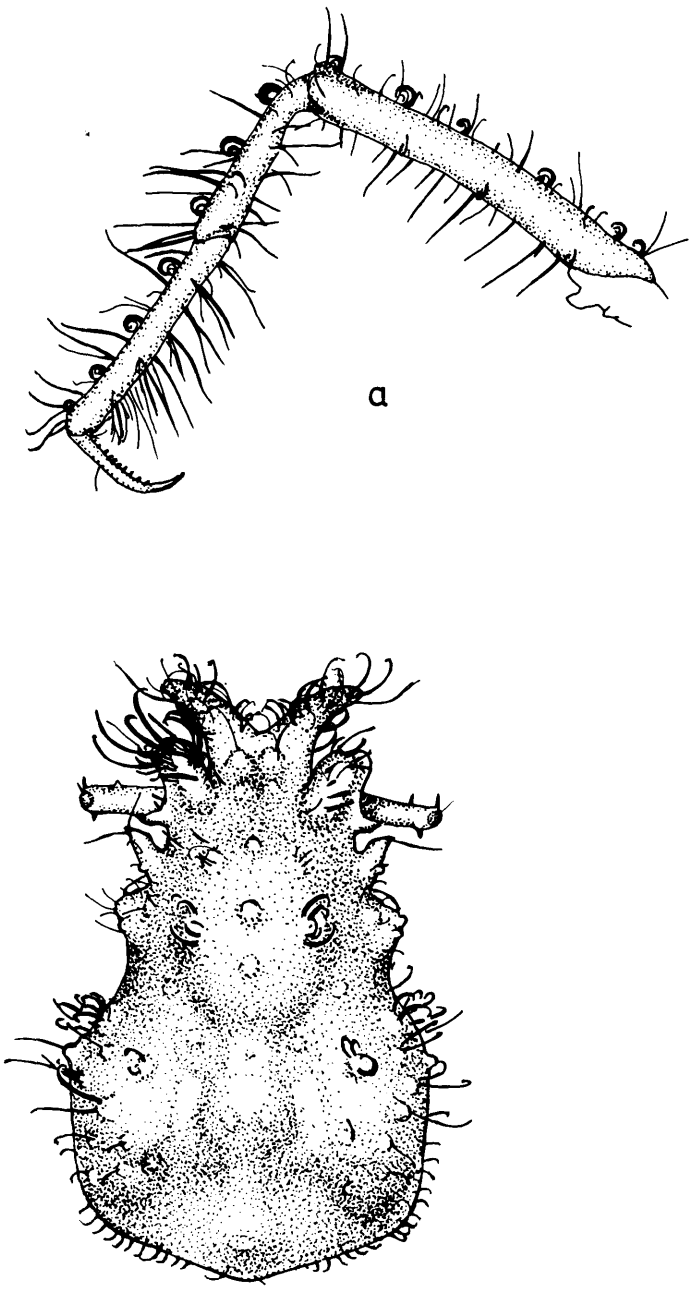

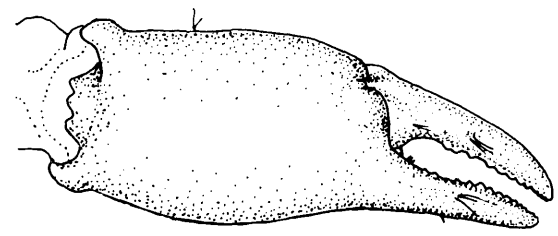

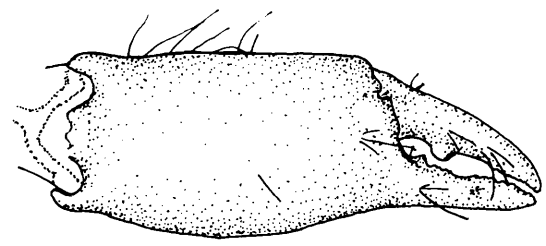

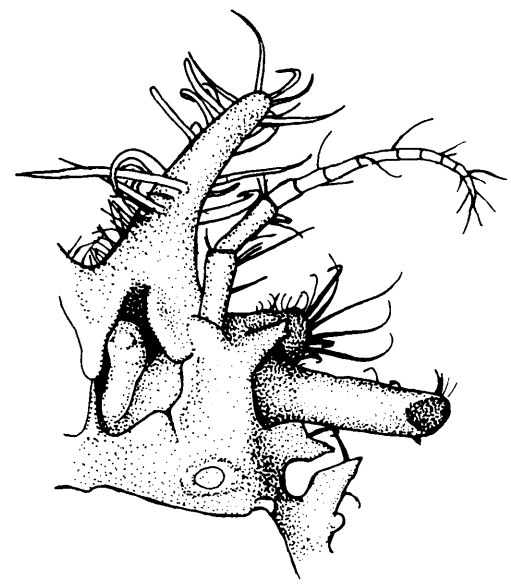

Fig. 84. *Pseudomicippe varians* (male, 22 mm, AM P.6955) (a) left first ambulatory leg; (b) right chela of adult male; *P. banfieldi* (male, 17 mm, AM P. 19541) (c) right chela of adult male; *P. varians* (as above) (d) carapace, dorsal view; (e) left orbit, ventral view.

Schizophroida manazuruana Sakai, 1933: 140, fig. 1; 1976: 245-246, pl. 89 fig. 2. — Buitendijk, 1939: 251.

Material examined. — 19 ♂♂, 18 ♀♀ (5 ovig.) 8.5-33.5 mm, smallest ovig. ♀, 12.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Hawaii, Hilo, 7 April 1915; 1 spec.

BRITISH MUSEUM (NATURAL HISTORY), LONDON

Kermadec Islands, coll. W. R. B. Oliver, 1908; 3 specs.

NATIONAL MUSEUM OF NEW ZEALAND, WELLINGTON

Kermadec Islands: Sunday I., R. S. Bell, 1909-1910, W. R. B. Oliver Collection; 1 spec. — Sunday I., R. S. Bell, 1909-1910, W. R. B. Oliver Collection; 7 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

Hawaii: Reef at Waikiki, under stones near shore, coll. M. Ward, 24-30 August 1927; 7 specs. (AM P. 29816, det. M. Ward). — Reef at Waikiki, under surface of dead coral blocks; 2 specs. (AM P. 29822, dry). — Waikiki, taken from blocks of coral brought up from below low tide; 2 specs. (AM P. 29823, dry).

Lord Howe I.: coll. A. R. McCulloch; 2 specs. (AM P. 5288). — coll. Lyman Clark, April 1932; 2 specs. (AM P. 29821, dry). — Reef, coll. A. A.

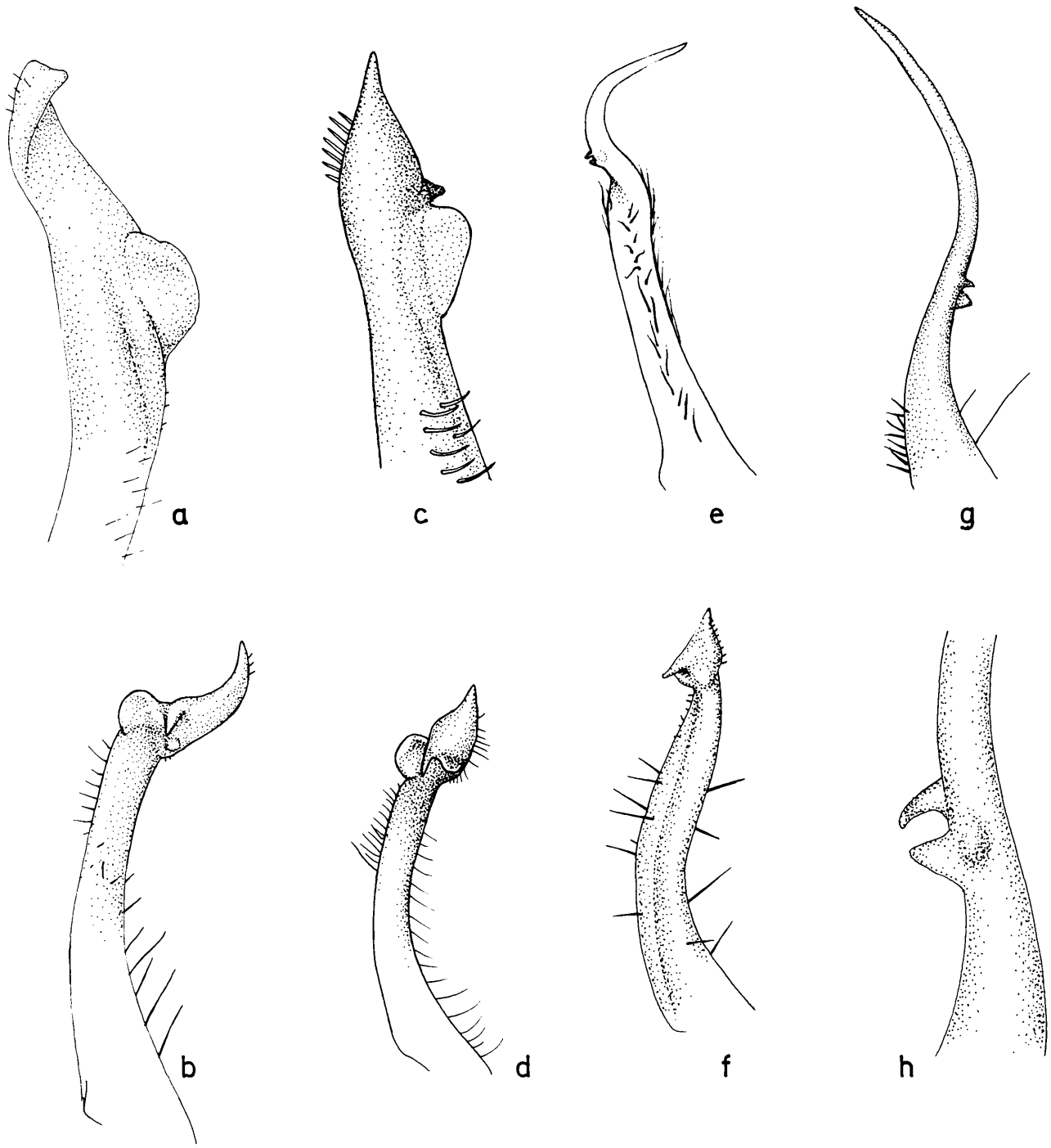

Fig. 85. Left first pleopod of male of *Pseudomicippe banfieldi* (17 mm, AM P.19541) (a) sternal tip of pleopod, (b) abdominal view of same; *P. maccullochi* (holotype) (c) sternal tip of pleopod, (d) abdominal view of same; *P. indonesica* (holotype) (e) abdominal view of pleopod; *P. philippinensis* (holotype) (f) abdominal view of pleopod; *P. indonesica* (holotype) (g) sternal tip of pleopod, (h) detail of abdominal aperture.

Livingstone, April 1933; 2 specs. (AM P. 10301). — Neds Beach, coll. I. Bennett, May 1964; 1 spec. (AM P. 19606). — Flat Rock, 25 m, coll. N. Coleman, 22 February 1979; 2 specs. (AM P. 29818). — Erscott's Hole, 3 m, coll. N. Coleman, 15 February 1979; 1 spec. (AM P. 29819). — Ball's Pyramid, 10 m, coll. N. Coleman, 24 February 1979; 1 spec. (AM P. 29820). — Deakon's Reef, 22 m, coll. N. Coleman, 30 November 1979; 2 specs. (AM P. 30996).

New Caledonia: 22°48.5′S 167°36.5′E, 85-100 m, large bottom dredge, 'Kimbla' Stn K4/71/4, coll. J. Paxton and P. Colman, 8 May 1971; 1 spec. (AM P. 29817).

Remarks. — There is considerable variation in this species, which has already led to Japanese specimens being considered as belonging to a species distinct from that described from Hawaii by Rathbun. There has been only one previous record of the species from the southwest Pacific (Chilton, 1911 — Kermadecs). The detailed remarks below set out these variations and our reasons for regarding southwest Pacific specimens as conspecific with those from Hawaii. Certain

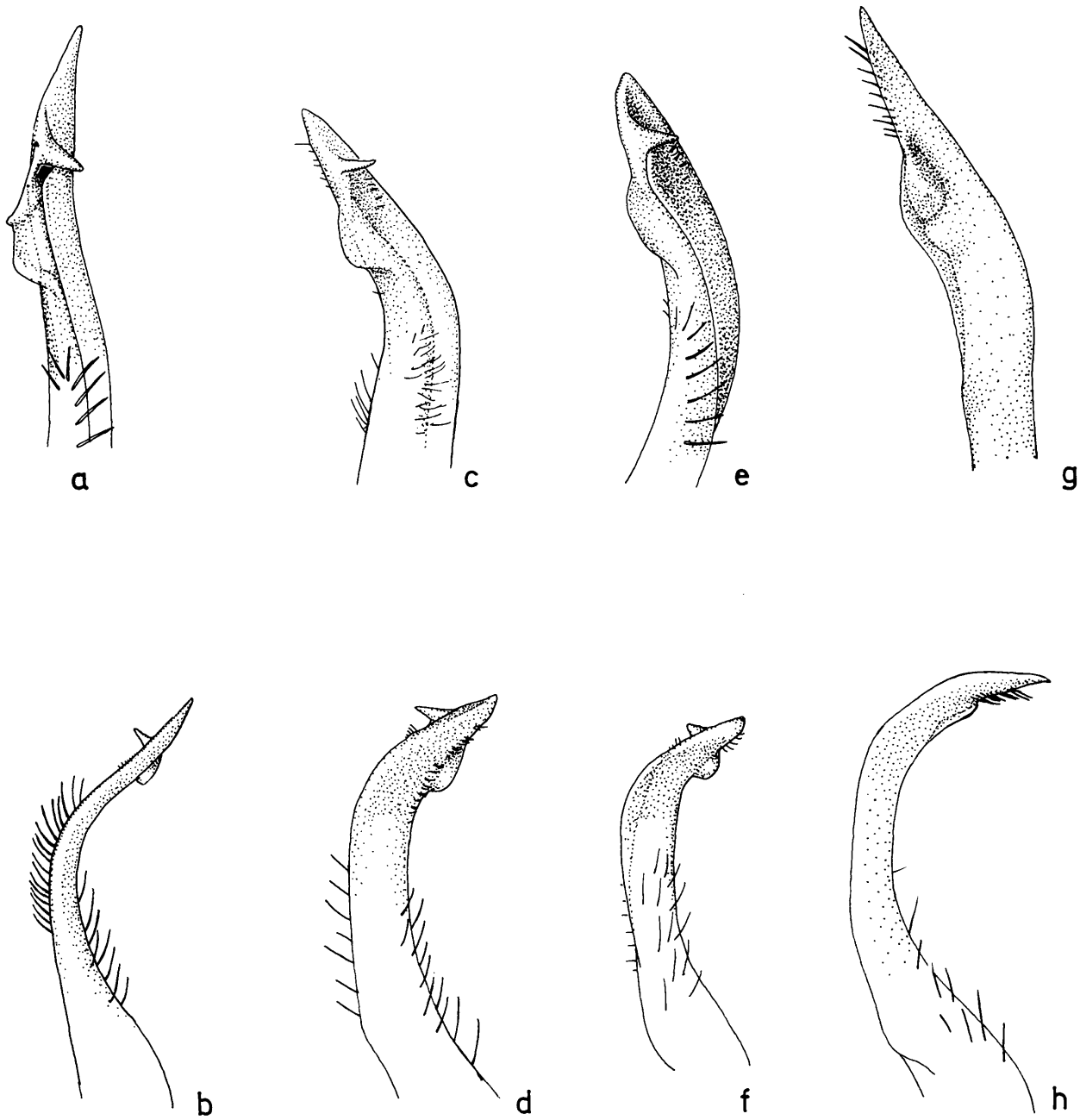

Fig. 86. Left first pleopod of male of *Pseudomicippe nodosa* (25 mm, Somalia, ZMF) (a) sternal tip of pleopod, (b) abdominal view of same; *P. eldredgei* (holotype) (c) sternal tip of pleopod, (d) abdominal view of same; *P. maldivensis* (holotype) (e) sternal tip of pleopod, (f) abdominal view of same; *Microhalimus deflexifrons* (14.5 mm, AM P.9047) (g) sternal tip of pleopod, (h) abdominal view of same.

characters, such as tuberculation, which would be considered normally to distinguish species from each other, appear to vary within the one species, perhaps in relation to age.

We have compared our series of twelve specimens (6 ♂♂, 6 ♀♀ (1 ovig.), 9.5-19.5 mm, ovig. ♀, 19.5 mm) from Hawaii with the description and figure given by Rathbun (1906). Our series agrees with the description in having five spines behind the postorbital spine, the first being the hepatic, and having a branchial spinule on either side of the intestinal spine. (This spinule is usually very small and is absent in the smallest specimen.) However, instead of a spinule, Rathbun's figure (fig. 38) shows an apparent sixth marginal spine lateral, and clearly anterior to the intestinal spine.

In our Hawaiian specimens the spines on the branchial margin and the posterior carapace margin are similar in length to the hepatic spine, but in those of our specimens not from Hawaii these spines are much shorter than the hepatic spine. The spinule on either side of the intestinal spine is absent in nearly all the specimens from the Kermadec Islands and in two of the smaller specimens from Lord Howe I.

In only eight of our Hawaiian specimens (and in none less than cl. 13.5 mm) are there any gastric tubercles. Of these

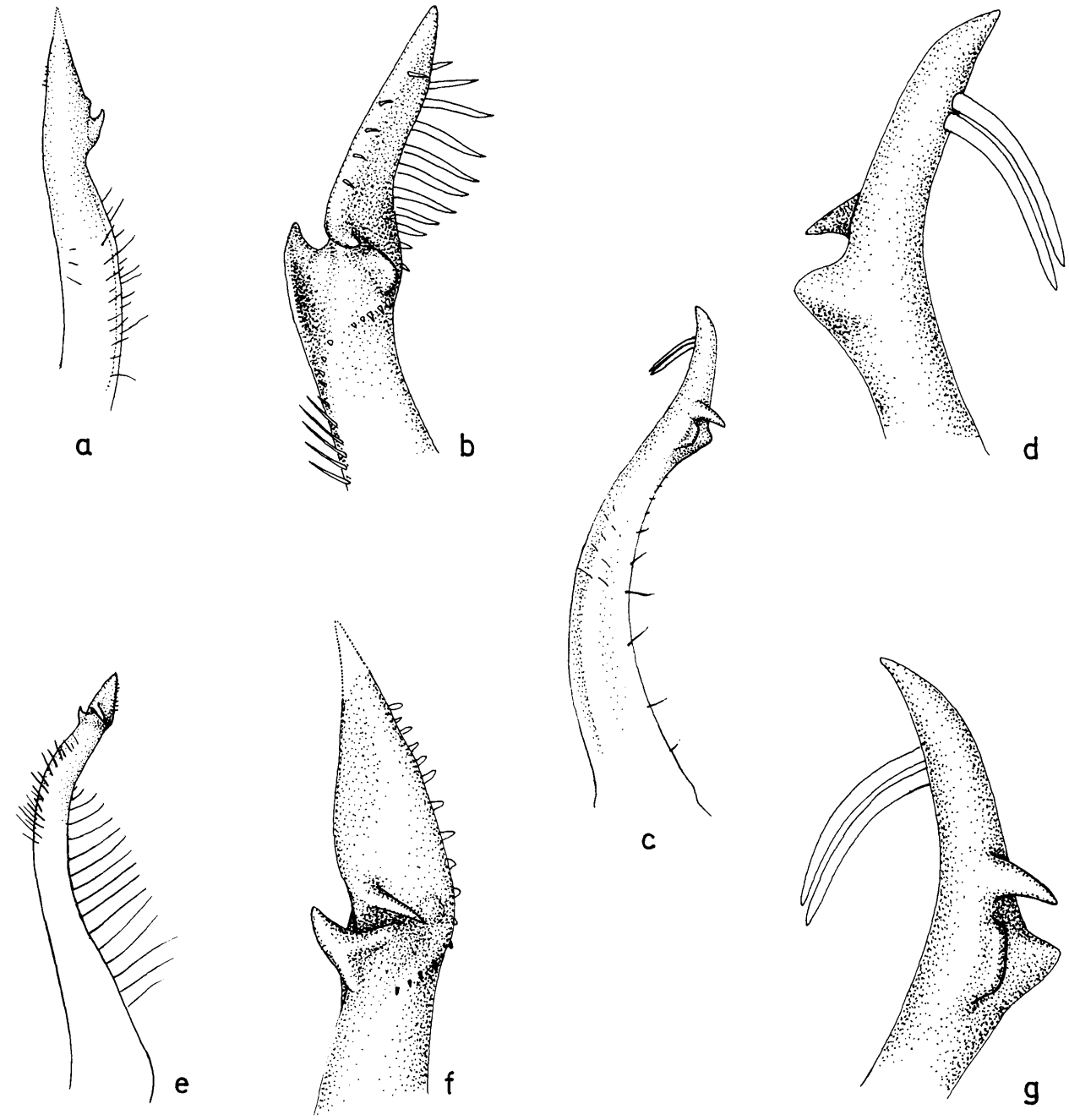

Fig. 87. Left first pleopod of male of *Pseudomicippe varians* (22 mm, AM P.6955) (a) sternal tip of pleopod; *P. nipponica* (25.5 mm, Japan, ZSM) (b) abdominal tip of pleopod; *P. tenuipes* (10.5 mm, AM P.19139) (c) abdominal view of pleopod, (d) sternal tip of same; *P. varians* (as above) (e) abdominal view of pleopod; (f) abdominal tip of same; *P. tenuipes* (as above) (g) abdominal tip of pleopod.

eight specimens one male and an ovigerous female have a distinct posterior mesogastric tubercle and two very small anterior protogastric tubercles, two other males have only a mesogastric tubercle and four other specimens have a very small or indistinct mesogastric tubercle. In the other 24 specimens in this series from Kermadec Islands (11 specimens), Lord Howe I. (13 specimens) and off New Caledonia (1 specimen) about half, i.e. 13 (and none of those less than cl. 13.5 mm) have tubercles on the gastric region; of these, three specimens from the Kermadec Islands and the specimen from off New Caledonia have only two small anterior protogastric tubercles; four of the specimens from Lord Howe I. have a transverse row of four protogastric tubercles; three of the specimens from Lord Howe I. and one specimen from the Kermadec Islands have a mesogastric tubercle as well as a transverse row of four protogastric tuberlces.

The rostral spines in this series vary in length from a fifth to about a quarter postrostral carapace length (Hawaii specimens 0.21-0.26; Kermadec specimens 0.19-0.25; Lord Howe I. specimens 0.19-0.27; New Caledonia specimen 0.3). The two anterior spines on the basal antennal article are

usually subequal in our Hawaiian specimens but in our other specimens the medial spine may be up to twice as long as the lateral spine.

Of the nineteen males in this series six have tubercles on the carpus of the cheliped. There are about eight tubercles — one central proximal tubercle, three or four in a row on either side dorsally and one or two about midway along the inner face. Of these six specimens, three are from Lord Howe I. (cl. 18; 18.5; 33.5 mm), two are from the Kermadec Islands (cl. 13.5, 14.0 mm) and one is from Hawaii (cl. 16 mm). Although there are differences in the chelae of the larger specimen from Lord Howe I. and the smaller ones and those from the Kermadec Islands they all have a distinct gape between the fingers and a large tooth on the dactyl in the gape. The male from Hawaii is less distinctly adult, there is only a narrow gape between the fingers and a few small teeth on both fingers in the gape; the palm is 3.5 times as long as high, while in other males from Hawaii without tubercles on the carpus the palm is four times as long as high. The chelipeds of the adult males from Lord Howe I. and Kermadec Islands are one and a half times postrostral carapace length, but in the Hawaiian specimen only 1.2 times postrostral carapace length. The chela of the adult males from Lord Howe I. is more elongate (palm length = 2.8 to 3.6 × height) than is that of the adult males from the Kermadec Islands (palm length = 2.2 × height) and in the largest male the tubercles on the carpus are smaller and confined to the proximal half, whereas in the smaller males and in the Kermadec males the tubercles are high and occur along the whole length of the carpus.

The first pleopods of the males from Hawaii, Kermadec Islands and Lord Howe I. are all very similar. At about the distal third the pleopod is curved strongly outwards and tapers to a sharp apex. The aperture is subterminal midway along the outwardly curved part and on the sternal surface; there is a triangular lobe on the lateral edge of the aperture.

Some female specimens from Lord Howe I. and off New Caledonia are larger at sexual maturity than our specimens from the Kermadec Islands or Hawaii. Ovigerous and adult females are in the size range 15-19.5 mm from Hawaii; 12.5-14.5 mm from the Kermadec Islands and the one ovigerous female from Lord Howe I. is 16 mm, but four females in the size range 16.5-25 mm from Lord Howe I. and off New Caledonia are still immature.

Our specimens from the Kermadec Islands, Lord Howe I. and off New Caledonia differ from our Hawaiian specimens in development of gastric tubercles, the size of the carapace spines, form of cheliped of the adult male and in the relative lengths of the anterior spines of the basal antennal article. As well there are differences in size at sexual maturity and in the cheliped of the adult male between our specimens from the Kermadec Islands and those from Lord Howe I. and off New Caledonia. There is, however, among these specimens a strong similarity to Hawaiian material in the first pleopod of the male, in the form of the orbit and position of the carapace spines. This series shows that the presence or absence of the gastric tubercles and the tubercles on the cheliped carpus is related to the size or age of the animal, and that the difference in relative length of the anterior spines on the basal antennal article is not necessarily a reliable character. Differences of size at sexual maturity in populations from different localities is often found in species of *Schizophrys*, *Notomithrax* and *Leptomithrax*. Therefore we do not feel that there is sufficient justification for recognising the south-western Pacific specimens as representing a new species.

Sakai (1933: 140), in his original description, distinguished *S. manazuruana* from *S. hilensis* by its smooth gastric region. (*S. hilensis* is described by Rathbun as having three spinules arranged in a triangle on the gastric region.) Later, Sakai (1938: 305) suggests that the two species are probably identical but "in the Japanese species the gastric region is smooth and not armed".

Buitendijk (1939: 251) identified her specimens from the Philippine Islands as *S. manazuruana* apparently because the gastric region is smooth, and suggests that the specimens of *S. hilensis*, from the Kermadec Is., described by Chilton are probably conspecific. Our specimens from the Kermadec Islands are those collected by W. R. B. Oliver and examined by Chilton.

Sakai (1976: 246) includes the Kermadec Islands in the distribution of *S. manazuruana* thus regarding Chilton's specimens as synonymous with his species.

We have not examined specimens from Japan identified as *S. manazuruana* but it is probable that that species is conspecific with *S. hilensis*. (The carapace length given by Sakai, 1976, for *S. manazuruana* is 14 mm.)

From the description of *S. simodaensis* Sakai 1938 (:304-305) it appears to be distinguished from *S. hilensis* by the presence of a larger number of spines (12-13) on the cheliped carpus and longer (1/3 postrostral carapace length), narrower rostral spines. There are about eight spines on the cheliped carpus in some specimens of *S. hilensis*, but the presence or absence of such spines appears to distinguish adults from juveniles in *S. hilensis*. The presence of a large tooth on the cheliped dactyl, the presence of only one (rather than three) gastric tubercles or the absence of a branchial spine near the intestinal spine are no longer valid characters to distinguish *S. simodaensis*.

Distribution. — Central and southwestern Pacific: Hawaii, Kermadec Islands, Lord Howe I., New Caledonia.

Schizophrys White, 1848

Type species. — *Mithrax aspera* H. Milne Edwards, 1834 by designation of Miers, 1879.

Remarks. — This genus contains four closely related species including two new species added here, both with restricted distributions; *S. dahlak* from Dahlak Archipelago in the Red Sea and *S. rufescens* from the southern coasts of Australia.

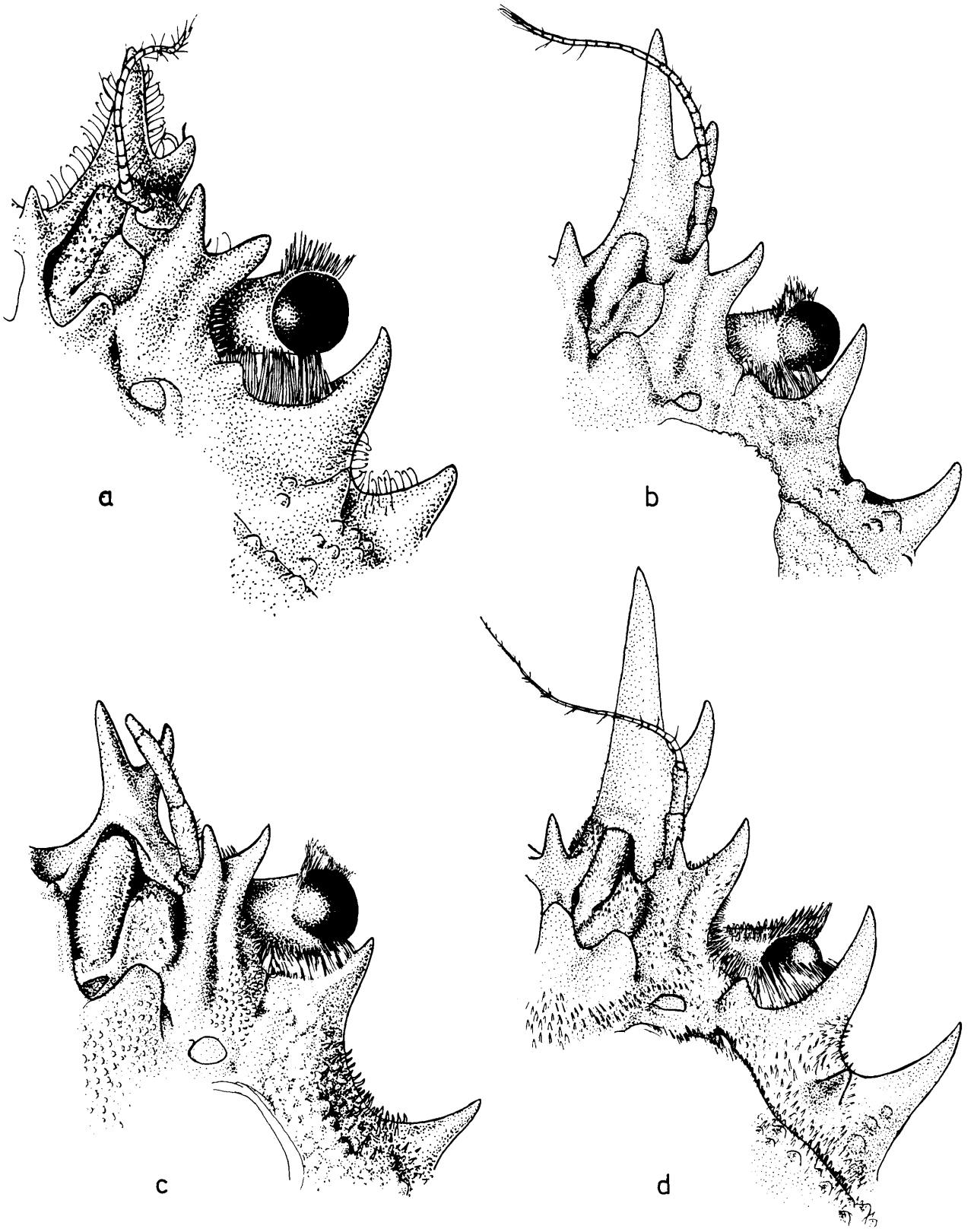

Fig. 88. *Schizophrys aspera* (male, 30.5 mm, AM P.17837) (a) left orbit, ventral view; *S. dama* (male, 59 mm, AM P. 13916) (b) left orbit, ventral view; *S. rufescens* (holotype) (c) left orbit, ventral view; *S. dahlak* (holotype) (d) left orbit, ventral view.

S. serratus White is considered to be a synonym of *S. aspera.* The orginal description of *S. spiniger* White (smooth chelipeds, two hepatic spines united at the base) appears to place it in the genus *Cyclax* rather than *Schizophrys*, and several specimens identified as *Cyclax spiniger* have been reidentified by Forest & Guinot (1961) as either *C. spinicinctus* or *C. suborbicularis. S. dichotomus* H. Milne Edwards from the 'Belearic Islands' has been figured and discussed in detail by Bouvier

(1940); we have seen no specimens that agree with this description and can say nothing about its status; its differences from *S. rufescens* are discussed under that species.

The first pleopod of the male in *Schizophrys* species is slender, curved outward distally, with a simple subterminal opening.

Distribution. — Widespread throughout the Indo-West Pacific.

KEY TO SPECIES OF *SCHIZOPHRYS*

1	Rostral spines each with two lateral accessory spines	*S. dama*
—	Rostral spines each with one lateral accessory spine	2
2(1)	Gastric region with a transverse row of four tubercles or spines	*S. aspera*
—	Gastric region granular, without tubercles or spines	3
3(2)	Rostral spines approx. 1/4 postrostral carapace length; first marginal branchial spine approx. one fifth carapace width; lower margin of orbit with a strong tooth	*S. dahlak*
—	Rostral spines approx. one sixth postrostral carapace length; first marginal branchial spine less than one tenth carapace width; lower margin of orbit without a tooth.....	*S. rufescens*

Schizophrys aspera (H. Milne Edwards, 1834) (Figs. 88a, 91g,h)

Mithrax asper H. Milne Edwards, 1834: 320.
Schizophrys aspera. — A. Milne Edwards, 1872: 231-234, pl. 10 fig. 1, 1a-f. — Alcock, 1895: 243-244. — Sankarankutty, 1962: 159-160, figs. 15-16. — Sakai, 1965a: 89, pl. 41 fig. 2; 1976: 246, pl. 89 fig. 3. — Griffin, 1966b: 286, pl. 16; 1966c: 312-313. — Takeda, 1973a: 109 — Griffin & Tranter, 1974: 181-182.
Schizophrys spiniger. — Ward, 1941: 1. (Not *Schizophrys spiniger* White, 1848.)
Schizophrys serratus. — Ward, 1942: 74.

Material examined. — 33 ♂♂,25 ♀♀ (9 ovig.), 5 juvs., 8-45 mm, smallest ovig. ♀, 21 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Is., Sapeh Strait, 08°23.5′S 119°4.6′E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec. (ZMA De. 100.886, det.Ihle). — Stn. 78, Borneo Bank, Lumu-Lumu shoal, reef, 34 m, shore exploration, coral and coral sand, 10/11 June 1899; 2 specs. (ZMA De. 100.887, det.Ihle). — Stn. 79b, Borneo Bank, Pulu Kabala-dua, 22 m, shore exploration, coral sand, 12/13 June 1899; 2 specs. (ZMA De.100.888, det.Ihle). — Stn. 89, Sulawesi, Pulu Kaniungan ketjil, 11 m, shore exploration, coral, 21 June 1899; 1 spec. (ZMA De.100.889, det.Ihle). — Stn. 152, NW. coast of Waigeo I., Wunoh Bay, 00°12.6′S 129°48′E, 32 m, dredge, townet and reef exploration, *Lithothamnion*, 12/13 August 1899; 1 spec. (ZMA De.100.890, det.Ihle). — Stn. 174, N. coast of Ceram, 18 m, dredge, townet and reef exploration, mud, 28/29 August 1899; 2 specs. — Stn. 193, Moluccas, E. coast of Sula Besi, Sanana Bay, 22 m, reef exploration, mud, 13/14 September 1899; 1 spec. (ZMA De.100.896, det. Ihle). — Stn. 206, Buton Strait, 04°58′S 122°41′E, 51 m, trawl, fine green mud, 21 September 1899; 1 spec. (ZMA De.100.893, det.Ihle). — Stn. 248, Ceram Sea, N. point of Tioor I., anchorage off Rumah Lusi, to 54 m, reef exploration. 4/5 December 1899; 2 specs. — Timor, E. coast of Roti I., Pepela Bay, 10°38′S 123°25.2′E, 22 m, reef exploration, 30 January 1900; 2 specs. (ZMA De.100.699, det.Ihle). — Banda Reef; 1 spec. (ZMA De.100.711, det.Ihle). — Savu Sea, Haingsisi Reef; 3 specs. (ZMA De.100.895, det.Ihle).

ZOOLOGICAL SURVEY OF INDIA, CALCUTTA

Sri Lanka, Pearl Banks, coll. T. Southwell, 1911; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Philippine Is., Mindoro, Puerto Galero, February 1914; 1 spec. — Sulu Archipelago, off Jolo, 36-54 m, dredge, sand, coral, 19 March 1914; 2 specs. — Sulu Archipelago, off Jolo, coral reef, 20 March 1914; 1 spec.

Mortensen Java — S. Africa Expedition: Java I., coral reef, April 1929; 3 specs. — Mauritius, Cannonier's Point, coral reef, 17 September 1929; 2 specs. — Mauritius, Flat I., 17 October 1929; 3 specs.

Danish Kei Islands Expedition: Ambon, 12 February 1922; 1 spec. — off Neira Banda, 13 m, dive, sand, coral, 12 June 1922; 1 spec. — Stn. 72, Java Sea, 05°41′S 105°57′E, 35 m, stones, 28 July 1922; 2 specs.

'Galathea' Expedition: Stn. 226, Madagascar, Bay at Cape Diego (Diego Suarez), 6 m, trawl, corals, mud, 3 March 1951; 1 spec. — Papua New Guinea, Port Moresby, 1 m, *Zostera*, October 1951; 1 spec. — Stn. 682, Tonga Makaha'a at Nukualofa, 21°07′S 175°10′W, 0.5-1 m, coral reef, 8 March 1952; 1 spec.

Singapore, low water, 20 April 1906; 1 spec.

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

Vanuatu (New Hebrides), 10 July 1934; 1 spec.

Fiji, Suva Harbour, 18°09′S 178°24′E, reef flat at low tide, living corals, coll. T. Wolff, 17 May 1965; 2 specs.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Fiji, Storm I., near Mbenggo, coll. H. Boschma, 5 March 1949; 2 specs.

MUSÉUM NATIONAL D'HISTOIRE NATURELLE, PARIS

'Calypso' Expedition to Red Sea: Abulat, corals, 1952; 1 spec. — Mersa bella, 1952; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. HP I. Moluccas, Halmahera, Teluk Pajahi, 00°19′N 127°37′E, 9 m, diving, coral bank, 21 May 1970; 1 spec. — Stn. KL III, Moluccas, between Laluin and Kajoa Is., 0°02′S 127°26′E, sand flats with marginal coral and patches of seagrass, 22 May 1970; 1 spec. — Stn. CP I, Ceram, Piru Bay, off Tg Tutuhuhur, 03°15′S 128°08′E, 36-43 m, dredge haul 7, coral, sponge and rubble, 1 June 1970; 2 specs. — Stn. AT I, N. of Aru, N. shore of Toba I., 05°21′S 134°27′E, shallow, coral reef and sand, 14 June 1970; 2 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Keppel Islands, Humpy I., coll. McGonigal and Kirkwood, 16 September 1970; 2 specs. (AM P. 17837). — Capricorn Group, Heron I., 7.5 m, channel in cave, January 1975; 3 specs. (AM P. 20627).

Western Australia: Warroora, 3 m, main outer reef, coll. N. Coleman, 30 June 1972; 1 spec. (AM P. 19431).

WESTERN AUSTRALIAN MUSEUM, PERTH

Indian Ocean, Christmas I., coll. D. Powell, October-November 1961; 3 specs. (WAM 315-73).

Remarks. — This species is distinguished from *S. dama*, *S. rufescens* and *S. dahlak* by the presence on the granular carapace of several distinct short spines or large tubercles. There is a transverse row of four tubercles and a posterior medial tubercle on the gastric regions and tubercles or spines anteriorly and posteriorly on the dorsal branchial region. In the other three species the carapace is covered in low granules, with either small posterior branchial tubercles only (*S. dahlak*) or with no tubercles (*S. dama* and *S. rufescens*). There is a tooth on the suborbital border and the carapace behind it is smooth. There is a single lateral accessory spine at the base of the rostrum and in most specimens there are distinct tubercles on the rostral ridges. Sometimes (about a

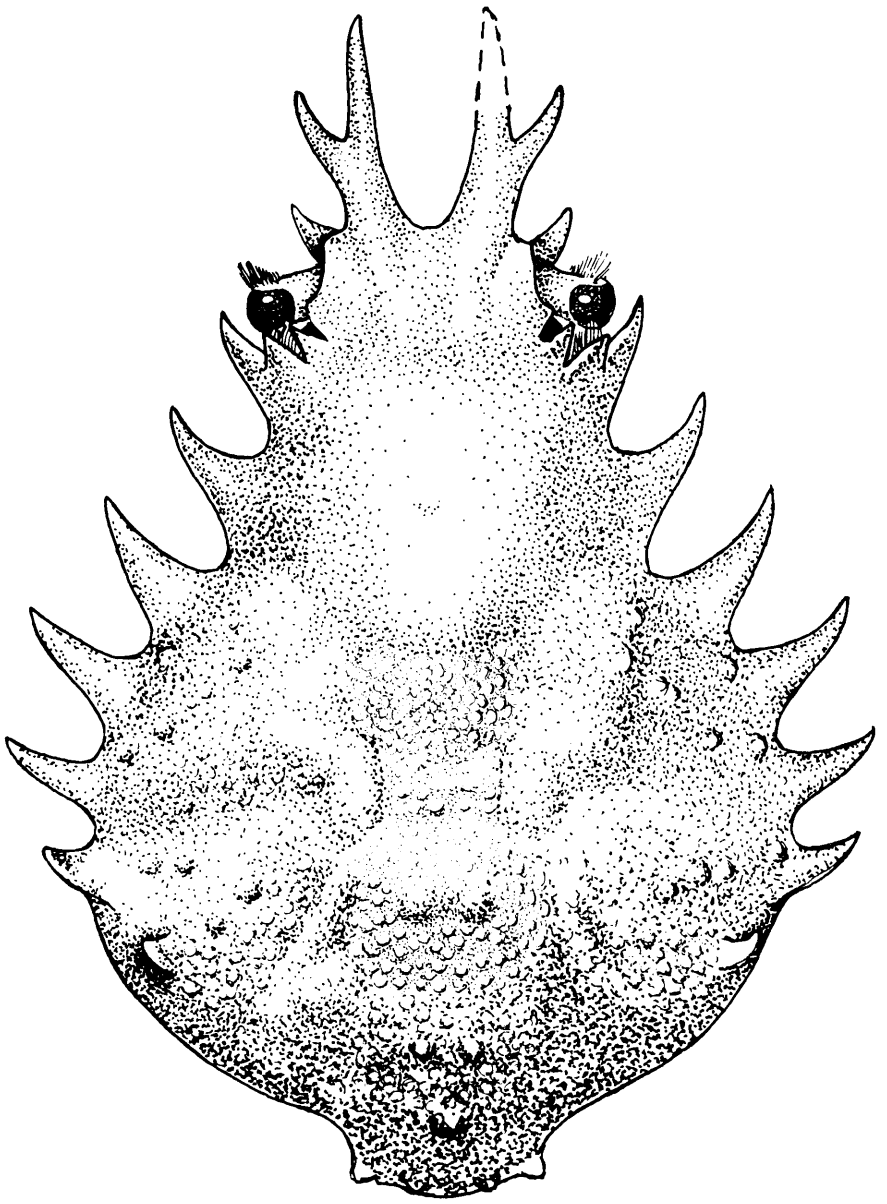

Fig. 89. *Schizophrys dahlak* (holotype) carapace, dorsal view.

third of our specimens) there is also a medial accessory spine or tubercle on the rostrum. There is a short acute terminal spine on the merus of the ambulatory legs. The first pleopod of the male is curved outward in the distal fifth with the opening on the sternal surface about midway between the curve and the apex (not subterminally as in the other species). In the female there is a strongly swollen area anterolateral to the narrow oval gonopore which opens posteromedially.

We have examined three specimens (1 ♂, 13 mm, 2 ♀ ♀, 16.5 21.5 mm, AM unregistered) from the Gulf of Davao, Philippine Islands, identified by Ward (1941) as *Schizophrys spiniger* White and they are *S. aspera.*

They differ from the brief description given by White (1847d: 223) in having small spines on the cheliped merus, and the two lateral carapace spines behind the postorbital spine are not united at the base. (From the original description *S. spiniger* White would appear to be a species of *Cyclax.*) We have also examined three specimens (1 ♂, 57.5 mm, 2 ♀ ♀, 49.5, 50.5 mm, AM unregistered) from Mauritius identified by Ward as *Schizophrys serratus* White (Ward, 1942) and they are also conspecific with our specimens of *S. aspera.* There are tubercles on the gastric region, sharp tubercles anteriorly and posteriorly on the dorsal branchial region and a triangular tooth on the suborbital border.

Distribution. — Widespread Indo-West Pacific from East Africa and the Red Sea to Japan, Australia, Fiji and Hawaii.

Schizophrys dahlak new species
(Figs. 88d, 89, 90a,b,d,e, 91c,d)

Material examined. — 8 ♂♂, 3 ♀ ♀ (1 ovig.), 33-72 mm, ovig. ♀, 64.5 mm.

Holotype. — Male, cl. 63.5 mm, Red Sea, 3 m, in large coral head, coll. J. Forest, 'Calypso', 1952, Muséum National d'Histoire Naturelle, Paris. Paratypes. As listed below:

MUSÉUM NATIONAL D'HISTOIRE NATURELLE, PARIS

Red Sea, 3 m, in large coral head, coll. J. Forest, 'Calypso', 1952; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Red Sea, Dahlak Archipelago: March-April 1962; 3 specs. (ISRSE 62/4240). — Umm Aabak I., 0-2 m, 5 April 1962; 1 spec. (ISRSE 62/2705). — 15°37'N 40°43'E, 27 m, hard bottom, 'Negus Solomon', 23 October 1965; 1 spec. (ISRSE 65/1900).

ZOOLOGICAL MUSEUM, TEL AVIV UNIVERSITY

Red Sea, Dahlak Archipelago: N. of Nocra I., Umm Aabak I., 0-2 m, low tide, among and under corals, 5-6 April 1962; 1 spec. (ISRSE 62/1447). — Umm Aabak I., (close to a hot spring), 1962; 1 spec. (ISRSE 62/2097). — Museri I., Mangrove Bay, 0.5-1.5 m, low tide, about 100 m offshore, corals and sand, fishing with pro-noxfish, 13 October 1965; 1 spec. (ISRSE 65/1051).

MUSEO CIVICO DI STORIA NATURALE, MILAN

Red Sea, Massawa; 1 spec.

Description. — Carapace broad, width, about four fifths (0.8) postrostral carapace length, surface covered with low granules, regions barely elevated.

Rostrum of two slender, cylindrical spines, in length about a quarter postrostral carapace length; spines apically sharp, only weakly divergent; a slender, lateral accessory spine at about proximal third; main spine equal to two to three times accessory spine and about twice basal width of rostral spine.

Orbit above consisting of an expanded eave, no preorbital spine, antorbital angle produced to a broad triangle; intercalated spine triangular, length about one and a half times basal width; postorbital spine slender, sharp, curved forwards, tip reaching almost to preorbital angle, anterior edge with a short accessory spine whose apex barely exceeds intercalated spine; no tubercles between orbits.

Hepatic margin with a spine equal to postorbital spine; a small, sharp subhepatic spine.

Branchial margin with five sharp lateral spines, first about 0.17 cw., last smallest and more dorsally placed.

Gastric regions smooth, very weakly elevated, a few larger granules but no tubercles or spines.

Cardiac region not elevated, smooth. Intestinal region with a pair of low, anterior, submedial tubercles; a central medial tubercle; a pair of curved submedial spines on posterior margin with four tubercles between them.

Branchial region with about six tubercles posterodorsally; remainder of region smooth (in one specimen a lateral spine is bifid).

Basal antennal article slender, longitudinally grooved, two sharp anterior spines, lateral two to three times longer than medial; suborbital border with a triangular tooth and area near its base smooth (not tuberculate as in *S. dama* and *S. rufescens*); no tubercle lateral to green gland. Third maxilliped smooth.

Pterygostomian region mainly smooth with a few lateral tubercles and about two rows of tubercles on margin.

Male cheliped merus with tubercles and spines; two or more sharp, curved spines distally on medial edge (one on distal margin); at least two other curved spines on distal margin; carpus with sharp tubercles; palm smooth with a proximal dorsal tubercle; length about three times height; a moderate gape between fingers with a large tooth on dactyl in gape.

Ambulatory legs smooth except for a slender terminal spine on merus.

Sternum smooth.

Male abdomen of seven segments; last segment slightly wider (1.2) than long. First pleopod of male straight, curved laterally at tip (distal 1/8), with elongate, subterminal, sternal opening.

Remarks. — This species is similar to *S. aspera* in having one lateral accessory spine and a tooth on the suborbital border; it differs from that species in 1) having no gastric tubercles; 2) tubercles only on the posterior part of the branchial region; 3) the lateral spine much longer than the medial on the basal antennal article; and 4) the opening on the first pleopod of the male much nearer the apex. The characters which distinguish this species from *S. rufescens* are the longer more slender rostral and carapace spines; the presence of a tooth on the suborbital border; the anteromedial spine of the basal antennal article much shorter than the anterolateral; and the presence of tubercles on the posterior part of the branchial region. The characters which distinguish this species from *S. dama* are dealt with under that species.

The specific name refers to the type locality of the new species.

Distribution. — This species is known only from the southern Red Sea.

Schizophrys dama (Herbst, 1804)
(Figs. 88b, 91e,f)

Cancer Dama Herbst, 1804: 5-6, pl. 59 fig. 5.
Schizophrys dama. — Alcock, 1895: 245. — Alcock & Anderson, 1898: pl. 35 figs. 2, 2a. — Balss, 1935a: 124. — Buitendijk, 1950: 67-68. — Yaldwyn, 1964: 362, fig. — Griffin, 1966b: 286 (key).

Material examined. — 7 ♂♂, 6 ♀♀ (1 ovig.), 7.5-59 mm, ovig. ♀, 58.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 164, off W. point of Irian Jaya, 01°42.5'S 130°47.5'E, 32 m, dredge, sand, small stones and shells, 20 August 1899; 2 specs. — Stn. 273, E. coast Aru I., anchorage off Pulu Jedan, 13 m, trawl, dredge and divers, sand and shells, 23/26 December 1899; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Ambon, ca. 126 m, dredge, stones, sand, 22 February 1922; 1 spec.

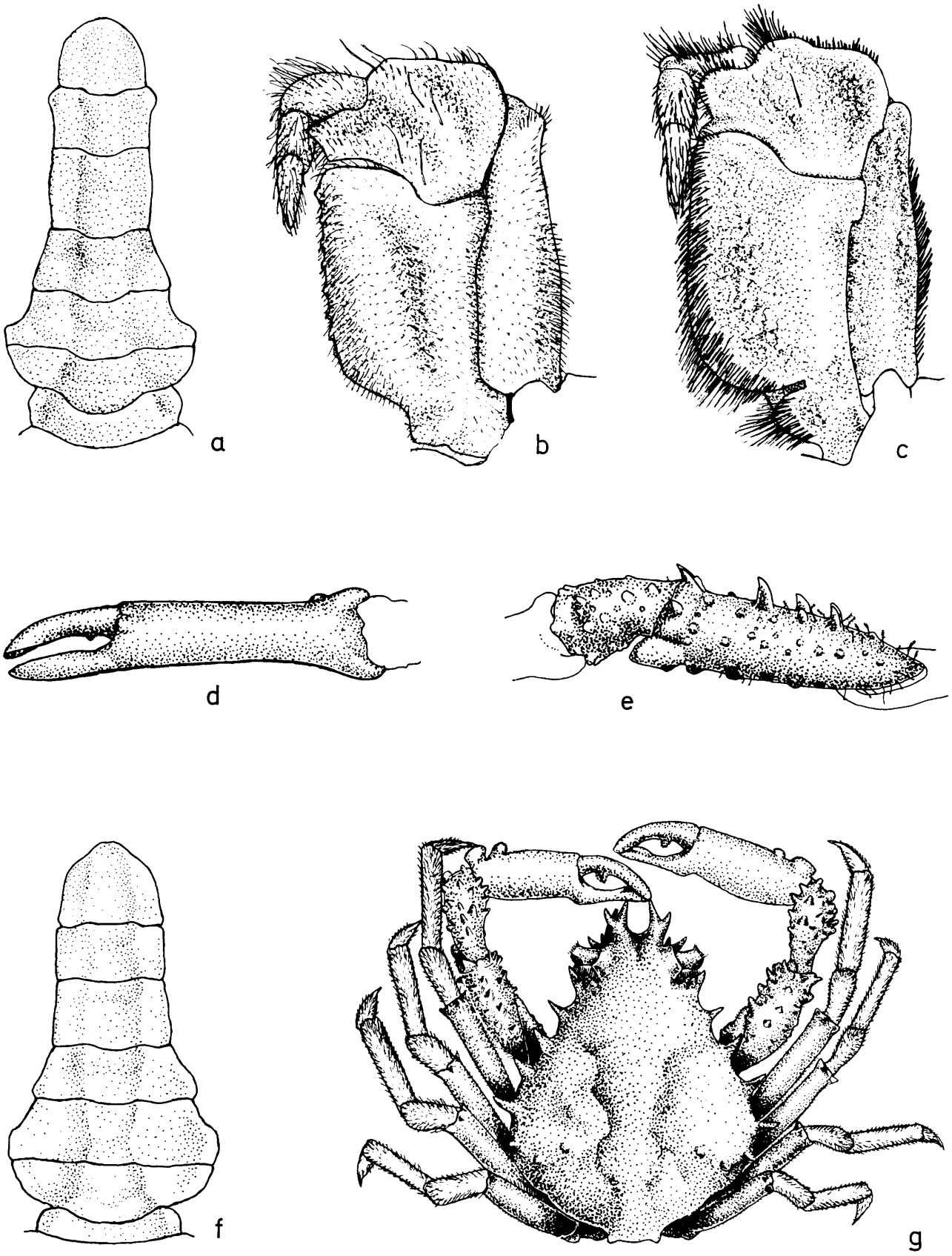

Fig. 90. *Schizophrys dahlak* (holotype) (a) male abdomen; (b) left third maxilliped; *S. rufescens* (holotype) (c) left third maxilliped; *S. dahlak* (holotype) (d) left chela; (e) left cheliped, merus and carpus; *S. rufescens* (holotype) (f) male abdomen; (g) whole animal, dorsal view.

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. 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.

WESTERN AUSTRALIAN MUSEUM, PERTH

Northern Territory: N. Darwin, on buoys and beacons near lighthouse, coll. R. Kersting, 12 October 1963; 2 specs. (WAM 62-77).

SOUTH AUSTRALIAN MUSEUM, ADELAIDE

Great Australian Bight, coll. E. H. Howard, 1888; 1 spec. (SAM C1145).

THE AUSTRALIAN MUSEUM, SYDNEY

Western Australia; Between Cape Bossut and Broome, dredge, coll. A. A. Livingstone, 10 September 1929; 1 spec. (AM P.13916).

'Alpha Helix' Expedition 1975: Stn. 4, Arafura Sea, Torres Strait, 10°44.4′S 140°07.3′E, 48 m, coll. E. Ball and J. R. Paxton, 16 March 1975; 1 spec. (AM P.25071). — Stn. 7, Arafura Sea, 10°40.2′S 139°19.2′E, 48 m, small rocks, coll. E. Ball and J. R. Paxton, 16 March 1975; 1 spec. (AM P.25069).

Remarks. — *Schizophrys dama* is distinguished from the other two smooth species *S. rufescens* and *S. dahlak* by the presence of two lateral accessory spines (not one) on the rostrum; the much coarser granules on the carapace; and the narrower seventh segment of the male abdomen (as long as wide, not wider than long). In *S. dama* the rostral spines (0.2 postrostral cl.) and the marginal branchial spines (0.1 cw.) are shorter than in *S. dahlak* but longer than in *S. rufescens*. Both *S. dama* and *S. rufescens* are distinguished from *S. aspera* and *S. dahlak* by the absence of any dorsal branchial tubercles; by the absence of a tooth on the suborbital border; and by the region just below the suborbital border being tuberculate, not smooth.

On the rostrum one of the lateral spines is proximal and the other is at the distal half; it is this more distal spine which is present in those occasional specimens, mostly juveniles, which have only one spine. On the intestinal region there is a low central medial tubercle and on the posterior carapace margin two submedial tubercles, with four to six small tubercles between them.

The merus of the ambulatory legs is armed with only a sharp terminal tubercle, not a spine as in the other three species. The cheliped merus of the male is armed with tubercles and short spines including three short spines on the medial edge; the carpus has tubercles and short spines; the palm is smooth with a dorsal proximal tubercle. In the largest male in the series (57 mm) there is a small gape between the fingers and a large tooth on the dactyl.

The first pleopod of the male is similar to that of *S. rufescens*, straight, with a short laterally curved tip and a round subterminal sternal opening. In the female there is a swollen area lateral to the oval gonopore which opens medially.

This species has not been recorded from the east coast of Australia nor south of approximately 20°S on the west coast. However there is one specimen from the Great Australian Bight (♂, 39.5 mm, SAM C1145) which we have examined and the identification of which we have confirmed: the source of the record is reliable, so that the occurrence of *S. dama* in this southerly area must be regarded as rare.

Distribution. — Straits of Malacca; Indonesia; north Australia from Torres Straits to Port Hedland, Western Australia; Great Australian Bight.

Schizophrys rufescens new species
(Figs. 88c, 90c,f,g, 91a,b)

Schizophrys aspera. — Rathbun, 1918: 25. — Hale, 1927: 138-139 (in part: 'smooth and robust form' from South Australian 'Gulfs'). (Not *Mithrax asper* H. Milne Edwards, 1834.)

Material examined. — 21 ♂♂, 30 ♀♀ (5 ovig.), 14-58 mm, smallest ovig. ♀, 25.5 mm.

Holotype. — Male, cl. 52 mm, South Australia, west coast, Whittlebee Point, coll. W. Zeidler, 28 February 1975, SAM C.3875, South Australian Museum, Adelaide.

Paratypes. As listed below:

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: southern Queensland; 1 spec. (AM P.3534, det. M. Rathbun as *S. aspera*).

South Australia: 'South Australia'; 3 specs. (AM P.2338-40). — Spencer Gulf, 36 m; 2 specs. (AM E.830, AM P.2319, det. M. Rathbun as *S. aspera*). — Spencer Gulf, coll. H. Hale; 2 specs. (AM P.7484-5). — Spencer Gulf, Port Hughes, Tiparra Reef, 6-7 m, under rock, coll. N. Coleman, 25 November 1970; 1 spec. (AM P.19533). — Gulf St. Vincent, N. of Aldinga, on small tidal reef, coll. W. Ponder, 11 January 1971; 2 specs. (AM P.17838). — Kangaroo I., Kingscote, 35°40′S 137°37′E, 3-5 m, under Kingscote Jetty, coll. B. Russell, 9 March 1978; 1 spec. (AM P.29825). — Kangaroo I., American River, 2 m, on wharf piles, coll. N. Coleman, 10 March 1978; 1 spec. (AM P.29824).

Western Australia: Perth, Cockburn Sound, 2.5 m, under rock, coll. N. Coleman, 11/12 January 1972; 2 specs. (AM P.19444, AM P.19599). — Fremantle, Woodman's Point, 2 m, under rock, coll. N. Coleman, 4 March 1972; 1 spec. (AM P.19432).

SOUTH AUSTRALIAN MUSEUM, ADELAIDE

South Australia: Nuyts Archipelago, 5-7 m, 2 specs. (SAM C.232). — Pt Willunga, coll. H. M. Hale; 4 specs. (SAM C.1142). — Investigator Straits; 4 specs. (SAM C.1143). — Gulf St. Vincent; 3 specs. (SAM C.1144, dry). — Gulf St. Vincent, coll. W. H. Baker; 6 specs. (SAM C.1147, dry). — Whittlebee Point, coll. W. Zeidler, 28 February 1975; 4 specs. (SAM C.3876). — Reef, 3 miles (~ 5 km) S. of Port Vincent, coll. M. Tilbrook, 15 February 1972; 1 spec. (SAM C.3879).

Western Australia: Fremantle, Woodman's Point, 1927; 1 spec. (SAM C.1801).

Northern Territory: Gulf of Carpentaria, Groote Eyelandt, east coast, coll. N. B. Tindale, August 1921; 1 spec. (SAM C.162, dry).

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: 10 miles (16 km) E. of Hopetoun, coll. R. W. George, 10 January 1959; 1 spec. (WAM 63-77). — Cheyne Beach, E. of Albany, sublittoral, rocky headland, 3 December 1968; 1 spec. (WAM 307-73). — Point Peron, 2 m, coll. H. W. Butler, 26 June 1960; 1 spec. (WAM 301-73 in part). — Point Peron, at National Fitness Camp, coll. R. W. George, 1 December 1961; 1 spec. (WAM 297-73). — Fremantle, Owen anchorage at power house, trawl, coll. R. W. George, 'Lancelin', 16 December 1959; 1 spec. (WAM 296-73). — Cockburn Sound, Woodman's Point, coll. B. R. Wilson, 13 February 1972; 1 spec. (WAM 295-73). — Jervoise Groyne, 6 m, on large black sponge, coll. B. R. Wilson, 22 April 1963; 2 specs. (WAM 66-77).

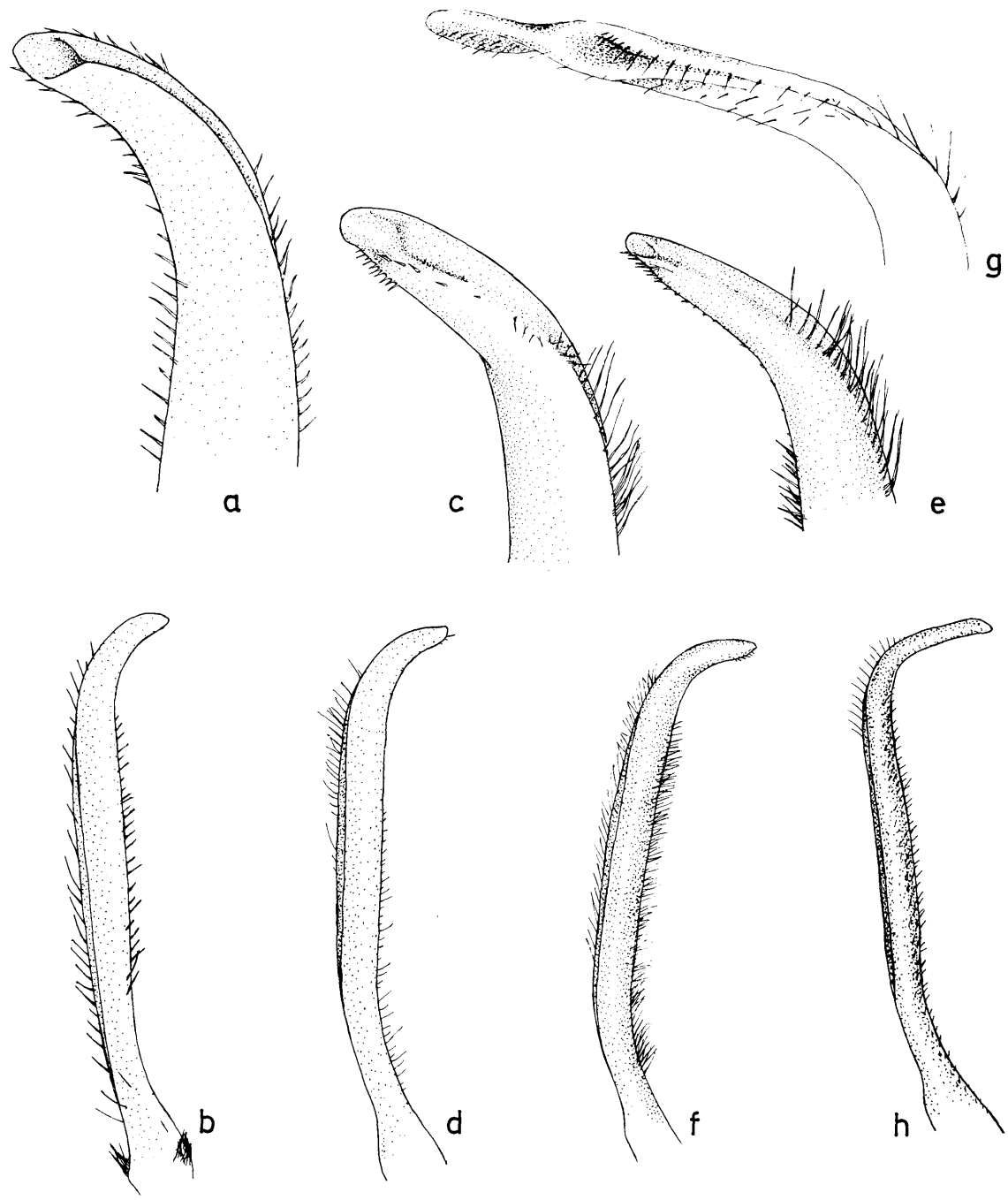

Fig. 91. Left first pleopod of male of *Schizophrys rufescens* (holotype) (a) sternal tip of pleopod, (b) abdominal view of pleopod; *S. dahlak* (holotype) (c) sternal tip of pleopod, (d) abdominal view of pleopod; *S. dama* (59 mm, AM P.13916) (e) sternal tip of pleopod, (f) abdominal view of pleopod; *S. aspera* (45 mm, AM P.20627) (g) sternal tip of pleopod, (h) abdominal view of pleopod.

Description. — Carapace broad, width five sixths (0.83) postrostral carapace length, surface covered with fine granules, mesogastric region weakly elevated.

Rostrum of two short spines, less than one sixth (0.15) postrostral carapace length; basal half broad and armed with one short, lateral accessory spine, distal half narrow; length of each rostral spine beyond accessory spine about half rostral length, one and a half times to twice length of accessory spine and less than (0.8) basal width of rostral spine.

Orbit above consisting of moderately expanded eave; no preorbital spine; antorbital angle produced to a short triangle. Intercalated spine triangular, length subequal to basal width; postorbital spine short, acute, apex reaching to about antorbital angle, armed anteriorly with a short accessory spine, apex of which slightly exceeds intercalated spine.

Hepatic margin with a spine equal to or smaller than postorbital spine; subhepatic region with several sharp tubercles. Branchial margin with five short spines (first spine

at most one fourteenth (0.07) carapace width), last spine much smaller and more dorsally placed.

Mesogastric region smooth, weakly elevated (more strongly elevated than in *S. aspera*), a larger central granule but no tubercles or spines. Protogastric region lacking tubercles between orbits.

Cardiac region very weakly elevated, with two larger granules in some specimens. Intestinal region with a central medial tubercle, two submedial tubercles on posterior margin but very small or no tubercles between them.

Branchial region without tubercles or spines.

Basal antennal article slender with a deep longitudinal groove, anterior medial spine equal to or slightly smaller than anterolateral spine. No tooth on lower edge of orbit adjacent to posterolateral angle of basal antennal article (present in *S. aspera*), carapace below border tuberculate (not smooth). Orbit open below. No suborbital tubercle lateral to green gland.

Pterygostomian region smooth with two rows of small tubercles on margin.

Male cheliped merus with short spines; dorsal spines sharp, including two on distal border; medial and ventral spines blunt; carpus with sharp tubercles or short spines; palm smooth with a proximal dorsal tubercle; adult male with a well developed gape between fingers and a large tooth on dactyl in gape.

Ambulatory legs armed with a short acute terminal spine on merus of first three pairs.

Male sternum smooth.

Male abdomen of seven segments; seventh segment wider (1.3) than long.

First pleopod of male straight, with a short laterally curved tip, opening round, sternal and subterminal.

Gonopore of female pear-shaped, opening posteromedially, a swollen area anterolateral to it.

Remarks. — Specimens of *S. rufescens* have previously been identified as *S. aspera* on the basis of the single lateral accessory spine. There are however, a number of characters which distinguish this species from *S. aspera*. There are no tubercles or spines on the gastric or branchial regions other than the marginal spines; the suborbital border lacks a tooth but the area between it and the anterolateral angle of the mouthfield is tuberculate (not smooth as in *S. aspera*); the first pleopod of the male has a short curved tip and a subterminal opening while in *S. aspera* there is a long curved tip and the opening is midway along it.

The characters which distinguish this species from *S. dama* and *S. dahlak* are dealt with under those species.

This species occurs from Gulf St Vincent, South Australia along the coast of the Great Australian Bight to Perth, Western Australia, but there are also two records, one from southern Queensland and one from the Gulf of Carpentaria; the specimens have been seen by us and we can confirm that they are *S. rufescens*. Other collections from southern Queensland and the Gulf of Carpentaria do not contain specimens of this species and the regular occurrence in those areas therefore is not confirmed although the sources for the two records are highly reliable.

S. dichotomus H. Milne Edwards from the 'Belearic Islands' figured by H. Milne Edwards (1934: pl. 15 figs. 1-4) and by Bouvier (1940: fig. 198, pl. 13 fig. 2) is similar to *S. rufescens* in the short rostral spines, in the absence of a tooth on the inferior border of the orbit and in the carapace which is without tubercles or spines except on the margins. However, both drawings show the postorbital lobe directed almost straight forward, not obliquely forward as in *S. rufescens* and in Bouvier's figure there are two spinules or tubercles on the posterior slope of the hepatic spine which is always smooth in *S. rufescens*. We do not know the status of *S. dichotomus*.

The specific name refers to the reddish colour of this new *Schizophrys*.

Distribution. — South Queensland, South Australia, southwestern Australia, Gulf of Carpentaria.

Seiitaoides new genus

Type species. — *Eurynome orientalis* Sakai, 1961.

Description. — Carapace pyriform to subpyriform, ornamented with a few large plates and some sharp tubercles. Rostrum of two distinct spines separated by a U-shaped hiatus. Supraorbital margin comprising eave, intercalated spine and postorbital lobe. Basal antennal article broad basally, narrow in distal half, antenna not excluded from orbit. Lower margin of orbit with a broad suborbital lobe. Ischium and merus of third maxilliped spinulated; anterolateral angle of merus produced. Cheliped of male spinous, longer than ambulatory legs; chela palm spinous, fingers short, bent on an angle towards fixed finger. Ambulatory legs short, with spinules. Abdomen of seven free segments in both sexes; abdomen of adult females covering sternum.

Remarks. — The very simple form of the male pleopod and the characteristic ornamentation of the carapace with a few large plates, rather than many tubercles, distinguish the species of this genus from those of *Eurynome* and *Choniognathus*. The first pleopod of the male of *Seiitaoides orientalis* (Sakai) is almost straight and the aperture is at the apex; the pleopod of the other species placed in the genus, *S. stimpsoni* (Miers), is unknown.

The name of the new genus is derived from the Japanese *Sei-ita* and refers to the armoured appearance of the carapace. *Sei-ita* is an extra back plate closing the opening in a *Harimake-do*, a type of Japanese armour opening down the back.[39])

[39]) Stone, G. C., 1961. A Glossary of the Construction, Decoration and Use of Arms and Armor. J. Brussel, New York.

Distribution. — Indo-West Pacific: Red Sea, Providence Reef, Western Australia, Indonesia, Japan.

KEY TO SPECIES OF *SEIITAOIDES*

1 Epibranchial plate subpyriform, laterally acute; surface of plates spiny, carapace surface between plates with 'star-shaped' tubercles; intercalated spine separated by fissures from supraorbital eave and postorbital lobe ..... *S. orientalis*

— Epibranchial plate subcircular; surface of plates tuberculate, carapace surface between plates with simple tubercles; intercalated spine contiguous with supraorbital eave and postorbital spine ..... *S. stimpsoni*

Seiitaoides orientalis (Sakai, 1961) new combination
(Fig. 69b,e,f)

Eurynome orientalis Sakai, 1961: 140-141, text fig. 1c,d, pl. 4 fig. 2; 1965a: 79-80, pl. 37 fig. 5; 1976: 221-222, text fig. 119, pl. 76 fig. 1. — Griffin, 1970b: 7-8, fig. 1.

Material examined. — 5 ♂♂, 4 ♀ ♀ (2 ovig.), 4-7 mm, smaller ovig. ♀, 6.5 mm (and 1 spec. in fragments).

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Is, Sapeh Strait, 08°23.5′S 119°4.6′E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec. — Stn. 51, Lesser Sunda Is., Madura Bay and other locations in S. part of Molo Strait, 69-91 m, dredge, trawl and shore exploration, fine grey sand, coarse sand with shells and stones, 19 April 1899; 1 spec. — Stn. 260, Kai Is., 2.3 miles (~ 4 km) N.63°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.

'Ihle collection', no locality data; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 3, Kai Is., 05°32′S 132°36′E, 245 m,trawl, sand, 31 March 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AH I, near Tg. Bt. Kapal, Haruku I., (E. of Ambon), 03°36′S 128°24′E, 108-113 m, dredge haul 4, shell, sand and rubble, 31 May 1970; 1 spec. (prev. det. R. Serène). — Stn. AW IV, Aru, Wokam, off W. end Udjir I., 05°37′S 134°10′E, 68-94 m, dredge hauls 4-7, mud and rubble, 16 June 1970; 1 spec. (prev. det. R. Serène). — Stn. AM II, Aru, Maikoor, approx. 8 miles (~ 13 km) SW. Tg. Ratoe, centred on 06°7′S 133°57′E, 45 m, dredge hauls 4-5, sand and rubble, 18 June 1970; 1 spec. (damaged),(prev. det. R. Serène).

Remarks. — This species is distinguished by the subpyriform, laterally acute hepatic and epibranchial plates. Like *S. stimpsoni* it possesses a large cardiac plate and a slightly smaller mesogastric plate. However, in *S. orientalis* the surfaces of the plates are spiny and the surface of the carapace between the plates bears small "star-shaped" tubercles. In *S. stimpsoni* on the other hand, the surface of the plates are tuberculate, and the surface of the carapace between the plates bears simple tubercles. *S. orientalis* also differs in a generally more spiny appearance and in having more slender chelae on the male.

The rostral spines are generally slender and of moderate length. The hepatic plate is sometimes incised midway along its anterior border but in one specimen there is a small but distinct, laterally acute hepatic plate and medial to this a small oval plate. The epibranchial plate is usually distinct from any of the nearby plates but in one specimen the plate on the posterolateral border is fused with the epibranchial plate. The basal antennal article of these specimens is as described by Griffin (1970b).

In one small specimen, cl. 4 mm, the plates of the carapace are small and more distinct from each other than in large specimens.

Distribution. — Japan - Sagami Bay; Kai Is., Aru, Ambon, Lesser Sunda Is.; off Western Australia between Carnarvon and North West Cape.

Teratomaia new genus

Type species. — *Leptomithrax richardsoni*, Dell, 1960, by monotypy.

Description. — Carapace pyriform, surface tuberculate with moderately long spines. Rostrum of two slender, divergent spines separate from their base. Orbit comprising a broad supraorbital eave with a preorbital and antorbital spine; an intercalated spine and a postorbital lobe excavated anteriorly; eave, intercalated spine and postorbital lobe closely approximated. Eyestalk short, slender, cornea large, terminal. Basal antennal article moderately broad, sub-rectangular, anteromedial and anterolateral angles toothed, flagellum excluded from orbit. Merus of third maxilliped subquadrate with a deep anteromedial notch. Ambulatory legs of moderate length, cylindrical. Abdomen of seven segments in both sexes. Male first pleopod outwardly curved distally and tapering, tip pointed, aperture subterminal, lateral, surface below aperture expanded as a thin flap.

Remarks. — It was suggested by Griffin (1966d) that *Leptomithrax richardsoni* with its strong preorbital spine may not be congeneric with other species of *Leptomithrax*. In fact the first pleopod of the male shows more similarity to the pleopods of species of *Thacanophrys* than to species of *Leptomithrax*. However, there are many differences in the carapace and chelipeds which set it apart from *Thacanophrys*. There are similarities in pleopods and preorbital spine with *Ageitomaia baeckstroemi* (Balss) but differences between the two species in male chelipeds and postorbital lobes. The reasons for not considering these two species congeneric are discussed under *Ageitomaia*. We consider, therefore, that this species should be placed in a new, presently monotypic, genus.

The name is derived from the Greek *teras*,-*atos*, monster; *Teratomaia richardsoni* is a relatively recently described large spiny spider crab from the deep sea.

Distribution. — New Zealand and southeastern Australia.

Teratomaia richardsoni (Dell, 1960) new combination

Leptomithrax richardsoni Dell, 1960: 2-4, fig. 3, pl. 2. — Griffin, 1966d: 79-81, figs. 16, 23, pls. 3,4. — Griffin & Brown, 1976: 253.

Material examined. — 18 ♂♂, 11 ♀ ♀ (8 ovig.), 24-102 mm, smallest ovig. ♀, 63 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

New South Wales: NE. of Sydney, 33°40′S 151°45′E, to 33°45′S 151°51′E, 540 m, trawl, F.R.V. Kapala, 4 May 1976; 2 specs. (AM P. 24181-2). — E. of Sydney, 540 m,,trawl, F.R.V. Kapala, 6 September 1978; 1 spec. (AM P.29947). — E. of Brush I., 35°35′S 150°47′E to 35°29′S 150°44′E, 504-576 m, trawl, F.R.V. Kapala, 9 June 1976; 10 specs. (AM P.24392, P. 24394). — E. of Brush I., 35°44′S 150°38′E to 35°41′S 150°40′E, 540 m, trawl, F.R.V. Kapala, 10 November 1976; 2 specs. (AM P.25039). — E. of Brush I., 35°36′S 150°44′E to 35°34′S 150°46′E, 594 m, trawl, F.R.V. Kapala, 1 December 1976; 2 specs. (AM P.25044). — E. of Twofold Bay, 37°12′S 150°22′E, 378 m, F.R.V. Kapala, 12 October 1977; 1 spec. (AM P.27026).

Victoria: SE. of Gabo I., 37°45′S 150°12′E to 37°38′S 150°16′E, 396-432 m, trawl, F.R.V. Kapala, 10 July 1975; 4 specs. (AM P.20808, P. 21579). — SE. of Gabo I., 37°36′S 150°17′E to 37°43′S 150°15′E, 540 m, trawl, F.R.V. Kapala, 11 July 1975; 7 specs. (AM P.20803).

Remarks. — This additional material agrees with that reported previously from Australia.

Distribution. — New Zealand and southeastern Australia.

Thacanophrys new genus

Type species. — *Chorinus aculeata* H. Milne Edwards, 1834.

Description. — Carapace subpyriform, with spines or lamellate lobes or both. Rostrum of two spines distinct from base. Orbit above comprising eave, intercalated spine and postorbital lobe; eave generally with two spines or lobes; postorbital lobe lamellate, excavate anteriorly. Eyestalk retractile to postorbital lobe. Basal antennal article not especially broad, distant from postorbital lobe, orbit open below. Third maxillipeds with merus as broad as ischium. Chelipeds of male generally distinctly ridged. Ambulatory meri usually spined. Abdomen of seven segments in both sexes. First pleopod of male with a flap protecting subapical aperture.

Remarks. — It was strenuously argued previously (Griffin, 1966a) that the species until 1966 most commonly included in *Acanthophrys* (a genus now considered to be close to the pisine *Hyastenus*), but less often referred to as *Chlorinoides* or *Paramithrax* (*Chlorinoides*), were conspecific with *Chlorinoides tenuirostris* Haswell. However, examination of the first pleopod of the males of all species and further consideration of other features convinces us that *C. tenuirostris* differs significantly from all other species and in respect of the first pleopod of the male, the structure of the orbit and so on *C. tenuirostris* has a much closer relationship with *Naxioides* species than with the species which it was previously grouped with: this is discussed further under *Naxioides*. It is thus necessary, yet again, to reallocate those species other than *C. tenuirostris* which were included previously in *Chlorinoides* or *Acanthophrys* and to establish a new genus for them! We have chosen the name *Thacanophrys* and the species (wrongly) assumed by Bouvier (1906b) to be the type species of *Acanthophrys* is chosen as the type species of the new genus.

Since 1966 three new species have been described. *Chlorinoides barunai* Serène (1969) is now regarded as a synonym of *Thacanophrys albanyensis* (Ward). *Chlorinoides tosaensis* Sakai (1969) is a species close to *T. acanthonotus* (Adams) and is known now from the western Indian Ocean. *Chlorinoides occidentalis* Griffin (1970a), the eastern Indian Ocean counterpart of the Pacific *T. goldsboroughi* (Rathbun) resembles the Japanese *T. brevispinosus* (Yokoya). *Acanthophrys germaini* (Bouvier, 1906b) is now regarded as a synonym of *T. halimoides* (Miers). Thus, *Thacanophrys* is presently considered to contain twelve species.

Other genera of the Majinae in which the pleopod has a form similar to that of *Thacanophrys* species are *Entomonyx*, *Jacquinotia*, *Kimbla* and *Teratomaia* and, in a modified, form, *Tumulosternum*.

Distribution. — Throughout the Indo-West Pacific.

KEY TO SPECIES OF *THACANOPHRYS*

1		Preorbital and antorbital lobes developed as spines, not lamellate 2
—		Preorbital or antorbital lobe or both, lamellate 10
2(	1)	Preorbital spine upwardly directed, more than three times antorbital spine in length 3
—		Preorbital spine outwardly directed, not greatly exceeding antorbital spine 4
3(	2)	Preorbital spine bifid, intestinal region with two spines fused at the base, one spine directed forward, one backward ..... *T. acanthonotus*
—		Preorbital spine simple, intestinal region with two distinct spines, both directed backwards ..... *T. tosaensis*
4(	2)	First marginal branchial lobe a flattened lamella, two or three spines behind it on margin 5
—		Branchial margin with one or two spines midway along, but no lamella anteriorly 7
5(	4)	One mesogastric spine; branchial margin behind anterior lamella with three spines ..... *T. brevispinosus*[40])
—		Two mesogastric spines in midline; branchial margin behind anterior lamella with one lamella and two spines or two spines only 6
6(	5)	Rostral spines one half postrostral carapace length, distance between tips two and a half times basal width; tips of preorbital and antorbital spines turned forwards ..... *T. occidentalis*
—		Rostral spines no more than one third postrostral carapace length, distance between tips one and a quarter times basal width; preorbital and antorbital spines directed obliquely forwards .... *T. goldsboroughi*
7(	4)	Rostral spines widely divergent distally, distance between tips at least more than two and a half times basal width; two branchial spines 8
—		Rostral spines moderately divergent, distance between tips no more than basal width; one branchial spine 9
8(	7)	A single cardiac spine; ambulatory meri with two long spines on distal margin ..... *T. aculeatus*
—		A pair of submedial cardiac spines; ambulatory meri with one moderately long spine and sometimes a shorter spine on distal margin ..... *T. longispinus*
9(	7)	Cardiac region with a single spine; postorbital lobe a wide lamella ..... *T. halimoides*
—		Cardiac region with a pair of submedial spines; postorbital lobe narrowly triangular ..... *T. harmandi*
10(	1)	Posterior intestinal margin with an acuminate spine; ambulatory legs trigonal ..... *T. albanyensis*
—		Posterior intestinal margin with a prominent lamellate lobe; ambulatory legs cylindrical 11

[40]) From the literature (Sakai, 1976).

11(10) Preorbital lobe lamellate, wide, apex truncate or concave, antorbital lobe a short spine; medial margins of rostrum armed with several short spines; posterior intestinal lobe widest midway from base, summit rounded..... *T. spatulifer*

— Preorbital lobe slender, spinous, acuminate, antorbital lobe lamellate, distally expanded and anteriorly directed; medial margins of rostrum lacking spines; posterior intestinal lobe widest at base, summit truncate to concave..... *T. filholi*

Thacanophrys acanthonotus (Adams, 1847) new combination (Figs. 92a,b,d, 93 a-c, Pls. 20,21a)

Chorinus acanthonotus Adams, *in* White, 1847c: 119-120. — Adams & White, 1848: 11-12, pl. 1 figs. 1, 1a-c.
Chlorinoides acanthonotus. — Griffin, 1966a: 4, 12.

Material examined. — 1♂, 20 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 320, Java Sea, 06°5′S 114°7′E, 82 m, trawl, fine grey mud, 23 February 1900; 1 spec. (ZMA De. 100.837, det. Ihle as *Paramithrax*).

Remarks. — This specimen agrees well with holotype (♀ ca. 27.3 mm, Borneo, BMNH 47.21).

On the hepatic region there are two or three tubercles ventral to the long hepatic spine which points obliquely backwards.

The basal antennal article is armed anteriorly with two long spines, that on the anterolateral angle pointing directly outwards and the medial spine pointing ventrally forwards; there is a short triangular spine on the proximal lateral angle.

The pterygostomian region is smooth with a short flattened spine in the middle of the border. The sternum of the male is smooth; the anterior margin of the abdominal fossa is carinate and there are a few granules on the lateral margins.

The merus of the cheliped is armed with three teeth ventrally and four dorsally, the terminal being the largest; the carpus has one proximal tooth and there are two on each of the dorsal ridges. The palm is not inflated, the dorsal length equals three times height and there are two low dorsal teeth.

The first pleopod of the male is similar to that of some other *Thacanophrys* species but the tip is produced into a narrow curving ridge on the sternal surface.

This is only the second record of this species and the first male known.

This species is very similar to *C. tosaensis* Sakai from Japan (Sakai, 1969: 254-255, pl. 1 fig. 3, text figs. 4c, 5a) and from off the eastern coast of Africa (Griffin, 1974: 7, 9, figs. 2, 3 f). In that species the preorbital spine is arched and simple, not straight and bifid, and on the intestinal region there are one or two separate spines pointing obliquely backwards instead of two spines in the midline, clearly united at the base, one directed anteriorly and the other posteriorly.

T. tosaensis from Japan has in common with *T. acanthonotus* a very long hepatic spine and a long postorbital spine. These spines are shorter in the specimens from the western Indian Ocean, and the anterolateral spine of the basal antennal article and the first free segments of the antenna are broader than in *T. acanthonotus.*

Distribution. — Borneo, Java Sea.

Thacanophrys aculeatus (H. Milne Edwards, 1834) new combination (Fig. 93 d,e)

Chorinus aculeata H. Milne Edwards, 1834: 316.
Chlorinoides aculeatus. — Griffin, 1966a: 4, 11, 13; 1974: 7; 1976: 186.

Material examined. — 2♂♂, 7♀♀(4 ovig.), 16-54 mm, smallest ovig. ♀, 26 mm.

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Singapore, trawl, 1903-1907; 1 spec.

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, 36-54 m, dredge, sand, coral, 19 March 1914; 1 spec.

Danish Kei Islands Expedition: Ambon, ca. 1 m, 28 February 1922; 1 spec. — Stn. 72, Kai Is., 05°41′S 105°57′E, 35 m, trawl, stones, 28 July 1922; 1 spec.

Mortensen Java-S.Africa Expedition: Stn. 90, Sunda Strait, 05°55′S 105°30′E, 36 m, hard bottom, 1 August 1929; 1 spec.

5 Thai Danish Expedition: West Malay Peninsula, 06°43′N 99°34′E, 17-18 m, 23 January 1966; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, Padaido Is., Ex. Natural Science Foundation, January-February 1956; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition - Moluccas: Stn. AN I, Aru Is., SW of Tg. Ngabordamlu, S. Trangan I., centred near 06°58′S 134°5′E, 26-29 m, dredge haul 1, coral and sponge, 20 June 1970; 2 specs.

Remarks. — The single preorbital spine is upcurved in all except one specimen. In all these specimens there is a single cardiac spine and two long spines on the intestinal region, one anteriorly and one on the posterior margin of the carapace. There are two spines at the distal end of the merus of each ambulatory leg.

Distribution. — Indo-West Pacific from Bay of Bengal to Japan and north Australia.

Thacanophrys albanyensis (Ward, 1933) new combination

Prismatopus albanyensis Ward, 1933: 391-392, pl. 23 fig. 3.
Chlorinoides albanyensis. — Griffin, 1966a: 4, 10, 13.
Chlorinoides barunai Serène, 1969: 285-288, figs. 1, 4, 6, 11, 12, pl. 1 figs. A-C; new synonymy.

Material examined. — 1♂, 1♀, 25.5, 30.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 274, Aru Is., 05°28.2′S 134°53.9′E, 57 m, dredge, sand and shells, stones, 26 December 1899; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AN I, Aru Is., S. Trangan I., SW. of Tg. Ngabordamlu, centred near 06°58′S 134°5′E,

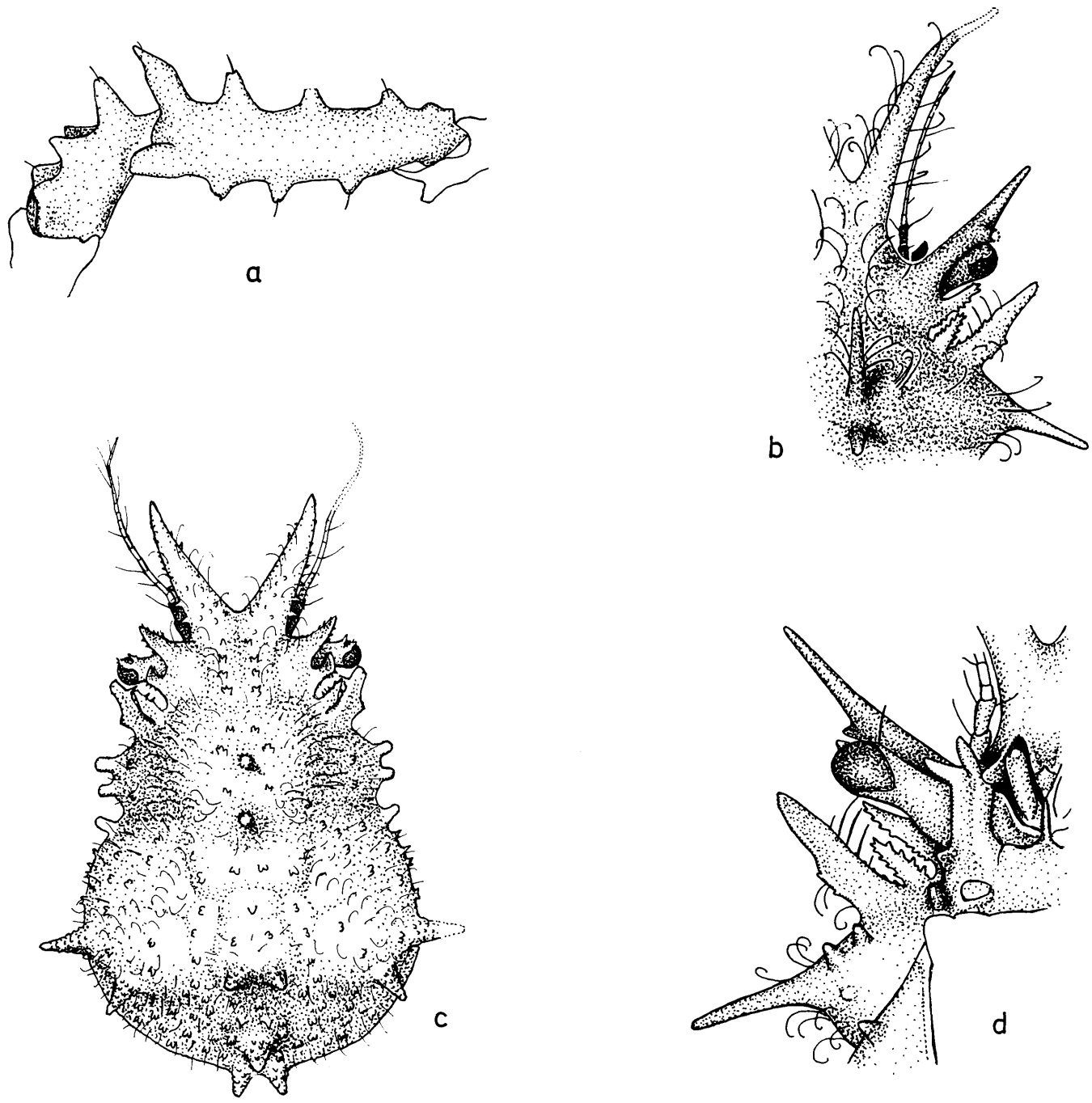

Fig. 92. *Thacanophrys acanthonotus* (male, 20 mm, Java Sea, ZMA De. 100.837) (a) left cheliped, merus and carpus; (b) right orbit, dorsal view; *T. goldsboroughi* (female, ovig., 16.5 mm, Kermadec Is., ZMC) (c) carapace, dorsal view; *T. acanthonotus* (as above) (d) right orbit, ventral view.

25-27 m, dredge haul 3, broken shell and coral, sponge and mud, 20 June 1970; 1 spec.

Remarks. — These specimens have been compared with type material of *T. albanyensis* (Ward) (3 ♀ ♀, 15, 19 (holotype), 24 mm, Albany Passage, N.Q'ld, AM P. 10639, P. 13942). They also agree well with *T. barunai* (Serène) (Serène, 1969). All the specimens have a long, single, upcurved preorbital spine. The antorbital spine is lamellate and concave on the anterior edge. The two cardiac spines are united basally and there is a single intestinal spine just above the posterior margin of the carapace.

The merus of the ambulatory legs is trigonal, there is a lamellate spine ventrally on the ischium, two distal spines dorsally on the merus and one on the carpus.

The palm of the cheliped of the large male is broader than that figured by Serène, the dorsal length being approximately 1½ times the greatest height.

The first pleopod of the male from Aru and of another from Broome, W.A. (11.5 mm, AM P. 13943) are extremely similar to that figured for *T. barunai* by Serène (1969: figs. 11, 12).

It is clear that *T. barunai* is conspecific with *T. albanyensis*.

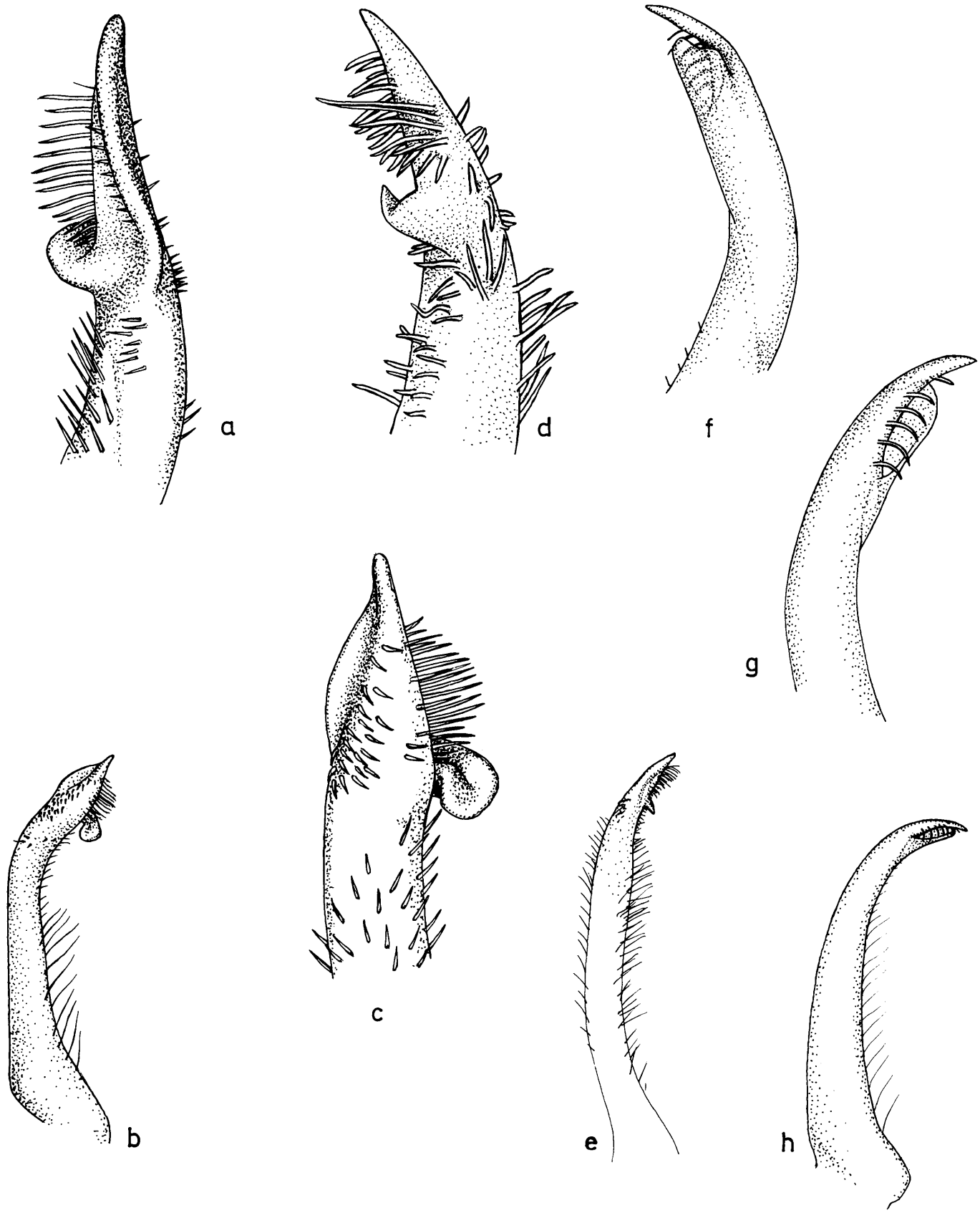

Fig. 93. Left first pleopod of male of *Thacanophrys acanthonotus* (20 mm, Java Sea, ZMA De. 100.837) (a) sternal tip of pleopod, (b) abdominal view of pleopod, (c) abdominal tip of same; *T. aculeatus* (39 mm, Aru Is., NIO Jakarta) (d) sternal tip of pleopod, (e) abdominal view of pleopod; *Kimbla neocaledonica* (holotype) (f) sternal tip of pleopod, (g) abdominal tip of same, (h) abdominal view of pleopod.

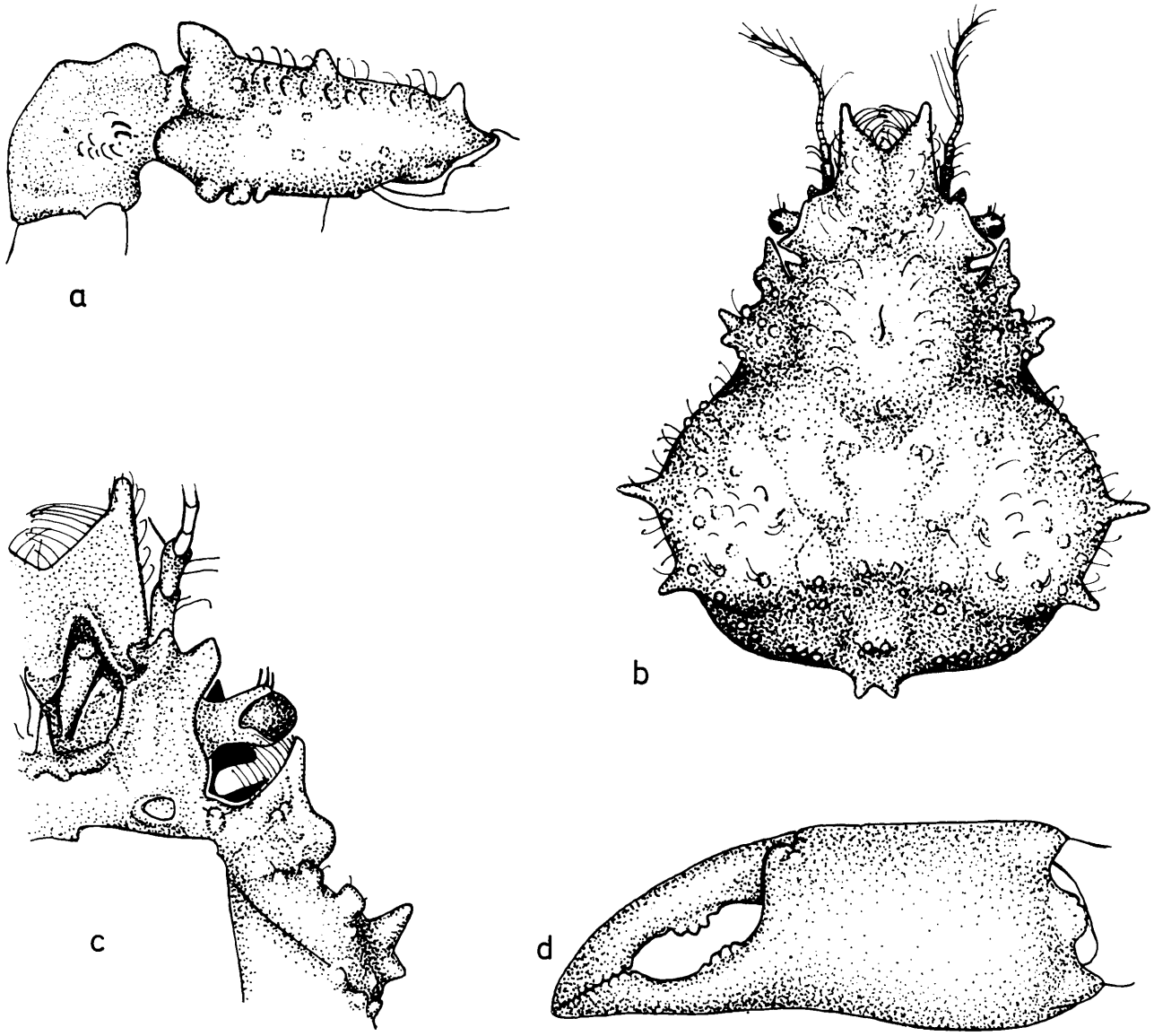

Fig. 94. *Tumulosternum parvispinosus* (male, 21 mm, AM P.29830) (a) left cheliped, merus and carpus; (b) carapace, dorsal view; (c) left orbit, ventral view; (d) left chela.

Distribution. — NE. Australia through the Arafura Sea to NW. Australia.

Thacanophrys goldsboroughi (Rathbun, 1906) new combination (Fig. 92c)

Chlorinoides goldsboroughi Rathbun, 1906: 881-882, pl. 14 fig. 7. — Griffin, 1970a: 67-70, figs. 1a, 2, 4b,c,f. — Griffin & Brown, 1976: 252.

Material examined. — 4 ♂♂, 3 (ovig.) ♀♀, 5.5-16.5 mm, smallest ovig. ♀, 14.0 mm.

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'Galathea' Expedition: Stn. 674, Kermadec Islands, Raoul Islet, 75-85 m, dredge, gravel and stones, 3 March 1952; 2 specs. — Stn. 675, Kermadec Islands, Raoul Islet, 29°13′S 177°57′W, 60 m, trawl, stones, 3 March 1952; 4 specs. — Stn. 676, Kermadec Islands, Raoul Islet, 29°13′S 177°37′W, 83-95 m, trawl, stones, 3 March 1952; 1 spec.

Remarks. — These seven specimens collected from between 60 m and 95 m in the Kermadec Islands are similar to *T. goldsboroughi* in most characters including general shape, length of rostral and carapace spines and the granular carapace surface. However, they differ from *T. goldsboroughi* in having two large spines on the posterior carapace margin and the merus of the third maxilliped is not so distinctly subcircular in shape as previously noted for *T. goldsboroughi*. These differences also distinguish *T. occidentalis* (Griffin) from *T. goldsboroughi* but that species differs from these specimens in having longer, more slender rostral and carapace spines and a smooth carapace surface between the spines.

In this series there are small tubercles on the urogastric region (urogastric region smooth in *T. occidentalis*); there is a compressed, blunt terminal spine on the cheliped merus (a weakly compressed terminal spine in other *T. goldsboroughi*

specimens, a slender, sharp terminal spine in *T. occidentalis*); the carpus of the adult male cheliped has a large lateral crest (similar to that in *T. occidentalis*); the first sternite of the male is broad anteriorly (as in *T. goldsboroughi*, narrow in *T. occidentalis*); many of the sharp granules on the carapace surface have two points; the first pleopod is of the same type as in both *T. goldsboroughi* and *T. occidentalis*.

T. goldsboroughi is a widespread species occuring in Hawaii and off eastern Australia, so these differences may represent geographical variation, though it is possible that these few specimens may prove to be a new species.

The specimen of *T. goldsboroughi* (♂, 19 mm, AM P. 19643) reported previously (Griffin & Brown, 1976) from off Gabo I., also differs from those figured (Griffin, 1970a). On the branchial region of that specimen there is a small, slender, anterior spine and a large, robust, posterior spine; there is an equally large medial spine on the posterior carapace margin; the small spines anteriorly on the branchial margin and on the hepatic region are sharp rather than lamellate and the merus of the third maxilliped is not subcircular. Although an immature male the first pleopod of the Gabo I. male is similar to those of other *T. goldsboroughi* and *T. occidentalis*.

Another similar species is *T. brevispinosus* (Yokoya) from Japan: the differences which distinguish it from *T. goldsboroughi* have been discussed by Griffin (1970a) and by Sakai (1976: 251-252, fig. 134), but the first pleopod of the male has not been figured. The different number of mesogastric spines and different configuration of spines and lamellae on the branchial margin in the two species lead us to maintain the view that *T. brevispinosus* and *T. goldsboroughi* are valid, distinct species.

Distribution. — Hawaii, Kermadec Islands, southeastern Australia.

Thacanophrys halimoides (Miers, 1879) new combination

Paramithrax halimoides Miers, 1879a: 10.
Acanthophrys germaini Bouvier, 1906b: 487-488.
Chlorinoides halimoides. — Griffin, 1966a: 13 (in key).
Chlorinoides germaini. — Serène, 1969: 282-284, figs. 2, 5, 7-10, pl. 2 A, B, C; new synonymy.

Material examined. — 1♂, 14.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Singapore, 27 November 1907; 1 spec.

Remarks. — This specimen agrees well with the type of *Paramithrax halimoides* (♂, 22 mm, 'Eastern Seas', BMNH 47.21) which one of us (D.J.G.G., 1970) has examined, and both the type and our specimen agree with the specimens figured and described as *C. germaini* (Bouvier) by Serène (1969). In our specimen the single cardiac spine has a terminal knob; the spine on the posterior margin of the carapace is flat and evenly tapering from the base. and the meri of the ambulatory legs are trigonal in section.

The six apparent differences between *T. halimoides* and *C. germaini* which Bouvier (1906b) noted in describing his new species, are the result of Miers' inadequate description and are clarified below —

1) the rostral spines are strongly divergent (not weakly so, as stated by Miers);
2) the spine on the posterior carapace margin is dorsoventrally flattened (not mentioned by Miers);
3) the anterior spines on the basal antennal article are not spiniform but lamellate (Miers says the anteroexternal angle is prominent);
4) the preorbital and antorbital spines arise from a strongly expanded eave (Bouvier refers to this as the preorbital spine which is divided distally, and Miers mentions the single preorbital but not the antorbital spine);
5) the preorbital lobe is narrow basally and broad distally (Miers simply says it is large and lamellate);
6) the carapace of the type of *T. halimoides*, although it is a smaller specimen, has the same proportions as the specimen (postrostral cl. 37 mm) described by Bouvier (it seems Bouvier misunderstood Miers' description "scarcely narrowing anteriorly").

It is clear therefore that *C. germaini* is conspecific with *T. halimoides*.

Distribution. — Singapore, Vietnam.

Thacanophrys harmandi (Bouvier, 1906) new combination

Acanthophrys harmandi Bouvier, 1906a: 484-485; 1906b: 487 (in key).
Acanthophrys harmandi. — Sakai, 1938: 307-308, text-fig. 42; 1965a: 87, pl. 40 fig. 3.
Chlorinoides harmandi. — Griffin, 1966a: 4, 13. — Takeda & Miyake, 1969: 514-515; 1972a: 76-77. — Sakai, 1976: 248-249, text-fig. 132, pl. 88 fig. 2.

Material examined. — 1♂, 1♀, 23.5, 15.5 mm.

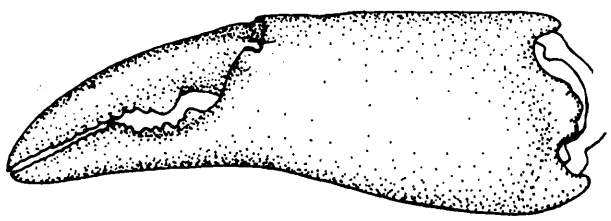
ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Mortensen Pacific Expedition: Sagami Bay, Okinose, 108 m, 11 June 1914; 1 spec. — Sagami Bay, Okinose, 540 m, 29 June 1914; 1 spec.

Remarks. — This species can be distinguished from all its congeners by the apically bifid preorbital spine, the pair of submedial tubercles between the posterior mesogastric spine and the cardiac spines and the presence of a single spine on the branchial region. There are two spines on the intestinal region, one anteriorly and one just above the posterior margin of the carapace. On the basal antennal article there are, in addition to the two anterior spines, two short spines on the middle of the medial border and one basally on the lateral border. The postorbital spine of these immature specimens is narrow.

Distribution. — Japan: Sagami Bay, Kii Peninsula and East China Sea.

Thacanophrys longispinus (De Haan, 1839) new combination

Maja (*Chorinus*) *longispina* De Haan, 1839: 94-95.
Maja (*Chorinus*) *aculeata.* — De Haan, 1839: pl. 23 figs. 2, 2a,b. (Not *Chorinus aculeata* H. Milne Edwards, 1834 = *Thacanophrys aculeatus*.)



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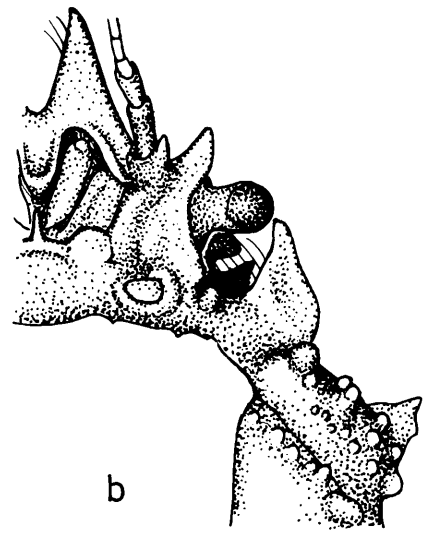

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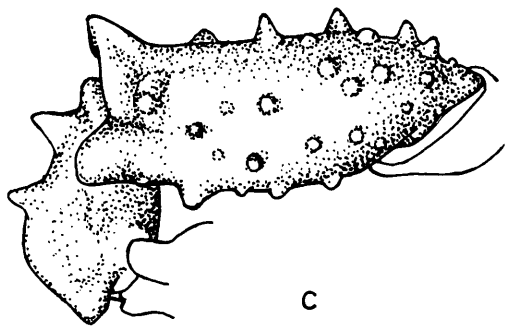

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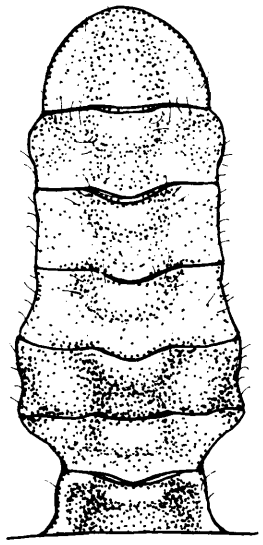

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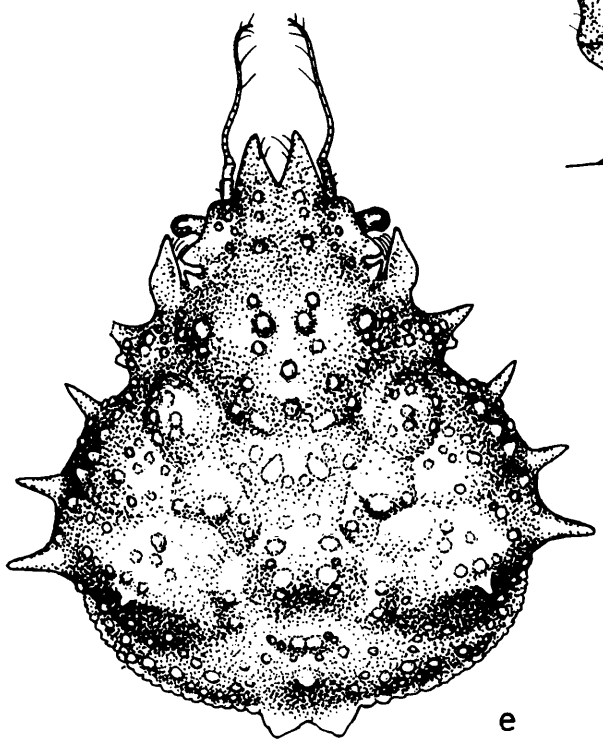

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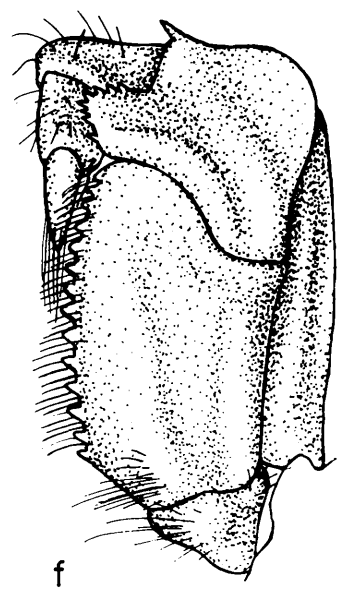

f

Fig. 95. *Tumulosternum wardi* (male, 20 mm, AM P.29839) (a) left chela; (holotype) (b) left orbit, ventral view; (AM P.29839) (c) left cheliped, merus and carpus; (male, 20.5 mm, AM P.29836) (d) male abdomen; (holotype) (e) carapace, dorsal view; (f) left third maxilliped.

Chlorinoides longispinus. — Griffin, 1966a: 4, 11, 13; 1976: 186. — Serène, 1969: 286-288, figs. 3, 13-15, pl. 3 figs. A, B. — Campbell & Stephenson, 1970: 262-263.

Material examined. — 13 ♂♂, 9 ♀♀ (5 ovig.), 9.5-30.5 mm, smallest ovig. ♀, 14 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 109, Sulu Archipelago, anchorage off Pulu Tongkil, 13 m, dredge, townet, *Lithothamnion* bottom, 5/6 July 1899; 1 spec. (ZMA De. 100.701, det. Ihle). — Stn. 164, N. Ceram Sea, 01°42.5′S 130°47.5′E, 32 m, dredge, sand, small stones and shells, 20 August 1899; 2 specs. (ZMA De. 100.900, det. Ihle and unreg.).

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, 36 m, dredge, *Lithothamnion*, 17 March 1914; 1 spec. — Sulu Archipelago, off Jolo, 54 m, sand, coral, 19 March 1914; 5 specs.

Mortensen Java-S.Africa Expedition: Stn. 9, Java, 08°30′-08°35′S 114°28′E, ca. 70-150 m, dredge, hard bottom, 6 April 1929; 1 spec.

Danish Kei Islands Expedition: Stn. 31, Kai Is., Doe Roa Bassin, 50 m, sand, 18 April 1922; 1 spec. — Stn. 53, Kai Is., 05°36′S 132°55′E, 85 m, trawl, sand, 9 May 1922; 1 spec. — Stn. 82, Sunda Strait, 06°38′S 105°21′E, 35 m, trawl, sandy mud, 30 July 1922; 1 spec. — Stn. 103, Sunda Strait, 06°05′S 105°42′E, 52 m, sand, shells, 4 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, 54 m, dredge haul 15, grey sand, fine with shelly grit, 2 June 1970; 1 spec. — Stn. KR VI, Kai Is., N. of Du Rowa I., N. of Nuhu Rowa, 05°32′S 132°41′E, 32-36 m, dredge haul 1, sand, 10 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 hauls 1-8, muddy sand and sponge, 11 June 1970; 2 specs. — Stn. KN II, Kai Is., off Elat Bay, W. coast Nuhu Tjut, 05°40′S 132°59′E, 48-54 m, dredge, rubble, algae and sand, 13 June 1970; 2 specs. — Stn. AW II, Aru, W. Wokam, NW. corner of Wasir I., 05°30′S 134°14′E, snorkel and shore collecting, 15 June 1970; 1 spec.

Remarks. — In this species there is considerable variation, especially in the form of the spines above the orbit (Griffin, 1976: 186). This series of specimens includes some with two upcurved preorbital spines, two hepatic spines and cardiac spines proximally united and others with a single upcurved preorbital spine, a single hepatic spine and the cardiac spines separated at the base. The specimens figured by De Haan (1839: pl. 23 figs. 2, 2a, 2b) have two preorbital spines as have those originally described as *Paramithrax coppingeri* by Haswell (1882) from northeast Australia and *Paramithrax* (*Chlorinoides*) *longispinus* var. *bituberculatus* by Miers (1884) from Providence I.; De Haan's material possessed two hepatic spines and proximally united cardiac spines. On the other hand the specimens figured by Alcock & Anderson (1898: pl. 34, figs. 4, 4a, 4b), from Sri Lanka and the Bay of Bengal, Laurie's (1906) *Paramithrax* (*Chlorinoides*) *longispinus* var. *bispinosus* from Sri Lanka and Bouvier's (1906b) *Acanthophrys longispinus* var. *spinosissima* from Mozambique have only one preorbital spine; the Alcock & Anderson specimens have only a single hepatic spine and the cardiac spines are separate at the base.

Seven of the specimens (three from the Kai Islands, one from the north Ceram Sea, four from the Sulu Archipelago) have a single preorbital spine which even in the adults is subequal to the antorbital spine and horizontal. In these seven specimens there is a strong tubercle on the anterolateral spine of the basal antennal article and there are three to four short, separate spines ventrally on the hepatic margin. On the intestinal region there is at most a low tubercle anteriorly and there is short spine (3 specimens) or no spine at all on the posterior margin of the carapace. As well as the usual curled hairs there are 'plumed' hairs on the rostrum, sternum and ambulatory legs.

In this series all these variations of the orbit were found among specimens from the Kai Islands.

Distribution. — Widespread Indo-West Pacific from east Africa to Japan and Australia.

Thacanophrys occidentalis (Griffin, 1970) new combination

Chlorinoides occidentalis Griffin, 1970a: 70-74, figs. 1b, 3, 4a, d,e.

Material examined. — 1♂, 1♀', 12.5, 14 mm.

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia, NW. of Rottnest I., 144 m, sand and Bryozoa, 'Bluefin', 15 September 1965; 1 spec. (WAM 93-71, in part). — Western Australia, W. of west end of Rottnest I., 144 m, 'Bluefin', 16 September 1965; 1 spec. (WAM 77-71).

Remarks. — These specimens are very similar to those previously described.

Distribution. — Southwestern Australia.

Tumulosternum McCulloch, 1913

Type species. — *Micippoides longimanus* Haswell, 1880, by designation of McCulloch (1913).

Description. — Carapace broad, pyriform, with tubercles and short spines; regions fairly well delimited; hepatic margin with a strong spine or flat topped tubercle. Rostrum of two short, broad spines. Orbit above comprising an eave with antorbital angle produced outwards; a small intercalated spine (which is sometimes absent) and a stout, angular, postorbital lobe; eyestalk short, retractile against postorbital lobe which is somewhat excavate to receive it. Basal antennal article broad, bilobed anteriorly, orbit open below. Third maxillipeds with merus as wide as ischium and with a broadly rounded external angle, palp articulated at notch on anteromedial angle. Chelipeds large in adult males, merus tuberculate, palm smooth, compressed; ambulatory legs short. Abdomen consisting of seven free segments in both sexes. (McCulloch -modified.)

Remarks. — The unusual form of the first pleopod of the male *T. longimanus* can be related to the *Thacanophrys* type of pleopod. There is a basal flap near the aperture but the distal portion of the pleopod is bent back on itself. *T. wardi* n.sp. has a similar pleopod although the basal flap is smaller. It has

been noted before (Griffin, 1966d) that *Leptomithrax parvispinosus* Ward differs in several features from other known species of *Leptomithrax* and examination of the pleopod confirms this. In fact, detailed examination shows that the pleopod is modified from the *Thacanophrys* type, the distal portion beyond the flap being very much reduced, while the flap is larger and more robust than usual. This similarity in the male pleopods is supported by similarities in the orbit and therefore we consider these three species to be congeneric. The accommodation of the two other species in the genus has required the modification of the generic description given by McCulloch.

On the basis of the form of the pleopod, and also of the orbit, this genus is now regarded as belonging to the Majinae. *Tumulosternum* was placed by Balss (1957) in the Majinae near *Tiarinia* and on that basis included in the Mithracinae by Griffin (1966b).

Distribution. — Southwest Pacific: apparently restricted to the east coast of Australia.

KEY TO SPECIES OF *TUMULOSTERNUM*

1 Carapace without lateral branchial spines; subhepatic region with a subcircular flattened plate, similar plates elsewhere on lower surface and margins of carapace ..... *T. longimanus*
— Carapace with two or more lateral branchial spines; carapace without flattened plates 2
2(1) Branchial margin with two spines; anterolateral spine of basal antennal article as wide as long; rostral spines fused for basal third, then each tapering abruptly to a narrow apex ..... *T. parvispinosus*
— Branchial margin with four spines; anterolateral spine of basal antennal article longer than wide; rostral spines triangular, tapering evenly from base ..... *T. wardi*

Tumulosternum longimanus (Haswell, 1880) (Fig. 96a,b)

Micippoides longimanus Haswell, 1880b: 444-445, pl. 26 fig. 5.
Tumulosternum longimanus. — McCulloch, 1913: 334-335, fig. 45. — Griffin, 1966b: 288 (in key).

Material examined. — 7 ♂♂, 6 ♀♀ (4 ovig.), 8.5-18.5 mm, smallest ovig. ♂, 13,5 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

New South Wales: mouth of Clarence River, Iluka, Woody Head, coll. A. A. Cameron, 3 September 1960; 1 spec. (AM P. 13486). — Collaroy, Long Reef, intertidal, sandy beach, under stones, 5 April 1924; 1 spec. (AM P. 7189). — Collaroy, Long Reef, coll. E. Pope, 9 December 1946; 1 spec. (AM P. 13166). — Port Jackson, Sow and Pigs Reef and Shark I., 9-12 m, dredged, coll. F. A. McNeill, 16 May 1923; 1 spec. (AM P. 6505). — Port Jackson, Sow and Pigs Rocks, about 5 m, dredged, coll. F. A. McNeill, 26 October 1926; 1 spec. (AM P.8715). — Vicinity Sow and Pigs Shoal, about 7 m, dredged, coll. F. A. McNeill and M. Ward, January 1930; 1 spec. (AM P. 9436). — Coogee, August 1920; 1 spec. (AM P.4935). — Coogee, intertidal, coll. F. A. McNeill and A. A. Livingstone, 15 December 1921; 1 spec. (AM P.6087). — Botany Bay, Kurnell, reef between tides, 22 January 1928; 1 spec. (AM P.9057). — Botany Bay, Kurnell, low tide on reef, February 1947; 1 spec. (AM P.11728). — Shellharbour; 1 spec. (AM P.6303); 1 spec. (AM P.6611); 1 spec. (AM P. 6845); 1 spec. (AM P.8434).

Remarks. — These specimens agree well with the syntypes (1♂, 20 mm, 1 ad. ♀, 18.5 mm, Port Jackson, AM G.5124). However, in these specimens and in the syntypes there is a small spine in the hiatus of the upper orbit. In three specimens the spine is very small and in two specimens it is only present in one orbit.

We have figured the first pleopod of the male which has not previously been described. The pleopod is broad and straight, curving outwards only in the distal fifth, with a long, slender, curved medial process at the apex. There is a short, narrow lobe just lateral to the subterminal aperture on the abdominal surface.

The specimen from Madagascar described and figured as *Tumulosternum longimanus* by Peyrot-Clausade & Serène (1976: 1350-1351, pl. 1A) is not this species. The rostral spines in *T. longimanus* are weakly deflexed but even in the male are always visible dorsally; there is no preorbital spine in this species; and the eyestalks are much shorter, not exceeding the postorbital lobe. The specimen figured by Peyrot-Clausade & Serene is probably *Pseudomicippe nodosa.*

T. longimanus is distinguished from *T. parvispinosus* and *T. wardi* by the absence of any spines on the lateral carapace margin and the presence of two flattened plates, one subhepatic and one anterior branchial, just above the carapace margin.

Distribution. — Southeast Australia.

Tumulosternum parvispinosus (Ward, 1933) new combination (Figs. 94, 96f-h)

Paramithrax parvispinosus Ward, 1933: 392, pl. 23 fig. 4.
Leptomithrax parvispinosus. — Griffin, 1963b: 234-235; 1966b: 284 (in key).

Material examined. — 8 ♂♂, 16 ♀♀ (8 ovig.), 11.5-22.5 mm (holotype, postrostral cl. 9.0 mm), smallest ovig. ♀, 14.0 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Little Lindeman I., under coral masses, coll. M. Ward; 3 specs. (AM P. 29833, dry). — Capricorn Group, North West Islet, coll. M. Ward, May 1930; 1 spec. (AM P.10640, holotype). — Capricorn Group, North West Islet, January 1929; 4 specs. (AM P.29832, dry).

New South Wales: Yamba, Angourie Point, coll. A. A. Cameron, January 1939; 1 spec. (AM P.11024). — Woody Head, near mouth of Clarence River, coll. A. A. Cameron, 15 June 1962; 1 spec. (AM P. 29826). — Woody Head, intertidal, coll. A. A. Cameron, August 1962; 1 spec. (AM P.29827). — Angourie, Green Point, intertidal, coll. A. A. Cameron, 19 December 1964; 1 spec. (AM P.29828). — Woody Head, below low tide, A. A. Cameron, 1 March 1965; 1 spec. (AM P. 17895). — Woody Head, intertidal rocks, coll. A. A. Cameron, 1 May 1965; 1 spec. (AM P. 15284). — Clarence River mouth, Iluka Bluff, intertidal, coll. A. A. Cameron, 11 September 1965; 1 spec. (AM P.29829). — Clarence River mouth, Woody Head, intertidal, coll. A. A. Cameron, January 1966; 1 spec. (AM P.29830). — Woody Head, coll. A. A. Cameron, 1966; 2 specs. (AM P. 16858). — Near Woody Head, Shark Bay reef, coll. A. A. Cameron, May 1969; 1 spec. (AM P.17353). — Near Grafton, Minnie Waters, intertidal rock platform, coll. J. C. Yaldwyn, 15 February 1965; 1 spec. (AM P. 15995). — Nambucca Heads, 14-24 September 1937; 2 specs. (AM P.29834, dry). — Near Sydney, Pittwater, dredged off Mackerel Point, January 1932; 2 specs. (AM P.29831, dry).

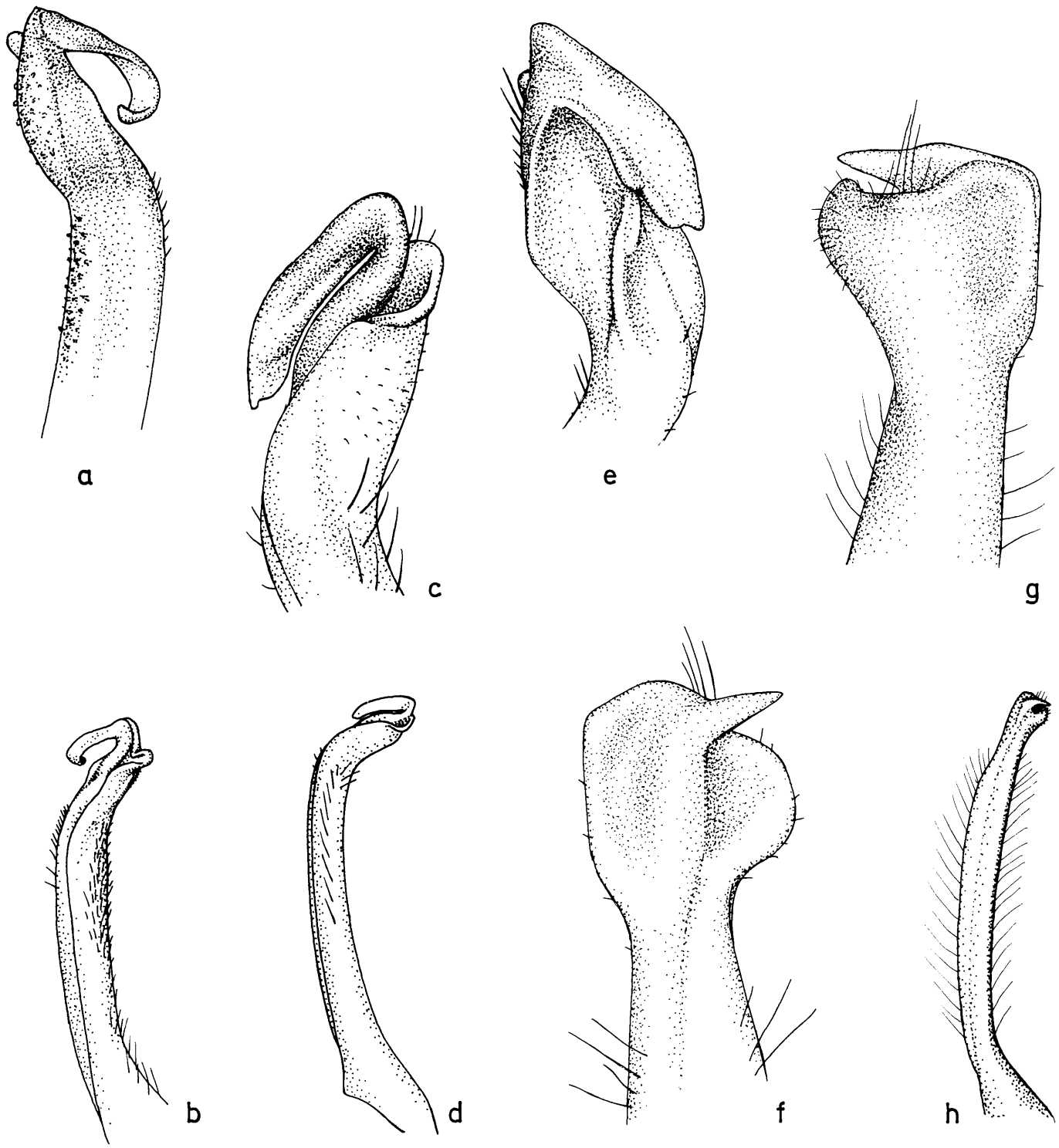

Fig. 96. Left first pleopod of male of *Tumulosternum longimanus* (17.5 mm, AM P.8715) (a) sternal tip of pleopod, (b) abdominal view of pleopod; *T. wardi* (20.5 mm, AM P.29836) (c) abdominal tip of pleopod, (d) abdominal view of pleopod, (e) sternal tip of same; *T. parvispinosus* (21 mm, AM P.29830) (f) abdominal tip of pleopod, (g) sternal tip of same, (h) abdominal view of pleopod.

Remarks. — These specimens agree well with the holotype (AM P.10640) and are clearly conspecific. However, the holotype has the rostral spines broken off and although Ward mentions them in the description they are not apparent in the photograph (pl. 23 fig. 4). In our series the rostral spines are fused in the proximal third and the lateral edges are parallel, they are separated in the distal two thirds by a broad V-shaped hiatus and are apically narrow; in length they are only one tenth (0.18 to 0.22) of the postrostral carapace length.

The intercalated spine is a short, narrow triangle the apex of which does not reach the apex of the antorbital spine and so

is excluded from the orbit. As stated by Ward the tubercles on the carapace are mostly small and few in number. There are two tubercles on each rostral ridge.

There are two mesogastric tubercles, one central and one posterior; there is a low transverse ridge anteriorly on the urogastric region with usually two and sometimes four small tubercles; on the cardiac region there is a pair of submedial tubercles at the summit and a pair of smaller tubercles on the posterior slope; there is a pair of submedial tubercles anteriorly on the intestinal region in all but three specimens which have only a single tubercle; on the posterior carapace margin there are two triangular spines directed obliquely upwards. There are two strong spines on the branchial margin, one dorsally on the posterolateral angle, the other in front of it, more ventrally and above the base of the first walking leg.

The broad anterolateral spine of the basal antennal article is weakly bilobed or truncate; there is a short blunt spine on the anteromedial angle; the lateral margin is concave. The merus of the third maxilliped has only a low, narrow ridge on the posterior margin at the junction with the ischium.

The male was not described by Ward. The merus of the cheliped of the adult male has a few small tubercles on the outer face, dorsally there is a large proximal tubercle, a similar tubercle midway along the dorsal edge and a large blunt, compressed terminal spine; there are three larger tubercles on the ventral margin in the distal half and a row of small tubercles ventrally on the inner face. The carpus has dorsally a large carinate outer ridge and a very low tuberculate inner ridge. The palm is smooth, about one and a half times as long as high; the fingers are about three quarters the length of the palm with a large gape between them in the proximal two thirds, the dactyl has a large three lobed tooth midway in the gape, the fixed finger has a similar tooth slightly more proximally and distally both fingers have small uniform teeth along the cutting edge.

The meri of the ambulatory legs is dorsally smooth with a sharp terminal spine, a thick fringe of hairs on the anterior and posterior borders, and a few ventral tubercles; the first ambulatory leg is about equal in length to the postrostral carapace length, the fourth leg is about three quarters the length of the first.

The sternum of the male is smooth, a narrow ridge running along the edge of the abdominal fossa on the third and fourth segments. The abdomen of the male hardly narrows distally (sixth segment 0.8 width of third segment), the sixth segment being more than twice (2.3) as wide as long, the seventh segment about one and a half times as wide as long.

The first pleopod of the male is nearly straight, curved slightly outwards, tapering a little before widening again at the tip; the tip consists of two broad lobes, an abdominal and a sternal lobe separated terminally, laterally and, somewhat less distinctly, on the medial edge; the abdominal lobe is produced as a spine like process on the anterolateral angle and curves dorsally across the broad, roundly produced, lateral edge of the sternal lobe.

The pleopod, although at first sight appearing extremely unusual, in fact, has the same basic structure as do the pleopods of the other two species of *Tumulosternum* and which are modified forms of the type of pleopod found in species of *Thacanophrys* (discussed in notes on genus).

This species is similar to *T. wardi* n.sp. in general carapace shape and in having the small intercalated spine excluded from the orbit. This species is distinguished from *T. wardi* by the form of the male pleopod, by the fewer spines on the branchial region, by the broad spine on the basal antennal article and by the shape of the rostral spines. These differences are discussed in more detail under *T. wardi*.

Distribution. — East coast of Australia: (Queensland) Lindeman I., Capricorn Group; (New South Wales) Woody Head, Angourie Point, Nambucca Heads, Pittwater.

Tumulosternum wardi new species
(Figs. 95, 96c-e)

Material examined. — 20 ♂♂, 15 ♀♀ (3 ovig.), 9.5-26 mm, smallest ovig. ♀, 16.5 mm.
Holotype. — Female (adult), cl. 26 mm, New South Wales, Collaroy, Long Reef, below low tide level, coll. M. Ward, 1932/1937; The Australian Museum, Sydney, AM P.29835.
Paratypes. As listed below:

THE AUSTRALIAN MUSEUM, SYDNEY

New South Wales: Collaroy, data as for holotype; 1 spec. (AM P.29836). — Collaroy, Long Reef, below low tide mark, 17 December 1937; 31 specs. (AM P.29839, dry). — Collaroy, Long Reef; 1 spec. (AM P.29837, dry). — Collaroy, Long Reef; 1 spec. (AM P.29838, dry).

Description. — Carapace broadly pyriform, broad posteriorly, greatest width about 0.8 postrostral carapace length; surface with scattered granules, tubercles and a few spines.

Rostral spines very short, broad at base and each tapering to a sharp apex, subparallel, about one tenth postrostral carapace length, three tubercles on each rostral ridge, posterior the largest.

Orbital eave strongly expanded, dorsally tuberculate, preorbital angle rounded, not produced, antorbital angle produced in a broad, blunt triangle; intercalated spine triangular, short, acute apex not reaching apex of antorbital spine; postorbital lobe basally broad, apically narrow, directed forward, anterior margin straight, posterior margin proximally convex but without any accessory spine or lobe.

Hepatic margin with a strong laterally directed spine, a few small tubercles dorsally above spine; subhepatic region tuberculate. Branchial margin with four strong spines, the fourth smallest and more dorsally placed.

Gastric regions elevated. Mesogastric region with two tubercles posteriorly. Protogastric region with four tubercles in a transverse row anteriorly and behind them a similar row of smaller tubercles; several small protogastric tubercles on either side of mesogastric tubercles. Urogastric region with a pair of submedial tubercles.

Cardiac region weakly elevated with a pair of submedial tubercles at summit, submedial pairs of smaller tubercles on anterior and posterior slopes.

Intestinal region with two medial tubercles, the anterior often transversely widened (or two submedial tubercles anteriorly); posterior carapace margin with a pair of broad, compressed, triangular spines, directed slightly upward.

Branchial region with an oblique row of five or six tubercles just dorsal to two anterior marginal spines and a similar row of about four tubercles in front of fourth marginal spine; a group of small tubercles at anteromedial angle and a large tubercle on medial edge midway between urogastric and cardiac tubercles, several small scattered tubercles dorsally.

Basal antennal article moderately broad, smooth, with a shallow longitudinal groove centrally; anterolateral angle produced forward as a broad curved spine, anteromedial angle with a slightly smaller cylindrical spine directed more ventrally than other spine; lateral border concave. Orbit open below. A small tubercle lateral to green gland.

Third maxilliped smooth, ischium with a well marked longitudinal depression; merus with a narrow ridge on posterior margin, medial edge with a spinulous lobe behind notch and a small, sharp spine in front of it.

Pterygostomian region smooth, margin with a row of four or five small tubercles and a large posterior tubercle.

Male sternum smooth, a lateral depression and a broad medial ridge anterior to abdominal fossa, third and fourth segments with a ridge on edge of abdominal fossa.

Merus of adult male cheliped tuberculate, with four or five sharp tubercles dorsally larger than others, and a strong, broad terminal spine; carpus with a proximal spine and two dorsal ridges, outer ridge carinate, inner ridge comprising three broad, compressed spines; palm highest proximally, tapering slightly distally, length of palm about one and a half times height; fingers nearly as long as palm with a moderate gape in proximal half, dactyl with a large tubercle midway in gape, fixed finger with a smaller proximal tubercle, distal half of both fingers with small uniform teeth along cutting edge.

Ambulatory legs short, first leg slightly longer (1.15) than, and fourth leg equal to postrostral carapace length, merus of first ambulatory leg with a short, acute terminal spine, a row of tubercles dorsally and ventrally and a row of smaller tubercles midway on outer face; posterior legs with fewer tubercles.

Male abdomen of seven segments, smooth, width of sixth segment about twice length, width of seventh segment about one and a half times length.

First pleopod of male curved laterally at about distal fifth, slightly flattened apex abruptly recurved medially and lying against preceding part of pleopod, just below where apex recurves, lateral edge formed into a flap on abdominal surface.

Female abdomen of seven segments, smooth.

Female gonopore opening posteromedially from a small rounded swelling.

Remarks. — This species is similar to *T. parvispinosus* (Ward) in general carapace shape and in having the small intercalated spine excluded from the orbit. This species can be distinguished from *T. parvispinosus* by the strongly elevated branchial region with four marginal spines (two spines in *T. parvispinosus*); the anterolateral spine on the basal antennal article longer than wide and apically subacute (in *T. parvispinosus* the spine is as wide as long, truncate or weakly bilobed); the male first pleopod has a long recurved terminal lobe (*T. parvispinosus* pleopod with a short spine like terminal process); the rostral spines taper gradually from the base (in *T. parvispinosus* the rostral spines are fused for the basal third then taper abruptly to a narrow apex); the carapace is also more tuberculate than in *T. parvispinosus*.

In 1965 J. C. Yaldwyn compared the specimen now designated as the holotype of *T. wardi* with the type of *Leptomithrax parvispinosus* and noted that they were not conspecific.

Distribution. — Presently known only from Collaroy, near Sydney, New South Wales.

SUBFAMILY MITHRACINAE

Maiinae Alcock, 1895: 161, 236 (in part: the Periceroida).
Mithracinae Balss + Macrocoelominae Balss, 1929: 16, 20.
Mithracinae. — Garth, 1958: 346. — Griffin, 1966b: 264.

Carapace broadened anteriorly by the outstanding, often tubular, orbits; the orbits formed (1) by an arched supraocular hood, or semi-tubular horn, (2) by a hollowed postocular process, and (3) by a remarkable broadening, or by a prolongation, of the anterior part of the basal antennal article, affording complete concealment to the retracted eye. Rostrum often more or less deflexed. (Alcock, as quoted by Garth.)

Pleopod 1 usually slender, straight or weakly curved, aperture terminal, apex simple or curved or expanded into two or three processes.

The mithracines, broadly speaking, must be regarded as more than majids with tubular orbits related in some way to, perhaps as a continuation of the evolutionary trends shown in, the Majinae. The first pleopod of the males resembles that of various pisines rather than species of any other group. We agree with Garth that there appear to be different groups presently contained within this subfamily. Thus males of some American species of the genera *Mithrax*, *Ala*, *Microphrys* and so on possess a first pleopod expanded apically and lobate or with 'flanges'. Other American species — of the genera *Macrocoeloma*, *Stenocionops*, *Libinia* (currently classed as a pisine) and *Coeloceros* — possess an apically expanded pleopod with a prominent medial lobe. In all Indo west Pacific species, on the other hand, the males possess first pleopods which are hardly expanded apically: they are at most truncate and possess no lobes or flanges.

It is possible then, that the subfamily, as presently envisaged, comprises three evolutionary lines distinct from early geological time. No mithracines occur in the east Atlantic.

We have included in this subfamily *Cylclocoeloma* from the Tychinae and *Cyphocarcinus* from the Epialtinae. On the other hand we have removed *Jaquinotia*, *Entomonyx* and *Tumulosternum*, all with male first pleopods similar to *Thacanophrys*, to the Majinae. '*Paramicippa*' *tuberculosa* has also been transferred to the Majinae as the new genus *Pippacirama*. '*Tiarinia*' *elegans* has been transferred to the Pisinae as representing the new genus *Lyramaia*.

The Mithracinae in the Indo west Pacific are thus represented by only two main genera, *Micippa* and *Tiarinia*, a great contrast with the diverse American fauna of tubular-orbitted majids.

KEY TO INDO-WEST PACIFIC GENERA OF MITHRACINAE

1		Rostral spines broad, flattened, fused for at least proximal two thirds; intercalated spine present in upper orbit ..... *Micippa*
—		Rostral spines slender, cylindrical, separate from base although sometimes contiguous; intercalated spine absent, orbit comprising only eave and postorbital lobe 2
2(	1)	Rostral spines with a single accessory spine apically or dorsally in distal half 3
—		Rostral spines unarmed or with two to four lateral spines proximally 4
3(	2)	Carapace narrow, width half postrostral carapace length, branchial region scarcely wider than hepatic region; preorbital spine small; small species (cl. less than 25 mm) ..... *Cyphocarcinus*
—		Carapace widened posteriorly, width at least two thirds postrostral carapace length, branchial region one and a half times as wide as hepatic region; preorbital spine large, acute; large species (cl. more than 50 mm) ..... *Paranaxia*
4(	2)	Orbits greatly expanded laterally, tubular; preorbital part of eave an upturned obtuse lobe extending almost to level of apex of very short rostral spines ..... *Cyclocoeloma*
—		Orbits expanded laterally but not tubular, closed above and below; preorbital angle blunt, acute or produced but not exceeding proximal third of rostral spines 5
5(	4)	Carapace anteriorly narrowed, interorbital width less than half width of carapace ..... *Tiarinia*
—		Carapace not noticeably narrowed anteriorly, interorbital width more than half width of carapace ..... *Leptopisa*

Cyclocoeloma Miers, 1880

Type species. — *Cyclocoeloma tuberculata* Miers, 1880, by monotypy.

Remarks. — This distinctive monotypic genus has been moved from the Tychinae to the 'mithracine' group because of the nature of the orbit which resembles that of *Tiarinia* species. The tubular orbit is closed above and below but has no intercalated spine or suborbital lobe.

Distribution. — Known only from the western Pacific.

Cyclocoeloma tuberculata Miers, 1880 (Fig. 102g,h)

Cyclocoeloma tuberculatum Miers, 1880: 229-230, pl. 13 figs. 1,2.
Cyclocoeloma tuberculata. — Buitendijk, 1939: 236. — Sakai, 1967: 76-77, frontispiece fig. 3.

Material examined. — 1 ♀, 36.5 mm, 1 ovig. ♀, 42 mm.

WESTERN AUSTRALIAN MUSEUM, PERTH

Sulu Archipelago, near Siasi I., north of Laminusa I., coll. B. R. Wilson, 'Pele', 17 February 1964; 1 spec. (WAM 40-67).

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland, Townsville, Wheeler Reef, 12 m, under plate coral, camouflaged with anemones, coll. I. Loch, 31 August 1975; 1 spec. (AM P.23824).

Remarks. — Our specimens agree well with those figured by Miers and by Sakai. The palm of the chela of the adult male is 1 1/2 times as long as high; there is a large gape proximally between the fingers and a small proximal tooth on the dactyl.

Segments four to six of the female abdomen are fused.

The first pleopod of the male is slightly narrowed distally and has a subterminal, medial opening.

Distribution. — Western Pacific: Japan, Sulu Archipelago, Ambon, Timor, northeast Australia.

Cyphocarcinus A. Milne Edwards, 1868

Type species. — *Cyphocarcinus minutus* A. Milne Edwards, 1868, by monotypy.

Remarks. — These small crabs have, like species of *Huenia*, been considered almost infinitely variable and great confusion has surrounded the use of specific names. This study recognises five species of which two are described as new. *C. capreolus* (Paul'son) and *C. suspensus* (Gravier) are recognised as separate species distinct from *C. minutus*. The species are distinguished without great difficulty on the basis of rostrum and basal antennal article. The broad orbit almost concealing the eye from view leads us to the view that *Cyphocarcinus* is appropriately placed near 'mithracine' genera like *Tiarinia*, not amongst the Epialtinae. The first pleopod of the male is very similar in each of the four species from which it is known.

Distribution. — Indian Ocean, one species occuring only in the Red Sea and Iranian Gulf.

KEY TO SPECIES OF *CYPHOCARCINUS*

1		First movable segment of antenna with a prominent lateral lobe .. 2
—		First movable segment of antenna cylindrical 3
2(	1)	First movable segment of antenna subtriangular, apically acute; lateral margin of basal antennal article produced into a prominent acute lobe extending anteriorly beyond anterior edge of article; rostral spines weakly divergent beyond small accessory spines ..... *C. rathbunae*
—		First movable segment of antenna produced as a blunt distal lobe; lateral edge of basal antennal article produced as a blunt lobe, no longer than, and not extending anteriorly beyond, anterolateral lobe; rostral spines strongly divergent beyond dorsal accessory spines ..... *C. alcocki*
3(	1)	Anterolateral angle of basal antennal article with a prominent rounded lobe larger than and extending laterally just beyond proximal lobe of lateral edge of article; rostrum deflexed ..... *C. minutus*
—		Anterolateral angle of basal antennal article with small lobe, no larger than lobe on lateral edge of article and not laterally produced as far as lateral margin; rostrum almost horizontal 4

4(3) Gastric region weakly elevated in male, moderately elevated in female, summit with a medial tubercle and two lateral tubercles, without ridges; intestinal region posteriorly without medial tubercle ..... *C. suspensus*

— Gastric region moderately elevated in male, strongly elevated in female, summit lacking a tubercle, one tubercle laterally, two submedial ridges; intestinal region posteriorly with a medial tubercle..... *C. capreolus*

Cyphocarcinus alcocki new species
(Figs. 97a-e, h,i, 98d,i, 99d)

? *Cyphocarcinus minutus* Alcock, 1895: 254.
Cyphocarcinus minutus. — Rathbun, 1911: 255 (part-male only). (Not *Cyphocarcinus minutus* A. Milne Edwards, 1868.)

Material examined. — 1♂, 2♀♀ (ovig.) 7-10.5 mm.
Holotype. — Male, cl. 7.0 mm, Amirante, 45-144 m, 11 October 1905, 'Sealark' Expedition, Stn. E11, Smithsonian Institution USNM 41430 (det. Rathbun, 1911, as *C. minutus*).
Paratypes. Female, ovig., cl. 8.5 mm, Andaman Is., Port Blair Harbour, coral reefs, Zoological Survey Calcutta 3853/9. — Female, ovig., cl. 10.5 mm, Sri Lanka, Pedro Shoal, Zoological Survey Calcutta 8887/6. (both det. Alcock, 1895, as *C. minutus*).

Description. — Carapace slender, length approximately 2 1/2 times width. (In this series of specimens the carapace of the male (Amirante) is more tuberculate than that of the female from the Andaman Islands. The female from Pedro Shoal has a large part of the carapace covered with encrusting growth and, where this has been removed, is smoother than either of the other two specimens.)

Rostral spines slender, short (approx. 1/4 postrostral carapace length) and strongly divergent beyond dorsal accessory spine.

Orbit above with a small acute preorbital spine directed laterally or obliquely forward, a tubercle on supraorbital eave and a pronounced postorbital lobe.

Hepatic region with one tubercle.

Gastric regions strongly elevated, more so in females than male, greatest height above orbit (female) or above hepatic region (male); two medial tubercles on anterior slope with a pair of small submedial tubercles between them and in male two small lateral tubercles in line with posterior tubercle forming a row of five tubercles, two or three small tubercles just medial to, and in front of preorbital spine.

Cardiac region weakly elevated with a broad medial tubercle and two small submedial tubercles on the anterior slope.

Dorsal ridge above lateral margin clearly defined and armed with four tubercles, the anterior being broad but low, the posterolateral being smaller but more acute. (In the female from the Andaman Islands the tubercles opposite the cardiac region are indistinct.)

Intestinal region with one lateral and three medial tubercles. In male but not female, a medial tubercle just in front of posterior margin and one between it and posterolateral tubercle; broad medial lobe on posterior margin deflexed.

Basal antennal article broad with a blunt lateral lobe at base of the first movable segment and a blunt subequal anterolateral lobe separated from it by a hiatus. Antenna with an obtuse distal lobe on lateral margin of first movable segment; lobe truncate (male and female from Pedro Shoal) to rounded (female from the Amdaman Is.).

Male cheliped merus with six dorsal and four ventral tubercles and a terminal spine; male chela slightly enlarged, gape between fingers small, one tooth on each finger in gape.

Ambulatory leg merus somewhat flattened dorsally with a row of thick hairs on each margin. Dactyl of fourth leg armed with one large subterminal spine and four smaller teeth.

Male abdomen with sixth segment broader than long, lateral margins convex, seventh segment longer than broad. Female abdomen slender, greatest width equal to half total length, last segment very short, broadly obtuse.

First pleopod of male straight, apex truncate, distal quarter tapering, flattened and twisted so as to lie in a dorsoventral plane. (This is similar to that of *C. minutus*.)

Remarks. — This species is distinguished from all other known species of *Cyphocarcinus* by the presence of an obtuse (truncate to rounded) distal lobe on the lateral margin of the first movable segment of the second antenna. In *C. rathbunae* this segment has an acute lobe and in the other three species the segment is slender and parallel-sided, without a distal lobe.

This new species is named in honour of A. Alcock whose studies of the Indian Ocean Crustacea still stand amongst the most notable contributions made to carcinology.

Distribution. — Amirante, Sri Lanka, Andaman Islands.

Cyphocarcinus capreolus (Paul'son, 1875)
(Figs. 98a,f, 99a)

Ixion capreolus Paul'son, 1875: 13, pl. 2 figs. 1a-f.
Cyphocarcinus minutus. — Nobili, 1906: 109 (not seen). — Stephensen, 1945: 108-109, fig. 21A,B. — Griffin & Tranter, 1974: 166.

Material examined. — 3♂♂, 6♀♀(4 ovig.), 11-21 mm, smallest ovig. ♀, 11 mm.

MUSEÚM NATIONAL D'HISTOIRE NATURELLE, PARIS

'Calypso' Expedition to Red Sea: Red Sea, Abulat, 26 December 1951; 1 spec. (prev. det. D. Guinot as *C. minutus*).

SMITHSONIAN INSTITUTION, WASHINGTON

Saudi Arabia, Iranian Gulf, Tarut Bay, coll D. S. Erdman, 18 May 1948; 3 specs. (USNM 89885, det. F. A. Chace Jr. as *C. minutus*).

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Expedition to Iran: Iranian Gulf Stn. 2, coral reef, 6 nautical miles S. of Bushire, 22-24 February 1937; 1 spec. — Iranian Gulf Stn. 49D, 2 1/2 nautical miles E.S.E. of Bustani, 5-6 m, algae, sand, coll. G. Thorson, 6 April 1937; 4 specs. (all det. K. Stephensen as *C. minutus*).

Remarks. — Balss (1929) considered the specimens he examined from the Red Sea and those described by Gravier from Madagascar to be two distinct species, *C. minutus* A.

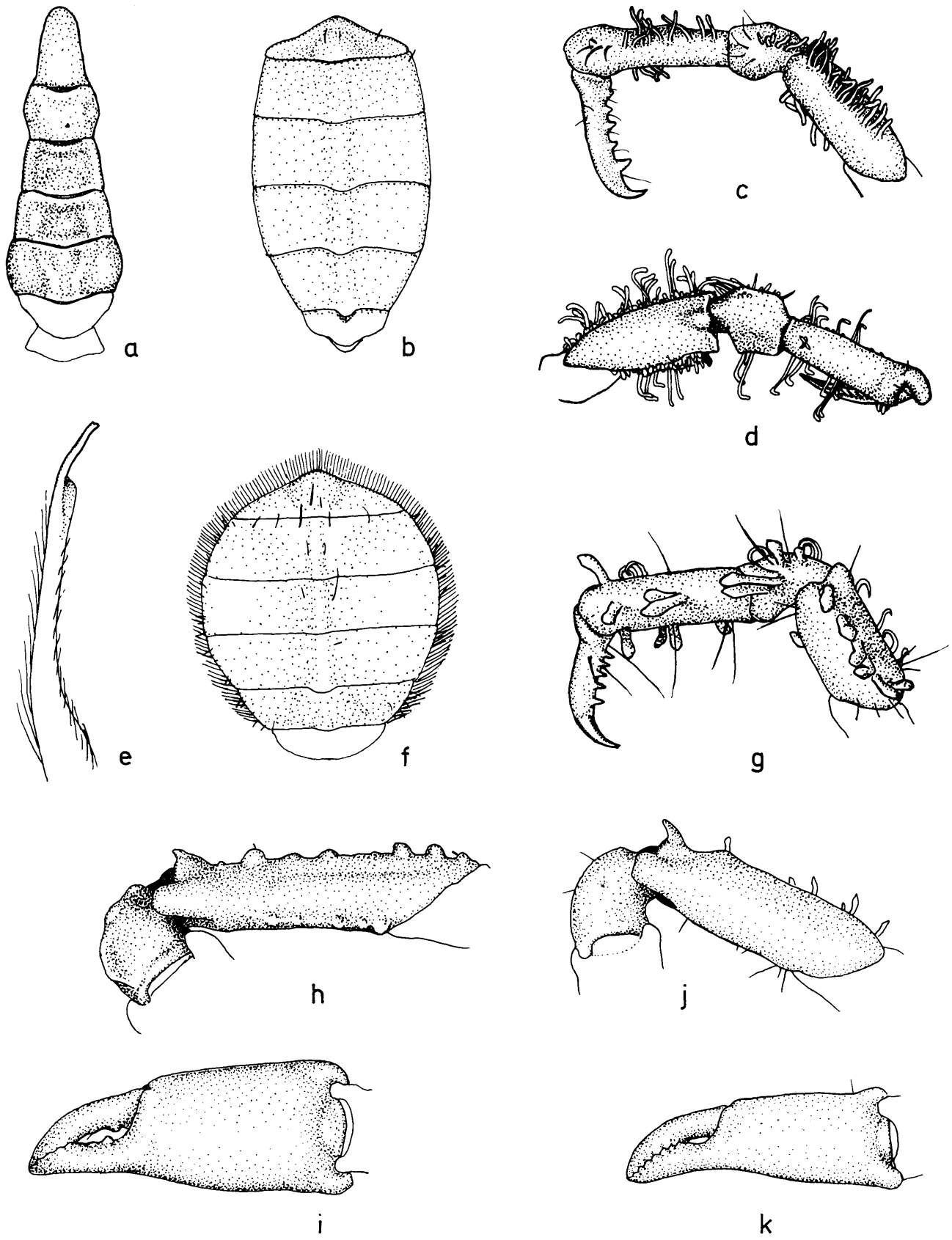

Fig. 97. *Cyphocarcinus alcocki* (holotype) (a) male abdomen; (female, ovig., 10.5 mm, Sri Lanka, ZSC 8887/6) (b) female abdomen; (holotype) (c) left fourth ambulatory leg (posterior); (d) left fourth ambulatory leg (dorsal); (e) left first pleopod, abdominal view; *C. rathbunae* (holotype) (f) female abdomen; (g) left fourth ambulatory leg; *C. alcocki* (holotype) (h) left cheliped, merus and carpus; (i) left chela; *C. rathbunae* (holotype) (j) left cheliped, merus and carpus; (k) left chela.

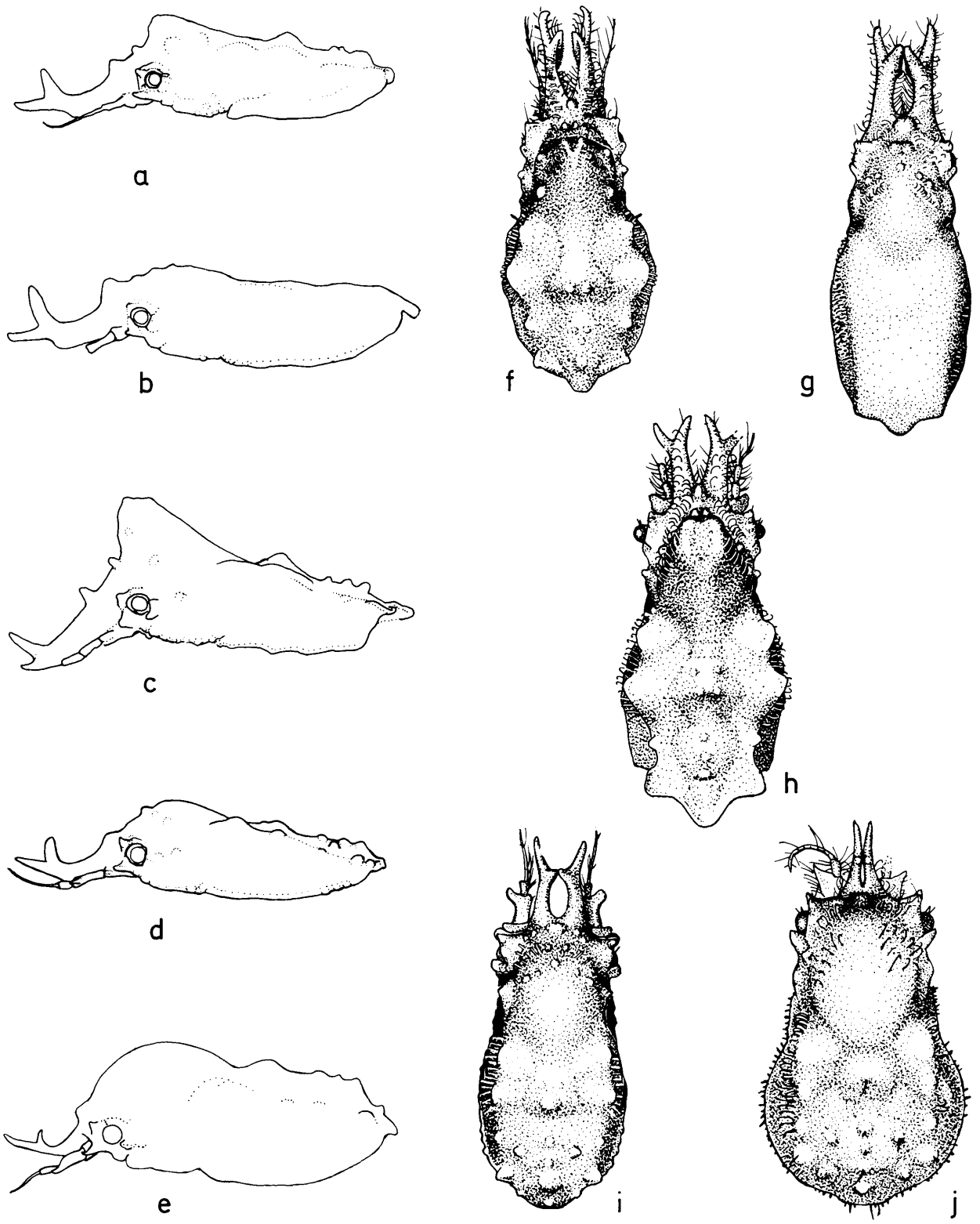

Fig. 98. *Cyphocarcinus capreolus* (male, 18.5 mm, Gulf of Iran, ZMC) (a) carapace, lateral view; *C. suspensus* (male, 15 mm, Delagoa Bay SAM A.10900) (b) carapace, lateral view; *C. minutus* (male, 11.5 mm, Mombasa, ZMC) (c) carapace, lateral view; *C. alcocki* (holotype) (d) carapace, lateral view; *C. rathbunae* (holotype, female) (e) carapace, lateral view; *C. capreolus* (as above) (f) carapace, dorsal view; *C. suspensus* (as above) (g) carapace, dorsal view; *C. minutus* (as above) (h) carapace, dorsal view; *C. alcocki* (holotype) (i) carapace, dorsal view; *C. rathbunae* (holotype, female) (j) carapace, dorsal view.

Milne Edwards and *C. suspensus* (Gravier) respectively, *Ixion capreolus* Paul'son being considered a synonym of *C. minutus*. Barnard (1955) retained the name *C. minutus* for the tuberculate Red Sea specimens, but regarded *C. suspensus* as a synonym of Paul'son's species. Since the time of the original description of *C. minutus*, no specimens agreeing with that description have been recorded until now, and the name has come to be used for the species more commonly found in the Red Sea. Peyrot-Clausade & Serène (1976) have examined the types of *C. minutus* and *C. suspensus* as well as specimens from the Red Sea reported on by Nobili (1906) as *C. minutus* and have shown that the first is a distinct species from the last two — *C. suspensus* and "*C. minutus*" of Nobili — which they regard as conspecific and to which they applied the name *C. capreolus*. We have not seen the specimens reported by Nobili from the Red Sea and Iranian Gulf but it is probable that they are conspecific with our material from this area. The two males which we have examined (see under *C. minutus*) also confirm the validity of A. Milne Edwards' species. We have examined specimens from the Red Sea and compared them with the specimens from Inhaca I. described by Barnard and they are not conspecific with each other. Therefore, we consider the species name *capreolus* to be validly applied to the distinct species from the Red Sea and the Iranian Gulf and the species name *suspensus* to be validly applied to the less tuberculate species described by Gravier (1923) and by Barnard.

We have examined the specimens described as *C. minutus* from Ceylon by Alcock (1895) and from the Seychelles by Rathbun (1911) and consider them to be not conspecific with any of the above three species (*C. capreolus*, *C. minutus* and *C. suspensus*). In those three species the first movable segment of the second antenna is slender and its sides parallel, while in Alcock's and Rathbun's specimens the disterolateral margin of the first movable segment of the second antenna is strongly produced. We have therefore designated them as new species, *C. alcocki* and *C. rathbunae* and they are discussed elsewhere.

As well as the Red Sea specimen from the 'Calypso', the three specimens from the Iranian Gulf in the USNM and the material from the Red Sea previously discussed as *C. minutus* by Griffin & Tranter (1974), we have examined specimens from the Iranian Gulf (3 ♂♂, 2 ♀♀ 13.5-21 mm) described by Stephensen (1945) as *C. minutus* and consider that they are all properly identifiable as *C. capreolus*. There is some variation among the specimens in the size of the tubercles on the dorsal ridge above the lateral margin of the carapace and in the degree of elevation of the gastric region within each sex (apart from the higher gastric elevation in the female due to sexual dimorphism). However, all these specimens agree with each other in several characters which distinguish them from *C. suspensus*.

On the summit of the gastric region of *C. capreolus* there are two low ridges anteriorly and a lateral tubercle. Anteriorly, there is a medial tubercle near the base of the rostral spines and behind it another medial tubercle (or two submedial tubercles). The anterior tubercle is at most twice as large (male) or the same size (female) as the tubercle behind it. In *C. suspensus* there is a third medial tubercle near the summit of the gastric region, and in line with it are two lateral tubercles, forming a transverse row of five tubercles; there are no ridges on the summit and the anterior tubercle (near the rostrum) is often the largest carapace tubercle, being about four times (male) or twice (female) as large as the tubercle behind it.

In *C. capreolus* there is a hiatus on the anterior edge of the basal antennal article. The medial edge of the hiatus, at the base of the flagellum, is weakly produced and rounded while the lateral edge is produced forward into a much larger rounded lobe. In *C. suspensus* the medial lobe of the hiatus is more strongly produced and the lateral lobe is subequal to it.

In *C. capreolus* there is a strong medial tubercle on the posterior margin of the carapace and a tubercle on the posterolateral angle. In *C. suspensus* (and *C. minutus*) there is no medial tubercle on the posterior margin, and at the most a very weak tubercle posterolaterally.

The abdomen of the adult female in both *C. capreolus* and *C. suspensus* is elongate oval in shape. In *C. capreolus* the lateral margin of the abdomen is curved towards the abdominal cavity and the length of segments three to seven is about one and a half times (1.4-1.6) the greatest width. In *C. suspensus* the lateral margin of the abdomen is flat and the length of segments three to seven is about one and three quarters times (1.7-1.8) the greatest width. The female gonopore is a slit-like aperture opening medially.

The characters which distinguish *C. capreolus* from *C. minutus* A. Milne Edwards are discussed under that species.

Distribution. — Red Sea, Iranian Gulf.

Cyphocarcinus minutus A. Milne Edwards, 1868
(Figs. 98c,h, 99c)

Cyphocarcinus minutus A. Milne Edwards, 1868: 73-76, pl. 19 figs. 7-12.
Cyphocarcinus capreolus. — Barnard, 1955: 15-18, fig. 4 (part-1 male). (Not *Ixion capreolus* Paul'son, 1875.)

Material examined. — 3 ♂♂, 1 ovig. ♀, 10-11.5 mm, and postrostral cl. 11 mm, ovig. ♀, 10 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Galathea' Expedition: Stn. 256, Mombasa, 04°05'S 39°41'E, 1-2 m, dredge, corals, 22 March 1951; 1 spec.

SOUTH AFRICAN MUSEUM, CAPE TOWN

Delagoa Bay, Inhaca I.; 1 spec. (SAM, Cape Town, A.16212, ? det. K. H. Barnard as *C. capreolus*).

MUSEO ZOOLOGICO, UNIVERSITY OF FLORENCE

Somalia, Sar Uanle, 20 km S. of Chisimaio, coll. M. Vanini, 1976; 2 specs.

Remarks. — We have examined the specimens reported on by Alcock (1895) and by Rathbun (1911) as *C. minutus* and

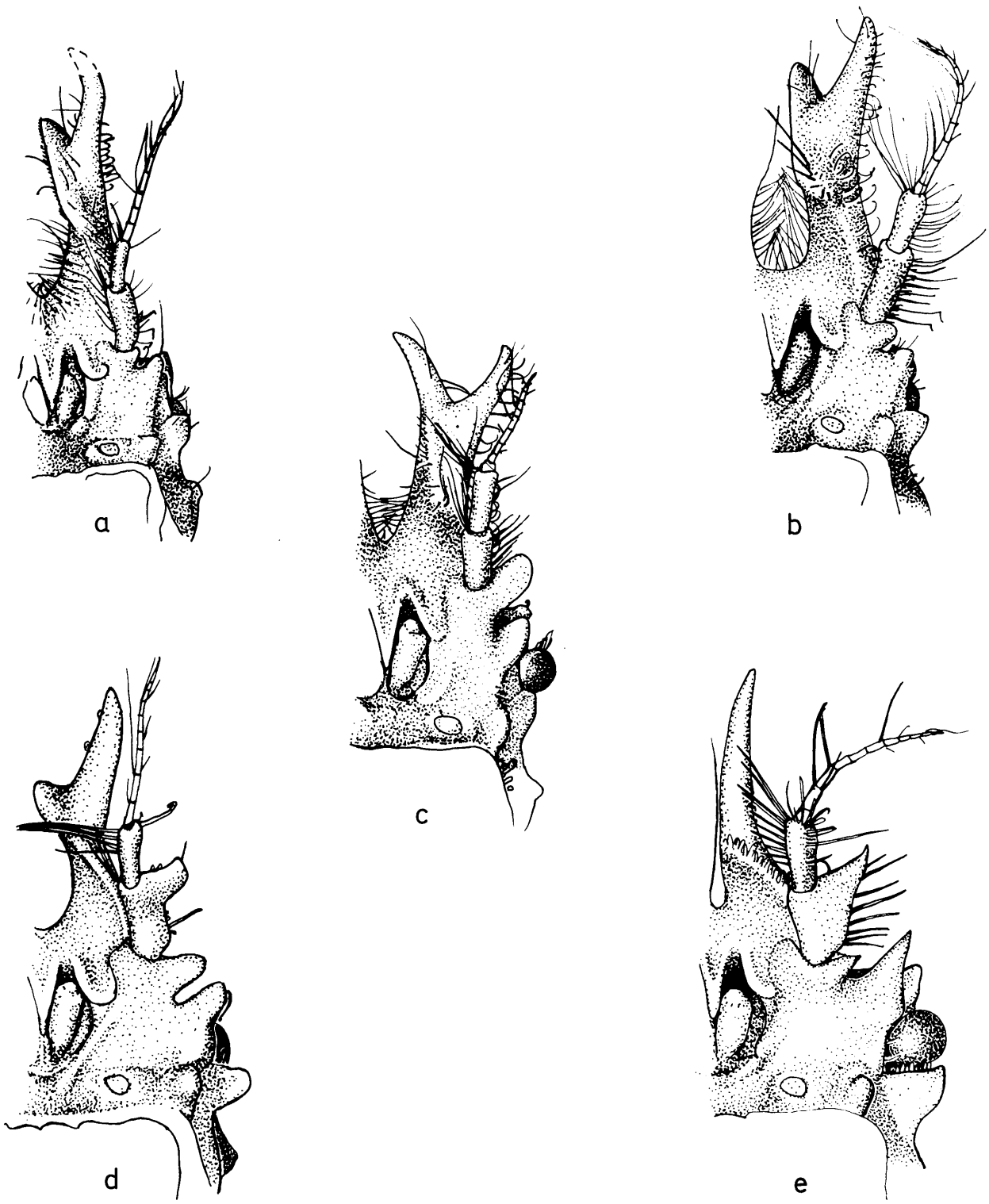

Fig. 99. *Cyphocarcinus capreolus* (male, 18.5 mm, Gulf of Iran, ZMC) (a) left orbit, ventral view; *C. suspensus* (male, 15 mm, Delagoa Bay, SAM A.10900) (b) left orbit, ventral view; *C. minutus* (male, 11.5 mm, Mombasa, ZMC) (c) left orbit, ventral view; *C. alcocki* (holotype) (d) left orbit, ventral view; *C. rathbunae* (holotype, female) (e) left orbit, ventral view.

they are not conspecific with our specimens. We have placed Alcock's specimens and one of Rathbun's specimens (a male) in one new species *C. alcocki*, and the other of Rathbun's specimens (a female) in another new species *C. rathbunae* (see under those species).

We have examined the specimens determined as *C. minutus* by Stephensen (1945) and they are conspecific with other material from the Red Sea and Iranian Gulf now known as *C. capreolus* (see under that species).

The specimen from Mombasa collected by the Galathea expedition agrees well with the holotype of *C. minutus* from Madagascar (female, 10.5 mm, Museúm National d'Histoire

Naturelle, Paris) figured by A. Milne Edwards, particularly in the shape of the basal antennal article.

We have examined four specimens (2 ♂♂, 2 ♀ ♀, Inhaca I., Delagoa Bay SAM, Cape Town. A.10900) apparently determined as *C. capreolus* by Barnard (1955). Although one male and the two females are clearly those described by Barnard (now considered to be *C. suspensus*), the other male (now SAM, Cape Town. A.16212) is conspecific with our specimen of *C. minutus* from Mombasa.

In these two males — the Mombasa specimen and the one male from Delagoa Bay — the gastric region is strongly elevated (though not as strongly as in the female holotype), vertical anteriorly, with the highest point above the orbit. The rostrum is less than half (0.4) postrostral carapace length (holotype rostrum about 1/4 postrostral carapace length). In the male and ovigerous female from Sar Uanle, Somalia, collected by Vannini, the rostral spines are very short, less than 1/4 and about 1/6 postrostral carapace length respectively. The spines are contiguous in the basal half and barely visible in dorsal view as in the holotype figured by A. Milne Edwards.

There are two low submedial ridges anteriorly on the summit and a lateral tubercle above the orbit. There is a medial tubercle near the base of the rostral spines and two submedial tubercles behind it. The dorsal ridge above the margin is well developed, the largest tubercle is level with the cardiac region. The posterolateral angle is produced but not tuberculate and there is a flat smooth medial lobe produced posteriorly and horizontally over the abdomen in the males and weakly deflexed in the female. There are two or four cardiac tubercles and a medial intestinal ridge or a row of three tubercles; the carapace surface is smooth between the tubercles.

There is only a small preorbital tubercle and the postorbital lobe is only weakly produced laterally. The basal antennal article is as figured for the holotype; the medial edge of the hiatus, at the base of the flagellum, is produced into a large blunt lobe directed obliquely forwards; the lateral lobe is smaller and posterior to it. (In the specimens from Sar Uanle the lateral lobe is much smaller than the anterior.) The margins of the first movable segment of the antenna are parallel: there is no lobe.

The palm of the chela of the adult male is compressed and there is a well developed gape, each finger being armed with a single tooth in the gape. The cheliped merus is armed with six dorsal and four ventral tubercles and a blunt terminal spine. The dactyls of the last three pairs of walking legs have a subterminal pair of teeth larger than the other teeth.

The first pleopod of the male is similar to that of *C. capreolus* (figured by Stephensen) and *C. suspensus* (figured by Barnard) but the truncate apex is terminally straight, not angled, and the flattened distal fifth of the pleopod, which *appears* to narrow suddenly, is twisted to lie in a dorsoventral plane. The first pleopod of *C. alcocki* is similarly flattened and twisted in the distal quarter.

The abdomen of the ovigerous female is about twice as long as wide.

This species is distinguished from the four other known species of *Cyphocarcinus* by the shape of the basal antennal article (see above). Further it is distinguished from *C. suspensus* (Gravier) by the more strongly elevated gastric region, with only one, not two, lateral tubercles; from *C. capreolus* (Paul'son) by the absence of the medial tubercle on the posterior margin of the carapace present in that species; and from *C. alcocki* and *C. rathbunae* by the more strongly elevated gastric region and the absence of a strong anterolateral lobe on the first movable segment of the antenna.

Distribution. — Madagascar, Delagoa Bay, Mombasa, Sar Uanle (Somalia); previously known only from Madagascar.

Cyphocarcinus rathbunae new species
(Figs. 97f,g,j,k, 98e,j, 99e)

Cyphocarcinus minutus. — Rathbun, 1911: 255 (part-female only). (Not *Cyphocarcinus minutus* A. Milne Edwards, 1868.)

Material examined. — 1 ♀ (ovig.), cl. 7.5 mm.
Holotype. — Female, ovigerous, cl. 7.5 mm, Seychelles, Coetivy, 1905. Smithsonian Institution USNM 41431 (det. Rathbun, 1911 as *C. minutus*).

Description. — Carapace pyriform, width approximately half postrostral length; margin and tubercles with large setae.

Rostral spines short (approx. 1/4 postrostral carapace length) with a short accessory spine; slender, subparallel, almost contiguous, separated by a proximal slit and weakly divergent distally.

Orbit above with a very small, sharp preorbital spine directed forward and upward; supraorbital eave without a tubercle; a distinct postorbital lobe present.

Hepatic region rounded with a low ventral tubercle.

Gastric regions moderately elevated, broadly rounded, smooth, greatest height above hepatic region; a low medial tubercle halfway down anterior slope and a slightly smaller lateral tubercle between this and preorbital spine. Urogastric region with a low conical tubercle. Dorsal ridge above lateral margin not so distinctly marked as in other species, with five low tubercles, the fifth close to intestinal region. Cardiac region with three medial tubercles and one tubercle laterally. Intestinal region depressed posteriorly, with one medial tubercle.

Basal antennal article broad with a very small sharp lobe at base of first movable segment of antenna and, separated from it by a hiatus, a large acute anterolateral lobe. Anterolateral angle of first movable segment similarly produced into a large acute lobe.

Cheliped merus with a terminal spine but no distinct tubercles, chela slender.

Merus of ambulatory legs with thick fringing hairs. Dactyl of fourth leg with a long curved terminal tooth and four very small teeth, other dactyls similarly armed.

Female abdomen broad, width subequal to length.

Remarks. — Rathbun (1911) commented briefly on this specimen. This species is distinguished from all other known species of *Cyphocarcinus* by the acute anterolateral lobe on the basal antennal article and on the first movable segment of the antenna. The gastric elevation is more broadly rounded and the dorsolateral margin less distinctly marked than in the other known species. Also the carapace is broader, as noted by Rathbun (l = w; other species l = $1^1/_2$ or 2 × w); the rostral spines are almost contiguous and the terminal tooth on the dactyls of the ambulatory legs is much longer in relation to the other teeth on the dactyl then in the other species.

This species is named for Mary Jane Rathbun (1860-1943) whose unmatched contributions to the study of Brachyura of the world extended over forty years.

Distribution. — Known only from the type locality: Coetivy, Seychelles.

Cyphocarcinus suspensus (Gravier, 1923)
(Figs. 98b,g, 99b)

Stenocarabus suspensus Gravier, 1923: 214-218, figs. 1-3.
Cyphocarcinus suspensus. — Balss, 1929: 23.
Cyphocarcinus capreolus. — Barnard, 1955: 15-18, fig. 4 (part-1♂, 2♀♀). (Not *Ixion capreolus* Paul'son, 1875.)

Material examined. — 1♂, 2♀♀ (1 ovig.), 13.5-15 mm, ovig. ♀, 13.5 mm.

SOUTH AFRICAN MUSEUM, CAPE TOWN

Delagoa Bay, Inhaca I.; 3 specs. (SAM, Cape Town. A. 10900, det. K. H. Barnard as *C. capreolus*).

Remarks. — We consider that this species should retain its status as a species distinct from *C. capreolus* (Paul'son) despite the views of Peyrot-Clausade & Serène (1976) who consider that these two species are synonymous and that the differences in tuberculation of the carapace are only minor. We have found consistent differences between the specimens from Inhaca I., described by Barnard and those examined from the Red Sea. In the former the lobes on the basal antennal article are subequal (not one twice as large as the other) and the hiatus between them is directed obliquely, not straight forward; there is one more tubercle on both the anterior and lateral slopes of the gastric elevation; and there is no medial tubercle on the posterior carapace margin. We discuss these differences in more detail under *C. capreolus*. In *C. suspensus* the gastric region is less strongly elevated than in either *C. capreolus* or *C. minutus* and the highest point, in both males and females, is level with the hepatic region.

Distribution. — Tuléar, Madagascar and Inhaca I., Delagoa Bay.

Leptopisa Stimpson, 1871

Type species. — *Tiarinia setirostris* Stimpson, 1871, by monotypy.

Remarks. — This genus has an unusual disjunct distribution. The type species occurs in the west Atlantic (Florida to Brazil) and the other two species are from the west Pacific. The first pleopod of the male of *L. australis* is here figured but the pleopod of *L. setrirostris* has not been described and only females are known of *L. nipponensis* Sakai (Sakai, 1976).

Distribution. — West Atlantic and West Pacific.

KEY TO SPECIES OF *LEPTOPISA*

(Only one species — *L. australis* — has been seen, information on the rest taken from the literature.)

1		Rostral spines long, about half postrostral carapace length; basal antennal article with two distal spines ..... *L. setirostris*
—		Rostral spines short, not more than a third postrostral carapace length; basal antennal article with only an anterolateral spine..... 2
2	(1)	Epibranchial spine short, acute; chelipeds and ambulatory legs unarmed..... *L. nipponensis*
—		Epibranchial tubercle small; chelipeds and ambulatory legs with tubercles ..... *L. australis*

Leptopisa australis new species
(Figs. 100, 107e, 112g,h)

Material examined. — 3♂♂, 8♀♀ (3 ovig.), 5.5-15.5 mm, smallest ovig. ♀, 11 mm.
Holotype. — Male, cl. 15.5 mm, Flores Sea, Postillon Is. (Liukang Tenggaja Kep.), 06°45′S 118°50′E, anchorage off Pulu Sarassa, up to 36 m, dredge, coral, 4/5 April 1899, Siboga Expedition, Stn. 43, ZMA De. 100.735 (in part), det. Ihle as *Tiarinia cornigera*.
Paratypes. As listed below.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn.43, as for holotype; 4 females (ZMA De 100.735, in part, det.Ihle as *T. cornigera*). — Stn. 66, S. Sulawesi, S. of Salajar, bank between Bahuluwang I. and Tambolungan I., 8-10 m, dredge, dead coral, *Halimeda*, *Lithothamnion*, 7/8 May 1899; 1 female. — Stn. 96, Sulu Archipelago, SE. side of Pearl Bank, 15 m, dredge, townet, *Lithothamnion* bottom, 27 June 1899; 2 females. — Stn. 315, Flores Sea, Paternoster Is. (Tengah Kep.), 07°30′S 117°30′E, anchorage E. of Sailus Besar, up to 36 m, dredge, coral and *Lithothamnion* 17/18 February 1900; 2 males, 1 female.

(Also examined: ZMA, 2♂♂, 9.5, 15.5 mm, 1♀, 12.0 mm, no data.)

Description. — Carapace about 0.7 postrostral carapace length, weakly tuberculate, tubercles mostly low and broad but some small and distinct; weak ridge just above posterior margin; scattered fine hairs (not plumose as in *Tiarinia* species).

Rostrum of two slender contiguous spines, length in male less than a third, in female a fifth to a quarter, postrostral carapace length, slightly upturned apically.

Orbit consisting above of a broad eave, preorbital spine small, upcurved; lateral edge of eave weakly concave; antorbital lobe hardly expanded; postorbital lobe adjacent to antorbital angle so as to close the orbit above, anterior margin weakly bilobed in most specimens. Eyestalks stout, short smooth, cornea large.

Hepatic region with three small tubercles. Branchial margin with a distinct epibranchial tubercle and two low tubercles anterior to it.

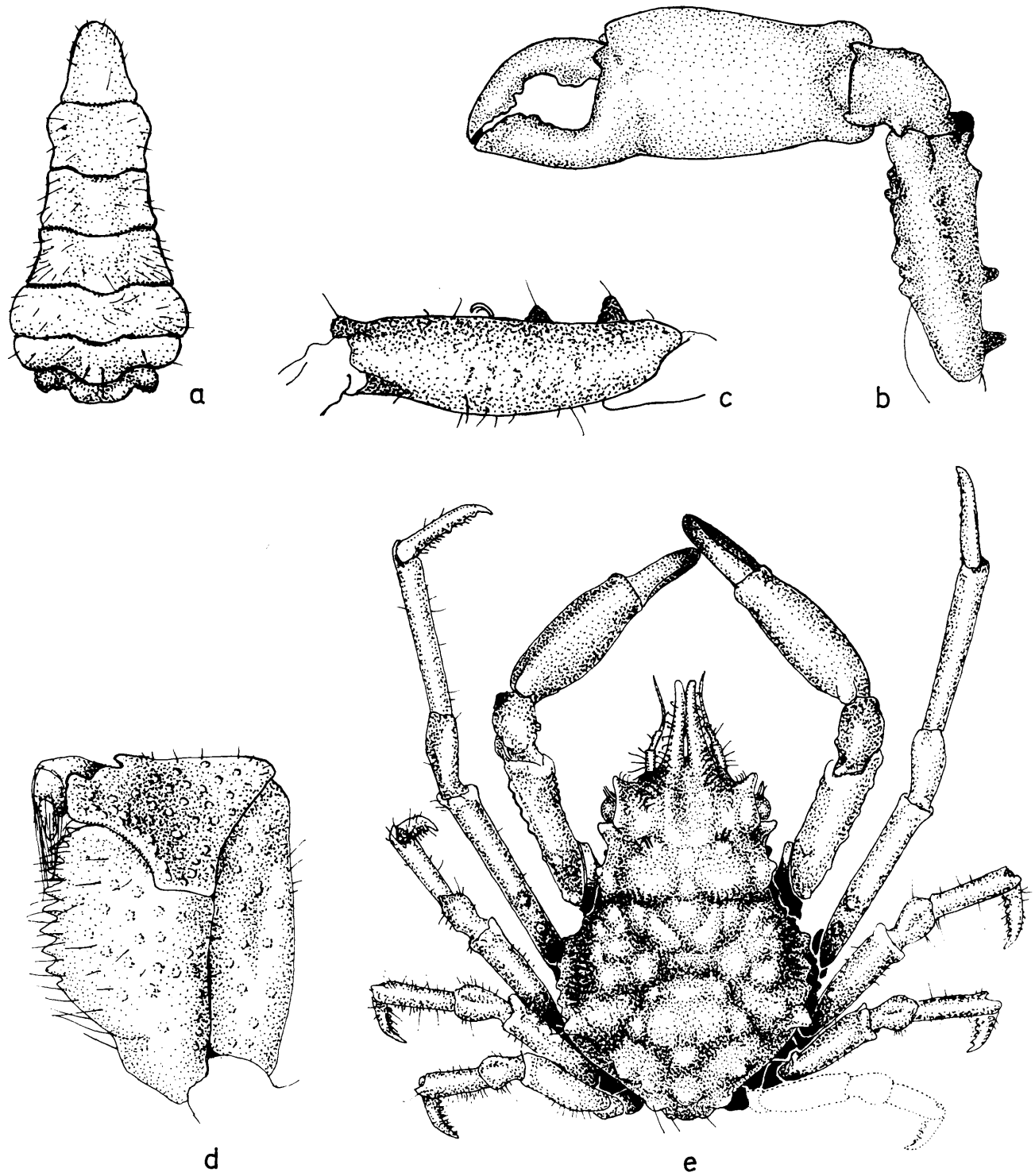

Fig. 100. *Leptopisa australis* (holotype) (a) male abdomen; (b) left cheliped; (c) merus of left second ambulatory leg; (d) left third maxilliped; (e) whole animal, dorsal view.

Gastric regions weakly elevated, surface indistinctly tuberculate, tubercles low and rounded. Urogastric region depressed with one low rounded tubercle.

Cardiac region with three extremely low rounded tubercles, two in front and one behind. Intestinal region with a central tubercle and behind it a pair of submedial tubercles which form medial points of a narrow unarmed ridge parallel to posterior carapace margin; posterior margin with three or four tubercles near midline.

Branchial region anteriorly with five low tubercles in two oblique rows; an irregular row of four to six small distinct tubercles above lateral carapace margin; and a metabranchial tubercle just posterolateral to cardiac region.

Basal antennal article broad, subquadrate, surface with a

shallow, longitudinal groove centrally, otherwise smooth; anterolateral angle with only a short spine, lateral margin entire. A small suborbital tubercle adjacent to green gland.

Pterygostomian region with two to three tubercles near margin.

Third maxilliped with anterolateral angle of merus moderately produced; notch of merus shallow, medial edge a broad rounded lobe. Male sternum smooth.

Cheliped merus of adult male with one distal and two proximal tubercles dorsally and a small terminal spine, a row of small tubercles ventrally and midway along outer face, a few tubercles on medial surface; carpus with four to five small tubercles on dorsal and medial surfaces; palm compressed, smooth, length about 1.75 times height, fingers gaping widely, fixed finger excavate, dactyl with a large tooth in gape proximally.

Ambulatory legs with merus cylindrical, two or three proximal tubercles dorsally but no terminal spine; dactyl of fourth leg with about six small teeth ventrally along its length. First ambulatory leg one and a half times longer than second leg in adult male.

Male abdomen of seven segments, smooth, sixth segment wider (1.5) than long, seventh segment as wide as long. Female abdomen of seven segments, smooth.

First pleopod of male straight, apex truncate, weakly produced at lateral angle, opening terminal.

Female gonopore a simple opening, wider laterally.

Remarks. — This species differs from *Leptopisa setirostris* (Stimpson) (as described by Rathbun, 1925: 375) in having shorter spines (a fifth to a quarter (female) or less than a third (male), rather than half postrostral carapace length); the basal antennal article is not armed with a spine midway along the anterior margin or at the base of the first free segment and the epibranchial spine is sometimes represented only by a tubercle.

This species is similar to *Leptopisa nipponensis* Sakai in general appearance but differs in having a less pronounced epibranchial spine and the cheliped and ambulatory legs armed, not smooth, as in that species; there are at least four small distinct tubercles laterally on the branchial region, just above the carapace margin, apparently not present in *L. nipponensis*; the anterolateral angle of the merus of the third maxilliped is not extremely produced as in *L. nipponensis* (but is produced more laterally than in *L. setirostris*) and the medial border is also different in the two species; in the ovigerous female the first ambulatory leg is only slightly longer than the second leg (as in *L. nipponensis*) but in the adult male it is one and a half times as long.

The specific name refers to the fact that this species is the southernmost western Pacific species of the genus.

Distribution. — Flores Sea, South Sulawesi, Sulu Archipelago.

Micippa Leach, 1817

Type species. — *Cancer cristata* Linnaeus, 1758, by monotypy.

Remarks. — With *Tiarinia*, *Micippa* represents one of the most speciose mithracines of the Indo-Pacific. Within the genus principal confusion has concerned the relationship of *Paramicippa tuberculosa* H. Milne Edwards to other *Micippa* species and the distinctness of *M. philyra* and *M. platipes*. As previously stated (Griffin, 1966b), Miers (1879c) confused the situation by designating *Micippa platipes* Rüppell as the type species of *Paramicippa* but later including only *P. tuberculosa* in his revision (Miers, 1885). *P. tuberculosa* is here transferred to a new genus and by Miers' action *Paramicippa* is reduced to synonymy with *Micippa*. The distinctness of *M. platipes* and *M. philyra* was clarified by Buitendijk (1939). *Lophomicippa* Rathbun, 1907 (type species *L. limbata* Rathbun by monotypy = *Micippa parca* Alcock) is reduced to synonymy with *Micippa*.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *MICIPPA*

1 Rostrum divided for distal quarter or more 2
— Rostral spines fused for almost entire length, only a notch in the midline apically 6
2(1) Rostrum bearing a short, broad, recurved spine on each side 3
— Rostrum with many lateral spines or lacking spines altogether 4
3(2) Basal antennal article smooth, orbit usually open below with a hiatus between basal antennal article and postorbital lobe; anterolateral borders of carapace with eight to ten spines..... *M. platipes*
— Basal antennal article tuberculate, orbit closed below, basal antennal article in broad contact with postorbital lobe; anterolateral borders of carapace with three to six spines..... *M. philyra*
4(2) Orbit closed below, basal antennal article adjacent to postorbital lobe; lateral margin of rostrum with numerous spines ... *M. cristata*
— Orbit open below, a wide hiatus between basal antennal article and postorbital lobe; rostrum without lateral spines 5
5(4) Postorbital lobe with a large lobe on posterior margin basally; anterior lateral margin of carapace without spines; basal antennal article smooth, anteromedial angle produced ..... *M. xishaensis*[41])
— Postorbital lobe with no lobe on posterior margin; anterior lateral margin of carapace with at least four spines; basal antennal article with tubercles on anterior and lateral margins, a small tubercle at anteromedial angle..... *M. thalia*
6(1) Carapace with three spines along dorsal midline; intercalated spine separated from postorbital lobe by a narrow fissure ..... *M. spinosa*
— Carapace without spines in dorsal midline; intercalated spine adjacent to postorbital lobe 7
7(6) Posterior margin of carapace with rounded 'bosses'; rostrum straight distally 8
— Posterior margin of carapace unarmed or granular; rostrum inflexed distally 9
8(7) Posterior margin of carapace with one medial and a lateral 'boss' on each side ..... *M. margaritifera*
— Posterior margin of carapace with one medial spine, a submedial spine and a lateral 'boss' on each side ..... *M. parca*
9(7) Hepatic margin without tubercles or spines; posterior carapace margin with small spines; basal antennal article with a central, tuberculate ridge ..... *M. curtispina*
— Hepatic margin with two tubercles; posterior carapace margin without spines; basal antennal article granular distally otherwise smooth..... *M. excavata*

[41]) From the literature (Chen, 1980).

Micippa cristata (Linnaeus, 1758)

Cancer cristata Linnaeus, 1758: 629.
Micippe cristata. — H. Milne Edwards, 1834: 330.
Micippa cristata. — Adams & White, 1848: 16. — Buitendijk, 1939: 252, fig. 20. — Takeda, 1973a: 110-111, fig. 4E, pl. 3 fig. D. — Griffin, 1976: 202.

Micippa cristata granulipes. — Sakai, 1976: 255-256, figs. 136, 137a.

Material examined. — 21 ♂♂, 18 ♀♀ (6 ovig.) 13.5-58 mm, smallest ovig. ♀, 32 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Sulu Archipelago, Tawi Tawi Is, Sanguisiapo, 1899; 3 specs. (ZMA De. 100.586, det. Ihle). — Stn. 172, Ceram Sea, anchorage between Geser and Seram Laut, 18 m, townet, reef exploration, coral and lithothamnion, 26/28 August 1899; 9 specs. (ZMA De. 100.719, De. 100.799, det. Ihle). — Ambon, 1899; 1 spec. (ZMA De. 100.860, det. Ihle). — Kai Is., Ellat Reef, December 1899; 1 spec. (ZMA De. 100.702, det. Ihle). — Aru, Dobo Reef, December 1899; 1 spec. (ZMA De. 100.817, det. Ihle). — S. of Timor, Haingsisi Reef; 1 spec. (ZMA De.100.816, det. Ihle). — Stn. 313, N. coast of Sumbawa, Saleh Bay, anchorage east of Dangar Besar, reef exploration, 14/16 February 1900; 1 spec. (ZMA De.100.861, det. Ihle as *M. cristata* var. *granulipes*).

Lesser Sunda Is., Sumba, on shore, coll. Laurense, 5 January 1909; 2 specs. (ZMA De.100.818, det. Ihle). — S. of Timor, Haingsisi Reef, on falling tide, coll. Laurense, 2 November 1909; 1 spec. (ZMA De.100.820, det. Ihle). — SW. Irian Jaya, Kaimana Reef, 03°41'S 133°44'E, 28 August 1910; 3 specs. (ZMA De.100.819, det. Ihle). — South Bali, Den Pasar; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Ambon I., Ambon Bay, 13-18 m, sand, 28 Febraury 1922; 1 spec. — Near Ambon, Saparua Bay, on beach, 12 March 1922; 1 spec. — Banda Sea, Banda, 7 June 1922; 8 specs.

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Mariel King Memorial Expedition — Moluccas: Stn.KL I, Moluccas, S. end of Kajoa I., 00°05'S 127°27'E, coarse sand cay with marginal corals, 0-3 m, 21 May 1970; 4 specs. — Stn.TS IV, Kai Is., Tanimbar, Selaru, N. side of Labuan Olendir, 08°07'S 130°59'E, 3 m, dredge, sand, 26 June 1970; 1 spec.

Remarks. — Takeda (1973a) has given a detailed description of this species, figured the first pleopod of the male and summarised the distribution and status of Zehntner's "subspecies". Zehntner's (1894) "varieties" *laevimana* and *granulipes* were based on differences in granulation of the chelipeds. Buitendijk (1939) noted the variation of cheliped granules with age and sex and Takeda suggested that *laevimana* represents the females and young males and *granulipes* the older males. This is confirmed by our material in which the chelipeds of large males (cl. greater than about 30 mm) have all segments granulate; all adult and ovigerous females have very weak granulations on the merus and carpus and the chela smooth; and immature females and smaller males have all cheliped segments completely smooth. Sakai (1976) continues to use the subspecies name *granulipes* without commenting on whether the two females he examined had granular or smooth chelipeds. We do not consider however, that the two subspecies are valid.

This species is easily distinguished from all other *Micippa* species by the laterally multispinate rostrum the strong anterior spine above the eye, strong spines on the carapace, and the meri of the ambulatory legs which are cylindrical and granular with few hairs.

Distribution. — West Pacific from Indonesia to Japan.

Micippa curtispina Haswell, 1880

Micippa curtispina Haswell, 1880b: 446-447, pl. 25 fig. 1, 1a. — Lanchester, 1900: 725. — Griffin, 1966b: 288 (in key).

Remarks. — No new material has been examined. There are two specimens of *M. curtispina* in the collections of the Australian Museum. In 1905, a specimen was registered as G.5136: the locality is stated as Port Denison and it was identified in the register as type at the same time as it was registered. Subsequently, in 1941, a second specimen was relocated and registered as P. 11385; it appears that at that time the existence of the previously registered specimen was unknown since (in McNeill's handwriting) there is a note on the catalogue card and in the register stating that "a specimen in the collection labelled type discovered since this was written". The specimen registered as P.11385 also has the locality 'Port Denison, Q'ld'; and a note in the round, glass-topped container in which it sits states in McNeill's handwriting, "labelled on base of box in Prof. Haswell's handwriting." Haswell stated that his specimen was 5 lines in length (i.e. 10.5 mm); the sex of the specimen was not stated although the figure shows an animal with very slender chelae (which suggests either a female or a juvenile male). Of the two specimens, that registered as P.11385 is a male with very slender chelae and is 9.5 mm long; all legs are detached as is also the abdomen. The other specimen (G. 5136) is 13 mm long, the chelae are folded under the body. In both cases, specimens of other Crustacea registered at the same time came from the 'Old Collection'.

In fact since both specimens are identified by us as *Micippa curtispina* determination of which is in fact the holotype doesn't affect the nomenclature. However, we consider the specimen registered as P.11385 as most probably the holotype because its size more nearly approaches that given by Haswell.

This species is similar to *M. excavata* but is distinguished from it by:

1) anterolateral margin of rostrum convex (*M. excavata* anterolateral margin of rostrum oblique);
2) hepatic margin granular without tubercles or spines (*M. excavata* with two distinct granular tubercles);
3) posterior carapace margin with 3-5 spines on each side of midline (*M. excavata* with granules, no spines, on posterior margin);
4) basal antennal article has a tuberculate ridge from the base of the first movable segment and is tuberculate laterally (*M. excavata* smooth near base of first movable segment and granular laterally);
5) cheliped merus with two dorsal spines in distal half (*M. excavata* cheliped merus with high undivided carina in distal half).

The specimens from Torres Strait reported by Miers (1884, 1885) in which the anterolateral angles of the rostrum are 'ob-

nion bottom, 29 June 1899; 4 specs. — Stn. 109, Sulu Archipelago, anchorage off Pulu Tongkil, 13 m, dredge and townet, *Lithothamnion*, 5/6 July 1899; 1 spec.

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Sri Lanka, Trincomali, 11 m; 1 spec. — Mauritius; 1 spec.

ZOOLOGICAL SURVEY, CALCUTTA

Sri Lanka, Pearl Banks, coll. T. Southwell, 1911; 1 spec.

Remarks. — This species is distinguished by the presence on the posterior margin of the carapace of three shiny 'bosses', one in the midline and one on each side. The lateral margins of the rostrum are parallel in these specimens, not sloping inwards as figured by Henderson (1893). On the anterior edge of the basal antennal article there are tubercles and a spine as well as a spine at the anterolateral angle. The first pleopod of the male is curved strongly outwards distally.

Distribution. — Indo-West Pacific: Mauritius, Seychelles, Sri Lanka, Gulf of Martaban, Maldive Islands, Sulu Archipelago, Japan.

Micippa parca Alcock, 1895
(Fig. 102a)

Micippa margaritifera var. *parca* Alcock, 1895: 253. — Alcock & Anderson, 1898: pl. 35 fig. 4, 4a.
Micippa parca. — Edmondson, 1951: 213, fig. 17a-c. — Holthuis, 1953: 5.
Lophomicippa limbata Rathbun, 1907: 65-66, pl. 5 fig. 3, pl. 6 fig. 1-1g; 1911: 255 (in discussion); new synonymy.

Material examined. — 6 ♂♂, 6 ♀ ♀ (4 ovig.), 7.5-13.5 mm, smallest ovig. ♀, 7.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 96, Sulu Archipelago, SE side of Pearl Bank, 15 m, dredge and townet, *Lithothamnion*, 27 June 1899; 1 spec. — Stn. 99, anchorage to W. of North Ubian, 06°07.5′N 120°26′E, 16-23 m, dredge and townet, *Lithothamnion*, 29 June 1899; 3 specs. — Stn. 109 Sulu Archipelago, anchorage off Pulu Tongkil, 13 m, dredge and townet, *Lithothamnion*, 5/6 July 1899; 1 spec. — Stn. 144, Moluccas, anchorage north of Damar I., 45 m, dredge, townet and reef exploration, coral and *Lithothamnion*, 7/9 August 1899; 2 specs. — Stn. 282, anchorage between Nusa Besi and NE.point of Timor, 08°25.2′S 127°18.4′E, 27-50 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Honolulu, 18-72 m, coral, 5 May 1915; 3 specs.

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Mariel King Memorial Expedition — Moluccas: Stn. AW II, Aru, W. Wokam, NW. corner of Wasir I., 05°30′S 134°14′E, snorkel and shore collecting, 15 June 1970; 1 spec.

Remarks. — This species can be clearly distinguished by the presence on the posterior margin of two round shiny 'bosses', one on each side of a medial group of three to seven spines.

There is a strong anterolateral spine on the basal antennal article; behind it there is another smaller spine or in some specimens only a strongly convex lateral edge.

On our male specimen from Honolulu, as in that figured by Edmondson (1951), there are about five flattened spines on the anterior lateral margin of the carapace. On the other specimens from the Philippine Islands and Indonesia, as in that figured by Alcock & Anderson (1898), the anterior lateral margin bears one tubercle or is quite unarmed.

The specimen (ovig. ♀, cl. 9.2 mm, Makemo, Paumotus, USNM 32856) described by Rathbun (1907) as *Lophomicippa limbata* is clearly conspecific with *M. parca*. Rathbun (1911) explained, "in describing *Lophomicippa limbata*, its relationship to *M. parca* Alcock was overlooked. The principal difference lies in the absence from the carapace of *M. limbata* of the coarse granulation plainly visible in *M. parca*; instead there are numerous punctae not visible to the naked eye. It is possible that the single punctate specimen from the reef at Makemo is really *M. parca* with the granules entirely worn off". We confirm Rathbun's later view now. In our specimens the carapace granules vary from very fine over the whole surface to coarse with larger granules on the protogastric, branchial and intestinal regions.

The first pleopod of the male is similar to that of *M. platipes*: lightly curved outwards in the distal half and tapering towards the tip.

This species is clearly distinct from *M. margaritifera* Henderson which possesses three shiny 'bosses' on the posterior margin of the carapace but no spines.

Distribution. — Andaman Islands, Indonesia, Sulu Archipelago, Honolulu.

Micippa philyra (Herbst, 1803)

Cancer philyra Herbst, 1803: 51-52, pl. 58 fig. 4.
Micippa philyra. — Buitendijk, 1939: 253-254, 255-256, fig. 21, pl. 10 figs. 1, 3. — Sakai, 1965a: 90, pl. 42 fig. 1; 1976: 257, figs. 138a,a', pl. 90 fig. 3. — Griffin, 1976: 202.

Material examined. — 18 ♂♂, 16 ♀ ♀ (7 ovig.), 7.5-23 mm, smallest ovig. ♀, 11.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 47, Lesser Sunda Is., Bay of Bima, near south fort, beach, mud with patches of fine coral sand, 8-12 April 1899; 1 spec. — Stn. 99, Sulu Archipelago, anchorage to W. of North Ubian, 06°07.5′N 120°26′E, 16-23 m, dredge and townet, *Lithothamnion* bottom, 29 June 1899; 1 spec. — Stn. 127, N. Sulawesi, Great Sangir I., Taruna Bay, 45 m, trawl and reef exploration, fine, dark coloured sand, 20-21 July 1899; 1 spec. (ZMA De. 100.721, det. Ihle). — Stn. 129, Celebes Sea, Karkaralong Group, anchorage off Kawio and Kamboling Is., 29-31 m, reef exploration, dredge and townet, sand, 22-23 July 1899; 1 spec. (ZMA De. 100.722, det. Ihle). — Stn. 258, Kai Is., Tual anchorage, 22 m, reef exploration and dredge, *Lithothamnion* sand and coral, 12-16 December 1899; 4 specs. (ZMA De.100.862, det. Ihle). — 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. (ZMA De.100.723, det. Ihle and unreg.). — Banda Sea, Banda, 5-20 m; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERISTY OF COPENHAGEN

Mortensen Siam Expedition: Gulf of Thailand, Koh Kahdat, 1.8 m, sandy bottom, sponges, dead corals, 11 January 1900; 1 spec. — Gulf of

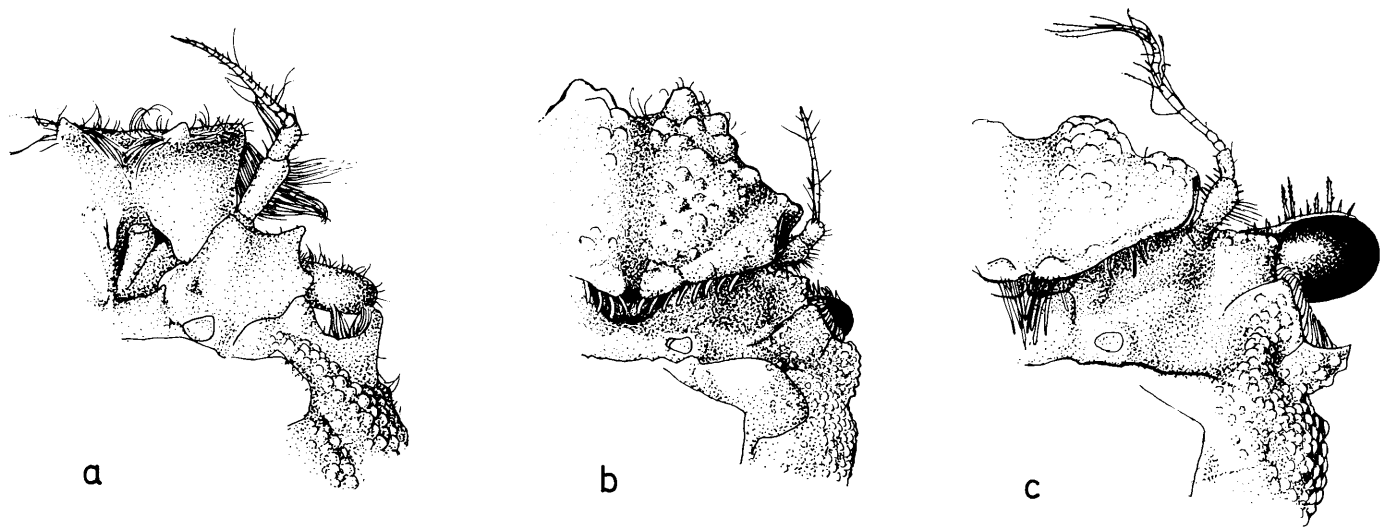

Fig. 101. *Micippa spinosa* (male, 18.5 mm, AM P. 180, in part) (a) left orbit, ventral view; *M. excavata* (male, 19 mm, Broome, AM P.13982) (b) left orbit, ventral view; *M. excavata* (female, ovig., 12 mm, Java, ZMC) (c) left orbit, ventral view.

solete' and the carina on the cheliped merus 'entire' may be *M. excavata* but are not *M. curtispina.*

Distribution. — Singapore, northeast Australia.

Micippa excavata Lanchester, 1900
(Figs. 101b,c, 102c,d, Pl. 22)

Micippa excavata Lanchester, 1900: 725-726, pl. 44 fig. 1a-c. — Buitendijk, 1950: 68.

Material examined. — 3 ♂♂, 5 ♀♀ (2 ovig.), 7.0-19 mm, smaller ovig. ♀, 12 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Is., Sapeh Strait, 08°23.5′S 119°04.6′E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec.

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Danish Kei Islands Expedition: Stn. 64, Java I., 05°51′S 106°22′E, 35 m, trawl, sandy mud, shells, 26 July 1922; 1 spec. — Stn. 71, Java Sea, 05°40′S 106°08′E, 54 m, trawl, sand and stones, 28 July 1922; 1 spec. — Stn. 106, Java Sea, 05°50′S 106°16′E, 32 m, trawl, sand, 5 August, 1922; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Torres Strait, north end of Albany Passage, coll. M. Ward, 1928; 1 spec. (AM P.13981). — Albany Passage, 16-22 m, dredge, 1928; 1 spec. (AM P.29883, dry).

Western Australia: Broome, Roebuck Bay, near entrance, 104 m, *Lithothamnion* reef bottom, coll. A. A. Livingstone, 26 September 1929; 1 spec. (AM P. 13982). — Broome; 1 spec. (AM P.29884, dry).

Remarks. — This species can be distinguished from the very similar *M. curtispina* by the presence of two tubercles on the hepatic margin, uniform granules, not spines, on the posterior carapace margin, and a high undivided carina, not spines, on the distal half of the cheliped merus. The differences between these two species are discussed more fully under *M. curtispina.*

The palm of the adult male cheliped is smooth, twice as long as high; the fingers are slightly more than half as long as the palm and gape strongly in the proximal two thirds, bearing very small teeth distally in the gape. The sternum of the male has tubercles posteriorly on the first segment and on the second, third and fourth segments. The male abdomen is narrow, the segments smooth except for a transverse medial ridge anteriorly; the sixth segment is twice as wide as long; the seventh segment is one and a half times as wide as long, the anterior margin straight or weakly concave.

The first pleopod of the male is broad, weakly curved outwards, tapers slightly to the tip, and the medial edge of the apex is produced into a short, narrow lobe.

In the specimens from Indonesia there is a depression on the proximal part of the basal antennal article separated by a ridge on the suborbital lobe from another more lateral depression. In the Australian specimens the ridge and the depressions are not so pronounced.

Only three specimens of this species, all from Singapore, have been recorded previously.

Distribution. — Singapore, Indonesia, northwest and north Australia.

Micippa margaritifera Henderson, 1893
(Fig. 102b)

Micippa margaritifera Henderson, 1893: 348-349, pl. 36 figs. 5-7 — Alcock, 1895: 253. — Alcock & Anderson, 1898: pl. 35 fig. 3, 3a. — Rathbun, 1911: 255. — Sakai, 1938: 317, pl. 32 fig. 1; 1976: 259, pl. 90 fig. 4. — Buitendijk, 1939: 252-253.

Material examined. — 2 ♂♂, 6 ♀♀ (5 ovig.) 4.5-15 mm, smallest ovig. ♀, 9 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 99, Sulu Archipelago, anchorage to W. of North Ubian, 06°7.5′N 120°26′E, 16-23 m, dredge and townet, *Lithotham-*

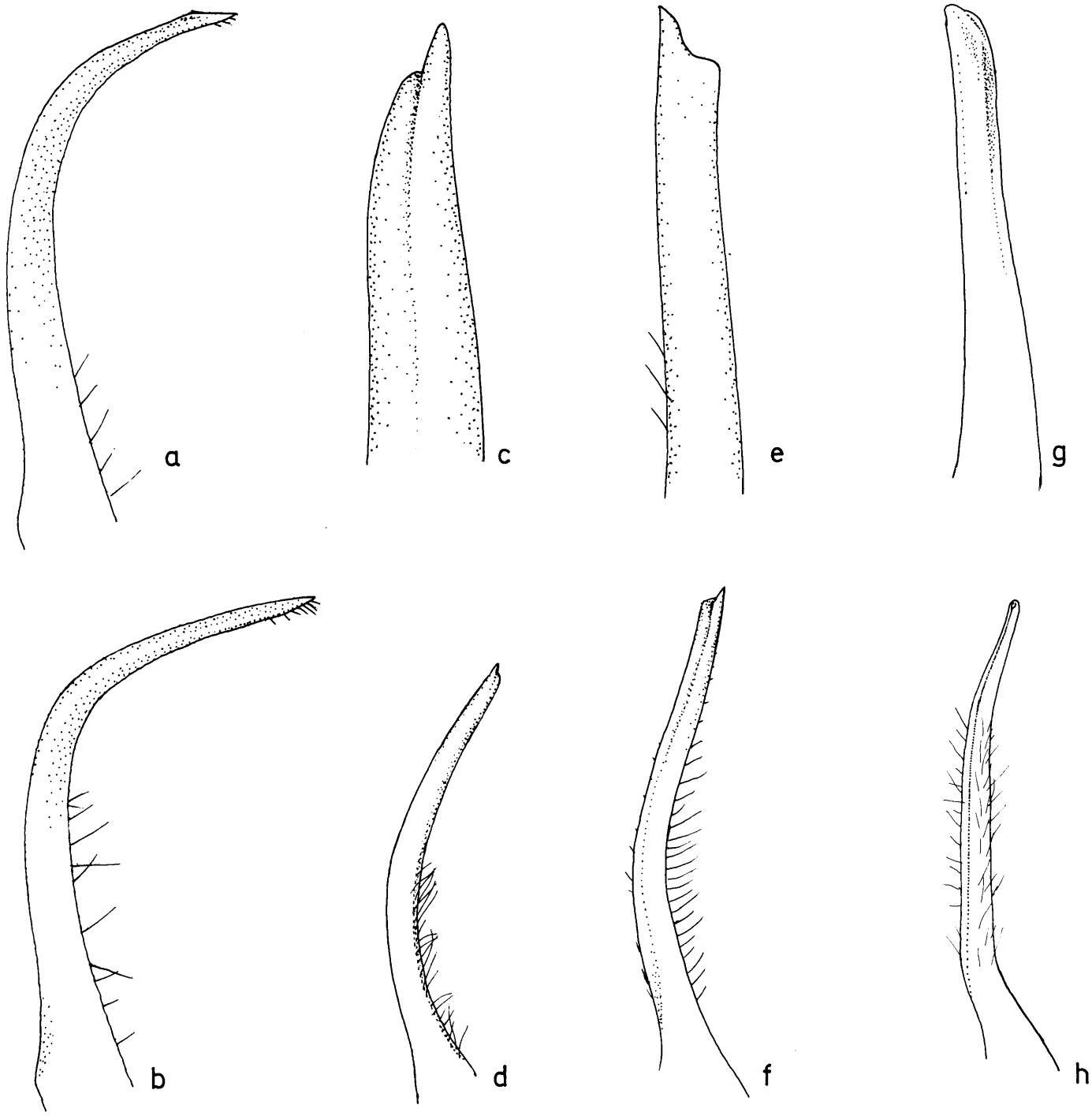

Fig. 102. Left first pleopod of male of *Micippa parca* (12 mm, Sulu Archipelago, ZMA) (a) abdominal view of pleopod; *M. margaritifera* (12 mm, Sulu Archipelago, ZMA) (b) abdominal view of pleopod; *M. excavata* (AM P.13982) (c) sternal tip of pleopod, (d) abdominal view of pleopod; *M. spinosa* (AM P.180) (e) sternal tip of pleopod, (f) abdominal view of pleopod; *Cyclocoeloma tuberculata* (36.5 mm, AM P.23824); (g) sternal tip of pleopod, (h) abdominal view of pleopod.

Thailand, Koh Kahdat, 7-9 m, sand, stones and coral, 15-18 February 1900; 1 spec. — Gulf of Thailand, S. of Koh Mak, 9-11 m, dredge, 17 February 1900; 3 specs.

Mortensen Pacific Expedition: Sulu Archipelago, off Marongas, 36-54 m, dredge, sand, coral, 19 March 1914; 2 specs.

Danish Kei Islands Expedition: Stn. 30, Kai Is., between Doe Roa and Kai Doelah, 40 m, trawl, sand, shells, 18 April 1922; 3 specs. — Off Neira Banda, ca. 20 m, dive, sand, 1 June 1922; 1 spec. — Banda, off Kombir, ca. 70-90 m, sand, 7 June 1922; 1 spec. — Stn. 67, Java Sea, 05°48′S 106°12′E, 38 m, sand, 27 July 1922; 1 spec.

Snellius Expedition: Moluccas, Morotai, 3-10 June 1930; 1 spec.

Danish Expedition to Iran: Stn. 39D, Iranian Gulf, 12 nautical miles ENE. of the lightship at Bahrein, 23 m, shell gravel, coll. G. Thorson, 27 March 1937; 1 spec. (ZMC unreg. det. K. Stephensen as *M. philyra* var. *mascarenica*).

5 Thai-Danish Expedition: Stn. 1154, West Malay Peninsula, 09°11′N 98°13′E, 20 m, coarse 'Amphioxus' sand, 5 March 1966; 1 spec.

Sumatra: 1917; 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. KR VI, Kai Is., N. of Du Rowa I., N. of Nuhu Rowa, 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., off Elat Bay, W. coast of Nuhu Tjut, 05°40′S 132°59′E, 48-54 m, dredge haul 6, rubble, algae and sand, 13 June 1970; 1 spec.

Remarks. — Buitendijk has adequately distinguished this species from *M. platipes* and given a complete bibliography of both species. In addition to the differences listed by Buitendijk we also note the following: in the upper orbital border of *M. philyra* the antorbital and intercalated spines are adjacent only in the basal half or two thirds and are distally separated by a wide V-shaped hiatus whereas in *M. platipes* these two spines are adjacent for their whole length; in *M. platipes* the postorbital spine has a flattened lobe on the posterior margin which is not present in *M. philyra*.

The holotype of *Cancer philyra* Herbst (ZM Berlin 77, ♀ cl. 22.1 mm) and the syntypes of *Paramicippa asperimanus* Miers (BMNH 82.24, 2♂♂, 5♀♀ (1 ovig.) 8.5-17.4 mm), considered a synonym since Miers (1885), have been examined.

Distribution. — Indo-West Pacific from east Africa to Japan and Australia.

Micippa platipes Rüppell, 1830

Micippe platipes Rüppell, 1830: 8-10, pl. 1 fig. 4.
Micippa platipes. — Buitendijk, 1939: 254-256, pl. 10 figs. 2, 4, text fig. 22. — Takeda, 1973a: 113, fig. 4G. — Griffin & Tranter, 1974: 176.
Micippa bicarinata. — Ward, 1941: 1 (in list).

Material examined. — 10♂♂, 20♀♀ (5 ovig.), 7.5-36 mm, smallest ovig. ovig. ♀, 10 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 16, Java Sea, S coast of Kangeang, Bay of Kankamaraan, 06°59′S 115°24.7′E, to 22 m, shore exploration, Hensen net, mud, 15-16 March 1899; 1 spec. — Stn. 127, Celebes Sea, Great Sangir I., Taruna Bay, 45 m, trawl, fine dark coloured sand, 20-21 July 1899; 1 spec. — Stn. 162, Irian Jaya, between Loslos and Broken Is., W. coast of Saluwati, 18 m, dredge, coarse and fine sand with clay and shells, 18 August 1899; 1 spec. (ZMA De.100.814, det. Ihle). — Stn. 193, Moluccas, E. coast of Sula Besi, Sanana Bay, 22 m, reef exploration, mud 13-14 September 1899; 1 spec. (ZMA De.100.815, det. Ihle). — Ambon, Ambon Reef; 3 specs. (ZMA.De 100.703, det. Ihle as *M. philyra*). — Ambon, Ambon Reef; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java-S.Africa Expedition: Mauritius, Cannonier's Point, coral reef, 17 September 1929; 1 spec. — Mauritius, Ilot Marianee, coral reef, November 1929; 1 spec.

'Galathea' Expedition (1846): Nicobars, Pulo Milu, coll. Reinhardt, ? 1846; 1 spec.

Sri Lanka: Krusadai, coll. H. Lemche (Stn. 27), 15 October 1951; 1 spec. — Galle, coll. H. Lemche, 19 October 1951; 1 spec.

'Te Vega' Expedition: North Tonga, Niuatobutabu, 15°58′S 173°48′W, tidal flat with coral mud, coll. T. Wolff, 1 June 1965; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Netherlands New Guinea Expedition: Stn. N628, Irian Jaya, N. of Jayapura, Pacific Ocean coast, beach (at Base G), slow spider crabs from among corals fished up from reef and broken up on shore, coll. L. B. Holthuis, 12 November 1954; 2 specs. — Stn. W636, Irian Jaya, N. of Jayapura, reef (by Base G), crabs among coral, coll. L. B. Holthuis, 27 November 1954; 3 specs. — Stn. 683, Biak, W. of Sorido, reef in front of naval barracks, in coral, January 1955; 2 specs. — Stn. 722, Irian Jaya, shore of Manokwari Bay, near town, under coral on shore and in living coral in the sea, 14 March 1955; 1 spec.

Kenya, Tiwi Beach, 10 miles (16 km) S. of Mombasa, 0-0.5 m, coll. L. B. Holthuis, 25 November 1969; 4 specs.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. TJ II, Kai Is., Tanimbar, W. side of Namwaan I., NW. Jamdena, 07°07′S 131°26′E, 0-3 m, snorkel collecting, coral reef, muddy stones close to shore 23 June 1970; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Philippine Islands, Mindanao, Davao Gulf, Padado Beach, coll. G. R. Oesch, 14-16-19 March 1936; 2 specs. (det. M. Ward as *M. bicarinata*).

Remarks. — This species was adequately distinguished from *M. philyra* by Buitendijk (1939) and a full bibliography given. Additional differences are discussed here under *M. philyra*.

We have examined two specimens from the Davao Gulf, Philippine Islands identified by Ward (1941) as *M. bicarinata* Adams & White: we consider them to be *M. platipes*.

Distribution. — Widespread throughout the Indo-West Pacific.

Micippa spinosa Stimpson, 1857
(Figs. 101a, 102e,f)

Micippa spinosa Stimpson, 1857: 218; 1907: 14-15, pl. 1 fig. 2. — Miers, 1885: 8-9. — Griffin, 1966b: 288 (in key); 1972: 73.
Paramicippe affinis Miers, 1879a: 13.
Paramicippa spinosa. — Hale, 1927: 140-141, fig. 143.

Remarks. — No new material has been examined. This species has been adequately described previously and there are also recent additional notes (Griffin, 1972). However, neither the ventral orbit nor the first pleopod of the male has been figured before. We therefore take the opportunity to do so now. The adult male (cl. 21 mm) figured was selected from a series (AM P.180) of 35 males and 39 females from Port Jackson. The first pleopod of the male is broad, weakly curved outwards, hardly tapering, the lateral edge of the apex with a small sharp lobe projecting beyond the aperture which is subterminal and situated on the abdominal surface.

Distribution. — South-eastern Australia from Port Stephens (N.S.W.) to Bass Strait and eastern South Australia.

Micippa thalia (Herbst, 1803)

Cancer thalia Herbst, 1803: 50-51, pl. 58 fig. 3.
Micippa thalia. — A. Milne Edwards, 1872: 238-239, pl. 11 figs. 1, 1a-b. — Alcock, 1895: 251-252. — Sakai, 1965a: 90, pl. 42 fig. 3; 1976: 256-257, fig. 137b, pl. 90 fig. 1. — Takeda, 1973a: fig. 4F. — Griffin, 1974: 21. — Griffin & Tranter, 1974: 177.

Material examined. — 7♂♂, 3♀♀, 1 juv., 6-26 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 164, Ceram Sea, 01°42.5'S 130°47'E, 32 m, dredge, sand, small stones and shells, 20 August 1899; 2 specs. — Sulawesi, Makassar, 27-32 m; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Siam Expedition: between Koh Kut and Koh Kahdat, 18 m, dredge, shell bottom, 10 January 1900; 1 spec. — Off Koh Sakait, 9-11 m, dredge, hard bottom, 23 February 1900; 1 spec.

Mortensen Pacific Expedition: Sulu Archipelago, off Marongas, 36-45 m, dredge, sand, coral, 19 March 1914; 1 spec.

Danish Kei Islands Expedition: Stn. 72, Java Sea, 05°41'S 105°57'E, trawl, stones, 28 July 1922; 1 spec.

Sri Lanka, Trincomali, 11 m; 2 specs. — Japan, Nagasaki, coll. James Jordan, 1909; 1 spec.

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, 25-27 m, dredge haul 3, broken shell and coral, sponge and mud, 20 June 1970; 1 spec.

Remarks. — In this species the orbit is incomplete below, the suborbital lobe is small and separate from the basal antennal article. Dorsally the antorbital lobe, the intercalated spine and the postorbital lobe are separate.

On all these specimens there are two mesogastric spines and one dorsal branchial spine. There is a spine or tubercle on the supraorbital eave in all except in one specimen from Sri Lanka.

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

Distribution. — Indo-West Pacific from Africa to Japan and Australia.

Paranaxia Rathbun, 1924

Type species. — *Pisa serpulifera* Guérin, 1829 , by designation of Rathbun, 1924.

Remarks. — The single distinctive species of this genus is unusual in that the young develop directly to juvenile crabs (Rathbun, 1914).

The orbit is closed above and below but there is no intercalated spine or suborbital lobe.

Distribution. — Western and northern Australia.

Paranaxia serpulifera (Guérin, 1829) (Fig. 103)

Pisa serpulifera Guérin, 1829, pl. 8 figs. 2-2d.
Naxia serpulifera. — H. Milne Edwards, 1834: 313-314.
Naxioides serpulifera. — Rathbun, 1914: 661-662, pl. 2 figs 9, 10.
Paranaxia serpulifera. — Rathbun, 1924: 7. — Griffin, 1966b: 266, 288 (in key), pl. 17 fig. a. — Sakai, 1976: 264-265, text fig. 143.

Remarks. — No new material has been examined. In the male both the abdomen and the sternum are excavated, the pits being distinctly rimmed. The first pleopod of the male curves outwards distally and the opening is subterminal and abdominal.

Until further specimens confirm the presence of this species in Japan we consider its distribution limited to western and northern Australia and the carapace recorded from the Kii Peninsula by Sakai (1976) as probably a specimen brought back to Japan from northern Australian waters by a fishing boat.

Distribution. — Western and northern Australia.

Tiarinia Dana, 1851

Type species. — *Pisa cornigera* Latreille, 1825, by subsequent designation of Miers, 1879.

Remarks. — *Tiarinia* is a predominantly West Pacific genus, only three of the eleven species occurring in the Indian Ocean. The present study recognises five new species. One species, *Tiarinia elegans* Haswell has been removed to a new genus in the Pisinae.

Distribution. — Indo-West Pacific.

KEY TO THE SPECIES OF *TIARINIA*

1		Rostrum with lateral accessory spines 2
—		Rostrum without lateral accessory spines 4
2(	1)	Sixth segment of abdomen in male twice as wide as long, wider than fifth segment; gonopore of female ovate ..... *T. takedai*
—		Sixth segment of abdomen in male hardly wider than long, fifth segment wider than sixth; gonopore of female more or less abruptly narrowed medially, 'keyhole' — shaped 3
3(	2)	First pleopod of male curving outwards at apex which is simple and only slightly narrowed, opening apical; medial portion of gonopore of female reduced to a slit ..... *T. alidae*
—		First pleopod of male straight distally, apex truncate with a broad rounded medial subapical lobe, opening subterminal; medial portion of gonopore of female narrower than lateral portion but not a slit ..... *T. angusta*
4(	1)	Branchial region with a well developed epibranchial spine 5
—		Branchial region tuberculate but without a well developed epibranchial spine 6
5(	4)	Two prominent subdorsal spines behind epibranchial spine; rostrum 1/4 postrostral carapace length ..... *T. spinigera*
—		No branchial spines behind epibranchial spine; rostrum 1/3 postrostral carapace length ..... *T. tiarata*
6(	4)	Basal antennal article with a strong anterolateral spine 7
—		Basal antennal article with anterolateral angle acute or right angled but without a spine 9
7(	6)	Posterior margin of carapace smooth ..... *T. macrospinosa*
—		Posterior margin of carapace tuberculate 8
8(	7)	Large tubercles on midline of carapace more pronounced than lateral branchial tubercles; ambulatory legs tuberculate ..... *T. cornigera*
—		Tubercles on midline of carapace low, less pronounced than large lateral branchial tubercles; ambulatory legs smooth or with indistinct tubercles ..... *T. gracilis*
9(	6)	Carapace with a few large 'islet-like' tubercles; surface beneath tomentum otherwise smooth ..... *T. garthi*
—		Carapace weakly or evenly tuberculate without any 'islet-like' tubercles 10
10(	9)	Rostral spines about 1/4 postrostral carapace length, strongly tapering from base to narrow apex; anteromedial branchial region weakly tuberculate ..... *T. mooloolah*

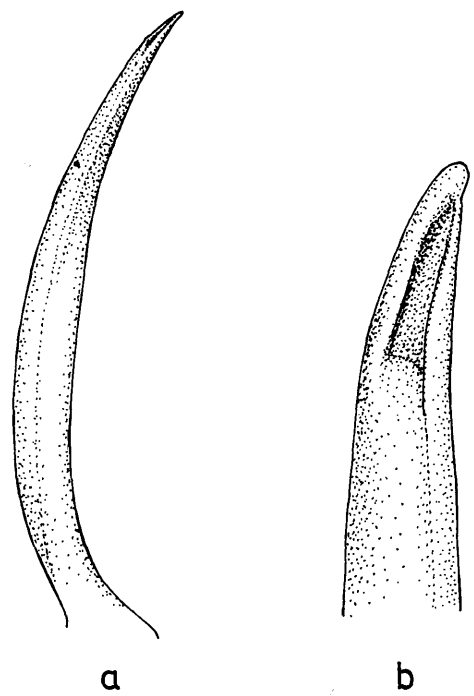


Fig. 103. Left first pleopod of male *Paranaxia serpulifera* (110 mm, AM P.13871) (a) abdominal view of pleopod, (b) abdominal-medial tip of same.

— Rostral spines more than 1/3 postrostral carapace length, weakly tapering from base to blunt apex; anteromedial angle of branchial region with a group of large rounded tubercles ..... *T. dana*

Tiarinia alidae new species

(Figs. 104, 105b, 111a,d,e)

Tiarinia angusta. — Buitendijk, 1939: in part, fig. 24. (Not *Tiarinia angusta* Dana, 1852.)

Material examined. — 2 ♂♂, 6 ♀♀ (4 ovig.), 20-39.5 mm, smallest ovig. ♀, 31.5 mm.
Holotype. — Female (ovigerous), cl. 39.5 mm. Philippine Islands, Sulu Archipelago, Tawi Tawi Group, 18 m, coral sand, 21 February 1908, 'Albatross' Philippine Expedition 1907-8, Stn. 5159, Smithsonian Institution USNM 49695 (in part), det. M. Rathbun as *Tiarinia angusta.*
Paratypes. As listed below.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Is., Sapeh Strait, 08°23.5′S 119°4.6′E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec. (ZMA De. 100.726, det. Ihle as *T. angusta*). — Stn. 169, W. coast of Irian Jaya, anchorage off Atjatuning, 57 m, trawl, dredge, townet, reef exploration, mud, 23/25 August 1899; 1 spec. — S. Sulawesi, Salajar; 1 spec. (ZMA De. 100.644, det. Ihle as *T. angusta*). — no locality; 2 specs. (ZMA De. 100.848, in part, det. Ihle as *T. angusta*).

SMITHSONIAN INSTITUTION, WASHINGTON

'Albatross' Philippine Expedition: Stn. 5159, (data as for holotype); 1 spec (USNM 49695, in part). — Stn. 5160, Sulu Archipelago, Tawi Tawi Group, 22 m, sand, 22 February 1908; 1 spec. (USNM 47374). — S. Sulawesi, Great Tobea I., Buton Strait, tide pool, 15 December 1909; 1 spec. (USNM 49560). (All det. M. Rathbun as *T. angusta.*)

Description. — Carapace width about two thirds postrostral carapace length, surface tuberculate.

Rostrum of two contiguous spines from 0.37 to 0.5 postrostral carapace length, separated at apex (sometimes divergent), with two or three lateral accessory spines on proximal half. Rostral ridges tuberculate.

Orbit above consisting of a strongly expanded eave; preorbital spine directed obliquely forward; supraorbital eave with a tubercle midway along; antorbital angle adjacent to postorbital lobe distally, but basally separated by a small slit; postorbital lobe with a tubercle on antero-external angle.

Hepatic and subhepatic regions tuberculate. Branchial region tuberculate with a large sharp epibranchial tubercle on lateral margin.

Mesogastric region with three medial groups of tubercles anteriorly and posteriorly two submedial pairs of groups of tubercles; protogastric region with an anterior and posterior group of tubercles. Urogastric region with a medial group of tubercles. Cardiac region with three large tubercles in form of a triangle, base forwards, and several small tubercles. Intestinal region tuberculate with three large tubercles in a triangle anteriorly, a large lateral tubercle just behind this group and two to four large tubercles along posterior margin.

Basal antennal article broad, a shallow longitudinal groove centrally, anterolateral angle produced to a spine, lateral edge sinuous, base adjacent to postorbital lobe.

Merus of third maxilliped with anterolateral angle strongly produced and rounded.

Pterygostomian region smooth except for two small tubercles, margin with two large blunt tubercles, posterior one more dorsal.

Sternum of male smooth, lateral lobes rounded, broad.

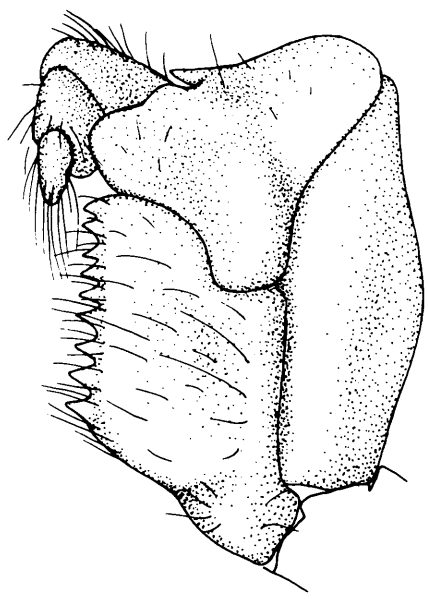
(We have not been able to examine an adult male so the description of the cheliped is based on an immature male and an adult female.) Merus with four dorsal tubercles, three large and one small and a sharp terminal spine curved somewhat forwards; ventrally one tubercle on inner edge and two tubercles on outer edge. Carpus smooth, sometimes with a low dorsal tubercle. Chela not enlarged on larger male (26.5 mm), length of palm more than two and a half times height, no gape between fingers.

Merus of first ambulatory leg with a row of four to five dorsal tubercles and on posterior slope three small tubercles, one distal and two proximally; no terminal spine; carpus flattened dorsally with a broad blunt tubercle at anterodistal angle. Dactyl with six to nine small teeth ventrally.

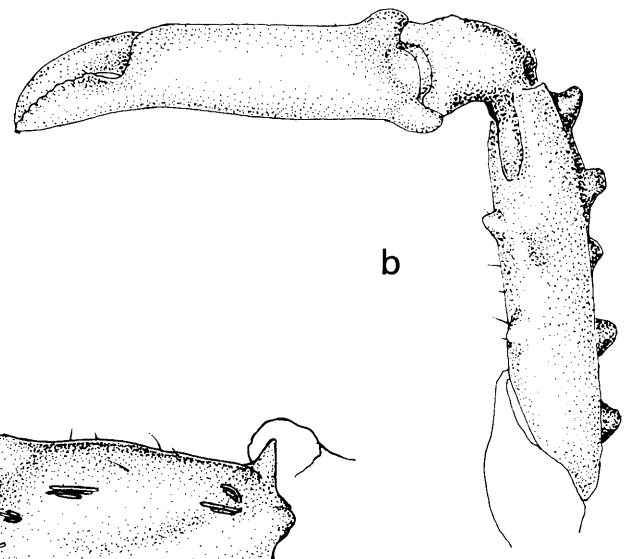
Male abdomen with fourth segment narrowing distally, basal width more than twice length; fifth and sixth segments slightly wider (1.3) than long; seventh segment slightly longer (1.3) than wide.

First pleopod of male (figured by Buitendijk, 1939) curving outwards at apex which is simple and only slightly narrowed, opening apical.

Gonopore of female opening ventrally, laterally rounded but in medial third opening reduced to a 'keyhole' by anterior and posterior lobes.



a



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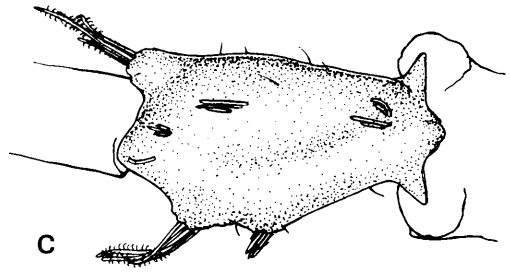

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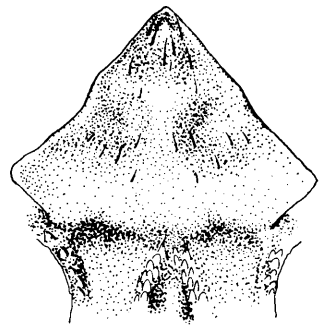

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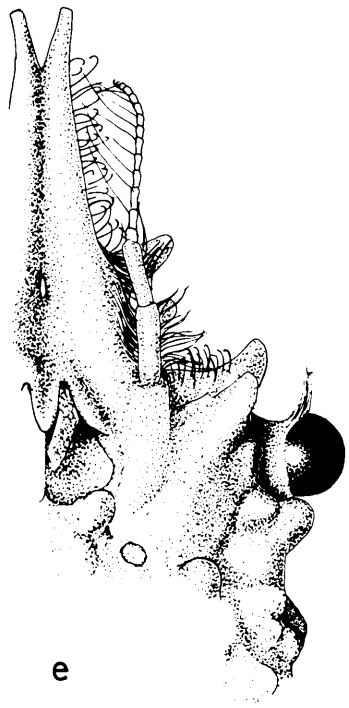

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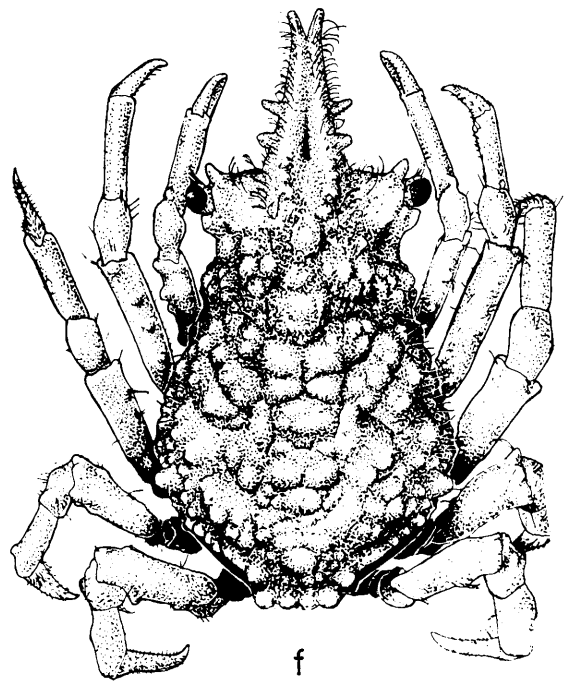
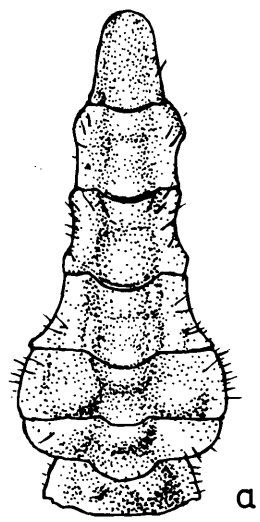
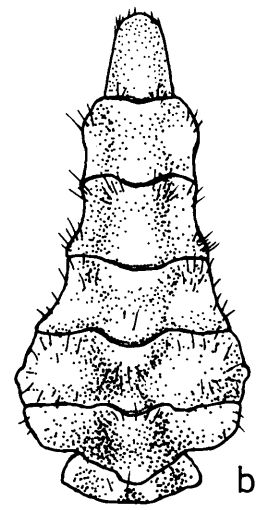
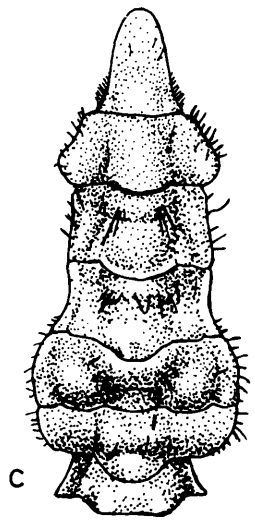


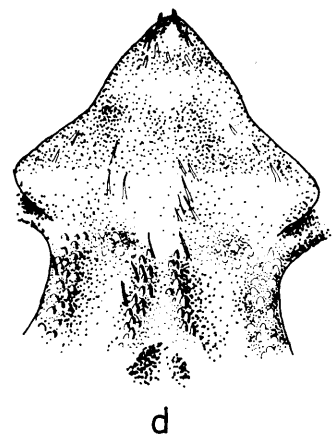
f

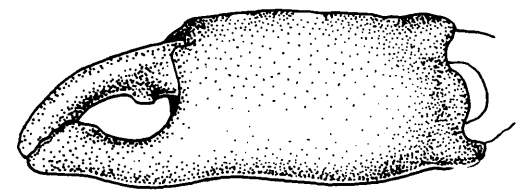
Fig. 104. *Tiarinia alidae* (female, 39.5 mm, USNM 49695, in part) (a) left third maxilliped; (b) left cheliped; (c) carpus of left first ambulatory leg, dorsal view; (male, 27 mm, ZMA De. 100.848) (d) male sternum; (holotype) (e) left orbit, ventral view; (f) whole animal, dorsal view.

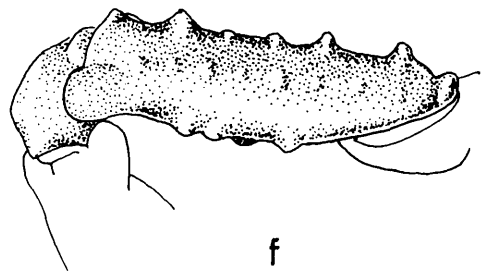












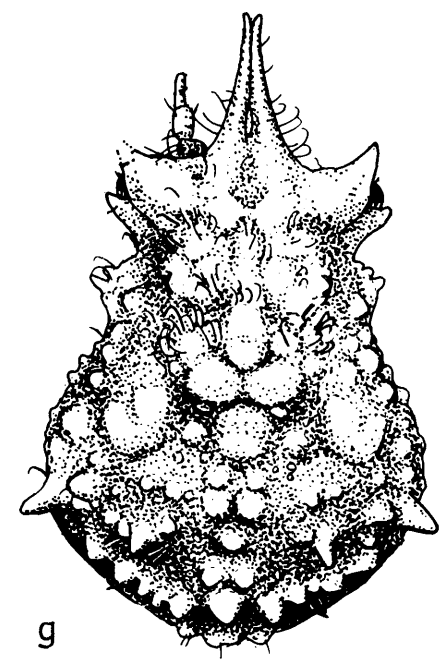


Fig. 105. *Tiarinia angusta* (neotype) (a) male abdomen; *T. alidae* (male, 27 mm, ZMA De.100.848) (b) male abdomen; *T. takedai* (holotype) (c) male abdomen; *T. angusta* (neotype) (d) male sternum; (e) left chela; (f) left cheliped, merus and carpus; *T. spinigera* (female, ovig., 19.5 mm, ZMA De. 100.853, in part) (g) carapace, dorsal view.

Remarks. — The basis of the decision to separate this series as a new species and the status of *T. angusta* are discussed under that species.

This species is very similar to *T. angusta* and *T. takedai* and is distinguished from them by the shape of the first pleopod of the male and the presence of two medial lobes on the female gonopore. In addition, the lateral lobes of the sternum are broader at their apex than in *T. takedai* but not as broad as in *T. angusta*; the terminal spine on the merus of the cheliped is more pronounced than in either of the two similar species; the carpus of the first ambulatory leg is slightly narrower (l = 1.5-1.8 w) than in *T. angusta* (l = 1.3-1.6 w); and the fifth and sixth segments of the male abdomen are narrower (l = $^3/_4$ w) than in *T. takedai* (l = $^1/_2$ w).

Buitendijk (1939) figured the first pleopod of a male from Sapoeka Besar, Postillon Is, Flores Sea, under the name

T. angusta. Unfortunately the only two males in our series (Siboga Exped., ZMA De. 100.484 (in part) det. Ihle as *T. angusta*) have no locality data. Because of the variation in the number of accessory spines on the rostrum in these very similar species it is not possible to say how many of the other specimens listed by Buitendijk are conspecific with the male figured by her. In our series of this species there were either two or three, but not four, accessory spines on each rostral spine.

The new species is named in honour of Alida Buitendijk, Dutch carcinologist, whose account of the collections of the Snellius expedition significantly advanced knowledge of tropical Indo-Pacific spider crabs.

Distribution. — Sulu Archipelago, Sulawesi, Flores Sea, Irian Jaya.

Tiarinia angusta Dana, 1852
(Figs. 105a,d-f, 111c,g,h)

Tiarinia angusta Dana, 1852: 113; 1855: pl. 3 fig. 7a,b. — Dai et al., 1978: 228, fig. 4a,b, pl. 1 fig. 4. — Chen, 1980: 131-132, fig. 14, pl. 3, fig. 1.
Tiarinia spinosirostris Haswell, 1882: 28.

Material examined. — *Neotype.* Male, cl. 38.5 mm, Philippine Islands, Sulu Archipelago, Marongas I., shore, coral head, 10 February 1908, 'Albatross' Philippine Expedition 1907-8, Smithsonian Institution USNM 47373 (in part), det. M. Rathbun as *Tiarinia angusta.*

In addition, 32 ♂♂, 35 ♀♀ (24 ovig.), 1 juv., 8.9-50 mm, smallest ovig. ♀, 25 mm, as follows:

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'Albatross' Philippine Expedition: Sulu Archipelago, as for neotype; 5 specs. (USNM 47373, in part, 1♂, 3 imm. ♀♀, 1 juv., det. M. Rathbun as *T. angusta*).

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.100.660). — Stn. 89, N. Makassar Strait, Pulu Kaniungan Ketjil, 11 m, shore exploration, coral, 21 June 1899; 1 spec. (ZMA De. 100.847). — Stn. 91, E. coast of Borneo, Karong Lintang and Pulu Palabangan I., shore exploration, 22 June 1899; 4 specs. (ZMA De. 100.806). — Stn. 144, Moluccas, anchorage N. of Damar I., 45 m, dredge, townet and reef exploration, coral and *Lithothamnion*, 7/9 August 1899; 1 spec. (ZMA De.100.641). — Stn. 301, E. coast of Roti I., Pepela Bay, 10°38′S 123°25.2′E, 22 m, reef exploration, 30 January 1900; 1 spec. (ZMA De.100.642). — Kai Is., Kur I.; 1 spec. (ZMA De. 100.846). (All det. Ihle as *T. angusta.*)

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

'Galathea' Expedition: Nicobar I., Sambelong, coll. Reinhardt; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, Biak I., coll. L. D. Brongersma, February-May 1952; 1 spec. — Netherlands New Guinea Expedition: Irian Jaya, Biak I., W. of Sorido village, reef near naval barracks, February 1955; 2 specs.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AT I, N. of Aru, N. shore of Toba I., 05°21′S 134°27′E, snorkel, shallow coral reef and sand, 14 June 1970; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Western Australia: Broome, Entrance Point, between tides on rocky shore, August 1929; 2 specs. (AM P. 13962). — Cape Leveque, intertidal, 20 August 1929; 9 specs. (AM P.13961).

Northern Territory: Darwin, Dudley Reef, coll. E. Pope, 13 October 1965; 2 specs. (AM P.15217); 24/25 October 1965; 1 spec. (AM P.15219). — Port Darwin, East Point, shore, 9 December 1934; 1 spec. (AM P.10584).

Queensland: Torres Strait, Murray I., August-October 1907; 1 spec. (AM P. 2871); 1 spec. (AM P. 2878); 1 spec. (AM P. 2879). — Murray I.; 9 specs. (AM P. 13960). — Green I.; 1 spec. (AM G. 3276); 1 spec. (AM P. 1283). — Hope I.; 1 spec. (AM P.3777); 1 spec. (AM P. 3778).

Papua New Guinea: Samarai, 16 February 1933; 1 spec. (AM P. 29881, dry).

Solomon Islands: Ysabel, Tunabuli Harbour, reef at Government Station, August-September 1924; 6 specs. (AM P.7639-7644); 1 spec. (AM P.7649). — Malaita, Bita'ama, coll. W. Dawbin, August 1966; 1 spec. (AM P. 15638).

Vanuatu: December 1888; 1 spec. (AM P.772). — Erakot Reef, 4 miles (~ 6.4 km) from Vila, coll. P. Homes, April-May 1974; 1 spec. (AM P.27155).

Philippines: Mindanao, Davao Gulf, Padado Beach, 6-19 July 1936; 1 spec. (AM P.29882, dry, det. M. Ward as *T. angusta*).

Remarks. — This species has been reported on by a number of authors (see synonymy given by Takeda, 1973a: 113) and the whole animal has been figured by Dana (1855), De Man (1895) and Sakai (1936; 1938; 1976). The first pleopod of the male was figured by Buitendijk (1939) and Takeda (1973a): comparing these two figures it is clear they are from different species. In the examination of this rather large series of specimens we have males (agreeing with the general description of *T. angusta*) with three quite distinct types of first pleopod, and females with gonopores of three distinct types. We consider that those specimens previously all described as *T. angusta* belong in fact to three species — *T. angusta*, *T. takedai* n.sp. and *T. alidae* n.sp. These three species, although very similar can be distinguished principally by sexual characters in the adults (see below). By detailed examination of this series it has been possible to determine which adult males and females are conspecific. We have less confidence in identifying immature females, especially those of less than 20 mm carapace length. At present it is not possible from the description and figure of the immature holotype (♂, 12.5 mm, no longer in existence) to assign it to one of these three species. In this series two of the three species are represented in the collection from the type locality (Sulu Archipelago) and we have decided to consider the most widely distributed of these two species as *T. angusta.* (Although *T. alidae* has a longer rostrum without lateral spines on the distal half, as shown in Dana's figure, this is also often true of young forms (< 16 mm) of the other two species.)

Clearly, it is necessary to fix the identity of *T. angusta* and to effect this we have selected as the neotype of this species an adult male from Marongas Island, Sulu Archipelago (38.5 mm, USNM 47373 (in part), det. M. Rathbun as *T. angusta*). There is no adult female of *T. angusta* from Sulu Archipelago in our series. However, from the same locality as the neotype, and collected with it, there are three immature females (cl. 23-25 mm) which, while they cannot be positively

identified as *T. angusta* by the form of the gonopore margin, agree well in other characters with this species, viz. there are four lateral accessory spines on each rostral spine, the lateral lobes of the sternum are broadly rounded and the carpus of the first ambulatory leg is only slightly longer (1.3-1.45 times) than wide. There are both male and female specimens of *T. angusta* from several other localities — NW. Australia, Torres Strait, NE. Australia, Solomon Is, Vanuatu, N. Irian Jaya and Makassar Strait. A juvenile (9.5 mm) collected with the neotype resembles the small male holotype of *T. angusta* (as figured) in having only three small accessory spines on the proximal half of each slender rostral spine. The holotype of *T. spinosirostris* Haswell, is also a small immature male (12.5 mm, AM G. 5139) with three accessory spines on the proximal half of each rostral spine: we see no reason to change the status of *T. spinosirostris* as a synonym of *T. angusta* (see Griffin, 1966b).

Also from the Sulu Archipelago in this series there are three ovigerous females (USNM 47374, 38.5 mm; USNM 49695, 37.0, 39.5 mm, det. M. Rathbun as *T. angusta*) which we have determined as *T. alidae* because on the marginal ridge of the gonopore there are two medial lobes which are lacking in *T. angusta* (discussed further under *T. alidae*).

This species as now understood is distinguished from *T. takedai* and *T. alidae* by the shape of the first pleopod of the male and the lack of any marginal ridge around the female gonopore. The male pleopod is straight and the apex truncate with a broad rounded medial lobe just below the apex, the opening is sternal and subterminal.

The rostrum varies from 0.3-0.47 of the postrostral carapace length, there are three or four lateral spines of which the most distal pair is usually on the distal half. The lateral lobes of the sternum are broader and more rounded than in either *T. takedai* or *T. alidae*.

The terminal spine on the cheliped is low, and blunt, especially in adults. In the largest males (cl. 40-50 mm) the chela is enlarged (l < 2 w), there is a large gape between the fingers and a large tooth on the dactyl in the gape. On the merus of the first ambulatory leg there is a row of four or five tubercles dorsally and one proximal and two or three distal tubercles on outer (posterior) face. The carpus is slightly broader (l = 1.3-1.6 w) and the anterodistal tubercle narrower and more acute than in *T. takedai* or *T. alidae*. The dactyl is armed with three to six small teeth.

This species appears to be more widely distributed than either *T. takedai* or *T. alidae*.

Distribution. — Nicobar I., Makassar Strait, S. Philippine Is., Moluccas, China, Timor, Irian Jaya, Papua New Guinea, Solomon Is., Vanuatu and N. Australian coast from Broome (W.A.) across to Moreton Bay, (Queensland).

Tiarinia cornigera (Latreille, 1825)

Pisa cornigera Latreille, 1825: 141.
Pericera cornigera. — Adams & White, 1848: 18.
Tiarinia cornigera. — Buitendijk, 1939: 259; pl. 11 fig. 1, text fig. 25. — Griffin, 1976: 216. — Sakai, 1976: 259-260, pl. 91 fig. 1.

Material examined. — 21 ♂♂, 49 ♀♀, (30 ovig.) 9.5-32 mm, smallest ovig. ♀, 13.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Islands, Sapeh Strait, 08°23.5'S 119°04.6'E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec. (ZMA De. 100.736, det Ihle). — Stn. 60, Timor, Samau I., Haingsisi, 23 m, shore exploration, reef, *Lithothamnion* in 3 m and less, 27/28 April 1899; 2 specs. (ZMA De. 100.737, det. Ihle). — Stn. 81, Makassar Strait (Borneo Bank), Pulu Sebangkatan, 34 m, dredge and shore exploration, coral and *Lithothamnion*, 14 June 1899; 2 specs. (ZMA. De.100.728, det. Ihle as *T. gracilis*). — Stn. 93, Sulu Archipelago, Tawi Tawi Is., Pulu Sanguisiapo, 12 m, dredge, townet and reef exploration, *Lithothamnion*, sand and coral, 24/25 June 1899; 4 specs. — Stn. 133, N. Sulawesi, Salibabu I., anchorage off Lirung, up to 36 m, trawl, dredge and reef exploration, mud and hard sand, 25/27 July 1899; 1 spec. (ZMA De.100.729, det. Ihle as *T. gracilis*). — Stn. 193, Moluccas, Sanana Bay, east coast of Sula Besi I., 22 m, reef exploration, mud, 13/14 September 1899; 10 specs. (ZMA De.100.851 (in part), det. Ihle). — Stn. 220, Banda Sea, west coast of Binongka, anchorage off Pasir Pandjang, reef exploration, 1/3 November 1899; 1 spec. (ZMA De.100.739, det. Ihle). — Stn. 225, Banda Sea, south of Lucipara I., 894 m, horizontal cylinder, coral and shells, 8 November 1899; 1 spec. (ZMA De.100.645 (in part), det. Ihle as *T. gracilis*). — Stn. 282, anchorage between Nusa Besi and NE. point of Timor, 08°25.2'S 127°18.4'E, 27-54 m, reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. (ZMA De.100.892, det. Ihle as *Schizophrys aspera*). — Stn. 299, south coast of Roti I., Boeka or Cyrus Bay, 10°52.4'S 123°01.1'E, reef exploration, 27/29 January 1900; 1 spec. (ZMA De.100.850, det. Ihle). — Ambon Reef; 2 specs. (ZMA De.100.849, det. Ihle). — Ambon Reef; 1 spec. — Kai Is., Kur I., reef; 1 spec. (ZMA De.100.732 (in part), det. Ihle as *T. gracilis*).

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Philippine Is, Zamboanga, Little St. Cruz I., coral reef, 28 February 1914; 1 spec. — Japan, Misaki, under stones, 28 April 1914; 4 specs. — Japan, Misaki, under stones, 28 June 1914; 1 spec. — Japan, (?) Nagasaki, coll. James Jordan; 2 specs.

Danish Kei Islands Expedition: Kai Is, Toeal, 0-1 m, 20/21 March 1922; 1 spec.

'Galathea' Expedition: Stn. 415, Philippine Is., Dinagat, Tubajon Bay, 10°20'N 125°32'E, coral reef, tidal zone, 18 July 1951; 4 specs.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, Pasir Poetih, near Manokwari, coll. J. C. Bauwens, received 1952; 1 spec.

Netherlands New Guinea Expedition, 1954-55: Stn. N 628, Irian Jaya, Pacific Coast, N. of Jayapura, beach (at base G), coll. L. B. Holthuis, 12 November 1954; 4 specs. — Stn. W 636, Irian Jaya, N. of Jayapura, reef (by Base G), crabs among coral, coll. L. B. Holthuis, 27 November 1954; 5 specs. — Stn. 683, Biak I., W. of Sorido village, reef in front of naval barracks, in coral, January 1955; 3 specs. — Biak I., W. of Sorido village, reef near naval barracks, February 1955; 3 specs. — Stn. 683F, Biak I., W. of Sorido, reef near naval barracks, among *Montipora* spec., 23 March 1955; 1 spec. — Biak I., W. of Sorido, reef near naval barracks, 2 May 1955; 7 specs.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. KL I, Moluccas, S. end of Kajoa I., 00°5'S 127°27'E, to 3 m, snorkeling, coarse sand cay with marginal corals, 21 May 1970; 1 spec. — Stn. OG I, Moluccas, S. coast of Gomumu I., S. of Obi I., 01°52'S 127°36'E, snorkeling, 23 May 1970; 1 spec. — Stn. KR I, Kai Is., W. of Tonguin I., W. side of Nuhu Rowa, 05°48'S 132°30'E, 9 June 1970; 1 spec. — Stn. TS IV, Tanimbar, Selaru, N. side of Labuan Olendir, 08°07'S 13°59'E, 26 June 1970, 1 spec.

WESTERN AUSTRALIAN MUSEUM, PERTH

Philippine Islands, Sulu Archipelago, near Siasi I., N. of Laminusa I., sponge and coral, coll. B. R. Wilson, 'Pele', 17 February 1964; 1 spec. (WAM 40-67).

Remarks. — This species is similar to *T. gracilis* and the characters which distinguish it from that species have been listed by Buitendijk (i.e. first pleopod of male wider distally, merus of first ambulatory leg more tubercular, tubercles in midline of carapace larger). In addition, we find that on the basal antennal article of *T. cornigera* there is a ridge running obliquely backwards from the anterolateral spine and separated from the swollen area at the base of the free segments by a pronounced groove whereas in *T. gracilis* there is no such strongly marked ridge and groove on the basal antennal article. The specimens from Japan (ZMC) are larger at maturity than those from the Philippines and Indonesia, and the carapace tubercles especially on the gastric region, are sharper.

This species is distinguished from *T. spinigera* by the absence of the three strong branchial spines present in that species, by having the outer margin of the supraorbital eave concave (it is straight in *T. spinigera*) and by the broader apex of the first male pleopod.

Distribution. — Indo-West Pacific: Japan through Philippines to Australia and to the Andaman Sea.

Tiarinia dana new species
(Figs. 106, 107c, 112e,f)

Material examined. — 3♂♂, 2♀♀ (1 ovig.), 6.5-21.5 mm, ovig. ♀, 19 mm.

Holotype. — Male, cl. 21.5 mm, Moluccas, Biaro Island, 0-0.5 m, 6 July 1929, 'Dana' Stn. 3743; Zoological Museum, University of Copenhagen.

Paratypes. As listed below:

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 172, Ceram Sea, anchorage between Geser and Seram Laut, 18 m, reef exploration, coral and *Lithothamnion* bottom, 26/28 August 1899; 1 spec. (ZMA De. 100.738, det. Ihle as *T. cornigera*).

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Netherlands New Guinea Expedition 1954-55: Stn. 683, Irian Jaya, Biak I., W. of Sorido village, reef in front of naval barracks, January 1955; 2 specs. — Irian Jaya, Biak I., W. of Sorido village, near naval barracks, April 1955; 1 spec.

Description. — Carapace width 3/4 postrostral length, surface tuberculate, covered by a low tomentum with longer hairs on tubercles.

Rostrum of two slender, contiguous, scarcely tapering spines, weakly upcurved distally, length equal to 1/3 — 1/2 postrostral carapace length; surface with rows of curled hairs.

Orbit above consisting of a strongly expanded eave and broad preorbital spine directed forward but not upward. Anterior margin of postorbital lobe convex, tip truncate. Antorbital angle adjacent to anteromedial angle of postorbital lobe in adult male, almost reaching it in female, so as to close orbit above; separation greater in young female and male. Eyestalk smooth, almost covered by orbital eave, cornea terminal, ventral.

Hepatic region rounded with many small tubercles.

Mesogastric region not greatly elevated; most anterior tubercle forms with two pairs of protogastric tubercles an anteriorly convex row of five tubercles, behind that, two medial tubercles and posteriorly a pair of submedial tubercles. Three pairs of small protogastric tubercles laterally, close to orbit and a posterior pair of larger submedial tubercles, other tubercles laterally. A single urogastric tubercle.

Cardiac region with a pair of submedial tubercles and a medial tubercle behind them. Intestinal region with one medial tubercle, and one small lateral tubercle; a weak ridge above posterior margin; posterior margin without tubercles but with a few long hairs.

Branchial region fairly evenly tuberculate, a group of large rounded tubercles anteriorly (in female two posterior tubercles are sharper); one submarginal tubercle, anteriorly, in line with those on pterygostomian margin.

Basal antennal article extremely broad, a shallow, longitudinal groove centrally, surface otherwise smooth; anterolateral angle almost a right angle, not produced as a spine. Edge of postorbital lobe slightly overlapping basal antennal article only in adult male.

Pterygostomian region with tubercles in two irregular parallel rows, one on margin.

Third maxilliped merus with anterolateral angle produced into a rounded lobe.

Male sternum with low ridges but no tubercles.

Cheliped merus with three dorsal tubercles and a terminal tubercle (or spine in female and young male), a few ventral tubercles; carpus with a few scattered tubercles; chela of large male with fingers only slightly gaping, both dactyl and fixed finger with small teeth in gape.

Ambulatory legs slender, smooth, merus cylindrical with groups of curled hairs dorsally in a central row and scattered plumose setae. Dactyl of fourth leg with five to seven small teeth ventrally along its length.

Male abdomen with sixth segment broader (1.5) than long; seventh segment longer (in holotype twice, in small male 1.5 times) than broad. Female abdomen smooth.

First pleopod of male straight, narrowing slightly before widening at apex (shaft with setae in large male).

Gonopore of female a simple, oval, anterior opening.

Remarks. — This species resembles *T. macrospinosa* in the large preorbital spine, the absence of tubercles on the posterior margin of the carapace and the smooth, cylindrical ambulatory legs. It can be distinguished from *T. macrospinosa* by the preorbital spine which is directed forward (not anterolaterally); the anterior edge of the postorbital lobe which is convex (not concave); the presence of only one tuber-

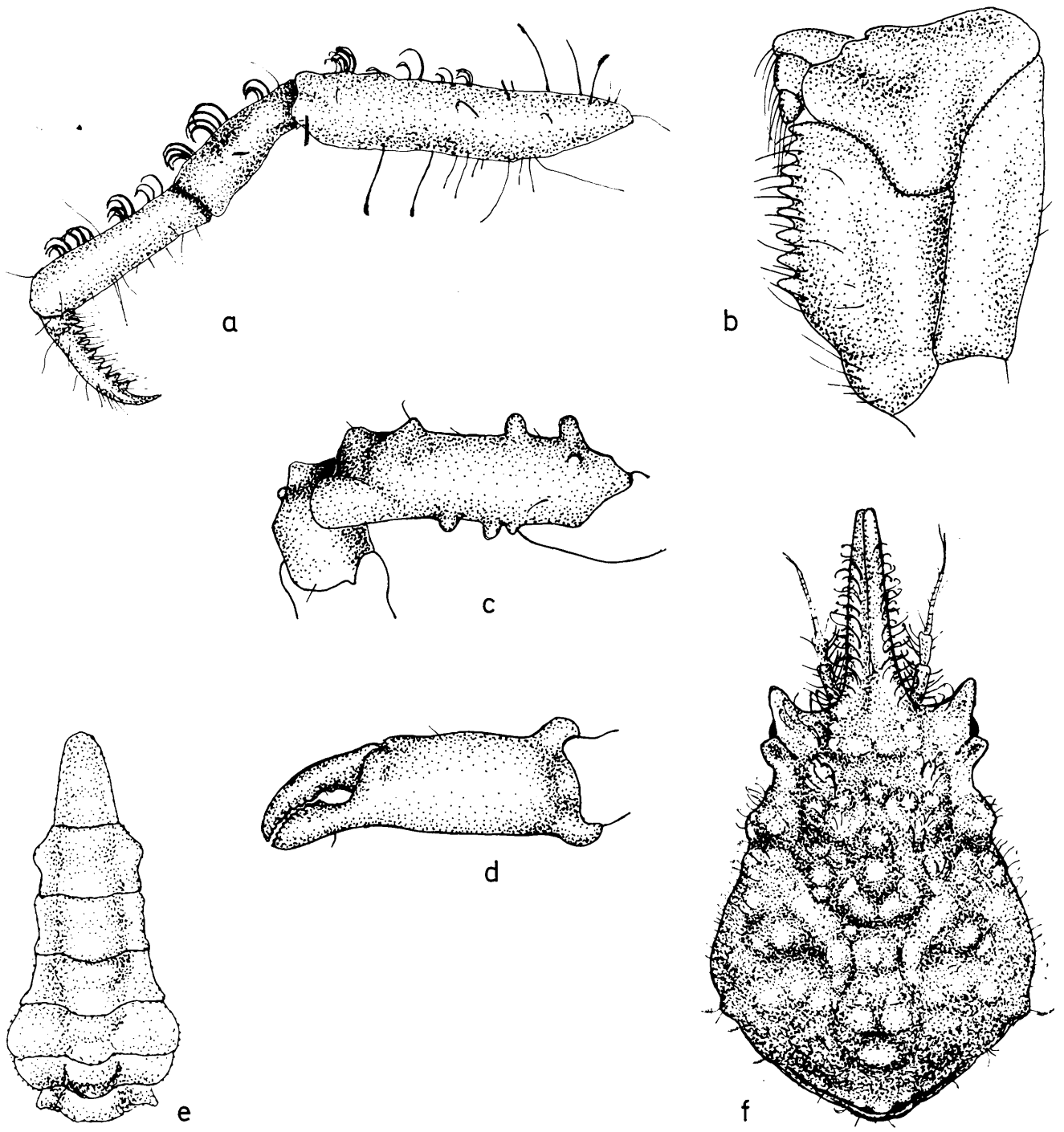


Fig. 106. *Tiarinia dana* (female, ovig., 19 mm, Biak I., RMNH) (a) left first ambulatory leg; (holotype, male) (b) left third maxilliped; (c) left cheliped, merus and carpus; (d) left chela; (e) male abdomen; (f) carapace, dorsal view.

cle (not five) on the branchial region just above the lateral carapace margin; the absence of an anterolateral spine on the basal antennal article; the presence of tubercles on the carpus of the cheliped (not smooth); the sixth segment of the male abdomen being wider than long (not longer than wide).

The new species is named for the Danish research vessel, Dana, which through its visit to the Moluccas in 1929 allowed this species to be collected.

Distribution. — Moluccas, N. Irian Jaya.

Tiarinia garthi new species
(Figs. 107a, 108, 112c,d)

Material examined. — 2♂♂, 3♀♀ (1 ovig.), 10-22 mm, ovig. ♀, 18.5 mm.

Holotype. — Male, cl. 22 mm, Western Australia, Broome, Entrance Point, intertidal, rocky reef shore, coll. A. A. Livingstone, August 1929. The Australian Museum, AM P. 13969.

Paratypes. Data as for holotype, 3 females, cl. 16.5 18.5 (ovig.), 19 mm (AM P.29877); 1 male, cl. 10 mm (AM P.24834).

Description. — Carapace broad, about three quarter to seven eighths postrostral carapace length, covered with a dense

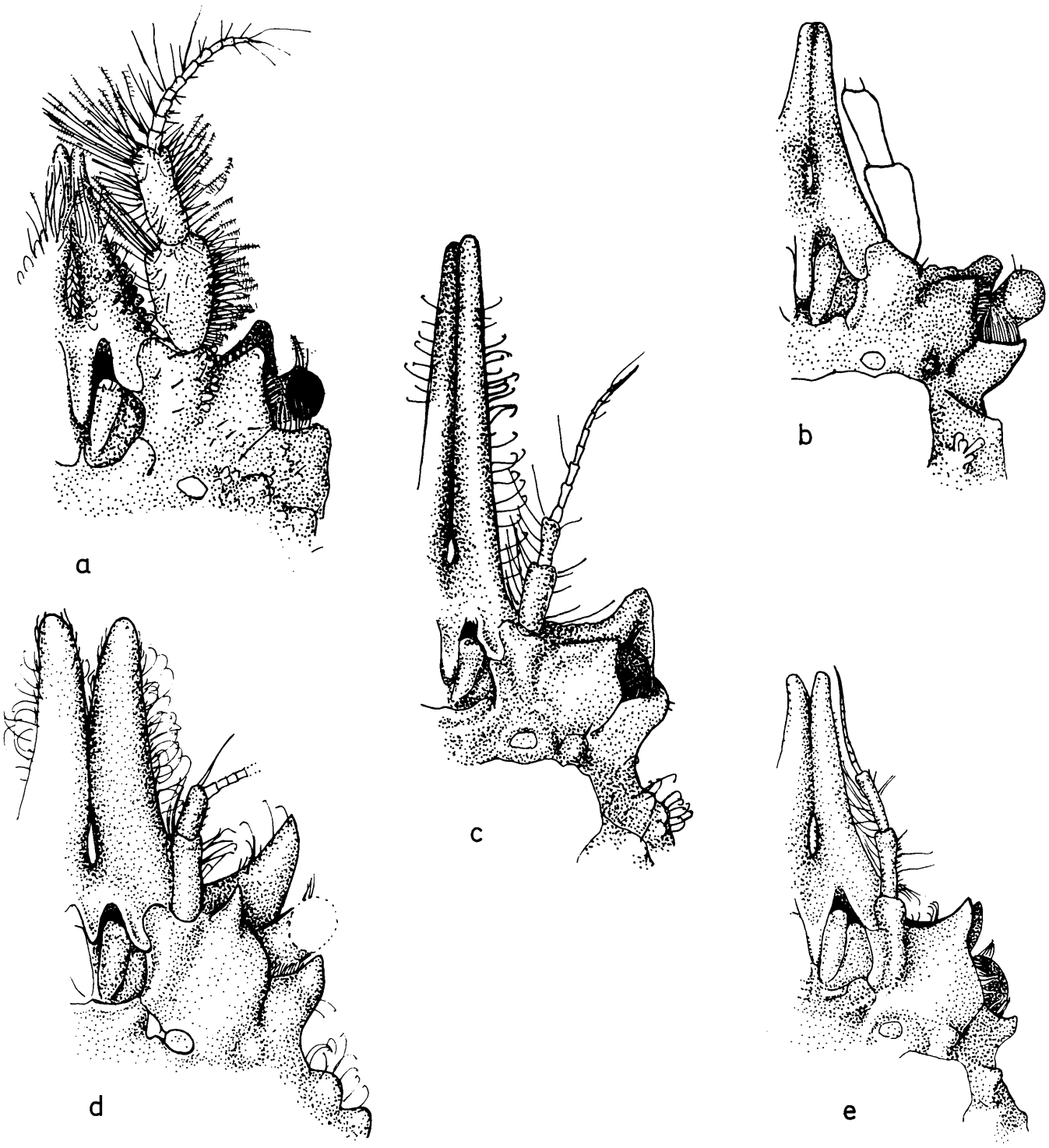


Fig. 107. *Tiarinia garthi* (holotype) (a) left orbit, ventral view; *T. mooloolah* (holotype) (b) left orbit, ventral view; *T. dana* (holotype) (c) left orbit, ventral view; *T. macrospinosa* (male, 23 mm, ZMA De.100.731) (d) left orbit, ventral view; *Leptopisa australis* (holotype) (e) left orbit, ventral view.

tomentum, with a few very distinct large elevated islet-like tubercles. (Holotype and one female paratype are infected with bopyrid parasites.)

Rostrum of two contiguous spines, one fifth (male) or one seventh (female) postrostral carapace length, strongly tapering, dorsal surface with rows of curled hairs.

Orbit above consisting of a moderately expanded eave, a blunt preorbital spine directed forward and weakly upward, and adjacent to eave a broad weakly flattened postorbital lobe.

Hepatic region with two low dorsal islets.

Mesogastric region with low, very broad tubercles, indistinct in smallest specimen; posteriorly two adjacent medial tubercles followed by a pair of submedial tubercles. Pro-

togastric region with two pairs of tubercles (islets) lying just behind most anterior mesogastric tubercle (islet) and forming with it a transverse row of five tubercles. Urogastric region depressed with an indistinct tubercle.

Cardiac region with three large adjacent tubercles (islets), two in front and one behind, giving appearance of one large three lobed tubercle (islet). Intestinal region with a transversely elongate medial tubercle (islet) and a smaller lateral tubercle on each side. Posterior margin with two groups of plumose setae.

Branchial region with an arc of three adjacent elevated tubercles (islets) anteriorly; two separate larger tubercles (islets) on posterior branchial region, lateral one with blunt pointed apex, directed obliquely posteriorly.

Basal antennal article very broad, a short groove between anterolateral angle and base of first free segment, surface otherwise smooth; anterolateral angle produced to a sharp point rather than a spine.

Third maxilliped moderately produced anterolaterally, a small notch on anterolateral angle.

Pterygostomian margin with two small tubercles.

Male sternum smooth, third and fourth segments with elevated ridges on margin of abdominal fossa (as in *T. gracilis*).

Cheliped merus with three or four dorsal tubercles and a short terminal spine; a group of small tubercles (in adult male) along a ventromedial ridge; male chela with a moderate gape between fingers, fixed finger excavate in proximal half, dactyl with a large tooth in gape.

Ambulatory leg meri smooth, heavily fringed with plumose setae along dorsal and ventral edges; other segments fringed with hairs; dactyl of fourth leg with only minute teeth ventrally along its length.

Male abdomen of seven segments, sixth and seventh segments about as long as wide. Female abdomen of seven segments, surface smooth.

First pleopod of male weakly curved outwards with medial edge of tip truncate.

Gonopore of female a simple slit, opening anteriorly.

Remarks. — The presence of prominent islet-like tubercles gives this species a superficial resemblance to a *Rochinia* but it can be distinguished from that genus by the broad supraorbital eave and basal antennal article which close the orbit above and below. This species is similar to *T. gracilis* in the flat basal antennal article and in the shape of the apex of the first pleopod of the male. However, the large tubercles are fewer in number and more elevated than in *T. gracilis*, and the carapace surface between them is quite smooth beneath the tomentum.

The new species is named in honour of John S. Garth, formerly of the Allan Hancock Foundation, University of Southern California, who has made so may notable contributions to our knowledge of majid spider crabs.

Distribution. — Known only from the type locality, Broome, Western Australia.

Tiarinia gracilis Dana, 1852

Tiarinia gracilis Dana, 1852: 111-112; 1855; pl. 3 figs. 6a-d, — Buitendijk, 1939: 259-264, text fig. 26, pl. 11 fig. 2. — Griffin, 1976: 216-217. — Takeda & Nunomura, 1976: 67.

Material examined. — 16 ♂♂, 26 ♀♀ (13 ovig.), 8.5-27 mm, smallest ovig. ♀, 16.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 7, Java, near reef at Batjulmati, 07°55.5'S 114°26'E, 15 m and more, dredge and shore exploration, coral and stones, 11 March 1899; 1 spec. — Stn. 34, Lombok, anchorage off Labuan Pandan, 18 m, shore exploration, coral reef, 27 March 1899; 1 spec. — Stn. 49a, Lesser Sunda Is., Sapeh Strait, 08°23.5'S 119°04.6'E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec. (ZMA De.100.727, det. Ihle). — Savu Sea, Sawu, Seba, reef, 24/25 April 1899; 1 spec. (ZMA De.100.734, det. Ihle). — Stn. 162, W. coast of Salawatti, between Loslos and Broken Is, South Island Reef, 18 m, dredge, coarse and fine sand with clay and shells, 18 August 1899; 1 spec. — Stn. 169, W. coast of New Guinea, anchorage off Atjatuning, 57 m, reef exploration, mud, 23/25 August 1899; 2 specs. (ZMA De.100.852, det. Ihle). — Stn. 193, Moluccas, E. coast of Sula Besi I., Sanana Bay, 22 m, reef exploration, mud, 13/14 September 1899; 3 specs. (ZMA De.100.851 (in part), det. Ihle as *T. cornigera*; ZMA De.100.853 (in part), det. Ihle). — Stn. 220, Banda Sea, W. coast of Binongka, anchorage off Pasir Pandjang, reef exploration, 1/3 November 1899; 1 spec. (ZMA De.100.730, det. Ihle). — Stn. 225, Banda Sea, S. of Lucipara I., 894 m, horizontal cylinder, coral and shells, 8 November 1899; 14 specs. (ZMA De.100.645 (in part), det. Ihle). — Stn. 285, anchorage, S. coast of Timor, 08°39.1'S 127°4.4'E, 34 m, dredge, on the limit between mud and coral, *Lithothamnion*, 18 January 1900; 1 spec. — Ambon reef; 1 spec. (ZMA De.100.733, det. Ihle). — Ambon reef; 1 spec. — Kai Is., Kur I., reef; 2 specs. (ZMA De. 100.732 (in part), det. Ihle). — Lombok, Pidjot Bay, 9-22m; 4 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Philippine Is., Zamboanga 25 February 1914; 3 specs.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, near Manokwari, Pasir Poetih, coll. J. C. Bauwens, received 1952; 1 spec.

Netherlands New Guinea Expedition: Stn. 709, Irian Jaya, Japen I., W. of Serui, seashore near Sarawandori, under rocks on the seashore, 24 February 1955; 2 specs. — Stn. 722, Irian Jaya, shore of Manokwari Bay, near town, under coral on shore and in living coral in the sea, 14 March 1955; 2 specs.

Remarks. — These specimens agree well with those described and figured as *T. gracilis* by Buitendijk. This species is distinguished from *T. cornigera* by the characters listed by Buitendijk and also by the absence of an oblique ridge on the basal antennal article (present in *T. cornigera* — see remarks under that species). In *T. gracilis* the third and fourth sternal segments of the male have a strong ridge on the margin of the abdominal fossa, while the corresponding segments are not ridged in *T. cornigera*.

This species is obviously very close to *T. depressa* Stimpson as described and figured by Sakai (1938; 1976) and regarded as endemic to Japan. *T. gracilis* has not been recorded north

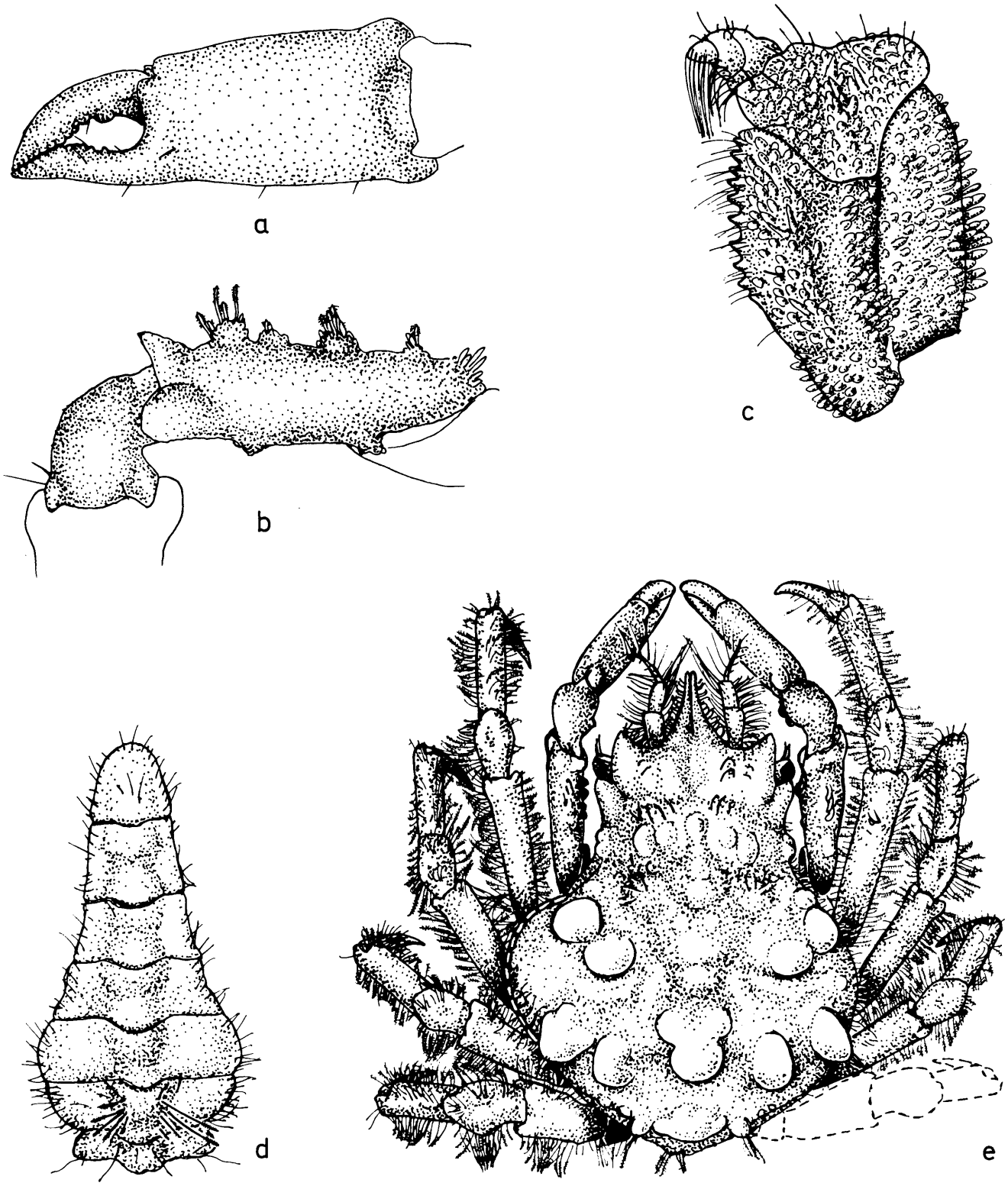


Fig. 108. *Tiarinia garthi* (holotype) (a) left chela; (b) left cheliped, merus and carpus; (c) left third maxilliped; (d) male abdomen; (e) whole animal, dorsal view (note expansion, indicated by dotted line, of left branchial region due to bopyrid parasite).

of the central Philippine Islands. In both species the branchial and intestinal tubercles are similarly flattened, the first pleopod of the male is similar in shape and the merus of the ambulatory legs is flattened, weakly tuberculate and fringed with haris. It is not possible without examining specimens from both regions to say what characters distinguish *T. gracilis* from *T. depressa* or if they are in fact conspecific. Takeda & Nunomura (1976) suggest that it is quite probable that the two species are synonymous.

Distribution. — West Pacific: central Philippine Islands to New Caledonia, north Australia and Singapore.

Tiarinia macrospinosa Buitendijk, 1939 (Fig. 107d)

Tiarinia macrospinosa Buitendijk, 1939: 264-265, pl. 10 fig. 5.

Material examined. — 1♂, 23 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 296, south coast of Timor, anchorage off Noimini, 10°14′S 124°5.5′E, 8-36 m, reef exploration, sandy mud, 24/26 January 1900; 1 spec. (ZMA De.100.731, det. Ihle as *T. gracilis*).

Remarks. — This immature male is about half the size of the holotype (ovig. ♀, cl. 42 mm) described by Buitendijk, but agrees well with it. As in Buitendijk's type specimen there is a slender preorbital spine directed anterolaterally, the anterior margin of the postorbital lobe is concave, there is a spine on the anterolateral angle of the basal antennal article, there are five tubercles on the branchial submargin just above the lateral carapace margin, there is a central intestinal tubercle and two submedial tubercles just anterior to it, the posterior margin is smooth and above it there is a smooth, narrow ridge on each side and there is a well developed tomentum.

In our specimen the rostral spines are 1/3 postrostral carapace length, slightly longer than in the type. There are four dorsal tubercles (one terminal) on the cheliped merus and the carpus is smooth. The dactyl of the fourth ambulatory leg possesses about eight close-set spines along the ventral surface. The abdomen is detached in our specimen, both the sixth and seventh segments are longer than wide (1 1/4 times and 1 1/2 times respectively). The first pleopod of the male is straight with a simple tip but this is an immature animal and the pleopod of the adult may be somewhat different.

This species resembles *T. dana* and the characters which distinguish it are dealt with under that species.

This is the first male and the second record for this species.

Distribution. — Known only from Timor.

Tiarinia mooloolah new species (Figs. 107b, 109, 112a,b)

Material examined. — 16♂♂, 20♀♀ (6 ovig.), 4.5-17 mm, smallest ovig. ♀, 8 mm.

Holotype. — Male, cl. 11.5 mm, Queensland, Point Cartwright, 26°41′S 153°08′E, coll. A. A. Livingstone, 2 August 1922; Australian Museum, AM P. 6377. (Holotype with both chelipeds and left second and third ambulatory legs; three other ambulatory legs loose with the specimen.)

Paratypes. As listed below:

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 301, Timor Sea, E. coast of Roti I., Pepela Bay, 10°38′S 123°25.2′E, 22 m, dredge and reef exploration, mud, coral and *Lithothamnion*, 30 January 1900; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Netherlands New Guinea Expedition 1954-55: Stn. N628, Irian Jaya, Pacific Ocean coast, N. of Jayapura, beach (at Base G), slow spider crabs from reef corals carried to shore to be broken up, coll. L. B. Holthuis, 12 November 1954; 1 spec. — Stn. W636, Irian Jaya, N. of Jayapura, reef (by base G), crabs among corals, coll. L. B. Holthuis, 27 November 1954: 3 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Heron I., reef, from dead coral growths, coll. W. K. Patton, December 1957; 1 spec. (AM P.13191). — Heron I., reef; 1 spec. (AM P.13193). — Heron I., under nigger head coral, 12 August 1960; 2 specs. (AM P.29873). — Masthead I.; 1 spec. (AM P.2573). — North West Islet, reef; 1 spec. (AM P.8673, det. Rathbun as *T. gracilis*). — North West Islet; 1 spec. (AM P.10365). — North West Islet, February 1929, M. Ward Collection; 3 specs. (dry) (AM P.29871). — North West Islet, July 1929, M. Ward Collection; 1 spec. (dry) (AM P.29869). — Gladstone (Port Curtis), Seal Rocks; 1 spec. (AM P.12192). — Tannum Sands, coll. J. S. Garth, 29 May 1973; 1 spec.

New South Wales: Woody Head, mouth of Clarence River, intertidal, coll. A. A. Cameron, 28 August 1965; 1 spec. (AM P.29875). — Woody Head, near mouth of Clarence River, coll. A. A. Cameron, 20 September 1966; 1 spec. (AM P.29876). — S. of Tweed Heads, Hastings Point, 1.5-3 m, on sublittoral algae, low tide, coll. J. Laxton, 12 June 1971; 1 spec. (AM P.29874). — Nambucca Heads, M. Ward Collection; 13 specs. (dry) (AM P.29870). — Nambucca Heads, 14-24 September 1937; 1 spec. (AM P.29872, dry).

Description. — Carapace width three quarters postrostral carapace length, surface almost smooth with only a few low tubercles, gastric region elevated.

Rostrum of two contiguous, strongly tapering spines, equal to one quarter to one third postrostral carapace length, dorsal surface with rows of curled hairs.

Orbit above consisiting of an expanded eave with a straight lateral edge and a short, blunt preorbital spine directed forward and weakly upward. Anterior margin of postorbital lobe straight, oblique or at right angles to edge of eave.

Hepatic margin rounded, without spines or tubercles; one or two ventral tubercles on region. Branchial margin with an epibranchial tubercle or small spine.

Gastric regions distinctly elevated with low rounded tubercles. Mesogastric region with an anterior tubercle and two medial tubercles behind, and in some specimens, a posterior pair of submedial tubercles. Two pairs of protogastric tubercles lying just behind most anterior mesogastric tubercle and with it forming a transverse row of five tubercles. Urogastric region depressed, smooth or with a low posterior tubercle.

Cardiac region elevated with three broad adjacent tubercles, a submedial pair anteriorly and one behind. Intestinal region with a medial tubercle and a small lateral tubercle; a very weak ridge or none at all above posterior margin (ridge stronger in three females from N. Irian Jaya and Timor Sea); no tubercles or up to three small tubercles on posterior margin.

Branchial region only weakly tuberculate, low tubercles anterior and medial to epibranchial tubercle; a tubercle or ridge near cardiac region; a tubercle anteriorly on dorsal margin but none on anteromedial border of branchial region which is depressed, smooth or bears two low ridges.

Basal antennal article very broad, a shallow, central, longitudinal groove anteriorly, surface otherwise smooth, anterolateral angle almost a right angle, weakly produced to a sharp point or small spine in some specimens. (In some specimens edge of postorbital lobe overlaps basal antennal article.)

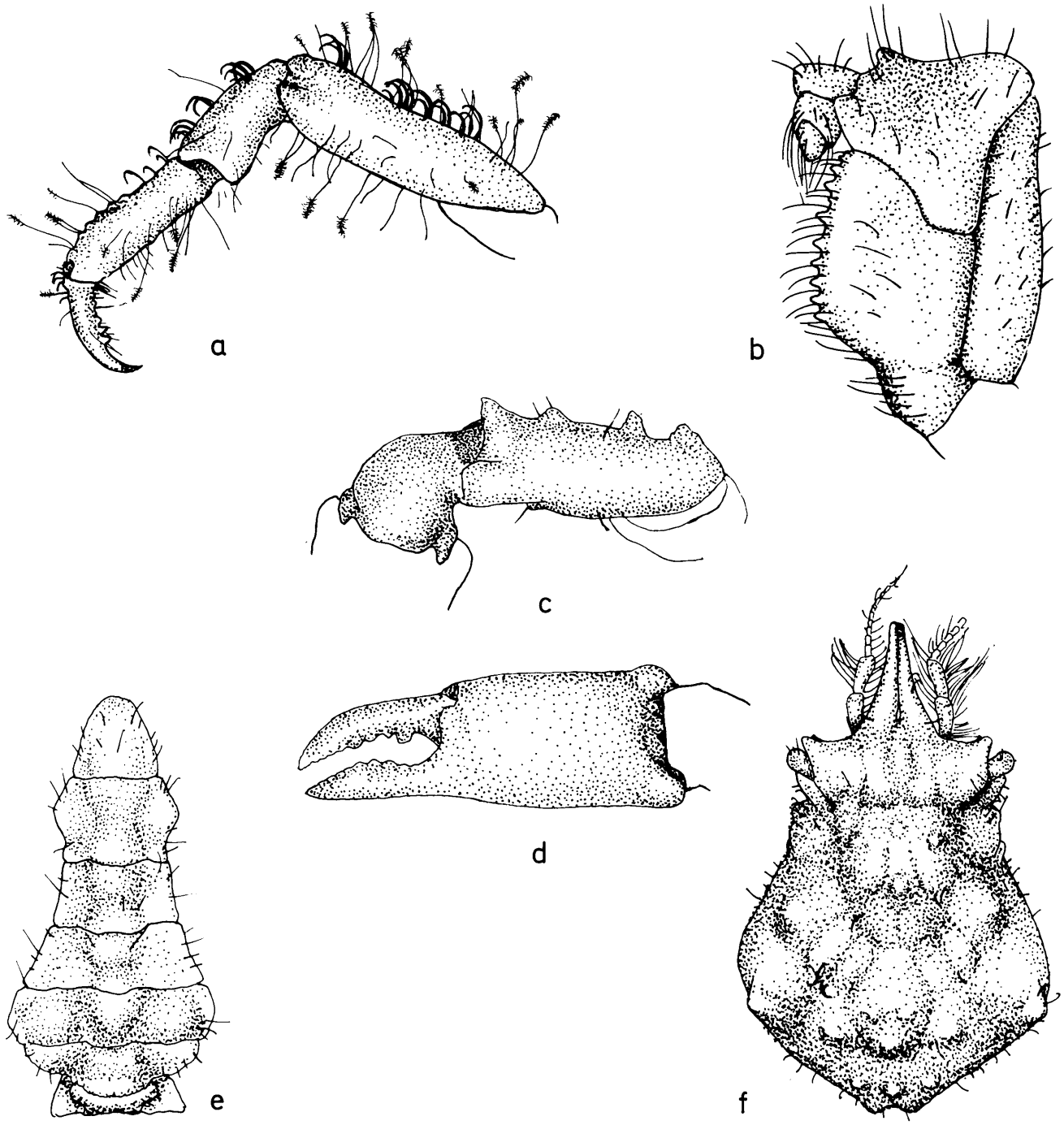


Fig. 109. *Tiarinia mooloolah* (female, 10.5 mm, AM P.12192) (a) left first ambulatory leg; (holotype, male) (b) left third maxilliped; (c) left cheliped, merus and carpus; (d) left chela; (e) male abdomen; (f) carapace, dorsal view.

Pterygostomian region smooth with two small tubercles on margin.

Third maxilliped merus only weakly produced at anterolateral angle. Male sternum smooth.

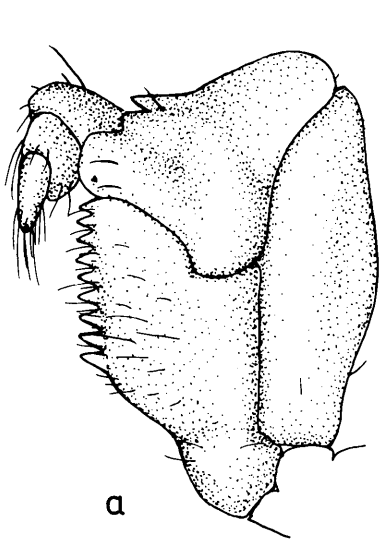
Cheliped merus with two dorsal tubercles, a low distal ridge and a short terminal spine. In adult male, merus with tubercles on medial face; palm of chela one a half times as long as high and one and a half times length of fingers; fingers coarsely toothed proximally, weakly gaping, dactyl with a large tooth in gape.

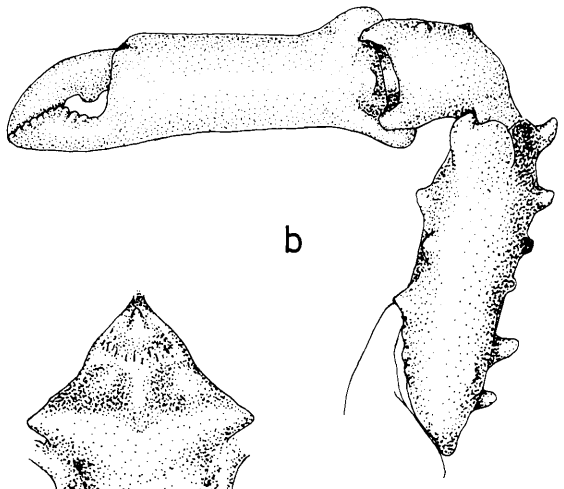
Ambulatory leg meri cylindrical, smooth, dorsal surface with a row of groups of curled hairs and scattered plumose setae. Dactyl of fourth leg armed ventrally with six small teeth along its length.

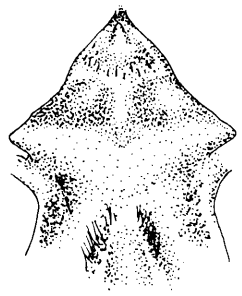
Male abdomen with sixth segment broader (1.5) than long and seventh segment about as long as broad. Female abdomen of seven segments, smooth.

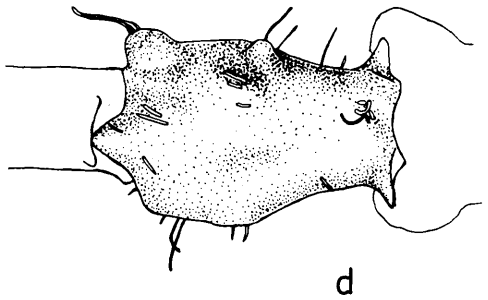
First pleopod of male straight, narrowing slightly just before truncate apex, opening terminal.

Gonopore of female a simple, round, ventral opening.









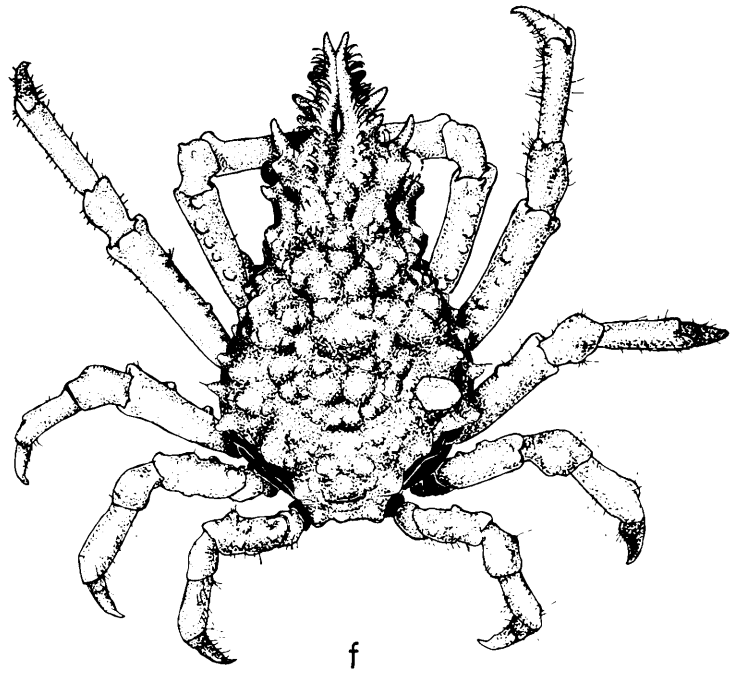


Fig. 110. *Tiarinia takedai* (holotype) (a) left third maxilliped; (b) left cheliped; (c) male sternum; (d) carpus of left first ambulatory leg, dorsal view; (e) left orbit, ventral view; (f) whole animal, dorsal view (barnacle on right hand side).

Remarks. — This species is distinguished from *T. gracilis* and *T. cornigera* by the straight (not concave) edge of the supraorbital eave; the much less tuberculate carapace and the shape of the first pleopod of the male.

T. mooloolah resembles *T. spinigera* in the shape of the upper orbit (upcurved preorbital spine, straight lateral edge of the eave, slender postorbital spine) but is distinguished from it by its less tuberculate carapace and absence of spines. In the

specimens of *T. mooloolah* from N. Irian Jaya in which the ridge above the carapace margin is distinct, it is smooth (not made up of sharp tubercles), there are three posterior branchial tubercles (not spines) and the carapace between them is smooth (not tuberculate).

T. mooloolah is similar to the larger species *T. macrospinosa* and *T. dana* in the absence of strong tubercles on the posterior margin of the carapace, but it is distinguished from them by the shorter rostral spines which are broader at the base and more strongly tapering; the more slender preorbital spine; and the much less tuberculate branchial region, especially the absence of large tubercles on the anteromedial border of the branchial region.

The new species is named for the town of Mooloolah near Point Cartwright, the type locality of this new *Tiarinia*.

Distribution. — Irian Jaya, Timor Sea, east coast of Australia from Capricorn Group (Great Barrier Reef) to Nambucca Heads, New South Wales.

Tiarinia spinigera Stimpson, 1907
(Fig. 105g)

Tiarinia spinigera Stimpson, 1907: 13-14, pl. 3 fig. 3. — Sakai, 1976: 260-261, text fig. 139, pl. 91 fig. 3.

Material examined. — 1 ovig. ♀, 19.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 193, Moluccas, Sanana Bay, E. coast of Sula Besi I., 22 m, reef exploration, mud, 13/14 September 1899; 1 spec. (ZMA De.100.853, det. Ihle as *T. gracilis*).

Remarks. — This specimen agrees well with that described and figured by Stimpson as *T. spinigera*. There are three sharp erect spines on the branchial region and the preorbital spine is long, sharp and upcurved. The ridge on the upper intestinal region is made up of five lateral tubercles and one larger central tubercle; there are four tubercles on the posterior margin.

In this specimen the rostrum is greater than 1/4 postrostral carapace length; the postorbital lobe is more slender and produced further laterally than in *T. cornigera*; the basal antennal article is nearly flat, and the anterolateral angle is produced into only a small spine. The gonopore is a simple round ventral opening while in *T. cornigera* it is an anteromedial slit.

This species has not previously been recorded outside Japan.

Previous descriptions and illustrations of *T. spinigera* generally agree with each other. However, the figure provided by Sakai (1938: fig. 48), differs from others in the preorbital lobe being shorter, the epibranchial spine shorter and the other branchial spines much shorter. In this respect also two figures of Sakai's of *T. tiarata* differ from the figure and description given by Balss (1929: 20-21, fig. 9). Sakai (1938: pl. 38 fig. 7; 1976: fig. 141) shows the preorbital lobe and the epibranchial spine as less prominent than does Balss. Since *T. spinigera* is quite similar to *T. tiarata* but differs from *T. tiarata* most obviously in possessing two prominent spines medial to the epibranchial spine and a shorter rostrum, it is clear that reliance on Sakai's figures could lead to a confusion of the two species.

Distribution. — Japan, Moluccas.

Tiarinia takedai new species
(Figs. 105c, 110, 111b,f)

Tiarinia angusta. — Takeda, 1973a: fig. 4H. (Not *Tiarinia angusta* Dana, 1852.)

Material examined. — 23 ♂♂, 13 ♀♀ (11 ovig.), 15.5-39 mm, smallest ovig. ♀, 22 mm.
Holotype. — Male, cl. 37.5 mm, North Queensland, Albany Passage, collected M. Ward, August-September 1928; Australian Museum, AM P.15235.
Paratypes. As listed below:

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Netherlands New Guinea Expedition: Stn. 646, Irian Jaya, Biak I., W. of Sorido, reef near naval barracks, 6 December 1954; 1 spec. — Stn. 683, Biak, I., W. of Sorido, reef in front of naval barracks, in coral, January 1955; 2 specs. — Biak I., W. of Sorido, reef near naval barracks, February 1955; 10 specs. — Biak I., W. of Sorido, reef near naval barracks, March 1955; 1 spec. — Stn. 683A, Biak I., W. of Sorido, reef in front of naval barracks, among *Pocillopora*, 22/23 March 1955; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition-Moluccas: Stn. KL II, Moluccas, S. end of Labuin I., SW. of Kajoea I., 00°05'S 127°26'E, 0-4.5 m, marginal coral reef, 22 May 1970; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Torres Strait, Albany Passage, coll. M. Ward, August-September 1928; 1 spec. (AM P.29879). — Torres Strait, Murray I.; 1 spec. (AM P.29878). — Ellison Reef, outer Barrier, 14.5 m, 1924; 3 specs. (AM P.8021). — Lindeman I., reefs, diving, 1934-35; 13 specs. (AM P.29880, dry). — Swain Reef, NW. end of Gillett Cay, intertidal, October 1962; 1 spec. (AM P.14020).

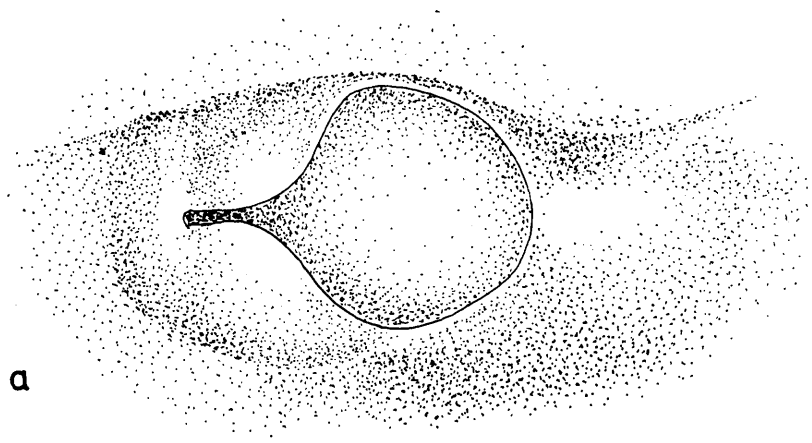
Description. — Carapace width two thirds postrostral carapace length, surface tuberculate.

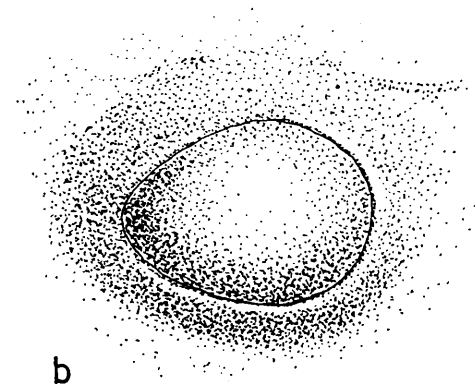
Rostrum of two contiguous spines of moderate length, from 0.3 to 0.45 postrostral carapace length, separated at the apex, each with three lateral accessory spines. Rostral ridges tuberculate.

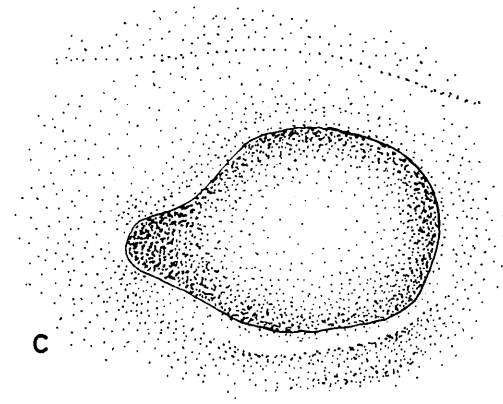
Orbit above consisting of a strongly expanded eave; preorbital spine directed obliquely forward; supraorbital eave with a tubercle midway along; antorbital angle adjacent to postorbital lobe distally, but basally separated by a small slit; postorbital lobe with a tubercle on anteroexternal angle.

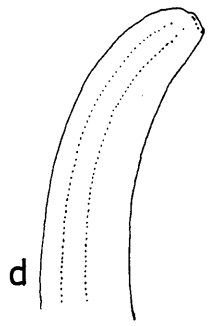
Hepatic and subhepatic regions tuberculate.

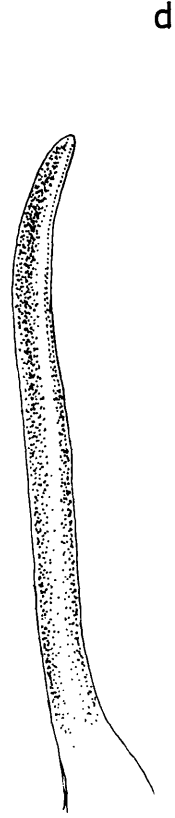
Mesogastric region with an anterior group of tubercles in the midline followed by two large medial tubercles or groups of tubercles and posteriorly by a submedial pair of tubercles or groups of tubercles. Protogastric region with an anterior and posterior group of tubercles. Urogastric region with a pair of small, anterior submedial tubercles and a large medial tubercle or group of tubercles.

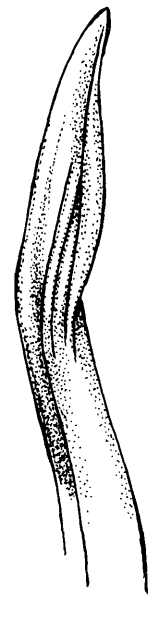


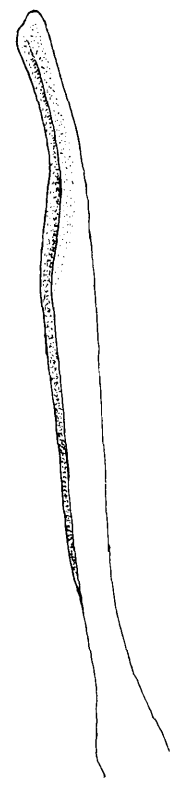












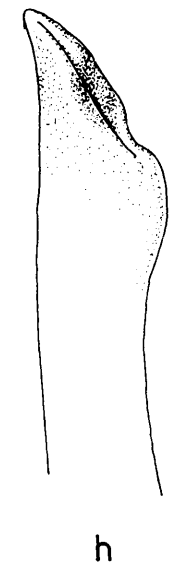


Fig. 111. Female of *Tiarinia alidae* (holotype) (a) left gonopore; *T. takedai* (ovig., 32 mm, AM P.29879) (b) left gonopore; *T. angusta* (adult, 34.5 mm, ZMA De.100.660) (c) left gonopore. Left first pleopod of male of *T. alidae* (27 mm, ZMA De.100.848) (d) sternal tip of pleopod, (e) abdominal view of pleopod; *T. takedai* (holotype) (f) abdominal tip of pleopod; *T. angusta* (neotype) (g) abdominal view of pleopod, (h) sternal tip of same.

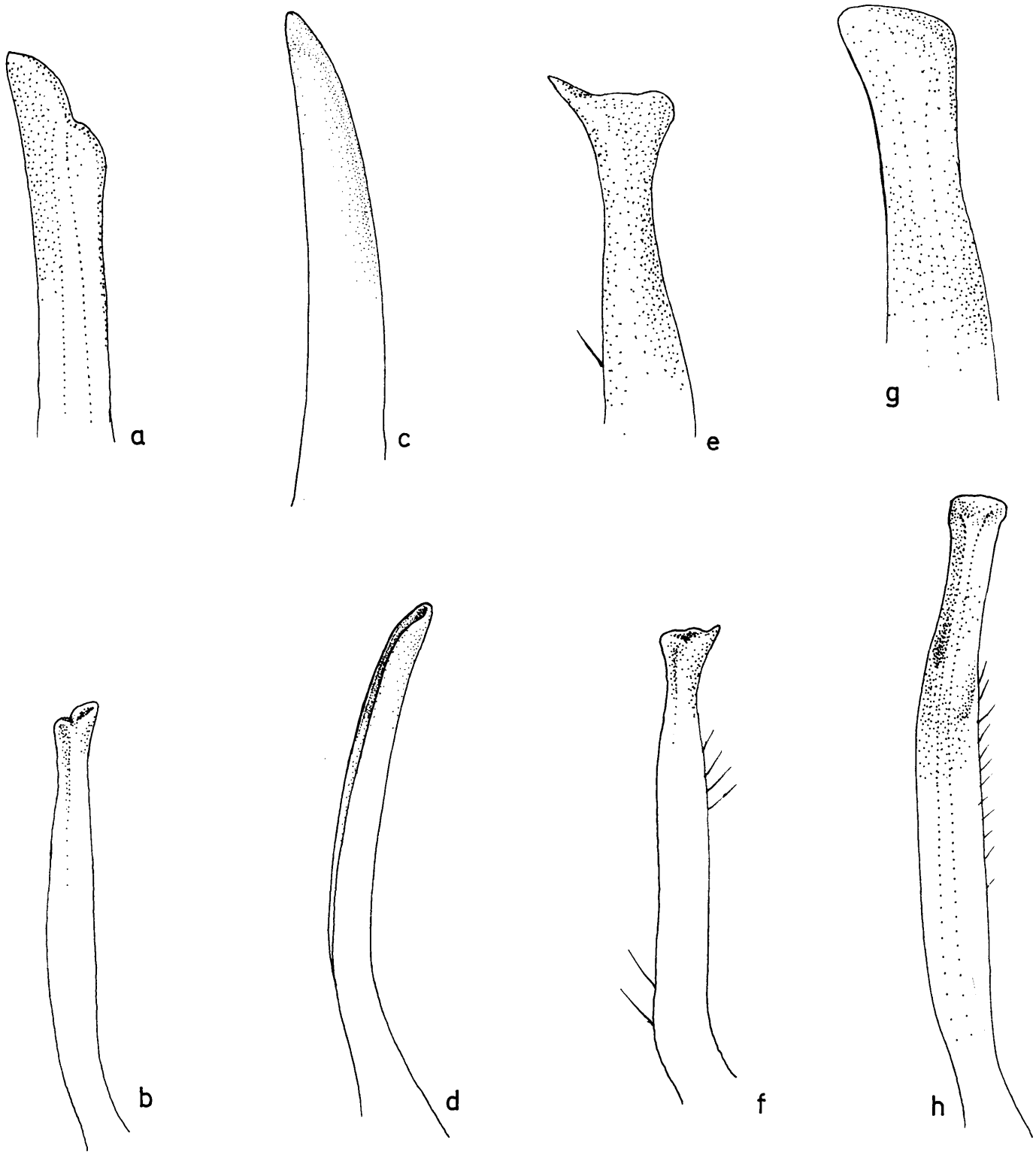


Fig. 112. Left first pleopod of male of *Tiarinia mooloolah* (holotype) (a) sternal tip of pleopod, (b) abdominal view of pleopod; *T. garthi* (holotype) (c) sternal tip of pleopod, (d) abdominal view of pleopod; *T. dana* (holotype) (e) sternal tip of pleopod, (f) abdominal view of pleopod; *Leptopisa australis* (holotype) (g) sternal tip of pleopod, (h) abdominal view of pleopod.

Cardiac region with three large tubercles in a triangle, base forwards, and several small tubercles. Intestinal region tuberculate with three large tubercles in a triangle anteriorly, a large lateral tubercle just behind this group and two to four large tubercles on posterior margin.

Branchial region tuberculate with four to five larger sharp tubercles just above lateral margin, a row below of smaller tubercles.

Basal antennal article broad, a shallow longitudinal groove centrally, anterolateral angle produced to a spine, lateral edge sinuous with a low tubercle midway along.

Merus of third maxilliped with anterolateral angle strongly produced and rounded.

Pterygostomian region smooth except for two small tubercles, margin with two large blunt tubercles.

Sternum smooth, lateral lobes triangular with a blunt apex.

Merus of cheliped of adult male with four short spines and a tubercle dorsally (often only three tubercles in females), and a small, sharp terminal spine; ventral surface with five scattered tubercles. Carpus with two small tubercles dorsally and one on inner (anterior) edge. Chela slender, not inflated even in largest male (cl. 37.5 mm, holotype), length of palm two and a half times height; a small gape between fingers, dactyl with a tooth in gape.

Merus of first ambulatory leg with a row of four short spines (or tubercles) dorsally and a low proximal and a low distal tubercle on outer (posterior) face, no terminal spine; carpus dorsally flat with a blunt tubercle at anterodistal angle. Dactyl armed with five to six small teeth along ventral edge.

Male abdomen with segments four to six broad, length only half width; segment four hardly narrowing distally; seventh segment longer (1.3) than wide.

First pleopod of male (figured by Takeda, 1973a) curving toward midline at distal third, straight in distal quarter, slightly oblique, with narrow lateral and medial lobes, tapering to a point; opening abdominal, about halfway along lobed section.

Gonopore of female a simple ventral opening, rounded laterally and pointed medially and with a marginal ridge of uniform height.

Remarks. — The basis of the decision to separate this series as a new species and the status of *T. angusta* are discussed under that species. This species is very similar to *T. angusta* and *T. alidae* and is distinguished from them by the apically narrower first pleopod of the male; the wider abdomen of the male (segments 5 and 6 twice as wide as long); and the presence around the female gonopore of an unlobed uniform ridge. The lateral lobes of the sternum are narrower at their apex than they are in either *T. angusta* or *T. alidae*. The terminal spine on the merus of the cheliped is sharper than in *T. angusta* but not as pronounced nor as forwardly curved as in *T. alidae*. The carpus of the first ambulatory leg is slightly more slender (l = 1.5-1.7 w) than in *T. angusta* (l = 1.3-1.6 w) and the anterodistal tubercle is slightly broader and blunter than in that species.

The number of lateral accessory spines on the rostral spine is not a reliable character to distinguish these three species, but in this species we have found none with only two spines as found in some specimens of *T. alidae* or with four spines as in some specimens of *T. angusta*.

In this series the specimens from Albany Passage, Lindeman Island and Biak include both male and female of this species.

The new species is named for Masatsune Takeda, now of the National Science Museum, Tokyo, in recognition of his contribution to our knowledge of spider crabs including the genus *Tiarinia*.

Distribution. — North Queensland, Torres Strait, Irian Jaya, Moluccas, Palau.

DISCUSSION

In this study 46 new species of majids have been described and the known range of many species has been extended. There are now 73 species in 28 genera recorded from the Kai and Aru Islands where collections were made by three of the major expeditions from which we received material.

The status of some subspecies has been changed and some known species placed in new genera. The more appropriate alignment of genera in subfamilies has resulted in a rearrangement in which the Tychinae now contains only nine species in three genera while the Majinae, in particular, has been expanded and now includes 87 species in 22 genera.

The following is a summary of the distribution of the genera and species in the Indo-West Pacific. We have omitted *Cyclonyx frontalis* and *Doclea rissonii* (location unknown); *Lambrachaeus ramifer* and *Planotergum mirabile* (not majids) and *Pyromaia tuberculata* which is a recent introduction from the East Pacific. Allowance should be made for the uncertain number of valid species in some genera eg. *Paratymolus* and for a number of older, unconfirmed records of species reported only once. We have taken the Indian Ocean to include Australian waters as far east as Torres Straits in the north and Kangaroo Island in the south.

The majority of genera (61% or 50) are represented in both the Indian Ocean and the west Pacific, nearly a third (30% or 25) are restricted to the West Pacific and only 9% (7) are restricted to the Indian Ocean. At the species level just over half of the species (46% or 176) are known only from the West Pacific, about a third (32% or 125) occur in both the Indian Ocean and the West Pacific while about a fifth (22% or 83) are restricted to the Indian Ocean. A similar pattern of species distribution is found at the subfamily level in the Inachinae and Mithracinae. However, in the Majinae 60% of the species are restricted to the West Pacific and only 10% to the Indian Ocean while in the Epialtinae there are equal numbers of species (about 40%) with a distribution restricted to either the West Pacific or the Indian Ocean. The Pisinae has the largest percentage of species (40%) occurring in both the Indian Ocean and West Pacific and a similar number of species (43%) known only from the West Pacific.

Distribution of majid genera in the Indo-West Pacific by subfamily

Subfamily	genera in subfamily	Indian O. only	Indo-West Pacific	W. Pacific only
Inachinae	22	5 (23%)	12 (57%)	5 (23%)
Tychinae	3	—	2 (66%)	1 (33%)
Epialtinae	10	—	8 (80%)	2 (20%)
Pisinae	19	—	12 (63%)	7 (27%)

Majinae	22	—	14 (63%)	8 (27%)
Mithracinae	6	2 (33%)	2 (33%)	2 (33%)
	82	7 (9%)	50 (61%)	25 (30%)

Distribution of majid species in the Indo-West Pacific by subfamily

Subfamily	species in subfamily	Indian O. only	Indo-West Pacific	W. Pacific only
Inachinae	86	19 (22%)	29 (34%)	38 (44%)
Tychinae	9	6 (66%)	2 (22%)	1 (11%)
Epialtinae	56	22 (39%)	12 (21%)	22 (39%)
Pisinae	117	20 (17%)	47 (40%)	50 (43%)
Majinae	86	9 (10%)	25 (29%)	52 (60%)
Mithracinae	30	7 (23%)	10 (33%)	13 (43%)
	385	83 (22%)	125 (32%)	176 (46%)

There are 13 species in eight genera which occur in both the Indian Ocean and the West Pacific and which appear to be restricted to Australian waters. There are now 124 species (in 57 genera) recorded from Australia (32% of the total Indo-West Pacific species) and 36 of the species (in 24 genera) are endemic. Eleven species are restricted to New Zealand and 37 species are restricted to Japan. There are 10 species in seven genera restricted to the Red Sea.

The relatively large number of new species described and the many extensions of range shown by this study suggest that the record of majid species and their distribution in the Indo-West Pacific is still incomplete.

REFERENCES

Adams, A. & A. White, 1848. Crustacea. *In*: A. Adams (ed.), The zoology of the voyage of H. M. S. Samarang; under the command of Captain Sir Edward Belcher, C. B., F.R.A.S., F.G.S. during the years 1843-1846: i-viii, 1-66, pls. 1-13. (Benham & Reeve, London).

Alcock, A., 1895. Materials for a carcinological fauna of India, 1. The Brachyura Oxyrhyncha. J. Asiat. Soc. Beng., **64**: 157-291, pls. 3-5.

——,1899. An account of the deep sea Brachyura collected by the Royal Indian marine survey ship Investigator: 1-85, pls. 1-4. (Calcutta).

Alcock, A. & A. R. S. Anderson, 1894. Natural history notes from H. M. Indian marine survey steamer Investigator, Commander C. F. Oldham, R. N., commanding, (2) 17. List of the shore and shallow water Brachyura collected during the season 1893-1894. J. Asiat. Soc. Beng., **63**: 197-209.

——,1896. Illustrations of the zoology of the Royal Indian marine surveying steamer Investigator, under the command of Commander C. F. Oldham, R. N. Crustacea, **4**: pls. 16-27. (Office of Supt. Govt. Printing, Calcutta).

——,1898. Illustrations of the zoology of the Royal Indian marine survey ship Investigator, under the command of Commander T. H. Heming, R. N. Crustacea, **6**: pls. 33-35. (Office of Supt. Govt. Printing, Calcutta).

Alcock, A., N. Annandale & A. C. MacGilchrist, 1907. Illustrations of the zoology of the Royal Indian marine survey ship Investigator, under the command of Commander T. H. Heming, R. N. Crustacea, **12**: pls. 77-79. (Office of Supt. Govt. Printing, Calcutta).

Alcock, A. & A. F. McArdle, 1902. Illustrations of the zoology of the Royal Indian marine survey ship Investigator, under the command of Commander T. H. Heming, R. N. Crustacea, **10**: pls. 56-57. (Office of Supt. Govt. Printing, Calcutta).

Baker, W. H., 1905. Notes on South Australian decapod Crustacea, 2. Trans. R. Soc. S. Aust., **29**: 116-131, pls. 21-24.

——,1906. Notes on South Australian decapod Crustacea, 4. Trans. R. Soc. S. Aust., **30**: 104-117, pls. 1-3.

Balss, H., 1924. Ostasiatische Decapoden. 5. Die Oxyrhynchen und Schlussteil (Geographische Übersicht der Decapoden Japans). Arch Naturgesch., **90** (A 5): 20-84, figs. 1-2, pl. 1.

——,1929. Expedition S. M. Schiff Pola in das Rote Meer. Nördliche und südliche Hälfte 1895/96-1897/98. Zool. Ergebn, 36. Decapoden des Roten Meeres, 4. Oxyrhyncha und Schlussbetrachtungen. Denkschr. Akad. Wiss. Wien (math-nat.), **102**: 1-30, figs. 1-9, pl. 1.

——,1935a. Brachyura of the Hamburg Museum expedition to south-western Australia 1905. J. Proc. R. Soc. W. Aust., **21**: 113-151, text figs. 1-3, pl. 13.

——,1935b. Die brachyuren Dekapoden der Reise Michaelsen-Hartmeyer nach Südwestaustralien 1905. Zool. Anz., **111**: 35-42, figs. 1-5.

——,1938. Die Dekapoda Brachyura von Dr. Sixten Bocks Pazifik Expedition 1917-1918. Göteborgs K. Vetensk.- Vitterh. Samh. Handl., (B) **5** (7): 1-85, figs. 1-18, pls. 1-2.

——,1957. Abteilung Brachyura, Borradaile 1907. In: H. G. Bronns, Klassen und Ordnungen des Tierreichs., **5** (1) 7, Decapoda 12: 1505-1672, figs. 1131-1199.

Barnard, K. H., 1950. Descriptive catalogue of South African decapod Crustacea (crabs and shrimps). Ann. S. Afr. Mus., **38**: 1-837, figs. 1-154.

——,1955. Additions to the fauna list of South African Crustacea and Pycnogonida. Ann. S. Afr. Mus., **48**: 1-107, figs. 1-53.

Bennett, E. W., 1964. The marine fauna of New Zealand: Crustacea Brachyura. N. Z. Dept. scient. ind. Res. Bull., **153**: 1-120, figs. 1-141.

Borradaile, L. A., 1900. On some crustaceans from the South Pacific, 4. The crabs. Proc. zool. Soc. Lond., **1900**: 568-596, pls. 40-42.

——, 1903. Marine Crustaceans, 10. The spider crabs (Oxyrhyncha). 11. On the classification and genealogy of the reptant decapods. In: J. S. Gardiner (ed.), The fauna and geography of the Maldive and Laccadive Archipelagoes, **2**: 681-698, figs. 122-126, pls. 47-48.

——,1916. Crustacea, 1. Decapoda. Nat. Hist. Rep. Br. Antarct. Terra Nova Exped., **3** (2): 75-110, figs. 1-16.

Bouvier, E. L., 1906a. Sur une nouvelle collection de Crustacés Décapodes rapportés du Japon par M. Harmand. Bull. Mus. natn. Hist. nat., Paris, **12**: 480-485.

——,1906b. Observations sur le genre Acanthophrys A. M.-Edw. et catalogue des Acanthophrys du Muséum. Bull. Mus. natn. Hist. nat., Paris, **12**: 485-491.

——,1915a. Décapodes marcheurs (Reptantia) et Stomatopodes recueillis à l'île Maurice par M. Paul Carié. Bull. sc. Fr. Belg., **48** (7): 178-318, figs. 1-42, pls. 4-7.

——,1915b. Étude sur un Cyrtomaia suhmi du Musée de Marseille. Annls. Mus. Hist. nat. Marseille, **15**: 9-15, pl. 1.

——,1922. Observations complémentaires sur les Crustacés décapodes (abstraction fait des Carides) provenant des campagnes de S.A.S. le Prince de Monaco. Résult. Camp. scient. Prince Albert I, **62**: 1-106, pls. 1-6.

——,1940. Décapodes marcheurs. Faune de France, **37**: 1-404, figs. 1-222, pls. 1-14. (Lechevalier, Paris).

Buitendijk, A. M., 1939. The Dromiacea, Oxystomata and Oxyrhyncha of the Snellius Expedition. Temminckia, **4**: 223-276, figs. 1-27, pls. 7-11.

——,1950. On a small collection of Decapoda Brachyura, chiefly Dromiidae and Oxyrhyncha, from the neighbourhood of Singapore. Bull. Raffles Mus., **21**: 59-82.

Calman, W. T., 1900. On a collection of Brachyura from Torres Straits. Trans. Linn. Soc. Lond. (Zool.) (2) **8**: 1-50, pls. 1-3.

——,1909. On decapod Crustacea from Christmas Island, collected by Dr. C. W. Andrews F.R.S., F.Z.S. Proc. zool. Soc. Lond., **1909**: 703-713, pl. 72.

——,1913. Note on the brachyuran genera Micippoides and Hyastenus. Ann. Mag. nat. Hist., (8) **11**: 312-314.

Campbell, B. M. & W. Stephenson, 1970. The sublittoral Brachyura (Crustacea: Decapoda) of Moreton Bay. Mem. Qld. Mus., **15**: 235-301, figs. 1-49, pl. 22

Chace, F. A., Jr, 1966. Decapod crustaceans from St. Helena Island, South Atlantic. Proc. U.S. natn. Mus., **118**: 622-661, figs. 1-15, pls. 1-2.

Chen, H. 1979. Two new species of crabs from the Xisha Islands, Guandong Province, China. Oceanol. Limnol. sin., **10** (1): 77-81, figs. 1-2.

——,1980. Studies on the crabs of the Xisha Islands, Guandong Province, China, 2. Stud. Mar. sin., **17**: 117-147, figs. 1-25, pls. 1-4.

CHHAPGAR, B. F., 1957. On the marine crabs (Decapoda, Brachyura) of Bombay State, 1 & 2. J. Bombay nat. Hist. Soc., **54**: 399-439, 503-549, figs. 1-3, A-B, 1-16.

CHILTON, C., 1911. The Crustacea of the Kermadec Islands. Trans. Proc. N.Z. Inst., **43**: 544-573, figs. 1-4.

CHOPRA, B. 1935. Further notes on Crustacea Decapoda in the Indian Museum, 8. On the decapod Crustacea collected by the Bengal pilot service off the mouth of the River Hooghly. Brachygnatha (Oxyrhyncha and Brachyrhyncha). Rec. Indian Mus., **37**: 463-514, text figs. 1-18, pl. 9.

CHUN, C., 1900. Aus den Tiefen des Weltmeeres: 1-549. (G. Fisher, Jena). (Quoted from Doflein, 1904).

CROSNIER, A., 1976. Données sur les Crustacés Décapodes capturés par M. Paul Guézé a l'île de La Réunion lors d'essais de pêche en eau profonde. Trav. Doc. ORSTOM, **47**: 225-256, figs. 1-9, pls. 1-2.

DAI, A., S. YANG, Z. FENG & Y. SONG, 1978. On the crabs of the Xisha Islands - Oxyrhyncha. Acta zool. sin., **24** (3): 225-230, figs. 1-4, pl. 1.

DANA, J. D., 1851a. Conspectus Crustaceorum quae in orbis terrarum circumnavigatione Carolo Wilkes e Classe Reipublicae Faederatae duce, lexit et descripsit, 6. Amer. J. Sci. Arts, (2) **11**: 268-274.

——,1851b. On the classification of the maioid Crustacea or Oxyrhyncha. Amer. J. Sci. Arts, (2) **11**: 425-434.

——,1852. Crustacea. In: United States Exploring Expedition during the years 1838-1842 under the command of Charles Wilkes, U.S.N., **13** (1): i-viii, 1-685. Atlas (1855): 1-27, pls. 1-96. (C. Sherman, Philadelphia).

DELL, R. K., 1960. Crabs (Decapoda, Brachyura) of the Chatham Islands 1954 Expedition. N.Z. Dept. sci. ind. Res. Bull., **139** (1): 1-7, figs. 1-6, pls. 1-2.

——,1963. Some deep-water crabs (Crustacea, Brachyura) from New Zealand. Rec. Dom. Mus., Wellington, **4**: 243-253, figs. 1-13.

DOFLEIN, F., 1904. Brachyura. Wiss. Ergebn. Dt. Tiefsee Exped. Valdivia, 1898-1899, **6**: I—XII, 1-314, 1 map, figs. 1-68. Atlas: pls. 1-58.

EDMONDSON, C. H., 1951. Some central Pacific crustaceans. Occ. Pap. Bernice P. Bishop Mus., Honolulu, **20**: 183-243, figs. 1-38.

——,1952. Additional central Pacific crustaceans. Occ. Pap. Bernice P. Bishop Mus. Honolulu, **21**: 67-86, figs. 1-11.

FOREST, J., 1964. Le genre Macropodia Leach en Méditerranée, 2. Remarques sur la nomenclature et les synonymies (Crustacea, Brachyura, Majidae). Bull. Mus. natn. Hist. nat. Paris, (2) **36** (3): 348-354.

——,1978. Le genre Macropodia Leach dans les eaux atlantiques européennes (Crustacea Brachyura Majidae). Cah. Biol. mar., **19**: 323-342, figs. 1-21.

FOREST, J. & D. GUINOT, 1961. Crustacés décapodes Brachyoures de Tahiti et des Tuamotu. Expédtion française sur les récifs coralliens de la Nouvelle Calédonie. Vol. prélim: i-xi, 1-195, 7 maps, figs. 1-178, pls. 1-18.

——,1966. Résultats scientifiques des campagnes de la Calypso, 7. Campagne dans le Golfe de Guinée et aux îles Principe, Sao Tomé at Annobon (1956), 16. Crustacés décapodes: Brachyoures. Annls. Inst. océanogr., Monaco, **44**: 23-124, figs. 1-19.

FOREST, J. & R. ZARIQUIEY ALVAREZ, 1964. Le genre Macropodia Leach en Méditerranée, 1. Description et étude comparative des espèces (Crustacea Brachyura Majidae). Bull. Mus. natn. Hist. nat., Paris, (2) **36** (2): 222-244, figs. 1-16.

GARTH, J. S., 1952. A review of the crustacean genus Stilbognathus von Martens (Decapoda, Maiidae) with description of a new species from the coast of Florida. Bull. mar. Sci. Gulf Caribb., **1** (4): 249-256, pl. 1.

——,1958. Brachyura of the Pacific coast of America: Oxyrhyncha. Allan Hancock Pacif. Exped., **21**: 1-854, tables 1-107, figs. 1-9, pls. A-Z4, 1-55.

GORDON, I., 1931. Brachyura from the coasts of China. J. Linn. Soc. (Zool.), **37**: 525-558, text figs. 1-36.

——,1934. Crustacea Brachyura. Résultats scientifique du voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princess Léopold de Belgique. Mém. Mus. r. Hist. nat. Belg., **3** (15): 1-78, figs. 1-37.

GRAVIER, M. Ch., 1923. Sur un nouveau type de crabe (Stenocarabus nov. gen., suspensus nov. sp.) de Madagascar. Bull. Mus. natn. Hist. nat., Paris, **29** (3): 214-218, figs. 1-8.

GRIFFIN, D. J. G. 1963a. The status of the majid brachyuran genus Campbellia Balss. Rec. Dom. Mus. Wellington, **4** (17): 235-241, figs. 1-4.

——,1963b. Notomithrax gen. nov. and the status of the genus Paramithrax H. Milne Edwards (Crustacea, Brachyura, Majidae). Trans. R. Soc. N.Z., (Zool.) **3** (22): 229-237.

——,1963c. Redescriptions of the Australian majid spider crabs Leptomitrax gaimardii (H. Milne Edwards) and Paramithrax barbicornis (Latreille). Rec. Aust. Mus. **26** (4): 131-143, figs. 1-14, pls. 6, 7.

——,1964. A review of the genus Eurynome Leach (Decapoda, Majidae) and a new species from New Zealand. Crustaceana, **6** (3): 195-206, figs. 1-11.

——,1965. A redescription of the Australian spider crab "Eurynome granulosa" Baker (Crustacea, Brachyura, Majidae). Rec. S. Aust. Mus., **15** (1): 29-37, figs. 1-5.

——,1966a. The genus Chlorinoides (Crustacea, Brachyura, Majidae), 1. A redescription of C. tenuirostris Haswell and the status of the genus Acanthophrys A. Milne Edwards. Rec. Aust. Mus., **27** (1): 1-16, figs. 1-11.

——,1966b. A review of the Australian majid spider crabs (Crustacea, Brachyura). Aust. Zool., **13**: 259-298, figs. 1-3, pls. 15-17.

——,1966c. Extension of range for two Indo-West Pacific spider crabs (Decapoda, Majidae). Crustaceana, **10**: 312-314.

——,1966d. The marine fauna of New Zealand: Spider Crabs, family Majidae (Crustacea, Brachyura). N.Z. Dept. sci. ind. Res. Bull., **172**: 1-111, figs. 1-23, pls. 1-4, frontispiece.

——,1968a. Two new species of Achaeus (Crustacea, Decapoda, Majidae) from South Africa. Ann. S. Afr. Mus., **52**: 75-87, figs. 1-4.

——,1968b. Hyastenus hilgendorfi De Man, a majid spider crab new to Australia. Aust. Zool., **15**: 103-106, fig. 1, pl. 1.

——,1970a. The genus Chlorinoides (Crustacea, Brachyura, Majidae). 2. Chlorinoides goldsboroughi Rathbun from eastern Australia, C. tenuirostris Haswell and a new species from Western Australia. Rec. Aust. Mus. **28** (3): 65-76, figs. 1-4.

——,1970b. Eurynome orientalis, a majid spider crab (Crustacea, Brachyura) new to Australia, and notes on E. granulosa. J. Proc. r. Soc. W. Aust., **53** (1): 7-8, fig. 1.

——,1970c. The Australian majid spider crabs of the genus Achaeus (Crustacea, Brachyura). J. Proc. r. Soc. W. Aust., **53** (4): 97-119, figs. 1-15.

——,1972. Brachyura collected by Danish expeditions in south-eastern Australia (Crustacea, Decapoda). Steenstrupia, **2**: 49-90, figs. 1-3.

——,1973. A revision of the spider crabs of the genus Phalangipus (Crustacea, Brachyura, Majidae). J. nat. Hist., **7**: 165-207, figs. 1-9.

——,1974. Spider crabs (Crustacea: Brachyura: Majidae) from the International Indian Ocean Expedition 1963-64. Smithson. Contr. Zool., **182**: i-iv, 1-35, figs. 1-8, tables 1-6.

——,1976. Spider crabs of the family Majidae (Crustacea: Brachyura) from the Philippine Islands. J. nat. Hist., **10**: 179-222, figs. 1-11, tables 1-2.

GRIFFIN, D. J. G. & D. E. BROWN, 1976. Deepwater decapod Crustacea from eastern Australia: Brachyuran crabs. Rec. Aust. Mus., **30** (11): 248-271, figs. 1-10.

GRIFFIN, D. J. G. & H. A. TRANTER, 1974. Spider crabs of the family Majidae (Crustacea: Decapoda: Brachyura) from the Red Sea. Israel J. Zool., **23**: 162-198, figs. 1-4, pl. 1.

GRIFFIN, D. J. G. & J. C. YALDWYN, 1965. A record of the majid brachyuran genus Achaeus from New Zealand with notes on the Australian species. Trans. R. Soc. N.Z., (Zool.) **6**: 33-51, text figs. 1-8.

GUÉRIN-MÉNEVILLE, F. E., 1829-1844. Iconographie du règne animal de G. Cuvier, ou représentation d'après nature de l'une des espèces les plus remarquables et souvent non figurées, de chaque genre d'animaux. Avec un texte descriptif mis au courant de la science. Ouvrage pouvant servir d'atlas à tous les traités de zoologie. 450 plates in 45 livraisons. Crustacea: 36 plates, 48 pages. (Paris).

GUINOT, D., 1962a. Sur une collection de Crustacés décapodes brachyoures de Mer Rouge et de Somalie. Boll. Mus. civ. Stor. nat. Venezia, **15**: 7-63, figs. 1-37, pls. 1-4.

——,1962b. Sur une collection de Crustacés décapodes brachyoures des îles Maldives et de Mer Rouge (Expédition Xarifa 1957-1958). Kieler Meeresforsch., **18**: 231-244, pls. 1-5.

GUINOT, D. & B. RICHER DE FORGES, 1982a. Nouvelles récoltes des genres Cyrtomaia Miers et Pleistacantha Miers (Crustacea, Decapoda, Brachyura). Bull. Mus. natn. Hist. nat., Paris (4) **3**, 1981 (1982), sect. A (4): 1087-1124, figs. 1-8, pls. 1-4.

——&——,1982b. Révision du genre Indo-Pacifique Cyrtomaia Miers, 1886: campagnes océanographiques du Challenger, de l'Albatross, du

Siboga et du Vauban (Crustacea Decapoda Brachyura). Ann. Inst. océanogr., Paris, **58** (1): 5-88, figs. 1-55.

HAAN, W. DE., 1833-1850. Crustacea. In: P. F. DE SIEBOLD, Fauna Japonica: i-xvi, i-xxxi, 1-244, pls. 1-2, A-Q, 1-55. (J. Muller, Amsterdam).

HARTNOLL, R. G., 1961. A re-examination of the spider crab Eurynome Leach from British waters. Crustaceana, **2**: 171-182, figs. 1-7.

HASWELL, W. A., 1879. On two new species of crabs, of the genus Stenorhynchus. Proc. Linn. Soc. N. S. W., **3**: 408-409.

——,1880a. On two new species of the genus Paratymolus Miers from Australia. Ann. Mag. nat. Hist., (5) **5**: 302-304, pl. 16.

——,1880b. On the Australian Brachyura Oxyrhyncha. Proc. Linn. Soc. N.S.W., **4**: 431-458, pls. 25-27.

——,1882. Catalogue of the Australian stalk-and sessile-eyed Crustacea: i-xxiv, 1-326, pls. 1-4. (Australian Museum, Sydney).

HALE, H. M., 1927. The Crustaceans of South Australia, **1**: 1-201, figs. 1-202. (Govt. Printer, Adelaide).

HELLER, C., 1861. Beitrage zur Crustaceen-Fauna des Rothen Meeres, 1. Sber. Akad. Wiss., Wien. (Math.-nat.), **43**: 297-374, pls. 1-4.

HENDERSON, J. R., 1893. A contribution to Indian carcinology. Trans. Linn. Soc. Lond., (Zool.) (2) **5**: 325-458, pls. 36-40.

HERBST, J. F. W., 1782-1804. Versuch einer Naturgeschichte der Krabben und Krebse, nebst einer systematischen Beschreibung ihrer verschiedenen Arten. 3 Vols. Atlas: pls. 1-62. (G. A. Lange, Berlin & Stralsund).

HOLTHUIS, L. B., 1953. Enumeration of the decapod and stomatopod Crustacea from Pacific coral islands. Atoll Res. Bull., **24**: 1-66, 2 maps.

IHLE, J. E. W. & M. E. IHLE-LANDENBERG, 1931. Über einige Tiefsee-Brachyuren der Siboga-Expedition aus der Gruppe der Oxyrhyncha. Zool. Anz., **93**: 147-163.

KEMPS, S. & R. B. S. SEWELL, 1912. Notes on Decapoda in the Indian Museum, 3. The species obtained by R.I.M.S.S. Investigator during the survey season 1910-11. Rec. Indian Mus., **7**: 15-32, pl. 1.

KENSLEY, B., 1977a. Lambrachaeus ramifer Alcock, a rare spider crab from the east coast of southern Africa (Decapoda, Brachyura, Majidae). Zoologica Afr., **12** (2): 323-327, figs. 1-2.

——,1977b. The South African Museum's Meiring Naude cruises, 2. Crustacea, Decapoda, Anomura and Brachyura. Ann. S. Afr. Mus., **72** (9): 161-188, figs. 1-17.

KREFFT, S., 1952. The early post-larval stages and systematic position of Eurynolambrus australis M. E. & L. (Brachyura). Trans. R. Soc. N.Z., (Zool.) **79** (3-4): 574-578, pl. 126.

KUBO, I., 1936. A new decapod Crustacean from Japan, Paramaja kominatoensis, gen. et sp. nov. Bull. Jap. Soc. scient. Fish., **4** (6): 361-364, figs. 1-2.

LANCHESTER, W. F., 1900. On a collection of Crustaceans made at Singapore and Malacca, 1. Crustacea Brachyura. Proc. zool. Soc. Lond., **1900**: 719-770, pls. 44-47.

LATREILLE, P. A., 1825. Entomologie, ou Histoire naturelle des Crustacé, des Arachnides et des Insectes. Encycl. méth. Hist. nat., **10**., 1-832.

——,1829. Crustacés, Arachnides et partie des Insectes. *In*: G. CUVIER, Le règne animal etc. **4**: i-xxvii, 1-584. (Deterville, Paris).

LAURIE, R. D., 1906. Report on the Brachyura collected by Professor Herdman, at Ceylon, in 1902. Rep. Ceylon Pearl Oyster Fish., **5**, Suppl. Rep., 40: 349-432, figs. 1-12, pls. 1-2.

LEACH, W. E., 1815. The zoological miscellany; being descriptions of new or interesting animals, **2**: 1-154 + 8 (unnumbered) pages. Atlas (1814): pls. 61-120. (Nodder and Son, London).

LINNAEUS, C., 1758. Systema naturae per regna tria naturae, secundum classes ordines, genera, species, cum characteribus, differentiis, synonymus, locis. Edn. 10, 1: i-iii, 1-824. (L. Salvius, Holmiae).

——,1764. Museum S:ae R:ae M:tis Ludovicae Ulricae Reginae Svecorum, Gothorum, Vandalorumque, etc.: 1-720. (L. Salvius, Homiae).

——,1767. Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis synonymis, locis. Edn. 12, 1(2): 533-1327. (Stockholm).

MCARDLE, A. F., 1900. Natural history notes from the Royal Indian marine survey ship Investigator, (3). 4. Some results of the dredging season 1899-1900. Ann. Mag. nat. Hist., (7) **6**: 471-478.

MCCULLOCH, A. R., 1908. Studies in Australian Crustacea, 1. Rec. Aust. Mus., **7**: 51-59, pl. 12.

——,1913. Studies in Australian Crustacea, 3. Rec. Aust. Mus., **9**: 321-353, figs. 42-53, pls. 10-11.

MACGILCHRIST, A. C., 1905. Natural History notes from the R.I.M.S.S. Investigator, (3) 6. An account of the new and some of the rarer decapod Crustacea obtained during the surveying seasons 1901-1904. Ann. Mag. nat. Hist., (7) **15**: 233-268.

MACLEAY, W. S., 1838. On the brachyurous decapod Crustacea. Brought from the Cape by Dr. Smith. In: His (MACLEAY's) Illustrations of the Annulosa of South Africa; being a portion of the objects of natural history chiefly collected during an expedition into the interior of South Africa, under the direction of Dr. Andrew Smith, in the years 1834, 1835 and 1836; fitted out by "The Cape of Good Hope Association for Exploring Central Africa": 53-71, pls. 2-3. (London).

MCNEILL, F. A., 1920. Studies in Australian Carcinology, 1. Rec. Aust. Mus., **13** (3): 105-109, figs. 1-5, pl. 19.

MAN, J. G. DE, 1887. Report on the Podophthalmous Crustacea of the Mergui Archipelago, collected for the Trustees of the Indian Museum, Calcutta by Dr. John Anderson, F. R. S., Superintendent of the Museum, 1. J. Linn. Soc., (Zool.) **22**: 1-64, pls. 1-3.

——,1888. Bericht über die im Indischen Archipel von Dr. J. Brock gesammelten Decapoden und Stomatopoden. Arch. Naturgesch., **53**: 215-600, pls. 7-22A.

——,1895-1898. Bericht über die von Hernn Schiffscapitän Storm zu Atjeh an den westlichen Küsten von Malakka, Borneo and Celebes sowie in der Java-See gesammelten Decapoden und Stomatopoden. (In 6 parts). Zool. Jb. Syst., **8-10**: 471 pp. 14 pls.

——,1902. Die von Hernn Professor Kükenthal im Indischen Archipel gesammelten Dekapoden und Stomatopoden. (Ergebnisse einer zoologischen Forschungsreise in den Molukken und Borneo). Abh. senckenb. naturforsch. Ges., **25**: 465-929, pls. 19-27.

——,1928. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16, 42. On four species of crabs of the families Inachidae and Xanthidae, two of which are new to science. Vidensk. Meddr. dansk naturh. Foren., **85**: 7-25, figs. 1-4.

MANNING, R. B. & L. B. HOLTHUIS, 1981. West African brachyuran crabs (Crustacea: Decapoda). Smithson. Contr. Zool., **306**: i-xii, 1-379, figs. 1-88.

MIERS, E. J., 1874. Crustacea. *In*: J. RICHARDSON & J. E. GRAY. The zoology of the voyage of H. M. S. Erebus and Terror (Command of Sir J. C. Ross) during the years 1839-1843 **20**: 1-5, pls. 1-4. (London).

——,1876. Catalogue of the Stalk- and Sessile-eyed Crustacea of New Zealand: i-xii, 1-36, pls. 1-3. (Janson, London).

——,1879a. Descriptions of new or little known species of maioid Crustacea (Oxyrhyncha) in the collection of the British Museum. Ann. Mag. nat. Hist., (5) **4**: 1-28, pls. 4-5.

——,1879b. On a collection of Crustacea made by Capt. H. C. St. John, R. N. in the Corean and Japanese seas, 1. Podophthalmia. Proc. zool. Soc. Lond., **1879**: 18-61, pls. 1-3.

——,1879c. On the classification of the majoid Crustacea or Oxyrhyncha, with a synopsis of the families, subfamilies and genera. J. Linn. Soc., (Zool.) **14**: 634-673, pls. 12-13.

——,1880. On a collection of Crustacea from the Malaysian Region, 1. Crustacea Oxyrhyncha and Cyclomatopa, except Thelphusidea. Ann. Mag. nat. Hist., (5) **5**: 226-239, pl. 13.

——,1882. On some crustaceans collected at Mauritius. Proc. zool. Soc. Lond., **1882**: 339-342, pl. 20, 538-543, pl. 36.

——,1884. Crustacea. *In*: Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H. M. S. Alert 1881-2: 178-322, 513-575, pls. 18-34, 46-52. (British Museum, London).

——,1885. On the species of Micippa, Leach, and Paramicippa, Milne Edwards. Ann. Mag. nat. Hist., (5) **15**: 1-13, pl. 1.

——,1886. Report on the Brachyura collected by H. M. S. Challenger during the years 1873-76. Rep. Voy. Challenger, (Zool.) **17** (2): i-l, 1-362, pls. 1-29.

MILNE EDWARDS, A., 1862. Faune carcinologique de l'Ile de la Réunion. *In*: L. MAILLARD, Notes sur l'Ile de la Réunion (Bourbon): 1-16, pls. 17-19. (Paris)

——,1865. Description de quelques Crustacés nouveaux appartenant à la tribu des Maiens. Annls Soc. ent. Fr., (4) **5**: 133-147, pls. 3-5.

——,1868. Description de quelques Crustacés nouveaux provenant des voyages de M. Alfred Grandidier à Zanzibar et à Madagascar. Nouv. Archs. Mus. Hist. nat., Paris, **4**: 69-92, pls. 16-21.

——,1872. Recherches sur la faune carcinologique de la Nouvelle-Calédonie. Nouv. Archs. Mus. Hist. nat., Paris, **8**: 229-267, pls. 10-14.

——,1873. Description de quelques Crustacés nouveaux ou peu connus provenant du Musée de M. C. Godeffroy. J. Mus. Godeffroy, **1**: 253-264, pls. 12-13.

MILNE EDWARDS, H., 1834. Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces Animaux; **1**: i-xxxv, 1-468. Atlas. (Lib. Roret, Paris).

MIYAKE, S., 1936. On three crabs from off Tori-shima, Danjo-Group, Japan. Annotnes zool. jap., **15**: 416-420, figs. 1-2, pl. 28.

——,1939. Notes on Crustacea Brachyura collected by Professor Teiso Esaki's Micronesia Expeditions 1937-1938 together with a check list of Micronesian Brachyura. Rec. oceanogr. Wks Japan, **10**: 168-247, figs. 1-13, pls. 12-17.

MIYAKE, S. & M. TAKEDA, 1969. On two majid crabs of the genus Achaeus from the Ogasawara Islands (Crustacea. Brachyura) Proc. Jap. Soc. Syst. Zool., **5**: 22-32, figs. 1-2.

MONOD, Th., 1938. Decapoda Brachyura. *In*: Mission Robert Ph. Dollfus en Egypte. Mém. Inst. Egypte, **37**: 91-162, figs. 1-29.

——,1939. Sur quelques Crustacés de la Guadeloupe (Mission P. Allorge, 1936). Bull. Mus. natn. Hist. nat., Paris, (2) **11** (6): 557-568, figs. 1-11.

——,1956. Hippidea et Brachyura ouest-africains. Mém. Inst. fr. Afr. noire, (**45**): 1-674, 2 tables, figs. 1-884.

MONTGOMERY, S. K., 1931. Report on the Crustacea Brachyura of the Percy Sladen Trust Expedition to the Abrolhos Islands under the leadership of Prof. W. J. Dakin in 1913; along with other crabs from Western Australia. J. Linn. Soc., (Zool.) **37**: 405-464, map 1, pls. 24-30.

NOBILI, G., 1906. Crustacées décapodes et stomatopodes. Mission J. Bonnier et Ch. Pérez (Golfe Persique 1901). Bull. scient. Fr. Belg., **40**: 13-159, pls. 2-7. (Quoted from Guinot, 1962a).

——,1907. Richerche sui Crostacei della Polinesia, Decapodi, Stomatopodi, Anisopodi e Isopodi. Memorie Accad. Sci. Torino, (2) **57**: 351-430, pls. 1-3.

ORTMANN, A. E., 1893. Die Decapoden-Krebse des Strassburger Museums, 6. Abteilung Brachyura, 1. Unterabteilung: Majoidea und Crancroidea, 1. Section Portuninea. Zool. Jb. (Syst.), **7**: 23-88, pl. 3.

——,1894. Crustaceen. In: R. SEMON (ed.), Zoologische Forschungsreisen in Australian und dem Malayischen Archipel. Denkschr. med.-naturw. Ges. Jena, **8**: 1-80, pls. 1-3.

PARISI, B., 1915. I Decapodi giapponesi del Museo di Milano, 3. Oxyrhyncha. Atti Soc. ital. Sci. nat., **54**: 281-296, figs. 1-4, pl. 7.

PAUL'SON, O., 1875. Studies on Crustacea of the Red Sea with notes regarding other seas, 1. Podophthalmata and Edriophthalmata (Cumacea). (1961 English translation by F. D. Por.) Israel program for scientific translations, Jerusalem: 1-64, pls. 1-21.

PEYROT-CLAUSADE, M. & R. SERÈNE, 1976. Observations sur quelques espèces de Brachyoures (Crustacés Décapodes) de Madagascar. Bull. Mus. natn. Hist. nat., Paris, (3) **416**: 1339-1371, pls. 1-5.

POCOCK, R. I., 1890. Report upon the Crustacea collected by P. W. Bassett-Smith, Esq., Surgeon R. N., during the survey of the Macclesfield and Tizard Banks, in the China Sea, By H. M. S. Rambler, Commander W. U. Moore. Ann. Mag. nat. Hist., (6) **5**: 72-80.

RATHBUN, M. J., 1897. A revision of the nomenclature of the Brachyura. Proc. biol. Soc. Wash., **11**: 153-167.

——,1902a. Crabs from the Maldive Islands. Bull. Mus. comp. Zool. Harv., **39**: 123-138, pl. 1.

——,1902b. Japanese stalk-eyed Crustaceans. Proc. U. S. natn. Mus., **26**: 23-55, figs. 1-24.

——,1906. The Brachyura and Macrura of the Hawaiian Islands. Bull. U. S. Fish Commn., **23**: 827-930, figs. 1-79, pls. 1-24.

——,1907. The Brachyura. Reports on scientific results of the expedition to the eastern tropical Pacific, in charge of Alexander Agassiz, Str. Albatross, 1899-1900 and 1904-1905. Mem. Mus. comp. Zool., **35** (2): 23-74, pls. 1-9.

——,1910. The Danish Expedition to Siam 1899-1900, 5. Brachyura. K. danske Vidensk. Selsk. Skr., (7) **5**: 303-367, map 1, pls. 1-2.

——,1911. The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of J. Stanley Gardiner, 3 (11), Marine Brachyura. Trans. Linn. Soc. Lond., (Zool.) (2) **14**: 191-261, figs. 1-2, pls. 15-20.

——,1914. Stalk-eyed crustaceans collected at the Monte Bello Islands. Proc. zool. Soc. Lond., **1914**: 653-664, pls. 1-2.

——,1916. New species of crabs of the families Inachidae and Parthenopidae. (Scientific results of the Philippine cruise of the fisheries steamer Albatross, 1907-1910. No. 34.) Proc. U.S. natn. Mus., **50**: 527-559.

——,1918. Report on the spider crabs obtained by F.I.S. Endeavour on the coasts of Queensland, New South Wales, Victoria, South Australia and Tasmania. Zool. (biol.) Results Fish. Exp. Endeavour, **5**: 1-29. figs. 1-3, pls. 1-15.

——,1924. Brachyura, Albuneidae and Porcellanidae. Results from Dr. E. Mjoberg's Swedish Scientific Expeditions to Australia 1910-1913. Ark. Zool., **16** (23): 1-33, figs. 1-7, pl. 1.

——,1925. The spider crabs of America. Bull. U.S. natn. Mus., **129**: i-xx, 1-613, figs. 1-153, pls. 1-283.

——,1932, Preliminary descriptions of new species of Japanese crabs. Proc. biol. Soc. Wash., **45**: 29-38.

RÜPPELL, E., 1830. Beschreibung und Abbildung von 24 Arten kurzschwänzigen Krabben, als Beitrag zur Naturgeschichte des rothen Meeres: 1-28, pls. 1-6. (H. L. Bronner, Frankfurt a. M.).

SAKAI, T., 1932. Notes on some rare materials of Japanese Oxyrhyncha. Sci. Rep. Tokyo Bunrika Daig., (B) **1**: 41-59, text figs. 1-8, pls. 2-3.

——,1933. A new genus and some new species of crabs from Simoda. Sci. Rep. Tokyo Bunrika Daig., (B) **12**: 137-144, text figs. 1-3, pl. 8.

——,1934. Brachyura from the coast of Kyushu, Japan. Sci. Rep. Tokyo Bunrika Daig., (B) **25**: 281-330, text figs. 1-26, pls. 17-18.

——,1935. New or rare species of Brachyura, collected by the Misago during the zoological survey around the Izu-peninsula. Sci. Rep. Tokyo Bunrika Daig., (B) **32**: 63-88, text figs. 1-17, pls. 6-8.

——,1936. Report on the Brachyura collected by Mr. F. Hiro at Palao Islands. Sci. Rep. Tokyo Bunrika Daig., (B) **37**: 155-177, text figs. 1-7, pls. 12-14.

——,1938. Studies on the crabs of Japan, 3. Brachygnatha Oxyrhyncha: 193-364, figs. 1-55, pls. 20-41. (Yokendo Co., Tokyo).

——,1961. New species of Japanese crabs from the collection of His Majesty the Emperor of Japan. Crustaceana, **3** (2): 131-150, figs. 1-4, pls. 3-4.

——,1965a. The crabs of Sagami Bay collected by His Majesty the Emperor of Japan: i-xvi, 1-206, 1-92, 1-32, map 1, text figs. 1-27, pls. 1-100. (Maruzen, Tokyo).

——,1965b. Notes from the carcinological fauna of Japan, (2). Researches Crustacea, **2**: 37-46, text figs. 1-2, frontispieces 2-3, pls. 5-6.

——,1967. Notes from the carcinological fauna of Japan, (3). Researches Crustacea, **3**: 68-83, text figs. 1-2, frontispiece 1.

——,1969. Two new genera and twenty-two new species of crabs from Japan. Proc. biol. Soc. Wash., **82**: 243-280, text figs. 1-20, pls. 1-2.

——,1976. Crabs of Japan and the adjacent seas: i-xxix, 1-773, 1-461, 1-16, maps 3, text figs. 1-379, pls. 1-251. (Kodansha, Tokyo).

SANKARANKUTTY, C., 1961. On some crabs (Decapoda-Brachyura) from the Laccadive Archipelago. J. mar. biol. Ass. India, **3**: 120-136, figs. 1-2.

——,1962. On Decapoda Brachyura from the Andaman and Nicobar Islands, 3. Families: Calappidae, Leucosiidae, Parthenopidae, Maiidae and Gecarcinidae. J. mar. biol. Ass. Inida, **4**: 151-164, figs. 1-23.

SENO, J. & K. KONNO, 1954. On Platymaia alcocki Rathbun (Brachyura, Oxyrhyncha) obtained from off Amatsu, province Boshu, Japan. J. Tokyo Univ. Fish., **41**: 85-88, text fig. 1, tables 3, pl. 2.

SERÈNE, R., 1965. Note sur un Oxyrhynche (Brachyura, Decapoda, Crustacea) aberrant du Sud-est Asiatique. Bull. Soc. zool. Fr., **90**: 457-468, figs. 1-4, pls. 1-2.

——,1969. Description de deux espèces nouvelles et redécourverte d'une espèce de Brachyoure (Decapoda-Crustacea) dans les eaux d'Indonésie. Cah. Pacif., **13**: 281-293, figs. 1-24, pls. 1-4.

SERÈNE, R. & P. LOHAVANIJAYA, 1973. The Brachyura (Crustacea: Decapoda) collected by the Naga Expedition, including a review of the Homolidae. Naga Rep., **4** (4): 1-187, figs. 1-186, pls. 1-21.

SERÈNE, R. & C. VADON, 1981. Crustacés Décapodes: Brachyoures. Liste préliminaire, description de formes nouvelles et remarques taxonomiques. *In*: Rés. Campagnes MUSORSTOM, 1. Philippines (18-29 mars 1976), 5. Collections Mém. ORSTOM, **91**: 117-140, figs. 1-3, pls. 1-4.

SHEN, C. J., 1937. Second addition to the fauna of Brachyuran Crustacea of North China, with a check list of the species recorded in this particular region. Contr. Inst. Zool. natn. Acad. Peiping, **3**: 277-313, text figs. 1-11.

STEBBING, T. R. R., 1902. South African Crustacea, 2. Mar. Invest. S. Afr., **2**: 1-92, pls. 5-16.

STEPHENSEN, K., 1945. The Brachyura of the Iranian Gulf. With an Appendix: The male pleopods of the Brachyura. Dan. scient. Invest. Iran, (**4**): 57-237, figs. 1-60.

STIMPSON, W., 1857. Prodromus descriptionis animalium evertebratorum, quae in expeditione ad Oceanum Pacificum Septentrionalem, a Republuca Federata missa, Cadwaladaro Ringgold et Johanne Rodgers ducibus observavit et descripsit, 3. Crustacea Maioidea. Proc. Acad. nat. Sci. Philad., **9**: 216-221.

——,1907. Report on the Crustacea (Brachyura and Anomura) collected by the North Pacific Exploring Expedition, 1853-56. Smithson. misc. Collns, **49** (1717): 1-240, pls. 1-26.

STREETS, T. H., 1870. Notice of some Crustacea of the genus Libinia, with descriptions of four new species. Proc. Acad. nat. Sci. Philad., **22** (3): 104-107.

SUZUKI, K. & Y. KURATA, 1967. On the carcinological fauna of the Izu-Ohshima and its adjacent Island. Researches Crustacea, **3**: 86-104, text figs. 1-2, pls. 8-9.

TAKEDA, M., 1973a. Studies on the Crustacea Brachyura of the Palau Islands, 1. Dromiidae, Dynomenidae, Calappidae, Leucosiidae, Hymenosomatidae, Majidae and Parthenopidae. Bull. Lib. Arts Sci. Course, Nihon Univ. Sch. Med., **1**: 75-122, figs. 1-6, pls. 2-3.

——,1973b. Report on the crabs from the sea around the Tsushima Islands collected by the research vessel Genkai for the Trustees of the National Science Museum, Tokyo. Bull. Lib. Arts Sci. Course, Nihon Univ. Sch.Med., **1**: 17-68, tables 1-3, figs. 1-5.

——,1975. Crabs from the East China Sea, 6. A collection from off the Danjo Islands made by the R/V Hakuho Maru Cruise KH-74-3. Bull. natn. Sci. Mus., Tokyo, (A) **1** (3): 137-156, figs. 1-4, tables. 1-3, pls. 1-3.

——,1977. Crabs of the Ogasawara Islands, 5. A collection made by dredging. Mem. natn. Sci. Mus., Tokyo, **10**: 113-140, figs. 1-5, table 1, pls. 12-17.

——,1978. A new spider crab from off Iriomote Island, the Ryukyu Islands. Bull. natn. Sci. Mus., Tokyo, (A) **4** (2): 117-121, figs. 1-11.

——,1980. Two new crabs associated with precious coral from the central Pacific. Bull. natn. Sci. Mus., Tokyo, (A) **8** (2): 71-76, figs. 1-3.

TAKEDA, M. & Y. KOYAMA, 1974. On some rare crabs from Kii Province. Researches on Crustacea, **6**: 103-121, figs. 1-3, pls. 10-12.

TAKEDA, M. & Y. KURATA, 1976. Crabs of the Ogasawara Islands, 3. Some species collected by coral fishing boats. Bull. natn. Sci. Mus., Tokyo, (A) **2** (1): 19-32, figs. 1-3, pls. 1-2.

TAKEDA, M. & S. MIYAKE, 1969. Crabs from the East China Sea, 3. Brachygnatha Oxyrhyncha. J. Fac. Agric. Kyushu Univ., **15**: 469-521, figs. 1-12, pls. 17-18.

——,1972a. Crabs from the East China Sea, 5. A remaining collection. Ohmu, **3** (8): 63-90, fig. 1, pl. 3.

——,1972b. New crabs from the sea around the Tsushima Islands. Bull. natn. Sci. Mus., Tokyo, **15** (2): 253-265, figs. 1-5.

TAKEDA, M. & N. NUNOMURA, 1976. Crabs collected by the Melanesia Expedition of the Osaka Museum of Natural History, 1958. Bull. Osaka Mus. nat. Hist., **30**: 61-92, figs. 1-3.

TAKEDA, M., K. OKAMOTO & T. FUKUDA, 1976. Huenia brevifrons Ward (Decapoda, Majidae) attached to calcareous green alga, Halimeda, from the Ryukyu Islands. Bull. natn. Sci. Mus., Tokyo, (A) **2** (2): 103-108, figs. 1-6. pl. 1.

TERAZAKI, T., 1902-1905. Nippon kanirui-Zusetu. *In*: Dobutsu Gaku Zasshi, **14-17**. (Quoted from Sakai, 1938).

THOMSON, C. W., 1873. The depths of the sea. An account of the general results of the dredging cruises of H.M.S.S. Porcupine and Lightning during the summers of 1868, 1869, and 1870, under the scientific direction of Dr. Carpenter, F.R.S., J. Gwyn Jeffreys, F.R.S., and Dr Wyville Thomson, F.R.S.: i-xx, 1-527, figs. 1-84, pls. 1-8. (Macmillan, London).

TIRMIZI, N. M., 1978. Notes on Simocarcinus simplex (Dana) from the Arabian Sea (Decapoda, Brachyura). Crustaceana, **35** (3): 311-312, figs. 1-8.

TIRMIZI, N. M. & R. SERÈNE, 1971. The rediscovery of two species of crabs (Decapoda, Brachyura) with observations on three other species from Pakistan. Crustaceana, **21** (1): 21-32, figs. 1-4, pls. 1-2.

WALKER, A. O., 1887. Notes on a collection of Crustacea from Singapore. J. Linn. Soc., (Zool.) **20**: 107-117, pls. 6-9.

WARD, M., 1933. New genera and species of marine Decapoda Brachyura from the coasts of New South Wales and Queensland. Aust. Zool., **7**: 337-394, pls. 21-23.

——,1934. Notes on a collection of crabs from Christmas Island, Indian Ocean. Bull. Raffles Mus., **9**: 5-28, pls. 1-3.

——,1936. Crustacea Brachyura from the coasts of Queensland. Mem. Qd. Mus., **11**: 1-13, pls. 1-3.

——,1941. New Brachyura from the Gulf of Davao, Mindanao, Philippine Islands. Am. Mus. Novit., (**1104**): 1-15, figs. 1-30.

——,1942. Notes on the Crustacea of the Desjardins Museum, Mauritius Institute, with descriptions of new genera and species. Bull. Maurit. Inst., **2**: 49-113, pls. 5-6.

WHITE, A., 1847a. Descriptions of a new genus and five new species of Crustacea. *In*: J. B. JUKES, Narrative of the surveying voyage of H.M.S. Fly in Torres Strait, New Guinea and other islands of the Eastern Archipelago, during the years 1842-46, **2**. Append., 8: 335-338, pl. 2.

——,1847b.[42]) Descriptions of new Crustacea from the eastern seas. Proc. zool. Soc. Lond., **15**: 56-58. -and also- Ann. Mag. nat. Hist. (1) **20**: 61-63.

——,1847c[42]). Descriptions of new or little known Crustacea in the collection at the British Museum. Proc. zool. Soc. Lond., **15**: 118-126. -and also- (1848) Ann. Mag. nat. Hist., (2) **1**: 221-228.

——,1847d[42]). Short descriptions of new or little-known decapod Crustacea. Proc. zool. Soc. Lond., **15**: 222-228. -and also- (1848) Ann. Mag. nat. Hist., (2) **2**: 282-288.

WHITELEGGE, T. 1900. Scientific results of the trawling expedition of H.M.C.S. Thetis, off the coasts of New South Wales, in February and March 1898, 2. Crustacea, 1. Mem. Aust. Mus., **4**: 135-199, figs. 11-14, pls. 32-35.

WILLIAMS, A. B., 1965. Marine decapod crustaceans of the Carolinas. Fish. Bull. U.S. Fish, Wildl. Serv., **65** (1): i-xi, 1-298, textfigs. 1-252.

WILLIAMS, A. B., J. K. SHAW & T. S. HOPKINS, 1977. Stilbomastax, a new genus of spider crab (Majidae: Tychinae) from the West Indies region, with notes on American relatives. Proc. biol. Soc. Wash., **90** (4): 884-893, figs. 1-9.

WOOD-MASON, J., & A. ALCOCK. 1891. Natural history notes from H. M. Indian marine survey steamer Investigator, Commander R. F. Hoskyn, R. N., commanding, 21. Note on the results of the last season's deep-sea dredging. Ann. Mag. nat. Hist., (6) **7**: 258-272, fig. 5.

YALDWYN, J. C., 1964. The Ornamental sea-toad. Aust. nat. Hist., **14** (11): 362, photograph.

YALDWYN, J. C. & E. W. DAWSON, 1976. First records of the crab genera Homola, Randallia and Rochinia from New Zealand (Crustacea: Decapoda: Brachyura). Rec. natn. Mus. N.Z., **1** (6): 91-103, figs. 1-9.

YOKOYA, Y., 1933. On the distribution of decapod crustaceans inhabiting the continental shelf around Japan, chiefly based upon the materials collected by the S. S. Sôyô-Maru, during the year 1923-1930. J. Coll. Agric. imp. Univ. Tokyo, **12**: 1-226, tables 1-4, text figs. 1-71.

ZEHNTNER, L., 1894. Crustacés de l'archipel Malais (voyage de MM. M. Bedot et Ch. Pictet dans l'Archipel Malais). Revue suisse Zool., **2**: 135-214, pls. 7-9.

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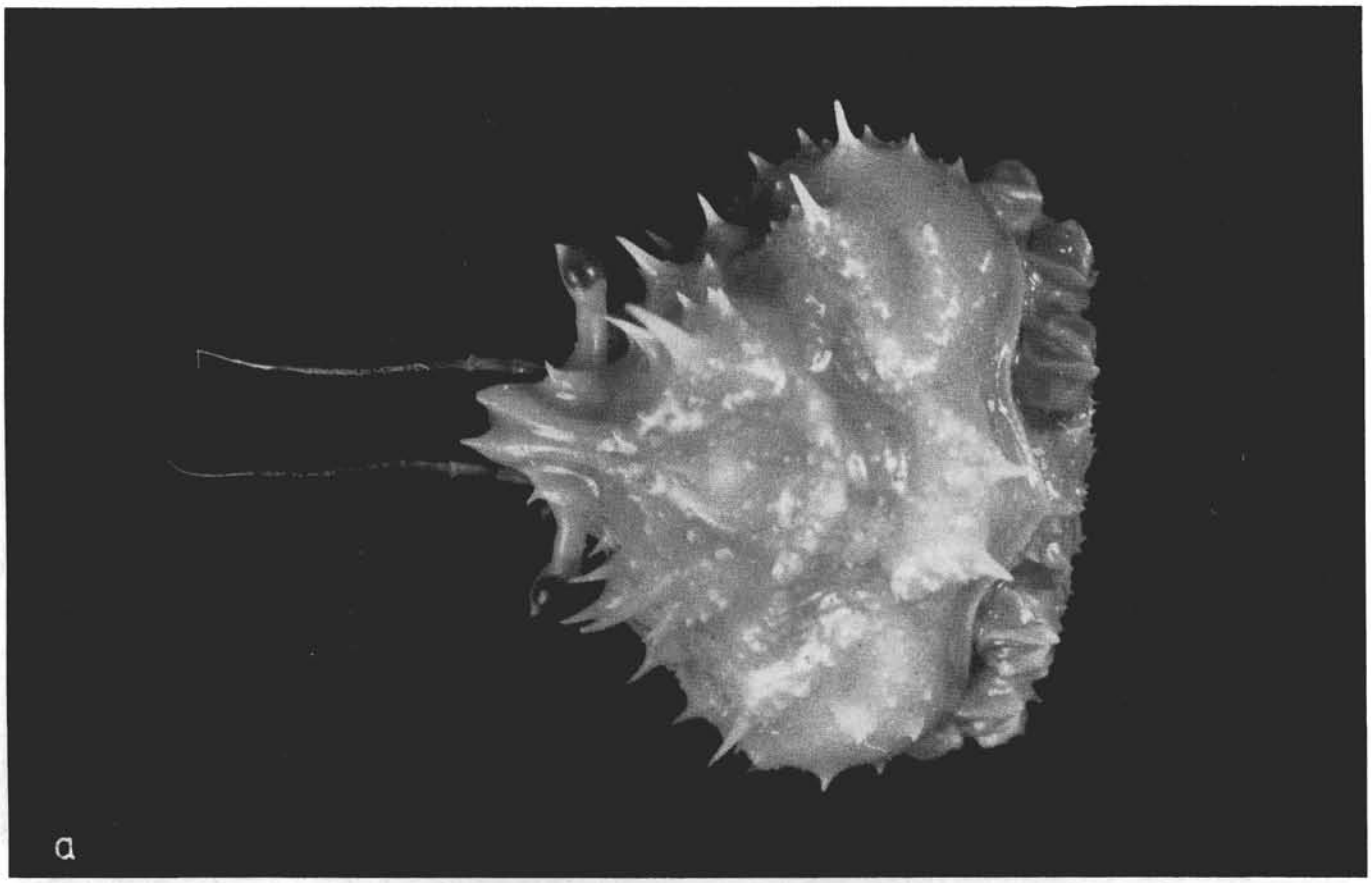
[42]) Pages cited in the synonymies refer to Proc. zool. Soc. Lond.

Plate 1. *Cyrtomaia goodridgei* (female, ovig., 38 mm, E. of Zamboanga, ZMC) (a) dorsal view, (b) ventral view.



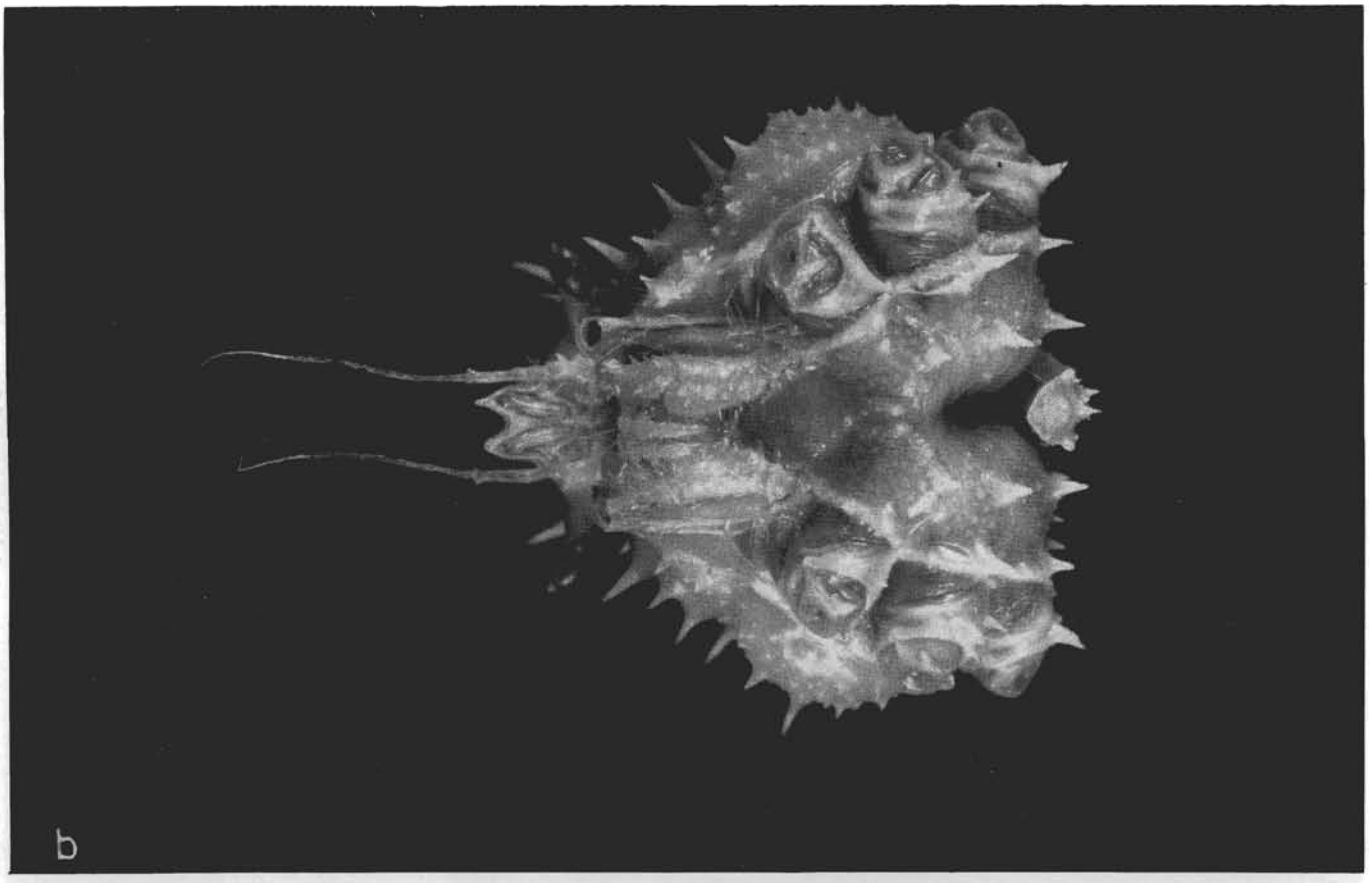


Plate 2. *Cyrtomaia murrayi* (male, 13 mm, Western Australia, WAM 13-67) (a) dorsal view, (b) ventral view.

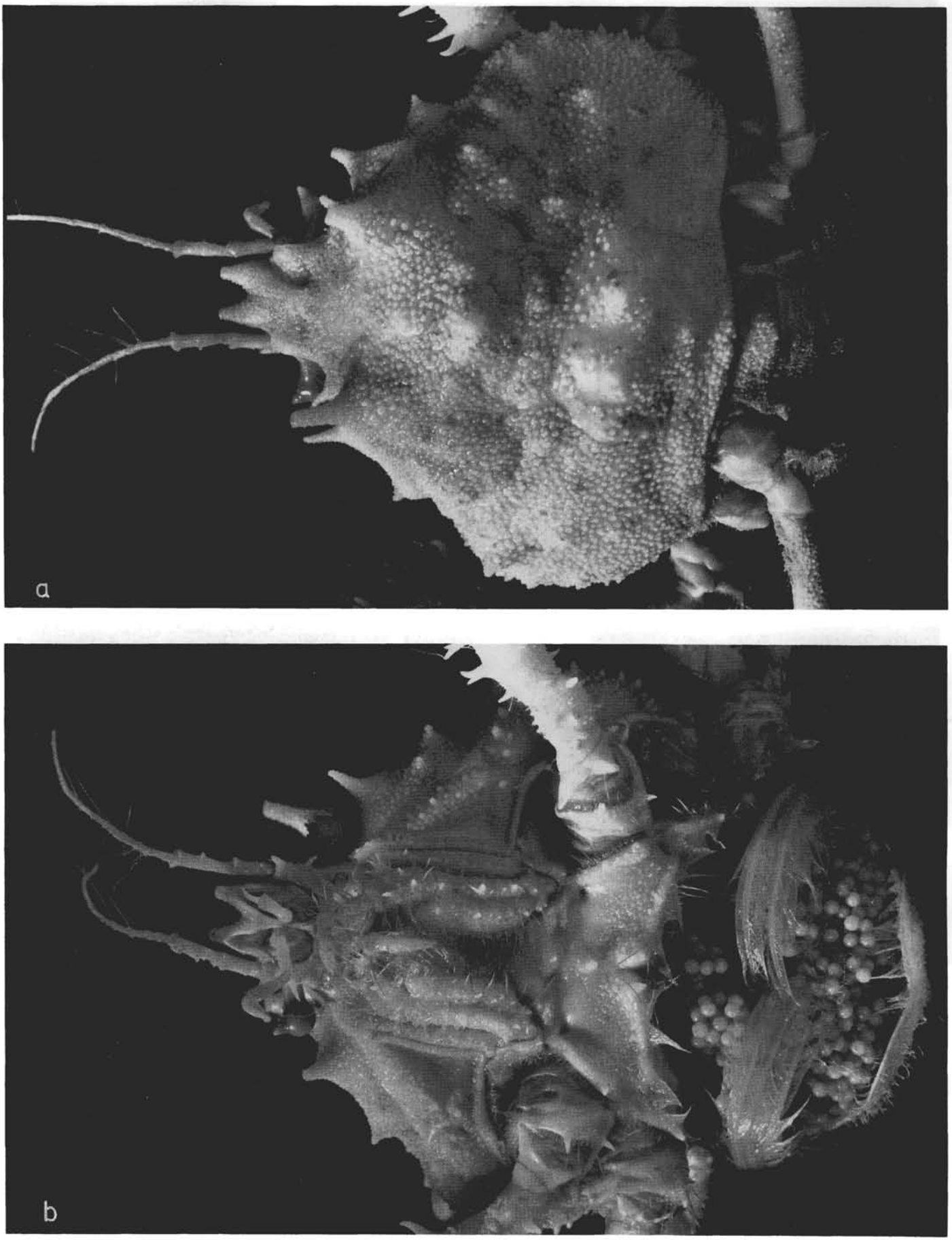
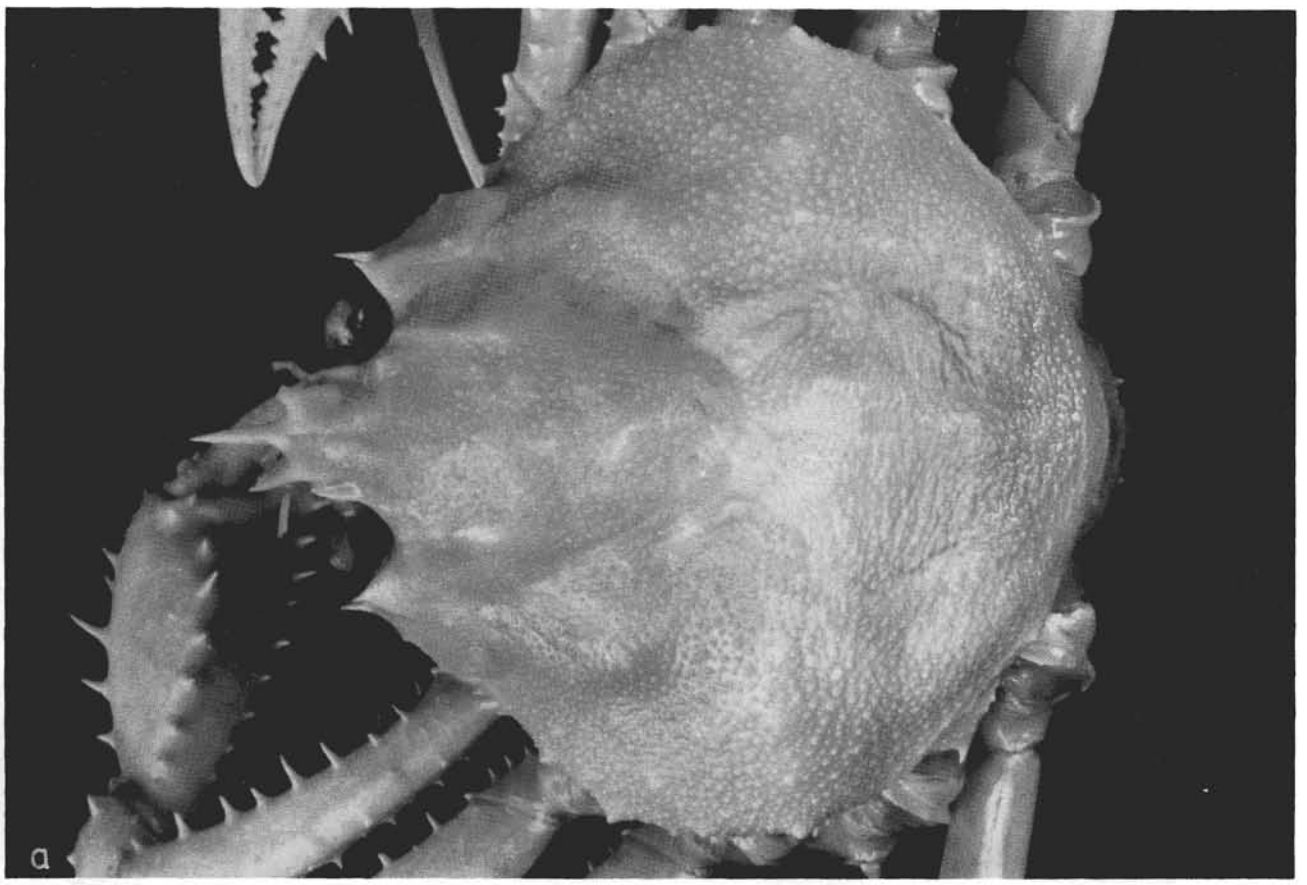


Plate 3. *Cyrtomaia bicornis* (female, ovig., 26 mm, Java Sea, ZMC) (a) dorsal view, (b) ventral view.



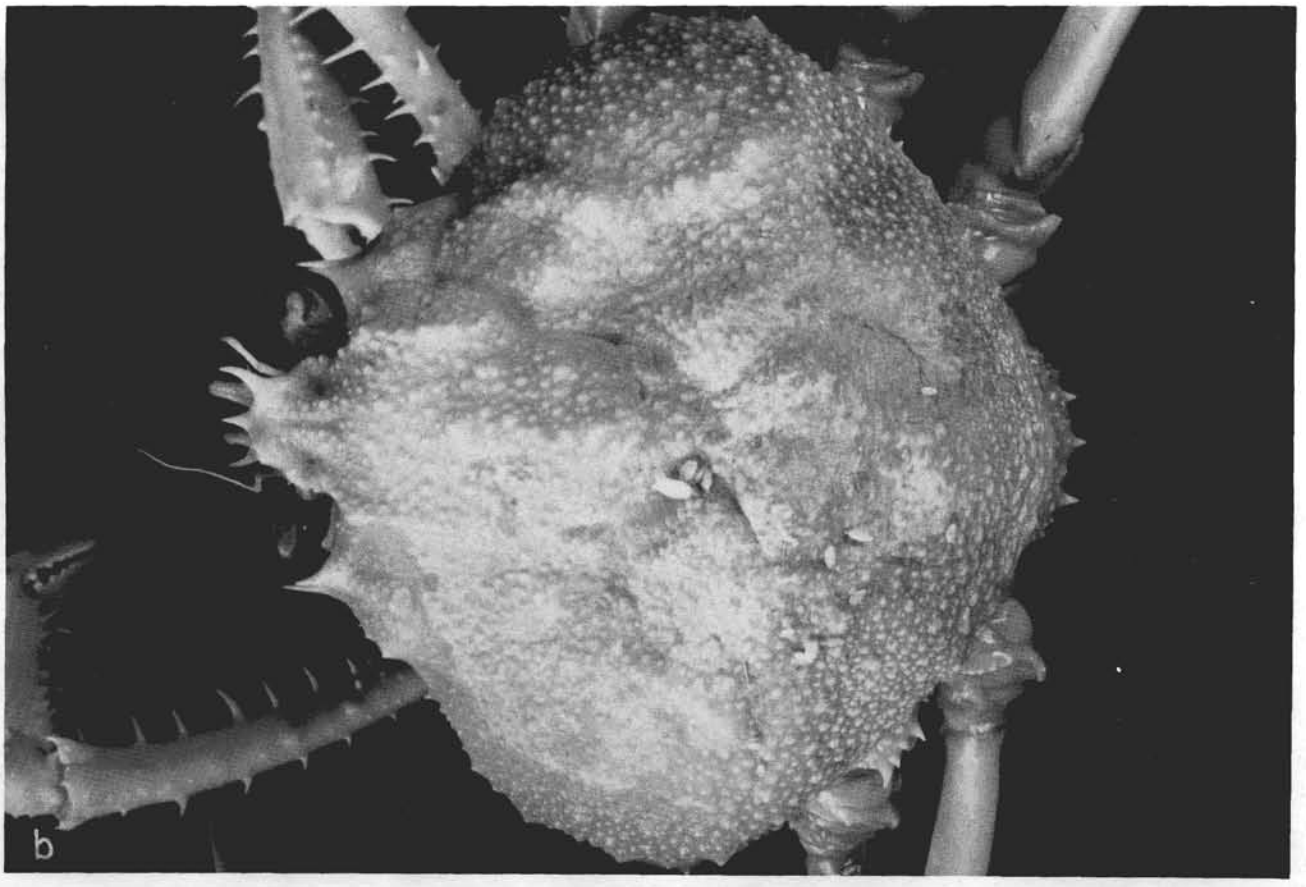


Plate 4. *Platymaia bartschi* (male, 59.5 mm, S. China Sea, AM P.20246) (a) dorsal view; *P. alcocki* (male, 62.5 mm, E. of Mombasa, AM P.17794) (b) dorsal view.

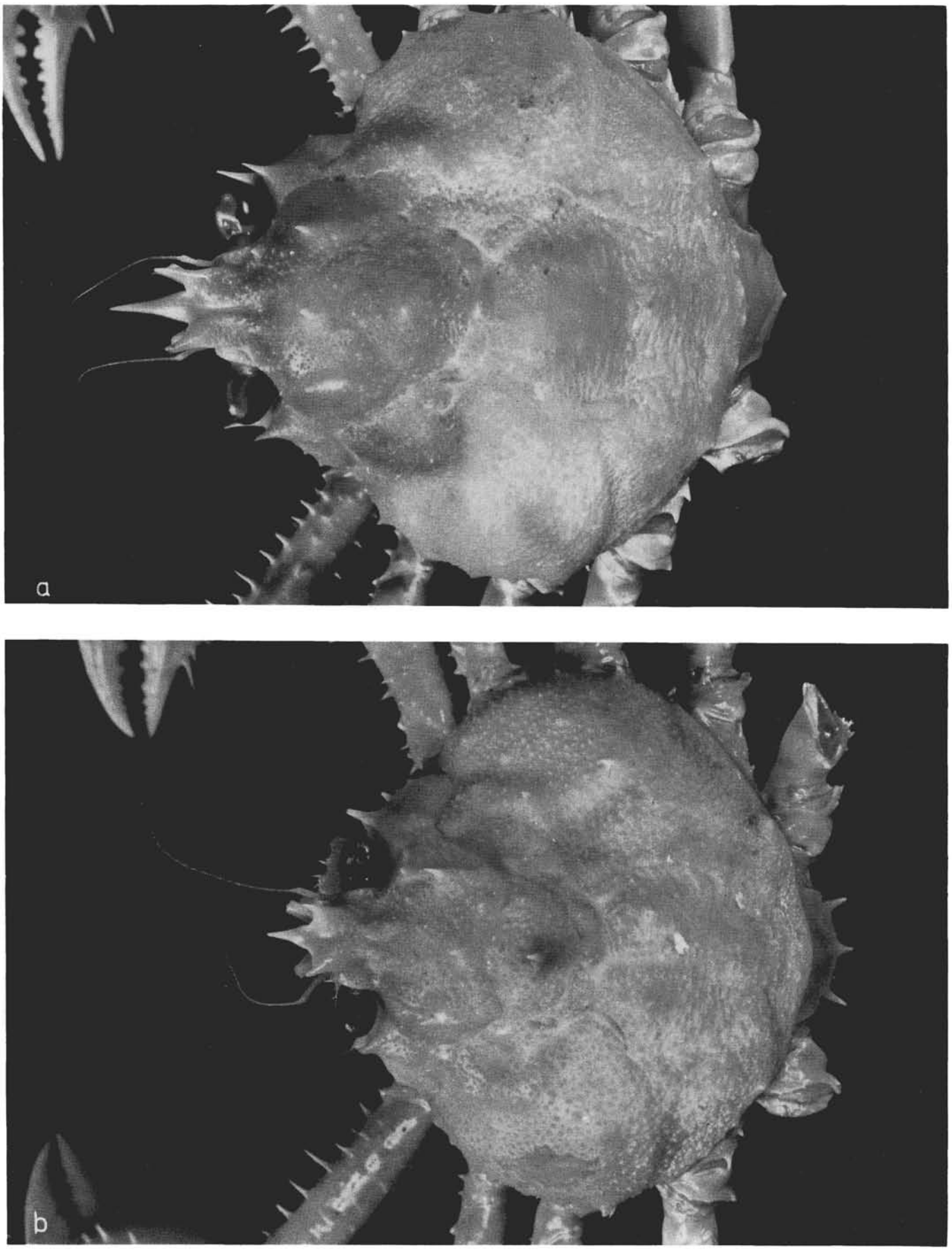


Plate 5. *Platymaia maoria* (male, 59.5 mm, off New South Wales, AM P. 29944) (a) dorsal view; *P. wyvillethomsoni* (male, 35 mm, off New South Wales, AM P.20744) (b) dorsal view.

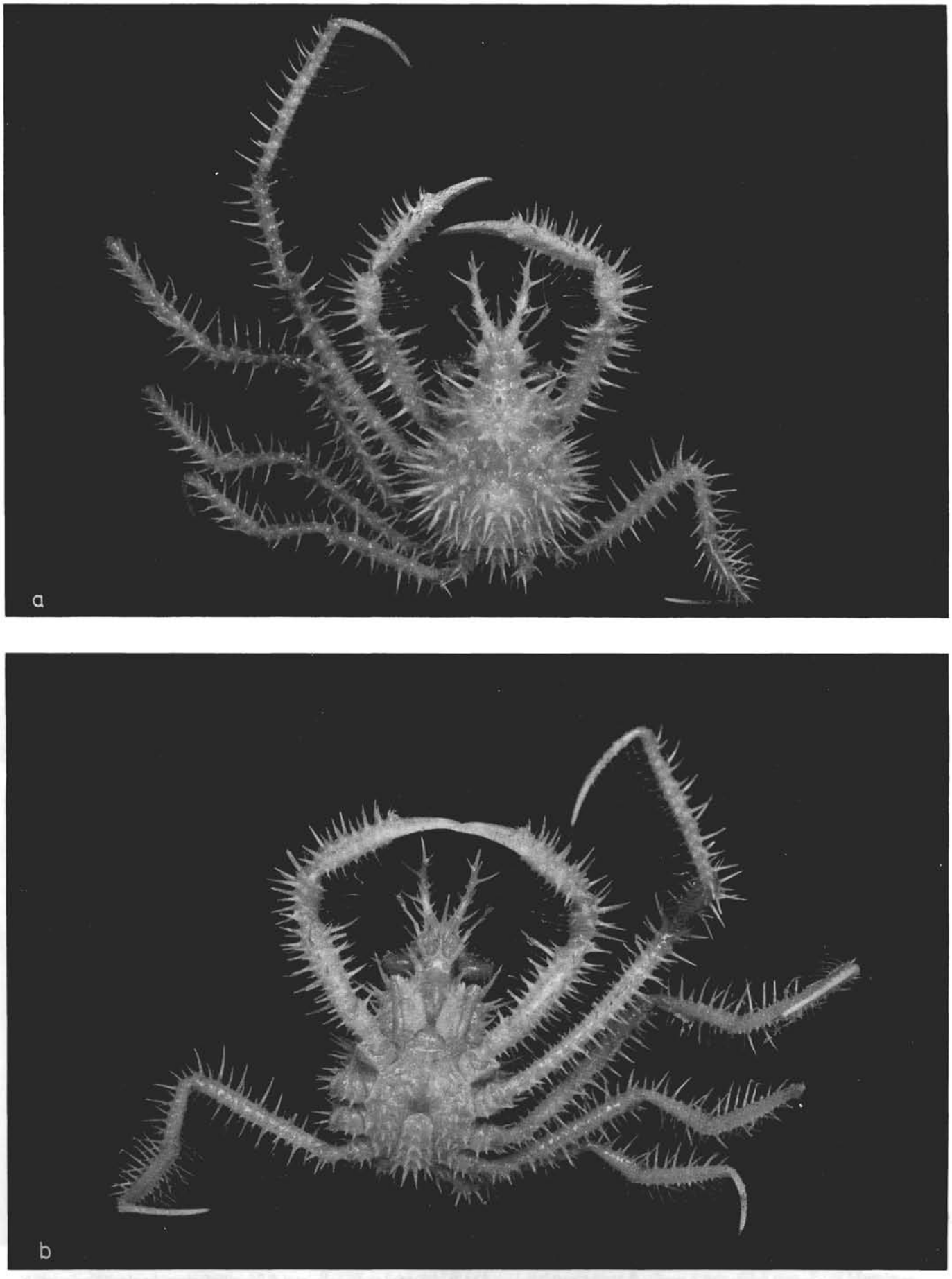


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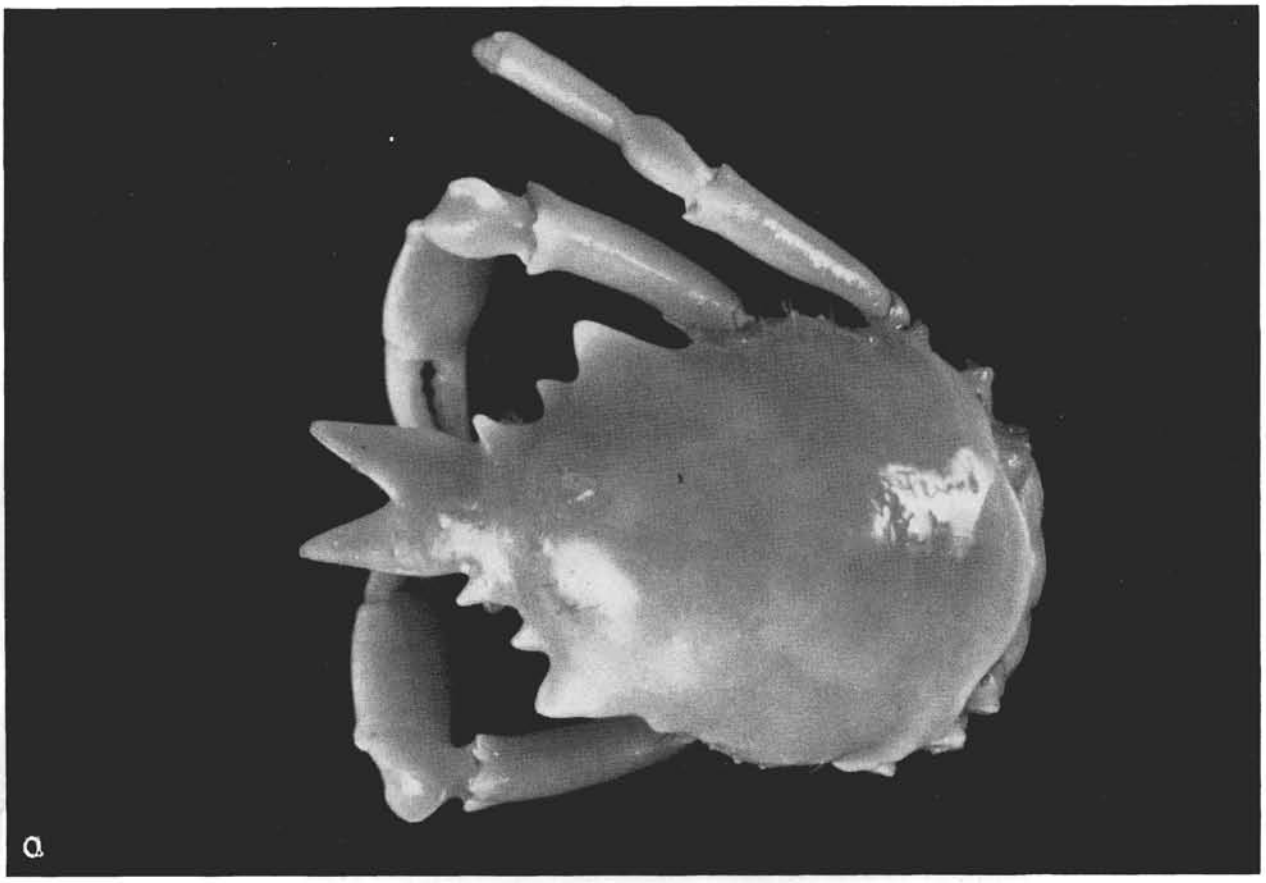
Plate 7. *Acanthonyx euryseroche* (holotype) (a) dorsal view, (b) ventral view.



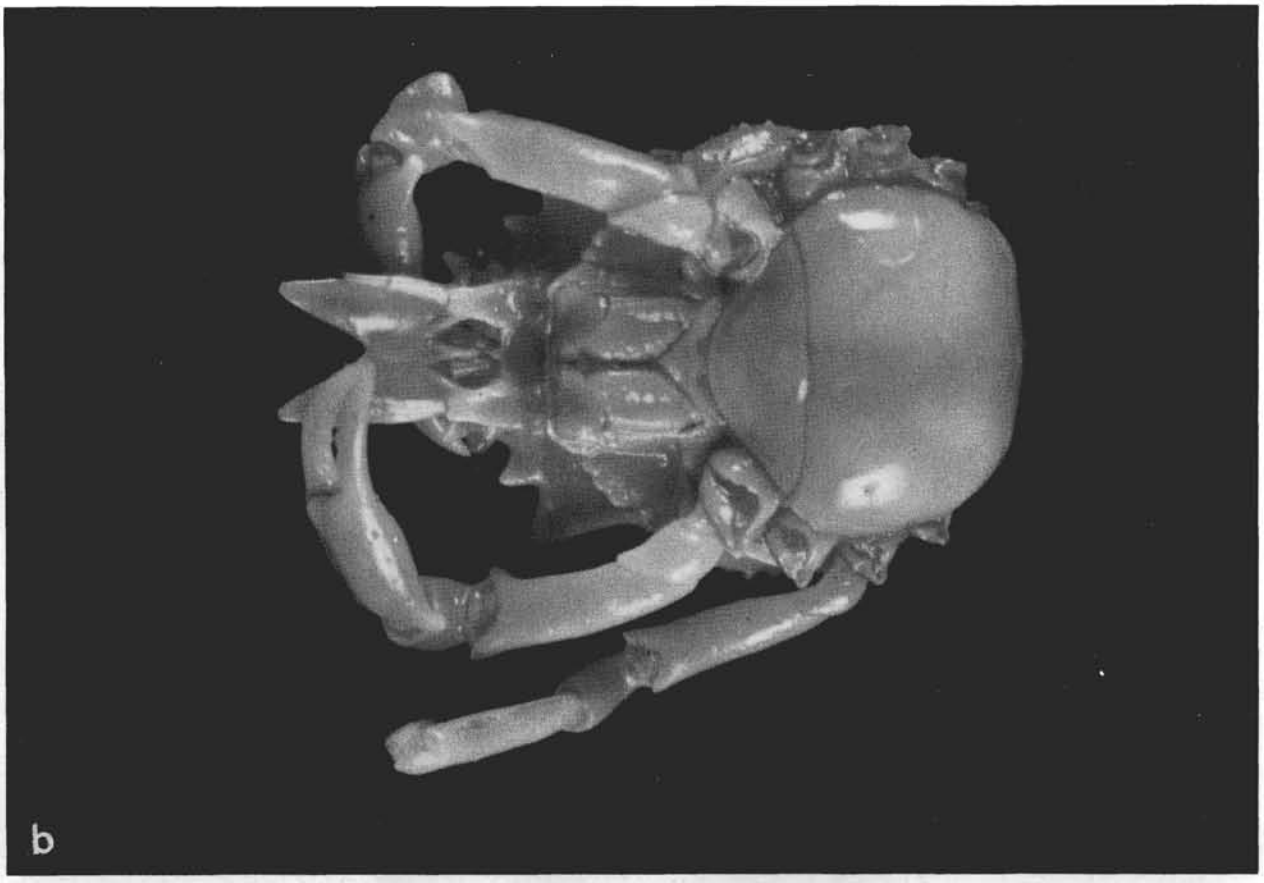
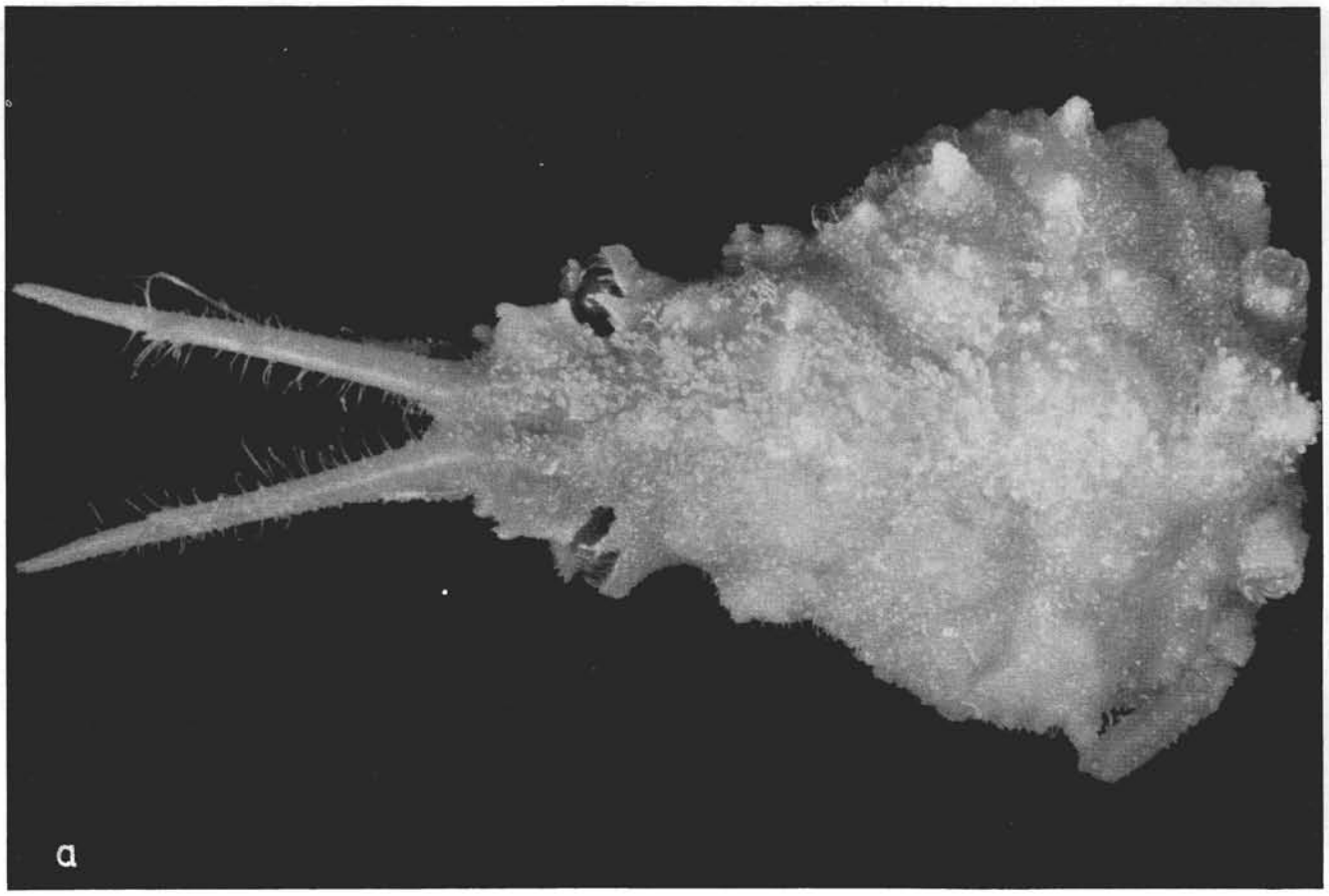


Plate 8. *Antilibinia polita* (holotype) (a) dorsal view, (b) ventral view.

Plate 9. *Doclea japonica* (male, 64 mm, China USNM 58743) (a) dorsal view, (b) ventral view.



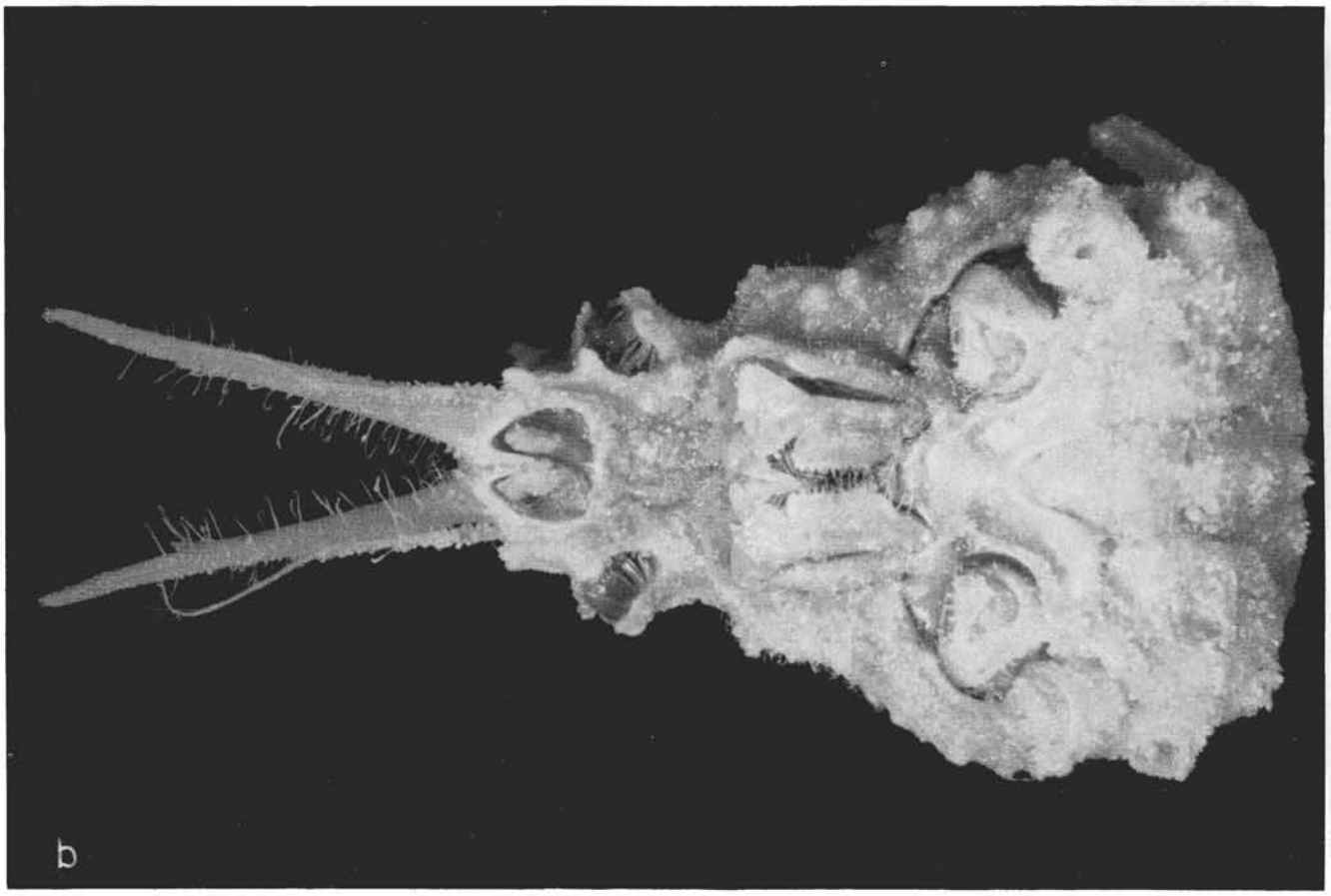
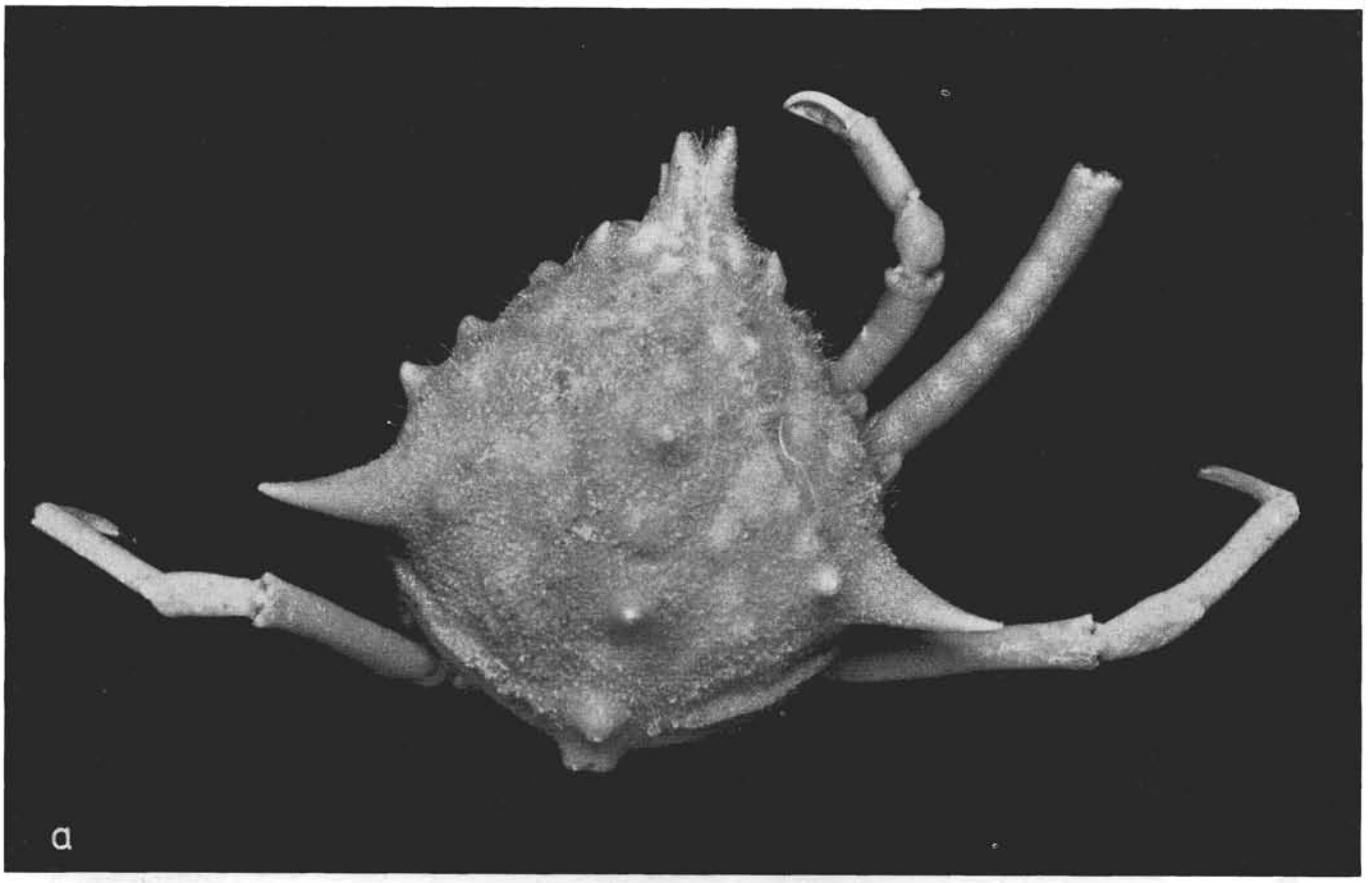


Plate 11. *Naxioides taurus* (male, 25.5 mm, Sulu Archipelago, ZMC) (a) dorsal view, (b) ventral view.



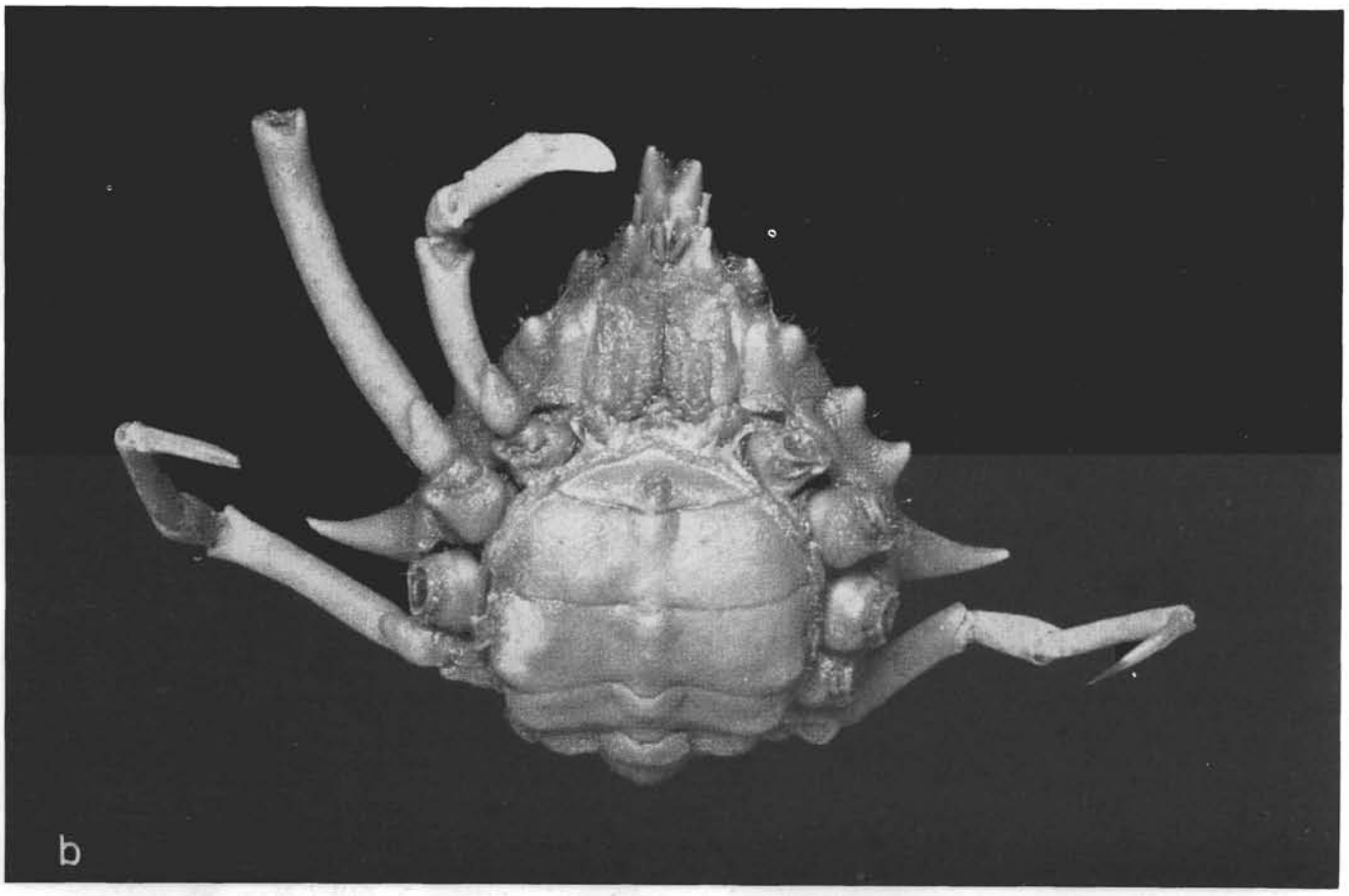
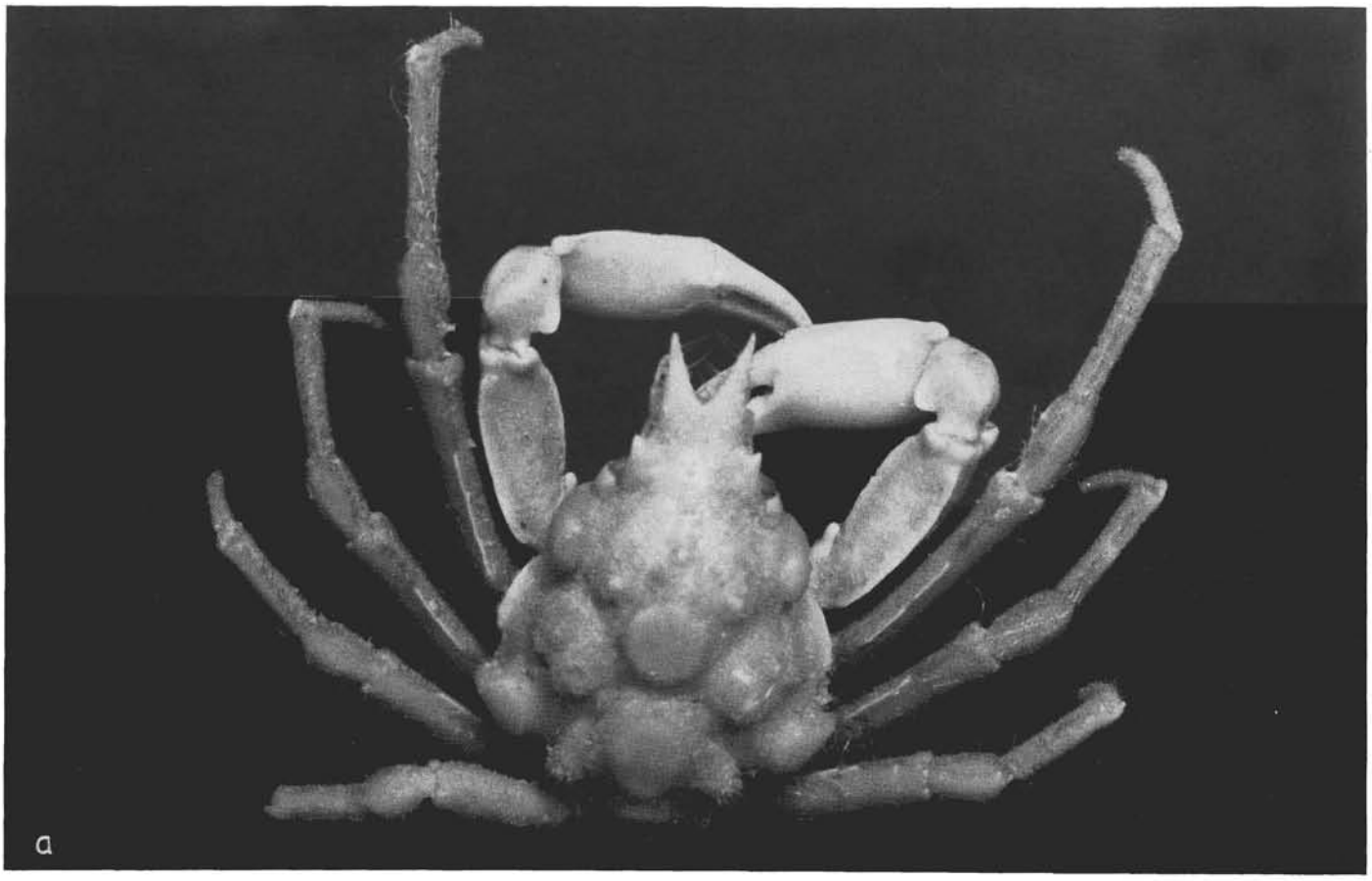


Plate 10. *Doclea simeti* (holotype) (a) dorsal view, (b) ventral view (large intestinal spine broken).



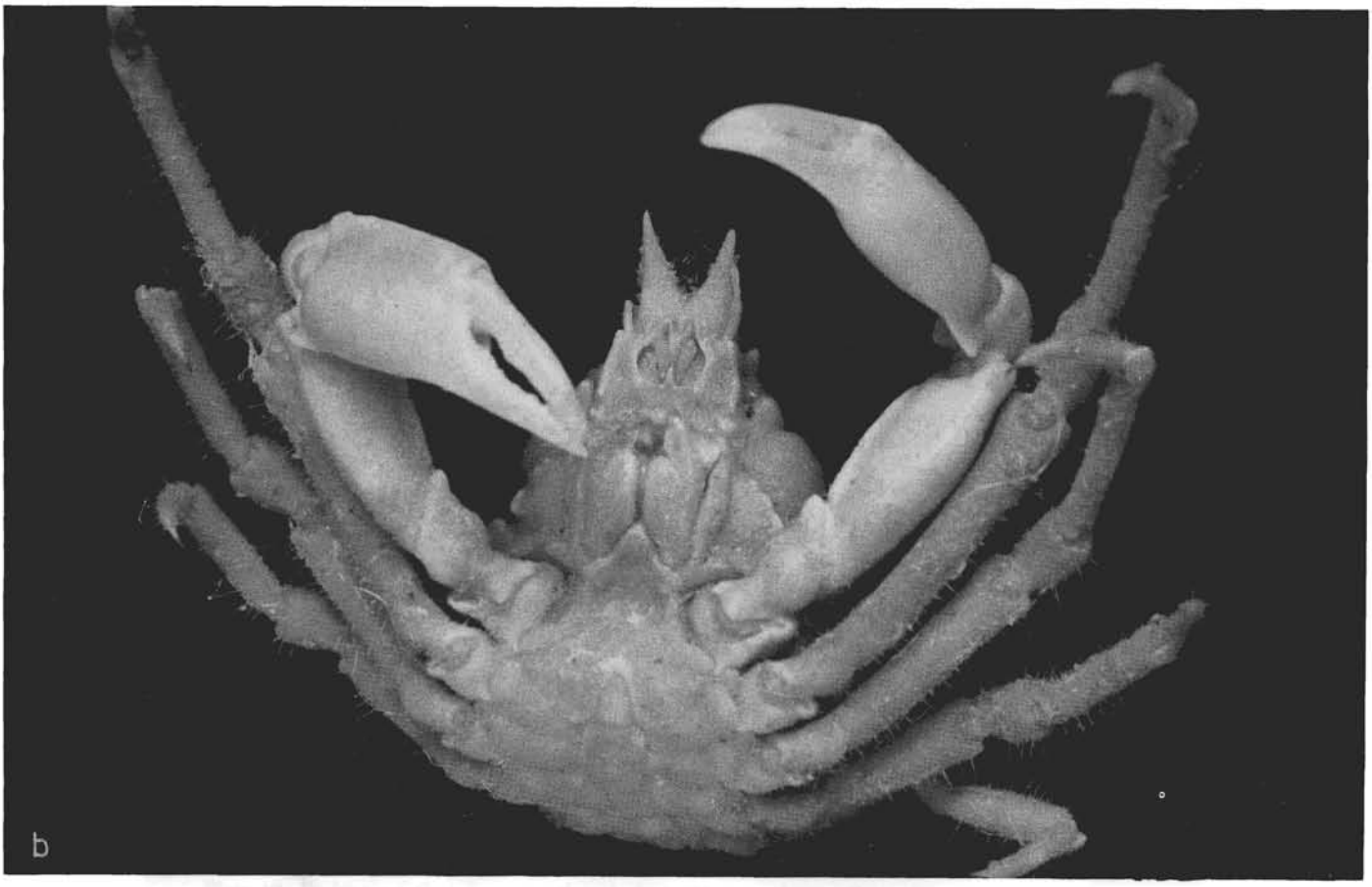


Plate 12. *Rochinia carinata* (holotype) (a) dorsal view, (b) ventral view.

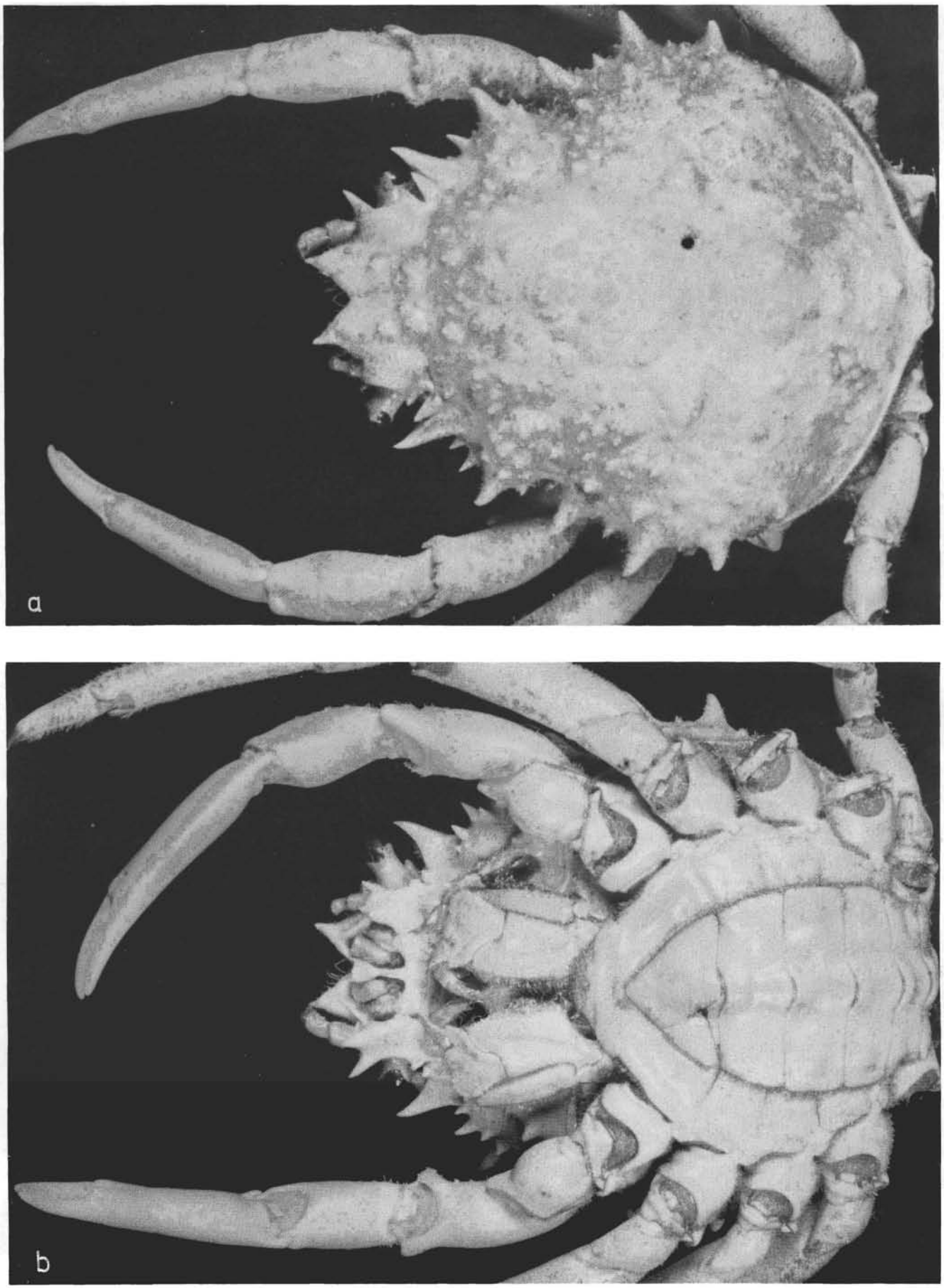


Plate 13. *Leptomithrax australis* (holotype of *L. brevirostris* Miers) (a) dorsal view, (b) ventral view.

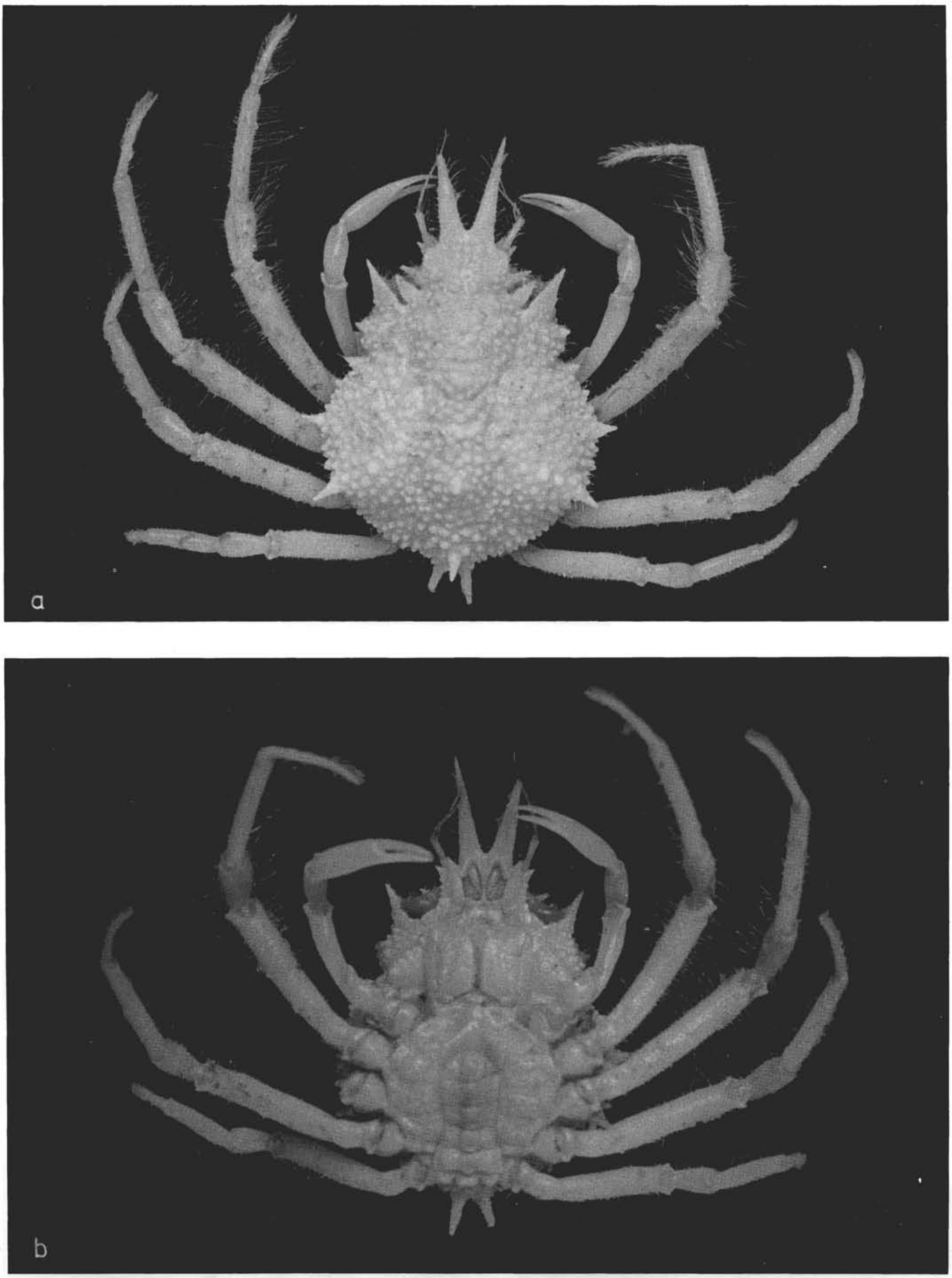


Plate 14. *Maja africana* (holotype) (a) dorsal view, (b) ventral view.

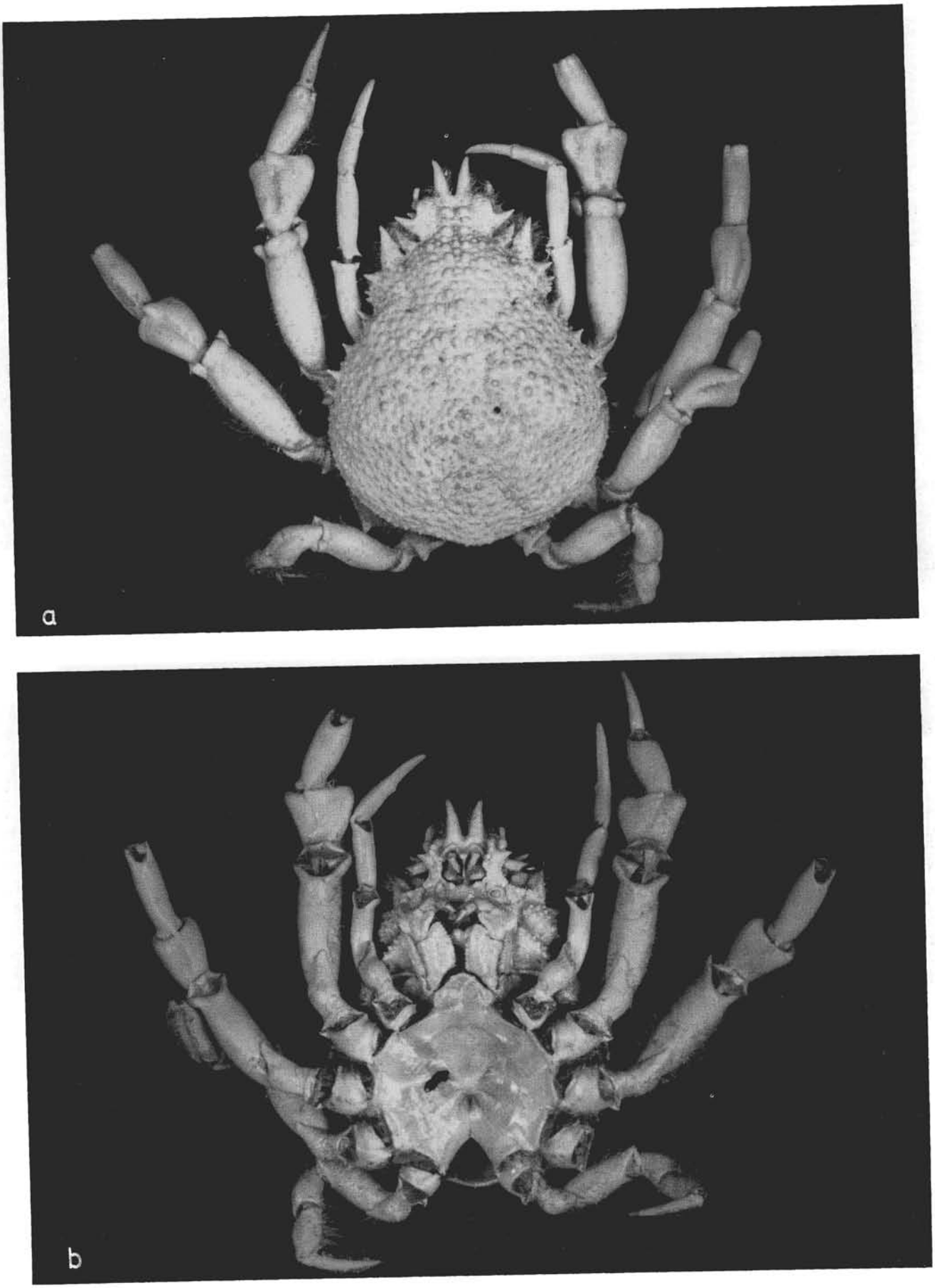


Plate 15. *Maja compressipes* (holotype) (a) dorsal view, (b) ventral view.

Plate 16. *Maja confragosa* (holotype) (a) dorsal view, (b) ventral view.

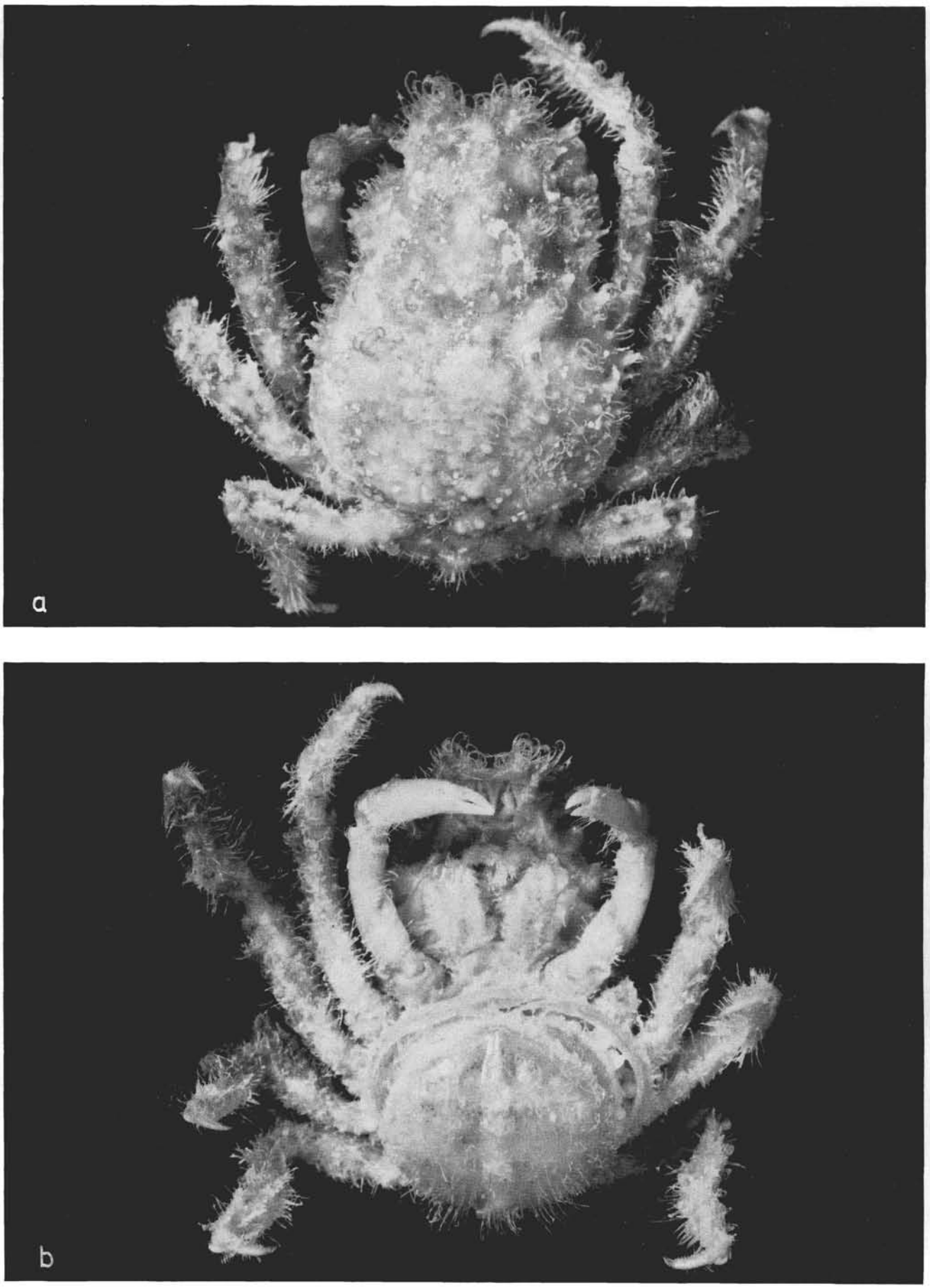


Plate 17. *Pseudomicippe maccullochi* (female, ovig., 24 mm, Lord Howe I., AM P. 30995) (a) dorsal view, (b) ventral view.

Plate 18. *Pseudomicippe tenuipes* (male, 10.5 mm, Western Australia, AM P.19139) (a) dorsal view, (b) ventral view.

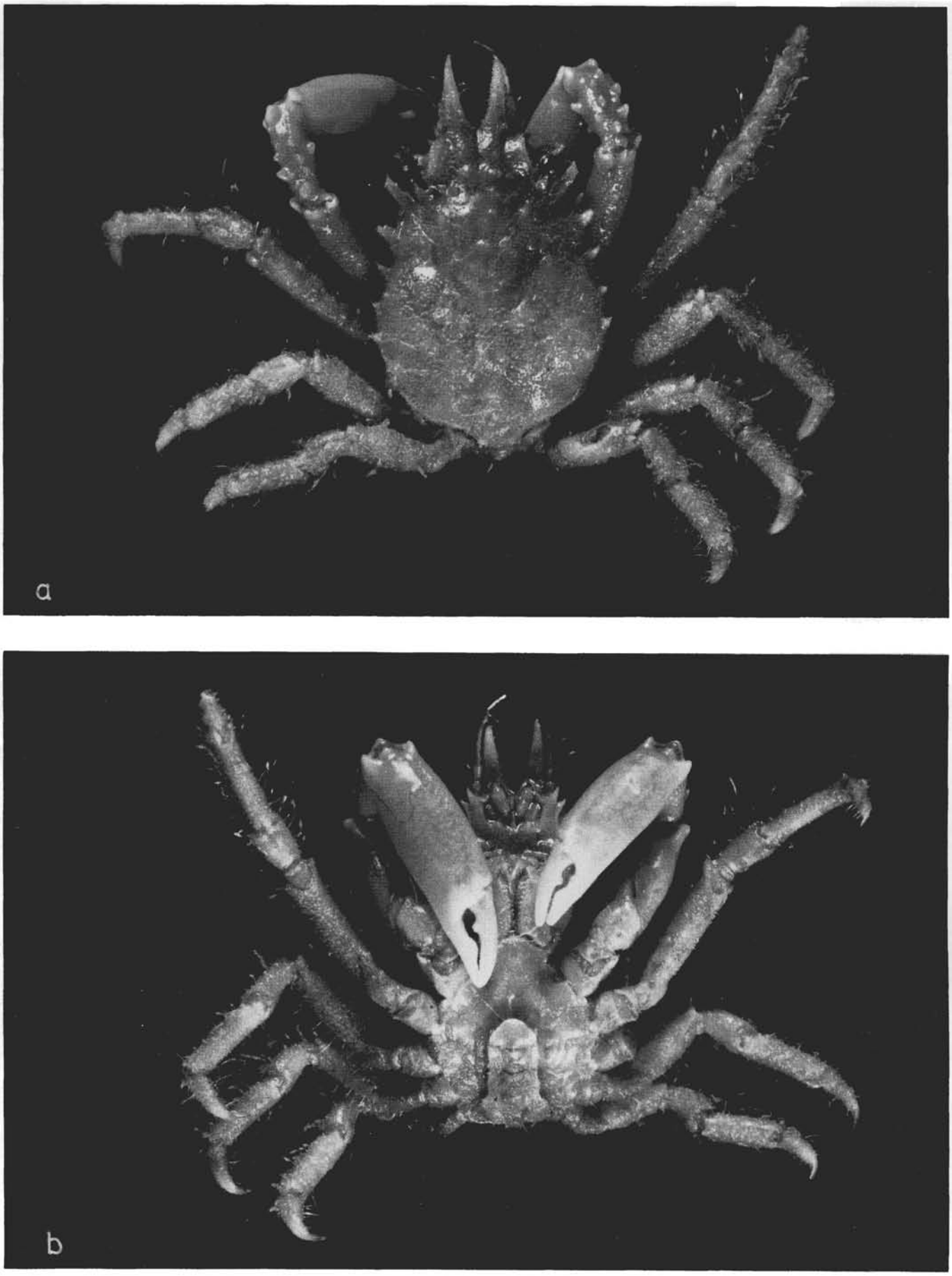


Plate 19. *Schizophroida hilensis* (male, 13.5 mm, Kermadecs, National Museum of New Zealand, Wellington) (a) dorsal view, (b) ventral view.

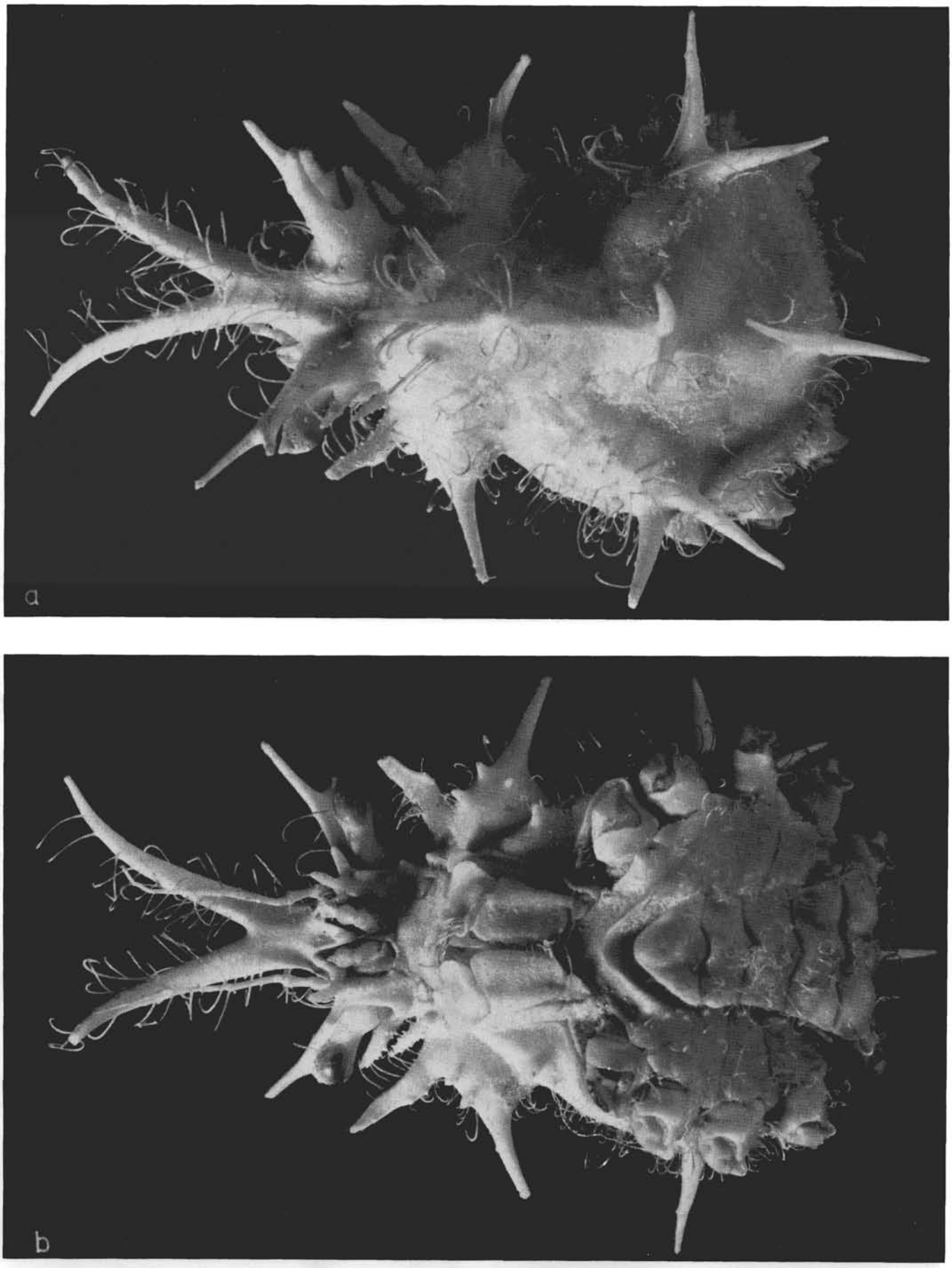


Plate 20. *Thacanophrys acanthonotus* (male, 20 mm, Java Sea, ZMA De.100.837) (a) dorsal view, (b) ventral view.

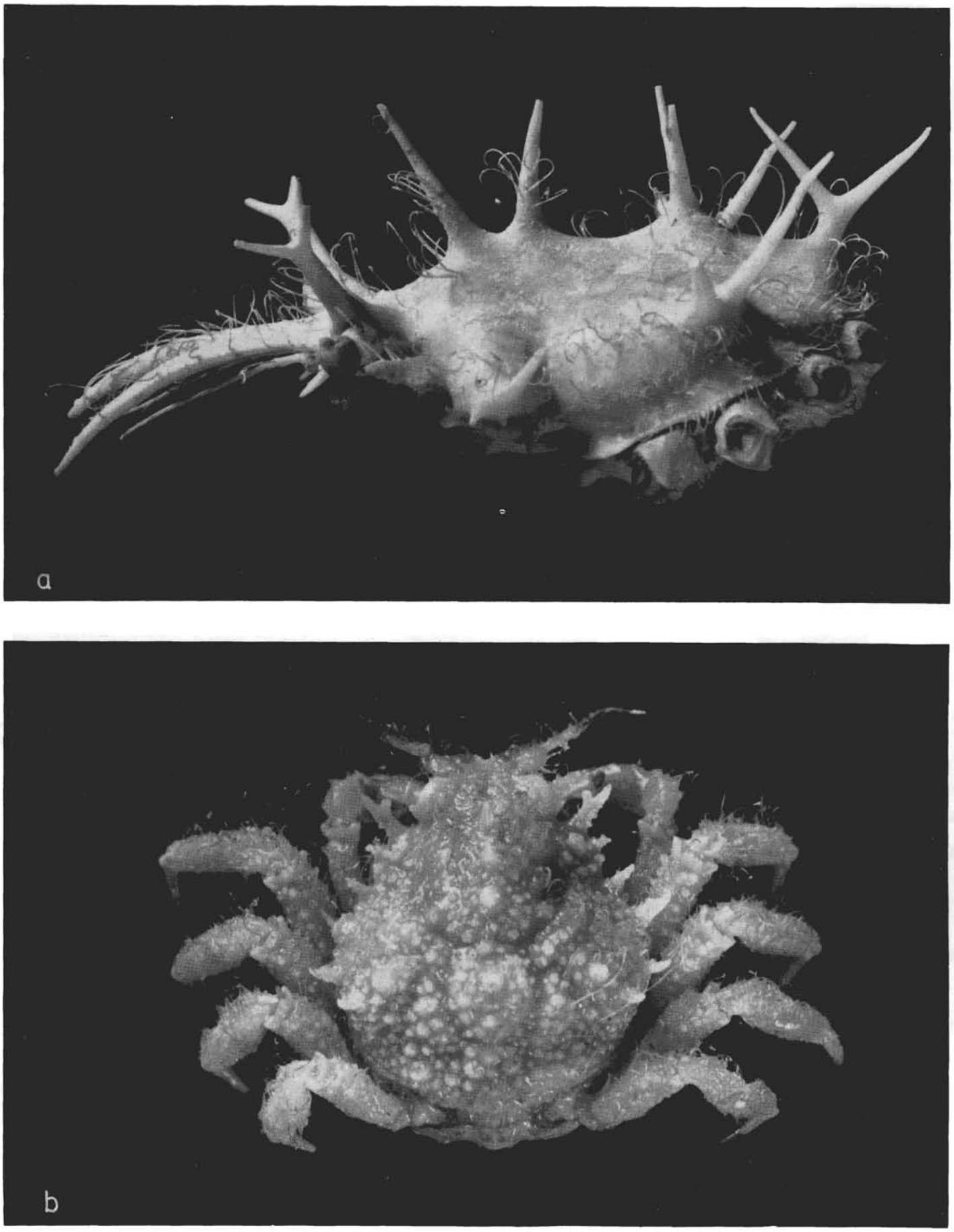


Plate 21. *Thacanophrys acanthonotus* (male, 20 mm, Java Sea, ZMA De.100.837) (a) lateral view. *Pippacirama tuberculosa* (female, ovig., 10.5 mm, New South Wales, AM P.8707) (b) dorsal view.

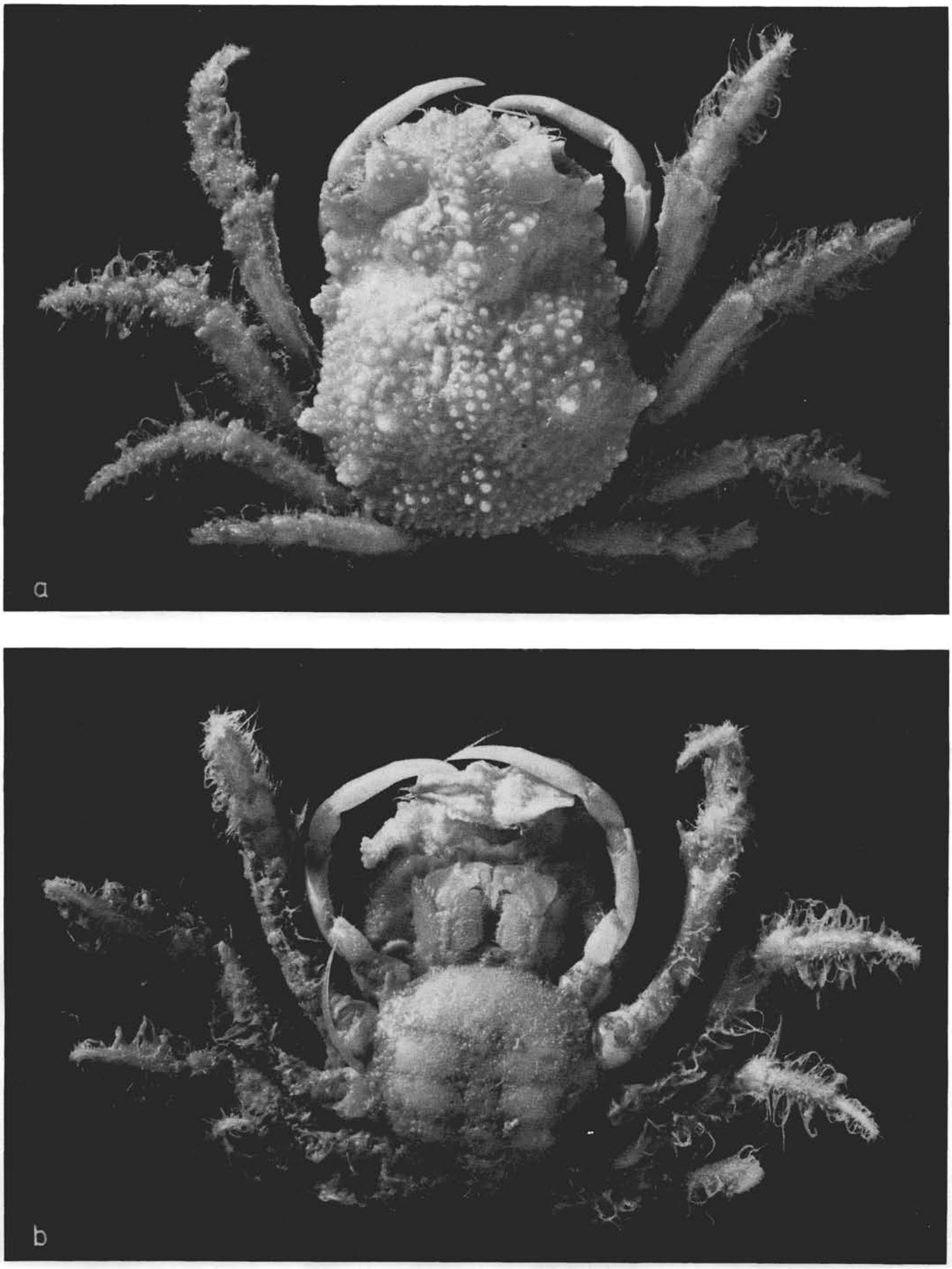


Plate 22. *Micippa excavata* (female, 15.5 mm, Java Sea, ZMC) (a) dorsal view, (b) ventral view.

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APPENDIX

Representative specimens of many species were donated to the Australian Museum by the Zoological Museum, Amsterdam and the Zoological Museum, University of Copenhagen at the conclusion of the study but these are still included under ZMA or ZMC in the lists of 'Material examined'. The Australian Museum registration numbers of these specimens are listed below.

Achaeus akanensis
(ZMC) 1 spec. (AM P. 34532).
Achaeus brevifalcatus
(ZMA) 1 spec. (AM P. 34533). — (ZMC) 1 spec. (AM P. 34534).
Achaeus brevirostris
(ZMC) 2 specs (AM P. 34535); 2 specs (AM P. 34536); 1 spec. (AM P. 34538); 1 spec. (AM P. 34537).
Achaeus curvirostris
(ZMA) 1 spec. (AM P. 34539).
Achaeus japonicus
(ZMC) 1 spec. (AM P. 34540).
Achaeus lacertosus
(ZMC) 6 specs (AM P. 34541).
Achaeus paradicei
(ZMC) 2 specs (AM P. 34542).
Achaeus pugnax
(ZMC) 1 spec. (AM P. 34543); 1 spec. (AM P. 34544).
Achaeus robustus
(ZMA) 2 specs (AM P. 34545).
Achaeus serenei
(ZMC) 1 spec. (AM P. 34547); 1 spec. (AM P. 34548).
Achaeus superciliaris
(ZMC) 10 specs (AM P. 34549).
Achaeus tuberculatus
(ZMC) 3 specs (AM P. 34550).
Achaeus villosus
(ZMA) 1 spec. (AM P. 34551).
Achaeopsis thomsoni
(ZMC) 8 specs (AM P. 34552).
Cyrtomaia horrida
(ZMC) 1 spec. (AM P. 34553).
Cyrtomaia lamellata
(ZMC) 1 spec. (AM P. 34554).
Cyrtomaia owstoni
(ZMC) 1 spec. (AM P. 34555).
Oncinopus angustifrons
(ZMC) 1 spec. (AM P. 34556).
Oncinopus aranea
(ZMA) 1 spec. (AM P. 34557); 1 spec. (AM P. 34558). — (ZMC) 1 spec. (AM P. 34559).
Oncinopus neptunus
(ZMC) 2 specs (AM P. 34560); 1 spec. (AM P. 34561); 1 spec. (AM P. 34562).
Oncinopus postillonensis
(ZMA) 1 spec. (AM P. 34563).
Paratymolus pubescens
(ZMA) 1 spec. (AM P. 34564); 1 spec. (AM P. 34565). — (ZMC) 1 spec. (AM P. 34566); 1 spec. (AM P. 34567); 1 spec. (AM P. 34568).
Physachaeus ctenurus
(ZMC) 1 spec. (AM P. 34569).
Platymaia fimbriata
(ZMA) 1 spec. (AM P. 34570).
Pleistacantha oryx
(ZMC) 4 specs (AM P. 34571).
Pleistacantha sanctijohannis
(ZMC) 3 specs (AM P. 34572); 3 specs (AM P. 34573).
Pleistacantha simplex
(ZMA) 1 spec. (AM P. 34574). — (ZMC) 2 specs (AM P. 34575); 1 spec. (AM P. 34576).
Prosphorachaeus multispina
(ZMA) 1 spec. (AM P. 34578); 1 spec. (AM P. 34577).
Prosphorachaeus suluensis
(ZMC) 1 spec. (AM P. 34579).
Sunipea indicus
(ZMA) 4 specs (AM P. 34581).
Criocarcinus superciliosus
(ZMA) 1 spec. (AM P. 34582); 1 spec. (AM P. 34583).
Antilibinia polita
(ZMC) 1 spec. (AM P. 34584).
Huenia grandidierii
(ZMC) 2 specs (AM P. 34585).
Huenia pacifica
(ZMA) 4 specs (AM P. 34586).
Menaethiops xiphias
(ZMA) 1 spec. (AM P. 34587).
Menaethius monoceros
(ZMA) 2 specs (AM P. 34588). — (ZMC) 2 specs (AM P. 34589); 1 spec. (AM P. 34590).
Menaethius orientalis
(ZMA) 1 spec. (AM P. 34591).
Perinia tumida
(ZMC) 2 specs (AM P. 34592).
Pugettia incisa
(ZMC) 1 spec. (AM P. 34593).
Pugettia intermedia
(ZMC) 1 spec. (AM P. 34594).

Pugettia marissinica
(ZMC) 1 spec. (AM P. 34595).
Pugettia minor
(ZMC) 2 specs (AM P. 34596); 2 specs (AM P. 34597).
Pugettia nipponensis
(ZMC) 1 spec. (AM P. 34598).
Simocarcinus simplex
(ZMC) 1 spec. (AM P. 34599).
Xenocarcinus conicus
(ZMC) 1 spec. (AM P. 34600); 1 spec. (AM P. 34601).
Austrolibinia andamanica
(ZMC) 1 spec. (AM P. 34602).
Doclea calcitrapa
(ZMC) 2 specs (AM P. 34603).
Doclea gracilipes
(ZMC) 4 specs (AM P. 34604).
Giranauria tinaktensis
(ZMA) 1 spec. (AM P. 34605). — (ZMC) 1 spec. (AM P. 34606).
Giranauria verrucosipes
(ZMC) 2 specs (AM P. 34608); 1 spec. (AM P. 34607).
Hyastenus ambonensis
(ZMC) 1 spec. (AM P. 34609).
Hyastenus aries
(ZMC) 4 specs (AM P. 34610); 3 specs (AM P. 34611).
Hyastenus auctus
(ZMC) 2 specs (AM P. 34612).
Hyastenus biformis
(ZMA) 2 specs (AM P. 34613).
Hyastenus bispinosus
(ZMA) 1 spec. (AM P. 34615).
Hyastenus brockii
(ZMA) 1 spec. (AM P. 34616); 1 spec. (AM P. 34617). — (ZMC) 1 spec. (AM P. 34618).
Hyastenus convexus
(ZMC) 1 spec. (AM P. 34619); 1 spec. (AM P. 34620); 3 specs (AM P. 34621).
Hyastenus cracentis
(ZMA) 1 spec. (AM P. 34622).
Hyastenus diacanthus
(ZMC) 2 specs (AM P. 34623); 3 specs (AM P. 34624).
Hyastenus elongatus
(ZMC) 1 spec. (AM P. 34625); 1 spec. (AM P. 34626).
Hyastenus fraterculus
(ZMC) 1 spec. (AM P. 34627).
Hyastenus hilgendorfi
(ZMA) 2 specs (AM P. 34628). — (ZMC) 1 spec. (AM P. 34629); 3 specs (AM P. 34630).
Hyastenus mindoro
(ZMA) 1 spec. (AM P. 34631); 1 spec. (AM P. 34632). — (ZMC) 2 specs (AM P. 34633).
Hyastenus planasius
(ZMA) 2 specs (AM P. 34634). — (ZMC) 3 specs (AM P. 34635).
Hyastenus scrobiculatus
(ZMC) 2 specs (AM P. 34636).
Hyastenus sebae
(ZMC) 4 specs (AM P. 34637); 4 specs (AM P. 34638).
Hyastenus trispinosus
(ZMA) 2 specs (AM P. 34639).
Hyastenus uncifer
(ZMC) 1 spec. (AM P. 34640).
Hyastenus whitei
(ZMA) 2 specs (AM P. 34641). — (ZMC) 3 specs (AM P. 34642).
Lahaina agassizii
(ZMA) 2 specs (AM P. 34643).
Lahaina mauritiana
(ZMC) 2 specs (AM P. 34644).
Lahaina ovata
(ZMC) 6 specs (AM P. 34645).
Naxioides taurus
(ZMC) 2 specs (AM P. 34646).
Phalangipus longipes
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Rochinia carinata
(ZMC) 2 specs (AM P. 34651).
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(ZMC) 1 spec. (AM P. 34652).
Rochinia hertwigi
(ZMC) 1 spec. (AM P. 34653).
Rochinia luzonica
(ZMC) 1 spec. (AM P. 34654); 1 spec. (AM P. 34655).
Rochinia makassar
(ZMA) 1 spec. (AM P. 34656).
Rochinia pulchra
(ZMC) 1 spec. (AM P. 34657).
Rochinia stimpsoni
(ZMC) 1 spec. (AM P. 34658).
Rochinia suluensis
(ZMA) 1 spec. (AM P. 34659).
Rochinia velutina
(ZMC) 1 spec. (AM P. 34661).
Thusaenys calvarius
(ZMC) 1 spec. (AM P. 34662).
Thusaenys irami
(ZMA) 1 spec. (AM P. 34663).
Thusaenys orbis
(ZMC) 1 spec. (AM P. 34664).
Tylocarcinus styx
(ZMC) 2 specs (AM P. 34665).
Eurynome erosa
(ZMC) 1 spec. (AM P. 34666).
Leptomithrax bifidus
(ZMC) 3 specs (AM P. 34667).
Leptomithrax edwardsi
(ZMC) 1 spec. (AM P. 34668).
Maja gibba
(ZMC) 1 spec. (AM P. 34669).

Maja japonica
(ZMC) 1 spec. (AM P. 34670).
Maja miersii
(ZMC) 1 spec. (AM P. 34671).
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(ZMC) 2 specs (AM P. 34672).
Schizophrys aspera
(ZMC) 1 spec. (AM P. 34673); 1 spec. (AM P. 34674); 1 spec. (AM P. 34675).
Seiitaoides orientalis
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Thacanophrys aculeatus
(ZMC) 1 spec. (AM P. 34677).
Thacanophrys longispinus
(ZMC) 2 specs (AM P. 34678); 1 spec. (AM P. 34679).
Cyphocarcinus capreolus
(ZMC) 2 specs (AM P. 34680).
Leptopisa australis
(ZMA) 1 spec. (AM P. 34681); 2 specs (AM P. 34682).
Micippa cristata
(ZMA) 1 spec. (AM P. 34683); 1 spec. (AM P. 34684). — (ZMC) 2 specs (AM P. 34685).
Micippa excavata
(ZMC) 1 spec. (AM P. 34686).
Micippa margaritifera
(ZMA) 1 spec. (AM P. 34687).
Micippa parca
(ZMA) 2 specs (AM P. 34688).
Micippa philyra
(ZMC) 2 specs (AM P. 34690).
Micippa thalia
(ZMC) 1 spec. (AM P. 34691).
Tiarinia alidae
(ZMA) 1 spec. (AM P. 34692); 1 spec. (AM P. 34693).
Tiarinia angusta
(ZMA) 1 spec. (AM P. 34694).
Tiarinia cornigera
(ZMA) 2 spec. (AM P. 34695). — (ZMC) 2 specs (AM P. 34696).
Tiarinia gracilis
(ZMA) 2 specs (AM P. 34697).

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