a,b.

*Pugettia veltima* (sic). — Yokoya, 1933: 153.

*Rochinia velutina*. — Serène & Lohavanijaya, 1973: 58-59, figs. 133-137, pl. 12 B,C.

*Sphenocarcinus velutinus*. — Griffin, 1976: 215.

Material examined. — 1♂, 1 ovig. ♀, 2 juv., 5.5-22.0 mm, ovig. ♀, 15.5 mm.

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Danish Kei Islands Expedition: Stn. 4, Kai Is., 05°31'40"S 132°26'E, 250 m, trawl, sand, 3 April 1922; 3 specs. — Stn. 50, Kai Is., 05°34'S 132°25'40"E, 233 m, trawl, sand, 4 May 1922; 1 spec.

Remarks. — These specimens agree closely with Miers' figure of *Pugettia velutina*. The hepatic lobe is flattened, with a dorsally directed point and there is a flattened lobe on the subbranchial region. The epibranchial spine is strong, directed

outwards and covered with short hair. The dorsal protuberances are in the form of tubercles not 'islets'. The first pleopod of the male is of the same type as in other species of *Rochinia*.

Distribution. — Kai Islands, Philippine Islands, South China Sea, Japan.

*Scyra* Dana, 1851

Type species. — *Scyra acutifrons* Dana, 1851, by monotypy.

Remarks. — This genus contains two species — one, the type, from the East Pacific (Alaska to Mexico) and the other, *S. compressipes* Stimpson from the western Pacific (Japan). In these two species the rostral spines are broad and taper to a point. There is a preorbital spine on the eave and the eave is separated from the postorbital lobe by a narrow slit. The basal antennal article is moderately broad, subrectangular and separated by a broad hiatus from the postorbital lobe. The cheliped merus of the male differs in the two species — in *S. acutifrons* the merus is subcylindrical and tuberculate while in *S. compressipes* it is prismatic with cristate margins.

The first pleopod of the male of *S. acutifrons* is scyroid and has been figured by Garth (1958) but the pleopod of *S. compressipes* hasn't been figured or described.

Distribution. — Northern Pacific.

*Thusaenyis* new genus

Type species. — *Hyastenus calvarius* Alcock, 1895, by present designation.

Description. — Carapace pyriform, surface only sparsely tuberculate. Rostrum of two short spines generally less than one third length of carapace. Orbit comprising above an eave separated by a narrow hiatus from postorbital lobe; no intercalated spine. Supraorbital eave strongly produced, preorbital lobe a broad blunt lobe; antorbital lobe weakly produced, rounded. Postorbital lobe at least moderately produced, posterior margin lobed or keeled, anterior margin with a lobe proximally. Basal antennal article moderately broad, bearing a strong acute anterolateral spine, separated by a notch from anteromedial base bearing peduncle of antenna; lateral margin of article variously produced or lobed, lobe sometimes extending dorsally; article broadly separated from postorbital lobe. Abdomen of seven segments in male.

First pleopod of male simple, twisted distally and (except in *T. irami*) narrowing abruptly at about distal sixth, long setae on at least distal portion.

Remarks. — This genus contains five species: *T. calvarius* (Alcock), *T. irami* (Laurie), *T. minimus* (Rathbun), *T. orbis* (Rathbun) and *T. pehlevi* (Laurie), previously included in

*Hyastenus*. The strongly produced basal antennal article with anterior notch and the broad but weakly lobed supraorbital eave distinguish the species of this new genus from others of the '*Hyastenus*' group.

*Thusaenys* species are distributed through Indonesia and the Philippines extending south to northern Australia and west to Sri Lanka and the Gulf of Manaar; one species is known from Fiji in the Pacific.

The name of the new genus is derived, by rearrangement of the letters, from *Hyastenus*; the gender is masculine as is *Hyastenus*.

Distribution. — Indo-West Pacific.

#### KEY TO SPECIES OF *THUSAENYS*

- 1 Anterior margin of postorbital lobe with a prominent proximal lobe; rostrum length at least  $\frac{1}{3}$  postrostral carapace length ..... 2  
 — Anterior margin of postorbital lobe sinuous; rostrum length  $\frac{1}{4}$  to  $\frac{1}{3}$  postrostral carapace length ..... 4  
 2( 1) Margin of supraorbital eave strongly bilobed; lateral margin of basal antennal article concave or notched behind anterolateral lobe; carapace with many low tubercles ..... *T. pehlevi*  
 — Margin of supraorbital eave straight or weakly concave; lateral margin of basal antennal article straight or convex behind anterolateral lobe; carapace smooth or with a few low tubercles... 3  
 3( 2) Lateral margin of basal antennal article strongly produced, convex; intestinal region with a short but strong medial spine ... *T. calvarius*  
 — Lateral margin of basal antennal article straight or weakly convex; intestinal region with a low tubercle ..... *T. irami*  
 4( 1) Lateral edge of basal antennal article straight behind anterolateral spine; anterolateral angle of mouthfield oblique; two compressed lobes on pterygostomian margin ..... *T. orbis*  
 — Lateral edge of basal antennal article concave or notched behind anterolateral spine; anterolateral angle of mouthfield rounded; two blunt conical tubercles on pterygostomian margin..... *T. minimus*

*Thusaenys calvarius* (Alcock, 1895), new combination  
(Figs. 65d, 66a,b)

*Hyastenus calvarius* Alcock, 1895: 213. — Alcock & Anderson, 1896: pl. 21 fig. 2. — Balss, 1938: 23.

Material examined. — 1♂, 5♀ (1 ovig.), 11-17.5 mm, ovig. ♀, 14 mm.

#### ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: ?Haingsisi; 1 spec.

North coast of Sumatra, K. S. Cableschip Telegraaf; 1 spec. (ZMA De. 100.802 (in part), det. Ihle as *Hyastenus* sp.).

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Danish Kei Islands Expedition: Stn. 16, Kai Is., 05°32'20"S 132°37'E, 50 m, dredge, sand with *Lithothamnion*, 12 April 1922; 1 spec. — Off Neira Banda, ca. 100-120 m, dredge, sand, stones, 5 June 1922; 1 spec. — Stn. 67, Java Sea, 05°48'S 106°12'E, 38 m, trawl, sand, 27 July 1922; 1 spec.

#### NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15'S 128°8'E, 36-47 m, dredge hauls 7-9, coral, sponge, coarse sand, *Lithothamnion* and rubble, 1-2 June 1970; 1 spec.

Remarks. — This species is distinguished by the broad basal antennal article, the prominent lobe on the anterior margin of

the postorbital lobe and the strong upright spine on the intestinal region.

The rostral spines are divergent and range from about half the postrostral carapace length to  $\frac{2}{3}$  the postrostral carapace length in an adult male (16.5 mm).

The supraorbital eave is relatively short and the preorbital angle is produced laterally and slightly upturned. The anterior border of the postorbital lobe has a very strong lobe proximally.

The gastric region is elevated. There are no mesogastric tubercles but there is sometimes a low rounded protogastric tubercle. On the branchial region there is only a very small epibranchial spine.

On the intestinal region, near the posterior margin, there is a strong upright spine curved forwards at the tip.

The basal antennal article is very broad for a species in this subfamily, its greatest width exceeding the length. The curved spine on the anterolateral angle of the article is separated by a shallow hiatus from the base of the first free segment of the flagellum; the lateral margin is produced to form a broad rounded lobe immediately posterior to the spine. The suborbital tooth is compressed laterally and the orbit is completely open below. There is a slender curved ridge extending on to the epistome from the base of the antennal fossa.

The anterolateral angle of the merus of the third maxilliped is quite strongly produced and rounded.

The palm of the chela of the adult male (16.5 mm) is twice as long as high with a tubercle at the base of the dactyl. The fingers gape moderately and there is a large tooth on the dactyl in the gape.

The dactyls of the ambulatory legs are slender and armed ventrally with small spines increasing in size distally.

The first pleopod of the male tapers abruptly at about the distal sixth and curves slightly outwards. Below this narrow tip there are long setae on the medial edge, and the most distal of these setae are as long as the narrow pleopod tip.

Distribution. — Fiji, Kai Is., Banda, Ceram, Java Sea, Andaman and Maldiv Islands.

*Thusaenys irami* (Laurie, 1906), new combination  
(Fig. 66c,d)

*Halimus irami* Laurie, 1906: 379-380, pl. 1 figs 4, 4a.

*Hyastenus irami*. — Rathbun, 1924: 5.

Material examined. — 3♂♂, 4♀♀, 8-15 mm.

#### ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 299, S. Timor, SE. of Roti I., 10°52.4'S 123°01.1'E, 34 m, dredge, reef exploration and diving, mud, coral and *Lithothamnion*, 27/29 January 1900; 1 spec. — Stn. 315, Flores Sea, Pater-noster Is., anchorage E. of Sailus Besar, up to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 2 specs.

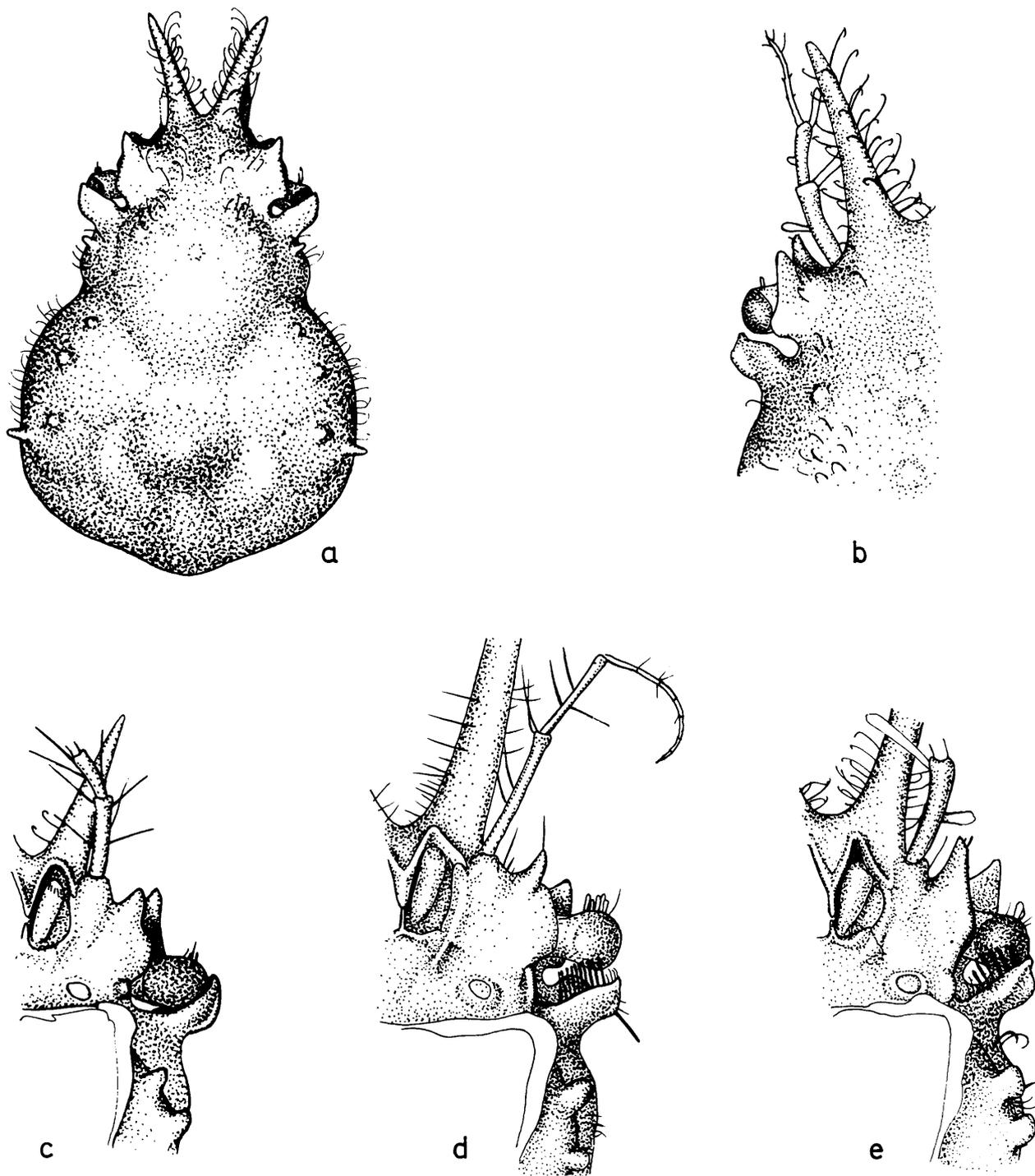


Fig. 65. *Thusaenys minimus* (female, 7.5 mm, AM P.29895) (a) carapace, dorsal view; *T. orbis* (male, 10 mm, Sulu Archipelago, ZMC) (b) left orbit, dorsal view; *T. minimus* (as above) (c) left orbit, ventral view; *T. calvarius* (male, 16.5 mm, Banda, ZMC) (d) left orbit, ventral view; *T. orbis* (as above) (e) left orbit, ventral view.

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Western Australia: north W. A., Broome, coll. B. Bardwell; 1 spec. (AM P.29899, dry, det. M. Ward). — Ninety Mile Beach, 25 m, from pearl shells, coll. B. Bardwell; 1 spec. (AM P. 29897, dry).

Queensland: Lizard I., Watsons Beach, under rocks below low tide, coll. H. Tranter, 3 May 1977; 1 spec. (AM P.29896).

Papua New Guinea: Port Moresby, 16/17 October 1932; 1 spec. (AM P.29898, dry, det. M. Ward).

Remarks. — This species is close to *T. phevli* and *T. orbis* in general appearance and the shape of the basal antennal article, but those two species have a tuberculate carapace, while that of *T. irami* is smooth. Also the first pleopod of the male of *T. irami* does not taper distally as it does in the other two species.

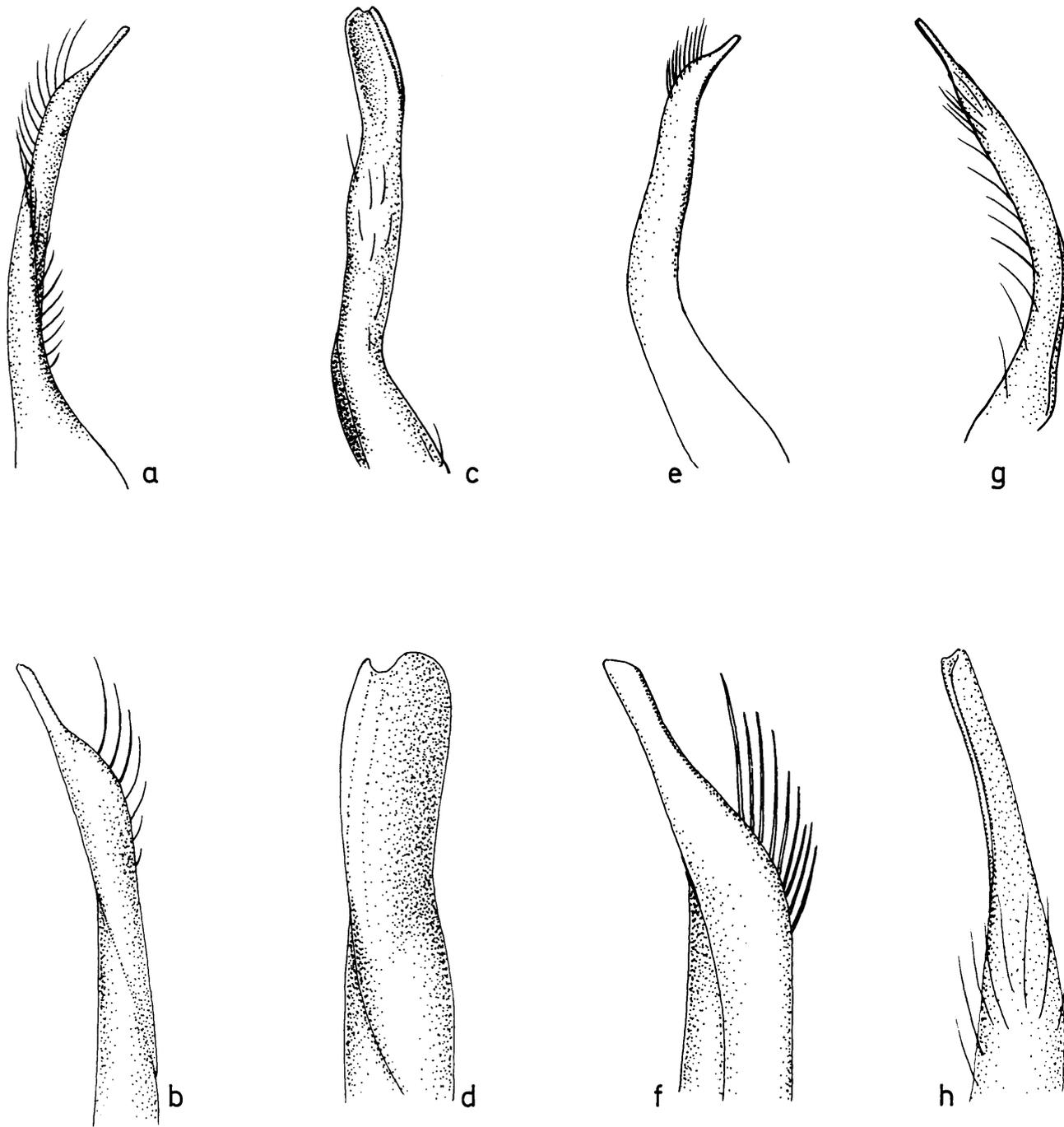


Fig. 66. First pleopod of male of *Thusaenys calvarius* (16.5 mm, Banda, ZMC) (a) abdominal view of left pleopod, (b) sternal tip of same; *T. irami* (13.5 mm, S. Timor, ZMA) (c) abdominal view of left pleopod, (d) sternal tip of same; *T. orbis* (10 mm, Sulu Archipelago, ZMC) (e) abdominal view of left pleopod, (f) sternal tip of same; *T. pehlevi* (11 mm, Sri Lanka, ZSC) (g) abdominal view of right pleopod, (h) abdominal tip of same.

The small tooth or lobe, on the posterior margin of the upper orbit hiatus, seems to be, as Rathbun indicated, a part of the postorbital lobe, and not an intercalated spine as Laurie suggested. In the small immature female (8.0 mm) the antorbital lobe is barely produced, and this small tooth is more separate from the postorbital lobe than it is in the larger specimens.

There is a very small epibranchial spine which may be concealed in the tomentum and a low tubercle on the intestinal region.

The basal antennal article is very broad, and the anterolateral angle is produced into a strong, straight spine; the lateral margin is convex (as figured by Laurie, pl. 1 fig. 4a) in three specimens, but much straighter in the other four.

The palm of the cheliped of the largest male has a tubercle midway along its dorsal margin, the fixed finger is slightly excavate and there is a large proximal tooth on the dactyl.

The first pleopod of the male expands slightly at the rounded tip, and the groove lies near the lateral margin on the abdominal surface.

Distribution. — Northeast and northwest Australia, Papua New Guinea, Timor, Sumbawa, Sri Lanka (Ceylon).

*Thusaenys minimus* (Rathbun, 1924), new combination  
(Fig. 65a,c)

*Hyastenus minimus* Rathbun, 1924: 4-5, fig. 1. — Griffin, 1966b: 281 (in key).

Material examined. — 2 ♀♀, 7.0, 7.5 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

Western Australia: Ninety Mile Beach, 25 m, from pearl shells, coll. B. Bardwell; 2 specs. (AM P. 29895, dry).

Remarks. — These specimens agree well with the description given by Rathbun and with type material (USNM 56391, ♂, 4.4 mm; USNM 56392, ovig. ♀ 7.0 mm; Cape Jaubert, W. A.) examined by one of us (D.J.G.G.).

This species is similar in general appearance to *T. orbis* (Rathbun) but is distinguished from that species by the lateral edge of the basal antennal article which is concave behind the anterolateral spine (straight in *T. orbis*); the anterolateral angle of the mouthfield is rounded (oblique in *T. orbis*); the tubercles on the pterygostomian margin are cylindrical and blunt (compressed lobes in *T. orbis*); and the mesogastric region is smooth except for one low anterior tubercle (three mesogastric tubercles in *T. orbis*).

Distribution. — Known only from northern Western Australia.

*Thusaenys orbis* (Rathbun, 1916), new combination  
(Figs. 65b,e, 66e,f)

*Hyastenus orbis* Rathbun, 1916: 544-545. — Griffin, 1976: 192-194, fig. 4(a).

Material examined. — 3 ♂♂, 4 ♀♀, 6-10 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 109, Sulu Archipelago, anchorage off Pulu Tongkil (06°02' N 121°51' E), 13 m, dredge, towntnet, *Lithothamnion*, 5/6 July 1899; 2 specs.

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Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, ca. 36 m, dredge, *Lithothamnion*, 17 March 1914; 2 specs. — Sulu Archipelago, off Jolo, off Marungas, 36-54 m, dredge, sand, coral, 19 March 1914; 3 specs.

Remarks. — These specimens agree well with the holotype (USNM 48216, ovig. ♀, 10.2 mm). The preorbital angle of the supraorbital eave is acute and produced forward and upward. On the gastric regions, the three mesogastric and transverse row of four protogastric tubercles are distinct, but the pair of tubercles at the base of the rostrum are less developed in some of the specimens. The cardiac region is elevated and conical but unarmed. On the branchial margin

there is an arc of three tubercles and a short epibranchial spine.

The basal antennal article is broad, there is a broad acute spine directed forward on the anterolateral angle, and the lateral edge is weakly convex.

There are two flat spines on the pterygostomian margin and a similar spine in line with them on the anterior branchial submargin.

This is the first record of a male of this species. The palm of the chela is somewhat inflated, about twice as long as high, and there is a distal tubercle near the insertion of the dactyl. There is a small proximal gape between the fingers.

The first pleopod of the male is narrowed distally, the tip being about half as wide as the rest of the pleopod. At the base of the tip on the medial edge, there are long setae which reach or exceed the apex.

Distribution. — Known only from the Sulu Archipelago, Philippine Islands.

*Thusaenys pehlevi* (Laurie, 1906), new combination  
(Fig. 66g,h)

*Halimus pehlevi* Laurie, 1906: 378-379, pl. 1 figs. 3, 3a.

Material examined. — 1 ♂, 11 mm.

ZOOLOGICAL SURVEY OF INDIA, CALCUTTA

Sri Lanka, Pearl Banks, coll. T. Southwell, 1911; 1 spec.

Remarks. — This species is distinguished by the supraorbital eave, which is divided into two lobes, and by the deep notch on the anterior border of the postorbital lobe. The eave is also divided in *Giranauria verrucosipes*, but in that species there is an intestinal spine, a large cardiac spine and two strong spines on the branchial region. In *T. pehlevi* there are only low tubercles on the carapace. This species resembles *T. calvarius* in the shape of the postorbital lobe, but in that species the supraorbital eave is only lightly notched and the carapace is smooth.

Our single specimen agrees well with that described and figured by Laurie. The basal antennal article is slightly wider than shown in Laurie's figure, but the lateral margin is the same shape. The compressed suborbital tooth lies close to the base of the basal antennal article.

The first pleopod of the male narrows slightly in the distal quarter and the apex is rounded. In *T. calvarius* and *T. orbis* the pleopod also narrows distally, but in those species there is a group of long setae on the medial edge at the base of the tip which is lightly curved outwards.

Distribution. — Sri Lanka (Pearl Banks) and Gulf of Manaar.

*Tylocarcinus* Miers, 1879

Type species. — *Cancer styx* Herbst, 1803, by original designation.

**Remarks.** — The upper orbit in species of this genus comprises an adjacent supraorbital eave, intercalated spine and postorbital lobe. The proximal part of the basal antennal article is adjacent to the postorbital lobe. The first pleopod of males of species of *Tylocarcinus* is straight with a large triangular lobe on the medial edge at the apex.

*T. gracilis* Miers is here shown to be a synonym of *Chorinus dumerilii* H. Milne Edwards. In 1978 Dai et al. described *T. sinensis* which we know only from the literature.

**Distribution.** — Indo-West Pacific.

#### KEY TO SPECIES OF TYLOCARCINUS

- 1 Merus of first ambulatory leg of adult male with four to five small tubercles dorsally behind the terminal spine and two tubercles proximally on outer face; merus of fourth ambulatory leg smooth ..... *T. sinensis*<sup>28a)</sup>
- Merus of first ambulatory leg of adult male with three or more dorsal spines as well as the terminal spine and two to four tubercles along the length of outer face; merus of fourth ambulatory leg with two tubercles on outer face ..... 2
- 2(1) Rostral spines fused basally, then separated by a V-shaped hiatus, length from anterior margin of antennal fossa to apex of the hiatus at least as long as  $\frac{3}{4}$  basal width of rostrum; basal part of rostrum with a well developed medial groove ventrally ..... *T. styx*
- Rostral spines separated from the base by a U-shaped hiatus, length from anterior margin of antennal fossa to apex of the hiatus less than  $\frac{1}{2}$  the basal width of the rostrum; basal part of rostrum ventrally flat, lacking a medial groove ..... *T. dumerilii*

*Tylocarcinus dumerilii* (H. Milne Edwards, 1834) new combination  
(Fig. 67a,b)

*Chorinus dumerilii* H. Milne Edwards, 1834: 316.

*Tylocarcinus gracilis* Miers, 1879a: 15. — Nobili, 1907: 382. — Calman, 1909: 712-713. — Balss, 1938: 22; new synonymy.

?*Hyastenus macrospinosus* Ward, 1934: 6-7, pl. 1 fig. 4, 4a. (Not *Hyastenus macrospinosus*. — Buitendijk, 1939: 242-244.)

Material examined. — 3♂♂, 3♀♀(1 ovig.), 7.5-15.5 mm, ovig. ♀, 13 mm.

#### ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Dana' Expedition: Stn. 3742, N. Sulawesi (Kepulaun Sangi), Biaro, 02°08.6'N 125°21.7'E, 11 m, 6 July 1929; 1 spec.

#### THE AUSTRALIAN MUSEUM, SYDNEY

Coral Sea, Herald Group, North East Cay: coral rock washings, coll. D. F. McMichael and J. C. Yaldwyn, 6 November 1964; 1 spec. (AM P. 17002). — Coral rock washings, coll. D. F. McMichael and J. C. Yaldwyn, 9 November 1964; 1 spec. (AM P. 17003). — From coral heads taken on outer reef at low tide, coll. D. F. McMichael and J. C. Yaldwyn, December 1964; 1 spec. (AM P. 17227).

Cook Islands, Raratonga, coll. M. Ward; 1 spec. (AM P. 29922, dry). — New Britain, Reef at Kokopo, near Rabaul, coll. M. Ward; 1 spec. (AM P. 29921, dry).

**Remarks.** — As well as *T. gracilis* described by Miers (1879a: 15), two animals apparently very closely related to it have

been described by other authors. These are *Chorinus dumerilii* H. Milne Edwards (1834: 316) and *Hyastenus macrospinosus* Ward (1934: 6-7, pl. 1 fig. 4, 4a). All are distinguished from *T. styx* by a less distinctly tuberculate carapace and rostral spines divergent from the base. One of us (D.J.G.G.) has examined the syntypes of *T. gracilis* (2♂♂, 4♀♀, 10.6-16.3 mm, 'Eastern Seas', BMNH 62.35) and the holotype of *Chorinus dumerilii* (♀, adult, 14.3 mm, Vanikora, Santa Cruz, Paris Museum). However, we have been unable to locate in the Ward collection the specimen of *Hyastenus macrospinosus* referred to by Ward as "One female measuring 10 mm retained in the Ward collection, Sydney."

Our series of specimens agree in many features with the type material of *Chorinus dumerilii* and *Tylocarcinus gracilis* and with *Hyastenus macrospinosus* as described and figured by Ward.

The rostral spines in our specimens are about half (0.45-0.6) postrostral carapace length; they are slender, divergent from the base and separated by a U-shaped hiatus; the distance from the apex of the hiatus to the anterior margin of the antennal fossa is less than half the basal width of the rostrum; there is no medial, ventral groove. In *T. styx* the rostral spines are fused basally and separated by a V-shaped hiatus; the distance from the apex of the hiatus to the anterior margin of the antennal fossa ranges between three quarters and the full basal width of the rostrum; there is a well developed medial, ventral groove.

The intercalated spine is more distinct in this series than in *T. styx*; it is more strongly convex distally (nearly straight in *T. styx*); and separated from the postorbital lobe by a narrow slit, at least in the distal half (contiguous throughout its length in *T. styx*). Ward describes his specimens as having the intercalated spine fused with the postorbital lobe, but it seems possible, from the figure, that there may be a small distal slit. The specimen recorded by Buitendijk (1939: 242-244) as *H. macrospinosus* has no intercalated spine and so cannot be synonymous with our material.

Within this series the number of distinct protogastric tubercles varies but in all except the two smallest specimens (7.5, 11.0 mm) there is an anterior, medial, mesogastric tubercle. This tubercle is present also in the type material of *Chorinus dumerilii* and *T. gracilis* but not in the holotype of *Hyastenus macrospinosus* (10 mm) as figured by Ward. There is no anterior medial mesogastric tubercle in *T. styx*.

Ward has described his specimens as having some "short, stiff, black bristles, the tips of which are slightly curved", and on three of our specimens (♂, 12 mm, N. Sulawesi; ovig. ♀, 13 mm, Coral Sea; ad. ♀, 15.5 mm, Rabaul) there are bristles like this in a distinct area on the branchial margin.

On the cheliped merus of our largest male (15.5 mm) there are two long suberect spines — a subterminal and a terminal spine; on the carpus there are about six short spines. In *T. styx* there is a short terminal but no subterminal spine on the merus and only a few low tubercles on the carpus. In our four largest specimens (12-15.5 mm) of *T. dumerilii* there are

<sup>28a)</sup> from the literature (Dai et al., 1978).

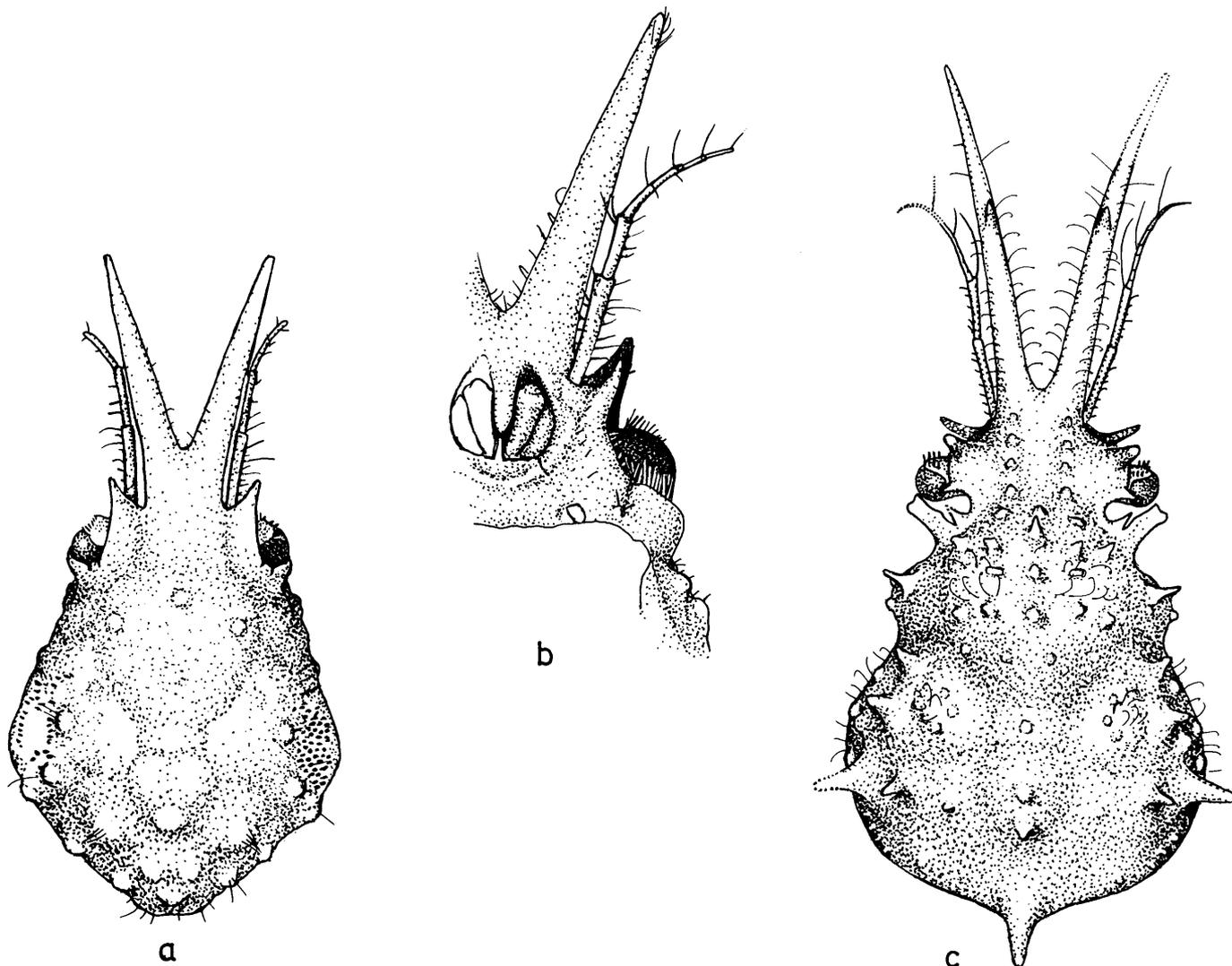


Fig. 67. *Tylocarcinus dumerilii* (male, 12 mm, N. Sulawesi, ZMC) (a) carapace, dorsal view, (b) left orbit, ventral view; *Naxioides carnarvon* (holotype, female, imm.) (c) carapace, dorsal view.

one to three small, proximal tubercles dorsally on the palm, as in the type material of *T. gracilis*. In our largest male the palm is about twice as long as high, there is a moderate gape between the fingers with one large and one small tooth on the dactyl in the gape and a few small teeth on the fixed finger, this specimen is probably subadult.

On the first ambulatory leg, in our specimens, there are four spines on the carpus — two on the anterior edge, one dorsally and one midway on the posterior edge; there are one to three proximal spines on the anterior edge of the propod and sometimes one or two small dorsal spines. In *T. styx* there is only one spine anteriorly on the carpus of the first leg and no spines on the propod. (The carpus of *H. macrospinosus*, as described and figured by Ward, has only one spine and there are no spines described or shown for the propod.)

The first movable segment of the second antenna is more slender in our specimens ( $l = 5$  to  $7.5 \times w$ ) than that in *T. styx* ( $l = 2.5$  to  $3.5 \times w$ ).

The specimens from Christmas I. described by Calman (1909) as *T. gracilis* seem quite clearly to be conspecific with our series. However, while it is probable that *H. macrospinosus* from Christmas I. is also conspecific, we cannot be completely certain from the description and figures given by Ward.

The first pleopod of the males agrees with that of the syntypes of *T. gracilis*, and is similar to that of *T. styx*.

Distribution. — Pacific Ocean: Paumotu Is., Cook Is., Tuvalu, Kiribati, Santa Cruz Is., Herald Group (Coral Sea), New Britain, Biaro (N. Sulawesi). Indian Ocean: Christmas I.

#### *Tylocarcinus styx* (Herbst, 1803)

*Cancer Styx* Herbst, 1803: 53-54, pl. 58 fig. 6.

*Microphrys styx*. — Paul' son, 1875: 11-12, pl. 1 fig. 1a-f.

*Tylocarcinus styx*. — Sakai, 1938: 271-272, pl. 36 fig. 5; 1976: 221, pl. 76 fig. 2. — Guinot, 1962b: 242, fig. 17a,b. — Griffin & Tranter, 1974: 186.

Material examined. — 14♂♂, 19♀♀, (14 ovig.), 6.5-23.5 mm, smallest ovig. ♀, 15.0 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 79b, Makassar Strait, Borneo - bank, Pulu Kabala-dua, 22 m, shore exploration, coral sand, 12/13 June 1899; 7 specs. (ZMA De. 100.789, det. Ihle). — Stn. 91, E. coast of Borneo, Moearas reef, inner side, up to 54 m, trawl and dredge, hard coral sand and coral, 22 June 1899; 4 specs. (ZMA De. 100.697, det. Ihle). — Stn. 220, Banda Sea, W. coast Binongko I., anchorage off Pasir Pandjang, to 278 m, townet, reef exploration, dredge, coral sand, 1/3 November 1899; 1 spec. (ZMA De. 100.813, det. Ihle).

Solomon Islands, Florida Group, Nggela, coll. M. J. A. de Koster, 1967; 3 specs.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Netherlands New Guinea Expedition: Irian Jaya, Biak, W. of Sorido, reef by naval barracks, February 1955; 1 spec. — Stn. 683A, Irian Jaya, Biak, W. of Sorido, reef in front of naval barracks, among *Pocillopora* spec., 22/23 March 1955; 1 spec. — Irian Jaya, Biak I., W. of Sorido village, naval barracks, on coral reef off the shore, coll. L. D. Brongersma and W. J. Roosdorp, 28 April 1952; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Dana' Expedition: Stn. 3594, Fiji, Suva, triangle dredge 19 November 1928; 1 spec.

Mortensen Java - S. Africa Expedition: Mauritius, Flat I., 17 October 1929; 7 specs.

Fiji Islands: Viti Levu, 14 May 1934; 1 spec. — Suva Harbour, 18°9'S 178°24'E, reef flat at low tide, living corals, coll. T. Wolff, 17 May 1965; 1 spec.

MUSÉUM NATIONAL D'HISTOIRE NATURELLE, PARIS

'Calypso' Red Sea Expedition: Orfèvre Sud Abulat, corals, 1952; 4 specs. (provisionally det. D. Guinot).

Remarks. — This species has been adequately described by several authors; the differences which distinguish it from *T. dumerilii* (H. Milne Edwards) are discussed under that species.

In this species the rostral spines are fused for about the basal half but this can vary from 0.4 to 0.6. The distance between the tips of the rostral spines can vary from slightly less than the basal width to one and a third times the basal width. None of the specimens in this series has the meri of the ambulatory legs as weakly tuberculate as those figured by Dai et al. (1978) for *T. sinensis*. On the merus of the first ambulatory leg there are at least three spines behind the terminal spine and there are usually more than two tubercles on the outer face of the merus. The merus of the fourth ambulatory leg is smooth only in some small specimens.

In the collections at the Australian Museum there is a specimen of *T. styx* (♀, imm., cl. 11.5 mm, Port Moresby, AM P.32089, in part) with a double rostrum, i.e. four rostral spines fused basally. The two pairs of spines diverge at an angle of about 60° and each pair, as in a normal specimen, is fused in the basal half. As a result of this deformity the specimen has no interantennular partition and on the anterior margin of the orbit the basal antennal article is incompletely fused to the front.

Distribution. — Indo-West Pacific: Red Sea and Mauritius to Fiji and Japan.

SUBFAMILY MAJINAE

Maiinae Alcock, 1895: 161, 166, 236 (in part: the Maioida).

Majinae, sensu restr., Balss, 1929: 16, 20. — Garth, 1958: 340-341. — Griffin, 1966b: 261, 264.

Orbit formed (1) by a supraocular hood, the posteroexternal angle of which is often produced as a spine, (2) by a sharp postocular tooth, and (3) by a spine intercalated between the two. Basal antennal (article) broad, but not specially produced to form a floor to the orbit; usually armed at both its anterior angles with a strong spine. (Alcock, as quoted by Garth.)

Pleopod 1 slender, weakly curved, aperture usually subterminal and usually protected by lobes or flaps, apex usually slender and simple.

Of the changes proposed in this report to the classification of the family the most drastic are wrought upon the Majinae. The subfamily is now regarded as comprising species without an intercalated spine as well as with one, species are accommodated which have a broad, well developed orbit and cupped postorbital lobe as well as ones with only moderately developed orbit and spine-like postorbital lobe.

However these genera have in common, in the male, an abdomen which is nearly uniform in width rather than triangular, the third segment only slightly wider than the sixth and the last segment broad. In most genera the basal antennal article possesses both anteromedial and anterolateral spines or lobes. Also the first pleopod of the male has prominent lobes or flaps adjacent to the aperture. These lobes may be longitudinal, strongly projecting or folded and may be accompanied by tubercles, long setae or a spine.

The subfamily is greatly enlarged to accommodate genera from the Inachinae (*Anacinetops*, *Microhalimus* and *Naxia*), Tychinae (*Pseudomicippe*, including *Zewa* species), Pisinae (*Eurynome*-which is subdivided- and *Choniognathus*) and the Mithracinae (*Jaquinotia*, *Entomonys*, *Tumulosternum* — which is enlarged — and *Pippacirama* — a new genus including '*Paramicippa*' *tuberculosa*). *Chlorinoides* is reduced to synonymy with *Naxioides* of the Pisinae. The species it contained, which until the 1960's were in the genus *Acanthophrys*, are now placed in a new genus *Thacanophrys*. A new genus *Seiitaoides*, is proposed for some species previously placed in *Eurynome*, *Teratomaia* is proposed for *Leptomithrax richardsoni* and *Ageitomaia* for the east Pacific *Paramithrax baekstroemi* formerly included in *Notomithrax*, a genus now regarded as confined to the southwest Pacific. A new genus *Kimbla*, is proposed for a new species *K. neocaledonica*, from near New Caledonia.

The great diversity of this subfamily in the Indo-west Pacific is shown by the presence of more than 20 genera and 70 species in contrast to the presence of two monotypic genera (*Maiopsis*, *Ageitomaia*) in the east Pacific, one genus (*Temnonotus*) in the west Atlantic and two genera (*Maja*, *Eurynome*) each with only a few, similar, species in the east Atlantic.

## KEY TO INDO-WEST PACIFIC GENERA OF MAJINAE

- 1 Eyestalks long, dorsally flattened with a lobe on both anterior and posterior margins in distal half; supraorbital eave only weakly expanded, barely covering bulbous base of eyestalk and curved over it; carapace surface covered with numerous blunt compound tubercles; second movable segment of antennal peduncle at right angles to first segment and directed laterally ..... *Pippacirama*  
 — Eyestalks of variable length but not dorsally flattened or lobed; supraorbital eave longer than basal width of eyestalk and not closely curved over it; carapace surface smooth or with spines, simple or boletate tubercles or tubercles fused to form flat plates; second movable segment of antennal peduncle in the same line as first segment and usually directed forward ..... 2
- 2(1) Eyestalks long, more than two thirds of length exposed in dorsal view ..... 3  
 — Eyestalks short or at least not more than half length exposed in dorsal view ..... 4
- 3(2) Postorbital lobe narrow, apex often subacute, intercalated spine absent; carapace with at least a few dorsal tubercles ..... *Pseudomicippe*  
 — Postorbital lobe and intercalated spine subequal, both broad and blunt; carapace without dorsal tubercles ..... *Anacinetops*
- 4(2) Flagellum of antenna arising from within orbit ..... 5  
 — Flagellum of antenna excluded from orbit by a process of the basal antennal article ..... 9
- 5(4) Intercalated spine short (nearly obsolete) or closely approximated to eave and postorbital lobe; branchial margin with blunt or boletate tubercles or large plates but without acuminate spines ... 6  
 — Intercalated spine well developed, well separated from eave and postorbital lobe; branchial margin usually with spines ..... 8
- 6(5) Tubercles of carapace fused into about ten to twelve large tuberculated or spinulated plates, small tubercles over surface; lateral margin of supraorbital eave spinulose ..... *Seiitoides*  
 — Tubercles of carapace numerous and distinct, very few fused to form larger plates; lateral margin of supraorbital eave smooth or with a few tubercles ..... 7
- 7(6) Carapace tubercles boletate with crenulate edges, sometimes fused into plates; hepatic margin with a flat triangular plate or with a large scutellate or boletate tubercle; first pleopod of male with one or two recurved lobes near distal end and long setae ..... *Eurynome*  
 — Carapace tubercles blunt, flat, or if boletate with edges entire, never fused into plates; hepatic margin with a broad blunt tuberculate lobe or one to two sharp processes; first pleopod of male without recurved lobes or long setae, aperture simple and subterminal ..... *Choniognathus*
- 8(5) Rostral spines without any accessory spines; carpus and propod of male cheliped smooth; supraorbital eave smooth in front of antorbital spine ..... *Maja*  
 — Rostral spines with one to three small accessory spines on lateral margin; carpus and propod of male cheliped spinulose; supraorbital eave spinulose in front of antorbital spine ..... *Majella*<sup>29)</sup>
- 9(4) Orbit open ventrally, basal antennal article widely separated from postorbital lobe ..... 10  
 — Orbit closed ventrally, basal antennal article in broad contact with postorbital lobe ..... 22
- 10(9) Postorbital lobe a conical to acuminate spine, not 'cupped', cornea of retracted eye not protected on either dorsal or ventral surfaces ..... 11  
 — Postorbital lobe excavate or 'cupped' anteriorly, the cornea of retracted eye protected on dorsal and ventral surfaces or sometimes only on dorsal surface ..... 15
- 11(10) Gastric, cardiac and intestinal regions of carapace smooth; basal antennal article narrowing slightly distally and notched before anterolateral angle which is produced as a short, rounded crenulate tooth ..... *Paramithrax*  
 — Gastric, cardiac and intestinal region of carapace with tubercles and/or short spines; lateral angle of basal antennal article unnotched, anterolateral angle produced as a sharp spine ..... 12
- 12(11) Preorbital angle of eave with a well developed spine, apically sharp; male cheliped merus with a dorsal crest of about six flat spines and outer ventral margin with five spines; first pleopod of male with aperture protected by a distally directed flap ..... *Ageitomaia*<sup>29)</sup><sup>30)</sup>  
 — Preorbital angle of eave without a spine or sometimes with a blunt

- spine; male cheliped merus with dorsal ridge entire or with two to five spines on dorsal margin and outer ventral margin entire or with tubercles only; first pleopod of male with margins of aperture expanded as lobes ..... 13
- 13(12) Basal antennal article narrow with one anterior spine; movable segments of antennal peduncle slender, first segment longer than wide (fig. 74) ..... 14  
 — Basal antennal article broad with two anterior spines; movable segments of antennal peduncle stout, first segment about as wide as long ..... *Notomithrax*
- 14(13) Propodi of ambulatory legs weakly or strongly expanded ventrally near distal margin; dorsal surface of carapace with at least one mesogastric tubercle, surface bare or with a few small hairs between groups of strong curled hairs; orbit with an intercalated spine present (almost fused to eave in *N. tumida*, fig. 74g) ..... *Naxia*  
 — Propodi of ambulatory legs cylindrical, not expanded ventrally; dorsal surface of carapace without a mesogastric tubercle, surface covered by a tomentum as well as a few groups of strong curled hairs; orbit lacking an intercalated spine ..... *Microhalimus*
- 15(10) Preorbital angle of eave smooth, rounded, not produced as a spine or tubercle ..... 16  
 — Preorbital angle of eave prominently produced as a spine or a tubercle ..... 19
- 16(15) Rostral spines with one or two lateral accessory spines .. *Schizophrys*  
 — Rostral spines without a lateral accessory spine ..... 17
- 17(16) Carapace densely spinose or tuberculate dorsally; large species (usually longer than 40 mm, sometimes up to 110 mm) ..... *Leptomithrax*  
 — Carapace with a few blunt tubercles but no spines dorsally; small species (usually less than 30 mm in length) ..... 18
- 18(17) Basal antennal article narrow with two slender anterior spines; intercalated spine larger than antorbital spine, not excluded from margin of orbit; carapace hardly broadened posteriorly ..... *Schizophroidea*  
 — Basal antennal article moderately broad with two short, blunt, anterior spines; intercalated spine much smaller than antorbital spine or else obsolete, or excluded from margin of orbit; carapace broadened posteriorly ..... *Tumulosternum*
- 19(15) Preorbital angle of eave armed with a blunt tubercle; carapace suborbicular; rostrum exceedingly short, an eighth to a twentieth postrostral carapace length; postorbital lobe with a prominent accessory spine on upper anterior edge near base ..... *Cyclax*  
 — Preorbital angle of eave armed with a spine; carapace narrowly pyriform to pyriform; rostrum of at least moderate length; postorbital lobe sometimes with lobes or tubercles on posterior edge but not on anterior edge ..... 20
- 20(19) Hepatic and branchial margins with tubercles but no spines or lobes; carapace surface with many small, rounded tubercles but no spines ..... *Kimbla*  
 — Hepatic and branchial margins with spines or lobes; carapace with spines at least in the midline ..... 21
- 21(20) Rostral spines no more than a fifth postrostral carapace length; branchial margin with four to six smooth acuminate spines (the last subdorsal), never with lamellate lobes; male chela long and slender (palm about four times as long as high); cheliped merus and carpus with spinous tubercles on all surfaces ..... *Teratomaia*  
 — Rostral spines usually longer than a third postrostral carapace length; branchial margin with one to three acuminate or knobbed spines (the last subdorsal), sometimes a lamellate lobe anteriorly; male chela short and stout (palm about one and a half times as long as high); cheliped merus and carpus usually with longitudinal ridges or crests ..... *Thacanophrys*
- 22(9) Supraorbital eave strongly expanded to form a tubular orbit; branchial margin with at least two long spines; rostral spines narrow, separate, a fifth to a quarter postrostral carapace length . *Entomonyx*  
 — Supraorbital eave only moderately expanded; branchial margin with tubercles only; rostral lobes very short (a twelfth postrostral carapace length), broad, fused for almost their entire length ..... *Jaquinotia*

<sup>29)</sup> from the literature (see genus accounts)<sup>30)</sup> separate genus containing *A. baekstroemi* (Balss) and restricted to SE. Pacific.

*Ageitomaia* new genus

Type species. — *Paramithrax baekstroemi* Balss, 1924, by monotypy.

We have not been able to examine this species. The generic description is based on the literature (Rathbun, 1925; Garth, 1958).

Description. — Carapace pyriform, surface granulate, margin and midline with a few spines. Rostrum of two divergent spines separate from their base. Orbit comprising a broad supraorbital eave with a preorbital and antorbital spine; an intercalated spine, and a long postorbital spine remote from orbit; eave, intercalated spine and postorbital spine separated by wide, deep fissures. Eyestalks slender, rather long. Basal antennal article broad, subrectangular, of even width throughout, lateral edge not notched, anterolateral and anteromedial angles each produced into a well developed spine, flagellum excluded from orbit by a narrow process of article. Merus of third maxillipeds subquadrate, with inner distal angle deeply notched. Merus and carpus of chelipeds ornamented with flat lobes or teeth, on carpus forming two crests. First pleopod of male curved outwards distally and tapering, tip pointed, aperture subterminal, lateral, covered by a broad lateral flap.

Remarks. — This species from Chile has been included in the genus *Notomithrax* until now, but it differs from other species of *Notomithrax* in having a preorbital spine and the first pleopod of the male (Garth, 1958: pl. U fig. 2) shows significant similarities with the pleopods of some species of *Thacanophrys* and differs from those of *Notomithrax* species.

There are similarities between *A. baekstroemi* and *Teratomaia richardsoni* (Dell) in the slender rostral spines, the preorbital spine, the basal antennal article with a strong anterolateral spine, the male abdomen and pleopod. However, there are marked differences in carapace spination and in shape and ornamentation of the cheliped. Both species appear to have very restricted distributions and to consider them congeneric would imply a zoogeographic relationship which cannot be justified at present.

The new name is derived from *ageiton* (Gk.), alone, separated, and *maia* (Gk.) a crab, in reference to the great geographic separation of *A. baekstroemi* from similar majines.

Distribution. — East Pacific, Juan Fernandez Islands.

*Anacinetops* Miers, 1879

Type species. — *Anacinetops simpsoni* Miers, 1879, by monotypy.

Remarks. — The one contained species has previously been placed in the Inachinae because of the long unprotected eyestalks and its similarity to *Camposcia*. However, *A. simpsoni* shows more similarity to *Paramithrax barbicornis* than to

*Camposcia* in the form of the rostrum, upper orbit, third maxilliped and male abdomen. The distal margin of the basal antennal article is fused to the carapace. The intercalated spine is the same shape as the postorbital spine and only slightly smaller.

The first pleopod of the male, figured here, while being of a general majine type does not resemble that of any other genus in the subfamily.

Distribution. — Australia, Timor, Kai Islands.

*Anacinetops simpsoni* Miers, 1879  
(Fig. 68a,b)

*Anacinetops simpsoni* Miers, 1879a: 3. — Ortmann, 1894: 38, pl. 3 figs. 2, 2a. — Buitendijk, 1939: 232. — Griffin, 1972: 70.  
*Paramicippa hispida* Baker, 1905: 126-127, pl. 24 figs. 6, 6a.  
*Eruma hispidum*. — McCulloch, 1913: 336-337, figs. 47, 48.

Material examined. — 5 ♂♂, 6 ♀♀ (2 ovig.) 17-25.5 mm, smaller ovig ♀ 22.5 mm.

## NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. KR VI, Kai Is., N. of Du Rowa I., N. of Nuhu Rowa, 05°32'S 132°41'E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 1 spec.

## THE AUSTRALIAN MUSEUM, SYDNEY

Torres Strait, Albany Passage, 16-22 m, dredge, coll. M. Ward, September 1926; 1 spec. (AM P.29814, dry). — N. Western Australia, Broome, coll. B. E. Bardwell; 9 specs. (AM P.29815, dry).

Remarks. — On the basal antennal article of our specimens the anterolateral angle is produced laterally and on the anteromedial angle there is a ventrally directed tubercle. The first pleopod of the male of *A. simpsoni* has not previously been described or figured. The pleopod is apically subacute and curved strongly outward from just behind the aperture; there is a broad abdominal lobe which arches over the aperture and a low ridge sternal to the aperture.

Distribution. — Timor, Kai Is., NW., N., NE., and S. Australia.

*Choniognathus* Rathbun, 1932

Type species. — *Eurynome reini* Balss, 1924, by monotypy.

Description. — Carapace pyriform to subovate, constricted behind hepatic regions; surface with many small tubercles. Rostrum of two spines separated by a wide U-shaped hiatus. Supraorbital margin without a preorbital spine, comprised of eave, intercalated spine and postorbital lobe. Basal antennal article broad basally, narrow distally, antenna not excluded from orbit. Lower margin of orbit with prominent suborbital lobe. Third maxilliped smooth or with tubercles, anterolateral angle of merus moderately or strongly produced, merus and ischium fused or separate. Cheliped as long or much longer

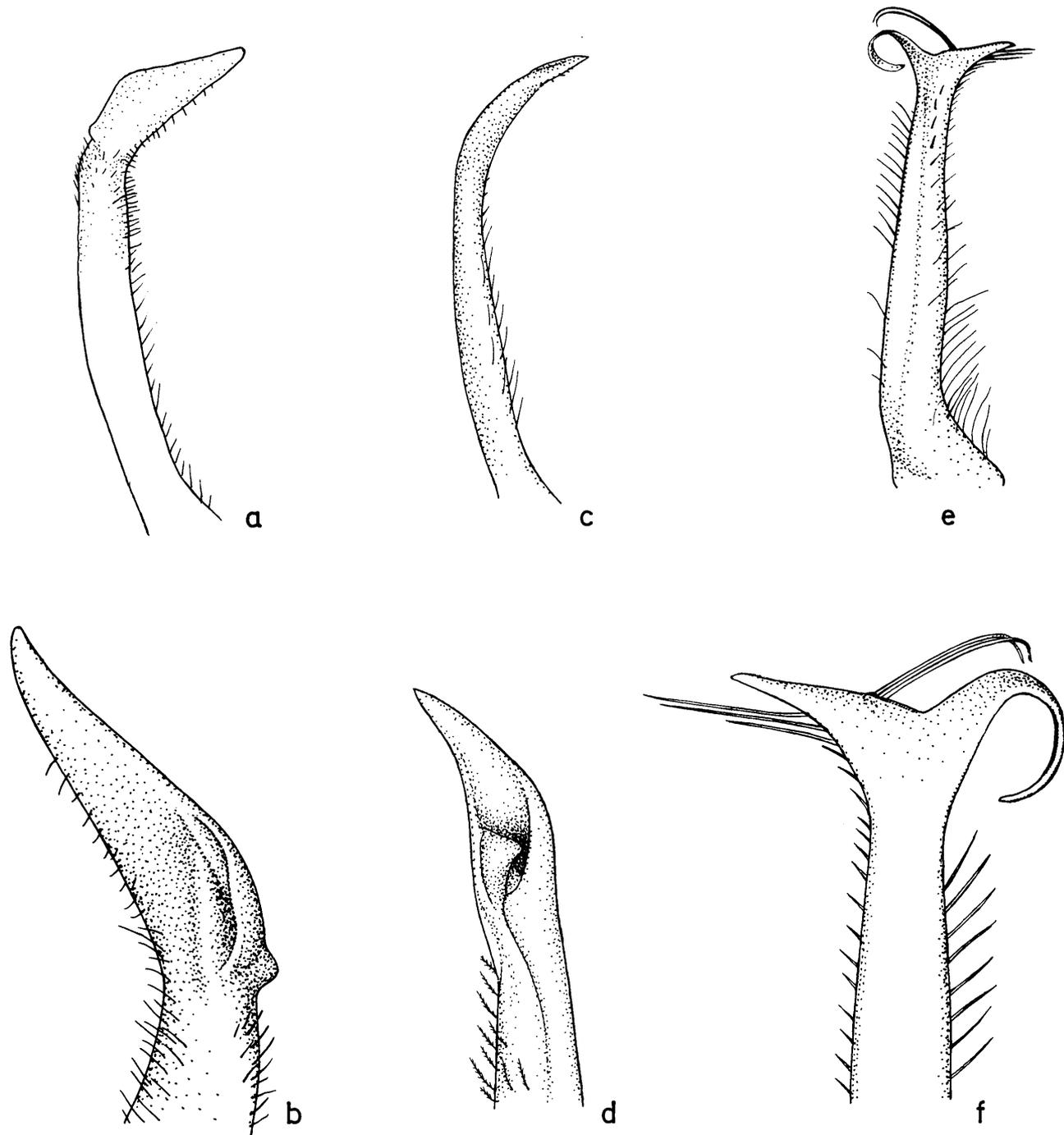


Fig. 68. Left first pleopod of male of *Anacinetops stimpsoni* (22.5 mm, Kai Is., NIO Jakarta) (a) abdominal view of pleopod, (b) sternal tip of same; *Schizophroida hilensis* (33.5 mm, AM P.19606) (c) abdominal view of pleopod, (d) sternal tip of same; *Pippacirama tuberculosa* (15.5 mm, AM P. 14006) (e) abdominal view of pleopod, (f) sternal tip of same.

than ambulatory legs, smooth or spinous; fingers short, bent on an angle towards fixed finger. Ambulatory legs short. Abdomen of seven free segments in both sexes; abdomen of adult female covering sternum. (Rathbun, modified.)

Remarks. — Rathbun (1932) described this genus for the species *Choniognathus koreensis*. Sakai (1938) declared that *C. koreensis* was a synonym of *Eurynome reini* Balss but maintained the separate genus. This genus has remained

monotypic because of the apparently unique (among majids) lateral fusion of the ischium and merus of the third maxilliped. However, weighing this unusual feature against the very close resemblance of *C. reini* to *Eurynome granulosa* Baker (Griffin, 1965) in which the maxilliped is not fused, it is our opinion that these two species are congeneric. This has required the modification of the original description of *Choniognathus* given by Rathbun. Other species without a fused maxilliped may also be included in this genus. We have

removed *E. elegans* Stebbing and *E. verhoeffi* Balss to *Choniognathus* on the basis of the type of carapace tubercles, the form of the basal antennal article and the first pleopod of the male. The pleopod of *C. granulosa* is unknown. In the other three species, although there is some variation, the pleopod has a simple subterminal opening without lobes or long setae.

Distribution. — Indo-West Pacific: south east Africa, Red Sea, Gulf of Oman, south and west Australia, Japan.

#### KEY TO SPECIES OF *CHONIOGNATHUS*

- 1 Third maxilliped with merus and ischium fused ..... *C. reini*  
 — Third maxilliped with merus and ischium free ..... 2  
 2(1) Carapace tubercles flat-topped (boletate); interantennular spine apically bifid..... *C. verhoeffi*  
 — Carapace tubercles not flat-topped; interantennular spine simple ..... 3  
 3(2) Hepatic margin laterally extended as a flattened lobe; basal antennal article subrectangular, bilobate anteriorly, lateral lobe rounded ..... *C. granulosa*  
 — Hepatic margin with acuminate spine; basal antennal article broad basally, narrow anteriorly, very small anterolateral spine *C. elegans*

#### *Choniognathus reini* Balss, 1924

(Fig. 69c,d)

*Eurynome reini* Balss, 1924: 31, pl. 1 fig. 3. — Yokoya, 1933: 158-159, text-fig. 57.

*Choniognathus koreensis* Rathbun, 1932: 33.

*Choniognathus reini*. — Sakai, 1938: 273-274, text-fig. 34, pl. 27 fig. 2; 1976: 222-223, text-fig. 120a,b, pl. 78 fig. 2. — Takeda & Miyake, 1969: 511-512.

Material examined. — 1 ♂, 7.5 mm

#### ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Okinose, 540 m, 26 June 1914; 1 spec.

Remarks. — This specimen agrees well with specimens described by Balss and Sakai and with type material (2 ovig, ♀♀, 9.1, 9.4 mm, Misaki; ZSM) examined by one of us (D.J.G.G.). The first pleopod of the male of *C. reini* has not previously been described. It is broad, straight and distally it is curved strongly ventrally and slightly outwards; apex blunt with long setae on the medial margin and a blunt subterminal lobe on the lateral margin; aperture is a narrow slit-like opening on the sternal surface of this subterminal lobe.

*C. reini* is unusual in the Majidae in having the ischium and merus of the third maxilliped fused in the lateral half.

This species resembles known species of *Eurynome* in the shape of the supraorbital eave, the presence of a well developed suborbital lobe and the sternum of the adult female completely covered by the abdomen.

As noted previously, *C. reini* is very similar to *C. granulosa* (Baker), redescribed by Griffin (1965), in the ornamentation and tomentum of the carapace; detail of the orbit and the

smooth cheliped and ambulatory legs. However, in that species the ischium and the merus of the third maxilliped are not fused. The first pleopod of the male of *C. granulosa* is unknown.

Distribution. — This species is known only from Japan.

#### *Cyclax* Dana, 1851

Type species. — *Cyclax perryi* Dana, 1851, by monotypy.

Remarks. — Forest & Guinot (1961) have discussed this genus in detail and listed the synonymies of the two species *C. spinicinctus* Heller and *C. suborbicularis* (Stimpson); several specimens previously identified as *C. spiniger* (White) have been reidentified by them as one or other of these two species (discussed under *Schizophrys*). Forest & Guinot also commented that while *C. perryi* and *C. spinicinctus* are possibly synonymous further research would be needed to confirm this. (*C. perryi* is not included as a distinct species in the key below.)

Distribution. — Widespread throughout the Indo-West Pacific.

#### KEY TO SPECIES OF *CYCLAX*

- 1 Intercalated spine distally with three subequal spinules; basal antennal article with a strong accessory spine between anterolateral and anteromedial spines; marginal spines of carapace granular almost to tip ..... *C. suborbicularis*  
 — Intercalated spine triangular, granulate basally only; basal antennal article lacking an accessory spine between main anterior spines; marginal spines of carapace granular only at their bases ..... *C. spinicinctus*

#### *Cyclax suborbicularis* (Stimpson, 1907)

*Mithrax suborbicularis* Stimpson, 1907: 18-19, pl. 4 fig. 1.

*Cyclax suborbicularis*. — Forest & Guinot, 1961: 15-24, figs. 5, 6, 8 bis, 10, pl. 6 figs. 1, 2.

Material examined. — 1 ♀, 24 mm.

#### ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java-S.Africa Expedition: Mauritius, Flat Island, 17 October 1929; 1 spec.

Remarks. — This specimen agrees well with that figured by Forest & Guinot, which also came from Mauritius.

Distribution. — Indo-West Pacific: Mauritius and Seychelles, Sri Lanka, New Caledonia, Samoa, Fiji and Tahiti.

#### *Entomonox* Miers, 1884

Type species. — *Entomonox spinosus* Miers, 1884, by monotypy.

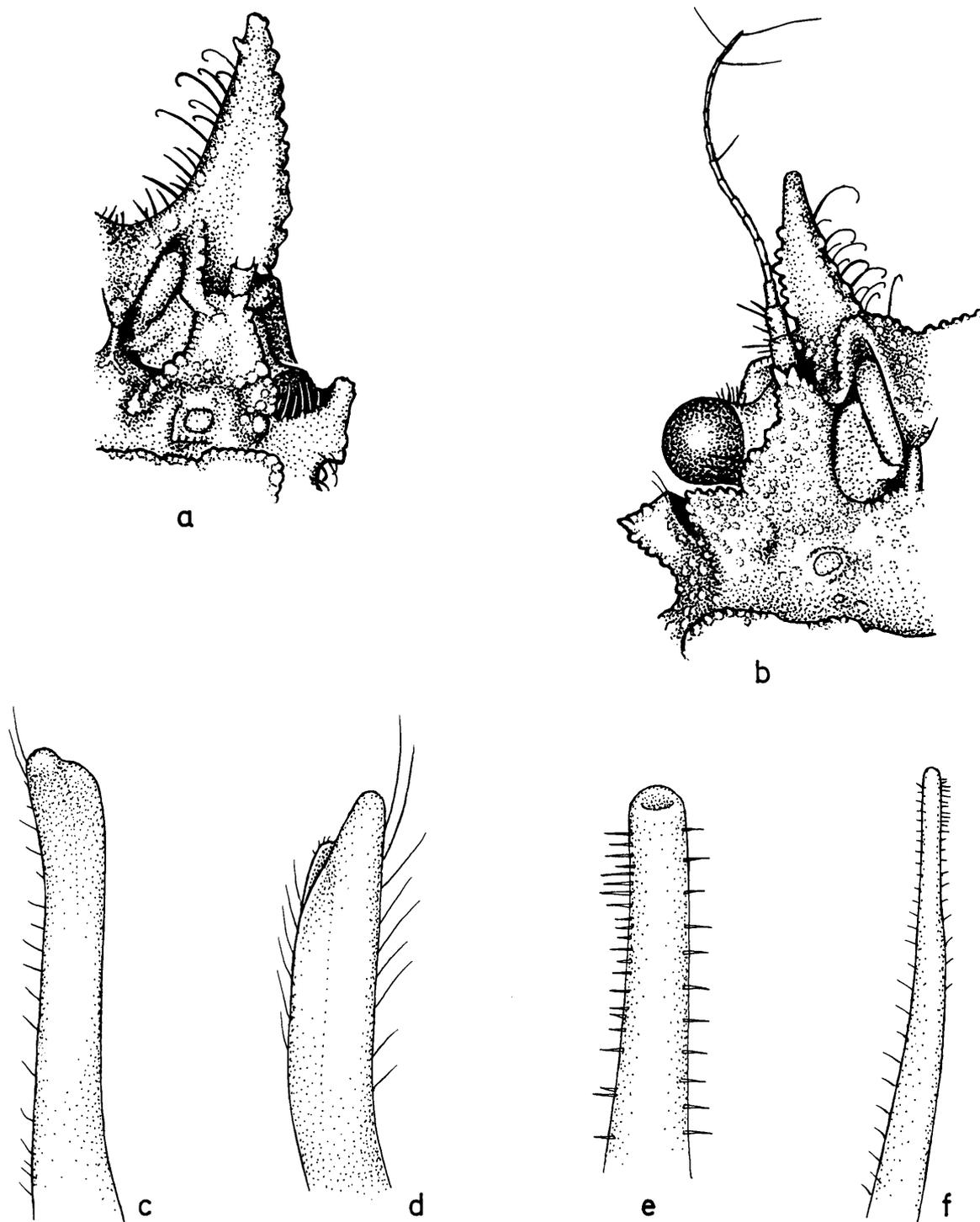


Fig. 69. *Eurynome erosa* (male, 8.5 mm, Cape of Good Hope, ZMC) (a) left orbit, ventral view; *Seiitaoides orientalis* (male, 6.5 mm, Kai Is., ZMC) (b) right orbit, ventral view; *Choniognathus reini* (male, 7.5 mm, Japan, ZMC) (c) abdominal-lateral view of left first pleopod, (d) sternal tip of same; *Seiitaoides orientalis* (male, 6.5 mm, Lesser Sunda Is., ZMA) (e) sternal tip of left first pleopod, (f) abdominal view of same.

Remarks. — The history of this genus has been discussed in detail previously (Griffin, 1966a). Balss (1929) and Sakai (1938, 1965a) considered that the single species then known belonged to the genus *Acanthophrys*. However, the broad eave and basal antennal article which form an almost tubular orbit, set it apart and justify its position as a separate genus. Sakai has added another species, *E. depressus*, which we know only from the literature (Sakai, 1976).

The form of the orbit suggests that *Entomonox* belongs in the subfamily Mithracinae but examination of the first pleopod of the male of *E. spinosus* shows its basic similarity to the *Thacanophrys* type of pleopod. The pleopod has no similarities to that of any mithracine and as considerable weight must be given to pleopod structure in showing subfamily relationships this genus is more appropriately included in the Majinae.

Distribution. — Widespread throughout the Indo-West Pacific.

KEY TO SPECIES OF *ENTOMONYX*

- 1 Branchial margin with four spines; posterior carapace margin with two submedial spines ..... *E. depressus*  
 — Branchial margin with two spines; posterior carapace margin with a single medial spine ..... *E. spinosus*

*Entomonyx spinosus* Miers, 1884

*Entomonyx spinosus* Miers, 1884: 526, pl. 47 fig. B. — Takeda & Miyake, 1969: 515-516, fig. 12d-f. — Griffin, 1974: 11. — Sakai, 1976: 253, pl. 87 fig. 2.

Material examined. — 1 ovig. ♀, 13 mm.

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia, W. of Shoal Point, 27°59'S 113°21'E, 108 m, trawl, sponge and Bryozoa, 'Diamantina' Stn. 78, coll. B. Wilson, 5 December 1970; 1 spec. (WAM 82-71).

Remarks. — In Australia this species has been recorded only from Dampier I. northern Western Australia.

Sakai in 1974 added a new species to this previously monotypic genus. *E. depressus* Sakai differs from *E. spinosus* in lacking a preorbital spine, in having a wider postorbital lobe and in having more spines on the branchial region (four) and the intestinal region (two). Similar kinds of differences separate the species of *Thacanophrys*.

This species has been considered by Balss (1929) and Sakai (1938, 1965a) as belonging to *Acanthophrys*. Extensive synonymies are given by Takeda & Miyake (1969) and by Sakai (1976).

Distribution. — Widespread throughout the Indo-West Pacific.

*Eurynome* Leach, 1814

Type species. — *Cancer asper* Pennant, 1777, by monotypy.

Description. — As given by Griffin, 1966d: 42 (modified from Hartnoll, 1961).

Remarks. — The ten species which have been placed in this genus previously, have in common a number of striking features:

1. a strongly ornamented carapace;
2. a ledge-like supraorbital eave without a preorbital spine;
3. the fingers of the chela much shorter than the palm and inflected;
4. a well developed suborbital lobe;
5. the abdomen of the adult female covering the whole sternum.

However, there are differences in the first pleopod of the male, in details of the orbit and in ornamentation of the carapace which, in our opinion, justify separating the species into three distinct genera. In the genus *Eurynome* we have re-

tained those species in which the male has a pleopod with a long, recurved, hook-like lobe just behind a pointed apex and with long, robust setae between the lobe and the apex. These species are *Eurynome aspera* (Pennant) *E. spinosa* Hailstone, *E. parvirostris* Forest & Guinot from the east Atlantic and *E. erosa* A. Milne Edwards and *E. bituberculata* Griffin from the Indo-West Pacific. In the last species there is a second recurved lobe on the sternal surface of the pleopod. These five species all have in common broadened rostral spines, boletate carapace tubercles and several prominent, flattened, triangular plates on the branchial margin.

The species *E. granulosa* Baker, *E. verhoeffi* Balss and *E. elegans* Stebbing we have removed to the genus *Choniognathus*. In that genus, the carapace tubercles are never fused into plates, they are blunt, flat or if they are boletate the edges of the tubercles are entire, not crenulate and the first pleopod of the male (unknown in *E. granulosa*) has a simple subterminal aperture.

For *E. stimpsoni* Miers and *E. orientalis* Sakai we have established the new genus *Seiitaoides*. In those two species there are a few large plates, rather than many tubercles, on the carapace and the first pleopod of the male, in *S. orientalis* anyway, is straight, with a simple apical aperture.

Distribution. — East Atlantic. Indo-West Pacific: South Africa, Samoa, New Zealand.

KEY TO SPECIES OF *EURYNOME*

- 1 Rostral spines truncate at tips, less than one sixth postrostral carapace length; a double row of distinct tubercles or spines dorsally on ambulatory meri ..... 2  
 — Rostral spines acuminate, to subacute, at least one sixth postrostral carapace length; meri of ambulatory legs dorsally cristate ..... 3  
 2( 1) Proximal medial margin of rostral spines smooth, proximal lateral margins expanded, smooth, distal margins sometimes tuberculate beyond expansion; supraorbital eave narrow, margin smooth; a flattened triangular lobe on hepatic margin ..... *E. bituberculata*  
 — Proximal margins of rostral spines with tubercles laterally and small spines medially, lateral margins not expanded; supraorbital eave broad, margin tuberculate; a large boletate spine on hepatic margin ..... *E. parvirostris*<sup>31)</sup>  
 3( 1) Hepatic margin with flattened triangular plate fused to postorbital lobe; anterolateral branchial margin with three similar blunt capitate or boletate tubercles ..... *E. spinosa*<sup>32)</sup>  
 — Hepatic margin with scutellate tubercle separate from postorbital lobe; anterolateral branchial margin with two boletate or capitate tubercles followed by a granular conical lobe or tubercle ..... 4  
 4( 3) Posterior gastric tubercles fused into a single U-shaped plate; several intestinal tubercles also fused; a large scutellate branchial plate anterolaterally just above margin ..... *E. aspera*  
 — Posterior gastric tubercles and intestinal tubercles discrete; two or three discrete branchial plates anterolaterally ..... *E. erosa*

*Eurynome bituberculata* Griffin, 1964

*Eurynome bituberculata* Griffin, 1964: 197-203, figs. 1-11; 1966d: 43-45, figs. 6, 7, 20.

Material examined. — 1 ♀ (ovig.), 10 mm.

<sup>31)</sup> From the literature (Forest & Guinot, 1966).

<sup>32)</sup> From the literature (Hartnoll, 1961)

## NATIONAL MUSEUM OF NEW ZEALAND, WELLINGTON

New Zealand Oceanographic Institute Stn. F932, New Zealand, off North Cape, 34°26.7'S 173°07.5'E, 113-115 m, 15 October 1968; 1 spec.

Remarks. — This single specimen agrees closely with the type material. The tubercles of the carapace are slightly larger and the spaces between them narrower than in the type material and the rostral lobes are tuberculate distally beyond the proximal lateral expansions; in the type material the margins of the rostral lobes are generally smooth.

Distribution. — Restricted to New Zealand.

*Eurynome erosa* A. Milne Edwards, 1873  
(Fig. 69a)

*Eurynome erosa* A. Milne Edwards, 1873: 254, pl. 12 fig. 1.

Material examined. — 1♂, 8.5 mm, 1♀, 11 mm.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Cap. 5.5.1875, Corneliussen'; 2 specs.

Remarks. — These two specimens agree closely with the holotype, an ovigerous female in the collection of the Zoologisch Museum, Hamburg registered as K344; A. Milne Edwards' figure is accurate.

The species is very similar to *E. aspera*, *E. spinosa*, *E. parvirostris* and *E. bituberculata* in general arrangement of tubercles on the carapace i.e. boletate tubercles in groups on the gastric, cardiac, intestinal and branchial regions; form of the basal antennal article, i.e. truncate triangular with a medial sulcus; and in a number of other features.

The male in this series is the first known; the first pleopod is scyiform with two distal lobes and is very similar indeed to that of the four species mentioned above.

The principal difference between the five species concerns the ornamentation of the legs and the small or obsolete intercalated spine in the upper orbit of *E. erosa*.

Although the present series clarifies the characteristics of this species the geographic distribution appears disjunct. We asked Dr. Torben Wolff (Zoological Museum, University of Copenhagen) for an interpretation of the label with the specimens 'Cap. 5.5.1875, Corneliussen' and he has replied as follows: "Corneliussen was one of several captains of the Danish merchant navy who were asked by Professor Japetus Steenstrup to provide mainly marine animals from all parts of the world. Cap. is no doubt Cape of Good Hope. In the museum's Accessory Journal under the date of 5 May 1875 are listed many animals, including fishes, molluscs, crustaceans and echinoderms, several of which are stated to be from Cap. or Kap. (Danish spelling). We have checked some of the identified echinoderms under that entry, labelled Cap. (and one labelled False Bay). At least two of the species occur only in that area which should be indicative of the correctness of this reference."

Distribution. — Samoa, Cape of Good Hope.

*Jacquinotia* Rathbun, 1915

Type species. — *Prionorhynchus edwardsii* Jacquinot, 1853, by monotypy.

Remarks. — This monotypic genus and the synonymous genus *Campbellia* have been discussed in detail by Griffin (1963a, 1966d). This genus was, in the past, included in the Mithracinae on the basis of its similarities to the American genus *Mithrax*. However, there are some characters which indicate that *Jacquinotia* more properly belongs in the Majinae. The third segment of the male abdomen is only slightly wider than the sixth segment, a character typical of many Majinae, and also the first pleopod of the male basically resembles the *Thacanophrys* type of pleopod and does not resemble any of the pleopods found among the Mithracinae.

Distribution. — Confined to the New Zealand subantarctic.

*Kimbla* new genus

Type species. — *Kimbla neocaledonica* new species.

Description. — Carapace suboval, hardly expanded posteriorly; surface tuberculate, regions weakly defined. Rostrum of two short divergent spines. Orbit above comprising cave with a preorbital and an antorbital spine, intercalated spine and postorbital lobe, the last three closely approximated; postorbital lobe excavated anteriorly. Eyestalk short, cornea large. Orbit open below, basal antennal article moderately broad, subrectangular, anterior angles toothed, flagellum excluded from orbit. Merus of third maxilliped with shallow notch at anterolateral angle, a small spine on anterior margin of notch. Merus and carpus of cheliped with tubercles but not with spines or crests. Male abdomen of seven distinct segments. First pleopod of male curved outwards distally and tapering, tip pointed, aperture subterminal, lateral, covered by a broad lateral flap, a few large hairs abdominally on lateral edge.

Remarks. — Whilst the new species described here basically possesses orbital features similar to a number of other majines, especially *Leptomithrax* species, absence of marginal spines from the carapace posteriorly, its tuberculate appearance and possession of a pleopod in the male more similar to that of *Thacanophrys* species than to pleopods of other genera make it extremely difficult to place it within another genus.

*K. neocaledonica* is similar to *Teratomaia richardsoni* in having a well developed lobe on the posterior margin of the postorbital lobe, a tuberculate merus of the cheliped and in *T. richardsoni* there is often a tubercle midway along the supraorbital cave. The fairly short, stout eyestalk of the single contained species of this genus is not present in any *Thacanophrys* species.

The new genus is named for the Australian naval vessel. HMAS 'Kimbla' which in recent years, despite its age and

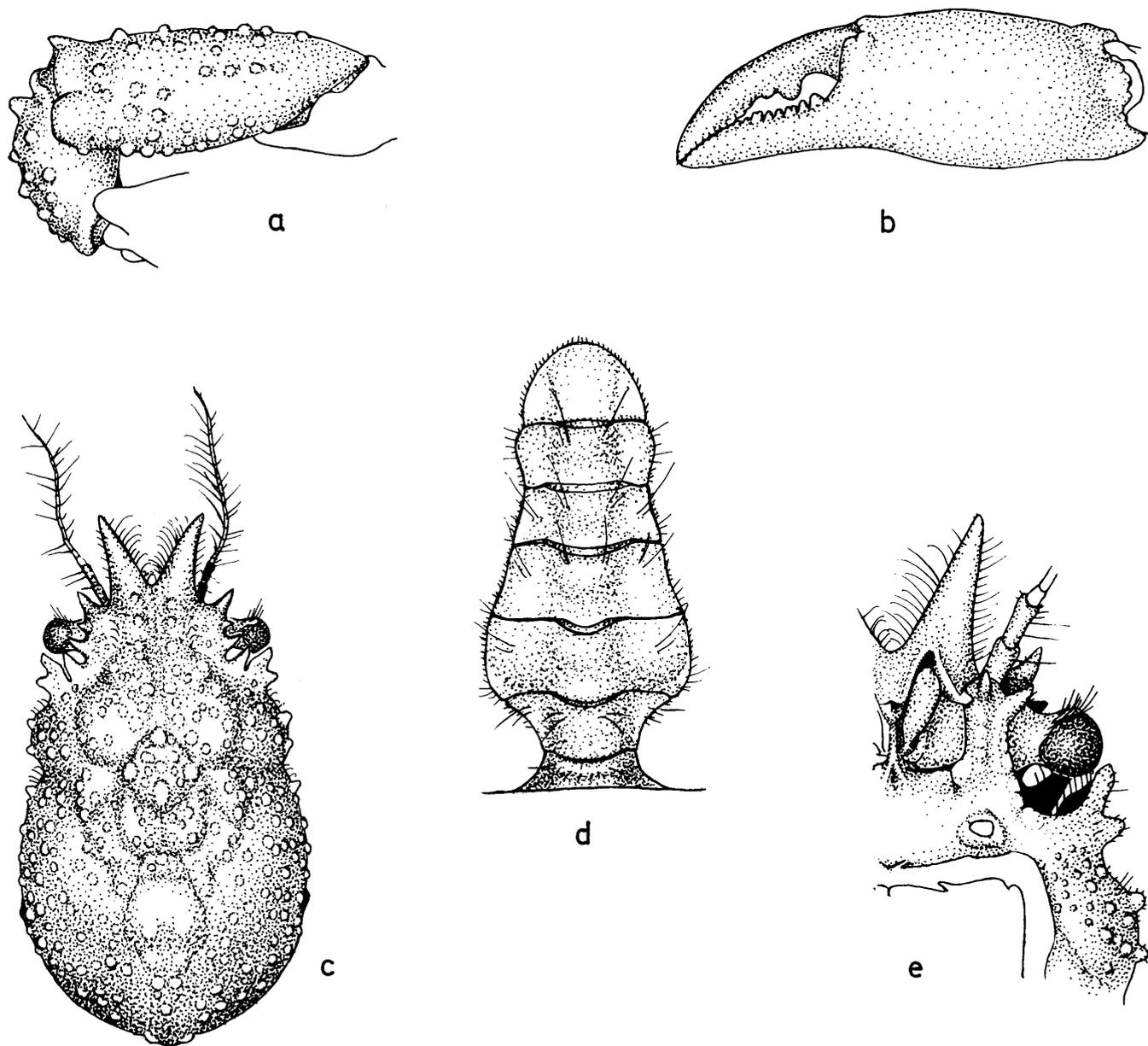


Fig. 70. *Kimbla neocaledonica* (holotype) (a) left cheliped, merus and carpus; (b) left chela; (c) carapace, dorsal view; (d) male abdomen; (e) left orbit, ventral view.

slow speed, has made no small contribution to marine science in eastern Australia.

Distribution. — Presently known only from near New Caledonia.

*Kimbla neocaledonica* new species  
(Figs. 70, 93f-h)

Material examined. — 1♂, 19 mm.

Holotype. — Male, cl. 19 mm, off New Caledonia, 22°48.5'S 167°36.5'E, 85-100 m, large bottom dredge, coll. J. Paxton and P. Colman, 'Kimbla' Stn. K4-71-4, 8 May 1971. The Australian Museum, AM P.29841.

Description. — Carapace hardly widened posteriorly, carapace width less than 2/3 postrostral carapace length; regions very weakly elevated and defined; surface with

numerous small, nearly uniform rounded tubercles but no spines.

Rostral spines short, about 1/5 post rostral carapace length, horizontal, divergent, tapering from a broad base to a sharp apex; rostral ridges each with three tubercles.

Orbital eave moderately expanded, preorbital angle produced into a sharp spine directed upwards and slightly outwards; a small erect spine midway along eave; antorbital angle produced laterally as a narrow triangular spine, tip up-curved; intercalated spine slightly larger than antorbital spine, separated from it by a narrow U-shaped hiatus, apices of both spines at same level; postorbital lobe basally broad, apically narrow, blunt, separated from intercalated spine by a narrow slit, anterior margin with an obtuse angle, posterior margin with a proximal accessory tubercle.

Hepatic margin with two tubercles, anterior one larger; surface of region dorsally tuberculate; subhepatic region tuberculate.

Branchial margin with only one sharp tubercle anteriorly.

Mesogastric region with a longitudinal row of about four tubercles on either side of midline; protogastric region tuberculate with two slightly larger tubercles one behind other anteriorly. A broad diamond-shaped metogastric region with slightly larger tubercles at each angle; urogastric region with many small tubercles.

Cardiac region only weakly elevated, a slightly larger submedial pair of tubercles at summit, smaller tubercles on anterior and posterior slopes.

Intestinal region with a pair of submedial tubercles anteriorly, a central tubercle and a pair of submedial tubercles on posterior margin of carapace.

Branchial region with small even sized rounded tubercles.

Basal antennal article with small tubercles along medial and lateral edges, a shallow longitudinal groove centrally; two spines anteriorly, a small, acute, anteromedial spine directed ventrally and forward, and a larger, acute anterolateral spine directed laterally; proximal margin of basal antennal article marked by a slit in suborbital border; no suborbital tubercle. Orbit open below.

Pterygostomian region smooth, two rows of granules and small tubercles along margin.

Third maxilliped smooth, ischium with about six large teeth on medial edge; merus with anterolateral angle moderately produced and rounded, a small spine in front of notch, medial edge behind notch convex with spinules on proximal part.

Cheliped merus of male with many small sharp tubercles, four or five along dorsal margin and a small sharp terminal spine; carpus also with many sharp tubercles but no ridges; palm smooth, length about twice height, fingers 2/3 length of palm and separated by a moderate gape in proximal half, dactyl with a large tooth midway in gape, fixed finger with small teeth along length of gape; both fingers with very small teeth uniformly along cutting edge in distal half.

(There are no ambulatory legs with the specimen.)

Sternum smooth except for a tubercle on edge of abdominal fossa in third segment and a tuberculate ridge in a similar position on fourth segment.

Abdomen smooth, third segment one and a half times as wide as sixth segment, sixth segment more than twice (2.3) as wide as long, seventh segment one and a half times as wide as long, anterior margin broadly convex.

First pleopod of male similar to that of *Thacanophrys goldsboroughi*, curved outwards distally and tapering, tip pointed, aperture subterminal, lateral, covered by a broad lateral flap, a few large hairs abdominally on lateral edge.

Remarks. — This species is clearly distinguished from those of the related genera *Thacanophrys* and *Teratomaia* by the narrow carapace which is evenly tuberculate but without spines.

The species name refers to the type locality.

Distribution. — Known only from the type locality off New Caledonia.

#### *Leptomithrax* Miers, 1876

Type species. — *Paramithrax (Leptomithrax) longimanus* Miers, 1876, by subsequent designation of Miers (1879).

Remarks. — This genus was discussed in detail by Griffin (1966d), and it was suggested then that *L. richardsoni* Dell with a preorbital spine, *L. parvispinosus* Ward with few tubercles and *L. bifidus* Ortman with long rostral spines were on the borderline of this genus. Consideration of the male pleopods of these three species suggests that the first two species should be removed from *Leptomithrax* and the third species should be retained in the genus. *L. richardsoni* has been removed to the new genus *Teratomaia* and *L. parvispinosus* is now placed in *Tumulosternum*. We take the view that *Paramithrax (Leptomithrax) compressipes* Miers 1879 is most appropriately placed in *Maja*.

The first pleopod of the male of species of *Leptomithrax* is apically narrow, the aperture is subterminal, a longitudinal slit usually with narrow abdominal and sternal flaps.

*L. sinensis* Rathbun from off China is known only from the holotype.

Distribution. — Western Pacific: Australia, New Zealand and Japan.

#### KEY TO SPECIES OF *LEPTOMITHRAX*

- |       |   |                                       |
|-------|---|---------------------------------------|
| 1     | Intercalated spine almost excluded from outer rim of supraorbital margin; sternum and/or abdomen in male excavated as pits.....     | 2                                     |
| —     | Intercalated spine not excluded from outer rim of supraorbital margin; sternum and abdomen of male without pits .....               | 6                                     |
| 2( 1) | Postorbital lobe simple, without a subapical spine or lobe .....  | 3                                     |
| —     | Postorbital lobe truncate apically, an enlarged subapical lobe .....  | 5                                     |
| 3( 2) | Third maxillipeds swollen at junction of ischium and merus.....   | 4                                     |
| —     | Third maxillipeds not swollen, at most weakly elevated at junction of ischium and merus .....                                       | <i>L. tuberculatus</i> <sup>33)</sup> |
| 4( 3) | Rostral spines subtriangular no more than 1/10 postrostral carapace length; pits of sternum and abdomen in male rimmed .....        | <i>L. longipes</i>                    |
| —     | Rostral spines acuminate, at least 1/6 postrostral carapace length; sternum in male with unrimmed pits, abdomen lacking pits .....  | <i>L. edwardsi</i>                    |
| 5( 2) | Three marginal branchial spines; pits of sternum in male rimmed. ....   | <i>L. sternocostulatus</i>            |
| —     | Four marginal branchial spines; pits of sternum unrimmed .....  | <i>L. bifidus</i>                     |
| 6( 1) | Postorbital lobe truncate.....  | <i>L. sinensis</i> <sup>34)</sup>     |
| —     | Postorbital lobe sometimes with spines or tubercles but not truncate .....  | 7                                     |
| 7( 6) | Postorbital lobe bearing spinules or tubercles on posterior edge; third maxillipeds elevated at junction of ischium and merus ..... | 8                                     |

<sup>33)</sup> both subspecies, see Griffin 1966d.

<sup>34)</sup> from the literature (Rathbun, 1916; Sakai, 1969).

- Postorbital lobe lacking spinules or tubercles on posterior edge; third maxillipeds not elevated at junction of ischium and merus. 10
- 8(7) Carapace narrowly pyriform; rostral spines slender; postorbital lobe with tip acuminate, adjacent spinule on posterior edge small in both juvenile and adult, posterior edge of lobe bearing a few small tubercles at base, otherwise unarmed; third maxillipeds with merus only swollen ..... *L. globifer*
- Carapace broadly pyriform; rostral spines stout; postorbital lobe with adjacent spinule on posterior edge subequal with tip, at least in juvenile, a second tubercle midway along posterior edge, lobe otherwise smooth; third maxillipeds with ischium at least weakly swollen ..... 9
- 9(8) Postorbital lobe with adjacent spinule large in juvenile, small in adult, tip acuminate; mid-dorsal regions of carapace thickly covered by both spines and tubercles ..... *L. gaimardii*
- Postorbital lobe markedly bifid distally, adjacent spinule on posterior edge subequal with tip in both juvenile and adult; mid-dorsal regions of carapace smooth except for a few prominent spines ..... *L. waitei*
- 10(7) Postorbital lobe generally with prominent spine or tubercle on upper anterior edge; carapace covered by short spines and tubercles ..... 11
- Postorbital lobe without spine on anterior edge; carapace dorsal surface with closely spaced tubercles or spinules ..... 12
- 11(10) Carapace in both male and female covered by a few spines; merus and carpus of cheliped bearing numerous spines on all surfaces; postorbital lobe with a small tubercle on upper anterior edge about one-third from base, a larger additional spinule seldom present ..... *L. garricki*
- Carapace in male densely covered by spines, in female by numerous tubercles; merus and carpus of cheliped in male with spines restricted to upper and outer surfaces, lower surface smooth; postorbital lobe with a strong spinule on upper anterior edge about midway along, a small tubercle basal to spinule sometimes present ..... *L. australis*
- 12(10) Rostral spines more than half postrostral carapace length; postorbital spine prominent, acuminate; chela sometimes with nodules ..... *L. kiensis*<sup>34</sup>
- Rostral spines less than  $\frac{1}{3}$  postrostral carapace length; postorbital spine broad, triangular; chela without nodules ..... *L. longimanus*

*Leptomithrax australis* (Jaquinot, 1853)  
(Pl. 13a,b)

*Paramithrax* (*Leptomithrax*) *brevirostris* Miers, 1879a: 8-9; new synonymy.  
*Leptomithrax australis*. — Griffin, 1966d: 66-69, figs. 13, 14, 22.

Material examined. — No new material.

Remarks. — We have examined the type (the only reported specimen) of *L. brevirostris* Miers (1879a) (female, imm., postrostral cl. 34 mm, no locality, BM(NH) 1939.5.8.18) which Miers distinguished by its very short triangular rostral spines. Examination of the specimen shows that the rostral spines and all but one of the anterior spines of the two basal antennal articles are deformed. The rostral spines are less than a tenth (0.09) postrostral carapace length and are not identical in shape. On the basal antennal article on the right hand side of the specimen the anterolateral spine appears normal but the medial spine on that article and the two anterior spines on the left hand article are each of a different length but all are shorter than the apparently normal spine. Also the two peduncle segments of the antenna on the left hand side are about half the size of those on the right hand side. We have compared the specimen of *L. brevirostris* with immature females of a similar size in a series of *L. australis* (15♂♂,

10♀♀, cl. 21.5-74.5 mm, Campbell I., New Zealand, coll. J. Lowry, AM P.32092 — P.32107) and except in the characters mentioned above, it agrees with them in all respects. The immature females of *L. australis* differ from the adults in having shorter spines on the carapace margins and the cheliped has tubercles rather than short spines dorsally on the merus and carpus.

We see no good reason for regarding Miers' *L. brevirostris* as a distinct species and we now add it to the synonymy of *L. australis*. No locality was given by Miers in his original description. However, Miers' report was based on material in the British Museum Collections and deals with species from several localities including Australia and the Pacific. We draw the conclusion we have despite the fact that Miers (1876) recorded *L. australis* from New Zealand and referred to an adult female of this species in the British Museum Collection. Miers may have been confused by the deformed rostrum of his *L. brevirostris* as the rostrum of an adult female of *L. australis* is about a sixth of the postrostral carapace length.

Distribution. — Restricted to southern New Zealand.

*Leptomithrax bifidus* Ortmann, 1893

*Paramithrax* (*Leptomithrax*) *bifidus* Ortmann, 1893: 52-53, pl. 3 fig. 6. — Parisi, 1915: 290, pl. 7 fig. 2. — Yokoya, 1933: 161.  
*Leptomithrax bifidus*. — Sakai, 1934: 298; 1938: 303-304, pl. 31 fig. 1; 1965a: 86, pl. 39 fig. 1; 1976: 243, pl. 87 fig. 1. — Takeda, 1973b: 43. — Takeda & Kurata, 1976: 25-27, fig. 3B-D.

Material examined. — 8♂♂, 9♀♀, 15-50 mm.

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Mortensen Pacific Expedition: Japan: 33°41'N 128°50'E, 135 m, trawl, sand, 17 May 1914; 2 specs. — 34°20'N 130°10'E, 108 m, dredge, sand, 18 May 1914; 3 specs. — Off Suno-Saki, 36-144 m, dredge, 12 June 1914; 1 spec. — Sagami Sea, Okinose, 180 m, 23 June 1914; 2 specs. — Sagami Bay, 540 m, 28 June 1914; 5 specs. — Sagami Bay, 540 m, 29 June 1914; 3 specs.

Japan, near Nagasaki, 32°59'15"N 129°23'50"E, 40 m, 'Store Nordiske', 6 August 1933; 1 spec.

Remarks. — In this species the postorbital spine is bifid at the tip and a lobe on the anterior edge meets the intercalated spine half way along its length, closing the sinus between the two. Ventrally there is a short U-shaped sinus between the basal antennal article and the postorbital spine. Sakai (1965a) uses this last character to distinguish *L. sinensis* from *L. bifidus*, but perhaps his remarks should read: "in *L. sinensis* no such sinus may be found". On a young male specimen (15 mm) the postorbital spine is completely separate from the intercalated spine and the orbit is much more open ventrally.

The cheliped is as described by Ortmann (1893): the merus and carpus are armed dorsally with sharp tubercles and some spines, while the palm is smooth. (In Sakai, 1938: 303, one should perhaps read "carpus" for "palm".)

The first sternite of the male is excavate but without pits and there are intersegmental, unrimmed pits on the following segments.

The first pleopod of the male has been figured by Takeda & Kurata (1976).

This species is similar to *L. sternocostulatus* (H. Milne Edwards) from Australia in the truncate, distally bifid, postorbital spine and the pitted male sternum, but in *L. sternocostulatus* there are three spines, not four, on the branchial margin and the pits on the sternum are rimmed and deeper. The first pleopod of the male of *L. sternocostulatus* is distally less narrow and only weakly outcurved; there is a compact group of setae on the lateral edge near the opening, but none between them and the apex.

Distribution. — Japan.

*Leptomithrax edwardsii* (De Haan, 1839)

*Maja* (*Paramithrax*) *edwardsii* De Haan, 1839: 92-93.

*Maja* (*Paramithrax*) *peronii*. — De Haan, 1839: pl. 21 fig. 2. (Not *Paramithrax peronii* H. Milne Edwards, 1834.)

*Paramithrax edwardsii*. — Adams & White, 1848: 14.

*Paramithrax* (*Leptomithrax*) *edwardsii*. — Ortmann, 1893: 52. — Parisi, 1915: 289-290. — Yokoya, 1933: 160-161.

*Leptomithrax edwardsii*. — Sakai, 1938: 302-303, pl. 30 fig. 4; 1965a: 86-87, pl. 39 figs. 2, 3; 1976: 242-243, pl. 86. — Takeda & Miyake, 1969: 513-514, figs. 12a-c; 1972a: 77. — Takeda, 1973b: 43.

Material examined. — 1♂, 2♀ (ovig.), 53.5 — postrostral cl. 59 mm, smaller ovig. ♀, 57.5 mm.

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Japan, Nagasaki, coll. James Jordan, 1911: 3 specs.

Remarks. — In this species the basal antennal article has a smooth surface and two strong anterior spines. The third maxilliped has a prominent, rounded swelling at the junction of the ischium and merus; the anterolateral angle of the ischium is produced laterally to a sharp spine.

There are two pairs of pits on the first sternite of the male and unrimmed intersegmental pits on the following segments. The first pleopod of the male has been figured by Takeda & Miyake (1969: fig. 12).

Distribution. — Restricted to Japan.

*Maja* Lamarck, 1801

Type species. — *Cancer squinado* Herbst, 1788, by subsequent designation (see Manning & Holthuis, 1981).

Remarks. — With the two new species described here, the number of species assigned to *Maja* is brought to 16. Of these 13 occur in the Indo-West Pacific and three in the east Atlantic and Mediterranean, seven species occur in Japan and four in the Philippines. There is one *Maja* species in Australia.

There is still some confusion about the identity of a few species. *M. linapacanensis* is known only from a single carapace

and *M. kominatoensis* may be a synonym of *M. gibba* Alcock. *Leptomithrax compressipes* Miers is here considered to be a *Maja*.

Species of *Maja* are characterised by the generally spiny appearance, a ventrally open orbit, a basal antennal article spined both anteromedially and anterolaterally and a male abdomen which is about as broad distally as at the third segment and is sometimes straight sided.

The first pleopod of the male typically opens subterminally but in some is partly protected by a flap and in some the distal part bears long hairs as in *Thacanthophrys* and *Eurynome*.

Distribution. — East Atlantic, Indo-West Pacific.

KEY TO INDO-WEST PACIFIC SPECIES OF *MAJA*

- 1 Carpus of first pair of ambulatory legs broad triangular, distal margin about three times basal width, distal margin of carpi of second and third pairs of ambulatory legs more than one and a half times basal width..... *M. compressipes*
- Carpi of first three pairs of ambulatory legs subcylindrical, distal margin less than one and a half times basal width..... 2
- 2( 1) Carapace with spines in midline and on margins ..... 3
- Carapace without spines in midline, margins of carapace with at most sharp tubercles ..... 10
- 3( 2) Basal antennal article with spine on lateral edge at base; branchial region with two dorsal spines; hepatic spine long, equal and parallel to postorbital spine ..... *M. spinigera*<sup>35)</sup>
- Basal antennal article without spine on lateral edge at base; branchial region with one dorsal spine or without any spine; hepatic spine shorter than postorbital spine and usually not parallel to it . 4
- 4( 3) Rostral spines usually projecting obliquely upwards; basal antennal article broad (l about 1½ w) or with 'teeth' on medial border, anterior spines long..... 5
- Rostral spines horizontal; basal antennal article narrow (l about 2 × w), surface with small tubercles, anterior spines short..... 7
- 5( 4) Four long marginal branchial spines including one subdorsal posteriorly; medial edge of basal antennal article with tubercles or lobes but not spines..... 6
- Six irregularly sized marginal branchial spines including one subdorsal posteriorly; medial edge of basal antennal article with one long spine and four shorter spines or 'teeth' .... *M. linapacanensis*<sup>36)</sup>
- 6( 5) Antorbital spine curved forward distally; anteromedial spine of basal antennal article acuminate, directed ventrally and curved forwards..... *M. suluensis*
- Antorbital spine straight, parallel to postorbital spine; anteromedial spine of basal antennal article, blunt, straight ..... *M. miersii*
- 7( 4) One hepatic and four marginal branchial spines, all subequal, long; two obvious dorsal spines on branchial regions..... *M. nagashimaensis*
- One hepatic and a varying number of marginal branchial spines, two or three branchial spines markedly longer than others; no dorsal branchial spines ..... 8
- 8( 7) Intestinal region with one medial spine followed by a submedial pair on posterior margin; rostral spines a third postrostral carapace length ..... *M. africana*
- Intestinal region without spines, sometimes with tubercles and enlarged granules; rostral spines no more than a quarter postrostral carapace length..... 9
- 9( 8) Carapace elongate pyriform; tip of first male pleopod ovate and fringed with hairs..... *M. sakaii*
- Carapace broader than in *M. sakaii*; tip of first male pleopod pointed with an ovate slit ..... *M. japonica*

<sup>35)</sup> From the literature (Sakai, 1938; 1976).

<sup>36)</sup> Known from carapace only, possibly a synonym of *M. compressipes*.

- 10( 2) Postorbital lobe with a prominent tubercle on anterior margin at base; basal antennal article lacking tubercles or spines on lateral edge and surface..... *M. bisarmata*  
 — Postorbital lobe without accessory tubercles or spines; basal antennal article with tubercles on lateral edge and surface..... 11  
 11(10) Carapace tubercles granular, small tubercles among the larger tubercles; midline with six medial spines and two to three pairs of submedial tubercles..... *M. confragosa*  
 — Carapace tubercles smooth, surface between tubercles smooth .. 12  
 12(11) Carapace uniformly covered with studded tubercles ..... *M. gibba*  
 — Carapace covered with large wart-like tubercles .....  
 ..... *M. kominatoensis*<sup>35)37)</sup>

*Maja africana* new species  
 (Figs. 71a-e; 73c,d, Pl.14)

Material examined. — 1♂, cl. 24 mm.

Holotype. — Male, cl. 24 mm, South Africa, off Durban, 21°54'25"S 31°09'45"E, ca. 122 m, dredge, sand, gravel, 29 August 1929; Mortensen Java-S.Africa Expedition, Stn. 31; Zoological Museum, University of Copenhagen.

Description. — Carapace pyriform, width equal to 0.8 postrostral carapace length; surface with many small even tubercles and a few short spines, margin with a few long spines.

Rostrum of two straight slender spines, one third postrostral carapace length, weakly divergent.

Orbit consisting above of a moderately expanded eave; rounded anteriorly, no preorbital spine; antorbital spine narrowly triangular, directed outward and slightly forward, surface granular; intercalated spine narrowly triangular, extending as far laterally as antorbital spine, surface and edges with granules; postorbital spine triangular, twice as long as intercalated spine, proximally excavate, extending laterally and anteriorly beyond apex of antorbital spine, granules proximally, without a lobe on anterior margin.

Eyestalks with two or three granules midway on dorsal surface, cornea large, mainly ventral.

Hepatic margin with single very short spine, one sixth postorbital spine, hepatic region moderately swollen.

Branchial margin with four spines, last more dorsally placed, anterior two very short, posterior two longer, about equal to intestinal spine.

Mesogastric region with three medial spines, anterior two very short, barely higher than carapace tubercles, posterior spine about twice height of anterior spines. Protogastric region with a compound tubercle lateral to anterior mesogastric spine.

Cardiac region weakly elevated with a short central spine. Intestinal region with a long (about a quarter length of rostral spines) acuminate anterior spine; posterior margin of carapace with two long acuminate submedial spines, at least half length of rostral spines (tips broken).

Branchial region with an anterior and posterior compound tubercle dorsally.

Basal antennal article narrow, anteromedial and anterolateral spines short, acute; surface with tubercles mainly in two longitudinal rows, one on lateral edge and one just inside medial edge, medial edge almost smooth. Suborbital border tuberculate, a very fine fissure between basal antennal article and suborbital lobe, no fissure between suborbital and postorbital lobe.

Third maxilliped ischium with a shallow, central, longitudinal groove, ridge lateral to groove granular; merus with granules midway along posteromedial border, a few centrally; anterolateral angle moderately expanded, rounded; exognath with granules on medial edge.

Pterygostomian region smooth with a few small tubercles laterally, margin with about five tubercles.

Male sternum densely tuberculate on posterior quarter of first segment and all remaining segments, anterior three quarters of first segment smooth.

Cheliped smooth, slender, merus with a minute acute terminal spine, fingers with minute proximal teeth. Ambulatory legs cylindrical, slender, meri without terminal spine; first pair of legs nearly one and a half times postrostral carapace length; all segments with long setae; fringe of shorter setae dorsally on dactyl.

Abdomen of male with third segment only slightly wider (1.2) than sixth segment, both sixth and seventh segment wider (2.1, 1.7) than long; second segment with a pair of submedial tubercles and a lateral tubercle; third segment granular and remaining segments with a few granules.

First pleopod of male is curved laterally and only tapers just before acute apex; a large group of setae just behind apex on medial edge, another group a little further back near lateral edge anterior to opening; opening is subcircular on abdominal surface.

Remarks. — This species is similar to *M. japonica* and *M. sakaii*, but can be distinguished from them by the longer rostral spines which are a third rather than a quarter or a fifth postrostral carapace length; by the longer intercalated spine which is subequal to, not shorter than, the antorbital spine; by the longer postorbital spine which exceeds the apex of the antorbital spine; and by the two very long submedial spines on the posterior margin of the carapace. The first pleopod of the male is similar to that of *M. japonica* but the setae on the lateral edge are in a distinct group, not scattered as in that species.

The specific name refers to the type locality of the new species.

Distribution. — Known only from the type locality, off Durban, South Africa.

*Maja compressipes* (Miers, 1879) new combination  
 (Pl. 15a,b)

*Paramithrax* (*Leptomithrax*) *compressipes* Miers, 1879a: 8.

Material examined. — No new material.

<sup>37)</sup> These are the characters used by Sakai (1976); we do not consider that these reliably distinguish the two species from each other.

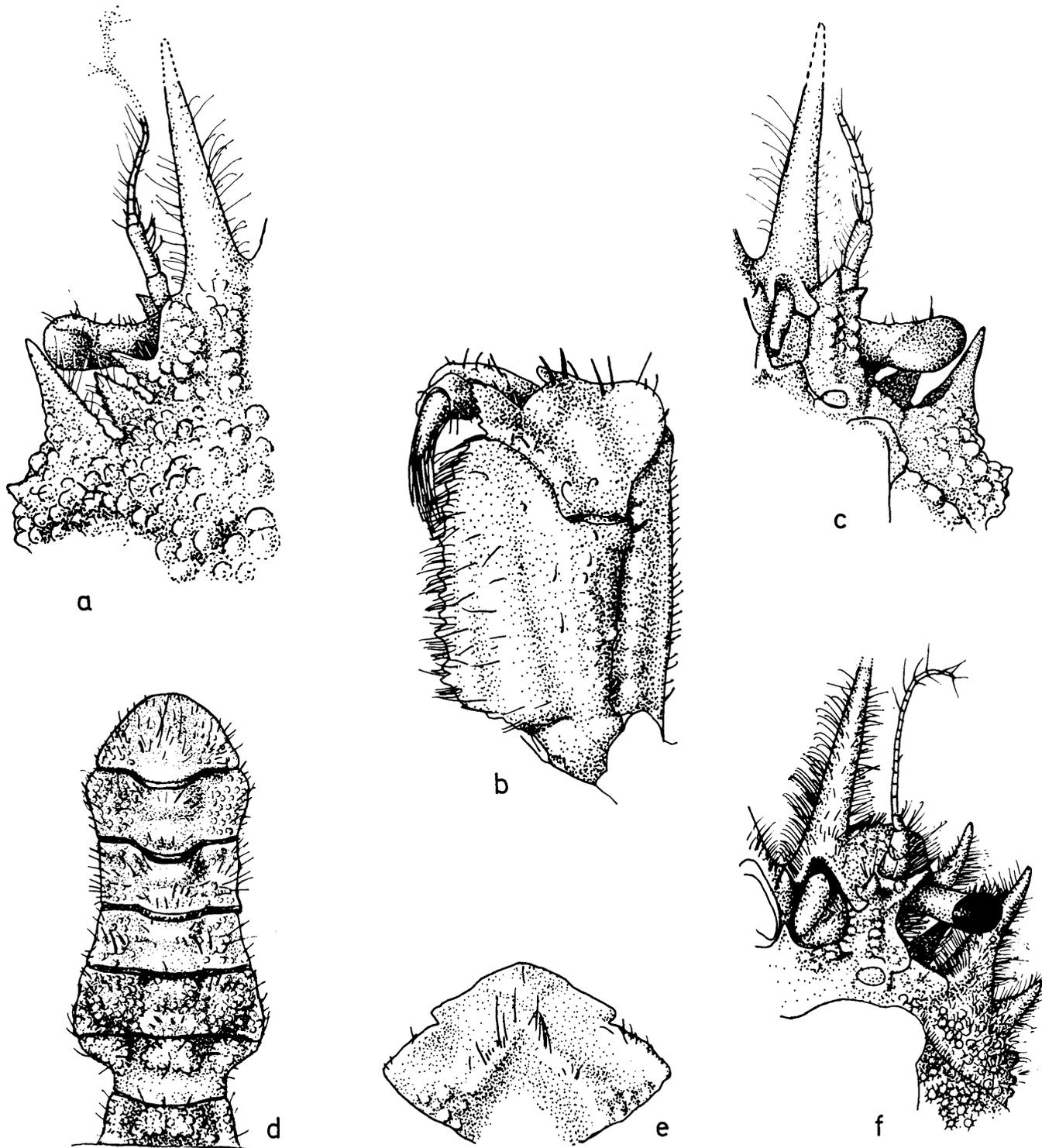


Fig. 71. *Maja africana* (holotype) (a) left orbit, dorsal view; (b) left third maxilliped; (c) left orbit, ventral view; (d) male abdomen; (e) male sternum; *M. suluensis* (female, 51.5 mm, N. of Jolo, ZMC) (f) left orbit, ventral view.

Remarks. — We have examined the type of this species (female, adult, postrostral cl. 51.6 mm, Canton, BMNH 1860.15). The flagellum of the antenna is included within the orbit and the chelipeds are smooth, indicating, with other characters, that this species is more correctly placed in *Maja* than in *Leptomithrax*. It is distinguished from all other known species of *Maja* by the carpi of the first three pairs of ambulatory legs which are dorsoventrally flattened and widened

distally. This feature is particularly marked in the first ambulatory leg where the distal margin of the carpus is three times as wide as the proximal margin and only slightly less (0.9) than the carpus length.

The basal antennal article is moderately broad; there is a triangular, laterally directed anterolateral spine and a blunt anteromedial spine directed ventrally. There are two to three small tubercles on the anterior margin of the anterolateral

spine and the lateral margin of the article behind the spine is concave and finely crenulate. On the anterior face of the anteromedial spine, near the base, there is a large granular tubercle and just posterior to the spine, on the medial margin of the article there is a similarly-sized spine with tubercles at its base. At the base of the article, on the margin of the antennular fossa, there is a medially directed granular lobe with its blunt apex adjacent to the granular tubercle on the epistome. There is a tubercle midway along the medial margin of the article on the left hand side but not on the right hand side.

The carapace is covered with small close-set blunt tubercles and lacks a strong ridge on the midline. There is a small mesogastric spine and a small spine (broken) on the cardiac region. There is also the base of a short dorsal spine on the branchial region, level with the cardiac spine. On the hepatic margin there are three to four spines; the anterior is largest, about quarter the length of the postorbital lobe and at right angles to it. There are four to five short spines on the anterolateral margin of the branchial region.

The intercalated spine is shorter than either the postorbital or antorbital lobes but is not excluded from the lateral margin of the orbit. The rostral spines are weakly divergent (but the tips are broken).

Rathbun (1916) remarked that her specimen (an incomplete carapace) of *Maja linapacanensis* was similar to this species although it was then placed in a different genus. However, Miers' specimen is, in our view, properly considered a *Maja* and there is a dorsal branchial spine in this species as Rathbun described for *M. linapacanensis*. There appear to be differences between the basal antennal article of this species and that of *M. linapacanensis* described by Rathbun, even allowing for the variation in the number of small tubercles shown in this specimen. The two species appear to be generally similar but it would require the examination of not only the types of the two species but also of some more complete material to decide whether they are the same species or not.

Distribution. — Known only from Canton, China.

*Maja confragosa* new species  
(Figs. 72, 73a,b; Pl. 16)

Material examined. — 1♂, cl. 39 mm.

Holotype. — Male, cl. 39 mm, Kai Islands, 05°39'S 132°26'E, 300 m, Sigsbee Trawl, mud bottom, 5 April 1922; Danish Kei Islands Expedition, Stn. 8, Zoological Museum, University of Copenhagen.

Description. — Carapace broad, width almost 0.9 times postrostral carapace length, surface densely covered with irregularly sized tubercles; dorsal midline weakly elevated with six low spines anteriorly and two or three pairs of submedial tubercles posteriorly.

Rostrum of two slender spines just over a third postrostral carapace length, parallel basally and divergent in distal half. (There is a spinule at distal third on left hand spine.)

Orbit consisting above of an expanded eave, rounded anteriorly, no preorbital spine; antorbital spine long, acute, directed outward and slightly forward; intercalated spine narrowly triangular, shorter than antorbital spine, sharp with granules on both edges; postorbital lobe reaching slightly further forward than antorbital spine, twice as long as intercalated spine, broad basally, excavate, narrow and acute distally, directed forward and slightly outward, small granular lobe proximally on anterior edge (on right hand side).

Eyestalks narrow, granules anteriorly on distal half, cornea large and mostly ventral.

Hepatic margin with a short spine, less than half postorbital spine and separate from it, basally granular; hepatic region behind spine swollen with two large tubercles. Branchial margin with four sharp spines on margin, last more dorsal on carapace.

Mesogastric region with four short blunt medial spines, first smaller than rest, urogastric region with one short medial spine. Cardiac region with two short medial spines, one anteriorly and one centrally, and a pair of submedial tubercles posteriorly.

Intestinal region with a pair of larger anterior submedial tubercles, and a pair of sharp submedial spines on posterior margin of carapace.

Branchial region dorsally with one short central spine, just lateral to central cardiac spine.

Basal antennal article narrow with an anteromedial and anterolateral spine, each with spinules, medial spine directed ventrally and forward, lateral spine directed outward and forward; two or three tubercles on lateral edge and close to medial edge, medial edge smooth. Suborbital lobe indistinctly separated from basal antennal article, no fissure marking separation from postorbital lobe. Epistome smooth.

Third maxilliped ischium with shallow, central longitudinal groove and granules on ridge lateral to groove; merus with granules midway along posteromedial border, anterolateral angle moderately produced, edge crenate; exognath with granules on medial edge.

Pterygostomian region smooth, margin with about five large and several small tubercles.

Sternal segments with small tubercles and granules on medial half adjacent to abdominal fossa, first segment smooth except for posterior edge, segments two to four each with one or two tubercles laterally.

Cheliped slender, smooth, small acute terminal spine on merus; chela slender, palm more than three times as long as high; fingers unarmed, one third length of palm.

Ambulatory legs slender, cylindrical, unarmed, all segments with long setae.

Male abdomen granulate, third segment only slightly wider (1.1) than sixth segment, sixth segment about twice as wide as

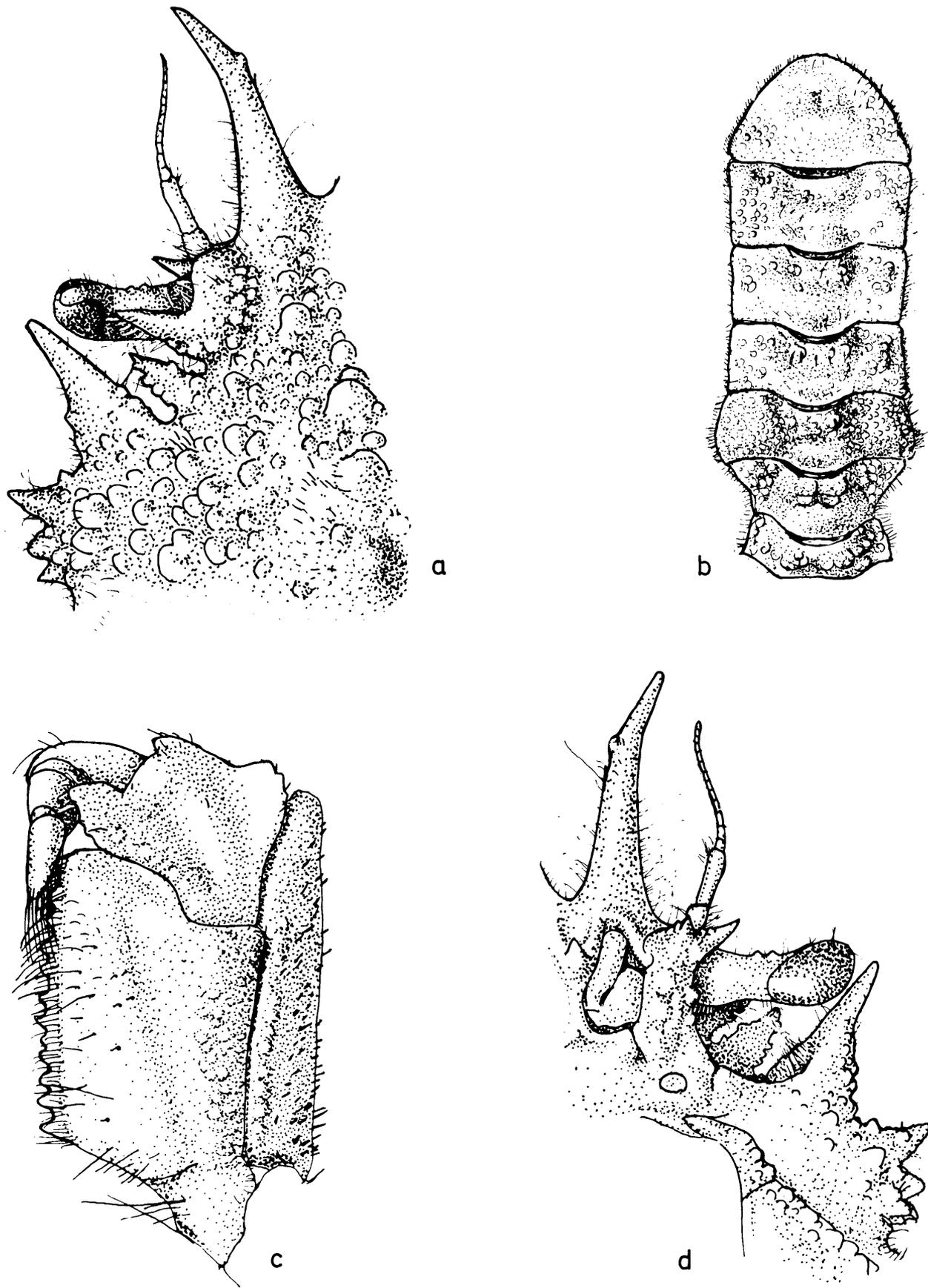


Fig. 72. *Maja confragosa* (holotype) (a) left orbit, dorsal view; (b) male abdomen; (c) third maxilliped; (d) left orbit, ventral view.

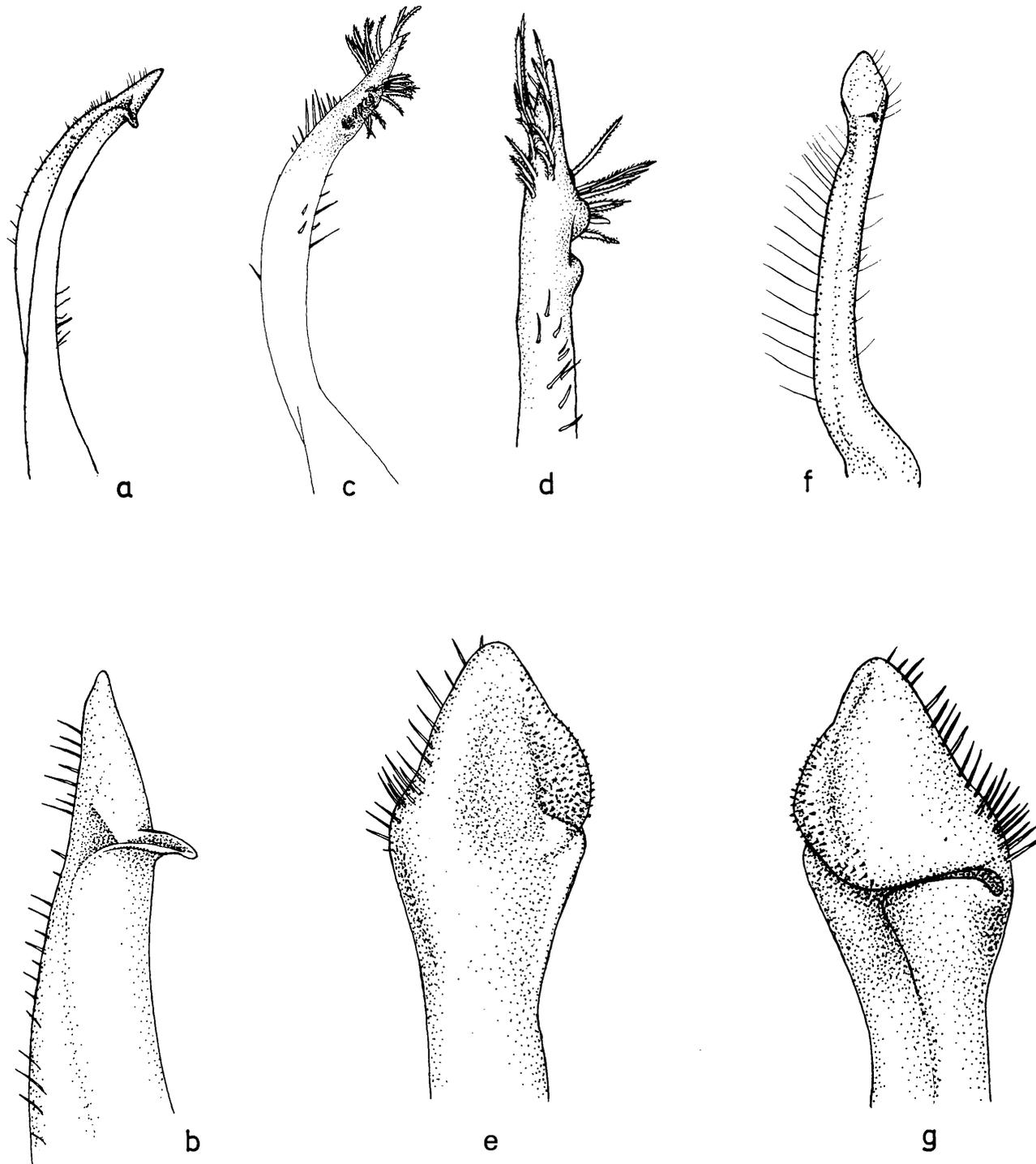


Fig. 73. Left first pleopod of male of *Maja confragosa* (holotype) (a) abdominal view of pleopod, (b) abdominal tip of same; *M. africana* (holotype) (c) abdominal view of pleopod, (d) sternal tip of same; *Notomithrax spinosus* (male, 12.5 mm, Kermadec Is., ZMC) (e) sternal tip of pleopod, (f) abdominal view of pleopod, (g) abdominal tip of same.

long, seventh segment about one and a half times as wide as long.

First pleopod of the male similar to that of *M. nagashimaensis* Sakai: distally curved slightly outwards and tapering only at apex; opening below apex on medial edge; ventral edge of opening with a short, narrow, acute lobe produced across abdominal surface.

Remarks. — This species can be distinguished from *M. mier-*

*sii*, *M. suluensis* and *M. spinigera* by the absence of long dorsal spines. The first pleopod of the male is similar to that of *M. nagashimaensis* but this new species is distinguished from that species and the other small species, *M. japonica*, *M. sakaii* and *M. africana*, by having large coarse tubercles, not fine granules, on the carapace surface, and a ridge of stout spines rather than a few slender spines in the midline. It is distinguished from *M. bisarmata* by the presence in that species of two cardiac spines and the smooth carapace surface

between the more scattered tubercles and spines. This species is similar to *M. gibba* in the convex carapace and coarse tubercles which are enlarged along the midline, but in *M. confragosa* the carapace tubercles are granular with many small tubercles and granules between them, not smooth, rounded, with the surface between them smooth as in *M. gibba*, and there are six distinct tubercles on the midline. *M. confragosa* can be distinguished from a young *M. gibba* of the same size by the three longer spines anteriorly on the branchial margin and the presence of a fourth spine more dorsally placed (absent in *M. gibba*); by the postorbital spine which is longer and more slender distally than in *M. gibba*; and by the rostral spines which are longer (0.36 rather than 0.17 postrostral cl.) and horizontal, not declivous as in *M. gibba*.

*M. confragosa* is similar to the Atlantic species *M. squinado* (Herbst) in the convex, generally tuberculate carapace and the ridge of short subequal spines on the midline. The first pleopod of the male in *M. squinado* is similarly broad and tapers near the apex, but it lacks the small process on the abdominal surface. The basal antennal article in *M. squinado* is much broader than in *M. confragosa* or any of the Indo-west Pacific species of *Maja*.

The specific name refers to the rough appearance of the new species.

Distribution. — Known only from the type locality, Kai Islands.

*Maja gibba* Alcock, 1895

*Maja gibba* Alcock, 1895: 239-240, pl. 4 fig. 5, 5a. — Kemp & Sewell, 1912: 31.

*Maja gibba*. — Serène & Lohavanijaya, 1973: 50 (in key), pl. 9 B. — Griffin, 1976: 200. — Sakai, 1976: 239-240, fig. 127a,b, pl. 84 fig. 1.

Material examined. — 4 ♂♂, 3 ♀♀ (1 ovig.) 35-85 mm, ovig. ♀, 76.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: East China Sea, 32°17'N 128°11'E, 198 m, trawl, sand, 14 May 1914; 4 specs.

Mortensen Java — S. Africa Expedition: Stn. 15, Bali Sea, 07°29'S 114°29.7'E, ca. 240 m, trawl, sand and mud with concretions, 10 April 1929; 2 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

South China Sea, 16°09.4'N 114°31.6'E to 16°11'N, 114°29.7'E, 266-295 m, Granton trawl, white muddy sand, Fisheries Research Station, Hong Kong, 12 June 1964; 1 spec. (AM P.20323).

Remarks. — The smaller specimens in this series (less than 57 mm cl.) agree with *M. gibba* as figured by Alcock (1895): the tubercles are rather sharp, a few are low spines in the mid-dorsal line, and there are three to four short spines on the branchial margin. In the larger specimens the tubercles are blunt even in the mid-dorsal line and there is only a sharp tubercle on the branchial margin representing the first marginal spine of the juvenile. This difference between the young and adult specimens of *M. gibba* has been reported also by Sakai (1976).

The larger specimens of *M. gibba* are very similar to *M. kominatoensis* (Kubo) (Kubo, 1936: 361-364, figs. 1, 2; Miyake, 1936: 418-419, pl. 28 figs. 1, 2) and in the descriptions of these two species by previous authors there seems to be no character which distinguishes clearly between them; the size and bluntness of the carapace tubercles is not a reliable character because it varies with age. Sakai has not reported on the differences if any, between the young specimens of *M. kominatoensis* and those of *M. gibba*. Until a detailed published description or an examination of specimens proves otherwise, we feel that it is probable that *M. kominatoensis* is conspecific with *M. gibba*.

In the specimens of *M. gibba* that we have examined the basal antennal article has a short spine at both the medial and lateral angles anteriorly, there is a tubercle on the medial edge and two tubercles on the lateral edge. The first sternite of the male is smooth except for a group of tubercles on the posteromedial angle; on sternal segments two to four there are tubercles near the abdominal fossa. The merus of the adult male cheliped is broadened distally with a very small acute terminal spine, the carpus bears two longitudinal ridges of which the outer is more tuberculate, the palm is expanded and flattened and subquadrate and about one and a half times as long as high; the fingers are nearly as long as the palm, slender, unarmed, with a moderate gape between them proximally. The ambulatory legs of the adult males have a fringing row of setae on the distal half of the dactyl, but few other hairs; in the ovigerous female, however, all the legs have a distinct covering of hair (this character is not a reliable distinction between the two species as may perhaps have been inferred by comparing the two figures given by Sakai (1976: pl. 84)). The first pleopod of the male is like that figured as *M. gibba* by Sakai (1976) and as *M. kominatoensis* by Kubo (1936). The gonopore of the female opens anteromedially and the lateral edge of the opening is thickened.

Distribution. — Andaman Sea, Java, Philippine Islands, South China Sea, East China Sea, Japan.

*Maja japonica* Rathbun, 1932

*Maja japonica* Rathbun, 1932: 33. — Sakai, 1965a: 83, pl. 37 fig. 1; 1976: 238-239, fig. 126a,b, pl. 82 fig. 1 — Takeda & Miyake, 1969: 512-513 (in discussion), pl. 17 figs. A, B. — Takeda, 1973b: 42. — Serène & Lohavanijaya, 1973: 50-51, figs. 93-97, pl. 9 fig. A. (Not *Maja japonica* Sakai, 1934; 1938 = *M. sakaii* Takeda & Miyake, 1969.)

Material examined. — 3 ♂♂, 6 ♀♀ (2 ovig.), 15-26 mm, smaller ovig. ♀, 16.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Sagami Bay, Misaki, off the station, 144-216 m, 10 June 1914; 1 spec. — Okinose, Sagami Sea, 180 m, 15 June 1914; 1 spec. — Off Misaki, 144-180 m, 19 June 1914; 1 spec. — Okinose, Sagami Sea, 180 m, 23 June 1914; 1 spec. — Okinose, Sagami Sea, 540 m, 29 June 1914; 1 spec.

## THE AUSTRALIAN MUSEUM, SYDNEY

South China Sea, 17°42.2'N 107°33.2'E to 17°42.8'N 107°29.2'E, 68 m, Granton trawl, mud bottom, Fisheries Research Station, Hong Kong, 6 October 1963; 4 specs. (AM P.20324).

Remarks. — The specimens from the Sagami Sea agree well with *M. japonica* Rathbun as described and figured. On the branchial margin anteriorly there is a short spine with two or three sharp tubercles behind it, and posteriorly there are two spines (one more dorsally placed) and a few sharp tubercles ventrally. The male in our Japanese series is infected with a bopyrid parasite and has only one sharp tubercle (not a spine) on the anterior and one spine (dorsal) on the posterior branchial margin.

Our specimens from the South China Sea are like that figured by Serène & Lohavanijaya (1973); on the branchial margin there are three short spines or sharp tubercles anteriorly and two posterior spines (one dorsal), with only one or two sharp tubercles ventral to them. The intercalated spine in the specimens from the South China Sea is slightly broader in the larger adult specimens, its margins are more granular and in the males it lies closer to the postorbital spine.

There is an anterior intestinal spine; the armament of the posterior margin of the carapace is variable and consists of two to four tubercles or enlarged granules.

The postorbital spine is directed forward with its apex about level with that of the antorbital spine; in *M. sakaii* the postorbital spine is shorter and more oblique.

The basal antennal article in this species is narrow with two short anterior spines, as it is in *M. sakaii*, but both edges and the surface are tuberculate, whereas in *M. sakaii* the tubercles are mainly along the edges.

The male of this species may be distinguished from that of *M. sakaii* by the form of the first pleopod (Sakai, 1976: fig. 126a). The gonopore of the female is a slit, opening anteromedially, with the lateral margin slightly thickened. (In *M. sakaii* it is a simple, round, opening.)

Distribution. — Japan, Tsushima Islands, South China Sea.

*Maja miersii* Walker, 1887

*Maia Miersii* Walker, 1887: 113-114, pl. 6 figs. 1-3.

*Maja miersii*. — Rathbun, 1924: 6. — Sakai, 1938: 298-299, pl. 38 fig. 2.; 1976: 237, pl. 82 fig. 3. — Griffin, 1966b: 284 (in key).

Material examined. — 2 ♂♂, 1 ♀ (ovig.), 22-51 mm, ovig. ♀, 51 mm.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Singapore, 1 September 1908; 1 spec. — Singapore, trawl, 1903-1907; 2 specs.

Remarks. — This species is similar to *M. suluensis* Rathbun, and the characters that distinguish it are discussed under that species.

In our specimens the hepatic region behind the spine is distinctly swollen with several large tubercles, but there is no

small secondary spine. This secondary spine was described and figured by Walker for the holotype, but not noted by Sakai (1938: 1976) for the Japanese specimens; it is absent from the specimen from Western Australia identified as *M. miersii* by Rathbun (1924).

Distribution. — Japan, Singapore, Western Australia.

*Maja nagashimaensis* Sakai, 1969

*Maja nagashimaensis* Sakai, 1969: 256-257, fig. 5b,b', pl. 1 fig. 2; 1976: 241-242, fig. 129, pl. 85 fig. 1.

Material examined. — 2 ♂♂, 16, 19 mm.

## ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 105, Sulu Archipelago, 06°08'N 121°19'E, 275 m, dredge, coral bottom, 4 July 1899; 1 spec.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Misaki, 360 m, 30 June 1914; 1 spec.

Remarks. — The hepatic spine in this species is directed obliquely backwards and fused basally with the postorbital spine. There are four strong marginal branchial spines. On the midline there is a low spine or tubercle between the mesogastric and cardiac spines. There is no intestinal spine but there are two small submedial spines on the posterior margin of the carapace.

The first pleopod of our male specimen shows no differences from that figured by Sakai (1969: 1976).

This is the first record of this species outside Japan.

Distribution. — Japan; Sulu Archipelago.

*Maja sakaii* Takeda & Miyake, 1969

*Maja japonica*. — Sakai, 1934: 297, figs. 10, 11a; 1938: 229, pl. 30 fig. 2. (Not *Maja japonica* Rathbun, 1932.)

*Maja sakaii* Takeda & Miyake, 1969: 512-513, pl. 17 fig. C. — Sakai, 1976: 237-238, figs. 125a,b, pl. 85 fig. 2.

Material examined. — 8 ♂♂, 7 ♀♀ (4 ovig.), 9-15.5 mm, smallest ovig. ♀, 12.5 mm.

## ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Islands, Sapeh Strait, 08°23.5'S 119°4.6'E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec. — Stn. 260, Kai Is., 2.3 miles (~3.7 km) N63°W. from N. point of Nuhu Jaan, 05°36.5'S 132°55.2'E, 90 m, Blake dredge, sand, coral and shells, 16/18 December 1899; 3 specs.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Ambon I., Ambon Bay, 126 m, stones, 23 February 1922; 1 spec. — Ambon I., Ambon Bay, 126 m, stones, 25 February 1922; 3 specs. — Ambon, 90 m, stones, 2 March 1922; 1 spec.

Mortensen Java-S. Africa Expedition: Stn. 18, Bali Sea, 07°15'S 114°45'E, ca. 100 m, trawl, 11 April 1929; 1 spec. — Stn. 22, Java Sea, 07°31'S 113°8'E, ca. 35 m, Sigsbee trawl, mud and sand, 12 April 1929; 1 spec.

## NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AH I, E. of Ambon, near Tg. Bt. Kapal, Haruku I., 03°36'S 128°24'E, 108-113 m, dredge haul 4, shell and rubble, 31 May 1970; 4 specs.

Remarks. — These specimens from Indonesia agree well with *M. sakaii* from Japan as described and figured under the name *Maja japonica* by Sakai (1934; 1938) and as *M. sakaii* by Takeda & Miyake (1969) and Sakai (1976).

The spines of the upper orbital border are well separated from each other. The postorbital spine is directed obliquely forwards, its apex does not reach as far forward as the apex of the antorbital spine and it has only a small lobe on the anterior border. (In *M. japonica* the postorbital spine is longer and less oblique.)

The carapace is slender and on the gastric region there are two mesogastric spines of which the anterior is either much shorter (two thirds of the specimens) or absent. There is a medial spine on the carapace region, one on the anterior intestinal region and one on the posterior margin of the carapace; in some specimens there are tubercles on either side of this last spine.

On the branchial margin there is a short spine anteriorly followed in some specimens by one or two tubercles; posteriorly there are two long spines, the more posterior situated more dorsally on the carapace.

The basal antennal article is narrow, there are two short anterior spines, tubercles on the lateral and medial margins and sometimes tubercles on the surface.

The males of this species may be distinguished from the similar species *M. japonica* by the form of the first pleopod (Sakai, 1976: fig. 125b). The gonopore of the female is a simple, round opening. (In *M. japonica* it is a slit, opening anteromedially.)

This species has not been recorded previously from Indonesia.

Distribution. — Indonesia: Java to Kai Islands; East China Sea, Japan.

*Maja suluensis* Rathbun, 1916  
(Fig. 71f)

*Maja suluensis* Rathbun, 1916: 552-553. — Griffin, 1976: 300, fig. 7a.

Material examined. — 2 ♀♀, postrostral cl. 38 mm, cl. 51.5 mm.

## ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Sulu Archipelago, N. of Jolo, ca. 36 m, dredge, *Lithothamnion*, 18 March 1914; 1 spec.

## NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. KN II, Kai Is., off Elat Bay, W. coast Nuhu Tjut, 05°40'S 132°59'E, 48-54 m, dredge haul 6, rubble, algae and sand, 13 June 1970; 1 spec.

Remarks. — This species is similar to *M. miersii* Walker. Rathbun distinguished it by the presence of two gastric spines (not one), and the absence of a secondary spine on the hepatic region. Our specimen from the Sulu Archipelago agrees with the type series of *M. suluensis* from the same locality described by Rathbun (1♂, 3♀♀, 14.5-50.5 mm, USNM 48224 (holotype), 48507, 49697) which one of us (D.J.G.G.) has subsequently examined: they all have two gastric spines. Our specimen from the Kai Islands, however, while being similar to these specimens in most characters, has only one gastric spine. In all these specimens the hepatic region behind the marginal spine is only weakly swollen and bears small tubercles. The holotype of *M. miersii*, according to the figures, has a secondary spine on the hepatic region but on the specimens described by later authors (Rathbun, 1924; Sakai, 1938, 1976) and those we have examined there is a group of large tubercles rather than a spine.

While we consider that *M. suluensis* and *M. miersii* are two valid species it seems that the characters which Rathbun used to diagnose *M. suluensis* are not reliable. The following characters appear to be more suitable in distinguishing the two species. In *M. suluensis* the antorbital spine is curved forward distally (straight, and parallel to the postorbital spine in *M. miersii*); on the basal antennal article the acute anteromedial spine is directed ventrally and curved forward distally as is the interantennular spine (blunt and straight in *M. miersii*); the anterolateral spine of the basal antennal article is directed outwards and slightly forwards (directed straight outwards in *M. miersii*) and the lateral edge is moderately concave and the proximal lobe moderately produced (strongly concave and strongly produced in *M. miersii*).

It is possible that the first pleopod of the adult males of these two species would provide additional distinguishing features, but they have not yet been figured and we have not had an opportunity to examine them.

This is the first record of this species outside the Sulu Archipelago.

Distribution. — Sulu Archipelago, Kai Islands.

*Majella* Ortmann, 1893

Type species. — *Majella brevipes* Ortmann, 1893, by monotypy.

Remarks. — This genus contains only a single species which appears to be confined to Sagami Bay, Japan; it has been discussed recently by Sakai (1965a: 84-85, text fig. 12, pl. 37 fig. 4). Dorsally the orbit comprises a spinulose eave, a sharp antorbital spine, an intercalated spine and a postorbital lobe; ventrally there is a suborbital lobe. The antenna is not excluded from the orbit. Sakai remarks that the chelipeds are like those of *Eurynome*, though not longer than the ambulatory legs, and the fingers are slightly bent toward the fixed finger. The first pleopod of the male, figured by Sakai, is straight, it

appears to have a terminal or subterminal aperture and a group of long setae on the lateral margin of the apex.

Distribution. — Restricted to Japan.

*Microhalimus* Haswell, 1880 new status  
(Fig. 86g,h)

Type species. — *Halimus* (*Microhalimus*) *deflexifrons* Haswell, 1880, by monotypy.

Remarks. — The status of *Microhalimus* has been uncertain for some time (Griffin, 1966b, 1966d). It was originally described by Haswell as a subgenus of *Halimus*; Miers (1884) remarked on its similarity to *Pseudomicippe*; McCulloch (1913) included it as a subgenus of *Naxia*, the genus in which he placed other species of *Halimus*. It is here given status as a distinct monotypic genus and included in the Majinae. In *Microhalimus* as in *Naxia* and *Pseudomicippe* the postorbital spine is remote from the eye and serves no protective function. (McCulloch regarded the two spines behind the orbit as hepatic spines; we consider the first spine to be postorbital and the second hepatic.) Both *Microhalimus* and *Pseudomicippe* lack the intercalated spine present in *Naxia*.

The first pleopod of the male of *M. deflexifrons* (fig. 86) has an aperture similar to that found in species of *Naxia* but the tip beyond the aperture, is much more elongate, the apex is acute, and there are longer setae on the abdominal surface. In species of *Pseudomicippe* there is usually a spine, a flap and a tubercle near the aperture of the male pleopod, none of which are found on the pleopod of *M. deflexifrons*.

*M. deflexifrons* also differs from species of *Naxia* in having more slender eyestalks; a small tubercle on the anterior margin of the postorbital spine; the carapace tomentose rather than smooth between the groups of curled hairs and the seventh segment of the male abdomen twice as wide as long, not as wide as long.

Distribution. — Southeast Australia.

*Naxia* Latreille, 1825  
(Figs. 74, 75)

Type species. — *Pisa aurita* Latreille, 1825, by monotypy.

Remarks. — The history of the generic name *Naxia* was dealt with in detail previously (Griffin, 1966d: 29-30). It seems that this genus has been included in the Inachinae on the basis of the incomplete orbit and slender eyestalk. However, the first pleopod of the male of four of the species of *Naxia* — *N. aries* (Guérin), *N. aurita* (Latreille), *N. spinosa* (Hess), *N. tumida* (Dana) — is similar to that of some Majinae, the aperture being slit-like with a rounded lobe and expanded margins. As well, in these four species, there is a developed, though not strongly broadened, eave; a broadened basal antennal article,

fused distally so that the antenna is excluded from the orbit; and the merus of the third maxilliped is broad. Further, the two conical spines behind the eave are part of the orbit, the more anterior being an intercalated spine as is typical of the Majinae. In *N. tumida* the intercalated spine is separated from the eave by only a small notch.

The fifth species *Naxia huttoni* (A. Milne Edwards) differs from the four species above in the male pleopod, orbital structure, third maxilliped and male abdomen. It is our opinion that this species should remain in the Inachinae and revert to the monotypic genus *Trichoplatus*. It is discussed under that genus.

Haswell's subgenus *Microhalimus* was included as a subgenus of *Naxia* by McCulloch (1913). *Microhalimus* is here given separate generic status within the Majinae.

Distribution. — Confined to the Australian littoral except for one species *N. spinosa* which also occurs in the Kermadec Islands (recorded by Miers, 1879a, as *Halimus truncatipes*).

#### KEY TO SPECIES OF NAXIA

- 1 Anterolateral spine of basal antennal article with accessory spinules; intercalated spine separated from supraorbital eave only by a notch (or fused to it) (Fig. 74g); hepatic spine short and blunt ..... *N. tumida*
- Anterolateral spine of basal antennal article unarmed; intercalated spine well separated from supraorbital eave; hepatic spine acuminate ..... 2
- 2( 1) Rostral spines slender, strongly curved outwards distally; neither preorbital nor antorbital angles of eave produced as spines; postorbital and hepatic spines close at base; basal antennal article very slender ..... *N. aries*
- Rostral spines stout, straight, divergent; both preorbital and antorbital spines present; postorbital and hepatic spines well separated at base; basal antennal article moderately broad ..... 3
- 3( 2) Preorbital and antorbital spines both broad and triangular; intercalated spine directed laterally; propod of ambulatory leg not strongly expanded near distal margin ..... *N. aurita*
- Preorbital spine broad, blunt, upturned, antorbital spine slender, acuminate; intercalated spine directed obliquely forwards; propod of ambulatory leg strongly expanded near distal margin. *N. spinosa*

#### *Notomithrax* Griffin, 1963

Type species. — *Paramithrax peronii* H. Milne Edwards, 1834, by original designation.

Remarks. — This genus was discussed in detail by Griffin (1963b; 1966d). In the first pleopod of the male of *N. peronii*, *N. minor* (Filhol) and *N. ursus* (Herbst) the aperture is transverse and the basal and distal edges are expanded to varying degrees; beyond the aperture the pleopod is slender with a finely pointed tip. The pleopod of *N. spinosus* (Miers) is much broader and quite blunt apically, it lacks the slender distal process of the other species and the edges of the aperture are not expanded.

*Notomithrax baekstroemi* (Balss) from Juan Fernandez Islands, Chile has been included in this genus until now, but

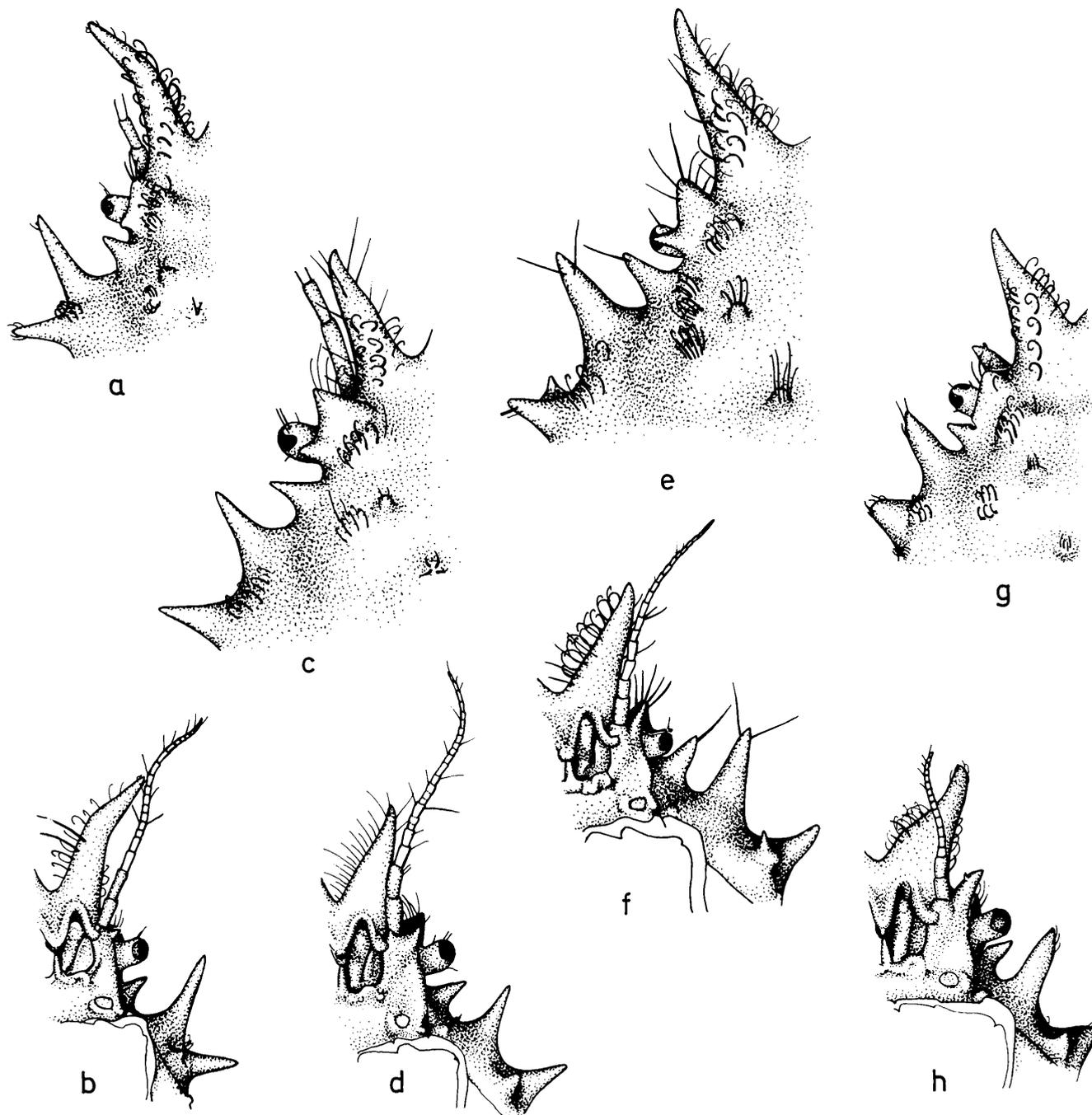


Fig. 74. Left orbit of *Naxia aries* (male, 39 mm, AM P.15992) (a) dorsal view, (b) ventral view; *N. aurita* (male, 62 mm, AM P.26918) (c) dorsal view, (d) ventral view; *N. spinosa* (male, 63 mm, AM P.12341) (e) dorsal view, (f) ventral view; *N. tumida* (male, 28 mm, AM P.10383) (g) dorsal view, (h) ventral view.

it differs from other species of *Notomithrax* in having a preorbital spine and the first pleopod of the male (Garth, 1958; pl. U fig. 2) shows more affinities with the pleopods of some species of *Thacanophrys* than with those of *Notomithrax* species. For these reasons we have removed *N. baekstroemi* from *Notomithrax* to the new genus *Ageitomaia*.

Distribution. — South West Pacific; restricted to Australia, New Zealand and adjacent islands.

#### KEY TO SPECIES OF *NOTOMITHRAX*

- 1 Carapace with spines in the dorsal midline as well as tubercles; five to seven marginal branchial spines ..... 2
- Carapace with tubercles in the dorsal midline; rarely short spines; two to four marginal branchial spines ..... 3
- 2( 1) Protogastric regions smooth or only faintly tuberculate; seven marginal branchial spines; merus of cheliped smooth dorsally, carpus with dorsal ridge poorly developed, tuberculate, lateral ridge well developed, sharp, entire ..... *N. minor*
- Entire surface of carapace covered by tubercles and spines leaving no smooth areas; five marginal branchial spines; merus of cheliped

- with a few spines and tubercles dorsally; carpus with dorsal ridge entire, blunt, lateral ridge well developed, blunt, entire. . . *N. peronii*
- 3( 1) Three marginal hepatic spines and three marginal branchial spines forward of widest part of carapace; intercalated spine acuminate, postorbital lobe slender; carpus of cheliped with serrate crests. . . . . *N. ursus*
- One marginal hepatic spine and four (sometimes two) marginal branchial spines, the last behind widest part of carapace; intercalated spine blunt, postorbital lobe broad; carpus of cheliped with sharp tubercles . . . . . *N. spinosus*

*Notomithrax spinosus* (Miers, 1879)  
(Figs. 73e-g, 76)

*Paramithrax* (*Paramithrax*) *spinosus* Miers, 1879a: 9, pl. 4 fig. 5.  
*Notomithrax spinosus*. — Griffin, 1963b: 232 (in key).

Material examined. — 1♂, 12.5 mm, 1♀ (ovig.), 9.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Galathea' Expedition: Stn. 674, Kermadec Islands, Raoul Islet, 29°13'S 177°57'W, 75-85 m, dredge, gravel and stones, 3 March 1952; 1 spec. — Stn. 675, Kermadec Islands, Raoul Islet, 29°13'S 177°57'W, 60 m, trawl, stones, 3 March 1952; 1 spec.

Remarks. — These specimens agree with the holotype described by Miers in the small size, granulated carapace surface and blunt supraorbital spines.

These specimens differ from the description and figure given by Miers in the following points:

1. the spines on the gastric region, intestinal region and posterior margin of the carapace in the holotype, are represented only by tubercles;
2. there are four small spines (not two) on the branchial region;
3. the carpus of the cheliped is armed with sharp tubercles rather than a dentate crest;
4. as well as an anterolateral spine there is a small anteromedial spine on the basal antennal article;
5. the rostral spines are broader.

In general these differences are of the kind encompassed by intraspecific variation in other species of *Notomithrax*.

The first pleopod of the male is apically more blunt than that of other species of *Notomithrax* (see Griffin, 1966d: fig. 21).

Distribution. — South Western Pacific: Norfolk I., Kermadec Is.

*Paramithrax* H. Milne Edwards, 1834

Type species. — *Pisa barbicornis* Latreille, 1825 by subsequent designation of Desmarest (1858).

Remarks. — This genus and its type species have been dealt with in detail previously (Griffin, 1963b, 1963c, 1966d).

The first pleopod of the male of *P. barbicornis* is apically truncate, but in fact examination shows that it is similar in its basic structure to the first pleopods of males of *Thacanophrys* species. In *P. barbicornis* the part of the pleopod beyond the aperture is greatly reduced so that the aperture is terminal. A similar reduction in the tip of the pleopod occurs in *Tumulosternum parvispinosus* (Ward).

This genus is set apart from other genera with a *Thacanophrys* type of pleopod by the carapace ornamentation (weakly tuberculate and weakly spinous) but more importantly by the structure of the orbit. Dorsally the postorbital lobe is remote from the orbit and ventrally the broad basal antennal article has a notch on the lateral margin just before the anterolateral angle, giving the article a peculiar appearance.

Distribution. — Restricted to southern Australia (southwest, south, southeast).

*Pippacirama* new genus

Type species. — *Paramicippa tuberculosa* H. Milne Edwards, 1834.

Description. — Carapace pyriform with tubercles and spines. Rostrum of two spines fused basally, separate in distal half, deflexed. Orbit above comprising an eave and postorbital lobe; eave with a small posterior lobe. Postorbital lobe lamellate not excavate, a lobe on anterior margin. Eyestalks long, slender, not retractile against postorbital lobe, orbit open below. First free segment of antenna flattened and dilated. Third maxilliped with merus wider than ischium, anterolateral angle produced. Chelipeds of male tuberculate. Ambulatory meri tuberculate. Abdomen of seven segments in both sexes. First pleopod of male with two well developed apical lobes.

Remarks. — It has been explained previously (Griffin, 1966b: 268) that because *Paramicippa* was not a valid genus for *P. tuberculosa* this species has been included until now in the genus *Micippa*. However, it differs from all other species of *Micippa* in several important characters. The upper orbit lacks an intercalated spine and is open while in species of *Micippa* there is an intercalated spine and the orbit is closed; the lower orbit is also open and the basal antennal article is widely separated from the postorbital lobe, while in species of *Micippa* the basal antennal article is broad and there is a suborbital lobe adjacent to both it and the postorbital lobe; there are two well developed apical lobes on the first pleopod of the male, while in *Micippa* species the first pleopod is apically simple. In addition the rostral spines are separate in the distal half and the anterolateral angle of the merus of the third maxilliped is strongly produced and rounded, features not found in *Micippa*. The open orbit of *Pippacirama* makes it entirely inappropriate to place it in the Mithracinae.

The new name is an anagram of *Paramicippa*.

Distribution. — Southeastern and southern Australia.

*Pippacirama tuberculosa* (H. Milne Edwards, 1834), new combination

(Figs. 68e,f, 77, Pl. 21b)

*Paramicippa tuberculosa* H. Milne Edwards, 1834: 333.  
*Micippa parvirostris* Miers, 1879a: 13-14, pl. 4 fig. 9.

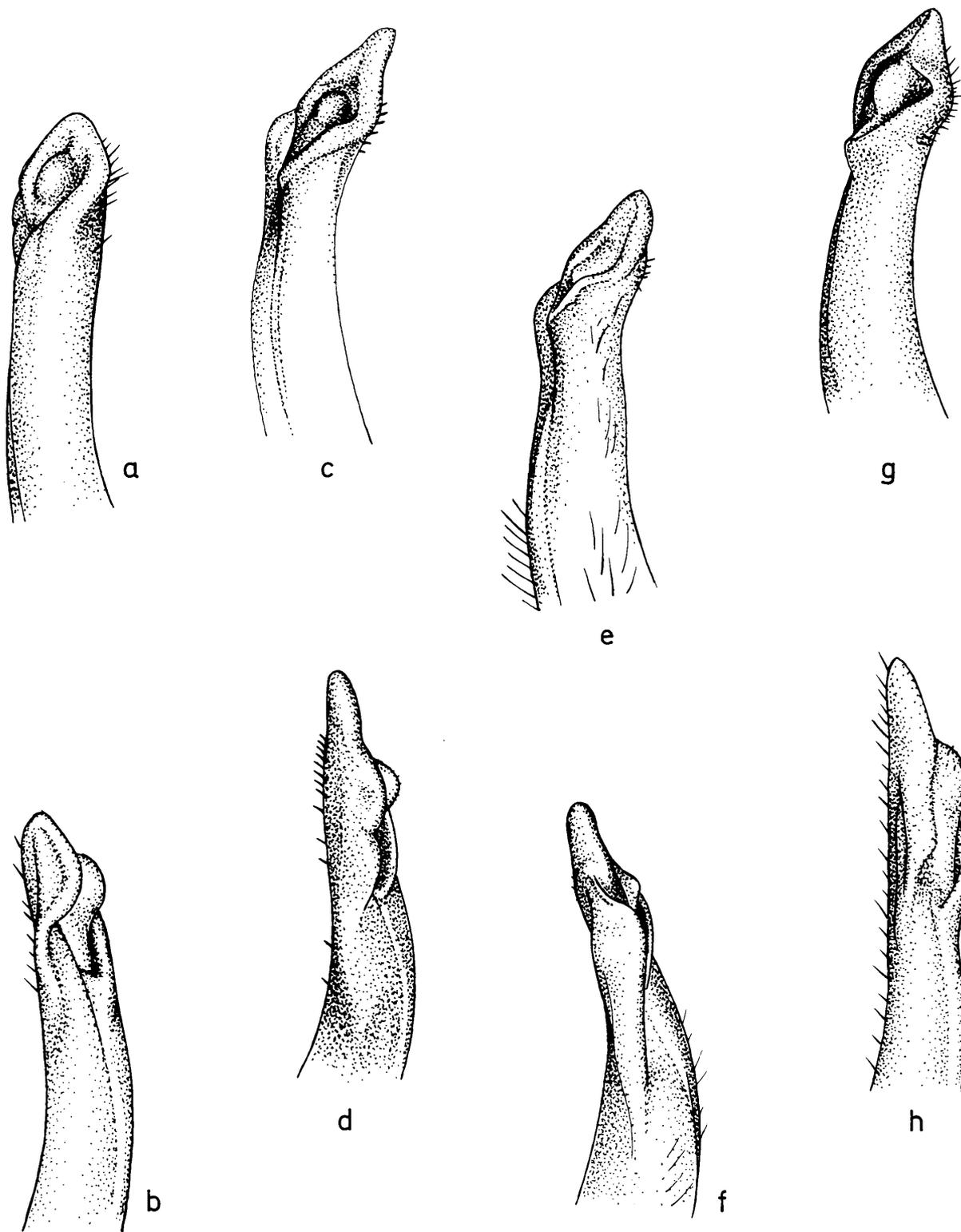


Fig. 75. Left first pleopod of male of *Naxia aries* (39 mm, AM P.15992) (a) abdominal tip of pleopod, (b) sternal tip of same; *N. aurita* (62 mm, AM P.26918) (c) abdominal tip of pleopod, (d) sternal tip of same; *N. spinosa* (63 mm, AM P.12341) (e) abdominal tip of pleopod, (f) sternal tip of same; *N. tumida* (28 mm, AM P.10383) (g) abdominal tip of pleopod, (h) sternal tip of same.

*Paramicippa tuberculosa*. — Miers, 1885: 12-13, pl. 1 fig. 1, 1a-c. — Hale, 1927: 140, fig. 142.  
*Micippa tuberculosa*. — Griffin, 1966b: 268, 287; 1972: 73.

Material examined. — 5 ♂♂, 11 ♀♀ (7 ovig.) 10-20 mm, smallest ovig. ♀, 10 mm.

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New South Wales: Collaroy, Long Reef; 1 spec. (AM P. 8707). — Port Jackson; 2 specs. (AM P. 165); 1 spec. (AM P.29840). — Port Jackson, Bottle and Glass rocks, intertidal, 27 May 1926; 1 spec. (AM P. 9225); 1 spec. (AM P. 8619). — Port Jackson, Sow and Pigs Reef, about 5 m, coll. F. A. McNeill, November 1926; 2 specs. (AM P. 8714). — Port Jackson,

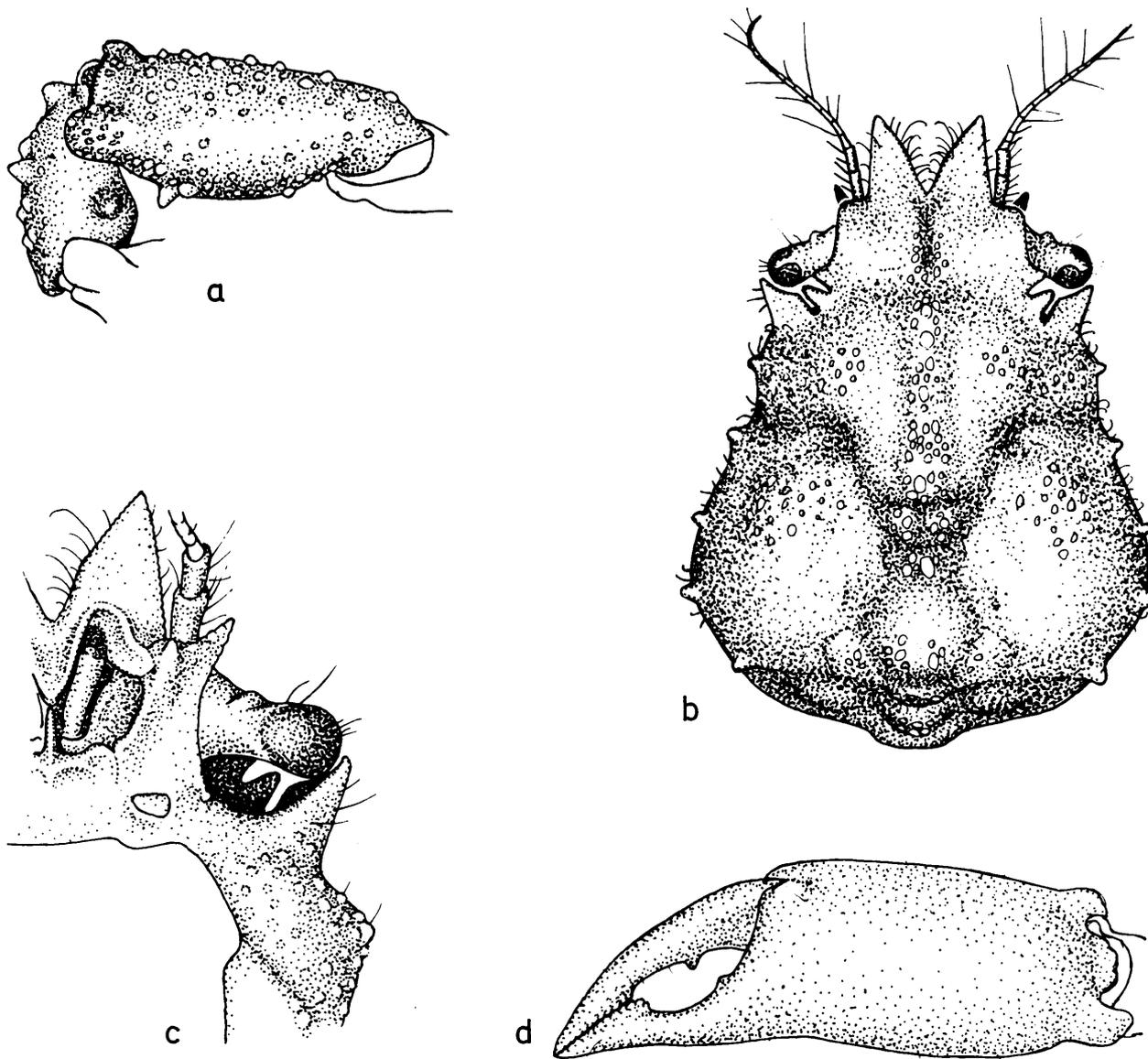


Fig. 76. *Notomithrax spinosus* (male, 12.5 mm, Kermadec Is., ZMC) (a) left cheliped, merus and carpus; (b) carapace, dorsal view; (c) left orbit, ventral view; (d) left chela.

vicinity of Sow and Pigs Reef, about 7 m, dredged, 16 January 1928; 1 spec. (AM P. 9049). — Botany Bay, Kurnell, coll. F. A. McNeill, December 1927; 1 spec. (AM P. 8941).

Victoria: Port Phillip; 2 specs. (AM G. 620); 1 spec. (AM G. 5936).

South Australia: 1 spec. (AM P.2350); 1 spec. (AM P. 3096).

Western Australia: near Albany, King George Sound, dredged, June 1948; 1 spec. (AM P. 14006).

**Remarks.** — This series of specimens comes from four discrete areas of Australia and shows geographic variation in several characters. In the specimens from New South Wales the margin of the supraorbital eave is smooth with a row of tubercles parallel to it; in specimens from Victoria and South Australia there is a continuous row of large tubercles on the margin; and in the specimen from Western Australia there are about six small, separate tubercles on the margin of the eave.

The postorbital lobe in the New South Wales specimens is blunt with a rounded accessory lobe on the anterior margin

and tubercles principally on the margins of the lobe; in the Victorian and South Australian specimens the lobe is also blunt with a rounded accessory lobe but there are many rounded tubercles on the surface of the lobe; in the Western Australian specimen the postorbital lobe and the accessory lobe are both apically pointed and there are only a few basal tubercles on the lobe.

There is a large compound tubercle or groups of compound tubercles dorsally on the hepatic region in the New South Wales specimens. In these specimens the gastric region is also more strongly and narrowly elevated than in the specimens from other areas and there are three tuberculate mesogastric spines rather than three large mesogastric tubercles. On the cardiac region there are similar variations in the degree of elevation, density of tubercles and height of the two spines.

In the males of the series as a whole, the merus and carpus of the male cheliped are tuberculate dorsally and on the outer

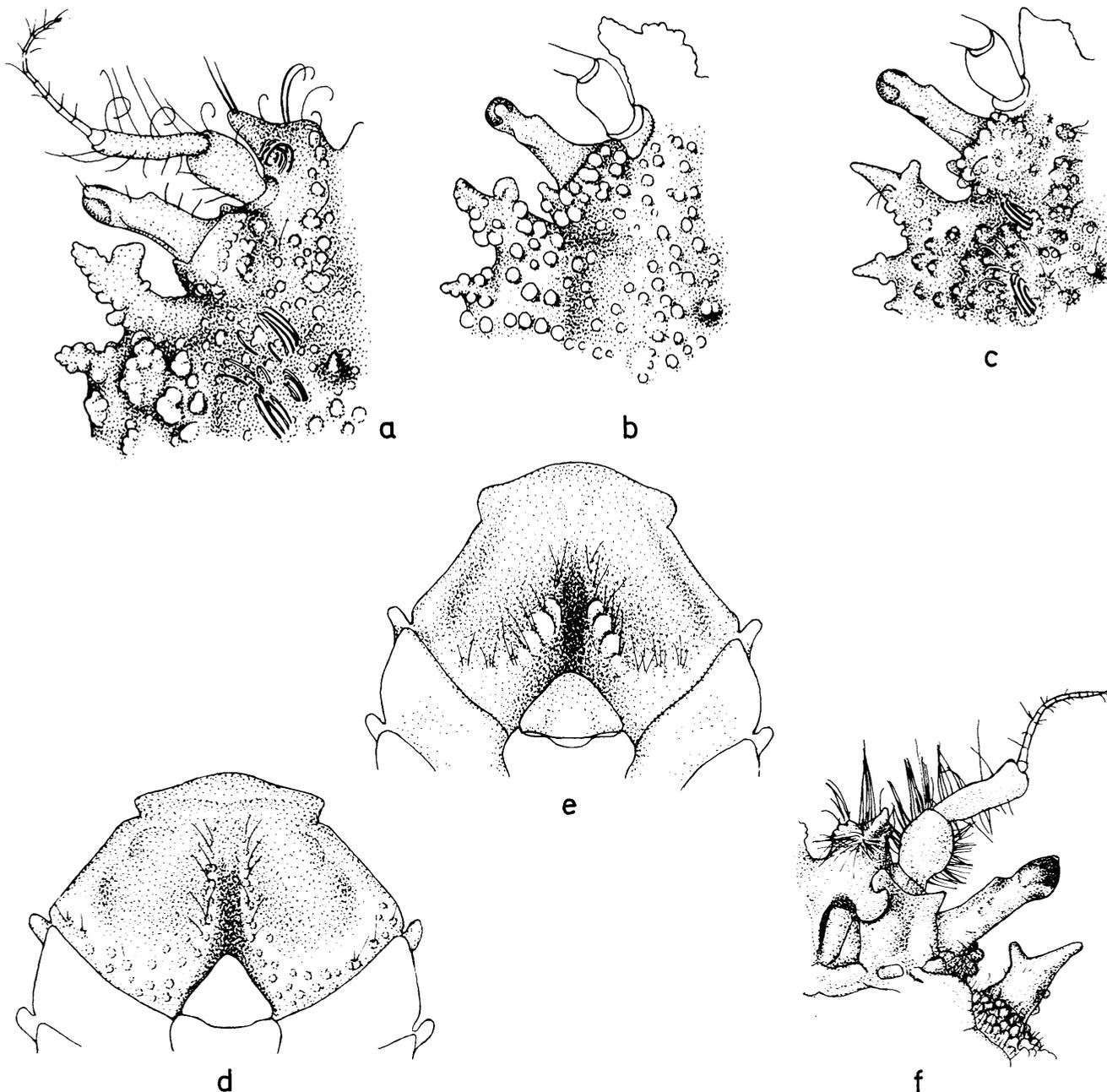


Fig. 77. *Pippacirama tuberculosa* (female, 14 mm, Port Jackson, AM P.8714 (a) left orbit, dorsal view; (male, 17.5 mm, S. Aust., AM P.3096) (b) left orbit, dorsal view; (male, 15.5 mm, W. Aust., AM P.14006) (c) left orbit, dorsal view; (male, 13.5 mm, Port Jackson, AM P.29840) (d) first sternite; (AM P.14006) (e) first sternite; (f) left orbit, ventral view.

face, but smooth on the inner face; there is a terminal spine on the merus. The palm is short, the length subequal to or only slightly longer (1.2) than the height; there are a few granules dorsally and about three small tubercles proximally on the dorsal margin; there is a proximal tubercle midway on the outer face. There is a large gape between the fingers and several small teeth on both fingers. In the Western Australian specimen there are fewer tubercles on the merus and carpus and only one or two granules on the palm.

Again, in all males of the series there is a groove on the first sternite, anterior to the abdominal fossa; in the New South Wales specimens the groove is bordered by many small

tubercles, but in the Victorian and Western Australian specimens there are four or five large tubercles and in the South Australian specimens there are about eight moderate sized tubercles.

We have figured the first pleopod of the male which has not been described previously. There is no difference in the first pleopod of the male in specimens from different areas. The pleopod is straight and broad with two apical lobes — a narrow triangular lateral lobe directed outwards and a curved, slender medial lobe; there are two long setae on the anterior margin of the lateral lobe.

There is no evidence of gradation of characters from east

to west. The variations in the smoothness of the eave do not occur in conjunction with particular characters of the sternum or cheliped: it is not possible to separate the specimens into four valid species on the basis of the several characters described. We regard these specimens as belonging to a single variable species.

Distribution. — South eastern and southern Australia from Port Jackson (N.S.W.) through Victoria and South Australia to King George Sound (W.A.).

*Pseudomicippe* Heller, 1861; emended

Type species. — *Pseudomicippe nodosa* Heller, 1861, by monotypy.

Description. — Carapace pyriform, variously tuberculate, with a few small spines. Rostrum of two spines of moderate length, sometimes fused for up to basal third, sometimes deflexed. Orbit above comprising an eave expanded anteriorly and a postorbital spine separated by a narrow hiatus. Basal antennal article quadrate, not especially broad, with a prominent anterolateral spine or lobe; orbit open below. Eyestalks slender, long, extending beyond margin of carapace. Third maxilliped with merus as wide as ischium and expanded anterolaterally. Cheliped and ambulatory legs of moderate length. Abdomen of seven segments in both sexes.

Remarks. — Up till now most small tuberculate spider crabs previously in the subfamily Tychinae have been regarded as belonging to one of two genera: *Pseudomicippe* Heller, 1861 (based on *P. nodosa* Heller) or *Zewa* McCulloch, 1913 (based on *Z. banfieldi* McCulloch). A distinction between the genera has been made on the basis of the prominence of the preorbital lobe and of the antorbital lobe ("antero-superior lobe" and "hinder angle" of orbit in McCulloch's terminology), *Zewa* species having an antorbital spine but not a preorbital lobe.

At present *Pseudomicippe* (including *P. nodosa* and *P. tenuipes* A. Milne Edwards) is known from the western Indian Ocean and Indonesia and *Zewa* (including *Z. banfieldi* McCulloch, *Z. varians* Miers (originally described as a *Pseudomicippe* species), *Z. nipponica* Sakai and *Z. okamotoi* Sakai) is known from the western Pacific (Japan, Indonesia, Australia) and the Indian Ocean (Western Australia). *Pseudomicippe incerta* Balss, 1938, from the Pacific is here shown to be a species related to *Lahaina ovata* one of the *Hyastenus* group of genera and is discussed under *Lahaina*.

It is extremely difficult, on the basis of one or two characters of the orbit to distribute the six previously known species and the five new species before us between two distinct genera. There are differences in the spininess, tuberculation, length and form of the rostrum (horizontal or deflexed), form of the basal antennal article and length of legs, differences which do not necessarily complement differences in the orbit. The preorbital area itself varies in prominence. All that re-

mains to support such a division in a not untidy geographic separation.

This confusion is further exacerbated by examination of the first pleopods of the males, that of *P. tenuipes* being similar to that of *P. banfieldi* but significantly different from that of *P. nodosa*. In summary, examination of the first pleopod of the males shows the existence of four groups as listed below. The addition of five new species to the previously described species of *Pseudomicippe* and *Zewa* assists the confusion.

Group 1	Group 2	Group 3	Group 4
<i>P. philippinensis</i> n.sp.	<i>P. tenuipes</i>	<i>P. indonesica</i> n.sp.	<i>P. nodosa</i>
<i>P. maccullochi</i> n.sp.	<i>P. varians</i>		<i>P. eldredgei</i> n.sp.
<i>P. banfieldi</i>	<i>P. nipponica</i>		<i>P. maldivensis</i> n.sp.
	(? <i>P. okamotoi</i> ) pl. 1, unseen		

There are only minor differences between the male pleopod of the first group and that of the second group, there is one major difference between the pleopod of these groups and that of the third group, and the male pleopod of the fourth group is even more distinct from that of the first three groups.

The principal feature of the first pleopod of males of these 11 species is the presence of three lobes near the tip. In most the distal lobe is spiniform, one of the other lobes (generally on or towards the medial surface) is a flap or process and the other (usually on or towards the lateral surface, and sometimes absent) is a tubercle or rarely a small flap. Most often the more distal lobe or spine is on the abdominal surface between the medial lobe and the lateral tubercle. In the fourth group (containing *P. nodosa*, *P. maldivensis* and *P. eldredgei*), however, these three lobes or processes occur on the sternal, not abdominal surface, the tip being rotated around 180° approximately as shown by the path of the groove leading to the aperture which is at or near the base of the more distal lobe or spine. In the third group (comprising only *P. indonesica* from Java) two of the three lobes are on the medial surface and the distal portion of the pleopod is extremely long and slender.

It would be possible on the basis of these features to assign members of the fourth group to the genus *Pseudomicippe* and the remaining species to *Zewa*, *P. indonesica* possibly being placed in a distinct genus. Both *P. maldivensis* and *P. eldredgei* possess rather prominent submarginal spines on the branchial region and, as in *P. nodosa*, the basal antennal article is expanded and 'petaloid' anterolaterally. (In other species the anterolateral angle of the basal antennal article is produced but is not 'petaloid'.) *P. nodosa*, however, does not have spines on the carapace. The preorbital area is strongly expanded in *P. nodosa* and *P. maldivensis* but in *P. eldredgei* is no more prominent than in *P. maccullochi* or *P. banfieldi*. Having regard to the many other similarities of the species of each group to species of other groups and the lack of support for such a division from geographic distributions we come to the conclusion that the eleven species represent one single genus *Pseudomicippe*.

We have taken the view that *Pseudomicippe* most appropriately belongs in the Majinae. Although the eyestalks are extremely long, the orbit is in general better developed than in any of the Inachinae but the eave is not expanded in the manner seen in the Tychinae. The third maxilliped and male abdomen are most similar to species of the Majinae in which the orbit is typically moderately developed with the postorbital lobe a spine rather than a strongly excavate lobe concealing the retracted eye as in pisines and mithracines. There is no intercalated spine in the upper orbit, a feature which is now recognised as varying within other genera and even species such as the pisine *Hyastenus*-like groups.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *PSEUDOMICIPPE*

- 1 Rostral spines directed anteriorly, at most only weakly deflexed ..... 2
- Rostral spines strongly deflexed ..... 5
- 2( 1) Anterolateral angle of basal antennal article strongly expanded, petaloid; posterior margin of carapace with a medial spine ..... *P. maldivensis*
- Anterolateral angle of basal antennal article a simple spine or small lobe; posterior margin of carapace without a spine ..... 3
- 3( 2) Postorbital lobe with a distinct tubercle on posterior edge; branchial margin with four prominent tubercles; anterolateral angle of basal antennal article a slender spine ..... *P. okamotoi*<sup>38)</sup>
- Postorbital lobe slender, without a tubercle on posterior edge; branchial region with groups of tubercles but not high marginal tubercles; anterolateral angle of basal antennal article a small triangular lobe ..... 4
- 4( 3) Mesogastric region with six tubercles in midline; protogastric regions with five pairs of submedial tubercles, second and third pairs large ..... *P. indonesica*
- Mesogastric region with four tubercles in midline; protogastric regions with two submedial tubercles ..... *P. banfieldi*
- 5( 1) Basal antennal article bearing a broad flattened lobe anterolaterally ..... 6
- Basal antennal article bearing a spine or a very small truncate lobe at anterolateral angle ..... 7
- 6( 5) Supraorbital eave strongly produced anteriorly; postorbital lobe broad, blunt, without a tubercle on anterior edge; anterolateral lobe of basal antennal article, lateral margin concave ..... *P. nodosa*
- Supraorbital eave with preorbital angle only slightly exceeding antorbital spine; postorbital lobe slender, with a prominent tubercle on anterior edge; anterolateral lobe of basal antennal article petaloid, lateral margin straight or convex ..... *P. eldredgei*
- 7( 5) Basal antennal article with small truncate lobe at anterolateral angle; carapace almost smooth, branchial regions with only small tubercles; three mesogastric tubercles ..... *P. philippinensis*
- Basal antennal article with a slender spine at anterolateral angle; carapace with at least some prominent tubercles, especially on branchial regions; four or five mesogastric tubercles ..... 8
- 8( 7) Supraorbital eave prominently expanded anteriorly, more massive than antorbital spine ..... *P. varians*
- Supraorbital eave no more prominent anteriorly than at antorbital angle ..... 9
- 9( 8) Lateral margins of branchial regions only moderately tuberculate; intestinal region with one or three tubercles, sometimes more near posterior margin ..... *P. tenuipes*
- Lateral margins of branchial regions with prominent tubercles or short spines on margin and several submarginal tubercles; intestinal region with five tubercles including a pair of submedials near posterior margin ..... 10

<sup>38)</sup> From the literature (Sakai, 1938).

- 10( 9) Preorbital angle of eave not produced at all; lateral margin of basal antennal article behind anterolateral spine straight; four tubercles on segments 2-4 of sternum in male ..... *P. nipponica*
- Preorbital angle of eave produced upwards to a small lobe; lateral margin of basal antennal article behind anterolateral spine concave; one tubercle on segment 3 and one on segment 4 of sternum in male ..... *P. maccullochi*

*Pseudomicippe banfieldi* (McCulloch, 1913) new combination  
(Figs. 84c, 85a,b)

*Zewa banfieldi* McCulloch, 1913: 332-333, pl. 10 figs. 5-6. — Griffin, 1966b: 277 (in key).

*Zewa varians*. — McCulloch, 1913: 334 (larger spec. only).

*Pseudomicippe varians*. — Calman, 1900: 39, pl. 2 figs. 25, 26. (Not *Pseudomicippe varians* Miers, 1879a.)

Material examined. — 9 ♂♂, 22 ♀♀ (9 ovig.), 13-29 mm, smallest ovig. ♀, 13.5 mm.

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Queensland: Thursday I.; 1 spec. (AM P. 3018). — Cape York, Possession I., 6 m, dredge, coll. M. Ward, 30 August 1928; 1 spec. (AM P. 13970). — Albany Passage, 16-22 m, dredge, coll. M. Ward, September 1928; 2 specs (AM P.29861, dry). — Dunk I.; 1 spec. (AM P. 2562, holotype) — Dunk I.; 1 spec. (AM P. 4474). — Dunk I.; 1 spec. (AM P. 4144). — Port Denison, 9 m; 1 spec. (AM P. 29862). — Whitsunday Group, Black I., near Langford Reef, shallow water, coll. N. Coleman, November 1969; 1 spec. (AM P. 19541). — Lindeman I., reefs below low tide, amongst thick sargassum, coll. M. Ward, 1934-35; 5 specs. (AM P.29860, dry). — Swain Reefs, off Gillett Cay, 63-72 m, dredge, October 1962; 1 spec. (AM P.14023). — Capricorn Group, North West Islet, ca. 16 m, coll. A. A. Livingstone and W. Boardman, December 1930 — January 1931; 1 spec. (AM P. 10053).

Northern Territory: Port Darwin; 1 spec. (AM P.9473).

Western Australia: Broome, off Gantheaume Point, 7 m, dredge, coll. A. A. Livingstone, August 1929; 2 specs (AM P.13974). — Broome, entrance to Roebuck Bay, 16 m, coll. A. A. Livingstone, 15 August 1929; 1 spec. (AM P. 13972). — Broome, off Gantheaume Point, dredge, coll. A. A. Livingstone, 30 August 1929; 2 specs. (AM P.13971). — Broome, near entrance Roebuck Bay, 9-14 m, dredge, coll. A. A. Livingstone, 26 September 1929; 3 specs. (AM P. 13973). — Broome, coll. B. E. Bardwell; 3 specs. (AM P.29859, dry). — 2 miles (~ 3 km) off Carnarvon, 8 m, algae beds, coll. N. Coleman, 17 June 1972; 1 spec. (AM P.20322).

MUSEUM AND ART GALLERIES OF THE NORTHERN TERRITORY

Near Darwin, Lea Point, in mid littoral rock pools, coll. A. J. Dartnall, 12 July 1975; 2 specs.

Remarks. — This species is superficially very similar to *P. varians* Miers and occurs over a similar geographic range: the differences which distinguish the two are discussed under *P. varians*.

On the first pleopod of the male in *P. banfieldi*, at about the distal fifth, there is a rounded flap on the medial edge adjacent to a spine and a small tubercle on the abdominal surface; the tip of the pleopod beyond the flap is curved laterally to become sternally directed apically.

Distribution. — Australia: northern Western Australia, Northern Territory and Queensland.

*Pseudomicippe eldredgei* new species  
(Figs. 78, 86c,d)

Material examined. — 2 ♂♂, cl. 12, 18.5 mm.

Holotype. — Male, cl. 18.5 mm, Guam, Agana Bay, 27 April 1967, Allan Hancock Foundation, University of Southern California.  
Paratype. Male, cl. 12 mm, data as for holotype.

Description. — Carapace pyriform, widened posteriorly, width about 0.7 postrostral carapace length; surface smooth with scattered low tubercles, each surmounted by a group of curled hairs; gastric region elevated.

Rostrum of two divergent, deflexed spines, in length about 0.2 to 0.25 postrostral carapace length, tapering from a broad base to a sharp apex and separated by a wide V-shaped hiatus.

Orbit above comprising a moderately broad eave and a postorbital lobe; preorbital angle produced outward into a blunt lobe; slightly exceeding small, acute antorbital spine; two rows of curled hairs on eave parallel to edge, eave with no large tubercle; postorbital lobe narrow, directed forward and slightly outward with a proximal lobe on anterior margin, no lobe proximally on posterior edge. Eyestalks long and slender, cornea small and terminal.

Hepatic region rounded with one large subhepatic tubercle.

Branchial margin with an arc of three high tubercles close together near broadest part of carapace, last in from margin.

Mesogastric region with a pair of very small submedial tubercles anteriorly and two medial tubercles posteriorly. Two groups of curled hairs on low tubercles, one behind other, on either side of mesogastric tubercles. Protogastric region with a pair of small submedial tubercles anteriorly between orbits. Urogastric region smooth.

Cardiac region weakly elevated with three small tubercles, two in front and one behind.

Intestinal region with a pair of very small anterior submedial tubercles, a central medial tubercle and a medial tubercle on posterior margin of carapace.

Branchial region with a small tubercle anteriorly just above carapace margin; a central group of curled hairs dorsally and another medially on anterior margin; other small groups of curled hairs scattered over region.

Basal antennal article smooth, distal half of lateral margin produced anterolaterally in a broad, blunt, "petaloid" lobe widest at about proximal third and apically truncate. A small tubercle near external angle of buccal cavity.

Pterygostomian margin with a large posterior tubercle, visible dorsally, and a small tubercle just in front of it.

Third maxilliped merus with anterolateral angle only slightly produced, crenate, posterior half of medial margin with a thick ridge.

Cheliped merus of large male with a low terminal spine; carpus with two strong dorsal ridges, lateral one smooth, medial one with four or five tubercles, one or two tubercles on inner face; chela smooth, length of palm about one and a half times height, fingers slightly exceeding half length of palm, gape small, both fingers with uniform small teeth along their length.

Ambulatory legs not elongate, length of first leg just exceeding postrostral carapace length; fourth leg about 0.75 of

first leg; surface smooth with longitudinal rows of long setae and a dorsal row of groups of curled hairs; fourth dactyl with two rows of about seven small teeth ventrally along its length.

Male sternum first segment with a pronounced channel, smooth except for a pair of submedial tubercles on anterior edge and a tubercle on posteromedial angle; remaining segments also channelled, each with a smooth lateral ridge and tuberculate medial ridge along edge of abdominal fossa; segments separated by narrow intersegmental ridges.

Male abdomen of seven segments each with a medial tubercle situated anteriorly in segments one to six and posteriorly in segment seven, third segment with a rounded lateral tubercle and convex lateral margins; both sixth and seventh segments about twice as wide as long.

First pleopod of male broad, curving outwards distally and tapering abruptly to an acute apex; a broad flap on lateral edge of the sternal surface, at about distal fifth, curving ventrally around lateral edge of pleopod; a short spine in front of flap is directed medially across opening.

Remarks. — This species is similar to *P. nodosa* and *P. maldivensis* in the presence on the mesogastric region of only two medial tubercles; the rounded hepatic region with a single large tubercle ventrally; and the first pleopod of the male with a sternal spine and a broad flap behind it on the lateral edge, rather than an abdominal spine and medial flap as in other species. It resembles *P. maldivensis* but not *P. nodosa* in having three tubercles, two anteriorly and one behind, on the cardiac region. It can be distinguished from *P. nodosa* by its much smaller preorbital spine; by the longer and distally narrower postorbital lobe; and by the lobe on the anterolateral angle of the basal antennal article which, while broad as in *P. nodosa*, is quite different in shape.

This species differs from other *Pseudomicippe* species in having two mesogastric tubercles (three to five in other species), three cardiac tubercles (two pairs of submedial tubercles in other species) and only one hepatic tubercle (several small tubercles in other species).

The new species is named in honour of Professor Lucius G. Eldredge, of the Marine Station at Guam.

Distribution. — Western Pacific: known only from Guam.

*Pseudomicippe indonesica* new species  
(Figs. 79, 85g,h)

Material examined. — 1♂, cl. 20.5 mm.

Holotype. — Male, cl. 20.5 mm, Java Sea, 1925, S. S. Radja, coll. G. J. Terwiel, Zoological Museum, Amsterdam.

Description. — Carapace narrowly pyriform, only slightly widened posteriorly, width about 0.6 postrostral carapace length; surface with scattered tubercles each surmounted by either one or two straight hairs or a group of curled hairs; gastric regions elevated.

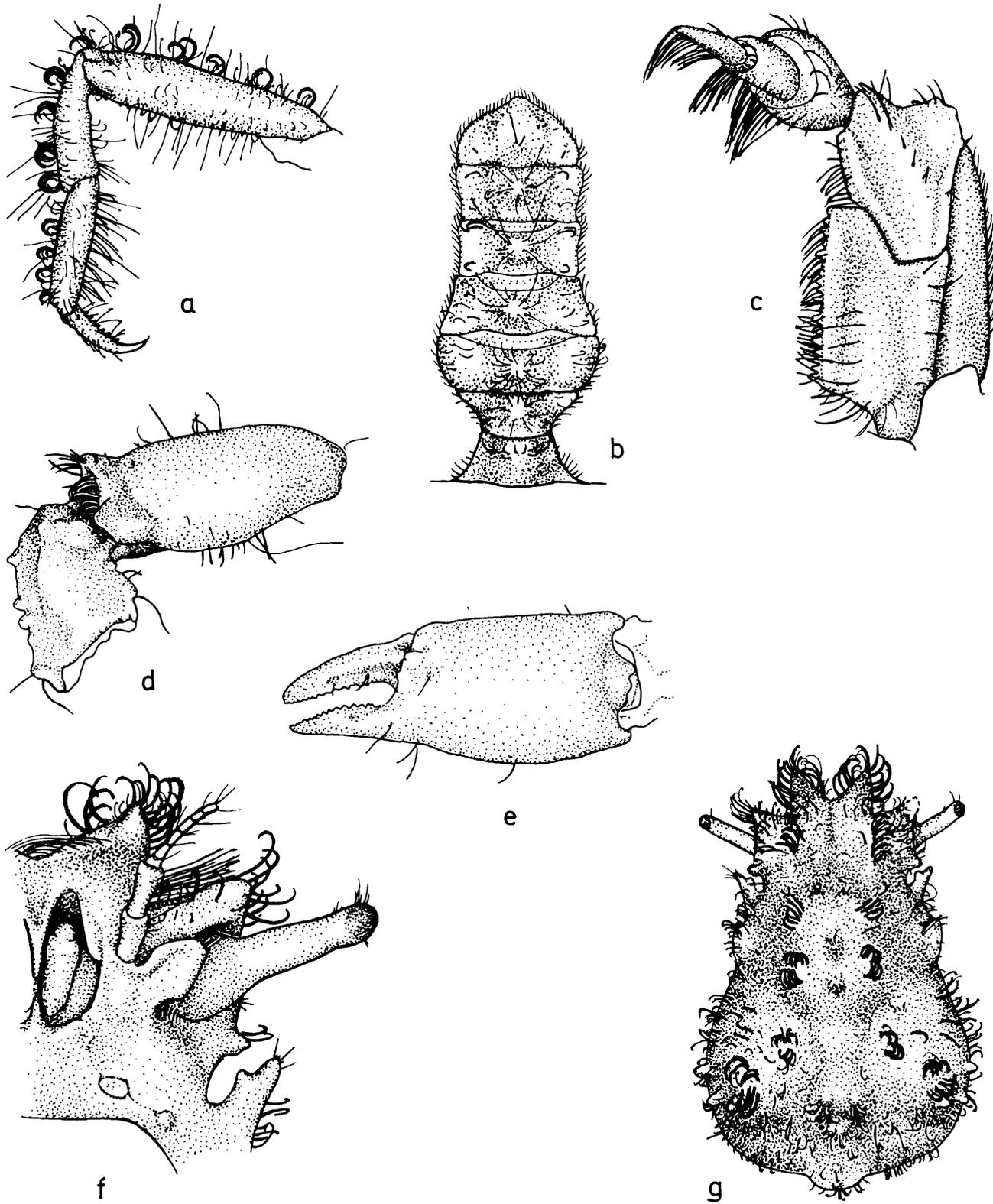


Fig. 78. *Pseudomicippe eldredgei* (holotype) (a) left first ambulatory leg; (b) male abdomen; (c) left third maxilliped; (d) left cheliped, merus and carpus; (e) left chela; (f) left orbit, ventral view; (g) carapace, dorsal view.

Rostrum of two weakly deflexed divergent spines, length about one third postrostral carapace length, cylindrical, each spine of almost uniform width, blunt apically.

Orbit above comprising a moderately expanded eave and a postorbital spine; preorbital angle only weakly produced,

rounded; antorbital spine short, acute, triangular, more prominent than preorbital lobe; postorbital spine narrow, a lobe midway along anterior edge and a small tubercle midway along posterior edge. A separate tubercle on carapace just behind postorbital spine. A large, nearly conical tubercle on

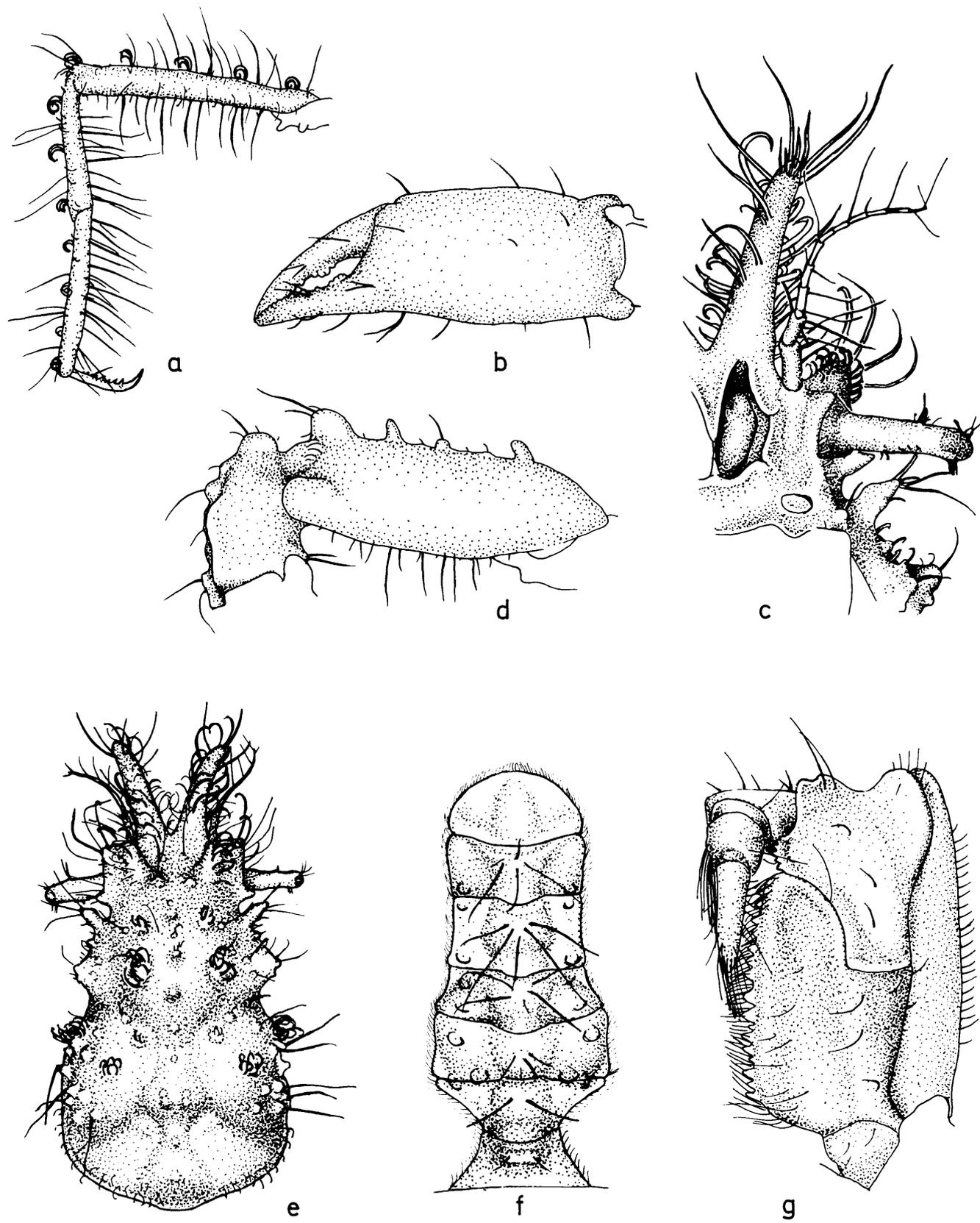


Fig. 79. *Pseudomicippe indonesica* (holotype) (a) left first ambulatory leg; (b) left chela; (c) left orbit, ventral view; (d) left cheliped, merus and carpus; (e) carapace, dorsal view; (f) male abdomen; (g) left third maxilliped.

eave, just inside edge, directed forward and surmounted by a large group of curled hairs.

Eyestalks slender, long, with three small tubercles anteriorly, posteriorly and ventrally, cornea small and terminal.

Hepatic margin with three tubercles; region swollen with group of three tubercles on dorsal surface; subhepatic region with a group of three tubercles and another of two small tubercles medially.

Branchial margin with a row of four tubercles dorsally, a pair of tubercles below the posterior two of this row and below these again a row of four small tubercles just above carapace margin; a bilobed tubercle anteriorly just above articulation of cheliped.

Mesogastric region with six medial tubercles, first, third and sixth smaller than others. Protogastric region with a pair of submedial tubercles anteriorly between orbits; posteriorly two large tubercles, one in front of the other, on either side of mesogastric tubercles and just lateral to anterior of these two, a much smaller tubercle with a similar tubercle behind it. Urogastric region with a medial tubercle.

Cardiac region with a pair of bilobed submedial tubercles. A medial tubercle at junction of cardiac and intestinal regions; central intestinal region weakly elevated with a tubercle at summit; posterior margin of carapace smooth.

Branchial region with three small tubercles anteriorly; close to medial margin, a low tubercle with curled hairs behind medial and lateral tubercles.

Basal antennal article moderately broad, smooth, anterolateral angle produced to a strong subtruncate spine; lateral edge weakly concave. A sharp tubercle near external angle of buccal cavity.

Pterygostomian region smooth, margin with two or three small tubercles posteriorly.

Third maxilliped smooth, anterolateral angle of merus unarmed, produced into a rounded lobe; medial edge of merus with four to five spinules midway along.

Cheliped merus with three dorsal tubercles and a blunt, laterally compressed terminal lobe; carpus with two blunt dorsal ridges, medial one uneven; palm smooth, length about 1.7 times height; fingers about three quarters length of palm, gaping moderately for proximal two thirds, a large, lobed tooth midway along dactyl in gape and a similar tooth proximally on fixed finger.

Ambulatory legs long, first leg about one and a half times postrostral carapace length, surface smooth, very slender; propod length about ten times width; dorsal surface with groups of curled hairs and longitudinal rows of long straight hairs; dactyls of ambulatory legs with two rows each of about ten small teeth ventrally along length.

Male sternum first segment with a shallow depression on either side of midline, smooth except for a tubercle on posteromedial angle; segments two to four each with two to four tubercles along border of abdominal fossa.

Male abdomen of seven segments, smooth except for anterior medial tubercles, anterolateral angle of sixth segment

convex, both sixth and seventh segments about twice as wide as long. Third segment about one and a third (1.37) times as wide as sixth segment, lateral margins straight or weakly concave.

First pleopod of male with a very slender distal process which curves first ventrally and then forward and outward; at base of process two small hooks on medial edge and a rounded tubercle on abdominal surface.

Remarks. — The holotype of this species is similar to the ovigerous female figured as *Pseudomicippe tenuipes* by Buitendijk (1939: pl. 8 fig. 3) but lacks the third (most posterior) pair of tubercles on the gastric region and there are two medial tubercles on the intestinal region (not a medial and lateral); also in that specimen the postorbital spine is directed almost straight forward and the rostral spines are broader basally and tapering.

This species is similar to *P. varians* Miers and *P. banfieldi* (McCulloch) in the tuberculation of the carapace and the slender, elongate ambulatory legs. In *P. varians* the rostral spines are strongly tapered and in *P. banfieldi* the anterolateral angle of the basal antennal article is more weakly produced. This species is similar to *P. maccullochi* and *P. varians* in having the lateral margins of the third segment of the male abdomen straight or weakly concave rather than convex as in other species. The first pleopod of the male, however, distinguishes this species from all other known species of *Pseudomicippe*: in no other species is the distal part of the pleopod so slender.

Distribution. — Known only from the type locality, Java Sea.

*Pseudomicippe maccullochi* new species  
(Figs. 80, 85c,d, Pl.17)

Material examined. — 6 ♂♂, 5 ♀♀ (2 ovig.), 8-24 mm, smaller ovig. ♀, 16 mm.

Holotype. — Male, 23.5 mm, Tasman Sea, Lord Howe I., southern end of lagoon, coll. J. Booth, May 1962; The Australian Museum (AM P. 20326). Paratypes. As listed below.

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Lord Howe Island: south end of lagoon, 18 September 1962, coll. J. Booth; 1 spec. (AM P. 29866). — Sylph's Hole, old settlement, in dead coral, coll. J. Booth, October 1962; 1 spec. (AM P. 29867). — lagoon, sand and dead coral, 'El Torito', Stn. LHI. 73-78, 23 February 1973; 1 spec. (AM P. 20325). — 2 specs. (AM P. 29865, dry). — lagoon, boat ramp rocks, 2 m, coll. N. Coleman, 26 November 1979; 1 spec. (AM P. 30995).

Norfolk Island: Slaughter Bay, coll. P. and R. Southwell, 31 March 1969; 1 spec. (AM P. 17286). — Slaughter Bay, coll. I. Milton, June 1969; 1 spec. (AM P. 17396).

Queensland: Swain Reefs, Capri Cay, 22°09'S 152°46'E, Swain Reefs Exped. Stn. 8, 1962; 1 spec. (AM P. 17015).

MUSEUM OF VICTORIA, MELBOURNE

Victoria: Shoreham, 10 November 1902; 1 spec. (J 1460).

Description. — Carapace pyriform, width equal to about 0.7 postrostral carapace length; surface with numerous distinct tubercles; gastric regions elevated behind orbits.

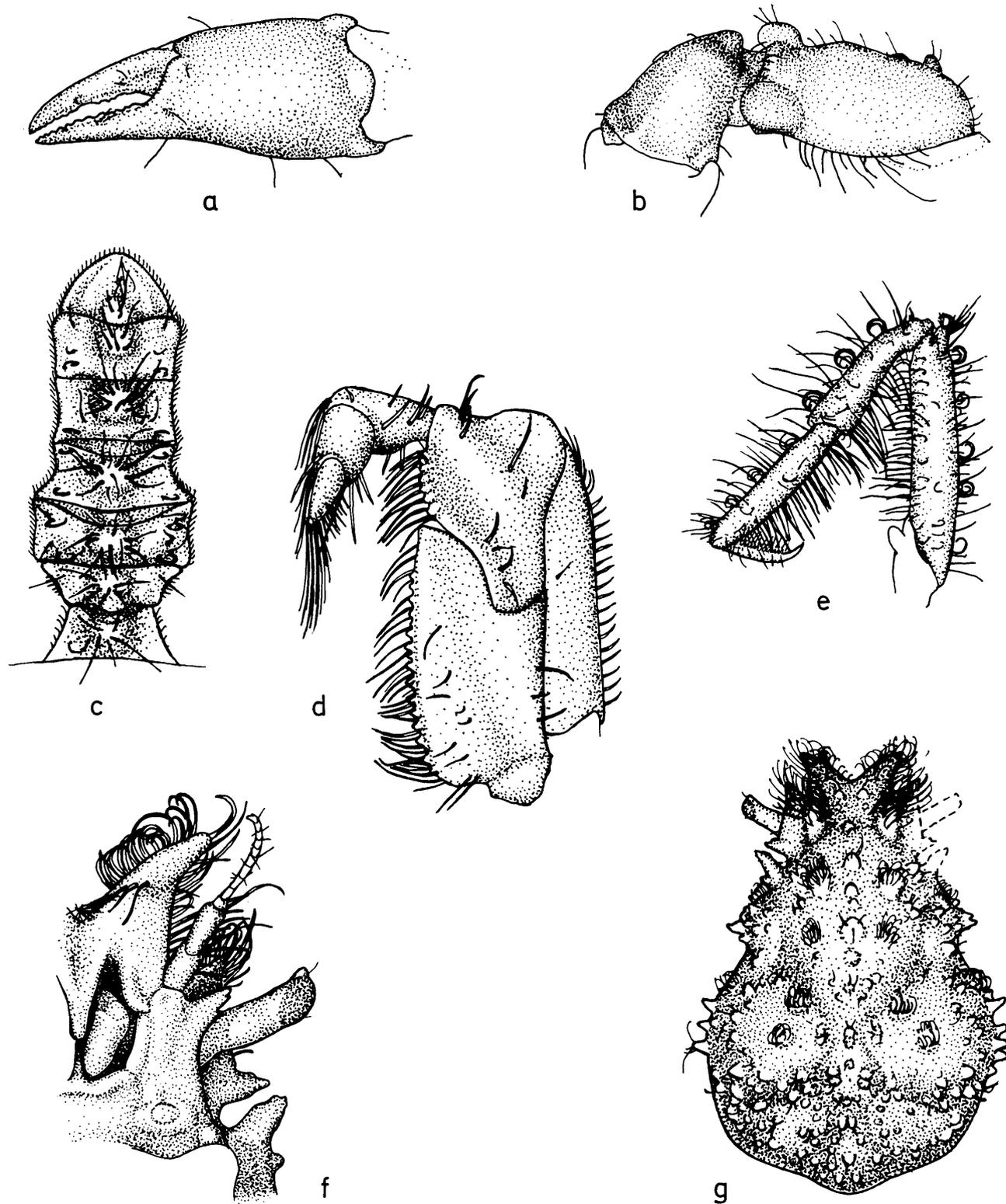


Fig. 80. *Pseudomicippe maccullochi* (male, 13.5 mm, AM P.17286) (a) left chela; (b) left cheliped, merus and carpus; (holotype) (c) male abdomen; (d) left third maxilliped; (e) left first ambulatory leg; (f) left orbit, ventral view; (g) carapace, dorsal view.

Rostrum of two short divergent spines, deflexed, wide basally and tapering distally; length equal to about one fifth (0.2) postrostral carapace length. (Two specimens with submedial tubercles on rostral ridges in front of orbits.)

Orbit above comprising a weakly expanded eave and a postorbital lobe; preorbital angle rounded, weakly produced;

antorbital spine small, acute, subtriangular, directed outwards; postorbital spine narrow, tapering slightly to a blunt apex, anterior edge sometimes convex, but without a lobe, a granule or small tubercle at base posteriorly; a broad smooth tubercle surmounted by curled hairs on eave just in from edge. Eyestalks long and slender, cornea small and terminal.

Hepatic margin rounded, bearing two or three sharp tubercles, three small tubercles on dorsal surface of region; subhepatic region with two or three sharp tubercles.

Branchial margin with a row of three to four tubercles of unequal size, a row above them of about four short tubercles, and below anteriorly, a small tubercle just above base of cheliped.

Mesogastric region with five medial tubercles, last on posterior slope, second and fifth tubercles sometimes with small adjacent tubercles. Protogastric region with a medial tubercle or group of tubercles at level of antorbital spine; posteriorly two large tubercles, one in front of other, on either side of mesogastric tubercles and just lateral to anterior of these two, one or two small tubercles with another one or two tubercles behind.

Cardiac region weakly elevated with a pair of submedial tubercles, rounded or weakly bilobed, a small medial tubercle between them on anterior slope.

Intestinal region with a pair of small submedial tubercles anteriorly and behind them a second pair more widely separated; a central medial tubercle and a pair of submedial tubercles just in front of posterior margin of carapace; scattered small tubercles or granules laterally on intestinal region.

Branchial region with three tubercles in an oblique row on anteromedial border, a broad central tubercle surmounted by curled hairs and a few small dorsal tubercles.

Basal antennal article smooth, anterolateral angle with a sharp, narrow, spinulate spine; a sharp tubercle in front of external angle of buccal cavity.

Third maxilliped smooth; merus with anterolateral angle produced and rounded, with small spinules on edge; medial edge crenulate from midway along to posterior margin; exognath with lateral fringing setae.

Pterygostomian region smooth, margin with one posterior tubercle. Male sternal segments smooth except for two tubercles on edge of abdominal fossa, one midway on third segment and one posteriorly on fourth segment.

Cheliped merus of male (not adult) with a proximal tubercle and a sharp, laterally compressed, terminal spine; carpus without ridges; fingers of chela with small teeth along their length. (Our adult male specimen lacks chelipeds, so it is possible that this species, like *P. varians*, may develop ridges on the carpus in the adult.)

Ambulatory legs smooth, not elongate, length of first leg just exceeding carapace length, propod length about three times its width; fourth leg more than three quarters length of first leg, dactyl with two rows, each of about ten small teeth, ventrally along its length.

Male abdomen of seven segments, third segment about one and a quarter times as wide as sixth segment, lateral margins straight or weakly concave; sixth and seventh segments both about twice as wide as long; medial tubercle anteriorly on segments 1-6. Female abdomen of seven segments, surface setae each with a basal granule.

First pleopod of male with a broad medial lobe at about

distal fifth; tapering only beyond lobe to acute apex; a spine on abdominal surface adjacent to anterior edge of lobe, and a rounded tubercle lateral to spine; opening abdominal, just behind spine and ventral to lobe.

Gonopore of female a narrow slit opening anteriorly.

Remarks. — Within our series of specimens there is a marked variation in the size of the carapace tubercles. In the adult male holotype and the larger ovigerous female (24 mm) there are distinct tubercles on the rostral ridges and additional small tubercles on the gastric regions and intestinal region. In some of the other specimens, especially females, several of the carapace tubercles are very low and their position is marked only by a group of hairs.

This species is very similar to *P. varians* Miers which also has a well developed process on the anterolateral angle of the basal antennal article and rostral spines which are broadened basally and deflexed. In *P. varians* however, there is a pair of submedial protogastric tubercles, not one medial tubercle on the level of the antorbital spine; the propod of the ambulatory legs is elongate and cylindrical; segments one and two of the male sternum have tubercles, not smooth; and the flap on the medial margin of the first pleopod is hook shaped rather than broad and flat.

The first pleopod of this species is similar to that of *P. banfieldi* but in that species the rostral spines are horizontal, not deflexed, and not broadened basally; the anterolateral angle of the basal antennal article is only weakly produced to a broad triangle; there is no medial protogastric tubercle at the level of the antorbital spines; and there is no medial tubercle on the urogastric region.

The ambulatory legs are similar to those of *Microhalimus deflexifrons* Haswell but in that species there is a long, narrow, forwardly directed process on the anterolateral angle of the basal antennal article and the first pleopod of the male lacks both a flap and a spine.

The new species is named for Alan R. McCulloch (1885-1925) who contributed significantly to our knowledge of Australian Crustacea and who was associated also with the early study of Lord Howe Island.

Distribution. — Norfolk I.; Lord Howe I.; Swain Reefs, Queensland; Shoreham, Victoria.

*Pseudomicippe maldivensis* new species  
(Figs. 81, 82, 86e,f)

Material examined. — 1 ♂, 1 ovig. ♀, cl. 6.5, 12 mm.

Holotype. — Male, cl. 12 mm, Maldives Islands, Male Atoll, Dunidu I., on rocky reef, collected J. S. Garth, 18 March 1964. Allan Hancock Foundation, University of Southern California.

Paratype. Female, ovigerous, cl. 6.5 mm, Maldives Islands, Addu Atoll, Gan I., on *Acropora*, collected G. Beardsley, 30 April 1964. Allan Hancock Foundation, University of Southern California.

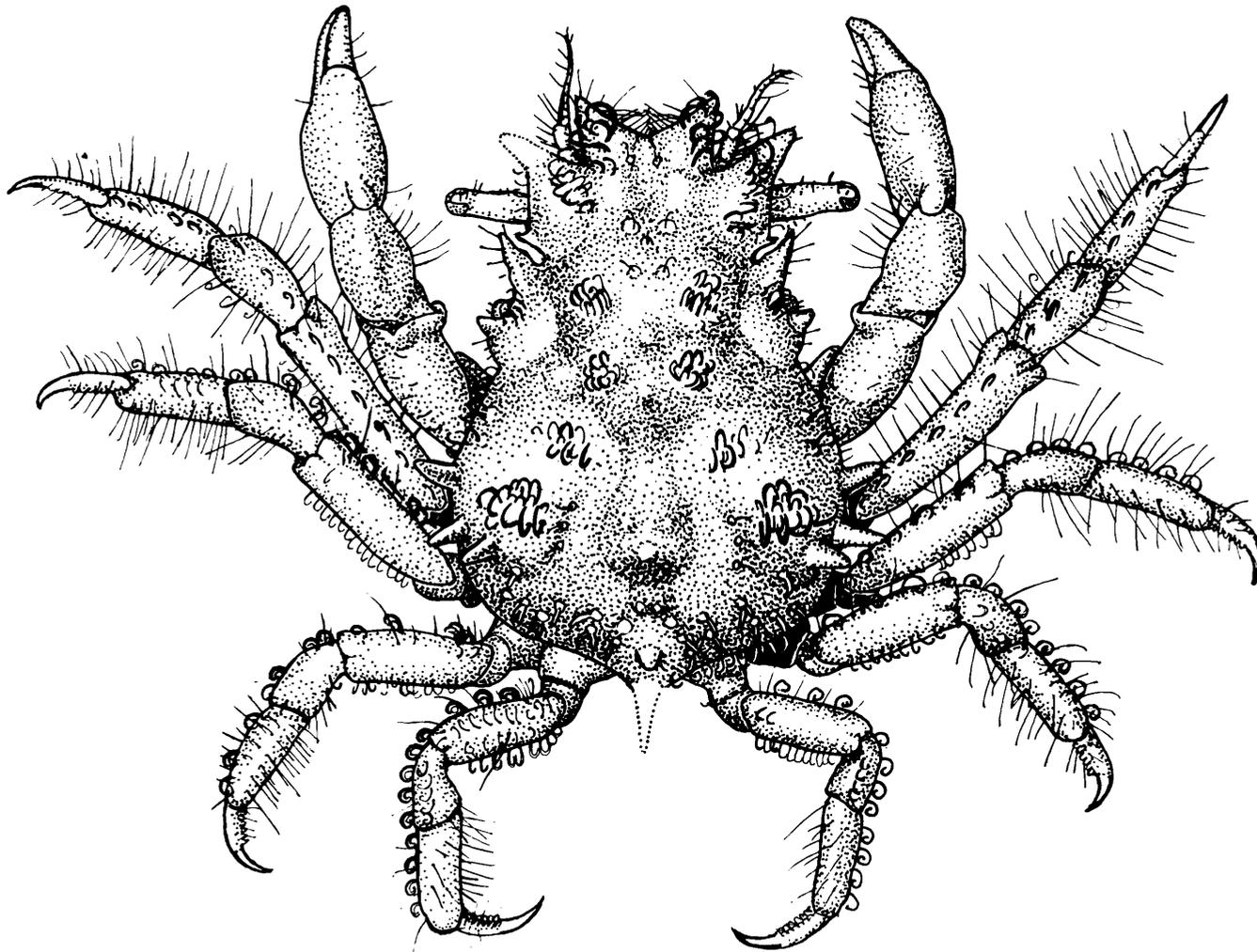


Fig. 81. *Pseudomicippe maldivensis* (holotype) whole animal, dorsal view.

Description. — Carapace pyriform, width about 0.8 postrostral carapace length; surface smooth between low tubercles which are each surmounted by a group of curled hairs; gastric regions elevated.

Rostrum of two divergent, deflexed spines, length about a quarter (male) or an eighth (female) postrostral carapace length; each spine tapering from a broad base to a narrow apex.

Orbit above comprising a moderately broad eave and a postorbital lobe; preorbital angle produced into a spine directed forwards; antorbital spine very small, acute; two rows of curled hairs on eave parallel to edge, no large tubercle; postorbital lobe narrow, directed obliquely forward, distally sharp, proximally with a small anterior and a weak posterior lobe. Eystalks long and slender, cornea small and terminal.

Hepatic margin rounded with a short spine or tubercle and a tubercle below it.

Branchial margin with an arc of three adjacent spines at widest part of carapace, last in from margin.

Mesogastric region with a pair of very small submedial tubercles anteriorly and two medial tubercles posteriorly (very

low in female). Protogastric region with a pair of submedial tubercles anteriorly between orbits, two groups of curled hairs (not on tubercles), one behind other, on either side of mesogastric tubercles. Urogastric region smooth.

Cardiac region weakly elevated with three tubercles, two in front and one behind. Intestinal region with a pair of small submedial tubercles anteriorly, a short central spine and a longer medial spine on posterior margin (damaged in holotype).

Branchial region dorsally with large, rounded, central tubercle and a smaller one near anteromedial border each surmounted by a group of curled hairs.

Basal antennal article with lateral margin distally produced obliquely forwards in a large acute, triangular “petaloid” lobe. A small tubercle near external angle of buccal cavity.

Pterygostomian margin with a large posterior tubercle and a much smaller tubercle just in front of it.

Third maxilliped merus with anterolateral angle only slightly produced, rounded; medial margin with about four very small teeth in male.

Cheliped merus of large male smooth except for a low dorsal ridge, a blunt proximal tubercle and a small blunt ter-

Japan, Kachiyama, east shore of the Urugu Canals, coll. L. Doflein, determined *P. tenuipes* by Balss.

minal spine; carpus with two low dorsal ridges, medial ridge uneven; palm smooth, length equal to one and a quarter times height; fingers three quarters length of palm, weakly gaping, both fingers with uniform small teeth along their length.

Ambulatory legs not elongate, first leg about equal to postrostral carapace length and fourth leg about two thirds length of first leg, surfaces smooth with longitudinal rows of long setae and a dorsal row of groups of curled hairs; dactyl of fourth leg with two rows of about six small teeth ventrally along length.

Male sternum first segment smooth with a ridge along anterior edge of abdominal fossa; segments 2-4 smooth except for a low medial, tuberculate ridge along margin of fossa.

Male abdomen of seven segments, third segment only slightly wider (1.1) than sixth segment, lateral margins weakly convex; both sixth and seventh segments about twice as broad as long, seventh segment subrectangular, anterior margin very weakly convex.

Female abdomen of seven segments, smooth.

First pleopod of male broad, hardly tapering, curving laterally in distal third, apex blunt; a spine and a flap on lateral edge of sternal surface proximal to tip, spine directed medially across sternal surface, broad flap behind it curved ventrally around lateral edge and visible in abdominal view.

Female gonopore oval, opening anteriorly and slightly medially.

Remarks. — This species is similar to *P. nodosa* and *P. eldredgei* in the presence of only two medial mesogastric tubercles instead of 3-5 as in other species and in the basal antennal article being produced anterolaterally into a broad "petaloid" lobe. It is similar to *P. nodosa* (but not *P. eldredgei*) in having a well developed preorbital spine and to *P. eldredgei* (but not *P. nodosa*) in having three tubercles in an inverted triangle on the cardiac region. It differs from *P. nodosa* in the shape of the anterolateral lobe on the basal antennal article and from all other species of *Pseudomicippe* in the presence of a strong medial spine on the posterior carapace margin.

In this species as in *P. eldredgei* and *P. nodosa* the first pleopod of the male is twisted so that there is a sternal spine and a lateral flap rather than an abdominal spine and a medial flap as in other species.

Distribution. — Indian Ocean: known only from the Maldiv Islands.

*Pseudomicippe nipponica* (Sakai, 1938) new combination  
(Fig. 87b)

*Pseudomicippe tenuipes*. — Balss, 1924: 35-36, pl. 1 fig. 6. (Not *P. tenuipes* A. Milne Edwards.)

*Zewa nipponica* Sakai, 1938: 244-246, figs. 22a-d, pl. 25 fig. 1; 1976: 188-189, figs. 99, 100a.

Material examined. — 1 ♂, cl. 25.5 mm.

Remarks. — This specimen agrees well with *Pseudomicippe nipponica* (Sakai). In our specimen there are five medial tubercles on the gastric region as described by Sakai (1938), not four as described by Balss (1924); there is a distinct tubercle basally on the posterior margin of the postorbital spine (as figured by Balss, but not clear in Sakai's figure); there is a small accessory spinule on the posterior margin of the antorbital spine; the anterolateral spine on the basal antennal article has two small accessory spinules on the posterior margin and the lateral margin of the basal antennal article is straight and oblique, not curved. There are three or four tubercles on each of sternal segments two to four. We have figured the first pleopod of the male. There is a large flap, curved sternally, and immediately ahead of it is a small spine directed abdominally; on the abdominal surface there is a broad flap, directed laterally, across the opening.

The third segment of the male abdomen is only slightly wider than the sixth segment, the lateral margins are nearly straight but the segment widens slightly posteriorly. The lateral margins of the fourth segment are oblique, not curved abruptly as in *P. maccullochi*.

This species is similar to *P. maccullochi* in the deflexed rostral spines, the tubercular carapace with high marginal tubercles and the shape of the basal antennal article. It is distinguished from *P. maccullochi* by 1) the preorbital angle of the eave which is not produced at all (weakly produced in *P. maccullochi*); 2) the lateral margin of the basal antennal article is straight and oblique behind the anterolateral spine (concave in *P. maccullochi*); 3) there are three or four tubercles on segments 2-4 of the male sternum (only one tubercle on segments 3 and 4 in *P. maccullochi*). In addition the first pleopod of the male of *P. nipponica* has a much more elongate apex than that in *P. maccullochi* with longer setae on the lateral edge and there are differences in the shape and position of the flap and the lobe.

*P. nipponica* is distinguished from *P. tenuipes* by the much more tuberculate carapace; the preorbital angle which is not even weakly produced as it is in *P. tenuipes* and the first pleopod of the male which lacks the two long medial processes present on the pleopod of *P. tenuipes*.

Distribution. — Japan.

*Pseudomicippe philippinensis* new species  
(Figs. 83, 85f)

Material examined. — 1 ♂, cl. 8 mm.

Holotype. — Male, cl. 8 mm, Sulu Archipelago, anchorage off North Ubian, 06°07.5' N 120°26' E, 16-23 m, dredge trowel, *Lithothamnion*, 28-30 June 1899, 'Siboga' Expedition. Stn. 99, Zoological Museum, Amsterdam.

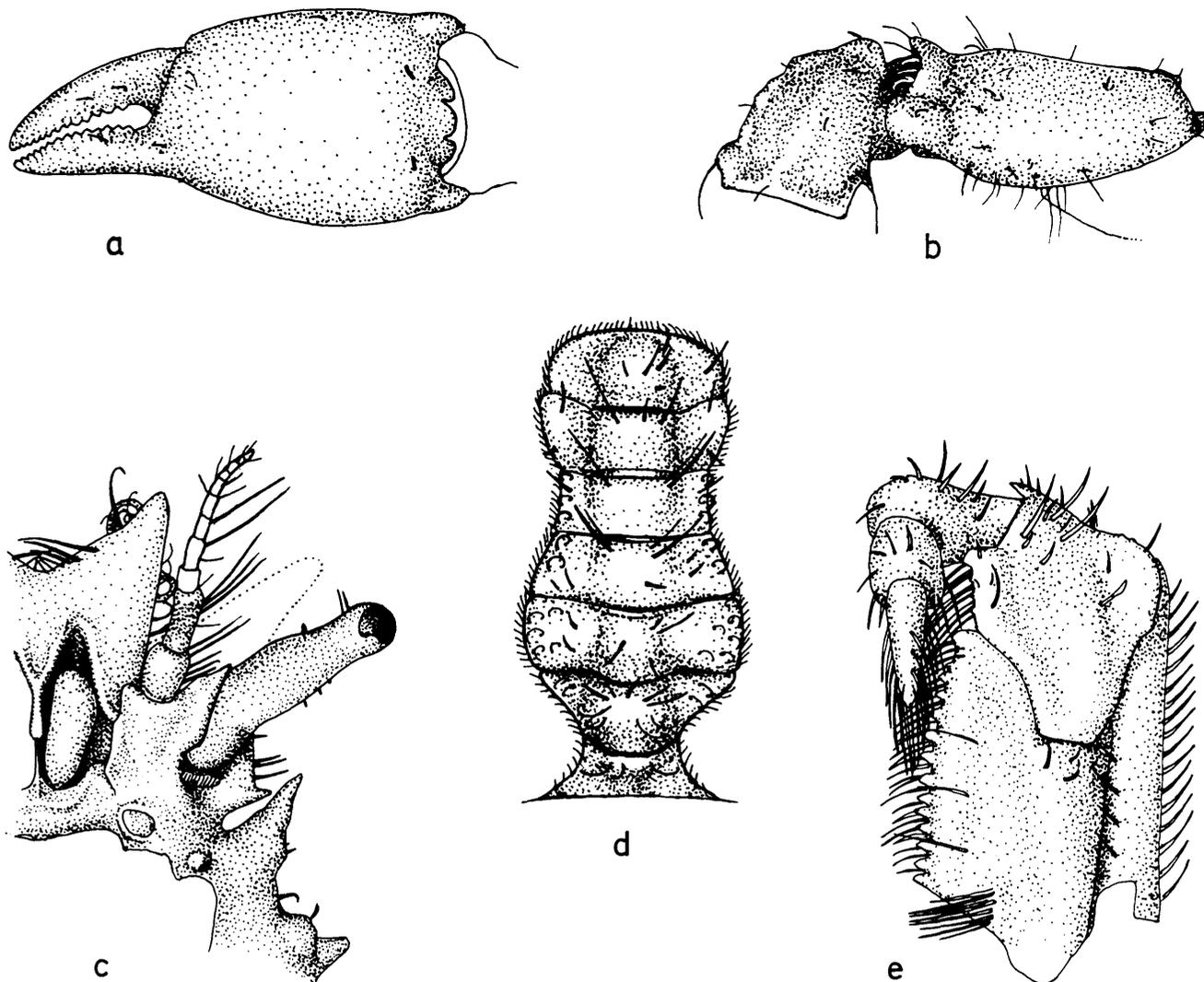


Fig. 82. *Pseudomicippe maldivensis* (holotype) (a) left chela; (b) left cheliped, merus and carpus; (c) left orbit, ventral view; (d) male abdomen; (e) left third maxilliped.

Description. — Carapace narrow pyriform, hardly widened posteriorly, width about 0.6 postrostral carapace length; surface generally smooth with a few small scattered tubercles surmounted either by long straight hairs or groups of curled hairs; gastric regions elevated.

Rostrum of two divergent spines about 0.2 postrostral carapace length, deflexed, each tapering from base.

Orbit above comprising a moderately broad eave and postorbital lobe; preorbital angle only slightly produced and rounded, not exceeding short, acute, triangular antorbital spine; postorbital spine slender, narrowing distally, apex blunt, a rounded lobe midway along anterior margin, a small tubercle at base posteriorly; a large tubercle on eave just inside edge. Eyestalks long, slender, with two small tubercles, one ventral and one posterior; cornea small and terminal, a small tubercle above cornea.

Hepatic margin rounded with two small tubercles and a small subhepatic tubercle. Branchial margin unarmed.

Mesogastric region with three medial tubercles. Progastric region with two pairs of submedial tubercles

anteriorly between orbits, posteriorly two tubercles, one behind other, on either side of mesogastric tubercles. Urogastric region smooth.

Cardiac region with a pair of low submedial tubercles. Intestinal region smooth except for an indistinct medial tubercle just in front of posterior margin.

Branchial region with three dorsal groups of curled hairs anteriorly, one medially and one laterally on anterior margin, a third group behind and between them; an arc of three small tubercles behind and below groups of curled hairs, two more small tubercles just above lateral margin.

Basal antennal article with anterolateral angle produced laterally into a short truncate lobe with distal spinules. A tubercle at external angle of buccal cavity.

Pterygostomian region smooth, a small posterior tubercle on margin. Third maxilliped smooth, merus with anterolateral angle moderately produced, edge spinulate; posterior medial edge of merus with spinules.

Cheliped merus with two dorsal tubercles and a terminal spine; carpus smooth; chela slender, palm about twice as long

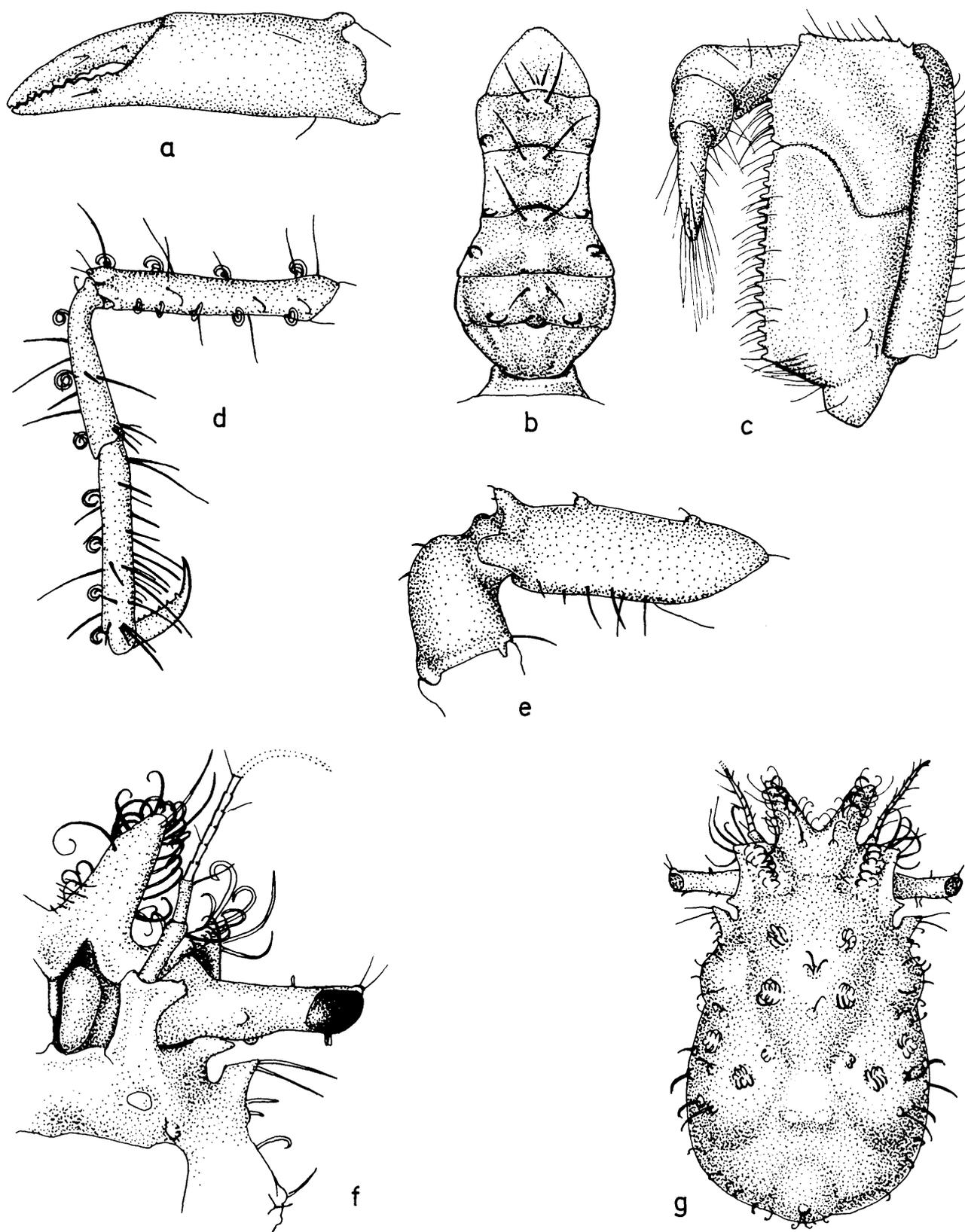


Fig. 83. *Pseudomicippe philippinensis* (holotype) (a) left chela; (b) male abdomen; (c) left third maxilliped; (d) left first ambulatory leg; (e) left cheliped, merus and carpus; (f) left orbit, ventral view; (g) carapace, dorsal view.

as high and slightly longer (1.25 times) than fingers; both fingers hardly gaping, with uniform, small teeth along their length.

Ambulatory legs slender, smooth, propod length about six times width, dorsal groups of curled hairs and longitudinal rows of straight hairs; dactyl with two rows each of about five small teeth ventrally along length.

Male sternum first segment smooth with shallow depressions; second segment with one lateral and two medial tubercles, third and fourth segments each with one lateral and one medial tubercle.

Male abdomen of seven segments, smooth except for an anterior tubercle on medial ridge of segments 3-6; third segment one and a quarter times as wide as sixth segment, lateral margins convex; sixth segment one and a half times as wide as long, anterolateral angles convex; seventh segment about as wide as long, blunt triangular.

First pleopod of male narrowing at about distal fifth, widening beyond, a spine and a lobe on medial edge, then tapering distally to acute apex; a tubercle on abdominal surface near spine and lobe.

Remarks. — This immature male is distinguished from other species of *Pseudomicippe* by the shape of the first pleopod. It is distinguished from *P. okamotoi* (Sakai) (pleopod not described) by the small, truncate lobe on the anterolateral angle of the basal antennal article; in *P. okamotoi* there is a slender spine on the anterolateral angle. *P. indonesica* and *P. banfieldi* resemble *P. philippinensis* in having a small anterolateral lobe on the basal antennal article and slender legs, but in both *P. indonesica* and *P. banfieldi* there are more tubercles on the branchial region and margin than in *P. philippinensis* and the rostral spines are longer and either horizontal or only weakly deflexed.

Distribution. — Known only from the type locality Sulu Archipelago.

*Pseudomicippe tenuipes* A. Milne Edwards, 1865  
(Fig. 87c,d,g, Pl. 18)

*Pseudomicippe tenuipes* A. Milne Edwards, 1865: 139, pl. 5 figs. 2, 2a. — Buitendijk, 1939: 235, pl. 8 figs. 3, 4. — Sankarankutty, 1962: 160-161, figs. 17-23.

Material examined. — 2 ♂♂, 2 ♀♀, 7.5-11.5 mm.

ZOOLOGISCHE STAATSSAMMLUNG, MUNCHEN

Madagascar, Nosy Bé, Nosy Komba; 1 spec. (ZSM 7929, previously det. *Pseudomicippe nodosa*).

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, Wakde I., Tsoemoar, coll. L. D. Brongersma, 7 July 1952; 1 spec.

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Western Australia, Warroora, low tide, in algae, coll. N. Coleman, 28 June 1972; 2 specs. (AM P. 19139).

Remarks. — In these specimens the rostral spines are short, basally broad, and distally strongly divergent and deflexed, they all have a rounded preorbital lobe which is no more prominent than the short, acute antorbital lobe and the basal antennal article has a broad triangular tooth, directed outwards, at the anterolateral angle.

The pattern of tubercles on the carapace in our series agrees quite well with that figured by A. Milne Edwards (1865). On the mesogastric region there are four tubercles in the midline and two lateral pairs of tubercles. There is sometimes a low medial tubercle on the urogastric region. The cardiac region is slightly elevated with two pairs of very low tubercles. On the branchial region there are three or four small tubercles laterally. There is a central medial tubercle on the intestinal region and sometimes two small submedial tubercles anterior to it.

There is considerable variation among the specimens in the size of the tubercles and the degree of separation of the regions of the carapace. (Both female specimens are immature.) The specimen from Western Australia has an almost smooth carapace, only the gastric region being elevated, and the tubercles being low and rounded; that from Nosy Bé has many small distinct tubercles and the branchial and cardiac regions are also separated. In both male specimens the carapace regions are clearly separated, the tubercles on the branchial regions are small and acute and those on the gastric and cardiac regions large and rounded.

The first pleopod of the male is as figured by Sankarankutty (1962: figs. 22-23) but the two curved spine-like processes on the medial edge just below the tip are long and subequal.

Distribution. — Indian Ocean: Madagascar, Nicobar Islands, Western Australia; Irian Jaya.

*Pseudomicippe varians* Miers, 1879  
(Figs. 84a,b,d,e, 87a,e,f)

*Pseudomicippe? varians* Miers, 1879a: 12-13, pl. 4 fig. 8; 1884: 197-198. *Zewa varians*. — McCulloch, 1913: 334 (smaller spec. only). — Griffin, 1966b: 277 (in key).

Material examined. — 27 ♂♂, 25 ♀♀ (14 ovig.), 6-23.5 mm, smallest ovig. ♀, 14.5 mm.

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Queensland: Dunk I.; 1 spec. (AM P. 2561). — Port Denison, intertidal among stones and dead coral; 1 spec. (AM P. 6955). — Lindeman I., reefs below low tide, amongst thick sargassum, coll. M. Ward, 1934-35; 46 specs., dry (AM P. 29864). — Port Curtis, Black Head; 1 spec. (AM P. 10379).

Remarks. *Pseudomicippe varians* Miers and *Pseudomicippe banfieldi* (McCulloch) are very similar species which often occur at the same locality and as a result of the brief original description and inadequate figure of *P. varians* given by Miers (1879a) have sometimes been confused by subsequent workers. We have examined series of specimens of both species including the holotype of *P. banfieldi* (♂, 29 mm,

Dunk I., Q'ld, AM P. 2562): we conclude that these species can be distinguished from each other by differences in the rostral spines, basal antennal article, arrangement of carapace tubercles, chela of adult male and female and first pleopod of the male as listed in the following table.

	<i>P. varians</i>	<i>P. banfieldi</i>
Rostral spines	broad basally, tapering distally, apex sharp, spines deflexed.	width almost uniform throughout length, apex blunt, spines nearly horizontal, curved downwards distally.
Rostral length	0.2-0.29 ♂	0.36-0.44 ♂
postrostral cl.	0.16-0.26 ♀	0.25-0.33 ♀
Basal antennal article, anterolateral angle	strongly produced, a narrow spine, often spinulate	weakly produced, a short blunt lobe
Anterior protogastric region	a pair of moderately large submedial tubercles	no submedial tubercles, or very low in adults
Urogastric region	a medial tubercle	no medial tubercle (or very small in adults).
First pleopod of male	distally a very small hook-like flap on the medial edge	distally a large rounded flap on the medial edge
Chela of adult male, gape between fingers	both fingers with a few small teeth	dactyl with large double tooth midway, fixed finger with smaller proximal tooth
Palm of adult female chela	dorsal and ventral margins converging, distal ht about $\frac{3}{4}$ proximal ht	dorsal and ventral margins parallel, distal ht equal to proximal ht

The type locality of *P. varians* is Shark Bay, Western Australia and our specimens of this species are from Dunk I., Port Denison, Lindeman I. and Port Curtis in Queensland. Our specimens of *P. banfieldi* are from Shark Bay, Carnarvon and Broome in Western Australia, through Darwin and Torres Straits to Port Curtis in Queensland, including the type locality Dunk I. (We have specimens of *P. banfieldi* from all the localities from which we have *P. varians*.)

Of the specimens, apart from the holotypes, described in the literature it seems certain that the specimen (♀, 19.5 mm) from Torres Straits described by Miers (1886) with 'rostral spines strongly deflexed' and 'distinct spine at anterolateral angle of basal antennal joint' is *P. varians* as identified by Miers. On the other hand, the specimen from Torres Straits figured by Calman (1900) as *Pseudomicippe varians* appears to be *P. banfieldi*: the anterolateral angle of the basal antennal article is only weakly produced into a short truncate tooth, and in the description Calman refers to 'rostral spines not perceptibly deflexed' and 'tapering only very slightly to the bluntly rounded tip'.

McCulloch (1913: 334) referred to two specimens of *P. varians* he had examined. We have reexamined these specimens and find that the female (18 mm, AM P. 3018) from Thursday I. is *P. banfieldi* while the smaller specimen from Dunk I. (10 mm, AM P. 2561) is *P. varians* and is an immature female not a male. The larger specimen from Thurs-

day I. is damaged, there is only one rostral spine, which is detached, but it does not taper and the apex is blunt; the anterolateral angle of the basal antennal article is only weakly produced to a blunt lobe. In the smaller specimen the rostral spines are deflexed and taper distally to a sharp apex, the anterolateral angle of the basal antennal article is strongly produced laterally.

In *P. varians* as in *P. maccullochi* and *P. indonesica* the lateral margins of the third segment of the male abdomen are straight, not convex as in *P. banfieldi*.

On the first pleopod of the male of *P. varians* at about the distal fifth there is a small hook-like flap on the medial edge adjacent to a spine and small tubercle on the abdominal surface; the tip of the pleopod beyond the flap is straight, and the apex acute. (The first pleopod of *P. nipponica* (Sakai) also has a medial hook but in that species there is only a small blunt spine on the abdominal surface.) In *P. banfieldi* there is a rounded flap not a hook on the medial edge and the tip of the pleopod beyond the flap is more elongate, curved laterally and, at the apex, sternally. In *P. maccullochi* there is a round flap on the medial edge of the pleopod but the tip beyond the flap is short and abruptly tapered to an acute apex. Other differences which distinguish *P. varians* from *P. maccullochi* are discussed under that species.

Distribution. — Western Australia (Shark Bay), northern Queensland.

#### *Schizophroidea* Sakai, 1933

Type species. — *Schizophrys hilensis* Rathbun, 1906, by present designation.

Remarks. — Neither Sakai nor Buitendijk designated a type for this genus so we have chosen as type the species described first. There are three described species in the genus. The differences which distinguish *S. hilensis* and *S. manazuruana* Sakai are not clear and it is possible that they are conspecific. *S. simodaensis* Sakai appears to be restricted to Japan. We have not provided a key to the three species as the status of them still seems uncertain; the differences which may serve to distinguish the species are discussed under *S. hilensis*. We have not examined the two Japanese species described by Sakai. *S. hilensis*, as understood here, shows variability in size at sexual maturity in populations from different localities just as do species of *Leptomithrax* and *Notomithrax*.

This genus is distinguished from *Schizophrys* White by the absence of both a lateral accessory spine on the rostral spine and an anterior accessory spine on the postorbital lobe.

Distribution. — Western Pacific: Hawaii, Kermadec Islands, Lord Howe I., Japan.

#### *Schizophroidea hilensis* (Rathbun, 1906) (Fig. 68c,d, Pl. 19)

*Schizophrys hilensis* Rathbun, 1906: 882, fig. 38. — Chilton, 1911: 562-563.  
*Schizophroidea hilensis*. — Sakai, 1933: 138 (in key).