SIBOGA-EXPEDITIE

UITGEGEVEN DOOR

de Maatschappij voor Wetenschappelijk Onderzoek in de Tropen

ONDER REDACTIE VAN

Dr. MAX WEBER† Dr. L. F. DE BEAUFORT† Dr. J. H. STOCK

MONOGRAPHIE XXXIX, C4 (= Livraison 148)

THE DECAPODA BRACHYURA OF THE SIBOGA EXPEDITION

PART VIII

MAJIDAE

BY

D. J. G. GRIFFIN and H. A. TRANTER

The Australian Museum, Sydney, Australia

LEIDEN
E. J. BRILL
1986

John S Garth

For guidance, stimulating
ideas and much more!

28 May 1988
Helen Tranter

SIBOGA-EXPEDITIE

SIBOGA-EXPEDITIE MONOGRAPHIEËN

UITKOMSTEN OP ZOÖLOGISCH, BOTANISCH, OCEANOGRAFISCH EN GEOLOGISCH GEBIED

verzameld in de Oost-Indische Archipel 1899-1900 aan boord H.M. Siboga onder commando van Luitenant ter zee 1e kl. G. F. TYDEMAN

Résultats des explorations zoologiques, botaniques, océanographiques et géologiques entreprises aux Indes Orientales en 1899-1900 à bord du SIBOGA

UITGEGEVEN DOOR

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DR. MAX WEBER†
Hoogleraar in Amsterdam
Leider der Expeditie

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With 112 text figures and 22 plates

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We would like to dedicate this report to

JOHN S. GARTH

Allan Hancock Foundation, University of Southern California

John Garth, over more than a quarter of a century, has carefully studied the majid spider crabs of the 'New World'. His synthesis of the classifications of Balss and Alcock, based on traditional regard for characters such as orbit, rostrum and abdomen and, most of all, his attention to the challenge posed by features of the male first pleopod have provided the stimulus for our approach to this study.

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THE DECAPODA BRACHYURA OF THE SIBOGA EXPEDITION

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(Text figures 1-112, plates 1-22)

INTRODUCTION

In March 1899 the Dutch research vessel the 'Siboga' entered the waters of Indonesia. Its collections, made from depths of 10 to 5,684m over the next 12 months, were returned to Amsterdam and over the next fifty years were the subject of numerous extensive reports: decapod Crustacea figured prominently amongst them. The spider crabs, however, were only briefly treated: Ihle & Ihle-Landenberg (1931), in a report outside the Siboga series, described a few new species of one of the subfamilies. The collections were also studied by A. Milne Edwards, Bouvier and Ihle but none of the studies were brought to a conclusion (Prof. J. H. Stock, pers. comm.).

Dr. Th. Mortensen conducted expeditions throughout the Indo-West Pacific over a period of 32 years. No attempt has been made previously to work up this spider crab material gathered in the Zoological Museum at the University of Copenhagen and its size and geographic scope makes inclusion of it in the present study almost mandatory.

Mrs. Mariel King, an American philanthropist, sponsored several small expeditions to the Pacific. One of these covered the Philippines — Moluccas area in 1970. Worked over briefly by the late Dr. R. Serène when he was a UNESCO consultant in Singapore, it was subsequently made available to us by Dr. B. R. Wilson, then of the Western Australian Museum.

Dr. L. B. Holthuis with other members of staff of the Rijksmuseum van Natuurlijke Historie, Leiden, visited West Irian (then Netherlands New Guinea) from October 1954 to May 1955 and the spider crabs collected on that expedition have been made available to us by Dr. Holthuis.

These collections, together with material from the Australian Museum, form the basis of the present report.

The Indo-West Pacific spider crab fauna has been treated in several major reports since Herbst, Fabricius and Latreille described the animals collected by early voyagers. The Japanese fauna is undoubtedly the best known through comprehensive treatments by Sakai (1938; 1965a; 1976) following the classic studies by De Haan (1833-50) and those of Miers (1879b), Parisi (1915), Balss (1924), Rathbun (1932) and Yokoya (1933); that additional species and genera await discovery has been shown by studies of the Japanese fauna by Takeda *et al.* (1969 *et seq.*).

The extensive studies by Mary J. Rathbun represent at least fifty per cent of the reports on the fauna of other areas. Her studies on the crabs of the Philippines (1916), the western Indian Ocean (1911), Hawaii (1906), Siam (1910), eastern Australia (1918) and north western Australia (1914; 1924) are basic to studies of any other local fauna. Only the earlier studies of Miers, referred to above, have contributed a similar amount to our knowledge of the Indo-West Pacific spider crab fauna. Smaller, or more local studies of the South African fauna by Barnard (1950; 1955), of the Red Sea by Parisi (1915), Balss (1929), Guinot (1962a, 1962b) and Griffin and Tranter (1974), of 'Indian Seas' by Henderson (1893), Alcock (1895), Borradaile (1903) and Chhapgar (1957), of Australia by Haswell (1882) a century ago and of New Zealand by Bennett (1964) and Griffin (1966b) — also have formed the basis for understanding regional faunas.

The present classification of the family owes more to the work of Alcock (1895) through important modification by Balss (1929) and Garth (1958) than to the earlier classifications of H. Milne Edwards (1834), Dana (1851b) and Miers (1879c).

In his review of Pacific American species Garth (1958: 7-9) has emphasized the multiple characters employed by Balss — the interantennular spine, degree of fusion of the rostral spines, coalescence of the abdominal segments and presence or absence of a supplementary spine (the intercalated spine) above the orbit between the eave or the antorbital spine anteriorly and the postorbital spine posteriorly — which form the basis of the present classification. Stephensen (1945) and Garth (1958) have given considerable emphasis to the form of the first pleopod of the male. Garth noted that divisions within subfamilies proposed by Balss on the basis of the intercalated spine, were not congruent with divisions based on male first pleopod form. Garth (1958: 13) went on to say that he would make further application of the groupings based on male first pleopods were it not for (i) the fact that each sub-

family in the existing scheme contained species with pleopods which did not fit into major groupings and (ii) absence of knowledge of the 'Old World' (and presumably Indo-Pacific) species: a new system could lead to confusion were it based solely on the 'New World' fauna.

The present collections are important, therefore, because together with that from recently studied material from the Philippines, Red Sea and Indian Ocean and on-going studies of Japanese, Australian and New Zealand faunas, they represent the most comprehensive ones ever assembled from the Indo-Pacific region. Over 2,000 specimens have been examined, the largest collection studied since those of the 'Alert' (1878-1882) and the 'Challenger' (1874-1876) and those accumulated by the Smithsonian Institution through expeditions of the 'Albatross', the 'Sealark' and others collected in the early part of the century. They provide the opportunity to examine whether Garth's proposals derived from the Pacific fauna may be extended to that of the Indo-West Pacific and, through recent studies by Monod (1956), Forest & Guinot (1966) and Williams (1965), to the 'Old World'.

The present report deals with all genera represented in the Indo-West Pacific except those of the subfamily Oregoniinae and the inachine genera *Macrocheira* and *Pyromaia*. The Oregoniinae are boreal animals: this report is not concerned with that area. We have nothing of substance to add to previous treatments (e.g. Sakai) of the two inachine genera. Generic rearrangements and more appropriate alignment of certain genera between subfamilies are explored; higher classification and overall evolutionary patterns will be covered separately.

In the systematic account the subfamilies are arranged in the order that has been used in most large studies, beginning with the Inachinae and concluding with the Mithracinae. Within each subfamily the genera are arranged in alphabetical order as are the species in each genus. Each account includes a reference to only the original description and major subsequent accounts. The carapace length (cl.) is given and this measurement includes the rostrum unless otherwise stated. The data are grouped under the museum where the material is housed. Where there are particular catalogue numbers for specimens the number is given after the abbreviation of the museum concerned. The abbreviations used are as follows:

Zoological Museum, Amsterdam — ZMA
Zoological Museum, University of Copenhagen — ZMC
Smithsonian Institution, Washington — USNM
British Museum (Natural History), London — BMNH
Rijksmuseum van Natuurlijke Historie, Leiden — RMNH
Zoological Survey of India, Calcutta — ZSC
National Institute of Oceanology, Jakarta — NIO, Jakarta
South African Museum, Cape Town — SAM, Cape Town
The Australian Museum, Sydney — AM
Museum of Victoria, Melbourne — NMV
Western Australian Museum, Perth — WAM
South Australian Museum, Adelaide — SAM

Representative specimens of many of the species studied have been retained by the Australian Museum and these are listed in the Appendix. We thank the authorities of the museums concerned.

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We wish to thank Drs. J. H. Stock and S. Pinkster, Zoological Museum, Amsterdam; T. Wolff, Zoological Museum, University of Copenhagen; L. B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden; B. R. Wilson, formerly of the Western Australian Museum and the late R. Serène, formerly of UNESCO, Singapore, in respect of the material to be deposited in the National Institute of Oceanology, Jakarta; Drs. F. A. Chace, R. B. Manning, B. Kensley and the late H. B. Roberts, Smithsonian Institution and K. K. Tiwari, Zoological Survey of India, Calcutta for making their collections available for study. We are also grateful for additional material which was made available by Drs. R. W. Ingle, British Museum (Natural History); D. Guinot, Muséum national d'Histoire naturelle, Paris; H. Fechter, Zoologische Staatssammlung, Munich; G. Hartmann, Zoologisches Institut und Museum, Hamburg University; J. S. Garth, Allan Hancock Foundation, Los Angeles; B. Kensley, formerly of the South African Museum; J. C. Yaldwyn, National Museum of New Zealand, Wellington; R. W. George, Western Australian Museum; W. Zeidler, South Australian Museum; and G. C. B. Poore, Museum of Victoria. We also wish to thank the New South Wales State Fisheries for making available for study material collected on the F.R.V. Kapala.

We wish to express our appreciation to Dr. J. S. Garth for the helpful discussions we had with him during his visit to Australia in 1979.

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This study commenced in 1970 whilst D. J. G. G. was on a Visiting Postdoctoral Research Associateship at the Smithsonian Institution, administered by the Institution's Office of Academic Programs, and travel to Europe and India was supported by a grant from the Smithsonian Institution's Office of International Activities Foreign Currency Program: additional financial assistance was provided by the New South Wales Government and the Trustees of the Australian Museum.

KEY TO THE SUBFAMILIES OF THE MAJIDAE IN THE INDO-WEST PACIFIC

The following key to the subfamilies is included as a practical guide for those using the keys to identify specimens

rather than as a statement about relationships of the subfamilies.

1 Eyes without orbits, or with incomplete or commencing orbits; basal antennal article generally rather slender 2
— Eyes with nearly complete, or complete, orbits; basal antennal article moderately to very broad 6
2(1) Male abdomen terminally broadened, seventh segment subquadrate and inserted deeply into sixth segment; male first pleopod longitudinally grooved, with rows of filamentous setae on either side of the groove ..... *Oregoniinae*
— Male abdomen not terminally broadened, seventh segment subtriangular and not inserted deeply into sixth segment; male first pleopod exceedingly varied but not as in Oregoniinae 3
3(2) Eyes without orbits; eyestalks generally long, either non-retractile, or retractile against an acute postorbital spine affording no concealment; basal antennal article usually extremely slender and sometimes free distally; merus of third maxilliped often not as wide as ischium ..... *Inachinae*
— Eyes with at most commencing orbits; eyestalks variously elongate, usually retractile (unless very short), postorbital lobe often distinct and affording some protection; basal antennal article not extremely slender, always fused distally; merus of third maxilliped as wide as ischium 4
4(3) Eyes without true orbits, supraorbital eave and postorbital lobe very weakly developed or absent; or orbit with either a prominent eave or with a moderate postorbital lobe; intercalated spine not present; eyestalks variously elongate 5
— Eyes with commencing orbits having, in addition to the supraorbital eave which is sometimes produced into a preorbital spine, a prominent postorbital process, often cupped, to receive the retracted eyestalk; an intercalated spine sometimes present; eyestalks short ..... *Pisinae*
5(4) Eyestalks long, orbit usually extravagantly expanded above and partially protected by a long hornlike supraorbital spine; postorbital spine lacking or small and remote from eye ..... *Tychinae*
— Eyestalks short, little movable and either protected by a small preorbital spine and/or postorbital spine or sunk in the sides of the rostrum ..... *Epialtinae*
6(1) Basal antennal article not specially expanded to form a floor to the orbit, which is formed above by a supraorbital eave and a postorbital lobe usually separated by a hiatus, sometimes an intercalated spine between the two ..... *Majinae*
— Basal antennal article expanded to form a floor to the orbit which is formed above by a supraorbital eave and an adjacent postorbital lobe, intercalated spine sometimes present ..... *Mithracinae*

SYSTEMATIC ACCOUNT
SUBFAMILY INACHINAE

Inachinae Alcock, 1895: 160, 162, 168. — Rathbun, 1925: 11. — Garth, 1958: 36-37. — Griffin, 1966b: 264.

Eyes without orbits; eyestalks generally long, either non-retractile, or retractile against sides of carapace, or against an acute postocular spine affording no concealment. Basal article of antenna extremely slender throughout its extent, and usually long. (Alcock, modified, as quoted by Garth).

Pleopod 1 not usually very stout, usually straight or weakly curved, rarely twisted, aperture terminal or subterminal, sometimes a slit, often protected by a flap, apex simple or with a lobe.

This subfamily is generally regarded as a discrete group of small majids with long eyestalks unprotected above by orbits and with a slender basal antennal article, long spindly legs, some with a double rostrum and others with a single rostrum; the first pleopod of the male is generally simple, the opening subterminal and sometimes protected by a flap. However, over the years the subfamily has become cluttered, in our view, by various species with long eyestalks but not necessarily resembling other inachines in other characteristics. We take the opportunity here to remove a number of genera to other subfamilies:

Lambrachaeus ramifer is not a majid at all.

Anacinetops stimpsoni and the Australian and southeast Pacific species of *Naxia* are transferred to the Majinae but *Trichoplatus* is resurrected to accommodate the radically different species *T. huttoni* from New Zealand.

New genera are proposed for *Aepinus indicus* Alcock (*Sunipea*), *Inachoides dolichorhynchus* Alcock (*Chorinachus*) and *Pseudocollodes demani* Balss (*Rhinospinosa*), since each of these species is regarded as generically distinct from the type species of those genera from American waters.

Although we retain in this subfamily *Encephaloides armstrongi* and '*Collodes*' *malabaricus* their affiliations need further consideration: the former is probably a pisine.

Affiliations of a number of other species groups also need examination. *Eurypodius* species have an unusual male first pleopod, *Cyrtomaia* and *Platymaia* species have at least superficial resemblances to *Chionoecetes* of the Oregoniinae and males of *Oncinopus* and *Macrocheira* species have peculiar twisted first pleopods unlike those of any other majids. The relationships of *Paratymolus*, *Camposcia* and *Ephippias* are also unclear to us at this time.

KEY TO THE INDO-WEST PACIFIC GENERA OF THE INACHINAE

1 Distal margin of basal antennal article extending forward no further than half diameter of eyestalk, free 2
— Distal margin of basal antennal article at least level with, usually extending forward beyond, anterior margin of eyestalk, free or fused to front 4
2(1) Rostrum of two blunt lobes; carapace without spines; interantennular partition weakly developed ..... *Oncinopus*
— Rostrum of two slender spines; carapace with at least a few spines; interantennular partition well developed and bearing a spine at its apex ventrally 3
3(2) Carapace narrowly pyriform; fourth pair of ambulatory legs with toothed ventral edge of dactyl folding back against ventral edge of propod; small species (cl. up to about 20mm) ..... *Grypachaeus*
— Carapace subcircular; fourth pair of ambulatory legs with dactyl normal; very large species (cl. more than 250mm) ..... *Macrocheira*
4(1) Green (antennal) gland immediately at the proximal junction of the basal antennal article 5
— Green (antennal) gland distinct and more or less distant from junction of basal antennal article and epistome 9
5(4) Rostrum of two short blunt lobes (sometimes with spinules); interantennular partition lacking a spine; carpus of cheliped with one large spine on inner margin, otherwise a few tubercles .. *Paratymolus*
— Rostrum of two slender spines (sometimes with accessory spines): interantennular partition with a well developed, sometimes bifid, spine at its apex ventrally; carpus of cheliped with many spines or tubercles 6
6(5) Carapace circular to subcircular 7
— Carapace pyriform 8
7(6) Basal antennal article free distally; interantennular spine horizontal, often long; propodi of ambulatory legs flattened ..... *Platymaia*

— Distal margin of basal antennal article fused to front; interantennular spine deflexed, often short; propodi of ambulatory legs cylindrical ..... *Cyrtomaia*
8(6) Supraorbital eave moderately produced, margin convex, smooth; propodi of all ambulatory legs flattened and strongly widened distally..... *Trichoplatus*
— Supraorbital eave weakly produced, margin nearly straight, spinous; propodi of ambulatory legs cylindrical ..... *Pleistacantha*
9(4) Third maxilliped with merus as broad as the ischium; basal antennal article usually flattened ventrally 10
— Third maxilliped with merus narrower than ischium; basal antennal article usually cylindrical or subcylindrical..... 15
10(9) Rostrum single, if long sometimes apically bifid..... 11
— Rostrum of two spines or fused only in basal half..... 13
11(10) Carapace with branchial regions extremely elevated and approximated in the midline; rostrum broad, beak-like, basal width about two thirds length ..... *Encephaloides*
— Carapace with branchial regions not greatly elevated or approximated in the midline; rostrum slender from the base, spine-like..... 12
12(11) Carapace narrowly pyriform; rostrum more than half postrostral carapace length, lateral margins spinulous, often apically bifid..... *Chorinachus*
— Carapace broad; rostrum less than a quarter postrostral carapace length, lateral margins smooth, apically acute..... *Pyromaia*[1])
13(10) Rostral spines separate from base; supraorbital eave lacking a preorbital spine and an antorbital lobe; intestinal region with a large blunt medial lobe on posterior margin; large species (cl. 30-120mm)..... *Ephippias*
— Rostral spines fused for about the basal half; supraorbital eave with a preorbital spine and often a small antorbital lobe; intestinal region with a slender medial spine or low tubercle on posterior margin; small species (cl. up to 12mm)..... 14
14(13) Postorbital lobe rudimentary; hepatic margin with a slender spine.. *Sunipea*
— Postorbital lobe prominent; hepatic margin lacking a spine..... *Collodes*[1, 2])
15(9) Upper orbit with a postorbital lobe or spine against which the eyestalk retracts..... 16
— Upper orbit lacking a postorbital lobe or spine, eyestalk, if movable, retracting against hepatic margin 19
16(15) Eyestalks long, curved; carapace dorsally smooth ..... *Camposcia*
— Eyestalks short, nearly straight; carapace with two spines dorsally in midline..... 17
17(16) Postorbital lobe cupped, basally broad in lateral view and anteriorly concave ..... *Inachus*
— Postorbital lobe spine-like, conical or subconical 18
18(17) Rostrum of two slender spines, apices acute; interantennular spine short, not visible in dorsal view ..... *Achaeopsis*
— Rostrum hardly produced beyond antennal fossa, of two short lobes, apices rounded; interantennular spine relatively long, exceeding rostral lobes, visible in dorsal view (fig. 15b) .. *Rhinospinosa*
19(15) Rostrum lacking; interantennular partition lacking; supraorbital eave rudimentary, not produced (fig. 11e)..... *Chalaroachaeus*
— Rostrum present; interantennular partition present; supraorbital eave narrow 20
20(19) Eyestalk with cornea small, almost immovable; epistome in a plane which is almost at right angles to the basal antennal article ..... *Physachaeus*
— Eyestalk with cornea not particularly small, movable; epistome in the same plane as the basal antennal article 21
21(20) Rostrum of two substantial contiguous spines, apices acute, produced well beyond antennal fossae; basal antennal article fused proximally with the epistome, usually free anteriorly.... *Macropodia*
— Rostrum of two short lobes, apices usually rounded or blunt, often hardly more than a thickened anterior border of antennal fossae, if produced sometimes contiguous; basal antennal article fused proximally to the epistome and also anteriorly..... 22
22(21) Ambulatory legs very slender and usually three to five times carapace length; first pleopod of male simple with a subterminal aperture; third segment of male abdomen not noticeably longer than fourth and fifth segments, smooth or sometimes with spinules on inflated lateral surfaces, without a transverse ridge..... *Achaeus*
— Ambulatory legs only moderately slender, length less than twice carapace length; first pleopod of male complex, aperture surrounded by lobes; third segment of male abdomen longer than fourth or fifth segments, arched, with a transverse ridge ..... *Prosphorachaeus*

[1]) from the literature (*Pyromaia* — Garth, 1958; *Collodes* — Alcock, 1895).
[2]) *C. malabaricus* only, not American species.

Achaeus Leach, 1817

Type species. — *Achaeus cranchii* Leach, 1817 by monotypy.

Remarks. — This is one of the most speciose of the Indo-Pacific spider crab genera. No less than 27 species are now recognised from the Indo-West Pacific, seven, including a new species described here, having been discovered in the last 15 years; an additional seven species are known from the eastern Atlantic. The genus thus rivals the similarly small *Podochela* in the eastern Pacific and west Atlantic.

The most recent treatments of this genus have dealt with Australian, New Zealand, South African and Japanese species. In an account of the then known Australian species Griffin (1970c) drew attention to the existence of three groups of species distinguished by first pleopods of the males. One of these groups, with strongly twisted pleopods has been removed to a new genus, *Prosphorachaeus*, by Takeda. Those remaining generally have the first pleopod of the male weakly curved outwards distally, the aperture usually being a simple slit near the apex. In some however, the opening is very prominent and in two it is protected by a flap as is characteristic of *Podochela* and some other American Inachinae. We have not seen fit to divide the genus up further, considering the presence of the flap to be a development confined to a few species otherwise very similar to other species of the genus.

Six of the species included in the key we know only from the literature. They are *A. anauchen* Buitendijk, 1939; *A. inimicus* Rathbun, 1911; *A. brevidactylus* Sakai, 1938; *A. boninensis* Miyake & Takeda, 1969; *A. varians* Takeda & Miyake, 1969; and *A. spinosus* Miers, 1879b.

Distribution. — Indo-West Pacific and eastern Atlantic.

KEY TO INDO-WEST PACIFIC SPECIES OF *ACHAEUS*

1 Supraorbital eave with one, or sometimes two or three, large spines 2
— Supraorbital eave smooth, or with four or more spinules or tubercles 8
2(1) Epistome absent; a prominent ridge across carapace between hepatic regions ..... *A. anauchen*[3])
— Epistome present; gastric regions without a prominent transverse ridge..... 3
3(2) Basal antennal article with three to four long spines; branchial region with five to six spines on, or close to, margin..... 4
— Basal antennal article with one to two long spines and sometimes two to four small spines; branchial margin with one to two tubercles or spines 5
4(3) Rostral spines slender, blunt, separated by a narrow slit; postorbital region with about four short spines laterally; hepatic margin with four to five short spines ..... *A. spinossisimus*
— Rostral spines slender, acuminate, separated from base by a broad U-shaped hiatus; postorbital region with one long spine laterally; hepatic margin with one long spine on margin and one subhepatic spine..... *A. erythraeus*

5(3) Postorbital neck short, carapace widening immediately behind eave; hepatic region strongly produced, margin with one anterior spine and one to two spines at the apex 6
— Postorbital neck at least moderately long, carapace constricted behind eave; hepatic region weakly or moderately produced, margin without anterior spine, apex with one spine and sometimes one to two additional smaller spines 7
6(5) Basal antennal article with two distal spines, otherwise spinulous; eyestalk with spinules and tubercle at extremity ..... *A. inimicus*[3])
— Basal antennal article with one distal spine, otherwise with two spinules; eyestalk with narrow process on anterior surface at distal third..... *A. akanensis*
7(5) Eyestalk with very small anterior tubercle or none at all; interantennular partition thin, shallow and ungrooved; lateral margin of postorbital neck smooth or with one spinule; adult male cheliped merus cylindrical, very slender in proximal third ..... *A. cadelli*
— Eyestalk with a well developed, narrow anterior tubercle; interantennular partition thick, deep and grooved; lateral margin of postorbital neck with one to five spinules; adult male cheliped merus trigonal, stoutness uniformly increasing distally..... *A. curvirostris*
8(1) Carapace without spines or tubercles dorsally or with only very low suppressed tubercles on gastric and cardiac region 9
— Carapace prominently tuberculate and sometimes bearing spines 15
9(8) Hepatic lobe strongly produced outwards and markedly convex, rounded or truncate..... 10
— Hepatic lobe not markedly produced outwards, subacute, obtuse or a low convexity 12
10(9) Carapace with a low tubercle on gastric and cardiac regions; dactyls of first two pairs of ambulatory legs terminally broadened ..... *A. brevidactylus*[3])
— Carapace smooth; dactyls of first two pairs of ambulatory legs slender..... 11
11(10) Rostrum deeply divided by a V-shaped notch, apically rounded, most of the margin spinulous; dactyl of last pair of legs semicircular ..... *A. lacertosus*
— Rostrum hardly divided apically by a very broad U-shaped notch, a few small spinules on distal part of margin; dactyl of last pair of legs weakly curved ..... *A. villosus*
12(9) Dactyls of last pair of ambulatory legs very weakly curved with one robust subterminal tooth; branchial regions with low tubercles ..... *A. laevioculis*
— Dactyls of last pair of ambulatory legs strongly curved with five or more robust teeth ventrally; branchial regions smooth 13
13(12) Hepatic lobe a smooth, low convexity; basal antennal article granulate; postorbital neck short..... *A. japonicus*
— Hepatic lobe subacute, sometimes with one or more tubercles; basal antennal article smooth or with up to four small spines; postorbital neck moderately long 14
14(13) Rostrum of two short, slender, subacute lobes separated by a very narrow slit; first free segment of antenna with a lateral spine; lateral margin of antennal fossae outwardly splayed ..... *A. barnardi*
— Rostrum broad, blunt, apically undivided or with a very shallow notch; first free segment of antenna smooth; lateral margins of antennal fossae not outwardly splayed..... *A. lorina*
15(8) Carapace with four to nine long spines dorsally..... 16
— Carapace with one to two long spines or with blunt tubercles or granules dorsally 17
16(15) Margin of supraorbital eave with many blunt spinules; rostral lobes with a few blunt spinules; branchial regions with two long spines submedially behind single cardiac spine ..... *A. superciliaris*
— Supraorbital eave with a few minute spinules midway along; rostral lobes with an apical spine; branchial regions with two long spines on each side near lateral margin, cardiac region with a pair of submedial spines..... *A. boninensis*[3])
17(15) Rostral lobes apically acute or subacute..... 18
— Rostral lobes apically blunt or rounded 24
18(17) Rostral lobes narrow, contiguous, separated only by a narrow V-shaped notch..... 19
— Rostral lobes moderately broad at base, well separated from base or by a broad apical concavity..... 20
19(18) Gastric and cardiac regions each with a single slender spine; basal antennal article with closely spaced tubercles on lateral margin as well as tubercles on ventral surface ..... *A. pugnax*
— Gastric and cardiac regions each with a large conical tubercle; basal antennal article smooth..... *A. dubia*
20(18) Postorbital region very short; hepatic region weakly or moderately produced and broad, laterally truncate or with blunt lobes 21
— Postorbital region moderately long; hepatic region produced, narrow and apically subacute to acute 23
21(20) Eyestalk with a row of three to four spines anteriorly; basal antennal article with a strong anterolateral spine as well as spinules on lateral and medial edges; dactyl of second ambulatory leg broadest subterminally..... *A. robustus*
— Eyestalk smooth; basal antennal article with tubercles but without spines or spinules; dactyl of second ambulatory leg tapering distally, not subterminally broadened..... 22
22(21) First pleopod of male flattened and spatulated at the tip ..... *A. tuberculatus*
— First pleopod of male widened distally, and ventrally produced and convex at the tip..... *A. varians*[3])
23(20) Protogastric and branchial regions smooth; supraorbital eave with posterior and sometimes anterior spinules; first pleopod of male with aperture at tip of sternal surface, not surrounded by a flap of tissue..... *A. brevifalcatus*
— Protogastric and branchial regions with tubercles; supraorbital eave lacking spinules; first pleopod of male with aperture subterminal and partly surrounded by a flap of tissue ..... *A. podocheloides*
24(17) Postorbital region not constricted; margins of rostral lobes and supraorbital eave spinulous ..... *A. paradicei*
— Postorbital region constricted; margins of rostral lobes smooth, supraorbital eave smooth or with a few anterior spinules 25
25(24) Cardiac tubercle without a secondary tubercle on posterior slope; postorbital 'neck' short; last segment of male abdomen subtriangular ..... *A. spinosus*[3])
— Cardiac tubercles with a secondary tubercle on posterior slope; postorbital 'neck' long; last segment of male abdomen distally truncate or weakly concave 26
26(25) Dactyl of last ambulatory leg only weakly curved, with minute teeth ventrally; dactyl of male chela with two large teeth .. *A. serenei*
— Dactyl of last ambulatory leg strongly curved with robust recurved teeth ventrally; dactyl of male chela with one large tooth ..... *A. brevirostris*

Achaeus akanensis Sakai, 1938
(Figs. 1, 5a, b)

Achaeus akanensis Sakai, 1938: 224-225, text fig. 15; 1976: 165, text fig. 88. — Griffin, 1976: 183.

Material examined. — 7 ♂♂, 3♀♀ (1 ovig.), 2.5-6.5 mm, ovig. ♀, 5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 260, Kai Is., 2.3 miles (∼ 3.7km) N 63°W from north point of Nuhu Jaan, 05°36.5′S 132°55.2′E, 90m, Blake dredge, sand, coral and shells, 16 and 18 December, 1899; 1 spec. — Stn. 282, anchorage between Nusa Besi and NE point of Timor, 08°25.2′S 127°18.4′E, 27-54m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Sagami Sea, Okinose, 180m, dredge, 23 June 1914; 1 spec.

Danish Kei Islands Expedition: Banda, off Neira, ca. 15m, dive, sand, 9 June 1922; 1 spec. — Banda, off Neira, 13m, dive, sand, 12 June 1922; 3 specs.

'Galathea' Expedition: Stn 675, Kermadec Group, Raoul I., 29°13′S 177°57′W, 60m, trawl, stones, 3 March 1952; 2 specs.

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[3]) from the literature

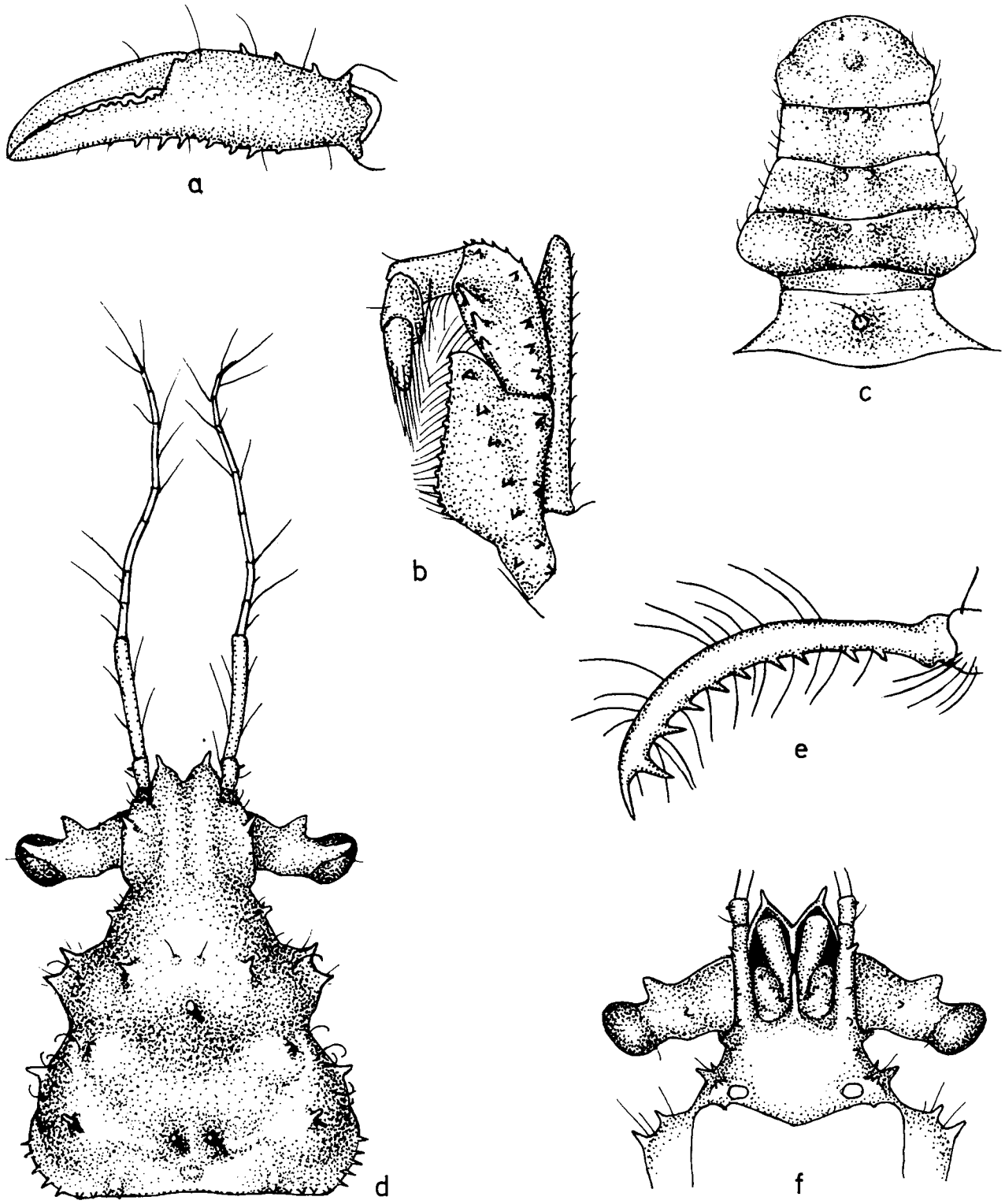


Fig. 1. *Achaeus akanensis* (male, 3.5 mm, Banda, ZMC) (a) left chela; (b) left third maxilliped; (c) male abdomen; (d) carapace, dorsal view; (e) dactyl of left fourth ambulatory leg; (f) orbits, ventral view.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. OG I, S of Obi I., south coast of Gomumu I., 01°52′S 127°36′E, 6m, corals, 23 May 1970; 1 spec.

Remarks. — These specimens agree well with the short description of the female holotype given by Sakai (1938; 1976; "male holotype" in the text is clearly a printing error) and with the two specimens previously recorded from the Philippine Islands (Griffin, 1976), in the apical spine on the rostrum, the spine on the supraorbital eave and the short postorbital neck. In the two male specimens from the Kermadec Group (3.5, 5.0 mm) there are tubercles, not spines,

dorsally on the carapace; in most of the remaining specimens the carapace tubercles are surmounted by a small spine, but these are broken off in some specimens. In two other male specimens, one from Kai Islands and one from Japan, there are strong spines on the carapace. The adult male of *A. akanensis* has never been described. Two of the males — the specimen from Japan (6.5 mm) and the larger specimen from the Kermadec Group (5.0 mm) — of our present series appear to be adult since the cheliped is enlarged and there is a wide gape between the fingers with one large basal tooth on the dactyl. In the male from the Kai Islands (4 mm) with strong carapace spines, the cheliped is somewhat enlarged and there are two teeth on the dactyl in the gape: we consider this specimen to be subadult. In both our specimens from Japan and the one from the Kai Islands the ambulatory legs are missing but as they agree in respect of other characters with the rest of the specimens in this series we have considered them to be conspecific.

In this series there is a broad tubercle surmounted by a group of curled hairs just behind the anterior margin on each rostral lobe. The anterior process on the eyestalk is narrow, rounded apically or subacute and with a small apical spine in some specimens. The postorbital neck is short, very short in the females, with one lateral spinule in most specimens; in the specimen from Kai Islands there are three small spinules and in the specimen from Japan about eight small spinules on the lateral margin. The hepatic region is strongly produced with one or two spines at the apex of the margin and a spine, which is usually subequal to that on the apex, on the anterior margin. There is a spine midway along the pterygostomian margin and one to three submarginal spines anteriorly on the branchial region. There are strong spinules posterolaterally on the carapace margin.

The protogastric spines or tubercles are smaller than the mesogastric spine or tubercle, not subequal as in the holotype. There are two submedial tubercles or spines on the cardiac region and a low tubercle on the posterior slope. The cardiac spines are sometimes weakly divergent, but in the specimen from Japan are strongly divergent. There are three tubercles or spines dorsally on each branchial region, the largest being either that at the same level as the cardiac region or the spine above the last ambulatory leg.

There is a long spine on the basal antennal article at the distal two thirds and two to four small spines proximal to it. Ventrally on the first free segment of the antenna there is a spinule at the anterolateral angle.

The chelipeds are large and stout in our male from Japan (6.5 mm) and in the larger of our males from the Kermadecs (5.0 mm). The merus of the cheliped in the adult male is subtrigonal with small spines on the three ridges and a subterminal spine dorsally. There is a spinulous ridge on the inner face of the carpus and three to four dorsal spines. The palm of the chela is one and a half times longer than the height with small spinules on the dorsal and ventral margins. The fingers are shorter than the palm and separated by a wide gape in the proximal two thirds; there is a large basal tooth on the fixed finger and a similar large tooth in front of it on the dactyl. The cheliped of our male from Kai Islands (4.0 mm) is not so stout, the palm is twice as long as high, the gape between the fingers is in the proximal third and there are two large teeth on the dactyl in the gape.

There is a subterminal tooth on the dactyl of the second ambulatory leg. In our specimens from the Philippine Islands (Griffin, 1976), Moluccas, Banda and Timor, the dactyl of the fourth ambulatory leg is moderately curved with about five small teeth along its length, the subterminal being the largest. In our specimens from the Kermadecs the fourth dactyl is more strongly curved, the teeth are more uniform in size and the subterminal tooth is more robust.

The third segment of the male abdomen is spinulous laterally in the larger males (greater than 3.5 mm); the last segment is wider than long, narrower in the distal half, with the anterior margin broadly rounded. The first pleopod of the male is only slightly broadened towards the blunt apex; the aperture is a lateral slit near the apex on the abdominal surface. The pleopod is curved inward distally in our two males from Kai Islands and Japan, while in the remaining five males the pleopod is nearly straight with only the apex turned inwards.

This species is very similar to *A. inimicus* Rathbun, known only from the holotype (♀, 5.4 mm, Mauritius), in the carapace spines; the absence of a postorbital neck in the female; and the curved dactyl of the fourth leg. *A. inimicus* as described by Rathbun (1911: 246, pl. 20 fig. 3) differs from *A. akanensis* only in the presence of spinules on the eyestalk rather than an anterior process; and in the basal antennal article having two long distal spines rather than one. It might well be that the two species are synonymous. (Buitendijk's, 1939, poor specimen of *A. inimicus* seems to agree with our *A. akanensis* specimens.)

A. akanensis is distinguished from *A. curvirostris* (A. Milne Edwards) and *A. cadelli* Alcock which also have a spine on the supraorbital eave by having a much shorter postorbital neck than in those two species.

Distribution. — Japan, Philippine Islands, Moluccas, Banda, Kai Islands, Timor, Kermadec Group.

Achaeus brevifalcatus Rathbun, 1911

Achaeus brevifalcatus Rathbun, 1911: 244-246. — Miyake & Takeda, 1969: 23-27, fig. 1. — Griffin, 1970c: 112-113, figs. 9, 10, 14b, c. — Sakai, 1976: 160.

Material examined. — 4♂♂, 1♀ (ovig.), 5-8 mm, ovig. ♀, 7 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

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

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java - S. Africa Expedition: Stn. 47, Mauritius, N of Port Louis, ca. 234 m, Sigsbee trawl, mud, coral, 6 November 1929; 2 specs.

Remarks. — These specimens agree well with those previously described in the strongly produced hepatic region with marginal spines; the apical spine on the rostral lobes and the strongly curved dactyl of the fourth ambulatory leg.

There is a smaller spine medial to the apical spine on the rostrum in two of the specimens from Timor, while in one of the specimens from Mauritius, the male, there is a small tubercle lateral to the apical spine. In all five specimens the supraorbital eave is nearly smooth with a few posterior spinules and laterally behind the orbits there are spinules. In one of the specimens from Mauritius, the female, there are small spinules on the eystalk near the anterior tubercle. In all of the specimens there is a distal spine on the basal antennal article with, in some, one to four very small spines proximal to it. The third segment of the male abdomen is spinulous in two of the specimens but bears only a few spinules in the other two.

This species is similar to *A. podocheloides* Griffin and *A. boninensis* Miyake & Takeda, in having the hepatic region strongly produced and the dactyl of the fourth leg strongly curved. However, in those two species there are three tubercles or spines dorsally on each branchial region, while in *A. brevifalcatus* there is only one such tubercle — above the last ambulatory leg.

Distribution. — Mauritius, Seychelles, Red Sea, Timor, Japan, Hawaii.

Achaeus brevirostris (Haswell, 1879)

Stenorhynchus brevirostris Haswell, 1879: 408-409; 1880b: 432, pl. 27 fig. 5.
Achaeus brevirostris. — Griffin & Yaldwyn, 1965: 46-48 (lit.). — Griffin, 1970c: 98-101, figs 1a, 2, 15e, f: 1976: 183.

Material examined. — 14♂♂, 11♀♀ (6 ovig.), 5-10 mm, smallest ovig. ♀, 6 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 162, West Irian Jaya, west coast Salawatti, between Loslos and Broken Is., 18 m, dredge, coarse and fine sand with clay and shells, 18 August 1899; 2 specs. — Stn. 253, Kai Is., 05°48.2′S 132°13′E, 304 m, trawl, grey clay, hard and crumbly, 10 December 1899; 1 spec. — Stn. 274, Aru Islands, 05°28.2′S 134°52.9′E, 57 m, Blake dredge, sand and shells, stones, 26 December 1899; 1 spec.
Singapore, 1903-1907; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 11, Kai Is., off Toeal, 20 m, trawl, fine sand, 9 April 1922; 3 specs. — Stn. 14, Kai Is., S of Doe Roa, 40 m, trawl, sand, 10 April 1922; 3 specs. — Stn. 20, Kai Is., Doe Roa Bassin, 50 m, trawl, sand, 14 April 1922; 1 spec. — Stn. 31, Kai Is., Doe Roa Bassin, 50 m, trawl, sand, 18 April 1922; 1 spec. — Stn. 35, Kai Is., Bay north of Noehoe-Roa, 35 m, trawl, sand, 23 April 1922; 1 spec. — Stn. 38, Kai Is., NE of Doe Roa, 35 m, trawl, sand, 24 April 1922; 2 specs. — Stn. 40, Kai Is., N of Doe Roa, 25 m, trawl, sand, 25 April 1922; 1 spec. — Stn. Pt. 19.4, Kai Is., off Toeal, 20 m, trawl, sand, 12 May 1922; 2 specs. — Stn. 60, Kai Is., S of Doe Roa, 25 m, dredge, gravel, shells *Lithothamnion*, 14 May 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition - Moluccas: Stn. KR VI, Kai Is., N of Nuhu Rowa, N of Du Rowa I., 05°32′S 132°41′E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 2 specs. — Stn. A III, Aru, Trangan, 3-4 miles (∿ 5-6.5 km) W of Tg. Lelar, 06°46′S 133°58′E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 3 specs.

Remarks. — These specimens agree well with those previously discussed. It was remarked before that on the chela there is sometimes a second tooth on the dactyl in the gape. In this series this second tooth was present in six males (6.5-7.0 mm), and there was only one proximal tooth on the dactyl in seven males (7.0-10 mm); this variation therefore appears to be related to size.

In the present series the rostral lobes are shorter than in the specimens previously described from Australia, and in a few specimens are separated only by a shallow notch. In most of these specimens there are one or two small tubercles on the basal antennal article and sometimes there are distal granules; in three specimens the basal antennal article is smooth and in one male (ZMA, Singapore) there is a small spine instead of a distal tubercle. There is a very small, recurved, subterminal tooth on the dactyl of the second ambulatory leg in all except one of the fourteen specimens which have a complete dactyl. On the ventral edge of the fourth dactyl there are five to eight pairs of small teeth proximally and five to eight unpaired, larger, recurved teeth distally. The gonopores of the female are near the midline and open anteriorly.

This species is very similar to *A. serenei* n.sp. and the differences which distinguish it are discussed under that species.

Distribution. — Zanzibar, Thailand, Singapore, Java, Australia, Kai Is., Aru, Sulu Archipelago.

Achaeus cadelli Alcock, 1895

Achaeus cadelli Alcock, 1895: 171, pl. 5 fig. 1. — Rathbun, 1911: 246.

Material examined. — 2♂♂, 6 ovig. ♀♀, 6-8.5 mm, smallest ovig. ♀, 6 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 82, Sunda Strait, 06°38′S 105°21′E, 35 m, trawl, sandy mud, 30 July 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition - Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg Tutuhuhur, 03°15′S 128°8′E, 27-54 m, dredge hauls 8-19, sand, *Lithothamnion* and rubble or shelly grit, 2 June 1970; 1 spec. — Stn. KR VI, Kai Is., N of Nuhu Rowa, N of Du Rowa I., 05°32′S 132°41′E, 27-36 m, dredge, sand and rubble, 11 June 1970; 1 spec. — Stn. KR IX, Kai Is., N end of Kai Dulah, 05°31′S 132°48′E, 18-21 m, dredge, sand and coarse sand, 12 June 1970; 1 spec. — Stn. AM II, Aru, Maikoor, approx. 8 miles (∿ 13 km) SW Tg. Ratoe, centred at 06°7′S 133°57′E, 45 m, dredge hauls 4-5, sand and rubble, 18 June 1970; 3 specs. — Stn. AM II (as above), 59-63 m, dredge hauls 8-11, sand and rubble, 18 June 1970; 1 spec.

Remarks. — These specimens agree well with that described and figured by Alcock (1895) except that, but for one

specimen, the rostral ridges are blunt and smooth, not carinate and spinulous. In that specimen (ovig. ♀, Sunda Strait) there is one short spine on the rostral ridge. One of us (D.J.G.G.) has examined a specimen of *A. cadelli* (male, 7.2 mm, Port Blair, Andamans, ZSC 1024/7) from the type locality, and the rostral lobes of this specimen have little trace of the serrations mentioned by Alcock.

In our specimens the rostrum is divided only apically into two very short triangular spines, separated by a shallow, broad U-shaped hiatus. The interantennular partition is not grooved ventrally. The supraorbital eave is smooth except for a single spine in the anterior half. The region behind the eave is constricted, smooth laterally or with one spinule, and broadening gradually to the hepatic region. There is one spine on the hepatic margin and two very small tubercles on the branchial submargin. There are two to four pairs of very small submedial protogastric tubercles anteriorly; a larger lateral protogastric tubercle ahead of the hepatic region and a posterior mesogastric tubercle. The cardiac region is strongly elevated with a pair of high submedial tubercles, sharp in one specimen, and a small medial tubercle on the posterior slope. There are two tubercles, one in front of the other, on the dorsal branchial region, and a tubercle or short spine at the posterolateral angle of the intestinal region.

The basal antennal article is long, reaching almost to the apex of the antennular fossa, slender, smooth except for two long spines, one midway along and one on the distal margin. The merus of the cheliped of the adult male is slender in the proximal third and widened in the distal two thirds. On the fixed finger of the adult male chela of our specimens there is a large basal tooth with a larger tooth on the distal edge of the gape; on the dactyl there is, in one specimen, one large tooth, in the other specimen two large teeth, opposite the hiatus between the large teeth on the fixed finger. The dactyl of the fourth ambulatory leg is almost straight, only weakly curved distally, and smooth or at least without prominent spines.

There are six segments in the male abdomen and the third segment is smooth. The first pleopod of the male is widened distally and the broad apex is curved inwards. The aperture is anterior and subterminal on the lateral margin of the abdominal surface.

The female abdomen is of six free segments and the female gonopore is large and opens laterally.

This species resembles *A. curvirostris* (A. Milne Edwards) in having a single spine on the supraorbital eave and in having the carapace constricted behind the eave into a postorbital 'neck'. *A. cadelli* can be distinguished from *A. curvirostris* by the points listed below, in addition to the characters of the rostrum mentioned above. The distinguishing character for *A. cadelli* is given first in each case and the corresponding character for *A. curvirostris* follows enclosed in brackets.

1. The interantennular partition is thin, shallow, not grooved and barely separates the antennular fossae anteriorly (the antennular fossae are separated anteriorly by a thick, deep, grooved interantennular partition).
2. The basal antennal article is long, reaching almost to the anterior margin of the antennular fossa, with two long spines, one midway and one on the distal margin (basal antennal article only reaching three quarters of antennular fossa, one long spine at distal two thirds); there are one to three small spinules on the posterior part of the article in both species.
3. The hepatic region is weakly produced with one small spine (hepatic region moderately produced with one large and one to two smaller spines).
4. The eyestalk is short with a pronounced constriction just beyond the base and there is only a very small anterior tubercle or none at all (eyestalk is moderately long with only a weak constriction and a well developed, narrow, anterior tubercle).
5. In the adult male the cheliped merus is cylindrical, very slender in the proximal third; on the fixed finger there are two large teeth separated by a wide hiatus (the merus is stout and trigonal, the stoutness uniformly increasing distally; on the fixed finger there are moderately large proximal teeth close together).
6. The third segment of the male abdomen is smooth (the third segment of the male abdomen is laterally spinulous).

These records extend the range of this species which was previously known only from Amirante and the Andamans in the Indian Ocean.

Distribution. — Amirante, Andamans, Sunda Strait, Ceram, Aru, Kai Islands.

Achaeus curvirostris (A. Milne Edwards, 1873)

Stenorhynchus curvirostris A. Milne Edwards, 1873: 253. — Haswell, 1882: 2.
Stenorhynchus fissifrons Haswell, 1879: 409.
Achaeus tenuicollis Miers, 1886: 9, pl. 1 figs 3a-c. (Not *Achaeus tenuicollis*. — Stephensen, 1945: 97, fig. 18A-B = *Macropodia formosa* Rathbun.)
Achaeus fissifrons. — Griffin & Yaldwyn, 1965: 38-43, figs 1-8. — Griffin, 1970c: 101-102, fig. 13b, c.
Achaeus curvirostris. — Griffin, 1974: 4.

Material examined. — 3♂♂, 7♀♀ (6 ovig.), 5-8 mm, smallest ovig. ♀, 5.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Islands, Sapeh Strait, 08°23.5′ S 119°4.6′ E, 69 m, dredge, coral and shells, 14 April 1899; 3 specs. — Stn. 310, E coast of Sumbawa, Sapeh Bay, 08°30′ S 119°7.5′ E, 73 m, dredge, sand with few pieces of dead coral, 12 February 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, 36-54 m, dredge, sand, coral, 19 March 1914; 2 specs.
'Galathea' Expedition: Stn. 675, Kermadec Group, Raoul I., 29°13′ S 117°57′ W, 60 m, sledge trawl, 3 March 1952; 4 specs.

Remarks. — These specimens agree well with those previously described and figured. In all our specimens there is a high tubercle on the anterior of the eyestalk and the supraorbital eave is smooth except for the single spine. On the postorbital neck there are two to five spinules, but in two of the specimens from the Kermadec Group there is only one spinule. All four specimens from the Kermadec Group have one high cardiac tubercle, while in the other specimens there are two low cardiac tubercles.

We have examined the specimens from the Iranian Gulf identified by Stephensen (1945) as *Achaeus tenuicollis* (3♂♂,

4♀ ♀, 8-12.5 mm) and they are not conspecific with this material; they are *Macropodia formosa* Rathbun.

Buitendijk (1939) recorded a specimen from the Sulu Islands as *A. lorina* which agreed with three specimens previously described as *A. lorina* by De Man (1902). One of us (D.J.G.G.) has examined all four specimens and they are all *A. curvirostris*.

A. curvirostris can be distinguished from *A. cadelli* Alcock which also has a spine on the supraorbital eave and the carapace constricted to form a neck, by its shorter basal antennal article; by the more strongly produced hepatic region with two to three spines rather than one spine and by the third segment of the male abdomen which is spinulous rather than smooth. These differences are discussed more fully under *A. cadelli*.

A. curvirostris can be distinguished from *A. akanensis* Sakai, by the presence of a postorbital neck (very small or absent in *A. akanensis*) and by the smaller hepatic spines (two strong hepatic spines directed obliquely forward in *A. akanensis*).

Distribution. — Widespread Indo-West Pacific: eastern Africa and the Philippine Islands, Japan, western and eastern Australia and New Zealand.

Achaeus japonicus De Haan, 1839

Inachus (Achaeus) japonicus De Haan, 1839: 99-100, pl. 29 fig. 3.
Achaeus japonicus. — Ortmann, 1893: 33-34. — Sakai, 1938: 211-212, fig. 5, pl. 22 fig. 1; 1976: 158-159, pl. 49 fig. 1. — Takeda, 1973b: 36.

Material examined. — 12 ♂♂, 21 ♀ ♀ (12 ovig.), 7.9-17.2 mm, smallest ovig. ♀, 13 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Misaki, ca. 18 m, 30 April 1914; 1 spec. — Japan, NW Kyushu, 33°51′N 130°3′E, 47 m, dredge, 18 May 1914; 2 specs.

SMITHSONIAN INSTITUTION, WASHINGTON

'Albatross' Expedition: Stn. 3707, Japan, off Honshu I., 113-135 m, 8 May 1900; 1 spec. (USNM 49076, det. M. Rathbun). — Stn. 3730, Japan, off Honshu, 61 m, 16 May 1900; 27 specs. (USNM 49081, det. M. Rathbun).

Japan, Obama, 108 m, coll. F. Baker, May 1914; 2 specs. (USNM 48847, det. T. Sakai).

Remarks. — These few specimens agree well with those previously described especially by Sakai (1938). The margin on the supraorbital eave and the postorbital region are sometimes minutely tuberculate; the basal antennal article is tuberculate distally and along the lateral edge.

Distribution. — Japan and Hong Kong.

Achaeus lacertosus Stimpson, 1907

Achaeus lacertosus Stimpson, 1907: 20, pl. 3 fig. 7. — Stephensen, 1945: 98, fig. 18C. — Griffin & Yaldwyn, 1965: 44-46 (lit.). — Griffin, 1970c: 105-108, figs 1b, 5, 14a, d; 1972: 69; 1974: 6. — Sakai, 1976: 159-160, text-fig. 82.

Material examined. — 21 ♂♂, 29 ♀ ♀ (19 ovig.) 4-6 mm, smallest ovig. ♀, 4 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Sumbawa, Sapeh Strait, 08°23.5′S 119°4.6′E, 69 m, dredge, coral and shells, 14 April 1899; 3 specs. — Makassar, 27-32 m, May 1899; 1 spec. — Aru, Jedan I.; 1 spec.

Java Sea, Jakarta, otter trawl, 'Rambang', May 1907; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Ambon, Ambon Bay, 90 m, dredge, sand, stones, 2 March 1922; 1 spec. — Stn. 10, Kai Is., off Doelah, 50 m, dredge, fine sand, 6 April 1922; 1 spec. — Stn. 14, Kai Is., S of Doe Roa, 40 m, trawl, sand, 10 April 1922; 1 spec. — Stn. 30, Kai Is., between Doe Roa and Kai Doelah, 40 m, trawl, sand, shells, 18 April 1922; 1 spec. — Stn. 61 Kai Is., between Doe Roa and Kai Doelah, 50 m, trawl, 14 May 1922; 1 spec. — Stn. 64, Java Sea, 05°51′S 106°22′E, 35 m, trawl, sandy mud, shells, 26 July 1922; 2 specs. — Stn. 72, Java Sea, 05°41′S 105°57′E, 35 m, trawl, stones, 28 July 1922; 1 spec. — Stn. 106, Java Sea, 05°50′S, 106°16′E, 13 m, trawl, mud, 5 August 1922; 1 spec.

Mortensen Java - S. Africa Expedition: Stn. 5, Java, 08°23′S 114°29′E, 70 m, trawl, sand, 5 April 1929; 3 specs. — Stn. 8, Java, 08°23′S, 114°24′E, 50 m, trawl, dredge, hard bottom, 6 April 1929; 19 specs.

Singapore, at low tide, 1903-1907; 1 spec. — Singapore, at low tide, 1 September 1908; 1 spec.

Formosa Strait, 23°8′N 117°30′E, 43 m, 23 January 1912; 2 specs.

South India, Pamban Passage, 5 m, coll. H. Lemche, 8 October 1951; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15′S 128°8′E, 48-41 m, dredge haul 4, coarse foramniferal and shell sand, 1 June 1970; 1 spec. — Stn. CP I, (as above), 25-63 m, dredge hauls 8-19, sand, *Lithothamnion* and rubble, 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, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 4 specs. — Stn. AN I, Aru, SW of Tg. Ngabordamlu, S Trangan I., centred near 06°58′S 134°5′E, 25-29 m, dredge hauls 1-3, coral, sponge, mud, broken shell, 20 June 1970; 1 spec. — Stn. A III, Aru, Trangan, 3-4 miles (∿ 5-6.5 km) W of Tg. Lelar, 04°46′S 133°58′E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 1 spec.

Remarks. — These specimens agree well with those previously described in the prominent spinules on the anterior edge of the rostrum; the long slender eyestalk with fine spinules but without an anterior lobe; the smooth carapace; the hepatic region expanded but not sharp nor with tubercles; and the strongly curved dactyl of the fourth ambulatory leg.

The present series shows the considerable variation in spinulation of the supraorbital eave, hepatic margin and posterolateral margins as commented on previously (Griffin, 1970c).

We have examined the specimens from the Iranian Gulf (6 ♂♂, 2♀ ♀, (1 ovig.) 5-8.5 mm, ovig. ♀, 7.5 mm, Stn. 15; ZMC) identified as this species by Stephensen (1945) and they are conspecific with our material. There are spinules on the anterior margin of the rostral lobes and the basal antennal article is smooth with distal granules. The supraorbital eave is smooth or with some very small spinules posteriorly, and the few spinules on the hepatic region, posterolaterally on the carapace and on the carapace margin are also very small.

This species is distinguished from *A. japonicus* De Haan by the long, slender eyestalk with spinules (eyestalk short without

spinules in *A. japonicus*); from *A. barnardi* Griffin by the broad rostral lobes with prominent spinules (narrow, smooth rostral lobes in *A. barnardi*); and from *A. villosus* Rathbun and *A. robustus* Yokoya by the fourth dactyl which is strongly curved rather than weakly curved as in those two species.

Distribution. — Widespread Indo-West Pacific: South Africa, Iranian Gulf, South India, Java Sea, northern Australia, Kai Is., Aru, Japan.

Achaeus lorina (Adams & White, 1848)

(Figs. 2c-e, 5c, d)

Inachus lorina Adams & White, 1848: 3-4, pl. 2 fig. 2.
Achaeus lorina. — Griffin, 1968a: 79 (in discussion); 1976: 183-184.

Material examined. — 1 ♂, 6 mm, 1 ovig. ♀, 6.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Island Expedition: Banda, off Kombir, ca. 70-90 m, dredge, sand, 7 June 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15′S 128°8′E, 25-63 m, dredge hauls 8-19, coarse sand, *Lithothamnion* and rubble, 2 June 1970; 1 spec.

Remarks. — Comparison of these specimens with the original description, with drawings of the holotype (♂, 11 mm (approx.), 'Eastern Seas', BM(NH)) of *Inachus lorina* by Dr. A. L. Rice (unpublished)) and with the female (ovig., 10.5 mm, North Balabac Strait, USNM 49837) discussed previously (Griffin, 1968a; 1976) shows their agreement in the following characters. The rostral lobes are broad, smooth and separated at most by a notch; the supraorbital eaves are smooth and subparallel; there is a postorbital neck; the carapace is smooth with only five tubercles (a small medial tubercle posteriorly on the elevated gastric region, a pair of submedial cardiac tubercles and a tubercle above the last ambulatory leg); the ambulatory legs are long, the first leg being above five and a half times carapace length; on the male chela there is a large tooth at the base of each finger.

Our specimens show the following differences from the holotype and the female from North Balabac Strait. The basal antennal article is smooth or with minute tubercles, not with two spines; the eyestalk is slightly longer and more slender; the dactyls of the third and fourth ambulatory legs are slightly more curved, though still with the greatest curve in the proximal half; and our specimens, though mature, are smaller (less than 2/3) than those two specimens.

The rostral lobes of our female specimen are separated by a notch while in the male there is no notch and the anterior margin is entire and uniformly convex. There is a small anterior lobe on the eyestalk of our male specimen but it is indistinct in the female. There is a low tubercle anteriorly on the submargin of the branchial region. The basal antennal article is smooth in our male while in the female there is a very small tubercle at about the distal quarter, with a smaller tubercle just posterior and medial to it. The original description refers to the antenna as being scarcely half as long as the carapace but the figure (given by Adams & White) shows only one segment present beyond the peduncle. In our male specimen the antenna is complete and is slightly longer (1.1) than the carapace length.

On the cheliped in both our specimens there are only a few small spines amongst the two rows of long hairs on the merus, rather than the long spines on the cheliped of the female from North Balabac Strait. The palm of the male chela is smooth, increasing in height distally, the ventral and dorsal edges blunt with long hairs, about two and a half times as long as the distal height. The fingers are about two thirds the length of the palm, directed slightly downwards towards the fixed finger; a wide gape is present in the proximal half with a large tooth proximally on each finger. The ambulatory legs are complete in our male specimen but incomplete or missing in our female specimen. There are about sixteen teeth ventrally along the length of the fourth dactyl, the proximal ones being very small.

In our male specimen the abdominal segments are broader than those figured for the holotype by Adams & White. The first pleopod of the male is curved inwards, apically flattened and subtruncate, the aperture is at the tip of the sternal surface near the medial edge.

This species is similar to *A. brevifalcatus* Rathbun in the smooth supraorbital eave, few carapace tubercles, a large basal tooth on each finger of the male chela, long ambulatory legs, curved fourth dactyl, and in the shape of the first pleopod of the male. It is distinguished from that species by the rostral lobes which are broad, smooth and weakly separated (subacute, with an apical spine and separated by a V-shaped hiatus in *A. brevifalcatus*); the hepatic region weakly produced (strongly produced with apical spines in *A. brevifalcatus*); the absence of spinules on the carapace or carapace margins and very few on the male sternum (spinules laterally on the postorbital neck, posterolaterally on the carapace and carapace margins and on the male sternum in *A. brevifalcatus*).

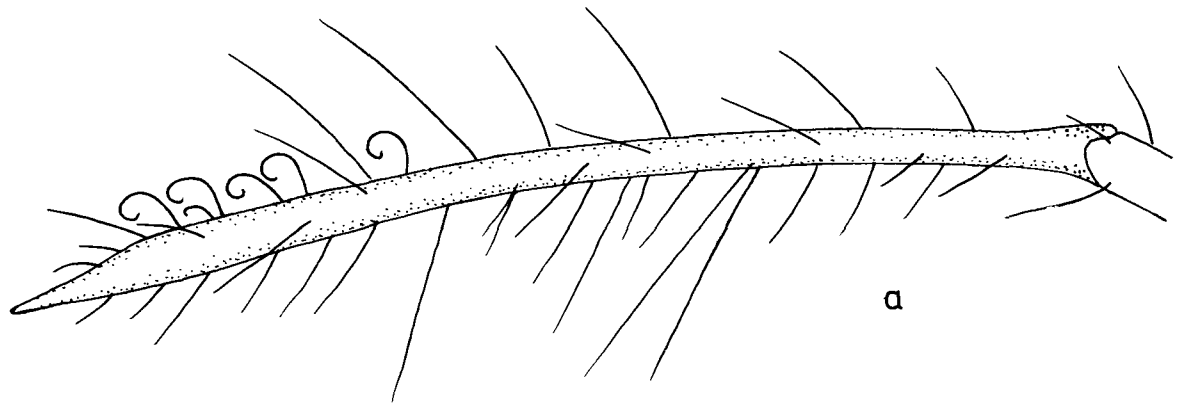
A. lorina is distinguished from *A. brevirostris* (Haswell) and *A. serenei* n.sp. by having a longer, more slender eyestalk; by having five rather than twelve tubercles on the carapace and by the first pleopod of the male which curves inward distally and lacks the tufts of long hairs present on the pleopod of the other two species.

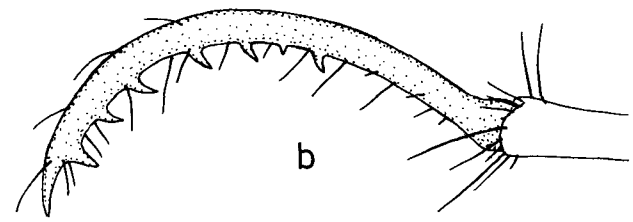
Distribution. — Philippine Islands, Ceram, Banda.

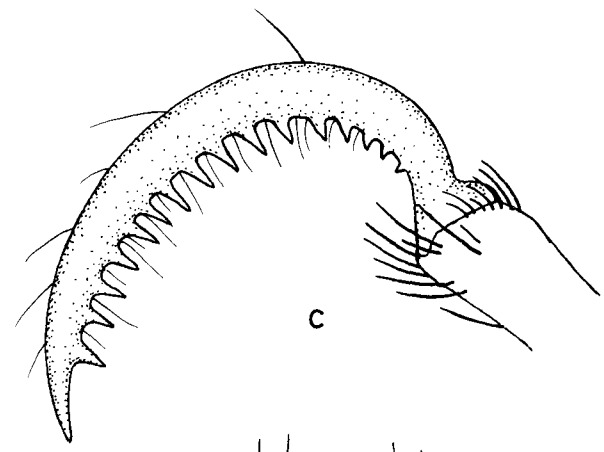
Achaeus paradicei Griffin, 1970

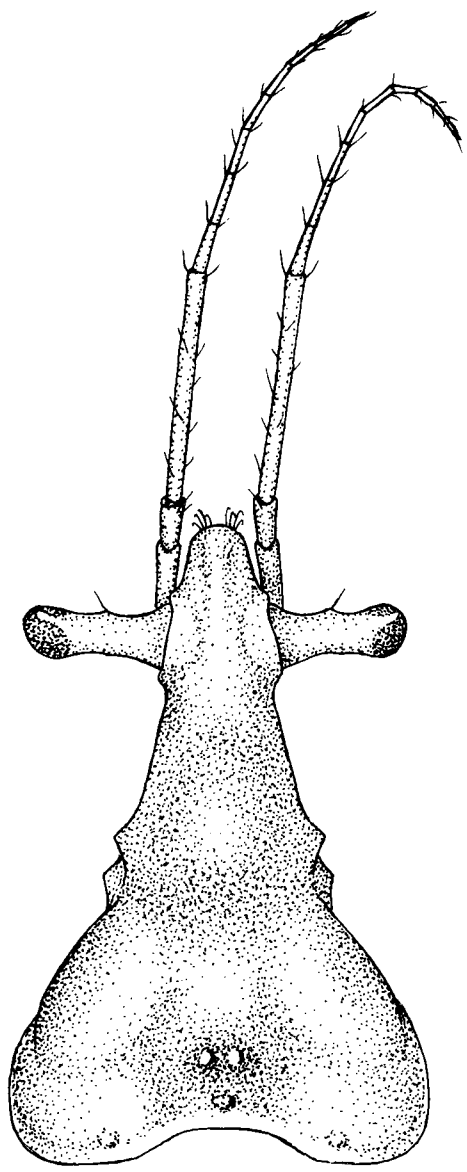
Achaeus sp. Griffin & Yaldwyn, 1965: 38. — Griffin, 1966b: 276; 1966d: 38.
Achaeus paradicei Griffin, 1970c: 108-109, figs. 3b, 6, 15b, c; 1976: 184.

Material examined. — 6 ♂♂, 7 ovig. ♀♀, 4.5-7 mm, smallest ovig. ♀, 5 mm.









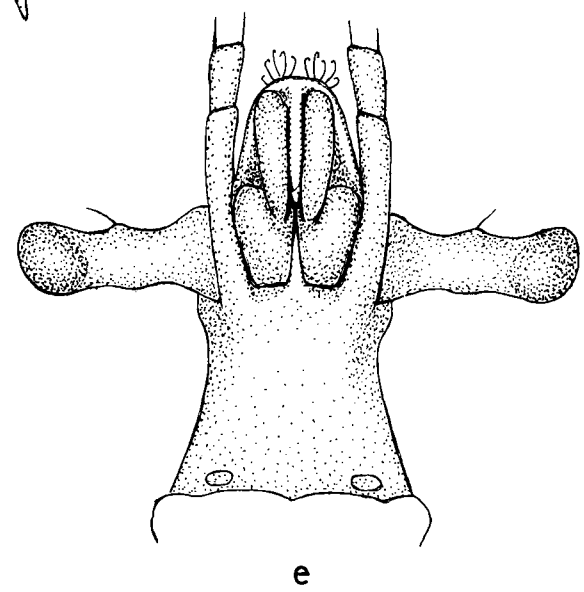


Fig. 2. *Achaeus robustus* (female, 4.5 mm, Kai Is., ZMA) (a) dactyl of left second ambulatory leg; (male, 4.5 mm, Kai Is., ZMA) (b) dactyl of left fourth ambulatory leg; *A. lorina* (male, 6.0 mm, Ceram, NIO Jakarta) (c) dactyl of left fourth ambulatory leg; (d) carapace, dorsal view; (e) orbits, ventral view.

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. 164, Irian Jaya, off Salawati, 01°42.5′ S 130°47.5′ E, 32 m, dredge, small stones and shells, 20 August 1899; 1 spec.
Makassar Strait, Donggala, 34 m; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Ambon, Ambon Bay, 90 m, stones, sand, 2 March 1922; 1 spec.
Mortensen Java - S. Africa Expedition: Stn. 8, E Java, 08°23′S 114°24′ E, ca. 50 m, trawl, dredge, hard bottom, 6 April 1929; 5 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, 48-63 m, dredge hauls 2-3, coarse foramniferal sand and shell sand, 1 June 1970; 1 spec. — Stn. KN II, Kai Is., west coast Nuhu Tjut, off Elat Bay, 05°40′ S 132°59′ E, 48-63 m, dredge hauls 3-4, rubble, fan coral, sand and green algae, 13 June 1970; 1 spec. — Stn. AW I, Aru, W. Wokam, off west coast of Wasir I., 05°30′ S 134°12′ E, 39-72 m, dredge hauls 7-10, sand and shell rubble, 15 June 1970; 1 spec. — Stn. AM II, Aru Is., Maikoor, approx. 8 miles (∿ 13 km) SW of Tg. Ratoe, centred at 06°7′ S 133°57′ E, 45 m, dredge hauls 4-5, sand and rubble, 18 June 1970; 1 spec.

Remarks. — These specimens agree well with the type series previously described and figured (Griffin, 1970c). Within the present series there are some small variations in the carapace spines and tubercles. The rostral lobes are broad, blunt and spinulous in eight of the specimens; in the remainder they are slightly narrowed or subacute at the apex, often with a longer apical spinule. There are often one or two spinules on the triangular lobe on the anterior margin of the eyestalk. In several of our specimens there is a spinule larger than the rest midway along the supraorbital eave. There are two to four spines on the margin of the hepatic region, sometimes the spines are bifid or spinulous. The spines, three to five in number, anteriorly on the submargin of the branchial region are small in the females but much more pronounced and visible dorsally in the males. However, in one male there is only one large spine and two very small spines.

There is a mesogastric spine present in all our specimens, short in the females, usually with apical spinules; moderate to long in the males and with two apical spinules in one male. The cardiac region is tumid with two tubercles which are low and granular in most specimens, but sharp or with spinules in three of the males. The three tubercles dorsally on the branchial region are usually very small, but sometimes the anterior or the posterior or both are more pronounced. On the basal antennal article there is a large distal spine directed forward, often with a small spine near its base; three to five small spines on the lateral edge (six to eight in the type series) and three small spines on the medial edge. The chela of the adult male agrees with that of the holotype in all except one specimen (cl. 6.0 mm) from Aru in which although the chela is enlarged there is no gape between the fingers. The gonopore of all the female specimens is an anterolateral opening.

Distribution. — Northeastern Australia, Aru Is., Kai Is., western Irian Jaya, Ambon, Ceram, Lesser Sunda Is., Java, Makassar Strait, Sulu Archipelago.

Achaeus pugnax (De Man, 1928)

Achaeopsis pugnax De Man, 1928: 7-14, figs. 1a-i.
Achaeus stenorhynchus Rathbun, 1932: 29.
Achaeus pugnax. — Sakai, 1938: 222-223, text-fig. 12, pl. 23 fig. 2; 1976: 163-164, text-fig. 86b, pl. 50 fig. 3. — Griffin, 1970c: 113-116, figs. 7b, 11, 15a,d.

Material examined. — 10 ♂♂, 7 ♀♀ (3 ovig.) 5.5-12 mm, smallest ovig. ♀, 8 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 302, Timor, N of Roti I., 10°27.9′ S 123°28.7′ E, 216 m, trawl, sand and coral sand, 2 February 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, 23 miles (37 km) NW ¾W of Goto, 32°49′ N 128°14′ E, 207 m, trawl, 14 May 1914; 1 spec. — Japan, off Misaki, 144-180 m, dredge, 19 June 1914; 2 specs. — Japan, Sagami Sea, Okinose, 180 m, 23 June 1914; 1 spec. — Japan, Sagami Bay, 540 m, dredge, 28 June 1914; 1 spec. — Japan, Sagami Bay, 540 m, 29 June 1914; 1 spec.

SMITHSONIAN INSTITUTION, WASHINGTON

'Albatross' NW Pacific Expedition: Stn. 4895, Japan, Eastern Sea, 10-20 miles (16-32 km) SW of Goto I., 171 m, 9 August 1906; 1 spec. (USNM 49831, det. M. Rathbun as *A. stenorhynchus*). — Stn. 4900, Eastern Sea, 10-20 miles (16-32 km) SW of Goto I., 250 m, 9 August 1906; 7 specs. (USNM 48257, det. M. Rathbun as *A. stenorhynchus*). — Stn. 4904, Eastern Sea, 10-20 miles (16-32 km) SW of Goto I., 192 m, 10 August 1906; 1 spec. (USNM 49856, det. M. Rathbun as *A. stenorhynchus*). — Stn 4903, Eastern Sea, 10-20 miles (16-32 km) SW of Goto I., 250 m, 10 August 1906; 1 spec. (USNM 49878, det. M. Rathbun as *A. stenorhynchus*).

Remarks. — This species was described in detail earlier (Griffin, 1970c). The males in this series possess the distinctive first pleopod with curved tip and terminal aperture. The present series shows variation in spinulation of the postorbital area and branchial margin previously noted in Australian material.

Distribution. — Western Australia, Timor, Japan.

Achaeus robustus Yokoya, 1933
(Fig. 2a, b)

Achaeus robustus Yokoya, 1933: 136, fig. 48. — Sakai, 1938: 212; 1976: 159, text fig. 81. — Takeda & Miyake, 1969: 481-483. — Takeda, 1973b: 36, fig. 4.
Achaeus sp. Griffin, 1970c: 116-117, figs. 12, 13e, f.

Material examined. — 4 ♂♂, 6 ♀♀ (4 ovig.) 3.5-5.5 mm, smallest ovig. ♀, 5.0 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Lesser Sunda Is., Sapeh Strait, 08°23.5′ S 119°4.6′ E, 69 m, dredge, corals and shells, 14 April 1899; 3 specs. — Stn.

260, Kai Is., 2.3 miles (3.7 km) N 63°W from N point Nuhu Jaan, 05°36.5′S 132°55.2′E, 90 m, Blake dredge, sand, coral and shells, 16/18 December 1899; 3 specs. — Stn. 289, S coast of Timor, 09°0.3′S 126°24.5′E, 112 m, trawl, mud, sand and shells, 20 January 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Banda, off Kombir, 75-90 m, dredge, sand and stones, 3 June 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AW I, Aru, W Wokam, off W coast Wasir I., 05°30′S 134°12′E, 39-72 m, dredge hauls 7-10, sand and shell rubble, 15 June 1970; 2 specs.

Remarks. — These specimens agree well with the holotype, figured by Yokoya, in the carapace shape and in length and form of the ambulatory legs, and with the redescription given by Takeda & Miyake (1969). They agree, with the exception of the smooth rostral lobe, with the three specimens described as *Achaeus* sp. by Griffin (1970c): there were no ambulatory legs with those three specimens and only a few specimens of this present series were complete enough to show the unusual second ambulatory leg so much longer than the first leg. Takeda (1973b), in his description of *A. robustus* from the Tsushima Islands did not refer to the length of the second ambulatory leg. Previous descriptions have been based on a few specimens and with this larger series we are able to describe some of the variations within the species.

The rostral lobes are smooth in only one specimen in this present series, in four specimens there is a small apical spine, and in five specimens there is a long apical spine.

In all the specimens there are horizontal spinules along the margin of the supraorbital eave, the posterior ones being larger. On the eyestalk there is a row of three to four spines, increasing in size laterally. The eyestalk appears smooth in the figure given by Takeda (1973b) but Takeda & Miyake (1969), in the redescription of the species, refer to small spinules on the lower anterior surface of the eyestalk.

There is a large, spinulous, metagastric tubercle which is armed with a very small spine in three specimens, with a longer spine in four specimens and without a spine in the remainder. On the cardiac region there is a high spinulous tubercle which is armed with two very small submedial spines in four of the specimens.

There are two to three spines, usually long, on the margin of the pterygostomian region. There are no spines anteriorly on the submargin of the branchial region.

All the males in this series are smaller (3.5-4.5 mm) than the ovigerous females (5.0-5.5 mm), their chelipeds are slender, and it is possible they are not adult. There is a row of long spines dorsally and ventrally on the merus; on the carpus there are a few small spinules. The palm is spinulous on the dorsal and ventral margins; length about twice the height. The fingers are slender, weakly incurved distally, slightly longer than the palm, with very slight, well spaced teeth along their length and a narrow gape between them. This agrees with the figure given by Takeda (1973b).

The first ambulatory leg is about twice the carapace length, the dactyl nearly straight and tapering to a sharp, curved apex. The second ambulatory leg is much longer than the first, three and a half to four times carapace length, the dactyl is slightly swollen in the distal quarter and tapers to a blunt, narrow apex. The third and fourth ambulatory legs are slightly shorter than the first leg; the dactyl of the fourth leg is weakly curved with seven to eight very small teeth well spaced along the ventral edge in the distal half.

The first pleopod of the male has been figured previously (Griffin, 1970c: fig. 13e, f; Takeda, 1973b: 4F). It is straight, broadening slightly near the truncate apex; the aperture is a wide opening in the anteromedial angle protected by a small lateral flap which was neither described nor figured by Takeda. The female gonopore is near the midline and opens anteriorly.

This species is similar to *A. villosus* Rathbun but is distinguished from it by the much shorter first ambulatory leg and the unusual broad dactyl of the second leg. The differences between the two species are discussed more fully under *A. villosus*.

A. robustus is distinguished from *A. lacertosus* Stimpson by the spines rather than small spinules on the eyestalk and the weakly curved dactyl of the fourth ambulatory leg.

Distribution. — Japan, East China Sea, Banda, Kai Islands, Aru, Timor, Sumbawa, north Western Australia.

Achaeus serenei new species
(Figs. 3, 5e, f)

Material examined. — 5 ♂♂, 3 ♀♀ (1 ovig.), 8.5-14 mm, ovig. ♀, 12.5 mm.

Holotype. — Male, cl. 11.5 mm, West Malay Peninsula, Thailand, north of Phuket, 08°22′ N 98°15′E, 15 m, coarse '*Amphioxus*' sand, 9 May 1966; 5 Thai Danish Expedition, Stn. 1176. (ZMC).

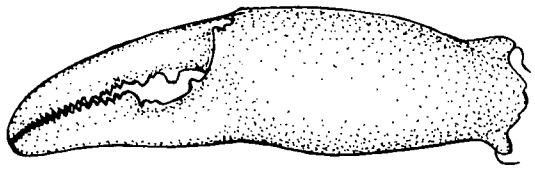
Paratypes. — As listed below.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

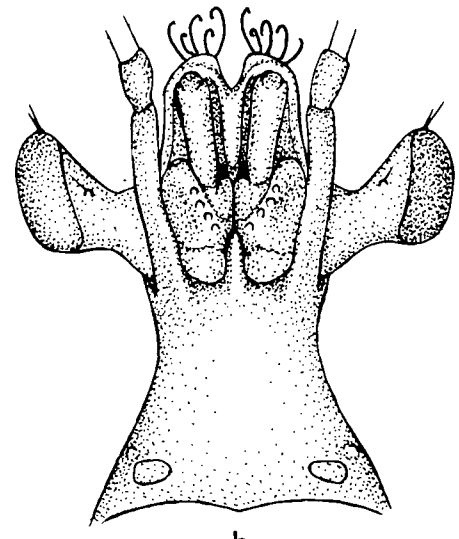
Mortensen Pacific Expedition: Philippine Islands, Sulu Archipelago, off Jolo, 22-40 m, *Lithothamnion* bottom, 17 March 1914; 1 spec.

Danish Kei Islands Expedition: Stn. 64, Java Sea, 05°51′S 106°22′E, 35 m, trawl, sandy mud, shells, 26 July 1922; 1 spec. — Stn. 66, Java Sea, 05°54′S 106°12′E, 24 m, trawl, sandy mud, shells, 27 July 1922; 1 spec. — Stn. 67, Java Sea, 05°48′S 106°12′E, 38 m, trawl, sand, 27 July 1922; 1 spec. — Stn. 75, Sunda Strait, 06°10′S 105°44′E, 40 m, trawl, sand, shells, 29 July 1922; 1 spec. — Stn. 84, Sunda Strait, 05°55′S 105°31′E, 38 m, trawl, sandy mud, pumice, 31 July 1922; 1 spec. — Stn. 90, Sunda Strait, 05°55′S 105°30′E, 36 m, trawl, dredge, hard bottom, 1 August 1922; 1 spec.

Description. — Carapace elongate, greatest width about two thirds (0.6-0.7) carapace length. Dorsal surface with 12 blunt tubercles, otherwise smooth. Branchial and cardiac regions well demarcated by broad groove from surrounding regions,



a



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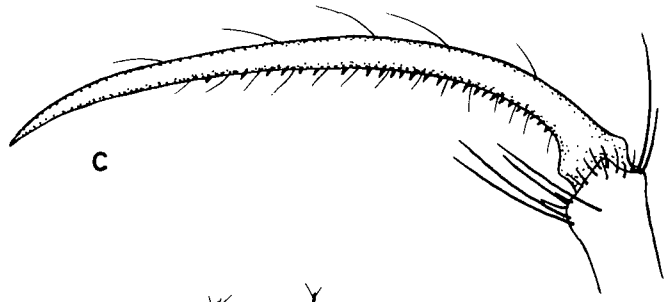

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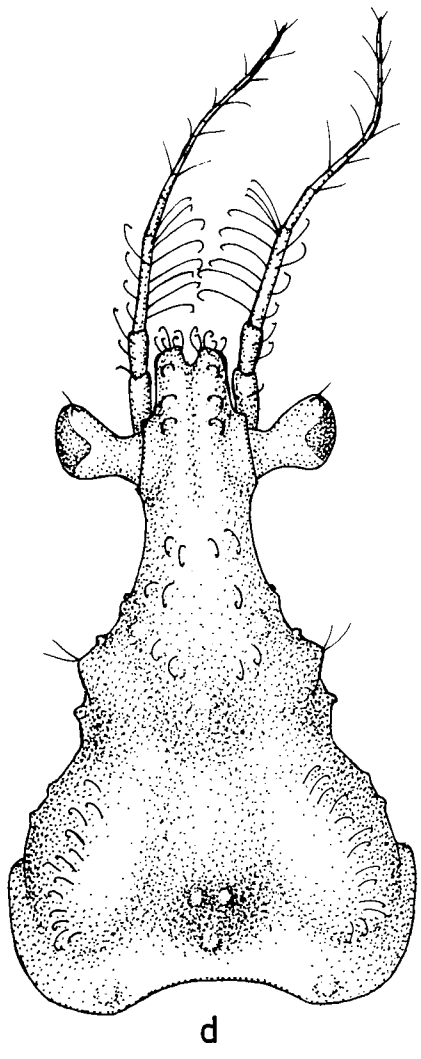

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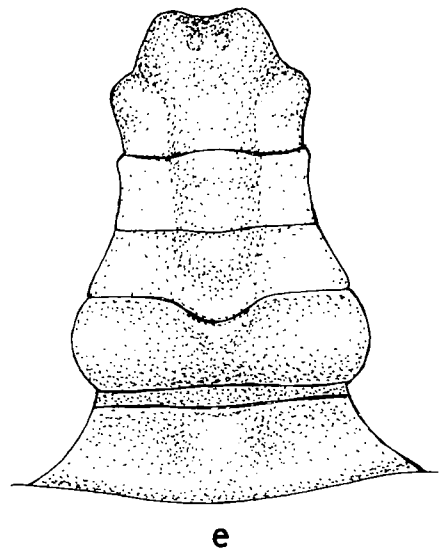

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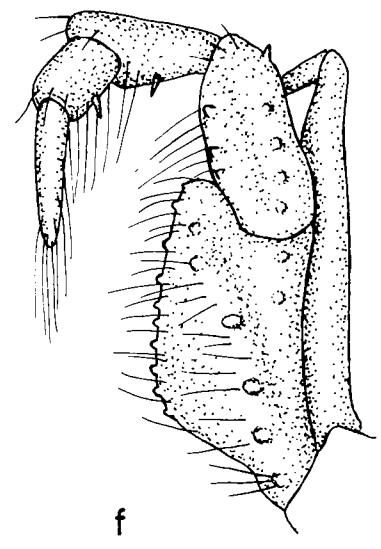


f

Fig. 3. *Achaeus serenei* (holotype) (a) left chela; (b) orbits, ventral view; (c) dactyl of left fourth ambulatory leg; (d) carapace, dorsal view; (e) male abdomen; (f) left third maxilliped.

otherwise ill-defined. Curled hairs grouped along edges of rostral spines, protogastric region and margin of branchial region.

Rostral lobes moderately long, separated by a narrow U-shaped hiatus in distal third, rounded or truncate apically.

Supraorbital eave unarmed. Eyestalks short and stout, a small tubercle midway along anterior surface (in five specimens but not in holotype), a small blunt tubercle opposite on ventral surface, and a tubercle above cornea at distal extremity of eyestalk; cornea large, circular, obliquely subterminal.

Region between eave and hepatic region long in male, broadening regularly, constricted, slightly shorter in female.

Hepatic regions weakly inflated, laterally acute with one tubercle; a small tubercle on anterior margin. Pterygostomian region with a small tubercle midway along margin and visible in dorsal view behind hepatic region.

Branchial regions swollen, bearing laterally two small tubercles, sometimes obscure, just forward of widest part of carapace. Posterolateral margins smooth in adults.

Dorsal surface of carapace with a low, broadbased tubercle far back on mesogastric region, tumid cardiac region with two blunt tubercles side by side and a low medial intestinal tubercle on posterior slope. Two small tubercles on protogastric regions laterally, well forward of mesogastric tubercle. Six similar tubercles laterally on branchial regions, three on each side in a semi-circle, one anteriorly, one opposite cardiac tubercles, and one near posterior margin above base of last ambulatory leg.

Antennular fossae large, oval. Basal segment of each antennule usually bearing four or five small spinules along medial edge. Interantennular partition a narrow, compressed, triangular lobe.

Basal antennal articles smooth or with one or two very small tubercles in proximal half. Antennae very long, two-thirds length of carapace, bearing numerous long hairs.

Epistome longer than wide in male, as long as wide in female, a small spine or tubercle just forward of, and lateral to, green gland opening.

Ischium of third maxillipeds with two oblique rows of small spines on each side of a shallow longitudinal groove; medial edge with about nine very small well spaced teeth. Merus with about three small spines laterally beside shallow central groove; distal edge irregularly crenulate with about two or three small spines slightly laterally; medial edge with two to four spines. Palp long and stout, laterally, medially and apically fringed by long hairs; carpus bearing a small spine medially near distal edge, propodus with a similar medial spine about midway along. Exopodite smooth.

Thoracic sternum in male with a transverse row of four tubercles near anterior end of abdominal fossa; one tubercle on second and third segments and three tubercles on fourth segment near edge of abdominal fossa.

Chelipeds in male long and robust. Ischium subtrigonal, merus subcylindrical, carpus subcylindrical, chela compressed. Merus with some small tubercles and spines on ventral surface and four very small tubercles, one proximal, one midway along and two distal, on dorsal surface. Carpus with small tubercles and spines ventrally. Chela with palm twice as long as high, with a few spinules dorsally and ventrally. Fingers slightly shorter than palm, gaping proximally, incurved distally and acute, inner edges toothed; fixed finger with a large tooth at base, a smaller double tooth separated from it by a concavity, proximal part of distal portion usually enlarged; dactyl with two large teeth distal to proximal tooth of fixed finger; distal parts of both fingers with irregular teeth along adjacent inner edges. Ventromedial edge of merus, medial surface of carpus and ventral edge of chela with large and small straight hairs. Cheliped of female slightly longer than (1.25) carapace, slender; merus subcylindrical, with several, scattered short spines ventrally; similar spines ventrally on carpus; palm with small spines dorsally and ventrally; fingers as long as palm, almost meeting along toothed cutting edges.

Ambulatory legs very long and slender, first longest, about four and a half times carapace length, remaining legs decreasing regularly in length, fourth shortest, three to three and a half times carapace length; curled hairs singly along carpus and propodus dorsally, long straight hairs ventrally. Dactyls of first two legs long and almost straight, weakly curved distally and unarmed, bearing long straight hairs; dactyls of third and fourth legs weakly curved, bearing short hairs and very small teeth ventrally along proximal three quarters, distally smooth; teeth in two rows each of about twenty teeth in proximal half, more distal teeth in a single row.

Male abdomen narrow, all segments except last clearly wider than long; third segment with strongly convex lateral edges. Last segment longest, length slightly less than or subequal to width, narrower in distal half, distal margin truncate or weakly concave. Surface elevated in midline, bearing a wide medial elevation distally on first and on third to fifth segments and on last segment a central tubercle and a transverse pair of smaller tubercles not far from distal edge; third segment laterally inflated, smooth. Female abdomen broad, elongate subovate, elevated in midline.

Male first pleopod moderately slender, bulbous basally, weakly expanded and slightly outwardly curved distally, tip rounded (broader than in *A. brevirostis*), aperture subterminal, a long slit at end of groove extending along medial surface; two rows of long hairs near tip, one on medial surface, one on lateral surface, pleopod otherwise naked.

Female gonopore an oval aperture, opening anteromedially near midline.

Remarks. — This species is very similar to *A. brevirostris* (Haswell) in the smooth, blunt rostral spines, smooth supraorbital eave, presence of a postorbital neck in the male and carapace with only low tubercles. It is distinguished from that species by the dactyl of the fourth leg which is only weakly curved with minute teeth on the proximal three quarters

and smooth distally, while in *A. brevirostris* the fourth dactyl is quite strongly curved with robust, recurved spines which are larger in the distal half. The first pleopod of the male in *A. serenei* is more broad apically than in *A. brevirostris* bearing a row of hairs on both medial and lateral surfaces but lacking the tuft of hairs on the sternal surface present in *A. brevirostris*. In *A. serenei* the chela of the male has two teeth on the dactyl in the gape which is in the proximal third, not one large tooth as in *A. brevirostris*. In subadult males of *A. brevirostris* there are sometimes two teeth on the dactyl but the gape occupies the proximal half. In the female of *A. serenei* there is a postorbital neck and the gonopores open anteromedially, while in *A. brevirostris* there is only a very short neck in the female and the gonopores open anteriorly.

This species is distinguished from *A. podocheloides* Griffin which also has a smooth eave, by the rounded (not pointed) rostral lobes; by the weakly (not strongly curved) fourth dactyl; and by the less strongly produced hepatic region. Of the species with a weakly curved fourth dactyl, *A. serenei* is distinguished from *A. tuberculatus* Miers by the absence of tubercles on the eave and from *A. brevidactylus* Sakai by the apically narrow, rather than broad, dactyls of the first two pairs of ambulatory legs.

This species is named in honour of the late Dr. R. Serène of Paris, formerly the UNESCO Science Regional Expert for South East Asia who made a major contribution to carcinological taxonomy in the South East Asian region.

Distribution. — West Malay Peninsula, Sunda Strait, Sulu Archipelago.

Achaeus superciliaris (Ortmann, 1893)

Achaeopsis superciliaris Ortmann, 1893: 36-37, pl. 3 figs. 3, 3a. — Rathbun, 1906: 877.

Achaeus superciliaris. — Sakai, 1938: 219-220, text-fig. 10, pl. 21 fig. 5; 1976: 162-163, text-fig. 86a, pl. 50 fig. 1. — Takeda & Miyake, 1969: 488-489.

Material examined. — 57 ♂♂, 48 ♀♀ (22 ovig.), 3.2-9.0 mm, smallest ovig. ♀, 3.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Sagami Sea, 720 m, 1-7 June 1914; 1 spec. — Japan, off Misaki, 144-180 m, 19 June 1914; 2 specs. — Sagami Sea, Okinose, 180 m, dredge, 23 June 1914; 16 specs. — Sagami Sea, Okinose, 540 m, 28 June 1914; 20 specs. — Sagami Bay, 540 m, dredge, 29 June 1914; 44 specs.

SMITHSONIAN INSTITUTION, WASHINGTON

'Albatross' Expedition: Stn. 3700, Japan, off Honshu I., 113 m, 7 May 1900; 6 specs. (USNM 49517). — Stn. 3702, Japan, off Honshu I., 74-56 m, 7 May 1900; 1 spec. (USNM 49881). — Stn. 3763, Japan, off Honshu I., 88-93 m, 22 May 1900; 2 specs. (USNM 49880). — Stn. 3727, Japan, off Honshu I., 61 m, 16 May 1900; 1 spec. (USNM 49882).

'Albatross' Expedition: Stn. 3939, Hawaiian Is., Laysan I., 1902; 12 specs. (USNM 29738) (all specs. det. M. Rathbun as *Achaeopsis* sp.).

Remarks. — The first pleopod of the male has been figured by Sakai (1938, text fig. 10b), the apex of the pleopod is blunt and the aperture is immediately subterminal on the abdominal surface, near the lateral margin.

One of us (D.J.G.G.) has examined specimens from Hawaii identified as this species by Rathbun (3 ♂♂, 9 ovig. ♀♀, 3.2-4.3 mm, USNM 29738; 1 ♂, 3.4 mm, USNM 29739) and confirmed the identification. The many blunt spinules around the orbit immediately set this species apart from other species of *Achaeus*.

Distribution. — Japan, East China Sea, Hawaii.

Achaeus tuberculatus Miers, 1879

Achaeus tuberculatus Miers, 1879b: 25. — Shen, 1937: 285-286, text-fig. 4. — Sakai, 1938: 214-215, text-fig. 7, pl. 22 fig. 3; 1976: 160-161, text-fig. 83, pl. 49 fig. 2. — Takeda & Miyake, 1969: 483-484. — Takeda, 1973b: 37-38.

Material examined. — 13 ♂♂, 8 ovig. ♀♀, 7-11.6 mm, smallest ovig. ♀, 7.0 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Misaki, 5 m, 26 April 1914; 1 spec. — Japan, Korea Strait, 33°41′N 128°50′E, 135 m, trawl, sand, 17 May 1914; 1 spec. — Japan, W. of Shimonoseki, 34°11′N 130°2′E, 101 m, dredge, sand, 18 May 1914; 1 spec. — Japan, Misaki, off the station, 45 m, dredge, 9 June 1914; 9 specs.

Nagasaki, coll. James Jordan, 1 July 1911; 1 spec.

SMITHSONIAN INSTITUTION, WASHINGTON

'Albatross' Expedition: Stn. 3725, Japan, off Honshu I., 15 May 1900; 1 spec. (USNM 49099, det. M. Rathbun).

'Albatross' NW. Pacific Expedition: Stn. 4832, Japan, Hondo, Nanao to Isuruga, 137 m, 23 July 1906; 1 spec. (USNM 49857, det. M. Rathbun). — Stn. D. 4815, North West Pacific; 1 spec. (USNM unreg., det. T. Sakai).

Japan, Tara Ibusuki, in prawn net, coll. T. Urita; 1 spec. (USNM 48460, det. M. Rathbun). — Japan, Hakodate; 1 spec. (USNM 49859, det. M. Rathbun). — Japan, Mogi; 1 spec. (USNM 49860, det. M. Rathbun). — Japan, Obama, 108 m, coll. F. Baker, May 1914; 2 specs. (USNM ex. 48847, det. T. Sakai as *A. japonicus*).

Remarks. — These specimens agree with the material described by Miers in that the cardiac tubercle is prominent, there is a broad lobe on the hepatic region, smooth eyestalks and curved, but not falcate fourth ambulatory dactyls. That the species is distinct from the smooth *A. spinosus* and *A. japonicus* has never been disputed. Sakai (1938) observes that the cardiac tubercle is sometimes bifurcate although Miers originally stated that it was not.

The present specimens also agree with that figured by Shen (1937) and by Sakai (1938). The fingers of the chela of the male gape weakly and the dactyl bears two or three larger teeth proximally. The first pleopod of the male is weakly curved distally, apically rounded, without lobes.

The species is further characterised by the rostral lobes being tuberculate, the edges of the supraorbital eave being tuberculate, the basal antennal article having prominent tubercles towards both medial and lateral edges, by the ster-

num in the male being tuberculate especially around the abdominal fossa and by the posterolateral margin of the carapace being minutely spinulous, although in some specimens the spinules are very few in number; the stout merus of the cheliped in the male is tuberculate.

Comparison of this material with Takeda & Miyake's (1969) *A. varians* suggests to us that a distinction from *A. tuberculatus* is not well made. However, the two species may be separated by the first pleopods of the male: there are no significant differences in features of the carapace, orbit, male abdomen, ambulatory legs and cheliped of the male.

Distribution. — Endemic to Japan.

Achaeus villosus Rathbun, 1916
(Figs. 4, 5g, h)

Achaeus villosus Rathbun, 1916: 528. — Griffin, 1976: 184, fig. 1a.

Material examined. — 2 ♂♂, 2 ♀♀ (1 ovig.), 5.5-7.5 mm, ovig. ♀, 7.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 133, north Moluccas, Salibabu I., anchorage off Lirung, up to 36 m, trawl, dredge and reef exploration, mud and hard sand, 25/27 July 1899; 1 spec. — Stn. 285, anchorage S. coast of Timor, 08°39.1′S 127°4.4′E, 34 m, dredge, on limit between mud and coral, *Lithothamnion*, 18 January 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 82, Sunda Strait, 06°38′S 105°21′E, 35 m, trawl, 30 July 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AH I, E. of Ambon, Haruku I., near Tg. Bt. Kapal, 108-113 m, dredge haul 4, shell sand and rubble, 31 May 1970; 1 spec.

Remarks. — These specimens agree well with the holotype (♂, 8.3 mm, Sulu Archipelago, USNM 4807) previously discussed (Griffin, 1976), in the short, stout eyestalk, in the rostral lobes being only apically separate, in the very weakly curved dactyl of the third ambulatory leg, in the second free segment of the antenna being less than twice as long as the first, and in the carapace with fine spinules but no tubercles or spines.

In this series there are long straight hairs anteriorly on the eyestalk with small spinules among them. There is an oblique row of spinules and long hairs from the posterior margin of the orbital eave outwards to the anterior margin of the hepatic region. The cardiac region is broadly elevated in the two females and is higher than the gastric region. This elevation is without the fine carapace spinules.

There is an oblique row of spinules from the base of the spinulous basal antennal article to the outer edge of the green gland.

The palm of the larger male (7.0 mm) is enlarged, highest about halfway along its length, length about one hand a half (1.7) times the greatest height. The fingers are slightly shorter (0.9) than the palm, there is a moderate gape between them in the proximal half, and in the gape there are two large teeth on the dactyl and four irregular sized teeth on the fixed finger. The fourth ambulatory leg is missing from the holotype. In these specimens the fourth leg is about twice as long as the carapace, two thirds the length of the first ambulatory leg and seven eighths the length of the third leg; the fourth dactyl is slender, nearly straight, with three or four minute teeth in the distal half.

The first three segments of the male abdomen are spinulous; the last segment is bluntly triangular, the length slightly less than the basal width.

The first pleopod of the male is curved inward distally, the apex truncate, the aperture anteriorly on the abdominal surface is subcircular with a raised rim. The female gonopore is an oval aperture near the midline which opens anteriorly and laterally.

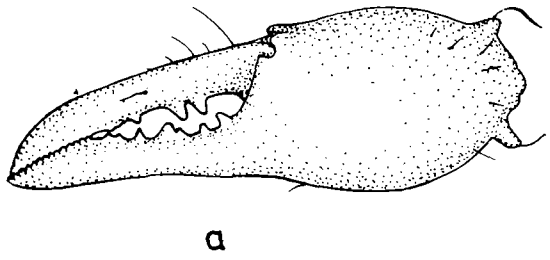
This species is similar to *A. robustus* Yokoya in having small carapace spinules on much of the carapace surface and in having the third segment of the antenna only one and a half times longer than the second segment. *A. villosus* is distinguished from *A. robustus* by the relative lengths of the first two pairs of ambulatory legs. In *A. villosus* the first leg is about three and a half times the carapace length and slightly longer than the second leg while in *A. robustus* the first leg is only twice the carapace length and less than two thirds the length of the second leg. As well, in *A. villosus* the eyestalk is shorter, there is no apical spine on the rostral lobes nor a distal spine on the basal antennal article and the gastric and cardiac elevations are much lower and broader than in *A. robustus*.

A. villosus differs from *A. brevidactylus* Sakai in having the dactyls of the first two pairs of ambulatory legs slender and acute at the tip, not broad and blunt; in having the triangular last segment of the male abdomen more rounded apically and in having the first pleopod of the male curved inwards at the tip, rather than straight as shown in Sakai's figure (1938: text fig. 8e).

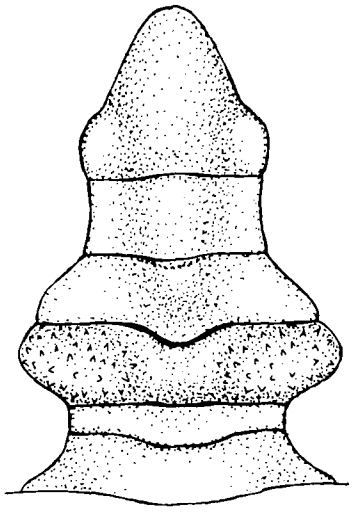
A. villosus is distinguished from *A. lacertosus* Stimpson, *A. barnardi* Griffin and *A. japonicus* De Haan by having the dactyl of the fourth ambulatory leg weakly curved, not strongly curved as in those three species. It is further distinguished from *A. lacertosus* by the short, stout eyestalk (long and slender in *A. lacertosus*); from *A. barnardi* by the broad rostral lobes separated only by a notch (slender rostral lobes in *A. barnardi*); and from *A. japonicus* by the spinulous carapace (smooth in *A. japonicus*).

This species was previously known only from the type locality, Sulu Archipelago.

Distribution. — Sulu Archipelago, north Moluccas, Ambon, Timor, Sunda Strait.



a



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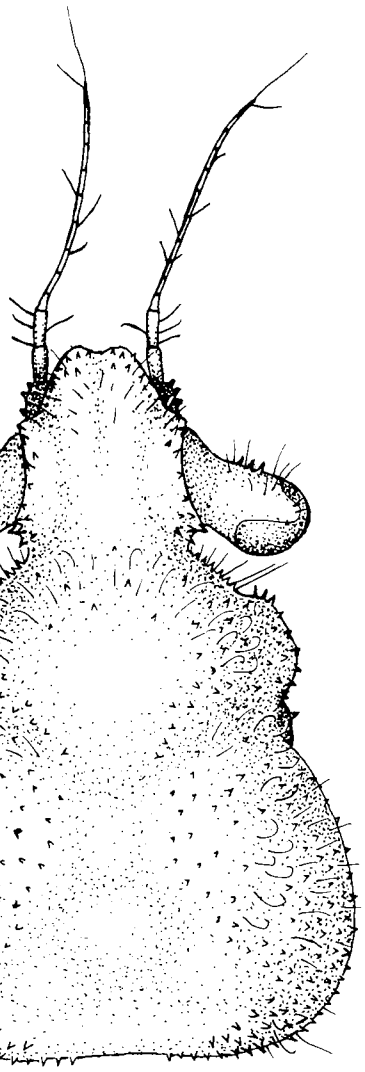

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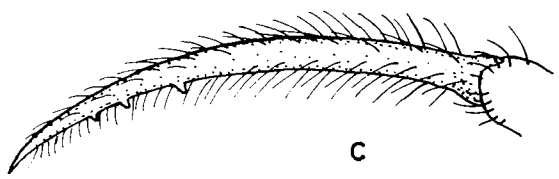

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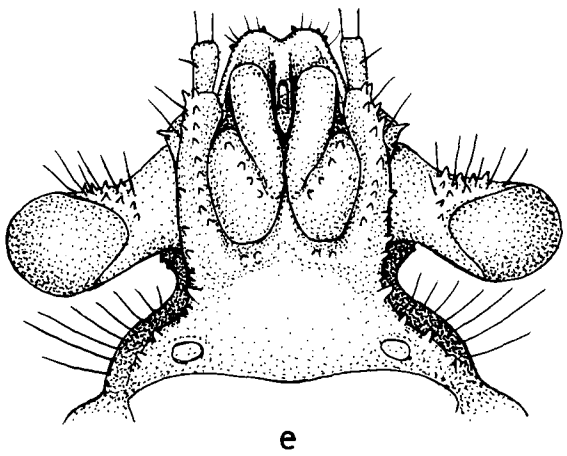

e

Fig. 4. *Achaeus villosus* (male, 7 mm, Sunda Strait, ZMC) (a) left chela; (b) male abdomen; (female, ovig., 7.5 mm, Ambon, NIO Jakarta) (c) dactyl of left fourth ambulatory leg; (male, 5.5 mm, Salibabu I., ZMA) (d) carapace, dorsal view; (e) orbits, ventral view.

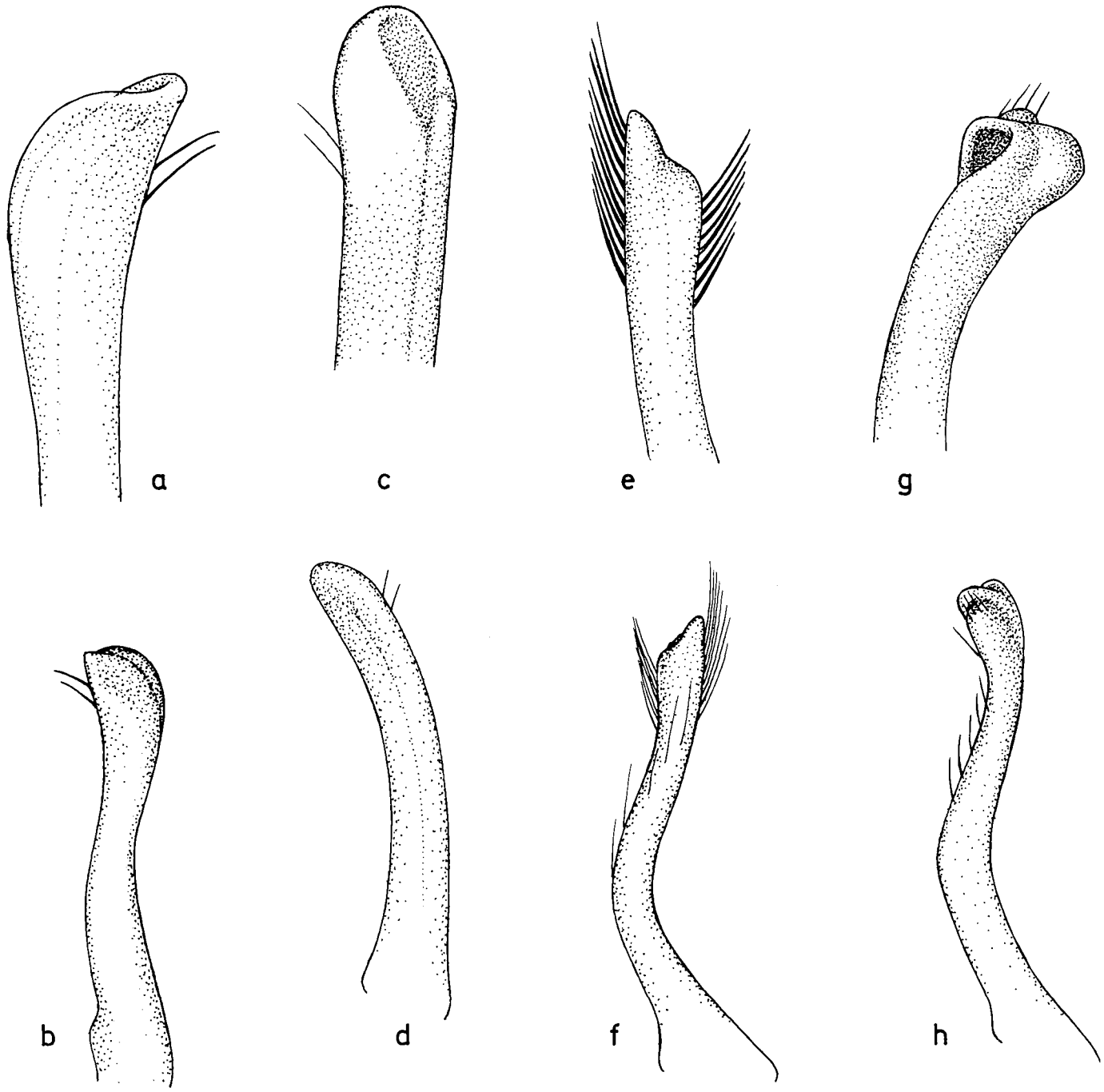

Fig. 5. Left first pleopod of male of *Achaeus akanensis* (3.5 mm, Banda, ZMC) (a) sternal tip of pleopod, (b) abdominal view of same; *A. lorina* (6 mm, Ceram, NIO Jakarta) (c) sternal tip of pleopod, (d) abdominal view of same; *A. serenei* (holotype) (e) sternal tip of pleopod, (f) abdominal view of same; *A. villosus* (7 mm, Sunda Strait, ZMC) (g) sternal tip of pleopod, (h) abdominal view of same.

Achaeopsis Stimpson, 1857

Type species. — *Achaeopsis spinulosus* Stimpson, 1857, by monotypy.

Remarks. — This genus was discussed in detail recently (Griffin, 1966d). Species of *Achaeopsis* are distinguished by the prominent postorbital spine which is slender and not excavated. There are six free abdominal segments in both sexes. The first pleopod of the male curves outwards distally and the aperture is subterminal on the abdominal surface.

This is the only majid genus containing a species [*A. thomsoni* (Thomson)] occurring in both the west and east Atlantic, and in the Indian Ocean. The records of *A. thomsoni* from off southern Australia are here reidentified as *A. ramusculus* (Baker) and the record from off Sydney is strongly doubted. The range of *A. rostrata* Sakai from Japan is extended to include the Kai Islands.

Manning & Holthuis (1981) make a stronger case than has been made previously for the retention of *Dorhynchus* as a

distinct genus. In our opinion *A. ramusculus* (Baker), *A. rostrata* Sakai and *A. thomsoni* (Thomson) are congeneric. We have not examined specimens of *A. spinulosus* Stimpson.

Distribution. — West and east Atlantic, Indo-West Pacific.

KEY TO SPECIES OF *ACHAEOPSIS*

1	Rostral spines short, not extending beyond end of peduncle of second antenna; meri of ambulatory legs lacking a distal spine.... 2
—	Rostral spines long, extending distinctly beyond end of peduncle of second antenna; meri of ambulatory legs with a well developed distal spine dorsally..... 3
2(1)	Rostral spines outwardly curved distally, lacking spinules marginally; supraorbital spine less than a third postorbital in length ..... *A. spinulosus*[4])
—	Rostral spines incurved distally, lateral margins with spinules; supraorbital spine about as long as postorbital ..... *A. rostrata*
3(1)	Protogastric regions each with a single strong spine; a spine or tubercle near anteromedial angle of branchial region ... *A. thomsoni*
—	Protogastric regions smooth; anteromedial angle of branchial region smooth ..... *A. ramusculus*

Achaeopsis ramusculus (Baker, 1906)

Stenorhynchus ramusculus Baker, 1906: 104-106, pl. 1 figs. 1, 1a.
Achaeopsis thomsoni. — Rathbun, 1918: 4. (Not *Dorhynchus thomsoni* Thomson, 1873.)
Achaeopsis ramusculus. — Hale, 1927: 124, fig. 121. — Griffin, 1966d: 35-37, fig. 4.

Material examined. — 3 ♂♂, 6.4-9.0 mm.

NATIONAL MUSEUM OF NEW ZEALAND, WELLINGTON

New Zealand, Bay of Plenty, 15 miles (∿ 24 km) N 50°E of Plate I., 540-576 m, 29 September 1962; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

'Endeavour' Expedition: Western Australia, Great Australian Bight, 60-80 miles (96-128 km) W of Eucla, 144-216 m, March 1912; 2 specs. (AM P. 4524; E. 3175).

Remarks. — We have examined two of the specimens from the 'Endeavour' collection identified by Rathbun (1918) as *Achaeopsis thomsoni*. These specimens have a terminal spine on the meri of the ambulatory legs, the rostral spines are subparallel, exceed the peduncle of the antenna and on each spine there are two ventral spinules, the proximal one near the lateral margin of the spine. However, there is a low tubercle not a spine on the protogastric region and the anteromedial angle of the branchial region is smooth. Also the larger specimen (7.5 mm) appears to be adult as the cheliped is enlarged, while in *A. thomsoni* adults are much larger (16-30 mm). The cheliped is less than twice (1.8) as long as the postrostral carapace length while in adult males of *A. thomsoni* the cheliped is two and a half to three times the postrostral carapace length. On this basis we have reidentified these specimens as *A. ramusculus*.

[4]) from the literature (Barnard, 1950).

We have also examined a specimen from Bay of Plenty, New Zealand which agrees well with the other specimens of *A. ramusculus* but in which the rostral spines are weakly divergent in the proximal half and strongly divergent in the distal half; there is a ventral spinule at about the distal third on one spine (left) but the other spine is smooth.

Distribution. — South Australia, New Zealand.

Achaeopsis rostrata Sakai, 1932

Achaeopsis rostrata Sakai, 1932: 45-46, text fig. 3a-c; 1976: 167, text figs. 90a, b. — Suzuki & Kurata, 1967: 89, 96.

Material examined. — 2 ♂♂, 5-7 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 59, Kai Islands, 05°28′S 132°36′E, 385 m, trawl, corals and sponges, 12 May 1922; 2 specs.

Remarks. — These specimens agree well with those described by Sakai (1932; 1976). In neither of the specimens do the rostral spines exceed the end of the antennal peduncle, nor is there a terminal spine on the meri of the ambulatory legs, and to this extent they agree with both *A. rostrata* and *A. spinulosus*. The smaller specimen (infected with a bopyrid parasite) is subadult, the rostral spines each have two small lateral accessory spines and the tips are incurved. In the larger, adult, male the tips of the rostral spines are broken and there is one small lateral accessory spine on each rostral spine. In both specimens the supraorbital spine and the postorbital spines are subequal and there is a well developed protogastric spine. There is no spine on the anteromedial branchial region. The cheliped of the larger male is about two and a quarter (2.3) times the postrostral carapace length.

This species has previously been recorded only from Japan.

Distribution. — Japan, Kai Islands.

Achaeopsis thomsoni (Thomson, 1873)

Dorhynchus thomsoni Thomson, 1873: 175-176, fig. 34.
Achaeopsis thomsoni. — Rathbun, 1925: 29-30, fig. 7, pl. 10. — Barnard, 1950: 25-26, fig. 4d, e. [Not *A. thomsoni*. — Rathbun, 1918: 4 = *A. ramusculus* (Baker).]

Material examined. — 33 ♂♂, 17 ♀♀ (1 ovig.), 7.5-28.5 mm, ovig. ♀, postrostral cl. 13 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java - S. Africa Expedition: Stn. 55, South Africa, 34°05′S 18°01′E, 212 m, dredge, mud, 17 December 1929; 1 spec. — Stn. 56, South Africa, N of Cape Town, 34°17′S 17°58′E, 288 m, trawl and dredge, 18 December 1929; 8 specs. — Stn. 57, South Africa, N of Cape Town, 34°21′S 17°57′E, 320 m, trawl, mud, 18 December 1929; 37 specs. — Stn. 58, South Africa, N of Cape Town, 34°23′S 18°08′E, 228 m, dredge, muddy sand and stones, 18 December 1929; 1 spec. — Stn. 59, South Africa, N of Cape Town, 34°24′S 18°16′E, 239 m, dredge, muddy sand, 18 December 1929; 3 specs.

Remarks. — In this large series the rostral spines are longer than the antennal peduncle but vary in some other aspects. The spines may be subparallel and separate or may be contiguous and sometimes divergent apically; there are usually one or two spinules ventrally on each spine but sometimes one spine is smooth. There is a protogastric spine and usually a spine near the anteromedial angle of the branchial region. There is a terminal spine, sometimes with one or two additional spines on the merus of each ambulatory leg. The cheliped of the adult male is about two and a half to three (2.4-2.9) times the postrostral carapace length.

We have examined the specimens from the Great Australian Bight identified as *A. thomsoni* by Rathbun (1918). We identify these specimens as *A. ramusculus* (Baker) and they are discussed under that species. The badly damaged specimen dredged by the 'Challenger' from off Sydney, which Miers (1886) provisionally identified as *A. thomsoni* has "one, not two spines, on each branchial region" and a postrostral carapace length of 7.5 mm. The rostrum of this specimen is broken and the ambulatory legs missing. It is possible that this specimen may be one of the west Pacific species of *Achaeopsis*, either *A. ramusculus* or *A. rostrata* Sakai, both of which lack a spine near the anteromedial angle of the branchial region and as adults have a carapace length of about 7-9 mm. The occurrence of *A. thomsoni* in Australian waters is thus in doubt and needs to be confirmed by further material.

Distribution. — West and east Atlantic and Indian Ocean.

Camposcia Latreille, 1829

Type species. — *Camposcia retusa* Latreille, 1829, by monotypy.

Remarks. — In this monotypic genus the rostrum is very short, the eyestalks are long and recurved and there is no interantennular partition. The anterior margin of the narrow basal antennal article is fused to the carapace. The abdomen of the male is wide and covers most of the sternum; the sixth segment is wider (1.25) than the third segment and the abdominal fossa is wide and shallow. The first pleopod of the male is straight, curves outward distally and has long hairs along both margins.

Distribution. — Throughout the Indo-West Pacific.

Camposcia retusa Latreille, 1829

Camposcia retusa Latreille, 1829: 60. — Sakai, 1965a: 69, pl. 30 fig. 1; 1976: 170-171, pl. 48 fig. 4. — Takeda, 1973a: 94-95, fig. 4 A, B. — Griffin, 1974: 7.

Material examined. — 6 ♂♂, 9 ♀♀ (3 ovig.) 9.5-27.5 mm, smallest ovig. ♀, 21,5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Ambon reef; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 104, Java Sea, 05°52′S 106°4′E, 38 m, trawl, stones, 4 August 1922; 1 spec.

Mortensen Java - S. Africa Expedition: Mauritius, Cannoniers Point, coral reef, 17 September 1929; 1 spec. — Mauritius, Cannoniers Point, coral reef, October 1929; 1 spec.

Nicobar Is. Sambelong, coll. Reinhardt, 'Galathea', 1845-7; 1 spec.

Samoa Is. Museum Godeffroy; 1 spec.

5 Thai Danish Expedition: Stn. 1173, West Malay Peninsula, SE corner Goh Similan I., shore collecting and skindiving to 1-2 m, 8 March 1966; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. AH II, E of Ambon, Haruku I., Haruku Strait, N side of Tg. Bt. Kapal, 03°37′S 128°35′E, intertidal, corals, 31 May 1970; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Lord Howe I., lagoon, coll. J. Booth, 29 March 1963; 1 spec. (AM P. 32088). — Christmas I. (Indian Ocean), Flying Fish Cove, 1 m, on coral after dark, coll. J. Tranter, 3 April 1981; 2 specs. (AM P. 32087).

Remarks. — The first pleopod of the male of *C. retusa* has been figured by Takeda (1973a). There are long hairs on both margins of the pleopod except in the distal fifth which is weakly curved outwards. The aperture is a subterminal slit on the sternal surface and the apex is subacute.

On the margin between the eave and the small preorbital spine there is a low elongate ridge which is more pronounced in some specimens.

Distribution. — Throughout the Indo-West Pacific from South Africa and the Red Sea to Australia and Japan.

Chalaroachaeus De Man, 1902

Type species. — *Chalaroachaeus curvipes* De Man, 1902, by monotypy.

Remarks. — This monotypic genus is distinguished from species of *Achaeus* and *Prosphorachaeus* by the absence of a rostrum and an interantennular partition and by the rudimentary orbital eave which covers only the base of the eyestalk. The basal antennal article is cylindrical but not free distally. The green gland is quite distinct from the base of the article and lies midway between the article and the anterior margin of the mouthfield. The male is unknown. Female abdomen of six free segments.

Distribution. — West Pacific.

Chalaroachaeus curvipes De Man, 1902
(Fig. 11d, e)

Chalaroachaeus curvipes De Man, 1902: 657-662, pl. 22 figs. 30, 30a-i.

Material examined. — 1 ovig. ♀, 3.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 133, Molucca Sea, Kepulauan Talaud, Salibabu I., anchorage off Lirung, up to 36 m, trawl, dredge and reef exploration, mud and hard sand, 25/27 July 1899; 1 spec.

Remarks. — This specimen agrees well with the specimen (ovig. female, 3.75 mm, Ternate) figured by De Man (1902). The ambulatory legs are long and slender, the fourth leg about three and a half times the carapace length. The basal antennal article is smooth except for a small spine laterally near the base. The merus of the third maxilliped is suboval, narrower than the ischium, with three small spines near the lateral margin. On the ischium there is an oblique row of small spines from near the base to the anteromedial angle and a larger spine near the lateral margin about midway along. The pleopods of the adult female are lamellate and the gonopores are large and open laterally. The few eggs with the specimen are large (about 1 mm diameter) in relation to its size.

This species was previously known only from the type specimen.

Distribution. — Moluccas: Ternate, Salibabu I.

Chorinachus new genus
(Fig. 15e)

Type species. — *Inachoides dolichorhynchus* Alcock & Anderson 1894, by present designation.

Description. — Carapace slender pyriform, surface with scattered short spines and sharp tubercles. Rostrum long, spines fused for most of their length, small accessory spines present. Orbit of a weakly expanded eave and a small postorbital spine remote from eye; preorbital spine small, antorbital spine lacking. Eyestalks short. Interantennular partition without a spine. Basal antennal article narrow, with a strong anterolateral spine. Antenna excluded from orbit. Anterior margin of mouthfield deeply concave. Merus of third maxilliped strongly produced at anterolateral angle and posterior part of medial margin produced. Cheliped of male with small spines on merus, carpus and dorsally on palm; palm somewhat inflated. Ambulatory legs slender with few small spines. Male abdomen of seven free segments, female abdomen with segments 4-6 fused. First pleopod of male with large terminal aperture.

Remarks. — Examination of specimens of *Inachoides dolichorhynchus* reported on previously (Griffin, 1974; Griffin & Tranter, 1974) and comparison of this species with the descriptions and figures of east Pacific species of *Inachoides* has led us to the opinion that they are not congeneric. We have therefore established the new, presently monotypic genus *Chorinachus*. In *I. microrhynchus* Milne Edwards & Lucas and *I. laevis* Stimpson, the rostrum is a single spine and the carapace is short and very broad. In *C. dolichorhynchus*, on the other hand, the rostrum comprises two spines fused for most of their length but apically separate and the carapace is slender pyriform. The first pleopod of the male of *I. microrhynchus*, figured by Garth (Garth, 1958), tapers distally and has a subterminal aperture with a broad flap as have many other east Pacific Inachinae. The first pleopod of the male of *C. dolichorhynchus*, figured here (fig. 15e), is broad and widens to a truncate apex with a terminal aperture.

The name is derived from the Greek *choris* — apart.

Distribution. — Indian Ocean: Red Sea, Mozambique Channel, Bay of Bengal.

Collodes Stimpson, 1860

Type species. — *Collodes granosus* Stimpson, 1860, by monotypy.

Remarks. — This genus has been discussed in detail by Garth (1958) who suggested that *Collodes malabaricus* Alcock, the only Indo-west Pacific species of this genus, may not be congeneric with the American species. *Collodes malabaricus* was included in the genus *Collodes* by Alcock (1895) but the first pleopod of the male is described by Stephensen (1945) as being similar to that of *Menaethiops nodulosa*. The pleopod of species of *Menaethiops* is apically produced into two lobes, one lateral and one medial; while the pleopod of species of *Collodes*, as figured by Garth (1958), is apically subacute with a low, broad lobe well behind the apex on the medial edge, adjacent to the aperture. It seems that this species is possibly not in the right genus or even perhaps the right subfamily, but examination of further specimens would be necessary to determine where it should be placed.

Cyrtomaia Miers, 1886

Type species. — *Cyrtomaia murrayi* Miers, 1886, by designation of Guinot & Richer de Forges, 1982b.

Remarks. — *Cyrtomaia* species are best represented in the west Pacific with only two species, *C. smithii* and *C. lamellata* occurring in Hawaii and five, *C. murrayi*, *C. suhmi*, *C. goodridgei*, *C. gaillardi* and *C. granulosa* occurring in the Indian Ocean. In this study we have reduced both *Echinomaia hispida* Borradaile and *C. platypes* Yokoya to synonymy with *C. lamellata* Rathbun. We regard *C. suhmi curviceros* Bouvier as not even a distinct subspecies and *C. curviceros* as recognised by Sakai (1976) is therefore included within *C. suhmi*. Our study and recent studies by Guinot & Richer de Forges (1982b) show that the type series of *Cyrtomaia smithii tenuipedunculata* Ihle & Ihle-Landenberg represents two species. One of the specimens is identifiable as *C. horrida*: the other four represent, in the view of Guinot & Richer de Forges a distinct species, *Cyrtomaia tenuipedunculata*.

All of the type material of the new *Cyrtomaia* species described in 1931 by Ihle & Ihle-Landenberg (*C. smithii tenuipedun-*

culata, *C. horrida pilosa*, *C. bicornis*, *C. balssi*) from the 'Siboga' Expedition could not be located when this study was commenced and due to a misunderstanding we were not notified when it was subsequently located. This material has been studied by Guinot & Richer de Forges and included in their review of the genus *Cyrtomaia* (1982b); they also examined the type material of most other described species. In general it seems that important conclusions are drawn by these authors from the study of only a few specimens or in some cases one specimen. More species are recognised by Guinot & Richer de Forges than we would be prepared to recognise with the limited amount of material of the, often very variable, species in this genus.

We presently recognise 17 species of *Cyrtomaia* most of which, in our opinion, need to be more accurately defined by examining more specimens from a range of geographical areas.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *CYRTOMAIA*

1 Antennal peduncle prominently flattened 2
— Antennal peduncle cylindrical 3
2(1) Basal antennal article bearing three simple spines ..... *C. balssi*[5])
— Basal antennal article with denticulate lobes or spines .. *C. lamellata*
3(1) Supraorbital eave with an anterior spine 4
— Supraorbital eave unarmed 5
4(3) A sharp spine in the centre of the upper orbit ..... *C. murrayi*
— A blunt tubercle in the centre of the upper orbit ..... *C. ericina*[5])
5(3) Protogastric spines of extreme length, greatly exceeding all other spines and generally produced forward or obliquely forward beyond margin of carapace 6
— Protogastric spines not of extreme length, seldom exceeding other spines of carapace, short or suberect 12
6(5) Carapace densely covered by variously sized spines and spinules between major spines ..... *C. echinata*
— Carapace smooth, with a few tubercles or granular between major spines 7
7(6) Branchial region with at least an anterior spine 8
— Branchial region with only tubercles ..... *C. bicornis*
8(7) Carapace surface densely and coarsely granular; posterior mesogastric spine with a flanking spine or tubercle 9
— Carapace surface smooth or finely granular; posterior mesogastric spine lacking a flanking spine or tubercle 10
9(8) Tomentum scanty (especially on large specimens); rostral spines longer than the interantennular spine ..... *C. horrida*
— Tomentum well developed; rostral spines shorter than the interantennular spine ..... ?*C. pilosa*[5])[6])
10(8) Eyestalk occupying more than half of orbit; a tubercle midway between protogastric and anterior branchial spine ..... *C. maccullochi*
— Eyestalk occupying less than half of orbit; a spine midway between protogastric and anterior branchial spine 11
11(10) Carapace surface smooth; rostral spines slightly arched .... *C. suhmi*
— Carapace surface densely covered with fine granules; rostral spines horizontal ..... *C. gaillardi*[5])
12(5) Protogastric and other spines extremely short 13
— Protogastric and a few other spines at least moderately developed 14
13(12) Basal antennal article with 3 lateral and one medial spine; a spine in centre of upper orbit ..... *C. smithii*
— Basal antennal article with 3 lateral spines only; no spine or tubercle in centre of upper orbit ..... *C. granulosa*[5])
14(12) Carapace with granular surface and sometimes prominent granular or spinulous ridges; branchial spines shorter than or subequal to protogastric spines 15
— Carapace with prominent spines but surface otherwise smooth; anterior branchial spine longer than protogastric spines . *C. owstoni*
15(14) Basal antennal article with 4 strong spines ..... *C. ihlei*[5])
— Basal antennal article with 3 strong spines 16
16(15) Eyestalk smooth except for distal process; rostral spines shorter than interantennular spine 17
— Eyestalk with granules; rostral spines longer than interantennular spine ..... *C. intermedia*
17(16) Ridge from protogastric spine to middle of upper orbit with sharp spines ..... *C. tenuipeduculata*[5])
— Ridge from protogastric spine to middle of upper orbit with high tubercles and/or blunt spinules ..... *C. goodridgei*

[5]) from the literature (Ihle & Ihle-Landenberg, 1931; Guinot & Richer de Forges, 1982b).
[6]) probably a synonym of *C. horrida*, based on the literature.

Cyrtomaia bicornis Ihle & Ihle-Landenberg, 1931 (Pl. 3)

Cyrtomaia bicornis Ihle & Ihle-Landenberg, 1931: 156-157. — Guinot & Richer de Forges, 1982b: 49-51, figs. 27A-C, 28A-B.

Material examined. — 1 ovig. ♀, postrostral cl. 24 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java - S. Africa Expedition: Stn. 15, Java, 07°29′S 114°49′E, ca. 240 m, Sigsbee trawl, sand and mud with concretions, 10 April 1929; 1 spec.

Remarks. — This specimen agrees well with the holotype, an ovigerous female, described by Ihle & Ihle-Landenberg and figured by Guinot & Richer de Forges.

The carapace, the ambulatory legs and the chelipeds are densely covered with broad, rounded granules. The rostral spines are broken but are separated at the base by a U-shaped hiatus; the interantennular spine is also broken at the apex. Although only the bases of the protogastric spines remain they are clearly parallel and directed forwards.

Anteriorly on the branchial region there is a tubercle rather than a spine and on the cardiac region there are two granular tubercles. There is a very low tubercle just anterior to the mesogastric spine and also on the ridge between the protogastric spine and the well developed, laterally directed spine in the orbit. The postorbital spine is longer than the other carapace spines except the protogastrics. There are low tubercles on the two weakly developed, transversely oblique ridges which are midway between the protogastric spine and the anterior branchial tubercle.

The pterygostomian region is granular and the granules increase in size and number laterally to form a marginal ridge. The abdomen is granular with a well developed tomentum, the only spine is a small anterior medial one on the sixth segment. There are curled hairs dorsally on the meri of the third pair of ambulatory legs and on the carpi of the third and fourth pairs.

This species is similar to *C. intermedia* Sakai but can be distinguished from it by the protogastric spines which are

directed forwards and subparallel rather than suberect and divergent; by the presence of anterior branchial and cardiac tubercles instead of spines and by the ornamentation of the carapace which comprises prominent, rounded, closely spaced granules rather than small scattered granules.

This is only the second record of this species. The male has not yet been described.

Distribution. — Indonesia: off Roti I., Timor; off NE Java.

Cyrtomaia goodridgei McArdle, 1900
(Pl. 1)

Cyrtomaia goodridgei McArdle, 1900: 472-474. — Alcock & McArdle, 1902; pl. 59 figs. 1, 1a-c — MacGilchrist, 1905: 251-253. — Alcock, Annandale & MacGilchrist, 1907: pl. 78 figs. 2, 2a. — Guinot & Richer de Forges, 1982b: 35-36, fig. 18.

Material examined. — 2 ♀♀ (1 ovig.) 13.5-38 mm, 1 damaged spec. 13 mm, 2 juv., 6-7 mm; ovig. ♀, 38 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 259, Kai Islands, 05°29′S 132°52′E, 487 m, trawl with dredge, sand and dead coral, 16 December 1899; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Philippine Islands, 25 miles (40 km) E of Zamboanga, 360-450 m, dredge, 4 March 1914; 1 spec. — Japan, Sagami Sea, ca. 942 m, 26 June 1914; 1 spec.

Danish Kei Islands Expedition: Stn. 1, Kai Is., 05°34′S 132°50′E, 370-400 m, tangles, mud, 30 March 1922; 1 spec.

Remarks. — The 38 mm ovigerous female from Zamboanga agrees closely with the holotype (♂, 33 mm, off Sri Lanka, ZSC 3744/10) and the ovigerous female figured by Alcock, Annandale & MacGilchrist. There are strong tuberculate ridges extending obliquely along the anterior part of each branchial region; there are spinulous ridges from the protogastric spine to the upper orbit and to the postorbital spine; the protogastric spines are erect, almost parallel and only slightly longer than the branchial spines. The basal antennal article has three long slender spines directed ventrally. The pterygostomian region is quite flat and smooth and the lateral margin consists of a narrow ridge of two to three long spines, several small spines and long hairs.

The major difference between our specimens and the holotype is the presence in the upper orbit of a well developed spine. This spine is directed forward in the same plane as the rostral spines.

Two immature specimens (cl. 13 mm) one from the Kai Islands and one from the Sagami Sea are clearly conspecific with the other specimens.

Two juvenile specimens (cl. 6-7 mm) taken by the 'Siboga' in the Kai Islands may belong to this species also. There are small spinules on the eave but this may be a juvenile character.

This species is distinguished from *C. horrida* Rathbun by having shorter more erect protogastric spines, shorter rostral spines, smooth eyestalks, and a stronger spinulous ridge between the protogastric spine and the upper orbit. The spine in the margin of the upper orbit is directed forward not obliquely ventrally as in *C. horrida*.

C. tenuipedunculata is similar in having smooth eyestalks, suberect protogastric spines and short rostral spines. However, the photographs of that species published by Guinot & Richer de Forges (1982b) show quite prominent acute spines on the ridge between the protogastric spine and the upper orbit. This feature would seem to distinguish *C. tenuipedunculata* from our specimens of *C. goodridgei*.

Distribution. — Sri Lanka, Bay of Bengal, Andaman Sea, Kai Islands, Philippine Islands, Japan.

Cyrtomaia horrida Rathbun, 1916

Cyrtomaia horrida Rathbun, 1916: 532-533. — Yokoya, 1933: 145. — Sakai, 1938: 242; 1976: 180-181, pl. 60. — Griffin, 1976: 188, fig. 3. — Guinot & Richer de Forges 1982b: 36-40, figs. 19A-E, 20A-B, 23C, C1, E.

Cyrtomaia Smithii tenuipedunculata Ihle & Ihle-Landenberg, 1931: 152-154 (in part, 1 ♂ spec. only); new synonymy. (Not *Cyrtomaia smithii* Rathbun, 1906.)

Material examined. — 7 ♂♂, 3 ovig. ♀♀, 41-61 mm, smallest ovig. ♀, 41mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 253, Kai Is., 05°48′S 132°13′E, 304 m, trawl, grey clay, hard and crumbly, 10 December 1899; 1 spec. (ZMA unreg., det. Ihle & Ihle-Landenberg as "*C. Smithii* Rathbun *tenuipedunculata*").

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java - S. Africa Expedition: Stn. 3, Java, 07°42′S 114°00′E, 450 m, Sigsbee trawl, mud with corals, 4 April 1929; 1 spec. — Stn. 11, Java, 08°30′S 114°38′E, ca. 450 m, Sigsbee trawl, 7 April 1929; 1 spec. — Stn. 15, Java, 07°29′S 114°49′E, ca. 24 m, Sigsbee trawl, sand with mud and concretions, 10 April 1929; 3 specs.

Danish Kei Islands Expedition: Stn. 29, Kai Is., 05°38′S 132°53′30″E, 430 m, trawl, sand, 17 April 1922; 1 spec. — Stn. 50, Kai Is., 05°34′S 132°25′40″E, 233 m, trawl, sand, 4 May 1922; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

South China Sea, 16°09.4′N, 114°31.6′E to 16°11′N, 114°29.7′E, 266-295 m, Granton trawl, white muddy sand, Fisheries Research Station, Hong Kong, 12 June 1964; 2 specs. (AM P. 20207).

Remarks. — These specimens agree closely with the holotype from the Philippine Islands (USNM 47321).

The pterygostomian region is smooth and flat and the ridge on the lateral margin consists of two or three irregular rows of spines and tubercles.

The sternum of the female is granular with medial spines. The lateral margin has a row of spines with the last and largest at the base of the cheliped and another single spine at the base of the first ambulatory leg.

The abdomen of the female is covered with numerous small spines which are larger than elsewhere on the sixth segment laterally. There are two small spines centrally on the seventh segment and small anterior medial spines on all other segments.

Ventrally on the merus of the third ambulatory legs there are spinules and granules and on the fourth ambulatory legs granules with a few spinules.

The third and fourth pairs of ambulatory legs of the ovigerous female from Java are covered with short hairs which are less pronounced in other specimens.

The first pleopod of the male is broad basally, narrowing gradually at first, but more abruptly in the distal quarter. It curves outwards slightly to the sub-acute tip which is flattened on the anterior surface. *Cyrtomaia suhmi*, *C. smithii* and *C. owstoni* have a similar type of pleopod.

The male (ZMA unreg.) from the Kai Islands ('Siboga' Stn. 253) is clearly conspecific with the other specimens. Ihle & Ihle-Landenberg included this specimen in their new subspecies *C. smithii tenuipedunculata* but with reservations because of its long protogastric spines. There is a short spine on either side of the mesogastric spine and a short spine in front of the mesogastric spine but posterior to the level of the protogastric spines. There are granules on the eyestalk. The rostral spines are broken. The photographs of the lectotype of *C. tenuipedunculata* published by Guinot & Richer de Forges (1982b) show a species with much shorter protogastric spines and a small mesogastric spine which is anterior to the level of the protogastric spines. In the lectotype, according to the figure, the eyestalks are smooth. All the specimens described as *C. smithii tenuipedunculata* by Ihle & Ihle-Landenberg have well developed carapace spines and so are clearly distinguished from adults of *C. smithii* in which all the carapace spines are very reduced.

We can see no reason for elevating *Cyrtomaia horrida pilosa* Ihle & Ihle-Landenberg to specific status as suggested by Guinot & Richer de Forges (1982b). The type specimen is an immature female which Ihle & Ihle-Landenberg compared with Rathbun's original unillustrated description. Specimens of *C. horrida* have a distinct tomentum and the denseness of the tomentum seems to vary with sex, age and locality. There are many granules on the eyestalk and the distal tubercle in *C. horrida* so the presence of three granules on the apex of the tubercle in *C. pilosa* does not represent a distinguishing feature. However, as we have not been able to examine the type specimen of *C. horrida pilosa* we do not include it in our synonymy of *C. horrida*.

This species differs from *C. goodridgei* McArdle in having much longer protogastric spines, longer rostral spines, more spines on the sternum and in lacking strong ridges on the anterior half of the carapace.

Distribution. — Java, Kai Islands, Philippine Islands, South China Sea, Japan.

Cyrtomaia intermedia Sakai, 1938

Cyrtomaja intermedia Sakai, 1938: 241-242, pl. 35 fig. 3.
Cyrtomaia intermedia Sakai, 1976: 179-180, fig. 95. — Guinot & Richer de Forges, 1982b: 57, fig. 34.

Material examined. — 1 ♀ (dry) postrostral cl. 21 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

Japan, Tosa Bay, 270-360 m, coll. K. Kurohara (donated M. Takeda), 20 March 1959; 1 spec. (AM P. 20208).

Remarks. — This dry specimen of an immature female agrees quite well with the holotype of the species, a large adult male (cl. 37 mm). The rostral spines are broken but are separated at the base by a V-shaped hiatus. The protogastric spines are also incomplete, they are probably shorter than in the holotype but they are clearly slightly divergent and suberect. There are scattered small, blunt granules over the whole carapace, short cardiac spines (broken) and an anterior branchial spine (also broken). There are granules on the eyestalk, particularly on the distal process. There is a broad tubercle with three granules just anterior to the mesogastric spine and a tubercle on the low ridge between the protogastric spine and the well developed spine in the centre of the orbit. The postorbital spine is longer than the other carapace spines except the protogastrics. There are a few small granules on the pterygostomian region and the granules increase in size and number laterally to form a marginal ridge. The abdomen is not present with the specimen. Whilst the rostral and protogastric spines are slightly shorter than shown in Sakai's figure we have no doubt that this specimen represents *C. intermedia*.

Distribution. — Japan.

Cyrtomaia lamellata Rathbun, 1906

Cyrtomaia lamellata Rathbun, 1906: 879, fig. 36. — Guinot & Richer de Forges, 1982b: 66-69, figs. 42, 43, 44, 52A, A1.
Echinomaia hispida Borradaile, 1916: 104, fig. 13; new synonymy.
Cyrtomaja hispida. — Balss, 1929: 3-4.
Cyrtomaia platypes Yokoya, 1933: 145-146, fig. 52. — Sakai, 1938: 242-243. — Takeda & Miyake, 1969: 501-503, fig. 11f-g. — Takeda & Kurata, 1976: 24, pl. 2 fig. 1. — Guinot & Richer de Forges, 1982b: 71-78, figs. 47, 48A-B, 49C-E; new synonymy.
Cyrtomaia hispida. — Bennett, 1964: 30-32, figs. 10-16, 110. — Griffin, 1966d: 28-29. — Sakai, 1976: 181-182, text fig. 96. — Guinot & Richer de Forges, 1982b: 69-71, figs. 45A-B, 46A-B, 49A-B, F, 52B, B1.

Material examined. — 4 ♂♂, 4 ♀♀ (3 ovig.), 7.5-15.5 mm, smallest ovig. ♀, 11.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, 32°15′N 128°12′E, 162 m, 15 May 1914; 3 specs.

NATIONAL MUSEUM OF NEW ZEALAND, WELLINGTON

NZOI: New Zealand: Stn. F923, off North Cape, 34°07.5′S 172°46.7′E, 143-216 m, 13 October 1968; 2 specs. — Stn. F932, off North Cape, 34°26.7′S 173°07.5′E, 113-115 m, 15 October 1968; 2 specs.

N.Z. Marine Dept., New Zealand, 10 miles (∿ 16 km) NNE of Flat Head, Northland, 148-157 m, 16 June 1963; 1 spec. (Cr. 1703).

Remarks. — The three species *Cyrtomaia lamellata* Rathbun, 1906, *Cyrtomaia hispida* (Borradaile, 1916), and *Cyrtomaia platypes* Yokoya, 1933, agree in many features which distinguish them from other species.

1) There are denticulate spines on the basal antennal article;
2) There are flattened lobes on the peduncle segments of the antenna;
3) There is no spine in the centre of the upper border of the orbit;
4) The interantennular spine is broad and its upper surface is granular;

Specimens from Japan collected by the Mortensen Pacific Expedition were compared with specimens from off New Zealand and there is agreement in many features. Slight differences were noted as follows: There are three tubercles dorsally on the cornea of the eye of the New Zealand specimens and two tubercles on the specimens from Japan. In the specimens from New Zealand, the carapace is granular in the male, posteriorly granular in the female, and the ridges from the protogastric spine to the rostrum, to the postorbital spine and to the mesogastric spine are well developed, especially in the male. The specimens from Japan have a smoother carapace and the ridges are less evident especially between the protogastric and mesogastric spines. On the dorsal branchial region of the Japanese specimens, the anterior spine is followed by a smaller spine and two to four tubercles, while on the New Zealand specimens the spine is followed only by three tubercles, two of which are very low.

The specimens were also compared with photographs of the type material of *C. hispida* (Borradaile) in the British Museum (Natural History) (reg. no. 1917.1.29.157-158, 2 males).

The specimen (ovig. female, Z.M. Berlin 5291) determined by Balss (see Balss, 1929) as *C. hispida* (Borradaile) and collected by the 'Gazelle' at Atapupu, Timor has been examined. It has three dorsal tubercles on the eye, denticulate lobes on the basal antennal article, granular ridges on the protogastric region and a very small posterior branchial spine, similar to the New Zealand specimens. This specimen was also examined by Ihle & Ihle-Landenberg (1931) who used it as the basis for their diagnosis of *C. hispida* (1931: 159), and who included Timor in their distribution of *C. hispida*. They compared this specimen with their new species *C. balssi* and distinguished the two species. They did not regard them as synonymous as stated by Guinot & Richer de Forges (1982b).

The syntypes of *C. lamellata* Rathbun (USNM 29701; 29702; 29737, 1 ♂, 3 ♀♀, 11.5-13 mm, Hawaiian Islands) have been examined, together with specimens (USNM 47295, 1 ♂, 6 ♀♀) collected at Goto Island by the 'Albatross' and identified by Rathbun as *C. lamellata*. This is the same locality as that from which the type material of *C. platypes* Yokoya (1933: 145) was taken. A specimen (1 adult ♂, Zool. Staatssammlung, Munich) identified by Yokoya as *C. platypes* and also from this locality [Goto Island, Japan, 152 m, S.S. Soyo-Maru, Stn. 448 (date on label — 14 March 1934)] has been examined also. The differences between these specimens and those mentioned above are not great enough to justify their being placed in separate species and it is concluded that they are all members of one species ranging widely in the west Pacific from the Hawaiian Islands to New Zealand, New Caledonia, Timor and Japan. Sakai (1976) has already conceded that *C. platypes* is probably a synonym of *C. hispida* and Takeda & Kurata (1976) have also considered this possibility although they did not have the opportunity to examine material from New Zealand.

Guinot & Richer de Forges (1982b) in their review of the genus *Cyrtomaia* consider *C. lamellata*, *C. platypes* and *C. hispida* as three valid species and they note the differences from the type and topotypic specimens of *C. platypes* of material from the Ogasawara Islands and off New Caledonia. Some variation could be expected over the geographic range of each species but because so few specimens have been collected neither the distribution nor variation of these species is known. In our opinion, the concept of three distinct species — one in Hawaii, one in New Zealand and one in Japan is mistaken and these species in fact represent the extremes of geographic distribution of a single wide ranging species.

Guinot & Richer de Forges (1982b) listed the differences between *C. platypes* and *C. hispida* and also between *C. platypes* and *C. lamellata*. We have considered all these differences in our comparison of our specimens from Japan collected by the Mortensen Pacific Expedition with specimens from off New Zealand and only five of them we regard as important. The first of these is the number of eyestalk tubercles. On the one hand there is *C. hispida* with three dorsal tubercles on the eyestalk and on the other hand *C. platypes* and *C. lamellata* with only two dorsal tubercles. The New Caledonian material (Guinot & Richer de Forges, 1982b) and our material from New Zealand show that there can be additional granules or variation in the size of the tubercles in different specimens from the same locality. However this remains the most distinct feature which might indicate that there could be two species.

The other four differences can be grouped together. *C. hispida* differs from *C. platypes* in having —

a) shorter rostral spines;
b) shorter, blunter postorbital and hepatic spines;
c) a posterior branchial tubercle rather than a spine;
d) a less distinct upper row of lateral branchial tubercles.

This kind of general difference in which *C. hispida* has several spines and tubercles which are less pronounced could be attributed to geographic variation.

There is a similarity in the ornamention of the basal antennal article. In all the specimens the medial distal lobe is slightly larger, and has more teeth which are more acute than has the lateral distal lobe. The subproximal lobe is simple, varying only in length. In our male from Japan the lobes on the basal antennal article are as figured by Guinot & Richer de Forges (1982b) but in both the Japanese females the distal

lobes are broader and resemble the lobes on the basal antennal article of the male from New Zealand. The ornamentation of the basal antennal article of *C. lamellata* does not seem significantly different from that of *C. platypes*.

The main difference cited between *C. lamellata* and *C. platypes* is the relative sizes of the anterior and posterior branchial spines. Examination of the syntypes of *C. lamellata* and the photograph of *C. lamellata* given by Guinot & Richer de Forges show that the posterior branchial spine is about half as long as the anterior spine. In our Japanese specimens the posterior spine is a quarter to a third the length of the anterior spine.

The first pleopod of our male specimens from both Japan and New Zealand have a lobe on the abdominal margin of the apex, although this is less elongate in the New Zealand specimens. Guinot & Richer de Forges (1982b: fig. 52) show a lobe on the first pleopod of *C. platypes* but not on the pleopod of *C. hispida*.

Distribution. — Japan, Ryukyu Is., Ogasawara Is., Timor, New Caledonia, New Zealand and Hawaii.

Cyrtomaia maccullochi Rathbun, 1918

Cyrtomaia maccullochi Rathbun, 1918: 4-7, figs. 1-2, pls. 1-2. — Griffin, 1966b: 273 (in key). — Guinot & Richer de Forges, 1982b: 26-30, figs. 13A-B, 14A-B, 23A.

Material examined. — 3 ♀♀, postrostral cl. 37.5-cl. 53.5 mm.

South China Sea, 16°20′N 114°39′E, 285-389 m, Agassiz trawl, white muddy sand, Fisheries Research Station, Hong Kong, 20 June 1964; 1 spec. (AM P. 20205).

Great Australian Bight, 33°28′S 127°15′E to 33°31′S 127°19′E, 640-650 m, otter trawl, J. R. Paxton, 'Dmitry Mendeleev', 28 February 1976; 2 specs. (AM P. 21964).

Remarks. — The two specimens (adult females) from the Great Australian Bight agree well with the type series (AM E. 3683, E. 5660, E. 6263 (holotype), E. 6264, AM P. 4499-4501; USNM 53416, 53418).

In all these specimens the carapace is quite densely covered with granules, the eyestalk occupies more than half the width of the orbit and there is a low, broad tubercle between the large protogastric spine and the anterior branchial spine. There is a tubercle, often low, in front of the mesogastric spine and usually two tubercles behind the anterior branchial spine, though in the holotype and in one small male there is a short spine and a tubercle. There are four spines on the basal antennal article and sometimes a small tubercle as well. There is no spine in the centre of the orbit of any of the specimens but there is a ridge of larger granules from the protogastric spine to the orbit and in some specimens these larger granules are present on the orbital margin.

The pterygostomian region of all specimens is flat and smooth with a lateral margin of two or three spines, many small tubercles and a row of long setae. The lateral margin of the sternum is unarmed except for a spine at the base of the cheliped. On one female from South Australia there is also a spine at the base of the first ambulatory leg.

The abdomen of the female is covered with sharp granules which become spinous laterally, especially on the sixth segment. There is a pair of small spines centrally on the seventh segment and small anteromedial spines on all other segments.

There are granules on the merus and carpus of the third and fourth pairs of ambulatory legs, usually more pronounced ventrally on the merus and dorsally on the carpus.

The specimen from the South China Sea, also an adult female, differs in several features from specimens in the type series. However, we include it, with reservations, under *C. maccullochi* as there is insufficient material to justify the description of a new species.

In this specimen the rostral spines are long (one third postrostral carapace length), slender and close together but weakly divergent in the distal third. The rostral spines in the type series are shorter, further apart and parallel except in one ovigerous female (AM P. 4499) where they are weakly divergent at the tip.

On the low ridge from the protogastric spine to the border of the upper orbit there are two small tubercles in front of the spine and a small tubercle and a large granule on the edge of the orbit. The basal antennal article has three short spines but lacks the small proximal spine on the lateral edge present in the type series. The eyestalk occupies slightly less than half of the orbital width and there are three small tubercles behind the anterior branchial spine. The abdomen is covered with small spines which are of almost uniform size rather than larger laterally.

Sakai (1976) regards *C. maccullochi* as conspecific with large specimens of *Cyrtomaia* from Japan, which he has identified as *C. curviceros* Bouvier, which also possess long parallel protogastric spines. These Japanese specimens appear to be conspecific with those we have described as *C. suhmi* and are discussed further under that species. The specimen figured by Sakai (1976: pl. 61) differs from the type series of *C. maccullochi* in having more divergent rostral spines, eyestalks which occupy less than half the width of the orbit and a short spine between the protogastric and anterior branchial spines. *C. maccullochi* is in our view a valid, distinct species.

This species has been dealt with recently by Guinot & Richer de Forges (1982b). They have retained *C. maccullochi* as a valid species, noting its subparallel rostral spines and dense granules on the carapace surface. We find that it is not always easy to determine the presence or absence of the anterior mesogastric tubercle, the third character used by these authors to distinguish *C. maccullochi* from *C. curviceros*. As stated above, we regard *C. curviceros* as conspecific with *C. suhmi* and discuss this further under *C. suhmi*.

We have compared this series of *C. maccullochi* with a large series of specimens we have described as *C. suhmi* from off the eastern Australian coast. The two species are similar but can be distinguished by the following points:

1) the carapace is granular (smooth in *C. suhmi*);
2) there is a low tubercle (rather than a spine as in *C. suhmi*) between the protogastric spine and the branchial spine;
3) the eyestalk occupies more than half (0.6) the width of the orbit which is about as wide (1.1) as the interorbital region (in *C. suhmi* the eye occupies less than half (0.4) the width of the orbit which is clearly wider (1.3) than the interorbital region — measurements taken from above the eyestalk on eave and the tip of the postorbital spine);
4) there are small spines laterally on the female abdomen (not present in *C. suhmi*);
5) there is a lateral spine on the fourth to sixth segments of the male abdomen (not present in *C. suhmi*);
6) the distal height of the cheliped palm in adult males (only 2 specimens from the type series) is 3 times the proximal height (distal height 2 to $2^1/_2$ times proximal height in *C. suhmi*);
7) the rostral spines are subparallel and horizontal (at least weakly divergent and arched in *C. suhmi*).

Guinot & Richer de Forges (1982a; 1982b) have described a new species *Cyrtomaia gaillardi*, from Madagascar which is similar to *C. maccullochi* in having a granular carapace surface and subparallel, horizontal rostral spines. However, the adult males are much larger, the eyestalk is shorter than half the orbital width and there is a spine rather than a tubercle between the protogastric spine and the anterior branchial spine. The palm of the chela is much higher distally in both species but it is not clear what the ratio of proximal to distal height is in *C. gaillardi*.

Distribution. — Southern Australia, South China Sea.

Cyrtomaia murrayi Miers, 1886
(Fig. 9h, i, Pl. 2)

Cyrtomaia murrayi Miers, 1886: 15, pl. 3 fig. 1. — Barnard, 1950: 33, fig. 6d. — Sakai, 1976: 180, pl. 62. — Guinot & Richer de Forges, 1982b: 16-18, figs. 5A-B, 6A-B, 7A-B.

Material examined. — 14♂♂, 3 ♀♀ (+ 3 damaged), 6-30.5 mm.

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Danish Kei Islands Expedition: Stn. 5, Kai Is., 05°31′30″S 132°26′E, 250-90 m, trawl, sand, 4 April 1922; 1 spec.

WESTERN AUSTRALIAN MUSEUM, PERTH

C.S.I.R.O. 'Diamantina': Western Australia: Geraldton, NW Bluff Pt., 27°40′S 113°03′E, 140 m, dredge or M.W. trawl, 22 August 1963; 1 spec. (WAM 207-67). — N of Pt. Cloates, 22°52′S 113°29′E, 146 m, triangle dredge, small catch of crustaceans and shells, 6 October 1963; 1 spec. (WAM 60-67). — W of Dirk Hartog I., 25°30′S 112°08′E, 200-0 m, oblique M.W. trawl, 8 October 1963; 1 spec. (WAM 13-67). — W of Bluff Pt., 27°40′S 113°20′E, 141 m, beam trawl, mass of sponge and Bryozoa, 10 October 1963; 10 specs. (WAM 285-67, 301-67). — SW Dongara, 29°50′S 112°24′E, 140-144 m, triangle dredge, mainly sponges, 11 October 1963; 1 spec. (WAM 66-67).

Western Australia: NW of Rottnest I., 186-190 m, 'Bluefin', sponge, 15 September 1965; 1 spec. (WAM 220-73). — W of west end of Rottnest I., 160 m, 'Bluefin', 16 September 1965; 2 specs. (WAM 223-73, 90-71).

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South China Sea, 19°05′N 112°10′E, 193 m, Agassiz trawl, muddy sand, Fisheries Research Station Hong Kong, 12 March 1965; 2 specs. (AM P. 20206).

Remarks. — These specimens agree well with the syntypes (2 ♂, cl. 18.8, 22.9 mm, Kai Islands, 'Challenger' Stn. 192, 05°49′15″S, 132°14′15″E, BMNH 84: 31) examined by one of us (D.J.G.G.) and with those specimens described and figured by Sakai (1976).

The spines of the basal antennal article vary; distally in four of the specimens (cl. 9-13 mm) there is a large spine bifid near its apex, while in 12 other specimens (cl. 6-9 mm) there is a long spine with an accessory spine near the base.

In our specimens the preorbital spine is about a third the length of the postorbital spine. All the specimens have some kind of spine in the centre of the orbit but this varies from very short (about a quarter the length of the preorbital spine) to subequal to the preorbital spine.

The pterygostomian region is flat and smooth with two spines on the lateral margin.

The specimen described by Barnard (1950) has two subequal tubercles on each cardiac elevation; our specimens have a well developed cardiac spine with a small tubercle on the anterior slope and up to ten smaller tubercles and granules, mostly on the lateral slope. There are 20 to 40 small spinules and granules on the lateral part of the branchial region and many small granules on the medial branchial region. There are fewer granules and smaller spinules on smaller specimens.

While the figures given by Miers (1886) and Sakai (1976) show quite distinct spinules on the carpus of the third and fourth ambulatory legs, in our specimens of cl. 6-13 mm there are at most six very small spinules on the dorsal margin of the carpus and in some specimens only a row of sharp granules.

Guinot & Richer de Forges (1982a; 1982b) also examined one of Miers' syntypes of *C. murrayi* from the Kai Islands and compared it with the holotype, the only specimen, of their new species *Cyrtomaia ericina* from New Caledonia. The principal features used to distinguish these two species are the presence on the orbital margin of a blunt tubercle in *C. ericina* rather than a sharp spine as in *C. murrayi* and by the weaker spinulation of the carpus of the third and fourth ambulatory legs. Our series shows that these two features vary within *C. murrayi* as does the bifid distal spine on the basal antennal article. These two species will only be clearly distinguished when a series of specimens of *C. ericina* has been examined.

C. murrayi is distinguished from other *Cyrtomaia* species (except *C. ericina*) by the presence of 1) a spine on the posterior margin of the carapace; 2) spines dorsally on the meri of ambulatory legs three and four; 3) a preorbital spine on the eave; 4) two subequal mesogastric spines; 5) two pairs of protogastric spines.

Distribution. — East Africa (Mozambique), Western Australia, Kai Islands, South China Sea, Japan.

Cyrtomaia owstoni Terazaki, 1903

Cyrtomaia owstoni Terazaki, 1903: 239, fig. (not seen). — Sakai, 1938: 240-241, pl. 35 fig. 1; 1976: 179, pl. 59. — Takeda & Miyake, 1969: 500-501, fig. 11 d, e. — Serène & Lohavanijaya, 1973: 46-47, figs. 73-78, pl. 7C,

D. — Griffin, 1976: 188. — Guinot & Richer de Forges, 1982b: 61-63, figs. 38A-D, 39A-B.
Cyrtomaia horrida japonica Balss, 1924: 23.
Cyrtomaia septemspinosa Rathbun, 1932: 30.

Material examined. — 3 ♀♀ (2 ovig.), 15.5-20 mm, smaller ovig. ♀, 15.5 mm.

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Mortensen Pacific Expedition: 16 miles (∿25.6 km) W by S of Bonomisaki, Japan, 360 m, trawl no. 2, 13 May 1914; 2 specs. — Sagami Bay, 720 m, 1-7 July 1914; 1 spec.

Remarks. — The three long slender spines on the basal antennal article are subequal, whereas Sakai (1938) described the distal spine as much larger than the others.

There are three long spines and long hairs on the lateral margin of the pterygostomian region, but the surface is smooth as it is in *Cyrtomaia goodridgei*. In *Cyrtomaia lamellata* and *C. bicornis* on the other hand, the pterygostomian region is granular with a granular ridge on the lateral margin. These species all belong to the group that have short, slender, curved, suberect, divergent protogastric spines.

The branchial spines are longer than the protogastric spines. There is no spine or tubercle on the intestinal region.

The abdomen of the female is granular with a spine medially on segment one and with very small spines laterally and medially on segments two to six.

Distribution. — Philippine Islands, South China Sea, southern Japan.

Cyrtomaia suhmi Miers, 1886
(Fig. 9e-g)

Cyrtomaia suhmi Miers, 1886: 16-17, pl. 3 fig. 2. — Alcock, 1899: 45. — Ihle & Ihle-Landenberg, 1931: 157. — Griffin, 1974: 9-10. — Griffin & Brown, 1976: 252-253, fig. 6. — Guinot & Richer de Forges, 1982b; 21-24, figs. 10, 11A-B, 23B.
Cyrtomaia Suhmi typica Doflein, 1904: 54-55, pl. 19 figs. 1, 2.
Cyrtomaia Suhmi curviceros Bouvier, 1915b: 9-15, pl. 1.
Cyrtomaia curviceros. — Sakai, 1976: 181, pl. 61. — Guinot & Richer de Forges, 1982b: 24-26, fig. 12A-D.

Material examined. — 12♂♂, 5 ovig. ♀♀, 17.5-89.5 mm, smallest ovig, ♀, 78 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 314, Flores Sea, 07°36′S 117°30′E, 694 m, trawl, fine sandy mud, 17 February 1900; 1 spec. (ZMA De.100.624) (det. Ihle).

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F.R.V. Kapala: New South Wales: E of Clarence R., 29°26′S 153°49′E to 29°20′S 153°50′E, 450 m, prawn trawl, 12 October 1975; 2 specs. (AM P.21678-9). — SE of Clarence R., 29°41′S 153°45′E to 29°32′S 153°47′E, 407-399 m, prawn trawl, 10 October 1975; 4 specs. (AM P.21674-7). — NE of Wooli, 29°52′S 153°43′E to 29°46′S 153°45′E, 495 m, 10 October 1975; 2 specs. (AM P.21664-5). — E. of Wooli, 29°52′S 153°43′E to 29°51′S 153°43′E, 495 m, 23 August 1977; 1 spec. (AM P.26578). — NE of North Solitary Islands, 360 m, 18 August 1978; 1 spec. (AM P.29936). — SE of Crowdy Head, 31°55′S 153°08′E to 31°57′S 153°07′E, 396-540 m, demersal fish trawl, 10 September 1975; 1 spec. (AM P.21130). — E. of Seal Rocks, 32°32′S 152°53′E to 32°25′S 152°57′E, 360 m, demersal fish trawl, 10 September 1975; 1 spec. (AM P.21571). — E of Sydney, 540 m, 6 September 1978; 1 spec. (AM P.29937). — E of Kiama, 34°36′S 151°16′E to 34°45′S 151°13′E, 495 m, demersal prawn trawl, 21 August 1975; 1 spec. (AM P.21074). — E of Brush I., 35°35′S 150°47′E to 35°29′S 150°44′E, 504-576 m, 9 June 1976; 1 spec. (AM P.24393); 1 spec. (AM P.24395).

Remarks. — *Cyrtomaia suhmi curviceros* appears to be the adult of the immature specimens described originally as *C. suhmi*. The holotype of *C. suhmi* described by Miers (male, postrostral cl. 25 mm, BMNH 84.31), 'Valdivia' specimens described by Doflein (2 females, 11.6, 25 mm, ZM Berlin 13615 and unreg.) and the 'Siboga' Expedition specimen from Java described by Ihle & Ihle-Landenberg (ZMA De. 100.624) have been examined and all are immature. There is no size given for the male collected off the south Indian coast described by Alcock. These small specimens have been compared with the large specimens of *Cyrtomaia* collected from the Andaman Sea by the 'Anton Bruun' (USNM 135119) (Griffin, 1974), those collected from off the east Australian coast by the F.R.V. 'Kapala' and that from Japan (Mus. Milan 1576-8) collected by Parisi and identified as *C. suhmi curviceros* by Bouvier. The locality from which Bouvier's original material came is not clear but was indicated as "?Japan".

All specimens and previously described material have in common a smooth carapace, parallel or subparallel protogastric spines, a well developed slender mesogastric spine, a single spine between the protogastric spine and the branchial spine and, in addition to the anterior branchial spine, two smaller posterior spines or tubercles. The pterygostomian region is flat and on the lateral margin there is only a weak ridge with scattered granules, up to four tubercles, some high, and a short posterior spine. The eyestalk in adults occupies less than half the width of the orbit. On the basal antennal article there are four spines, one medial and three on the lateral margin, of which the proximal is sometimes much smaller than the others; behind the anterolateral spine there is a tubercle or short spine. In the immature male (cl. 17.5 mm) from the 'Siboga' Expedition the proximal spine is very much smaller than the spine in front of it and there is no tubercle behind the anterolateral spine.

Most of the specimens previously described have no spine in the orbit between the eave and the postorbital spine, but there is a granule in this postion in the holotype (Guinot & Richer de Forges, 1982b: fig. 11) and a small spine in the juvenile specimen from Java (Ihle & Ihle-Landenberg, 1931). In the specimens from off the eastern Australian coast there is a small spine about a third the length of the postorbital spine. The spine in the orbit of *Cyrtomaia* and similarly *Platymaia* doesn't constitute a more useful distinguishing feature than the other small carapace spines. Where this is the only difference between two described species we do not regard this as being sufficient to validly distinguish them.

Sakai (1976) elevated *C. curviceros* to specific status and regards *C. maccullochi* as a synonym of this species. However,

we find nothing in his notes or figure to validly distinguish his specimens from *C. suhmi*. The characters which distinguish these Japanese specimens from *C. maccullochi* are discussed under that species.

It is concluded that all these specimens belong to *C. suhmi* and that Bouvier's subspecies does not, in fact, exist as a separate, distinct subspecies or species.

This species has been dealt with recently by Guinot & Richer de Forges (1982b) who regard *C. suhmi* and *C. curviceros* as separate species although suggesting that the holotype of *C. suhmi* Miers may indeed be a younger specimen of *C. curviceros*. They note the very long cheliped merus in Bouvier's holotype and also the absence of a spine between the protogastric spine and the anterior branchial spine. In the figure given by Sakai (1976) of a smaller male, identified by him as *C. curviceros*, the merus of the first ambulatory leg is slightly longer than the cheliped merus and there is a small spine between the protogastric and the anterior branchial spine. An adult male of *C. suhmi* from the eastern Australian coast has the merus of the first ambulatory leg more than one and a third (1.4) times as long as the cheliped merus and in some adults there is a high tubercle rather than a spine between the protogastric and anterior branchial spine. In the series from eastern Australia there is sometimes, behind the anterior branchial spine, a spine and a tubercle and sometimes two tubercles as shown in Bouvier's figure of *C. suhmi curviceros*. The basal antennal article of Bouvier's holotype has four lateral spines and one medial spine. In the eastern Australian *C. suhmi* there are three lateral spines, one medial spine and a high tubercle behind the anterolateral spine. This high tubercle is represented by a short spine in Bouvier's holotype as can be seen in the photograph of the holotype given by Guinot & Richer de Forges (1982b: fig. 12C).

Guinot & Richer de Forges (1982a; 1982b) have described a new species, *C. gaillardi*, which is similar to *C. suhmi* in size and general appearance and it also has a small spine in the orbit and a spine between the protogastric and anterior branchial spine. It is, however, densely covered with granules and the rostral spines appear to be horizontal rather than arched as in *C. suhmi*.

C. suhmi is similar to *C. maccullochi* but in the latter species the carapace is granular, not smooth as in *C. suhmi*. Other differences between the two species are discussed further under *C. maccullochi*.

Distribution. — Southern India, Bay of Bengal, Indonesia, eastern Australia and Japan.

Encephaloides Wood-Mason, 1891

Type species. — *Encephaloides armstrongi* Wood-Mason, 1891, by monotypy.

Remarks. — The one species contained in this genus has been discussed recently (Griffin, 1974) and the first pleopod of the male figured. This species is distinguished by its beak-like rostrum, the enlarged efferent branchial openings and the inflated branchial regions which meet dorsally in the midline. The narrow basal antennal article is fused proximally and distally and the flagellum of the antenna excluded from the orbit. The supraorbital eave is weakly expanded and the postorbital lobe, in the form of a conical tubercle, is remote from the eye. The first pleopod of the male is broad and straight with an elongate lobe on the medial edge just before the apex; the aperture is on the anterior margin of the lobe. The first pleopods lie near the lateral margins of the abdominal fossa rather than near the midline. These features, especially the form of the orbit and the first pleopod of the male, lead us to the view that this genus may be better placed in the Pisinae.

Distribution. — Gulf of Oman, Bay of Bengal.

Ephippias Rathbun, 1918

Type species. — *Ephippias endeavouri* Rathbun, 1918, by monotypy.

Remarks. — In this monotypic genus the supraorbital eave is not expanded and there are neither preorbital nor antorbital spines or lobes; the postorbital spine is small and remote from the eye. The basal antennal article is slender with one large anterior spine and the antenna is excluded from the orbit. The first pleopod of the male curves outward distally and the aperture is a subterminal slit.

Distribution. — Indo-West Pacific, but restricted to Australian waters.

Ephippias endeavouri Rathbun, 1918
(Fig. 9c, d)

Ephippias endeavouri Rathbun, 1918:9-11, pl. 15. — McNeill, 1920: 109. — Hale, 1927:131-132, fig. 131. — Montgomery, 1931:416. — Balss, 1935a:119. — Griffin, 1966b:274 (in key).

Material examined. — 3♂♂, 2♀♀, 27.5-114.5 mm.

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New South Wales, near Grafton, off Minnie Waters, 18 m, crayfish pot, coll. K. Knox and G. Biddle, 1964; 1 spec. (AM P.15991). — South Australia, northern Great Australian Bight, Deal Island, Cape Northumberland, 32°24′S 133°30′E, coll. P. Symonds, 'Explorer', 23 August 1973; 3 specs. (AM P.20152). — Great Australian Bight, 32°43′S 125°43′E to 32°45′S 125°43′E, 43 m, coll. G. Maxwell, CSIRO F.R.V. 'Soela', Stn. 14, 18 January 1980; 1 spec. (AM P.32086).

Remarks. — In *E. endeavouri* the orbit is not expanded and the first pair of ambulatory legs is twice as long as the chelipeds and much longer and stouter than the other pairs of legs. The first pleopod of the male of *E. endeavouri* has not previously been figured. We have figured the pleopod of a specimen (114.5 mm) from New South Wales. The pleopod narrows and curves outwards just before the subacute apex; the aperture is a subterminal slit on the medial edge.

Distribution. — Restricted to Australia, from the northwest around the southern coasts to northern New South Wales.

Grypachaeus Alcock, 1895

Type species. — *Grypachaeus hyalinus* Alcock, 1895, by monotypy.

Remarks. — In 1978 Takeda described a second species of this genus from the Ryukyu Islands, *G. tenuicollis* Takeda.

In this genus the basal antennal article is similar to the second and third peduncle segments, the proximal margin is fused to the epistome but the distal margin is free and doesn't extend to the anterior margin of the eyestalk. The propodus and dactyl of the fourth leg, which is subchelate, are armed with numerous spinules ventrally.

The first pleopod of the male has a large subterminal aperture.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *GRYPACHAEUS*

1 Rostral spines with a strong accessory spine at base and a few spinules distally; hepatic margin with 2 or 3 spines; cheliped palm strongly spinulous (male) or with 3 or 4 dorsal spines (female)..... *G. hyalinus*
- Rostral spines with 2 strong accessory spines distally; hepatic margin with one large spine; cheliped palm with a few conical tubercles (male)... ..... *G. tenuicollis*[7])

Grypachaeus hyalinus (Alcock & Anderson, 1894)

Achaeus hyalinus Alcock & Anderson, 1894:205.
Grypachaeus hyalinus. — Alcock, 1895:177-178, pl. 3 figs. 4, 4a.
Gryphachaeus (sic) *hyalinus*. — Griffin, 1974:14, fig. 1e, f; 1976:190.

Material examined. — 3♀♀ (1 ovig.), postrostral cl. 6.5-14 mm, ovig. ♀, postrostral cl. 14 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 289, south coast of Timor, 09°0.3′S 126°24.5′E, 112 m, trawl, mud, sand and shells, 20 January 1900; 2 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

South China Sea, 128-174 m, trawl, Fisheries Research Station, Hong Kong, December 1963; 1 spec. (AM P.29934).

Remarks. — These specimens agree with those previously discussed (Griffin, 1974; 1976). The two specimens from Timor have not been well preserved and are somewhat distorted, and one is infected with a sacculina parasite. The rostral spines of this species are longer and more slender than shown in the figure by Alcock (1895, fig. 4). In adult specimens the carapace is wider in females (about 2/3 postrostral carapace length) than in males (about $^1/_2$ postrostral carapace length).

This species is distinguished from *G. tenuicollis* Takeda (Takeda, 1978) by the following points:

1. the rostral spines have a few small spinules in addition to a basal accessory spine (2 strong accessory spines in *G. tenuicollis*);
2. there are 2 or 3 spines on the hepatic margin (1 large spine in *G. tenuicollis*);
3. the cheliped palm is strongly spinous (few and small spines on the palm of *G. tenuicollis*);
4. first pleopod of the male straight or slightly curved laterally, the rim of the aperture not projecting (apex strongly curved medially and the rim of the aperture projecting and acute in *G. tenuicollis*);
5. last segment (6 and 7 fused) of male abdomen with lateral edges concave and distal width less (0.8) than proximal width (in *G. tenuicollis* the lateral edges are parallel and the distal and proximal widths subequal).

Distribution. — N. of Mombasa, mouth of Gulf of Aden, off Sri Lanka, Timor, Philippine Islands, South China Sea.

Inachus Weber, 1795

Type species. — *Cancer scorpio* Fabricius, 1779 (= *Cancer dorsettensis* Pennant, 1777) by subsequent designation of H. Milne Edwards, 1837.

Remarks. — This genus is reasonably well represented in the eastern Atlantic. Only *I. dorsettensis* and *I. guentheri* occur in the Indo-west Pacific, the latter extending to Lourenco Marques, the former to the mouth of the Gulf of Aden and the Seychelles. Males of *Inachus* species have first pleopods which are similar to those of *Achaeus* and its relatives.

Distribution. — East Atlantic and western Indian Ocean.

KEY TO INDIAN OCEAN SPECIES OF *INACHUS*

(modified from Barnard, 1950)

1 Protogastric regions smooth or with 2 small spinules; mesogastric spine larger than cardiac spine; branchial region with a spinule or tubercle near cardiac spine, anteriorly smooth ..... *I. guentheri*
- Protogastric regions with 4 tubercles or small spines (in a transverse row); mesogastric spine subequal to cardiac spine; branchial region with a short spine near cardiac spine and a tubercle anteriorly ..... *I. dorsettensis*

Inachus guentheri (Miers, 1879)

Achaeopsis guentheri Miers, 1879a:2-3, pl. 4 figs. 1, 1a.
Inachus guentheri. — Barnard, 1950:27-29, fig. 5a-c. — Monod, 1956: 529-531, figs. 723-730. — Griffin, 1974:18-19.

Material examined. — 1 ovig. ♀, 13.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java — S. Africa Expedition: Stn. 43, Mauritius, off Tombeau Bay, ca. 234 m, swabs, 11 October 1929; 1 spec.

Remarks. — This specimen agrees well with those previously described. There is a strong mesogastric spine, but on the cardiac region there is a short spine rather than a tubercle and only a low tubercle on its posterior slope. In our specimen there is a spinule on the supraorbital eave and on the rostral

[7]) from the literature

spines apically and a pair of spinules distally on the postorbital lobe. The hepatic margin is spinulous and there is a small spinule on the protogastric and branchial regions. There is a sharp tubercle on the posterior margin of the antennal fossa. There are proximal and distal spinules on the basal antennal article but only granules along the rest of its length.

Distribution. — Atlantic and Indian Ocean coasts of southern Africa; Mauritius.

Lambrachaeus Alcock, 1895

Type species. — *Lambrachaeus ramifer* Alcock, 1895, by monotypy.

Remarks. — As previously remarked, the single contained species is unique amongst those presently contained in the Majidae in that the male has a long second pleopod. Alcock saw similarities with *Macropodia* (as *Leptopodia*) and *Metoporaphis*. Yet, in fact, the similarities are general: long rostrum, poorly developed orbits, long ambulatories. We, therefore, propose to exclude this genus from the Majidae.

Distribution. — Indo-West Pacific.

Lambrachaeus ramifer Alcock, 1895

Lambrachaeus ramifer Alcock, 1895:168-169, pl. 3 fig. 1. — Rathbun, 1911:244. — Edmondson, 1952:82-83, fig. 9a-d. — Griffin & Tranter, 1974:172-173, fig. 2a-c. — Kensley, 1977a:323-327, figs. 1-2.

Material examined. — 1 ♂, 24 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Hawaii, off Honolulu, 19-72 m, dredge, 5 May 1915: 1 spec.

Remarks. — In this specimen, an adult male, the rostrum is about as long as the postrostral carapace length (11.5 mm). As was noted and figured previously (Griffin & Tranter, 1974) this species is unique among known majids in having the second pleopod of the male as long as the first. In addition the antenna is very small; the very short basal segment is articulated near the green gland and free distally; the second and third peduncle segments are also short and slender and only reach the anterior margin of the eyestalk. This is quite distinct from the superficially similar *Stenorhynchus* in which there is a long basal antennal article fused proximally and distally and the green gland is at the base of the 'neck' just in front of the mouthfield.

The cheliped is longer and heavier than the following ambulatory legs and the fingers are bent at an angle to the palm. However, there is only a commencing orbit with a slender postorbital spine and there are curled hairs on the protogastric region and on the merus of the cheliped.

Distribution. — Red Sea, east coast of South Africa, Amirante Islands, Andaman Islands, Maldive Islands, Hawaii.

Macropodia Leach, 1814

Type species. — *Cancer rostratus* Linnaeus, 1761, as *Macropodia longirostris* (Fabricius, 1775) by monotypy (see Rathbun, 1897:155).

Remarks. — This genus is well represented in the eastern Atlantic and Mediterranean and species from these areas have been treated extensively by Forest (1964, 1978) and Forest & Zariquiey Alvarez (1964). Species from the western Indian Ocean were dealt with by Griffin (1974).

The generally long, contiguous rostral spines, distinguish species of this genus from *Achaeus* and its relatives, the males of which have similar first pleopods. The basal antennal article is distally free, not fused to the carapace as it is in *Achaeus*.

Distribution. — Eastern Atlantic, Mediterranean, western Indian Ocean.

KEY TO INDIAN OCEAN SPECIES OF *MACROPODIA*

1 Basal antennal article smooth or with minute denticles; lateral margins of antennal fossae not splayed outwards ..... *M. formosa*
\- Basal antennal article with one or more spines; lateral margins of antennal fossae splayed outwards 2
2 (1) Rostrum long, exceeding antennal peduncle; basal antennal article with one spine ..... *M. falcifera*[8])
\- Rostrum short, not reaching end of antennal peduncle; basal antennal article with 3 spines ..... *M. intermedia*

Macropodia formosa Rathbun, 1911

Macropodia formosa Rathbun, 1911:242-244, fig. 1. — Griffin, 1974:19, fig. 4c-d.

Achaeus tenuicollis. — Stephensen, 1945:97, fig. 18 A, B. [Not *Achaeus tenuicollis* Miers, 1886 = *Achaeus curvirostris* (A. Milne Edwards).]

Material examined. — 3♂♂, 4♀♀, 8-12.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Expedition to Iran: Iranian Gulf, Stn. 24, 29°07'N 49°56'E, 40 m, sandy clay, 13 March 1937; 4 specs. — Iranian Gulf, Stn. 25, 63 nautical miles W 1/2S of Bushire, 49 m, sand with some clay, 14 March 1937; 3 specs. (all previously det. K. Stephensen, as *Achaeus tenuicollis* Miers).

Remarks. — These specimens agree well with the specimens of *Macropodia formosa* collected by the *Anton Bruun* and described previously (Griffin, 1974). The short rostral spines are contiguous, there is a mesogastric spine and a cardiac spine in the midline and the supraorbital eave and the basal antennal article are both smooth.

Distribution. — Western Indian Ocean: off S. Africa, south of Gulf of Aden, Iranian Gulf and Cargados Carajos.

[8]) From the literature (Barnard, 1950).

Oncinopus De Haan, 1839

Type species. — *Inachus (Oncinopus) aranea* De Haan, 1839 by monotypy.

Remarks. — The first species of this genus, *O. aranea* De Haan was described from Japan in 1839 and the second species *O. neptunus* was described by Adams & White (1848) from the Philippine Islands (Sea of Mindoro). A third *O. subpellucidus* was described from Port Jackson, Australia by Stimpson (1857) but later Haswell (1880) described *O. angulatus*, also from Port Jackson, perhaps without knowing of Stimpson's species, for in 1882 Haswell listed *O. angulatus* as a synonym of *O. subpellucidus*. However, all these species were amalgamated by Miers (1884) who considered that the characters which has been used to distinguish the three—length of ambulatory leg; size of male chela; size of rostral lobes—were not consistent. Subsequent authors (Henderson, 1893; Ortmann, 1893; Alcock, 1895; Sakai, 1938; 1965a) followed Miers and *O. aranea* was regarded as a wide ranging variable species until Takeda & Miyake (1969) examined the first pleopod of the male in a number of specimens. They found that the pleopod of males from Port Jackson agreed with that of the type of *O. neptunus* but differed from that of specimens from Japan. The Japanese specimens were considered to be *O. aranea* and a new species *O. angustifrons* was described from the East China Sea.

The type material of *O. subpellucidus* is no longer in existence. We have examined the type material of *O. angulatus* (2♂♂, 10, 12.5 mm, 1♀, 12 mm, dry, glued to glass) and compared it with a large number of specimens from Port Jackson. We are convinced that *O. angulatus*, and thus presumably *O. subpellucidus*, is conspecific with *O. neptunus*.

The records of *O. aranea* by several earlier authors cannot, therefore, be regarded as valid (eastern Australia (Miers); Sri Lanka, Gulf of Martaban (Henderson); Laccadives, Maldives, Sri Lanka, Andamans, Malay Peninsula (Alcock); Japan (Ortmann) (Sakai)) until the specimens are re-examined. Records of specimens identified since the study of Takeda & Miyake (1969)—including this paper—indicate that all three species occur in Japan, Philippine Islands and Kai Islands; *O. aranea* has also been collected from northeastern Australia, Lesser Sunda and Sunda Islands; while *O. neptunus* is widespread in the Indo-West Pacific including east Africa, Sri Lanka and Hawaii. The distribution of each species is listed in detail in the accounts.

In this genus the basal antennal article is very slender, free distally and doesn't even reach the anterior margin of the eyestalk. There is only a weakly developed interantennular partition and no interantennular spine. The first pleopod of the male is twisted about three times, this is much more twisted than is usual in majids.

In this report we describe a new species of *Oncinopus* which is clearly distinguished from the three other known species by its relatively long, dorsoventrally flattened rostral lobes and the broad interorbital region of the carapace.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *ONCINOPUS*

1 Rostral lobes broad, dorsoventrally flattened, separated by a narrow hiatus, inner margins of lobes parallel, outer margins curved, converging distally; interorbital region broad, concealing most of unretracted eyestalk ..... *O. postillonensis*
– Rostral lobes weak and narrow or triangular, not dorsoventrally flattened, separated by a broad hiatus, lobes divergent or outer margins parallel; interorbital region only concealing basal part of unretracted eyestalk 2
2 (1) First pleopod of male only slightly widened before apex, aperture on abdominal surface; female gonopore a simple ventral opening, not elevated ..... *O. neptunus*
– First pleopod of male strongly widened before apex or with a lateral lobe; female gonopore at least weakly elevated 3
3 (2) First pleopod of male strongly widened subapically; female gonopore on a weak elevation, opening more posteriorly than medially ..... *O. angustifrons*
– First pleopod of male with a beak-like lateral lobe subapically; female gonopore distinctly elevated and opening medially ..... *O. aranea*

Oncinopus angustifrons Takeda & Miyake, 1969

Oncinopus angustifrons Takeda & Miyake, 1969:478-481 figs. 4, 5c, d. — Sakai, 1976:156.

Material examined. — 3♂♂, 4♀♀ (2 ovig.), 6-10.5 mm, smallest ovig. ♀, 7.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 260, Kai Is., 2.3 miles (∿ 3.7 km) N 63°W from the north point of Nuhu Jaan, 05°36.5'S 132°55.2'E, 90 m, dredge, sand, coral and shells, 16/18 December 1899; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Philippine Is., San Bernadino Strait, 12°27'N 124°3'E, 90-180 m, 3 August 1911; 1 spec.

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

Danish Kei Islands Expedition: Stn. 24, Kai Is., 05°37'S 132°56'E, 100 m, hard bottom, 15 April 1922; 1 spec.

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Mariel King Memorial Expedition — Moluccas: Stn. AM II, Aru Is., Maikoor, approx. 8 miles (∿ 13 km) SW of Tg. Ratoe, centred near 06°7'S, 133°57'E, 45-75 m, dredge hauls 1-4, sand and rubble, 18 June 1970; 1 spec. — Aru, 54-63 m, dredge, sand and rubble, June 1970; 1 spec.

Remarks. — the males of this species can be distinguished from those of *O. aranea* and *O. neptunus* by the first pleopod of the male (Takeda & Miyake, 1969). Our male specimens of *O. angustifrons* are from Kai Islands and Aru. The females of this species can usually be distinguished from those of *O. neptunus* and *O. aranea* by the shape of anterior carapace and rostral lobes. In *O. angustifrons* the anterior part of the carapace is tapered strongly from the broad hepatic region to the constriction behind the rostral lobes which are directed obliquely outwards. In *O. aranea* the anterior part of the carapace is not so strongly tapered and the rostral lobes are less constricted basally, while in *O. neptunus* the lateral margins in front of the hepatic region are only weakly convergent or almost subparallel, the rostral lobes are parallel and directed forward. Mature females agreeing closely with the female figured by Takeda & Miyake (1969: fig. 4b) have a gonopore on a weak elevation and opening more posteriorly than medially. In *O.*

neptunus the gonopore is a simple ventral opening and in *O.* ***aranea*** it is distinctly elevated and opens medially.

These records extend the range of this species previously known only from off Japan.

Distribution. — Japan, Philippine Islands, Kai Islands, Aru.

Oncinopus aranea De Haan, 1839

Inachus (Oncinopus) aranea De Haan, 1839:100, pl. 29 fig. 2.
Oncinopus aranea. — Takeda & Miyake, 1969:477, 481, fig. 5, e, f. — Sakai, 1976:155-156, pl. 48 fig. 1.

Material examined. — 6 ♂♂, 14♀♀ (7 ovig.) 5.5-11 mm, smallest ovig. ♀, 6 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 65a, Flores Sea, Tanahdjampea, near 07°S 120°34′E, from 400 m, dredge, pale grey mud changing to coral, 6 May 1899; 1 spec. — Stn. 99, Sulu Archipelago, anchorage off North Ubian, 06°07.5′N 120°26′E, 16-23 m, dredge, townet, *Lithothamnion* bottom, 29 June 1899; 3 specs. — Stn. 260, Kai Is., 2.3 miles (∼ 3.7 km) N 63°W from N point of Nuhu Jaan, 05°36.5′S 132°55.2′E, 90 m, dredge, sand, coral and shells, 16/18 December 1899; 1 spec. — Stn. 315, Flores Sea, Paternoster Is., (Kepulauan Tengah), anchorage E of Sailus Besar, up to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 2 specs. — Lesser Sunda Islands, Haingsisi; 2 specs.

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

Mortensen Java - S. Africa Expedition: Stn. 5, Bali Strait, 08°23′S 114°29′E, 70 m, trawl, sand, 5 April 1929; 1 spec.

Danish Kei Islands Expedition: Stn. 83, Sunda Strait, 06°42′S 105°17′E, 45 m, trawl, sandy mud, 30 July 1922; 1 spec. — Stn. 93, Sunda Strait, Lampung Bay, 05°44′S 105°30′E, 3 m, dredge, 1 August 1922; 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; 3 specs.

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Queensland: Off Moreton Bay, 27°27′22″S 153°39′E, 75 m, coll. W. F. Ponder, 'Kimbla', 29 March 1969; 2 specs (AM P.29931). — Coral Sea, Saumarez Reef, near 21°40′S 153°40′E, 8 m, in cave at night, coll. N. Coleman, 17 August 1977; 1 spec. (AM P.29930).

Remarks. — The males of this species can be distinguished from those of *O. neptunus* and *O. angustifrons* by the form of the first pleopod of the male (Takeda & Miyake, 1969). Our male specimens of *O. aranea* are from Ceram, Sulu Archipelago and the eastern coast of Australia.

Females were associated with the males of this species on the basis of their similarity in the shape of the anterior carapace and the rostral lobes. The anterior part of the carapace is not as strongly tapered as in *O. angustifrons* but not almost subparallel or only weakly tapered as in *O. neptunus*. The rostral lobes are usually blunt, directed forward and slightly outwards and only weakly constricted basally. In *O. neptunus* the rostral lobes are parallel and directed forwards and in *O. angustifrons* the rostral lobes are strongly constricted at the base.

In mature females of this species the gonopore is on a distinct elevation and the opening is more medial than posterior; in *O. angustifrons* the elevation is not as prominent and the opening is more posterior than medial; while in *O. neptunus* there is a simple unelevated ventral opening.

Distribution. — Eastern Australia, Kai Islands, Ceram, Lesser Sunda Islands, Sunda Islands, Sulu Archipelago, Japan.

Oncinopus neptunus Adams & White, 1848

Oncinopus neptunus Adams & White, 1848:1-3, pl. 2 figs. 1, 1a, b. — Takeda & Miyake, 1969:477, 478, figs. 3, 5a, b. — Griffin, 1974:22. — Takeda, 1977:120-121, pl. 12A.
Oncinopus subpellucidus Stimpson, 1857:221; 1907:34.
Oncinopus angulatus Haswell, 1880b:433-434.

Material examined. — 11♂♂, 27♀♀ (12 ovig.), 5-13 mm, smallest ovig. ♀, 6.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 43, Flores Sea, Postillon Islands, anchorage off Pulu Sarassa, to 36 m, dredge, coral, 4-5 April 1899; 1 spec. — Stn. 99, Sulu Archipelago, anchorage off North Ubian, 06°07.5′N 120°26′E, 16-23 m, dredge, townet, *Lithothamnion* bottom, 29 June 1899; 4 specs. — Stn. 282, anchorage between Nusa Besi and NE point of Timor, 08°25.2′S 127°18.4′E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. — Aru, Jedan, 1899; 1 spec. Java Sea, otter trawl, 'Rambang', April-May 1907; 1 spec. — Aru, Jedan, 10 December 1907; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, 36-54 m, sand, coral, 19 March 1914; 1 spec. — Honolulu, 18-72 m, coral, 5 May 1915; 4 specs.

Danish Kei Islands Expedition: Off Neira Banda, ca. 20 m, dive, sand, 1 June 1922; 1 spec. — Stn. 67, Java Island, 05°48′S 106°12′E, 38 m, trawl, sand, 27 July 1922; 1 spec. — Stn. 72, Java Sea, 05°41′S 105°57′E, 35 m, stones, 28 July 1922; 1 spec. — Stn. 82, Sunda Strait, 06°38′S 105°21′E, 35 m, trawl, sandy mud, 20 July 1922; 1 spec. — Stn. 90, Sunda Strait, 05°55′S 105°30′E, 36 m, hard bottom, 1 August 1922; 2 specs. — Stn. 91, Sunda Strait, 05°53′S 105°27′E, 42 m, dredge, mud, 1 August 1922; 2 specs. — Stn. 106, Java Sea, 05°50′S 106°16′E, 32 m, sand, 5 August 1922; 3 specs.

'Galathea' Expedition: Stn. 330, 5 miles (8 km) SE. of Singapore, 40 m, trawl, sand and coral, 15 May 1951; 1 spec.

Sri Lanka, 61 m, don. Indian Museum; 1 spec. (previously det. as *O. aranea*).

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Mariel King Memorial Expedition — Moluccas: Stn. CP I, Ceram, Piru Bay, 03°15′S 128°10′E, 25-36 m, dredge hauls 8-19, coarse sand, *Lithothamnion* and rubble, 2 June 1970; 1 spec. — Stn. KR VI, Kai Is., N of Nuhu Rowa, N of Du Rowa I., 05°32′S 132°41′E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 2 specs. — Stn. KR VII, Kai Is., between Du Rowa and Kai Dulah Is., 05°32′S 132°46′E, 32-36 m, dredge haul 3, muddy sand and sponge, 11 June 1970; 1 spec. — Stn. AM II, Aru, 8 miles (13 km) SW of Tg Ratoe, Maikoor, 06°07′S 133°57′E, 25 m, dredge haul 15, *Lithothamnion* nodules, 18 June 1970; 1 spec. — Stn. AN 1,

Aru Is., S Trangan I., Tg. Ngabordamlu, 06°58′S 134°05′E, 26-29 m, dredge haul 1, coral and sponge, 20 June 1970; 3 specs.

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Noumea: Fosse aux Canards, 25 m, coll. Catala, 1972; 1 spec. (AM P.29933).

New South Wales: Byron Bay, Julian Rocks, 18 m, on sponge, coll. N. Coleman, May 1975; 1 spec. (AM P.23817). — Port Jackson, coll. R. Kuiter, October 1976; 1 spec. (AM P.29932).

Remarks. — The males of this species are distinguished from those of *O. aranea* and *O. angustifrons* by the form of the first pleopod of the male (Takeda & Miyake, 1969). Our male specimens of *O. neptunus* are from Hawaii, Noumea, eastern Australia, Ceram, Timor, Sunda Islands, Sulu Archipelago and Sri Lanka. The females were associated with the males of this species on the basis of specimens from Port Jackson; all males of *Oncinopus* from Port Jackson in the Australian Museum collection are *O. neptunus*. In this species the female gonopore is a simple, ventral opening which is not elevated; in *O. angustifrons* the gonopore is slightly elevated and opens posteriorly rather than medially and in *O. aranea* there is a distinct elevation and the opening is medial.

Among the specimens which can be identified as *O. neptunus* on the basis of the male pleopod or female gonopore there is some variation in the form of the rostral lobes. In *O. aranea* and *O. angustifrons* the small rostral lobes are the angles formed laterally when the front is folded downwards. In some specimens of *O. neptunus* this is also true but the folded front is usually more robust than that found in *O. aranea* and *O. angustifrons*. In other specimens of *O. neptunus* the rostral lobes are distinct structures produced forward from these angles and about equal in length to the width of the hiatus between them. The rostral lobes are either blunt, triangular, each about as long as its basal width and with a broad V-shaped hiatus between them or narrow basally, hardly tapering, each about twice as long as the basal width and with a broad U-shaped hiatus between them. The different types of rostral lobes do not seem to be restricted to particular geographic areas. In our series there are specimens with very weakly developed rostral lobes from Hawaii, Noumea, Sulu Archipelago, Timor and Java Sea; specimens with broad triangular rostral lobes from eastern Australia, Ceram, Sunda Strait and Sri Lanka; and specimens with narrow rostral lobes from Aru, Java Sea and Singapore. Although there are three different kinds of rostral lobes there is no justification for considering these specimens as belonging to more than one species. The same kind of first pleopod of the male is found in specimens with each of the different rostral lobes.

In the pleopod of the adult male of *O. neptunus* there are two close coils just beyond the broad base and the pleopod is twisted distally. In the immature male (with a slender chela) there is one open coil between the base and the twisted distal half.

Distribution. — East Africa, Red Sea, Arabian Sea, Sri Lanka, Straits of Malakka, Sunda Islands, Timor, Ceram, Banda, Kai Islands, Sulu Archipelago, Japan, Noumea, Hawaii and eastern Australia.

Oncinopus postillonensis new species
(Fig. 6)

Material examined. — 2 ♂♂, 2 ♀♀ (1 ovig.) 5-6 mm, ovig. ♀, 6.5 mm.

Holotype. — Male, cl. 6.0 mm, Flores Sea, Postillon Is., anchorage off Pulu Sarassa, up to 36 m, dredge, coral, 4/5 April 1899; 'Siboga' Expedition, Stn. 43. Zoological Museum, Amsterdam.
Paratypes. As listed below:

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 96, Sulu Archipelago, SE side of Pearl Bank, 15 m, dredge, townet, *Lithothamnion*, 27 June 1899; 1 spec. — Stn. 301, Timor, E coast of Roti I., Pepela Bay, 10°38′S 123°25.2′E, 22 m, dredge, mud, coral and *Lithothamnion*, 30 January 1900; 1 spec. — Stn. 315, Flores Sea, Paternoster Is., anchorage east of Sailus Besar, up to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 1 spec.

Description. — Carapace of almost uniform width anteriorly, widened posteriorly; carapace width about 0.7 (male) to 0.8 (female) postrostral carapace length. Surface smooth with only two low tubercles.

Rostrum of two broad parallel lobes, dorsoventrally flattened, separated by a narrow U-shaped hiatus; length about one fifth (0.2) postrostral carapace length; medial margins with curled hairs.

Interorbital region broad, concealing most of eyestalk, only terminal cornea visible dorsally; lateral margin weakly elevated above eyestalk; eyestalk short and stout.

Hepatic margin very weakly produced.

Branchial region with longitudinal rows of curled hairs on dorsal margin.

Gastric regions elevated with a low, round posterior mesogastric tubercle. Cardiac region with a low, weakly bilobed tubercle. Intestinal region smooth.

Basal antennal article slender, smooth, distally free; second segment longer (1.5) than basal segment and more slender; third segment much shorter (0.3) than second and articulated with it at right angles (antennal filament directed laterally).

Third maxilliped smooth, ischium with a low ridge parallel and near to lateral margin; anterolateral angle of merus weakly produced, rounded.

Pterygostomian region narrow, smooth; margin weakly indicated, smooth. Sternum smooth; anterior apex with a narrow medial ridge separating lateral depressions.

Merus and carpus of male cheliped smooth with a row of long plumose hairs ventrally on outer face and a row of shorter hairs dorsally; chela with a row of short plumose hairs dorsally and ventrally; palm about three times as long as high; fingers about half as long as palm, weakly incurved; a very narrow, smooth gape between fingers in proximal two thirds.

First, ambulatory leg about twice (2.1) postrostral carapace length, smooth, propod and dactyl dorsoventrally flattened, length of propod about three times greatest width; anterior

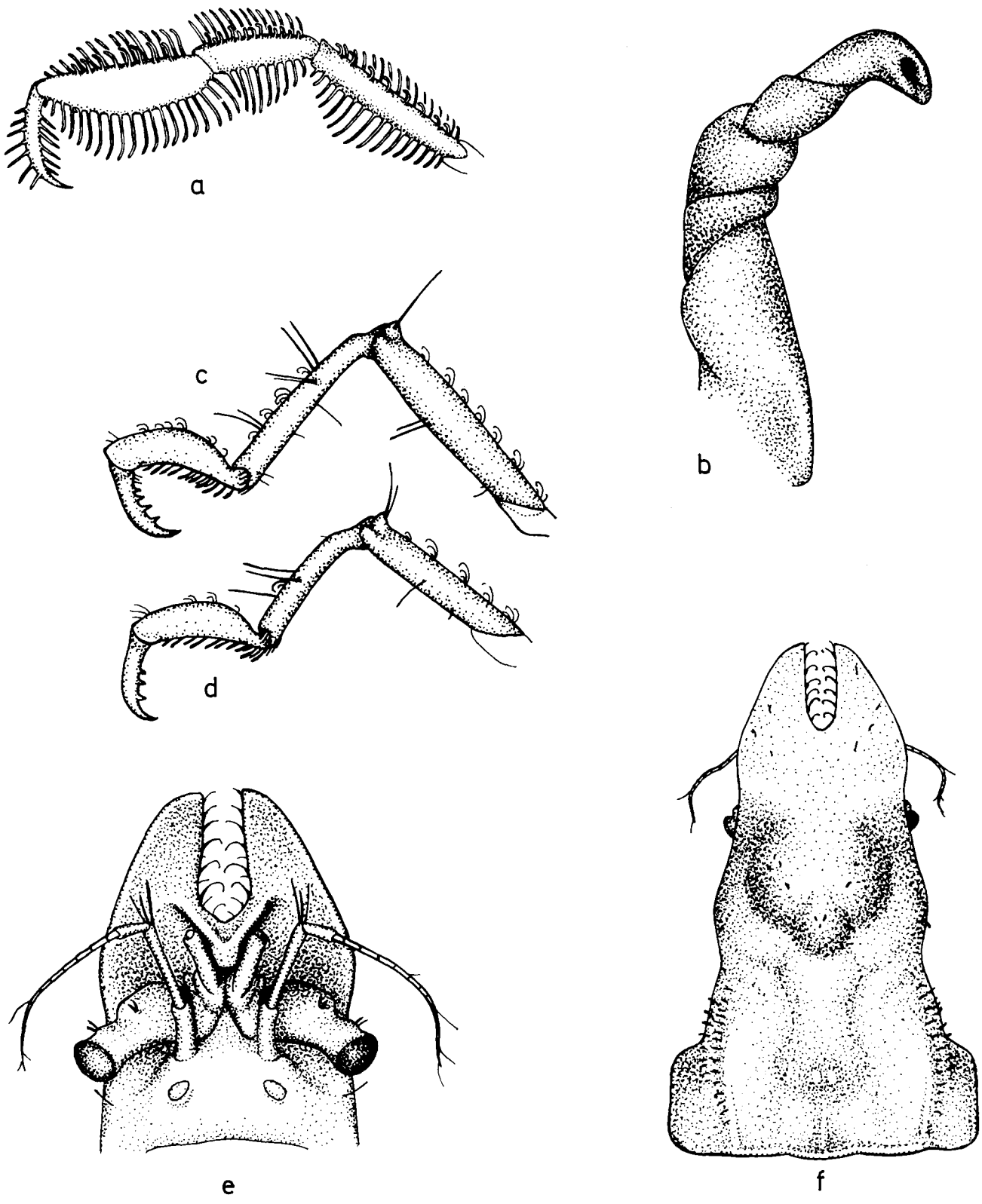

Fig. 6. *Oncinopus postillonensis* (holotype) (a) left first ambulatory leg, dorsal view; (b) left first pleopod, abdominal view; (c) left third ambulatory leg; (d) left fourth ambulatory leg; (e) orbits, ventral view; (f) carapace, dorsal view.

and posterior margins of all leg segments with a fringing row of long plumose hairs; a row of curled hairs dorsally on merus and carpus, anteriorly on propod and dactyl. Fourth ambulatory leg about half as long as first leg and slightly longer (1.1) than postrostral carapace length; merus, carpus and propod with groups of curled hairs dorsally; propod with a row of short plumose hairs ventrally; dactyl subchelate with three to five small teeth ventrally along its length.

Male abdomen of seven segments, third segment with lateral margin strongly produced, convex; fourth and fifth

segments with a large medial tubercle anteriorly and a rounded elevation laterally; sixth segment about two thirds as wide as third segment, width about five times length, a small medial tubercle anteriorly, and a small rounded elevation at anterolateral angle; seventh segment about three times wide as long.

First pleopod of male similar to that of other species of *Oncinopus*, twisted, with aperture terminal and abdominal.

Female abdomen of seven segments, smooth, a medial tubercle on third to fifth segments; a low medial ridge on sixth and seventh segments. Female gonopore a round aperture opening ventrally.

Remarks. — This species is distinguished from other known species of *Oncinopus* by the long, dorsoventrally flattened rostral lobes; by the broad interorbital region which conceals most of the eyestalk and by the presence on the first and second ambulatory legs of two fringing rows of evenly spaced hairs with setose margins.

We have in the collection another specimen (ovig. ♀, cl. 5 mm, Mortensen Pacific Expedition, Mindoro, Puerto Galera, 9 m, 3 February 1914, ZMC) in which the interorbital region is broad, concealing most of the unretracted eyestalk but which is not conspecific with *O. postillonensis*. The rostrum comprises two broad truncate lobes each about as wide as long, their lateral margins parallel and separated by a narrow medial slit. This specimen lacks the anterior interantennular partition present in *O. postillonensis* and the fringing hairs on the first and second pairs of ambulatory legs do not have such setose margins. The gastric regions are strongly elevated. This specimen appears to be a new species of *Oncinopus* but the material would not justify a full description.

Distribution. — Flores Sea, Timor, Sulu Archipelago.

Paratymolus Miers, 1879

Type species. — *Paratymolus pubescens* Miers, 1879, by monotypy.

Remarks. — In this genus the basal antennal article is not fused anteriorly to the carapace, the rostral lobes are only weakly developed and the abdomen in both males and females is triangular, with segments 3-5 fused in the male. The first pleopod of the male differs from that of most majids and the relationship of *Paratymolus* to other genera needs to be studied further.

P. latipes Haswell 1880 and *P. sexspinosus* Miers 1884 are recognisably distinct species. The status of *P. bituberculatus* Haswell 1880 and *P. hastatus* Alcock 1895, both possible synonyms of *P. pubescens*, is uncertain. We here describe and figure five kinds of male first pleopods of specimens which belong to a 'pubescens' group but we cannot yet satisfactorily distinguish them as distinct species using other characters.

Distribution. — Indo-West Pacific.

PARTIAL KEY TO SPECIES OF *PARATYMOLUS*

1 Carapace with several dorsal tubercles .....*P. pubescens* species group
- Carapace dorsally smooth 2
2 (1) anterolateral margin behind orbit with three spines; rostral lobes apically truncate with a medial and a lateral spine; second segment of antennal peduncle at least 2/3 as long as last segment of peduncle; first pleopod of male short and broad .....*P. latipes*
- Anterolateral margin behind orbit with two blunt tubercles (or one tubercle and one spine); rostral lobes apically convex with a small spine on the lateral slope; second segment of antennal peduncle only about $^1/_2$ as long as last segment; first pleopod of male long and slender.....*P. sexspinosus*

Paratymolus latipes Haswell, 1880
(Figs. 7h, 11b)

Paratymolus latipes Haswell, 1880a:303-304, pl. 16 figs. 3-5; 1882: 143. — Griffin, 1966:276 (in key).
Paratymolus latipes var. *quadridentata* Baker, 1906:107-108, pl. 1 fig. 2. — Hale, 1927: 123, fig. 119.

Material examined. — 6♂♂, 7♀♀ (6 ovig.), 4-10 mm, smallest ovig. ♀, 7.0 mm.

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New South Wales: Port Stephens Heads, September 1919; 1 spec. (AM P.4868). — Port Stephens, off Red Rocks, 6-12.5 m, dredge, 30 August 1920; 2 specs. (AM P.4927). — Off Norah Head, 47-68 m, coll. F. A. McNeill and A. A. Livingstone, June 1921; 1 spec. (AM P.5352). — Port Jackson, off Sow and Pigs Shoal, 10 m, 1929; 4 specs. (AM P.9400). — Port Jackson, off Chinaman's Beach, dredge, dead shells and sand, 8 May 1971; 1 spec. (AM P.23821). — Near Sydney, Bondi Beach, January 1922; 3 specs. (AM P.5651). — Near Sydney, 2 km E of Long Bay, 66 m, dredge, 23 May 1973; 1 spec. (AM P.20695).

Remarks. — Haswell (1880a) described this species as having a lateral spine on each rostral lobe and Baker (1906) described *P. latipes quadridentata* from South Australia as having two spines on each rostral lobe. All the specimens of *P. latipes* in the collection at the Australian Museum have two spines on each rostral lobe, one lateral and one medial or else it can be seen obviously where they have been broken off.

The first pleopod of the male of this species has not previously been figured. The pleopod is short, straight, broad and robust with setae anteriorly on the medial and lateral margins and on the sternal surface. The apex is nearly truncate with a small area of pale-brown chitin-like surface with a straight sternal edge. The aperture is indistinct but appears to lie on the sternal surface just below this straight, sharp edge.

The sixth segment of the male abdomen is about one and a half times as long and one and a half times as wide as the seventh segment. The abdomen of the adult female is triangular with seven free segments.

Distribution. — Restricted to Australia, southeast and south to southwest Australia.

Paratymolus pubescens Miers, 1879
(Fig. 7a-e)

Paratymolus pubescens Miers, 1879b:45-46, pl. 2 figs. 6, 6a, b. — Ortmann, 1893:35, pl. 3 figs. 2, 2i; 1894:38. — Rathbun, 1910:317. — Sakai,

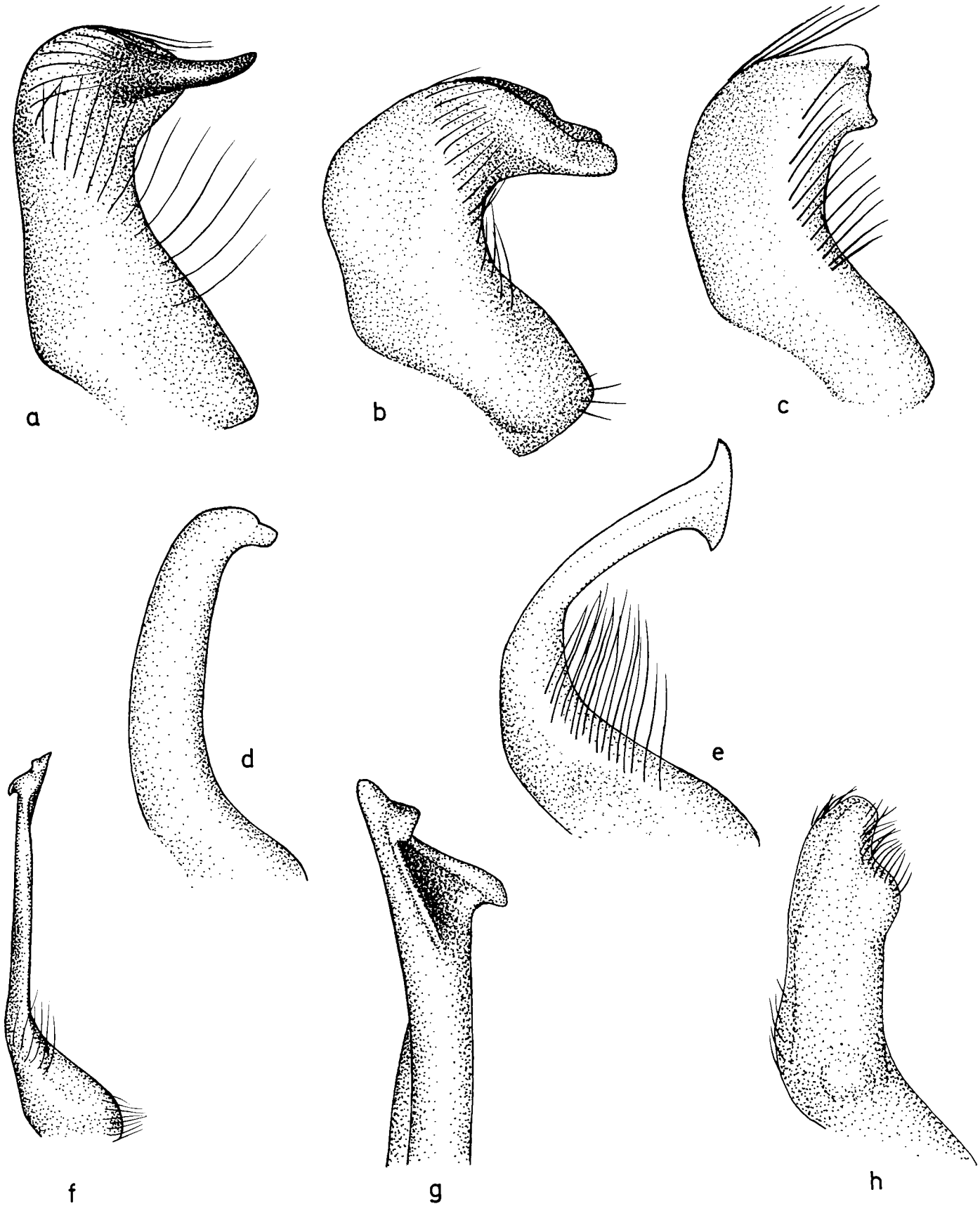

Fig. 7. *Paratymolus* '*pubescens*' group; left first pleopod of male, abdominal view: (a) 4.5 mm, Zamboanga, ZMC; (b) 4 mm, Salibabu I., ZMA; (c) 5.5. mm, Misaki, ZMC; (d) 3.5 mm, Singapore, ZMC; (e) 4 mm, Gulf of Thailand, ZMC. Left first pleopod of male of *P. sexspinosus* (6 mm, Aru, NIO Jakarta) (f) abdominal view of pleopod, (g) sternal tip of same; *P. latipes* (8 mm, AM P. 9400, in part) (h) abdominal view of pleopod.

1938:208-209, text fig. 4, pl. 21 fig. 1; 1965a:66, pl. 26 figs. 3, 4; 1976: 156-157, pl. 48 fig. 3. — Barnard, 1955:9-12, figs. 1, 2.

Material examined. — 5♂♂, 15♀♀ (7 ovig.), 3.5-6 mm, smallest ovig. ♀, 4 mm.

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'Siboga' Expedition: Stn. 49a, Sumbawa, Sapeh Strait, 08°23.5′S 119°4.6′E, 69 m, dredge, coral and shells, 14 April 1899; 1 spec. — Stn. 99, Sulu Archipelago, anchorage off North Ubian, 06°07.5′N 120°26′E, 16-23 m, dredge, townet, 28-30 June 1899; 1 spec. — Stn. 133, North 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. — Stn. 258, Kai Is., Tual anchorage, 22 m, reef exploration, dredge, *Lithothamnion*, sand and coral, 12/16 December 1899; 1 spec. — Aru Is., Jedan; 1 spec. — Banda; 3 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Siam Expedition: Singapore, 4-5 m, 4 December 1899; 1 spec. (det. M. Rathbun). — Gulf of Thailand, Koh Kahdat, 7-9 m, sand, stones, coral, 15-18 February 1900; 1 spec. (det. M. Rathbun). — Gulf of Thailand, Tung Kaben, 11 m, dredge, sand and mud, 22 February 1900; 1 spec. (det. M. Rathbun).

Mortensen Pacific Expedition: Philippine Islands, Zamboanga, 5-9 m, sand, 1 March 1914; 2 specs. — Japan, Misaki, Aburazebo, 5.5 m, dredge, 2 May 1914; 1 spec.

Mortensen Java — S. Africa Expedition: Stn. 8, Java, 08°23′S 114°24′E, ca. 50 m, trawl, dredge, hard bottom, 6 April 1929; 1 spec.

Singapore, low water, 12 December 1906; 1 spec. — Singapore, low water, 22 July 1907; 1 spec. — South India, Pamban Passage, 5 m, coll. H. Lemche, 9 October 1951; 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, 25-63 m, dredge hauls 8-19, sand, 2 June 1970; 1 spec. — Stn. KR VI, Kai Is., N of Nuhu Rowa, N of Du Rowa I., 05°32′S 132°41′E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 1 spec.

Remarks. — This species has been described and figured in some detail by Barnard (1955) and Sakai (1938; 1965a; 1976). Both Ortmann (1894) and Barnard suggest that *P. bituberculatus* Haswell 1880 is probably a synonym of *P. pubescens*. Barnard also regarded *P. hastatus* Alcock 1895 as probably belonging to this species. Takeda (1977) described and figured a specimen from the Ogasawara Islands which he identified as *P. bituberculatus* and which he distinguished from *P. pubescens* by the strong tubercle on the eave; more prominent hepatic tubercle directed obliquely forward; and a greater number of larger tubercles on the cheliped, including a large terminal tubercle on the upper border of the palm. The only first pleopod of the male figured for any of these three species is that given for *P. pubescens* by Barnard (1955: fig. 2).

In this present series of 20 specimens there are five males and fifteen females. In three of these males the first pleopod is short and broad and in two males the first pleopod is long and slender. Of the males in the short pleopod group—in one (N. Sulawesi) the apex of the pleopod tapers laterally as in the specimen figured as *P. pubescens* by Barnard; in one (Japan) the apex of the pleopod is truncate and lateral and agrees with that of a male from Japan (AM G.468, in part) in the collection of the Australian Museum identified as *P. pubescens*; and in the remaining one (Zamboanga) the apex bears a strong, laterally directed spine. Of the two males in the long pleopod group, one (Gulf of Thailand) has the pleopod apex broad and truncate, while in the other (Singapore) the pleopod apex is narrow and convex.

Such pleopod differences would normaly indicate five clearly distinguishable species. We have examined these specimens in detail to determine what other differences distinguish them and find very few. Between the two pleopod groups there are small differences in the number and size of tubercles on the dorsal margin of the branchial region, in the direction of the spine on the cheliped carpus and, with one exception, in the presence or absence of large teeth on the dactyls of the ambulatory legs. There are none of the differences one would expect to find in shape and ornamentation of the rostral lobes, supraorbital eave, hepatic lobes, carapace generally and adult male chela, features which distinguish *Achaeus* species from one another.

In all the specimens in this series there is a tubercle or a tuft of large setae on the supraorbital eave, a small tubercle on the margin behind the orbit, a larger tubercle on the margin of the hepatic region, and dorsally a protogastric tubercle. The rostral lobes are usually separated by a small notch. In many specimens there is, concealed within the groups of large setae, a small spinule which has not been figured or described by previous authors. Such a spinule is often present on the anterior margin of the rostral lobes, the apex of the hepatic tubercle and on the merus and carpus of the cheliped.

The characters of the male specimens with different kinds of pleopods are summarised in table form and then discussed in detail.

We consider first the specimens with the short male pleopod. In the specimen from N. Sulawesi and the two specimens from Japan there is a mesogastric and a cardiac tubercle on the midline, there are two to three low tubercles on the dorsal margin of the branchial region and one small submarginal tubercle laterally. The male from Zamboanga differs from these in having no mesogastric tubercle, the cardiac tubercle is very low and there are two small submarginal tubercles laterally on the branchial region. In these four males the long spine on the carpus of the cheliped is directed forward, or slightly upward, and concealed behind the palm of the chela. Ventrolaterally on the merus of the cheliped there are three tubercles in the males from Japan and Zamboanga, but four larger setae in the male from Sulawesi. In all four males there are low tubercles or groups of setae on the outer face of the palm but the anterodorsal angle is not strongly produced. In the males from Japan and Zamboanga the first ambulatory leg is about twice the carapace length and in the male from N. Sulawesi it is more than three times the carapace length. The dactyls of the ambulatory legs in the specimen from N. Sulawesi are armed ventrally with many minute teeth; in the specimens from Japan with minute teeth and two larger recurved teeth; in the specimen from Zamboanga with

	Japan (fig. 7c)	N. Sulawesi (fig. 7b)	Zamboanga (fig. 7a)	Singapore (fig. 7d)	Gulf of Thailand (fig. 7e)
first pleopod	short, broad	as for Japan		long, slender	as for Singapore
mesogastric tubercle	1	1	0	1	1
cardiac tubercle	1	1	1 very low	1	1
tubercles on branchial dorsal margin	2-3	2-3	2	4	4
tubercles on branchial submargin	1	1	2	1	1
cheliped carpus spine	obliquely forward, hidden	as for Japan		almost vertical, visible	as for Singapore
cheliped merus ventrolateral margin	3 tubercles	4 large setae	3 tubercles	3 curved spinules	3 curved spinules
anterodorsal angle of palm strongly produced	no	no	no	no	no
$\frac{\text{amb leg 1}}{\text{cl}}$	2	3	2	2	3
teeth on dactyls of amb. legs	minute and 2 larger recurved	minute	2 large recurved	2 large recurved	2 large recurved

two very large recurved teeth, the proximal longer than the height of the dactyl.

The two males from Singapore and Gulf of Thailand with long first pleopods are similar in several respects. Both have a mesogastric and a cardiac tubercle on the midline, four tubercles on a ridge on the dorsal margin of the branchial region and a small submarginal tubercle laterally. The long spine on the cheliped carpus is nearly vertical or directed slightly forward, but not hidden behind the palm of the chela. There are three curved spinules ventrolaterally on the cheliped merus, two to three spinules on the outer face of the palm but the anterodorsal angle of the palm is not produced into a large tubercle. The dactyls of the ambulatory legs are armed ventrally with two large recurved teeth, the proximal longer than the height of the dactyl and twice as long as the distal tooth. In the male from Singapore the first ambulatory leg is slightly more than twice the carapace length and in the male from the Gulf of Thailand it is about three times the carapace length. The second last segment of the abdomen is very broad, almost three times as wide as the last segment in the specimen from the Gulf of Thailand, but only about twice as wide as the last segment in the specimen from Singapore.

Of the females in this series there are only three which we are able to confidently consider as conspecific with a particular male — one female conspecific with the male from Zamboanga and collected at the same station; the female registered with the male from Japan (AM G.468); and a female from the Gulf of Thailand which appears to be conspecific with the male from there. There are thirteen females from eleven stations which we do not feel confident in assigning to any of the males described. Five of these specimens (from Singapore, Java Sea, Sapeh Strait, South India) agree with each other in having a large mesogastric tubercle; a distinct row of three or four tubercles on the dorsal branchial margin; and the long spine on the cheliped carpus somewhat curved upwards, but not vertical. In these points they resemble the males from the Gulf of Thailand and Singapore and three of these females (from Singapore and South India) have two large recurved teeth on the ambulatory dactyls but cannot be assigned with certainty to either species represented by these males. The female from Sapeh Strait differs in having small teeth on the ambulatory dactyls and the specimen from Java Sea has the ambulatory legs missing.

Six of the females (from Aru, Kai Islands and Banda) agree with each other in having a small or indistinct mesogastric tubercle; one or two indistinct tubercles on the dorsal branchial margin; the long spine on the cheliped carpus horizontal and concealed behind the palm; and very small straight teeth with one or two slightly larger recurved teeth on the ambulatory dactyls. In these points they are similar to the males from N. Sulawesi and Japan but again there are insufficient distinguishing characters to assign them to either.

In two of our females (from Sulu Archipelago and Ceram) the mesogastric tubercle is small or indistinct; there are one or two low tubercles dorsally on the carapace margin; the spine on the cheliped carpus is nearly vertical and the teeth on the ambulatory dactyls are small. In these respects these specimens resemble the specimen from east Africa figured by Barnard. In the specimen from Ceram the ambulatory legs are longer (amb. leg 1 = 3 × cl.) than in the specimen from Sulu Archipelago (amb. leg 1 = 2 × cl.).

In this series of specimens the chela is more elongate in the female than in the male, the fingers are equal to the length of the palm in the female, while in the male the fingers are shorter (about 0.8) than the palm. In the females the cheliped and ambulatory legs are shorter in relation to the carapace length than they are in the male.

We feel there is no good purpose to be served in trying to assign these specimens to previously described species or to describe new species from this small and confusing sample of material. The relationships within the genus and the relationship of *Paratymolus* to other genera need to be studied more thoroughly. Beyond that, it is even possible that this genus should not be included in the Majidae because of the unusual pleopods of the males. Two other species of this genus *P. latipes* Haswell and *P. sexspinosus* Miers, discussed separately, are clearly distinguished by their smooth dorsal carapace from the specimens we have discussed under *P. pubescens*. The first pleopod of the male of *P. latipes* is short and broad, while that of *P. sexspinosus* is long and slender.

A female of *P. bituberculatus* Haswell was recently reported from Japan by Takeda (1977), but until a male specimen and its first pleopod are adequately described we feel the status of this species is uncertain.

Distribution. — This species (or group of species) is widely distributed throughout the Indo-West Pacific. (The distribution of any contained individual species is uncertain.)

Paratymolus sexspinosus Miers, 1884
(Fig. 7f, g)

Paratymolus sexspinosus Miers, 1884:261-262, pl. 27 fig. B. — Sakai, 1938: 209, pl. 21 fig. 2; 1976:157, pl. 48 fig. 2. — Griffin, 1966b:276 (in key).

Material examined. — 3♂♂, 2♀♀ (1 ovig.), 4-7.5 mm, ovig. ♀, 6.5 mm.

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Mariel King Memorial Expedition — Moluccas: Stn. A III, Aru, Trangan, 3-4 miles (∿ 5-6.5 km) W Tg. Lelar, 06°46′S 133°58′E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 3 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

Western Australia: Broome, near entrance to Roebuck Bay, 9-11 m, dredge, coll. A. A. Livingstone, 26 September 1929; 1 spec. (AM P.13985). — 2 miles (∿ 3 km) S of Carnarvon, 7.5 m, on algae, coll. N. Coleman, 17 June 1972; 1 spec. (AM P.25101).

Remarks. — This species is distinguished from *P. pubescens* Miers by its smooth carapace without gastric, cardiac or branchial tubercles and from *P. latipes* Haswell by the presence of two blunt tubercles, not three sharp spines, on the anterolateral margin behind the orbit. The anterior margin of each rostral lobe is convex and there is a very small spine or tubercle on the lateral margin at the base of the curve in our specimens. This is clearly different from the rostral lobe of *P. latipes* in which the anterior margin is truncate with a spine at both the medial and lateral angles.

The first pleopod of the male of this species has not previously been figured. The pleopod is slender and straight, the apex obliquely truncate, with the medial angle produced into a ventrally curved lobe. The aperture is subterminal on the medial surface behind the lobe. This kind of pleopod is quite different from that in *P. latipes* where the first pleopod is broad and short.

The seventh segment of the male abdomen is small, only about a third as long and half as wide as the sixth segment. The abdomen of the adult female is triangular with seven free segments.

Distribution. — Japan, Aru Islands, NE and NW Australia, south India.

Physachaeus Alcock, 1895

Type species. — *Physachaeus ctenurus* Alcock, 1895, by present designation.

Remarks. — Only two species of this genus are known, *P. ctenurus* and *P. tonsor*, both described by Alcock. *Achaeus* (?) *longipes* Capart, from the Atlantic, which was tentatively included in this genus by Monod (1956) and others, has now been placed by Manning & Holthuis (1981) in a new genus *Capartiella*. *Physachaeus* species are distinguished from *Capartiella longipes* by the short almost immovable eyestalks and the double rostrum.

P. ctenurus is the better known species and is therefore chosen as the type species of the genus, neither Alcock nor subsequent authors having made any designation.

Distribution. — Indo-West Pacific.

Physachaeus ctenurus Alcock, 1895
(Fig. 8, 15f, g)

Physachaeus ctenurus Alcock, 1895:175-176, pl. 3 figs. 2, 2a-b. — Doflein, 1904:71-72, pl. 24 figs. 1-4, pl. 42 figs. 1-7. — Kemp & Sewell, 1912:30.

Material examined. — 1♂, 4♀♀ (3 ovig.) 6.5-8.5 mm, smallest ovig. ♀, 8.0 mm.

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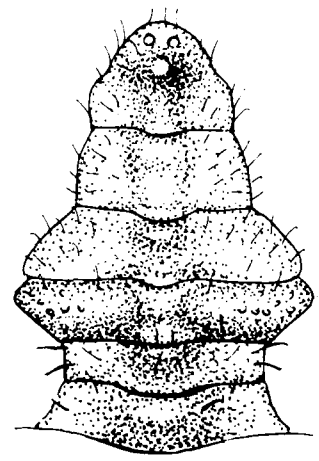
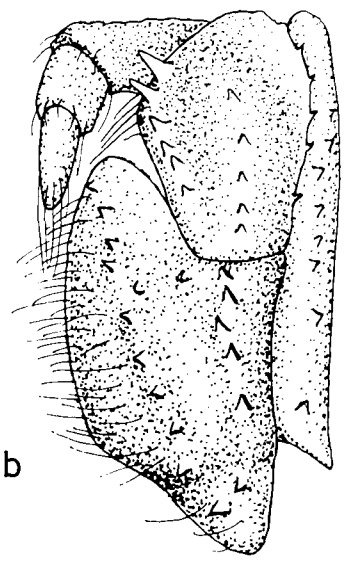
Andaman Sea, 450 m; 1 spec.

Mortensen Pacific Expedition: Mindanao, 7 miles (∿ 11 km) S of Olutanga, ca. 540 m, trawl, 8 March 1914; 1 spec. — Japan, 16 miles (∿ 26 km) W by S of Bonomisaki 360 m, trawl, 13 May 1914; 2 specs.



a



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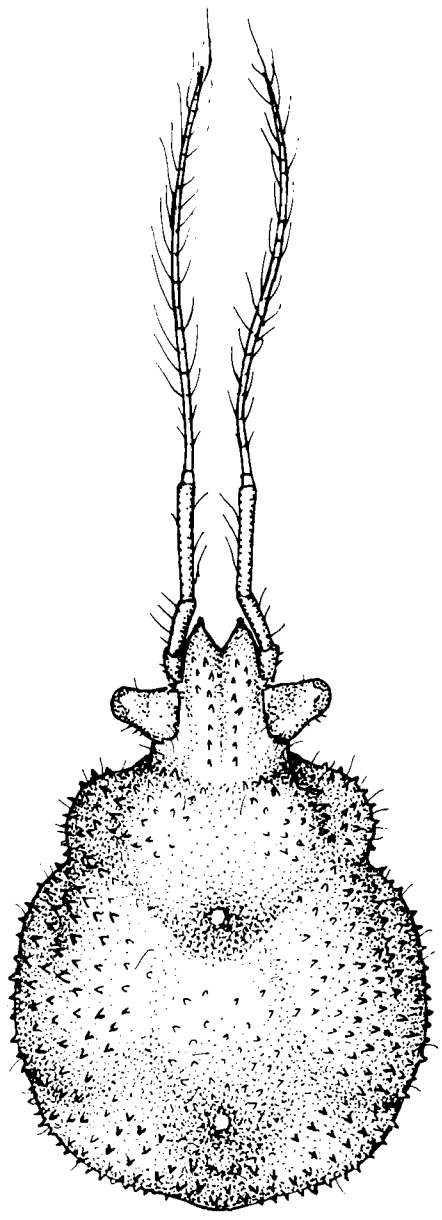

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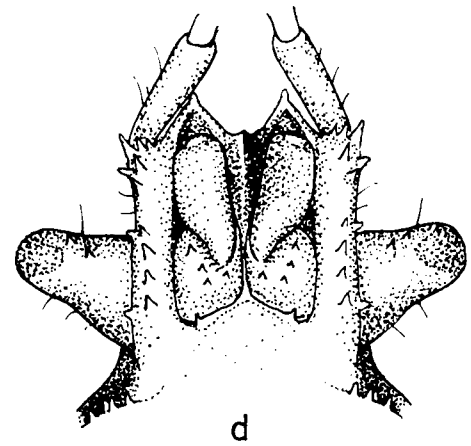

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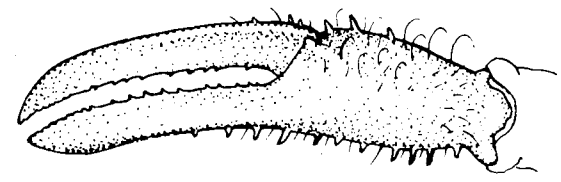

e

Fig. 8. *Physachaeus ctenurus* (male, 6.5 mm, Japan, ZMC) (a) male abdomen; (b) left third maxilliped; (c) carapace, dorsal view; (d) orbits, ventral view; (e) left chela.

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Andaman Sea, 428-495 m, 'Investigator'; 1 spec. (AM P.2688).

Remarks. — These specimens agree well with those figured and described by Alcock and by Doflein and with type material (1 ♂, 1 ovig. ♀, 7.3, 8.3 mm, Andaman Sea, BMNH 96.5.14.8) examined by one of us (Griffin in 1970). In all our specimens there is a blunt protogastric tubercle, a short mesogastric spine and a longer cardiac spine with a low transverse tubercle on the posterior slope. In the male specimen the apex of the rostral lobes exceeds the distal margin of the basal antennal article, but in all the female specimens the apex is level with the distal margin. The basal antennal article is not completely smooth in any of the

specimens: there are at least some granules and sometimes spines along the length of the basal antennal article in all the specimens. Alcock describes the distal end of the basal antennal article as fused to the rostral lobes. However, it is not actually fused as it is in *Achaeus*: the distal end of the basal antennal article is broadened and simply overlaps the rostral lobe dorsally, also being partly secured there by the spinulous lobe in front of the orbit. In the Japanese specimens the distal end of the basal antennal article is quite free and adjacent to the rostral lobe.

The first pleopod of the male is broad, curving only weakly outwards distally, the apex is blunt with a subterminal aperture on the medial edge of the abdominal surface and with a small flap on the proximal margin of the aperture. In our male specimen the tip of the pleopods is not covered by the last segments of the abdomen.

The abdomen of the female has the last three segments coalesced with a suture visible in the midline between the fifth and sixth segments; the narrow medial ridge terminates in a tubercle or short spine, in front of which is a transverse row of four small spines; beyond this row of spines the abdomen is abruptly curved dorsally.

Our specimens from Mindanao and Japan differ from those from the Andaman Sea in width of the rostral lobes, length of the basal antennal article and degree of spinulation. In our specimens from the Andaman Sea the basal antennal article is long (length is 7 to 8 times width) and the ventral interorbital area (between the lateral margins of the basal antennal articles) narrows anteriorly to about three quarters (0.7 to 0.8) of the proximal width. In the Pacific specimens, especially those from Japan, the basal antennal article is not so long (length is 5 to 6 times width) and the ventral interorbital area is almost square and does not narrow anteriorly. The rostral lobes of our specimens from the Andaman Sea are basally narrow and hardly tapering; they are separated by a narrow U-shaped hiatus and there is a deep narrow groove between the rostral ridges. The rostral lobes of the specimens from Japan are broad, triangular, separated by a wide V-shaped hiatus and there is a broad, shallow groove between the rostral ridges. The Japanese specimens are more spinulous than the specimens from the Andaman Sea, and also somewhat more spinulous than the specimen from Mindanao. In the Japanese specimens there are well developed spinules along the length of the basal antennal article, there are also spinules on the basal segment of the antennule, on the posterior margin of the antennal fossa and ventrally on the eyestalk. In both the male and immature female from Japan there is a row of spinules on the first sternite, across the anterior margin of the abdominal fossa, and there are also spinules on the midline.

This species was previously known only from the Indian Ocean and these specimens extend the range to the west Pacific. We are unable to say, from the study of the small number of specimens we have on hand whether there are consistent differences between populations in various parts of the total geographic range, as now known, which would warrant the recognition of distinct species. We have figured the male specimen from Japan.

Distribution. — East coast of Africa, SW coast of India, Andaman Sea, Nicobar Islands, Sumatra, Philippine Islands, Japan.

Platymaia Miers 1886

Type species. — *Platymaia wyvillethomsoni* Miers, 1886, by monotypy.

Remarks. — Like *Cyrtomaia* this genus is principally West Pacific. Of the six species only *P. turbynei* and *P. alcocki* occur in the Indian Ocean. Most confusion between species has concerned *P. wyvillethomsoni, P. remifera* and *P. alcocki*. One species was described from New Zealand in 1963, the first to be added to the genus since 1916 when Rathbun added three to the Philippines Indonesian fauna. However, it is possible that a further species remains to be described from Australia and New Zealand: an intensely spinous species quite different from *P. fimbriata*.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *PLATYMAIA*

1 Carapace surface granular or smooth, with or without a few small spines or tubercles; carapace usually subcircular.....2
\- Carapace surface spinulous or with at least 10 prominent spines; carapace usually subpyriform 5
2 (1) Interantennular spine well over twice length of rostral spines, rostral spines longer than postorbital spine 3
\- Interantennular spine no more than $1^1/_2$ times length of rostral spines, rostral spines equal to or shorter than postorbital spine 4
3 (2) A transverse row of 3 spines on gastric regions, mesogastric spine at same level as protogastric spines; branchial regions inflated posteriorly; first segment of abdomen of male with a single spine.....*P. maoria*
\- Mesogastric spine at a level posterior to protogastric spines; branchial regions not inflated posteriorly; first segment of abdomen in male with 3 spines in a transverse row .....*P. bartschi*
4 (2) Protogastric ridge running forward on each side of midline bearing one or two spines as well as tubercles; branchial regions separated from mesogastric region by shallow groove, not approximated in midline; palm of chela of male no more than $1^1/_2$ times height .....*P. wyvillethomsoni*
\- Protogastric ridge tuberculate, lacking spines; groove on each side of mesogastric region deep, branchial regions approximated in midline; palm of chela of male at least twice as long as high.....*P. alcocki*
5 (1) Carapace with numerous small spines in addition to larger spines; postorbital spine subequal to rostral spines; interantennular spine $2^1/_2$ to 3 times length of rostral spines.....*P. fimbriata*
\- Carapace surface smooth between major spines; postorbital spine greatly reduced, much smaller (0.25) than rostral spines; interantennular spine no more than twice length of rostral spines.....*P. turbynei*

Platymaia bartschi Rathbun, 1916
(Fig. 10e, f, Pl. 4a)

Platymaia bartschi Rathbun, 1916:529-530. — Sakai, 1965b:39, 43, Frontispiece 3; 1976:176, pl. 56. — Griffin, 1976:205.

Material examined. — 3 ♂♂, 59.5-65 mm, 1 juv. ♀, 16 mm.

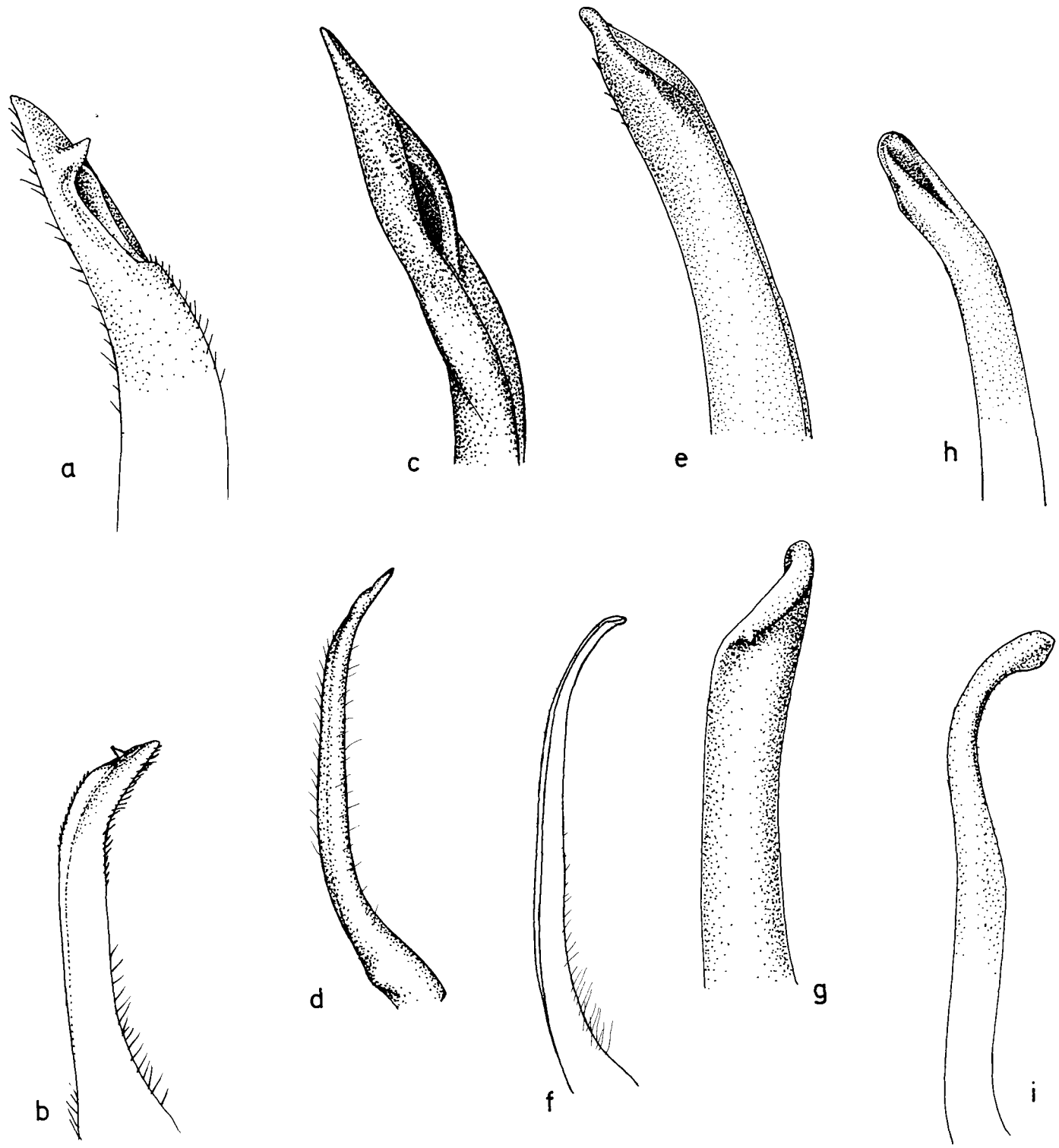

Fig. 9. Left first pleopod of male of *Pleistacantha cervicornis* (25 mm, New Caledonia, ZMC) (a) sternal tip of pleopod, (b) abdominal view of same; *Ephippias endeavouri* (114.5 mm, AM P.15991) (c) sternal tip of pleopod, (d) abdominal view of same; *Cyrtomaia suhmi* (AM P. 21572) (e) sternal tip of pleopod, (f) abdominal view of same, (g) abdominal tip of same; *C. murrayi* (WAM 13-67) (h) sternal tip of pleopod, (i) abdominal view of same.

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South China Sea, 16°09′N 114°31′E to 16°11′N 114°28′E 266-295 m, Granton trawl, fine, white, muddy sand, Fisheries Research Station Hong Kong, 12 June 1964; 1 spec. (AM P.20245). — South China Sea, 16°10′N 114°29′E to 16°11′N 114°26′E, 302-306 m, Agassiz trawl, fine, white, muddy sand, Fisheries Research Station Hong Kong, 12 June 1964; 1 spec. (AM P.20244). — South China Sea, 21°12′N 116°06′E to 21°13′N 116°02′E, 274-284 m, Granton trawl, sandy mud, Fisheries Research Station Hong Kong, 23 August 1964; 1 spec. (AM P.20246). — South China Sea, 20°06′N 115°04′E to 20°04′N 115°03′E, 454-461 m, Agassiz trawl, sandy mud, Fisheries Research Station Hong Kong, 22 August 1964; 1 spec. (AM P.20247).

Remarks. — This species is similar to *Platymaia wyvillethomsoni* and *P. alcocki* but may be distinguished by the following characters:-

a) the greater length (more than twice) of the interantennular spine in relation to the rostral spines; in *P. wyvillethomsoni* the interantennular spine is one and a half times the length of the rostrum and in *P. alcocki* equal to the rostrum;
b) the rostral spines are straight, weakly divergent and not broad basally;
c) the margins of the supraorbital eave are smooth—without spines, spinules or tubercles—and parallel to each other;
d) the gastric regions are strongly elevated, and the protogastric ridges are low, smooth or with very low tubercles, without prominent spines or tubercles;
e) the apex of the tip of the first pleopod of the male is directed laterally, not curved up as in the other two species.

The characters which distinguish *P. bartschi* and *P. maoria* Dell are discussed under that species.

The juvenile male in our series agrees well with juvenile specimens from the same area identified as *P. bartschi* by Rathbun (USNM, 47340, 26 juv.). Juveniles have twelve prominent carapace spines as well as spines on the lateral branchial margin. In the adults these spines are represented only by tubercles or are absent altogether. On the gastric regions there are two mesogastric spines, one anterior protogastric spine and two small spinules in front of it and almost on the edge of the orbit. There are two spines on the cardiac region: an anterior and posterior spine and a lateral spine on the intestinal region.

Distribution. — Philippine Islands, South China Sea, Japan.

Platymaia fimbriata Rathbun, 1916
(Fig. 10i, j)

Platymaia fimbriata Rathbun, 1916:531-532. — Ihle & Ihle-Landenberg, 1931:149-152. — Sakai, 1965b:39, 43, pl. 5 fig. 5; 1976:177-178, pl. 58. — Takeda & Miyake, 1969:497-498. — Griffin, 1976:206, fig. 9.

Material examined. — 6♂♂, 11♀♀ (8 ovig.), 14.5-51 mm, smallest ovig. ♀, 34.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn 38, Bali Sea, 07°35.4′S, 117°28.6′E, 521 m, trawl, coral, 1 April 1899; 4 specs (ZMA De. 100.622, det. Ihle). — Stn 178, Ceram Sea, 02°40′S. 128°37.5′E, 835 m, deep sea trawl, blue mud, 2 September 1899; 1 spec. (ZMA De. 100.623, det. Ihle). — Stn 262, Kai Is, 05°53′S 132°48.8′E, 560 m, trawl, solid bluish grey mud, upper layer more liquid and brown mud, 18 December 1899; 1 spec. (ZMA De. 100.452, det. Ihle).

THE AUSTRALIAN MUSEUM, SYDNEY

F.R.V. Kapala: New South Wales: Off Point Danger, 28°06′S 153°59′E to 27°59′S 153°59′E, 405 m, trawl, 2 June 1978; 2 specs (AM P.29938). — Off Point Danger, 28°01′S 154°0′E to 27°58′S 154°0′E, 540 m, trawl, 17 August 1978; 1 spec. (AM P.29939). — NE of Wooli, 29°52′S 153°43′E to 29°46′S 153°45′E, 495 m, trawl, 10 October 1975; 3 specs (AM P.21689); 1 spec. (AM P.21797). — E of Clarence River, 29°26′S 153°49′E to 29°20′S 153°50′E, 450 m, trawl, 12 October 1975; 1 spec. (AM P.21693). — E of Wooli, 29°52′S 153°43′E to 29°51′S 153°43′E, 495 m, trawl, 23 August 1977; 3 specs (AM P.29946).

Remarks. — The specimens from ZMA were described by Ihle & Ihle-Landenberg (1931). The specimens from Australian waters agree with those previously described, though in a few of these specimens the carapace is less spinulous and on the dorsal surface of the third and fourth pairs of ambulatory legs there are only granules and a few very small spines. The interantennular spine is curved downwards at the apex. The previously known range of this species is extended.

Distribution. — Eastern Australia, Indonesia, Philippine Islands and Japan.

Platymaia maoria Dell, 1963
(Fig. 10g, h, Pl. 5a)

Platymaia maoria Dell, 1963:247-251, figs 4-13.

Material examined. — 9♂♂, 3♀♀ (3 ovig.), 38-59.5 mm, smallest ovig. ♀, 52.5 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

F.R.V. Kapala: New South Wales: Off Point Danger, 28°06′S 153°59′E to 27°59′S 153°59′E, 405 m, trawl, 2 June 1978; 1 spec. (AM P.29943): 3 specs. (AM P.29944). — Off Point Danger, 28°01′S 154°0′E to 27°58′S 154°0′E, 540 m, trawl, 17 August 1978; 3 specs. (AM P.29942). — E of Clarence river, 29°26′S 153°49′E to 29°20′S 153°50′E, 450 m, trawl, 12 October 1975; 1 spec. (AM P.21692). — NE of Wooli, 29°41′S 153°45′E to 29°32′S 153°47′E, 495 m, trawl, 10 October 1975; 1 spec. (AM P.21694); 1 spec. (AM P.21798). — E of Wooli, 29°52′S 153°43′E to 29°51′S 153°43′E, 495 m, trawl, 23 August 1977; 1 spec. (AM P.29945). — Off Cape Hawke, 32°15′S 153°02′E, 450 m, trawl, 5 April 1978; 1 spec. (AM P.29941).

Remarks. — These specimens agree well with the original description. This species is distinguished from *P. wyvillethomsoni* by the mesogastric spine which is level with the protogastric spine (not posterior to it) and forms a transverse row of three spines; there is one spine, not three, on the first abdominal segment of the male; the tip of the first pleopod of the male is directed laterally and straight (not abruptly curved forward); the eyes (cornea) are proportionately larger (length about $^3/_4$ interorbital width, not less than 2/3 as in *P. wyvillethomsoni*); and the branchial region is more inflated laterally, especially posteriorly. (The presence or absence of a marginal spine on the supraorbital eave is not a reliable character for distinguishing *P. wyvillethomsoni*.)

This species is distinguished from *P. bartschi* by the presence of a transverse row of three spines on the gastric region; the absence of a weakly tuberculate protogastric ridge; the presence of one spine not three on the first abdominal segment of the male; and by having distinct spines rather than tubercles on the carapace.

In *P. turbynei* there is a similar transverse row of three spines on the gastic region, but the carapace surface in that species is quite smooth (not granular) and the carapace is clearly longer than broad.

This species was previously known only from New Zealand.

Distribution. — New Zealand, eastern Australia.

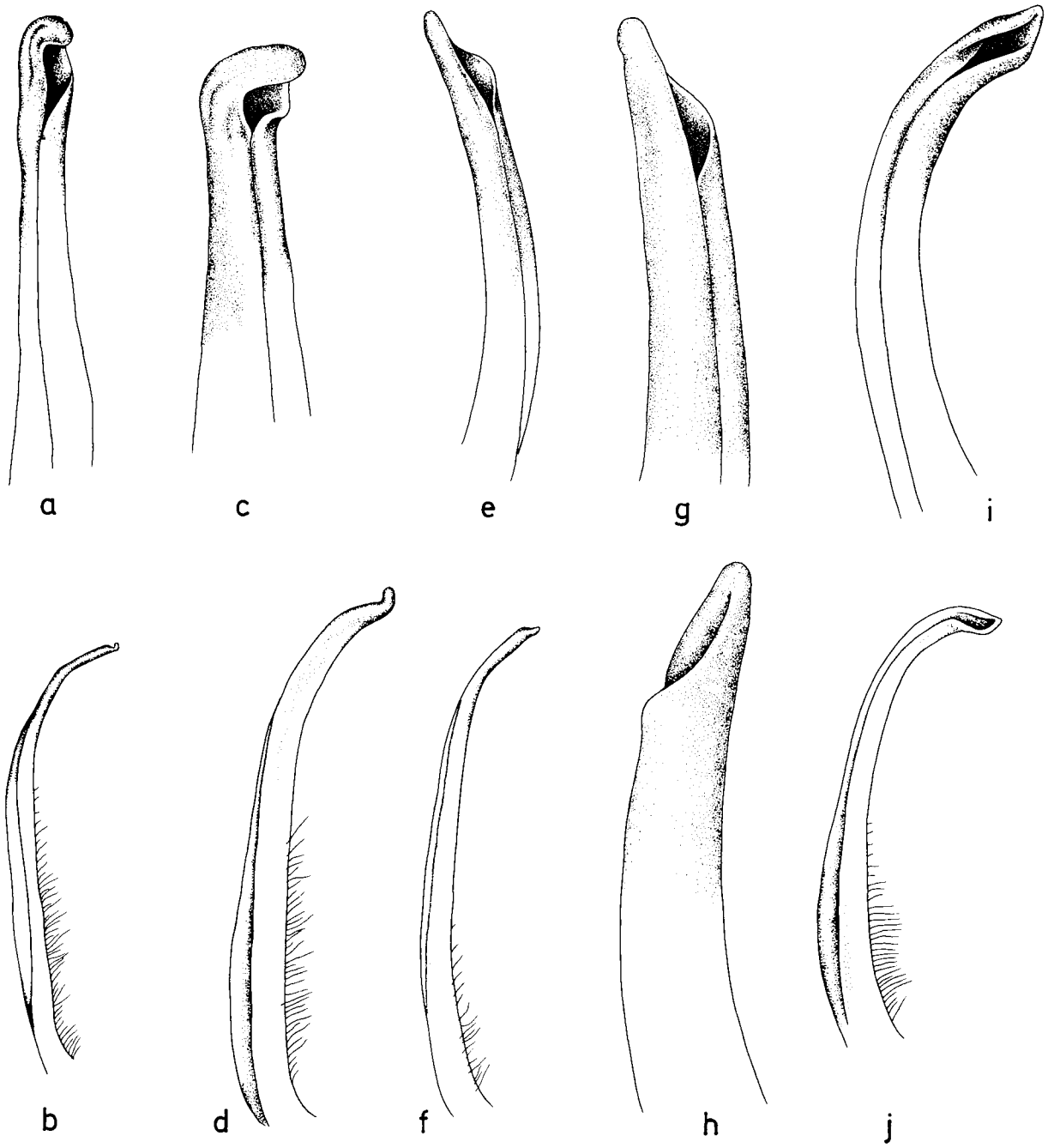


Fig. 10. Left first pleopod of male of *Platymaia alcocki* (62.5 mm, AM P.17794) (a) sternal tip of pleopod, (b) abdominal view of same; *P. wyvillethomsoni* (35 mm, AM P. 20744) (c) sternal tip of pleopod, (d) abdominal view of same; *P. bartschi* (65 mm, AM P. 20245) (e) sternal tip of pleopod, (f) abdominal view of same; *P. maoria* (38 mm, AM P.21694) (g) sternal tip of pleopod, (h) abdominal tip of same; *P. fimbriata* (32.5 mm, Ceram Sea, ZMA De. 100.623) (i) abdominal tip of pleopod, (j) abdominal view of same.

Platymaia wyvillethomsoni Miers, 1886 (Fig. 10c, d, Pl. 5b)

Platymaia wyvillethomsoni Miers, 1886:13-14, pl. 2 fig. 1. — Rathbun, 1918:7-9, pls. 3, 4, 14. — Ihle & Ihle-Landenberg, 1931:148-149. — Miyake, 1936:417-418, fig. 1, pl. 28 fig. 3. — Sakai, 1938:238-239, pl. 24 fig. 2.

Platymaia remifera Rathbun, 1916:530-531. — Serène & Lohavanijaya, 1973:48-49, figs. 79-92, pl. 8A-C.

Platymaia alcocki. — Seno & Konno, 1954:85-88, fig. 1, pl. 2. — Takeda & Miyake, 1969:498-500, figs. 10a, b, 11a-c. — Sakai, 1976:176-177, fig. 94a, pl. 57. (Not *Platymaia alcocki* Rathbun, 1916.[9])

Platymaia wyvillethomsoni. — Griffin, 1976:206, 208. — Sakai, 1976:177, text-fig. 94b.

Material examined. — 19♂♂, 18♀♀ (2 ovig.), 15-51.5 mm, 1 juv. 9 mm, smaller ovig. ♀, 32.5 mm.

[9]) The name *alcocki* was first used in 1916 although Rathbun (1918) cites the name as a *nom. nov.*

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 12, Bali Sea, 07°15′S 115°15.6′E, 289 m, trawl, mud and broken shells, 14 March 1899; 1 spec. (ZMA De.100.675, det. Ihle). — Stn. 139, Moluccas, 00°11′S 127°25′E, 397 m, trawl, mud, stones and coral, 4 August 1899; 1 spec. (ZMA De.100.636, det. Ihle).

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Philippine Is., 25 miles (40 km) E by S of Zamboanga, 290-360 m, Sigsbee trawl, 3 March 1914; 1 spec. — Philippine Is., 15 miles (24 km) W ½S of Jolo, 450 m, Sigsbee trawl, soft bottom, 27 March 1914; 6 specs. — Near Nagasaki, 9 miles (~ 14 km) W by N ½N of Bonomisaki, 243 m, trawl, 13 May 1914; 1 spec. — Japan, 23 miles (~ 37 km) NW ¾W of Goto, 32°49′N 128°14′E, 207 m, trawl, sand, 14 May 1914; 1 spec. — Japan, ca. 32°17′N 128°11′E, 198 m, trawl, sand, 14 May 1914; 2 specs.

Mortensen Java — S. African Expedition: Stn. 15, Bali Sea, 07°29′S 114°49′E, ca.240 m, Sigsbee trawl, sand and mud with concretions, 10 April 1929; 2 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

South China Sea: 19°09′N 112°31′E, 184-194 m, prawn trawl, hard sand, University Hong Kong Fisheries Research Unit, 22 July 1958; 2 specs. (AM P.20242). — South China Sea, 16°09′N 114°31′E to 16°11′N 114°28′E, 266-295 m, Granton trawl, fine, white, muddy sand, Fisheries Research Station Hong Kong, 12 June 1964; 1 spec. (AM P.20243).

Queensland: SE Noosa Heads, 26°33′S 153°50′E, 270 m, coll. A. J. Bruce, F. V. Nimbus, Stn. 13, 27 July 1968; 2 specs. (AM P.17882). — SE Noosa Heads, 26°27′S 153°50′E, 266 m, coll. A. J. Bruce, F. V. Nimbus, Stn. 55, 5 August 1968; 1 spec. (AM P.17881).

New South Wales: E of Kiama, 34°38′S 151°15′E to 34°46′S 151°13′E, 450-432 m, trawl, F.R.V. Kapala, 30 June 1975; 1 spec. (AM P.20744). — SE of Coffs Harbour, 30°26′S 153°24′E to 30°20′S 153°26′E, 263-252 m, trawl, F.R.V. Kapala, 14 October 1975; 1 spec. (AM P.21695). — Off Port Stephens, 32°33′S 152°53′E to 32°30′S 152°53′E, 360 m, F.R.V. Kapala, 29 March 1978; 1 spec. (AM P.29940).

Western Australia: Great Australian Bight, 33°18′S 127°19′E to 33°20′S 127°29′E, 300-310 m. otter trawl, coll. J. Paxton, 'Dmitry Mendeleev', 27 February 1976; 14 specs. (AM P.21955).

Remarks. — Japanese authors (e.g. Sakai, 1976) still use the presence or absence of a small spine proximally on the supraorbital eave as the basis for distinguishing *P. wyvillethomsoni* from *P. alcocki* Rathbun. However, it has been shown previously (Griffin, 1974; 1976) that this is not a reliable character for distinguishing the two species. Other characters of *P. alcocki*, referred to by Rathbun (1916:530)—the approximation of the branchial regions in the midline; the interantennular spine subequal to the rostral spines; the palm of the chela more than twice as long as high—have proved to be much more reliable in distinguishing that species from *P. wyvillethomsoni*. Of the 37 specimens in this series 13 are without any spine on the supraorbital eave while the rest, including 14 small specimens (15-18 mm) from the Great Australian Bight, have a small tubercle or spinule on the orbit. Of the 66 specimens from the Philippine Islands reported previously (Griffin, 1976) 27 have a spine of some sort on the supraorbital eave. Of 10 specimens of *P. alcocki* from the Indian Ocean (Griffin, 1974) all but the three smallest specimens have one to five spinules or small tubercles laterally on the supraorbital eave.

The two species can be distinguished by the following characters: —

Character	*P. wyvillethomsoni*	*P. alcocki*
Interantennular spine	1½ × rostral spines	equal to rostral spines
Protogastric region	2 spines or 1 spine & anterior tubercle	tubercular ridge without spines
Branchial regions	not approximating in midline; no ridge between dorsal tubercles	approximating in midline; ridge between dorsal tubercles
Palm of adult male chela	dorsal length = 1½ × height	dorsal length more than twice height.
Seventh segment female abdomen	free edge without medial notch	free edge with medial notch
cl. ovigerous females	24-38 mm	58-65 mm

We have figured the carapace, first left pleopod and chela of the male of *P. alcocki* (Pl. 4b; figs. 10a, b; 11c).

It is quite clear from the very large series of specimens we have examined that *P. wyvillethomsoni* is a western Pacific species and that *P. alcocki* occurs in the Indian Ocean.

Distribution. — West Pacific from South Australia through Indonesia and the Philippine Islands to Japan.

Pleistacantha Miers, 1879

Type species. — *Pleistacantha sanctijohannis* Miers, 1879, by monotypy.

Remarks. — In this genus the basal antennal article is very slender and not fused distally to the carapace. There is a well developed, usually bifid, interantennular spine, and in addition to the rostral spines there is a short spine at or near the apex of each antennular fossa. The first pleopod of the male has a subterminal aperture near the medial edge and in five species there is a slender process just in front of the aperture.

P. terribilis Rathbun is here shown to be a synonym of *P. cervicornis* Ihle & Ihle-Landenberg. The sub-species *P. sanctijohannis erecta* described by Ihle & Ihle-Landenberg and elevated to a species by Guinot & Richer de Forges (1982a) is not given status by us.

All of the type material of the new *Pleistacantha* species described in 1931 by Ihle & Ihle-Landenberg (*P. cervicornis*; *P. sanctijohannis erecta*) from the 'Siboga' Expedition could not be located when this study was commenced and due to a misunderstanding we were not informed when it was eventually located. This material has been studied by Guinot & Richer de Forges (1982a).

When Miers (1886) described *Ergasticus naresii* from the Admiralty Islands he placed it in the genus *Ergasticus* on the basis of the rostral spines only having accessory spines near the base; the female abdomen having six, not seven, free segments and the merus of the third maxilliped being produced and rounded at the anterolateral angle. The type and only other species of the genus *Ergasticus* is *E. clouei* Studer,

1883 from the Mediterranean. Some later authors (Doflein 1904; Bouvier, 1922) regarded the genus *Ergasticus* as synonymous with *Pleistacantha* while others (Ihle & Ihle-Landenberg, 1931; Balss, 1957) regarded *E. naresii* as belonging to *Pleistacantha* and *E. clouei* as representing a distinct genus. Bouvier (1940) has retained both species in *Ergasticus*. The characters of *E. naresii* which Miers listed as distinguishing that species from *Pleistacantha* are also found in other species of the latter, expanded, genus as it is presently known or are characters which are very variable within the genus. In *P. simplex* Rathbun there are no spines, only a few long setae, on the rostral spines above the base; there are only six free abdominal segments in the females of *P. sanctijohannis*, *P. cervicornis* and *P. exophthalmus* Guinot & Richer de Forges and the degree to which the anterolateral angle of the third maxilliped is produced varies from narrow to broadly triangular. The interantennular spine is undivided in *E. naresii, P. cervicornis* and *P. exophthalmus* while in other species it varies from basally divided (*P. simplex*) to apically bifid (*P. japonica* (Yokoya)). One of us (D. J. G. G.) has examined the holotype of *Ergasticus naresii* (♀, cl. 9.0 mm, BMNH 84.31): we believe that the distinctions made by Miers do not justify placing this species in a separate genus and that it should be included in *Pleistacantha*.

The first pleopod of the male of *E. clouei* also has a narrow process just in front of the subterminal aperture. In *E. clouei* the carapace is smooth between the spines, the antennular fossa is surrounded by a rim and the accessory spine at the base of the rostral spine does not arise from the edge of the fossa.

Two species of *Pleistacantha* are widespread throughout the Indo-West Pacific while the other six species appear to be restricted to the West Pacific.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *PLEISTACANTHA*

1 Interantennular spine simple 2
- Interantennular spine bifurcate at least apically 4
2 (1) Carapace granular with about 9 longer spines; rostral spines with only 1 or 2 accessory spines near the base ..... *P. naresii*
- Carapace and legs densely covered by long spines and spinules; rostral spines each with at least 4 long accessory spines along their length 3
3 (2) Rostral spines at least 1/3 postrostral carapace length, clearly exceeding interantennular spine ..... *P. cervicornis*
- Rostral spines less than 1/4 postrostral carapace length, subequal to interantennular spine ..... *P. exophthalmus*[10])
4 (1) Rostral spines adjacent in proximal half or more; carapace spinulous with a few prominent spines dorsally and on anterior and posterior branchial margins ..... *P. sanctijohannis*
- Rostral spines separate from base; carapace spinulous, sometimes with a few prominent spines but not on posterior branchial margin ... 5
5 (4) Rostral spines short, about 1/4 postrostral carapace length with 2 or 4 accessory spines including those at the base 6
- Rostral spines at least 1/3 postrostal carapace length with 9-12 accessory spines including those at the base 7
6 (5) Interantennular spine bifid from the base; rostrum with accessory spines only at the base; carapace surface with sharp tubercles or short spines, but no prominent spines ..... *P. simplex*
- Interantennular spine bifid at the tip; rostrum with accessory spines beyond the base; carapace surface spinulous with a few more prominent spines ..... *P. japonica*[10])
7 (5) Interantennular spine usually bifid for no more than distal third; spines of carapace including several prominent ones on gastric, cardiac and branchial region; size intermediate (about 40 mm cl.).. *P. oryx*
- Interantennular spine bifid for at least the distal half; spines of carapace of uniform size; a large species (up to 130 mm cl.).. *P. moseleyi*

[10]) from the literature (Guinot & Richer de Forges, 1982a).

Pleistacantha cervicornis Ihle & Ihle-Landenberg, 1931 (Figs. 9a, b, 11a, Pl. 6)

Pleistacantha cervicornis Ihle & Ihle-Landenberg, 1931: 161-163. — Guinot & Richer de Forges, 1982a, 1107-1109, figs. 7B, 8B, B1, pl. 4 fig. 1, 1a.
Pleistacantha terribilis Rathbun, 1932: 30. — Sakai, 1938: 237; 1976: 175, pl. 54 fig. 2. — Guinot & Richer de Forges, 1982a, 1109-1110, figs. 7C, 8C, C1, pl. 4 fig. 2, 2a; new synonymy.

Material examined. — 2 ♂♂, 1 ♀, 9.5.5-25 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 4, Kai Islands, 05°31′40″S 132°26′E, 250 m, Sigsbee trawl, sand, 3 April 1922; 1 spec.
'Dana' Expedition: Stn. 3606, New Caledonia, 20°48′S 164°13′E, 490 m, 26 November 1928; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

FRV 'Kapala': New South Wales, N of North Solitary I., 29°47′S 153°41′E to 29°49′S 153°40′E, 234 m, prawn trawl, 19 April 1978; 1 spec. (AM P.29935).

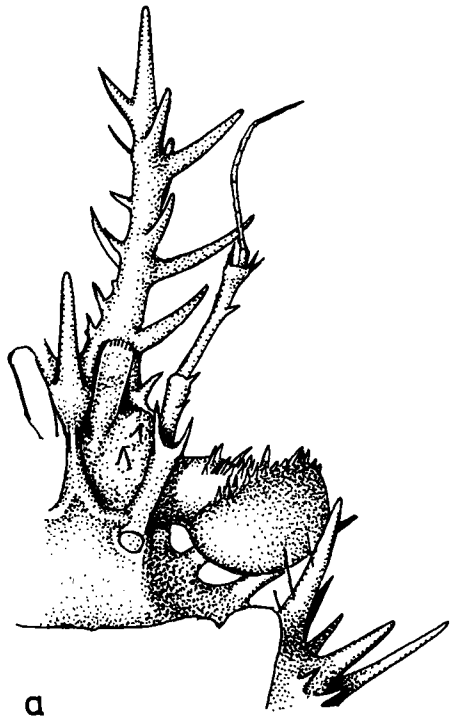
Remarks. — These specimens have been compared with the holotype (USNM 48263) of *P. terribilis* and 13 other specimens from Japan identified by Rathbun and Sakai, and they agree closely. The basal antennal article has two spines anteriorly. The interantennular spine is straight but in the larger specimen it is weakly upcurved at the tip as in some of the larger Japanese specimens.

The anterolateral angle of the merus of the third maxilliped is strongly produced into a triangular process about as long as the margin of the merus proper and armed with two or three teeth on each edge.

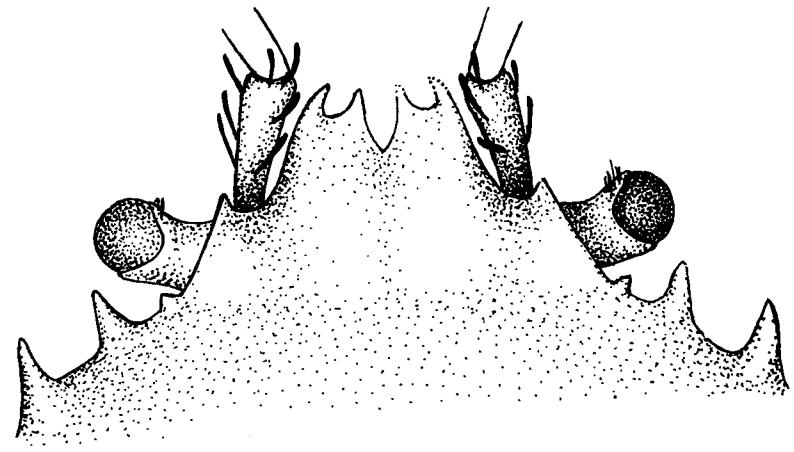
The dactyls of the ambulatory legs lack the large spines of the other segments, but are armed with long hairs and small spinules on at least the proximal half. Rathbun regarded the presence of these spinules as one of the characters distinguishing *P. terribilis* from *P. cervicornis*. However, it seems likely that Ihle was referring to the absence of long spines on the dactyls, rather than the dactyls being completely unarmed.

The rostral spines are equal to half the postrostral carapace length as in the specimens described by Ihle & Ihle-Landenberg. In Japanese specimens the rostrum varies in length from a third to half the postrostral carapace length.

The palm of the cheliped of the 'Dana' specimen from New Caledonia (cl. 25 mm) is three times as long as its distal height; in other male specimens the palm is shorter (only two to two and a half times as long as its distal height). This



a



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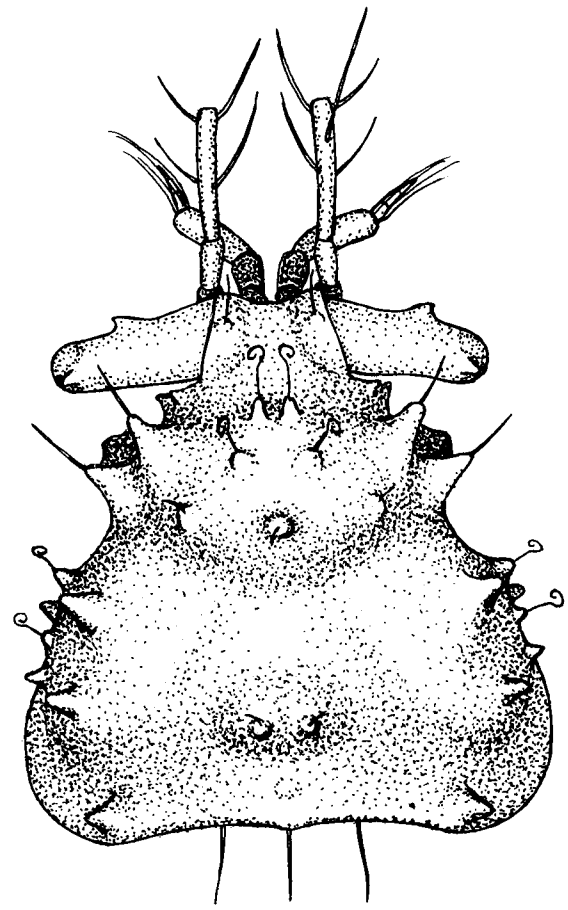


e

Fig. 11. *Pleistacantha cervicornis* (male, 25 mm, New Caledonia, ZMC) (a) left orbit, ventral view; *Paratymolus latipes* (male, 8 mm, AM P. 9400, in part) (b) anterior carapace, dorsal view; *Platymaia alcocki* (male, 62.5 mm, AM P.17794) (c) left chela of adult male; *Chalaroachaeus curvipes* (female, 3.5 mm, Salibabu I., ZMA) (d) dactyl of left fourth ambulatory leg; (e) carapace, dorsal view.

character varies with age and it cannot be regarded as of specific importance.

The first pleopod of the 'Dana' specimen is the same as that of the holotype of *P. terribilis*, with a small process near the apex.

Guinot & Richer de Forges (1982a) examined two specimens of *P. terribilis* (one the holotype) and two of the syntypes of *P. cervicornis* from the Kai Islands and found very little to distinguish the two species, suggesting only three features which may possibly separate the two. They considered that *P. cervicornis* has longer rostral spines, a more curved interantennular spine and an oval rather than round corneal region of the eye. As well as the present specimens, one each from the Kai Islands, New Caledonia and Australia, we have examined 14 specimens from Japan identified as *P. terribilis* (one the holotype). Firstly these 17 specimens are conspecific. Secondly they agree well with the syntypes of *P. cervicornis* described and figured by Guinot & Richer de Forges (1982a). In Japanese specimens the rostrum is only sometimes less than half the postrostral carapace length, the interantennular spine is curved in some specimens and the oval cornea is only slightly less elongate than in the specimens from the Kai Islands and other localities.

It is concluded that *P. cervicornis* Ihle & Ihle-Landenberg and *P. terribilis* Rathbun are conspecific; the former name has precedence. The species is characterised by the extraordinarily spiny nature of the body and appendages.

Two specimens identified by Takeda & Miyake (1969: 494-497, fig. 9c-d, pl. 18 fig. A) as *Pleistacantha japonica* (Yokoya) are regarded by Sakai (1976) as conspecific with *P. terribilis*. We can see no good reason for such a view and Guinot & Richer de Forges (1982a) have come to the same conclusion. The specimen figured by Takeda & Miyake in pl. 18 fig. A is a syntype of *P. japonica* and the two more recent specimens are certainly not *P. terribilis (P. cervicornis* as here understood). The first pleopod of the male, as figured by Takeda & Miyake, lacks the small process present in *P. cervicornis*; there are only four accessory spines on each rostral spine (10 to 12 in *P. cervicornis*); the interantennular spine is bifid at the tip (undivided in *P. cervicornis*); the basal antennal article has four prominent spines (only two anterior spines in *P. cervicornis*); and the specimen figured by Takeda & Miyake does not appear to have the long, robust spines so typical of *P. cervicornis*.

Distribution. — Japan, Kai Islands, New Caledonia, eastern Australia.

Pleistacantha oryx Ortmann, 1893

Pleistacantha oryx Ortmann, 1893: 39. — Sakai, 1965a: 69-70, fig. 10a, b, d, pl. 30 fig. 2; 1976: 172-174, fig. 93, pl. 55. — Griffin, 1974: 28; 1976: 209.
Pleistacantha orynx (sic). — Takeda & Miyake, 1969: 492-493.
Pleistacantha moseleyi. — Sakai, 1938: 234-236, fig. 20, pl. 34 figs. 2, 3. (Not *Pleistacantha moseleyi* Miers, 1886.)

Material examined. — 11 ♂♂, 8 ♀♀ (6 ovig.), 10-65.5 mm, smallest ovig. ♀, 22 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 260, Kai Is., 2.3 miles (∿ 3.7 km) N63°W from N point of Nuhu Jaan, 05°36.5′S 132°55.2′E, 90 m, dredge, sand, coral and shells, 16/18 December 1899; 1 spec. — Stn. 302, Timor Sea, between Timor and Roti, 10°27.9′S 123°28.7′E, 216 m, trawl, sand and coral sand, 2 February 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: East China Sea, 32°17′N 128°11′E, 198 m, trawl no. 6, 14 May 1914; 1 spec. — Japan, Sagami Bay, Okinose, 180 m, 23 June 1914; 2 specs. — Japan, Sagami Sea, Okinose, 540 m, 28 June 1914; 6 specs. — Okinose, Japan, 540 m, 29 June 1914; 2 specs. — Japan, Misaki, 360 m, 30 June 1914; 2 specs. — Japan, Sagami Bay, 720 m, 2 July 1914; 1 spec. — Japan, Nagasaki, 1 spec.

Mortensen Java — S. Africa Expedition: Stn. 15, Bali Sea, 07°29′S 114°49′E, ca. 240 m, Sigsbee trawl, sand and mud with concretions, 10 April 1929; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. TS V, Tanimbar, Selaru, 3 miles (∿ 5 km) NW of Tg Tuwau, 08°12′S 130°49′E, 144 m, dredge hauls 3-4, mud and rubble, 27 June 1970; 1 spec.

Remarks. — This species has been dealt with previously (Griffin, 1974; 1976) and this series confirms the distinguishing features already noted.

In most adult specimens of *P. oryx* the interantennular spine is divided only for the distal third or less, while in *P. moseleyi* it is usually divided for at least the distal half. However, as shown in Sakai's figure (1965a: fig. 10b, c), the interantennular spine tapers much more in *P. oryx* than it does in *P. moseleyi* and this distinction is also important. In this series, of eight adults, five have the spine divided for the distal third, in the other three for less than a third; of seven immature specimens, five have the spine divided for less than the distal half and in two for the distal half. That is, the spine is more strongly divided in the younger specimens.

In *P. oryx* there are several prominent spines which stand out above the smaller spines on the carapace surface, whilst in *P. moseleyi* the carapace is covered with spines of more uniform size. In *P. oryx* there are four prominent gastric spines and an anterior branchial spine which are all about two thirds the length of the postorbital spine. These long spines are about four times as long as the general carapace spines (similar spines in *P. moseleyi* are about twice as long as small spines). The cardiac region has a pair of prominent spines which are a little more than half as long as the postorbital spine and there is a similar sized pair of spines on the intestinal region. There is a posterior branchial spine, slightly shorter than the cardiac spines and just anterolateral to them. The branchial regions are only moderately elevated and do not approximate in the midline, the cardiac region is as high or slightly higher than the branchial regions. In *P. moseleyi* the medial margins of the branchial regions are elevated and approximate in the midline, the cardiac region being depressed. There is a prominent terminal spine of the meri of all the ambulatory legs,

whereas in *P. moseleyi* this spine is small. The merus of the third maxilliped has the anterolateral angle produced into a narrow spined lobe whereas in *P. moseleyi* the anterolateral angle is a right angle.

The length of the rostral spines is about half (0.46-0.58) the postrostral carapace length in the ovigerous females and about three quarters (0.68-0.78) the postrostral carapace length in the adult males. All the series have rostral spines divergent in the distal half and in most they are weakly divergent proximally, but in two specimens they are parallel and in one large female (cl. 65.5 mm) they are widely divergent from the base. This large specimen has most carapace spines longer and more robust than in the other specimens, but the four large gastric spines and the two anterior branchial spines are at least four times as long as the other carapace spines. A large male from Nagasaki has similar robust carapace spines and a few larger, prominent spines but the rostrum and interantennular spine are broken off. The chelipeds are enlarged, the length of the palm is equal to the postrostral carapace length and it is increased distally to one and a half times the proximal height. A similar specimen, also from the East China Sea, was reported on by Takeda & Miyake (1969) and another large female (cl. 60.5 mm) has been figured by Sakai (1938: pl. 34 fig. 3, as *P. moseleyi*; 1976: fig. 93, as *P. oryx*). Smaller females (postrostral cl. 20-24.5 mm) with less divergent rostral spines and less prominent carapace spines are also ovigerous. In the smaller adult males (postrostral cl. 23-30 mm) the palm is increased distally to one and a half times the proximal height but the length is only about two thirds the postrostral carapace length. On the male chela there is a large double tooth near the base of the movable finger.

Distribution. — Indo-West Pacific; from Japan, East China Sea and Philippine Islands through Java and the Andaman Sea to the West Arabian Sea.

Pleistacantha sanctijohannis Miers, 1879

Pleistacantha sancti-johannis Miers, 1879b: 24-25, pl. 1 fig. 1. — Sakai, 1965a: 70-71, pl. 30 fig. 3.
Pleistacantha sanctijohannis. — Griffin, 1976: 209. — Sakai, 1976: 172, pl. 53 fig. 2.

Material examined. — 15 ♂♂, 21 ♀♀ (5 ovig.), 12-22 mm, smallest ovig. ♀, 17 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Japan, Nagasaki, coll. James Jordan, 1 July 1911; 2 specs.
Mortensen Pacific Expedition: East China Sea, 32°17′N 128°11′E, 198 m, trawl no. 6, 14 May 1914; 1 spec. — East China Sea, 33°41′N 128°50′E, 135 m, trawl, 17 May 1914; 1 spec. — Japan, off Misaki, 144-180 m, 19 June 1914; 15 specs. — Japan, Sagami Bay, Okinose, 180 m, 23 June 1914; 7 specs. — Japan, Sagami Sea, Okinose, 540 m, 28 June 1914; 2 specs. — Japan, Okinose, 540 m, 29 June 1914; 6 specs. — Japan, Misaki, 360 m, 30 June 1914; 2 specs.

Remarks. — This species has been discussed recently elsewhere (Griffin, 1976). One small specimen (♂, 12.0 mm), in which the rostral spines are parallel but well separated from the base and divergent at the tips, may still be distinguished from *P. oryx* by the presence of two strong posterior branchial spines, absent in that species.

In 1931, Ihle & Ihle-Landenberg described a subspecies *P. sanctijohannis erecta* based on two specimens, collected by the 'Siboga' Expedition between Timor and Roti Island, which they distinguished by the nearly vertical rostral spines. In the figure of the holotype of *P. sanctijohannis* by Miers (1879b) the rostral spines are only slightly elevated. We have not had the opportunity to examine the type specimens of *P. sanctijohannis erecta* but one of them, now in poor condition, has been described recently, as *P. erecta*, by Guinot & Richer de Forges (1982a) with a photograph showing the strongly elevated rostral spines. We have examined the angle of elevation of the rostral spines of 34 specimens of *P. sanctijohannis* from Japan. In nine specimens the angle is similar to that in Miers' figure, in five specimens the rostral spines are nearly vertical, while in the majority of specimens (20) the angle of the rostral spines is somewhere between these two. Clearly the degree of elevation of the rostral spines is not a valid distinguishing feature.

In these specimens the rostral spines usually diverge at about the distal third but sometimes sooner. The large carapace spines are as prominent as in the photograph of *P. erecta* in lateral view (Guinot & Richer de Forges, 1982a). In the younger males the chelipeds are slender.

P. sanctijohannis was collected in the Mindoro region of the Philippines by the 'Albatross' Expedition (Griffin, 1976: 209) and has been reported from the South China Sea (Serène & Lohavanijaya, 1973) so it is already known outside Japanese waters.

As we have not examined the type specimens of *P. sanctijohannis erecta* Ihle & Ihle-Landenberg we have not included it in the synonymy of *P. sanctijohannis*; however, we can see no reason to consider it a separate subspecies or species.

Distribution. — Philippine Islands, Japan, S. China Sea, Kai Islands.

Pleistacantha simplex Rathbun, 1932

Pleistacantha simplex Rathbun, 1932: 30-31. — Sakai 1935: 68-69, fig. 4, pl. 8 fig. 2; 1965a: 71, pl. 31 fig. 1; 1976: 174-175, pl. 54 fig. 1. — Takeda & Miyake, 1969: 494, fig. 9a, b.

Material examined. — 8 ♂♂, 14 ♀♀ (9 ovig.), 5.5-10.5 mm, smallest ovig. ♀, 7.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 105, Sulu Archipelago, 06°08′N 121°19′E, 275 m, dredge, coral bottom, 4 July 1899; 4 specs. — Stn. 156, Straits of Bougainville, 00°29.2′S 130°5.3′E, 469 m, dredge, coarse sand and broken shells, 15 August 1899; 1 spec. — Stn. 253, Kai Is., 05°48.2′S 132°13′S, 304 m, trawl, grey clay, hard and crumbly, 10 December 1899; 3 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, 32°49′N 128°14′E, 23 miles (∿ 37 km) NW 3/4 W of Goto, 207 m, trawlings 4-5, 14 May 1914; 1 spec. — Japan, off Misaki, 144-180 m, 19 June 1914; 4 specs. — Japan, Okinose, Sagami Bay, 180 m, 23 June 1914; 2 specs. — Japan, Okinose, Sagami Sea, 540 m, 28 June 1914; 2 specs. — Japan, Okinose, 540 m, 29 June 1914; 2 specs. — Japan, Misaki, 360 m, 30 June 1914; 2 specs. — Sagami Sea, June 1914; 1 spec.

Remarks. — The specimens agree well with the holotype (♂, 10.5 mm, SW of Goto I., Japan, USNM 48251) but the spines on the supraorbital eave are longer, like the specimen figured by Sakai (1935: text fig. 4). The parallel spines on the eave may be horizontal or directed slightly upwards or downwards. The rostral spines also vary from being directed almost horizontally forwards to tilting upwards at an angle of 45° and from subparallel to moderately divergent.

The basal antennal article has a medial and a lateral spine on the anterior edge and a small spine laterally at its midpoint. The flagellum is longer than half the postrostral carapace length and carries scattered long and short setae. The branches of the bifid interantennular spine may be parallel or slightly incurved at the tips.

In the male there is a row of strong spines on the posterior border of the first sternite and two small spines anteriorly in the medial line. The other sternal segments each have a spine at the base of the leg and at the edge of the abdominal cavity. The abdomen has anterior medial tubercles on segments 1-6 and there are rounded lateral elevations on the third segment.

The records from Indonesia are the first from outside the Japanese region.

Distribution. — Japan, East China Sea, Indonesia.

Prosphorachaeus Takeda & Miyake, 1969

Type species. — *Achaeopsis suluensis* Rathbun, 1916, by monotypy.

Remarks. — This genus is distinguished from species of *Achaeus* by the complex first pleopods of the male and by the broad arching abdomen that covers them. For each known species of *Prosphorachaeus* the first pleopod and the abdomen of the male are quite distinctive, but in many other characters—the rostral lobes, the eyestalks, carapace shape and ornamentation—the species are all very similar and the females of each species are less easily distinguished from each other.

Relatively few specimens of these small fragile species have been collected and this series of specimens would seem to indicate that there are probably many more species to be collected and described. No species of *Prosphorachaeus* have been recorded previously from Indonesia. Two new species are described here from Indonesia, both of which are represented in the Kai Islands and yet another female specimen, also from the Kai Islands, is not conspecific with either. Some female specimens in this collection which do not agree with previously known or newly described species are discussed under *P. suluensis*.

Distribution. — Western Pacific.

KEY TO SPECIES OF *PROSPHORACHAEUS*

1 Basal antennal article with spinules on both lateral and medial margins; surface of sternum spinulous; pterygostomian margin with a spinulous tubercle ..... *P. multispina*
- Basal antennal article with spinules in a single row, often saw-like; surface of sternum lacking spinules; pterygostomian margin with a smooth tubercle 2

2 (1) Anterior lobe on eyestalk apically acute or subacute; rostral lobes apically sharp, usually with a small apical spine; branchial region with a central dorsal tubercle or spine 3
- Anterior lobe on eyestalk apically blunt; rostral lobes apically rounded, sometimes with small spinules; branchial region lacking a distinct central dorsal tubercle or spine ..... *P. suluensis*

3 (2) Basal antennal articles oblique; merus of third maxilliped subtriangular, medial margin angular; sternum with one to two medial spines; first pleopod of male stout, unlobed ..... *P. galatheae*
- Basal antennal articles subparallel; merus of third maxilliped suboval, medial margin curved (fig. 13); sternum with a medial ridge anteriorly; first pleopod of male very broad, with three prominent lobes (fig. 14) ..... *P. sumbawa*

Prosphorachaeus multispina new species
(Fig. 12)

Material examined. — 6 ovig. ♀♀, 3-4 mm, smallest ovig. ♀, 3 mm.

Holotype. Female, cl. 3.0 mm, ovigerous, Kai Islands, 05°36′S 132°55′E, 85 m, trawl, sand, 9 May 1922; Danish Kei Islands Expedition Stn. 53, Zoological Museum, University of Copenhagen.

Paratypes. As listed below.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 51, Madura Bay and other localities in southern Molo Strait, 69-91 m, dredge and trawl, sand with shells and stones, 19 April 1899; 2 specs. — Stn. 260, Kai Is., 2.3 miles (∿ 3.7 km) N 63°W from north point of Nuhu Jaan, 05°36.5′S 132°55.2′E, 90 m, Blake dredge, sand, coral and shells, 16/18 December 1899; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 53, data as for holotype; 1 spec.

Description. — Carapace broad, width about four fifths (0.85) postrostral carapace length; surface finely granular with two medial spines and spinules on carapace margin.

Rostral spines short, broad, about one tenth postrostral carapace length; apex bluntly pointed and with a spinule; separated by a V-shaped notch; lateral margins with small blunt spinules.

Supraorbital eave with several small, well spaced spinules along its margin; antorbital angle produced, acute, spinulous. Eyestalk moderately stout, long, with a flattened, subtriangular, apically sharp process in distal half of anterior surface and a narrow ventral tubercle. Cornea terminal and ventral. Region behind eave only shortly constricted, lateral margin in front of hepatic region with two to three spinules.

Hepatic region swollen with about five sharp spines on margin, some additional smaller spines above and below.

Branchial submargin with a row of three to four sharp, mostly bifid, spines anteriorly; below them another group of three similar spines just above base of cheliped; large spinules along carapace margin.

Gastric regions weakly elevated; protogastric region smooth with a group of curled hairs laterally; a long upright mesogastric spine posteriorly. Cardiac region weakly elevated with a long upright spine. Intestinal region smooth, spinules along posterior carapace margin.

Dorsal branchial region smooth with a short, backwardly directed spine above base of last ambulatory leg.

Basal antennal article slender with about eight large sharp spinules on lateral edge, three or four similar spinules near medial edge centrally. Epistome wider than long.

Pterygostomian margin with several small spinules and midway along its length a stout spine with accessory spinules.

Sternum of female deeply excavated anteriorly, a large tubercle in midline, surface of sternum spinulous.

Merus of female cheliped with a row of spinules dorsally and a ventral row of spinules on both inner and outer faces; carpus with a row of spinules dorsally and a few spinules on inner margin; palm with a dorsal and a ventral row of spinules, length more than twice height; fingers about as long as palm with almost no gape between them, both fingers only very weakly denticulate along their length.

Ambulatory legs very slender, merus and propod with a ventral row of spinules; carpus with a few lateral spinules; groups of curled hairs dorsally; merus without a terminal spine. First ambulatory leg about twice postrostral carapace length, fourth leg about three quarters first; dactyl of fourth leg nearly straight, distally curved, smooth or with two minute teeth distally.

Female abdomen with six segments, surface with spinules, larger laterally on last fused segment. On anterior margin of first segment a medial tubercle, on second segment a short spine, on third segment a medial lobe with three short spines, in fourth and fifth segments with a medial spinulous ridge, last fused segment with a triangle of three spines centrally, base forward, largest spine at apex.

Female gonopore a large semi-circular aperture opening ventrally. Eggs large, diameter about 0.5 mm.

Remarks. — *P. multispina* is distinguished from other known species of *Prosphorachaeus* by the presence of many more spinules and spines, some of the spines being bifid or spinulous. There are spinules along the whole of the lateral margin of the basal antennal article and also on part of the medial margin. On the pterygostomian margin there are spinulous tubercles rather than a smooth ridge and a smooth posterior tubercle as in other species. The sternum is spinulous with a central spinulous tubercle (smooth with a ridge and/or spine in other species).

Distribution. — Java, Kai Islands.

Prosphorachaeus suluensis (Rathbun, 1916)

Achaeopsis suluensis Rathbun, 1916:535.
Achaeus suluensis. — Sakai, 1938:220-222, fig. 11, pl. 22 fig. 2; 1965a:68, pl. 28 fig. 2.
Prosphorachaeus suluensis. — Takeda & Miyake, 1969: 490-491, fig. 8. — Takeda, 1973b:38. — Griffin, 1976:209. — Sakai, 1976: 166, fig. 89a-c, pl. 50 fig. 2.

Material examined. — 1 ♂, 2 ♀♀ (1 ovig.) 4.5-5 mm, ovig. ♀, 4.5 mm.

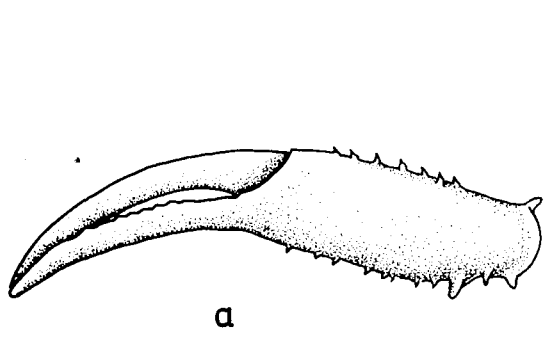
ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Misaki, 5.5 m, 26 April 1914: 1 spec. — Misaki, about 36 m, dredge, 25 May 1914; 2 specs.

Remarks. — These specimens agree with those described and figured by Sakai (1938; 1976) and by Takeda & Miyake (1969) and the male is clearly distinguished by the form of the first pleopod and the abdomen. The description of the female holotype by Rathbun (1916) is now inadequate to distinguish *P. suluensis* from the other known species of *Prosphorachaeus* and some comments should be made. Takeda & Miyake (1969) have already referred to the lack of a postorbital spine in this genus. The two small spinules behind the orbit noted by Rathbun are present in some of our specimens but neither is large enough to be considered as a postorbital spine such as is found in *Achaeopsis*. Rathbun described the supraorbital eave as 'entire' but in our specimens, as in those described by Sakai (1938), the margin is spinulous. Also in our specimens and in that figured by Takeda & Miyake (1969) there is no tubercle on the posterior slope of the cardiac spine. The basal antennal articles in our specimens from Japan are subparallel, not 'very oblique' as Rathbun described for this species. On the abdomen of our females there is a tubercle or short spine on the first segment, a short spine on the second and third segments, a low ridge on the fourth and fifth segments and a triangle of a short spine and two tubercles on the last fused segment. The female gonopores are submedial apertures opening medially.

In these collections there are also five ovigerous female specimens (two from the Sulu Archipelago and three from Indonesia) which agree as well with Rathbun's description of *P. suluensis* as do the two females we have from Japan but in these five specimens the basal antennal article is either strongly or moderately oblique. However, we cannot say that these five specimens are conspecific with each other as there are differences in the position of the female gonopore and small differences in the basal antennal article. The abdomen of these females differs from that of our Japanese specimens in having a smaller spine or a tubercle on the first two segments and a ridge rather than a short spine on the third segment.

It appears that the Japanese specimens, Rathbun's material and our five females may represent two or three very similar species in which the females are not easily distin-



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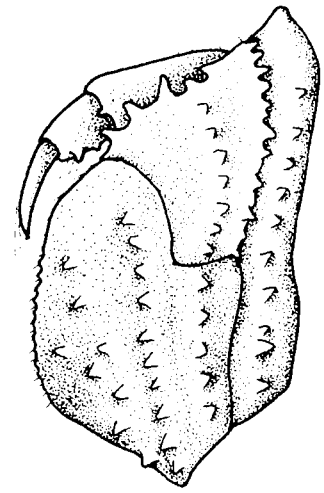

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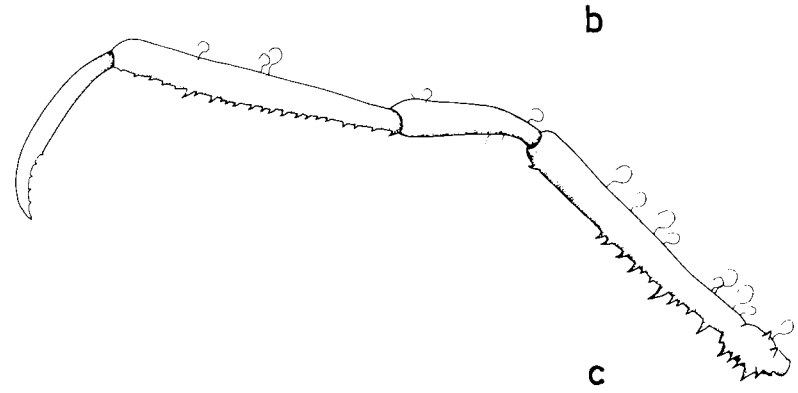

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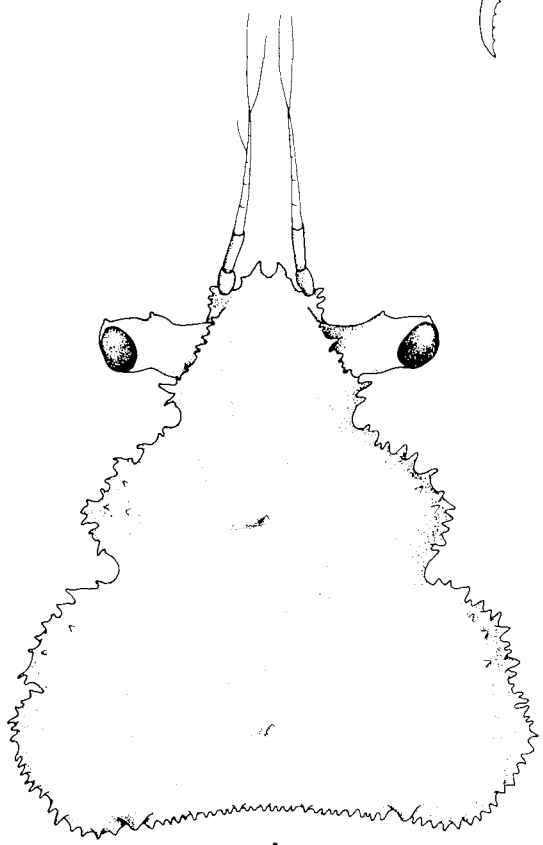

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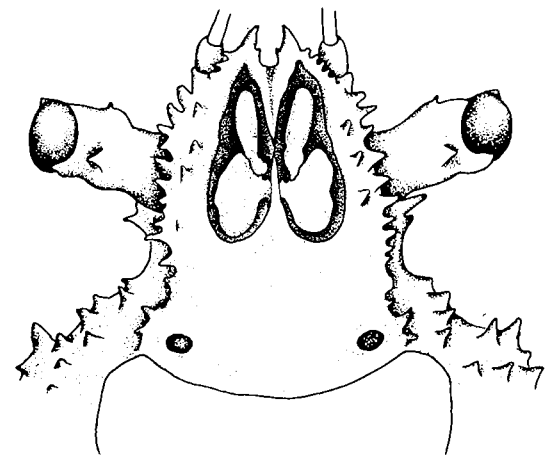

e

Fig. 12. *Prosphorachaeus multispina* (holotype, female) (a) left chela; (b) left third maxilliped; (c) left first ambulatory leg; (d) carapace, dorsal view; (e) orbits, ventral view.

guished. The status of these specimens will only be determined through examination of further material.

The data for these five specimens are as follows: —

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 37, Flores Sea, Paternoster Is., Sailus Ketjil, 27 m and less, dredge, coral and coral sand, 30/31 March 1899; 1 spec. — Stn. 109, Sulu Archipelago, anchorage off Pulu Tongkil, 13 m, dredge, townet, *Lithothamnion* bottom, 5/6 July 1899; 1 spec. — Stn. 301, E coast of Roti I., Pepela Bay, 10°38′S 123°25′E, 10-25 m, dredge, 30 January 1900; 1 spec.

Sulu Archipelago; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 11, Kai Is., off Toeal, 20 m, trawl, sand, 9 April 1922; 1 spec.

The five specimens have the following characters in common: —

1) cornea of the eyestalk ovate and relatively small;
2) basal antennal article oblique with a single row of, mostly, small teeth;
3) sternum with a medial ridge but without a spine or tubercle;
4) branchial region without a central dorsal tubercle;
5) no (or a very small) tubercle behind the cardiac spine;
6) no tubercle or spine on carapace above the base of the last leg (or tubercle small or blunt).

However, there are also differences among these five specimens. In one of the specimens from the Sulu Archipelago ('Siboga' Stn. 109) the gonopores are submedial and open medially and the distal part of the basal antennal article is laterally compressed. In the other specimen from the Sulu Archipelago and the specimen from Timor ('Siboga' Stn. 301) the distal part of the basal antennal article is similarly compressed but the gonopores are laterally placed and open laterally, and on the third maxilliped there are two to four spinules on the exognath. The distal part of the basal antennal article is not laterally compressed in the remaining two specimens from the Flores Sea ('Siboga' Stn. 37) and the Kai Islands (Kei Is. Exped. Stn. 11), the gonopores are laterally placed and open ventrally and there are six spinules on the exognath of the third maxilliped.

Which of these differences are merely variations, perhaps geographic, and which are valid specific differences will only be determined by further study of more specimens, including males.

P. suluensis, as currently understood, is distinguished from other described species of *Prosphorachaeus* by the form of the first pleopod and the abdomen of the male. It is also distinguished by the blunt lobe on the anterior margin of the eyestalk (rather than acute or subacute); by the rostral lobes which are rounded with small spinules rather than subacute with an apical spine and also the branchial region lacks the central dorsal tubercle present in *P. galatheae* and *P. sumbawa*.

Distribution. — Sulu Archipelago, Japan.

Prosphorachaeus sumbawa new species
(Figs 13, 14)

Material examined. — 1 ♂, 2 ♀♀, 3-3.5 mm.

Holotype. — Male, 3.0 mm, Indonesia, Sumbawa, Sapeh Strait, 08°23′S 119°4′E, 69 m, dredge, coral and shells, 14 April 1899, 'Siboga' Expedition, Stn. 49a. Zoological Museum, Amsterdam.
Paratypes. — As listed below.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 310, Sumbawa, Sapeh Strait, 08°30′S 119°7′E, 73 m, dredge, sand with dead coral, 12 February 1900; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 26, Kai Is, 05°38′S 132°55′20″E, 90 m, trawl, sand, 16 April 1922; 1 spec.

Description. — Carapace broad, width only slightly less (0.9) than postrostral carapace length; surface smooth or with fine granules laterally; margins with spinules; two long medial spines.

Rostral spines short, broad, about one sixth (0.15) postrostral carapace length, separated in distal half by a V-shaped notch; apex subacute, armed with a spinule; lateral margins only weakly spinulous, proximal angle curved outwards.

Orbital eave with several small, well spaced spinules along its margin; antorbital angle moderately produced, rounded, weakly spinulous. Eyestalks stout, long, a flattened subtriangular process midway along anterior surface and a ventral tubercle. Cornea terminal and ventral. Region behind orbits only shortly constricted.

Hepatic region swollen with three to four spinules on margin and a few smaller spinules above and below.

Branchial submargin with two to three short spines anteriorly and two to three smaller spines below them on epimeral ridge.

Gastric regions weakly elevated, protogastric region with a group of curled hairs laterally, a small tubercle on margin of mesogastric region; a long upright mesogastric spine posteriorly. Cardiac region elevated with a long upright spine. Intestinal region smooth with spinules along posterior carapace margin.

Dorsal branchial region with a small central tubercle; a small spine and some spinules above the base of the last ambulatory leg.

Basal antennal article slender, straight (not oblique) with a large spinule (bifid in holotype) at about distal third; one to three smaller spinules along proximal two thirds.

Pterygostomian margin with a narrow ridge anteriorly and a short posterior spine.

Ischium of third maxilliped with five tubercles on a ridge parallel to lateral margin and a diagonal ridge of similar length, of six to eight smaller tubercles. Merus narrower than ischium, longer than broad, anterolateral angle only very weakly produced, margin spinulous; medial margin with spinules and two spines; a row of three to four tubercles parallel to lateral margin; first segment of palp with small spinules on distal margin.

There are no chelipeds or ambulatory legs with holotype. Merus of cheliped of adult female paratype with a row of spines dorsally and ventrally on outer face; no terminal spine or tubercle; a few spinules ventrally on inner face; carpus with two rows of spines, one dorsally and one obliquely on inner face; chela slender, length of palm about one and a half times height, dorsal and ventral margins with a row of spines; fingers slender, length about one and a half times palm, weakly incurved, smooth, a narrow gape between fingers in proximal half.

Male sternum smooth, anterior half deeply excavate with a medial ridge; posterior half of sternum elevated towards recurved transverse ridge on anterior margin of abdominal

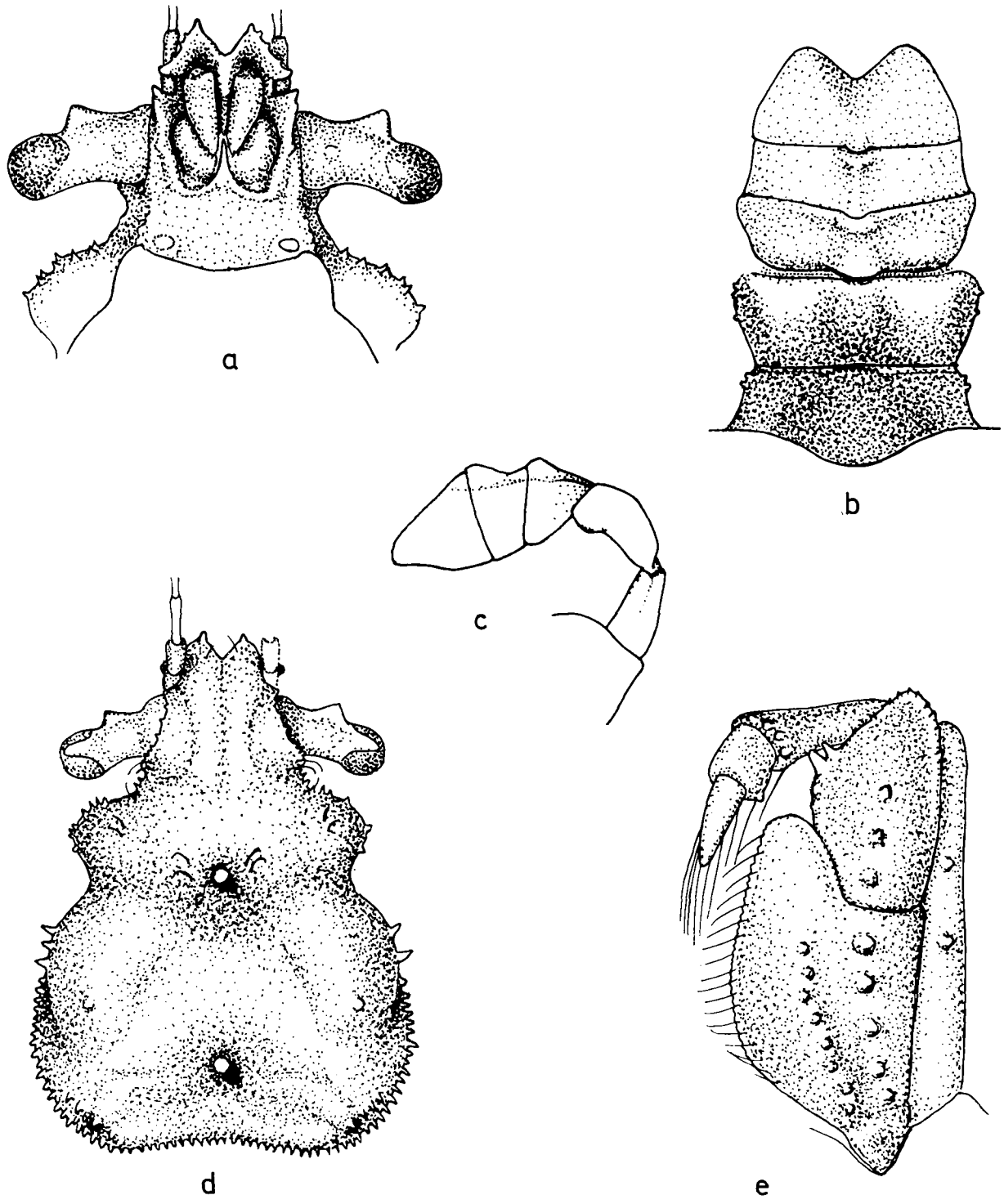

Fig. 13. *Prosphorachaeus sumbawa* (holotype) (a) orbits, ventral view; (b) male abdomen, (c) lateral view of same; (d) carapace, dorsal view; (e) left third maxilliped.

fossa. Anterior of abdominal fossa with a triangular medial lobe, posterior apex of lobe with a spine; abdominal fossa approximately square, deeply excavate into two anterior and two posterior depressions.

Male abdomen of five segments; first segment with spinules on lateral margin and medially on anterior margin; third segment large, abruptly curved, rigid, with lateral elevations, width about three times length; width of last fused segment slightly less than (0.9) third segment, length about half (0.5) width, two elevated lobes anteriorly separated by a broad V-shaped notch.

Female abdomen of six segments, surface with some spinules; segments one to four with a medial elevation anteriorly, armed with a small spine in segments one and two and with a group of three short spines in segments three and four; fifth segment with an unarmed medial ridge; last fused

segment with a central triangle of three spines, base forward.

First pleopod of male very broad, lobed, calcified at base; medial lobe ventral in position, curved strongly inward and then produced forward with a blunt apex; lateral lobe dorsal in position, short and apically blunt; between lateral and medial lobes a cylindrical process divided into three apically.

Female gonopore a broad oval aperture, opening anteriorly.

Remarks. — This species is distinguished from other described species of *Prosphorachaeus* by the form of the first pleopod of the male and the male abdomen. As well it is distinguished from *P. suluensis* by the more acute rostral lobes with a small apical spine and by the presence of a central dorsal branchial tubercle; it is distinguished from *P. galatheae* by the subparallel basal antennal articles (rather than oblique) and the presence of a medial sternal ridge (rather than a

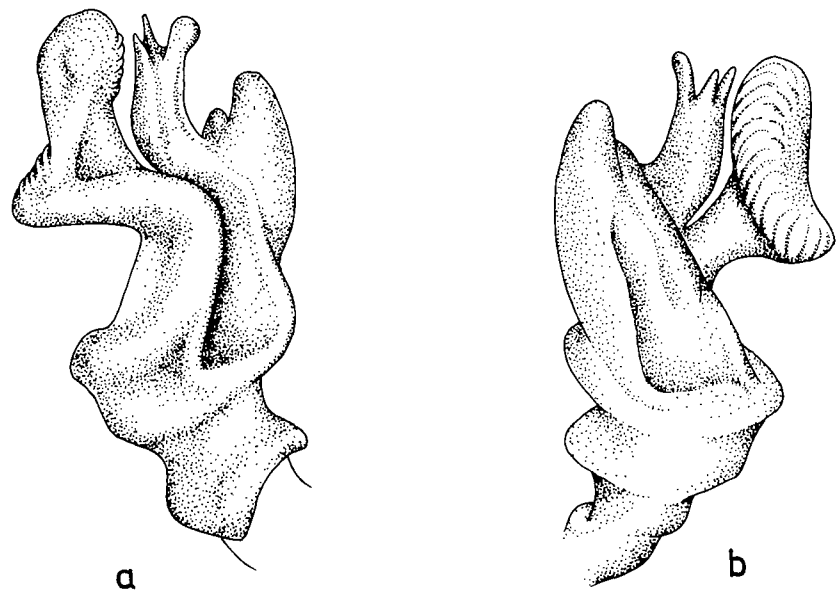

Fig. 14. Left first pleopod of male of *Prosphorachaeus sumbawa* (holotype) (a) abdominal view, (b) sternal view.

spine); and it is distinguished from *P. multispina* by having fewer spines and spinules especially on the basal antennal article and on the pterygostomian margin.

Distribution. — Sumbawa (Sapeh Strait), Kai Islands.

Rhinospinosa new genus

Type species. — *Pseudocollodes demani* Balss, 1929, by present designation.

Description. — Carapace pyriform with a few spines medially and elsewhere on the dorsal surface and posterior margin; orbit spinulous. Rostrum hardly developed beyond anterior margins of antennular fossae; interantennular spine projecting forward as a single short spine armed with lateral spinules near base. Orbit open above and below, eave not developed, a prominent postorbital spine. Basal antennal article narrow, spinous. Abdomen of six segments in both sexes, sixth and seventh fused. First pleopod of male almost straight, not tapering, apically blunt, opening medial, large, subapical, a prominent flap extending along abdominal surface of aperture.

Remarks. — The reasons for establishing a new genus to accommodate Balss' species is dealt with under *R. demani*.

The new name refers to the short rhinoceros-like interantennular spine; gender feminine.

Distribution. — West Pacific: Japan and East China Sea.

Rhinospinosa demani (Balss, 1929) new combination (Fig. 15b, c)

Pseudocollodes demani Balss, 1929: 4, fig. 2. — Yokoya, 1933: 146, text-fig. 53. — Sakai, 1938: 225-227, text-figs. 16a, b; 1976: 167-168, text-fig. 91. — Takeda & Miyake, 1969: 491-492.
Achaeopsis atypicus Rathbun, 1932: 29-30.

Material examined. — 1 ♂, 9.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Mortensen Pacific Expedition: Japan, off Danjo Group, 32°15′N 128°12′E, 162 m, dredge, 15 May 1914; 1 spec.

Remarks. — This species was placed by Balss in the genus *Pseudocollodes* Rathbun, of which the type is *P. complectens* Rathbun (1911). This latter species has been shown (Griffin, 1974) to be synonymous with *Inachus dorsettensis* (Pennant) and is not congeneric with Balss' species. Manning & Holthuis (1981) suggest that *I. complectens* and *I. dorsettensis* may be

distinct species and that the specimens figured by Monod (1956) and Barnard (1950) as *I. dorsettensis* may have been misidentified. Their redescription of *I. complectens* is awaited. Balss' species differs from other inachines principally in having a produced spinulous interantennular spine, a feature mentioned by Rathbun as a principal reason for the setting up of the genus *Pseudocollodes*; however, in *Inachus dorsettensis* the interantennular spine is much less prominent. In this species the orbit bears two strong spines followed by spinules, an unusual feature, and in addition the strong hepatic lobe is depressed and at a lower level than the remainder of the carapace margin. In a number of other respects this species is similar to species of *Achaeus* and *Achaeopsis*.

Our specimen agrees well with specimens previously described and figured by other authors and with the holotype (female, ovig., 9.0 mm, Misaki, ZSM. 2571) examined by one of us (D.J.G.G., 1970). Just behind the spine on the supraorbital eave, in our specimen, there is another smaller spine; there is an accessory spine on the postorbital spine, almost equal to it in length and only slightly more slender. There is a spine on the carapace just above the base of the fourth ambulatory leg. The abdomen on our specimen differs somewhat from that described by Yokoya. There is a slender medial spine on the first segment and several spinules laterally on the third segment. The sixth and seventh segments are fused and no junction is visible: there is a robust spine as shown in Yokoya's figure, but the spine is just forward of the mid-point of the last segment. There is a rounded elevation followed by a notch on the lateral margin just behind the spine: this interruption may mark the junction of the sixth and seventh segments. We consider the figure of the male abdomen given by Yokoya to be incorrect. The female abdomen as figured by Balss (1929) and described by Rathbun (1932, as *Achaeopsis atypicus*) has six free segments and the fused last segment is spinulous.

The aperture of the first pleopod of the male is subterminal on the medial edge of the sternal surface with a broad flap abdominal to it. The pleopod has been figured in abdominal view by Sakai (1938: fig. 16b).

Distribution. — Japan and East China Sea.

Sunipea new genus

Type species. — *Apocremnus indicus* Alcock, 1895 by present designation.

Description. — Carapace slender pyriform, surface with few spines or tubercles. Rostrum fused basally, divergent distally, spinules on margins. Orbit of a moderately expanded eave with a slender preorbital spine and small antorbital lobe; lacking a postorbital lobe. Eyestalks with anterior process and terminal tubercle above cornea. Interantennular partition without a spine. Basal antennal article moderately broad with strong anterolateral spine, a suborbital lobe present. Antenna excluded from orbit. Merus of third maxilliped strongly produced at anterolateral angle, and posterior part of medial margin produced. Cheliped of male with tubercles on merus and carpus, palm smooth, dorsally carinate. Ambulatory legs slender with some tubercles. Male abdomen of seven free segments, female abdomen with junction of segments 4 and 5, and 5 and 6, indistinct. First pleopod of male apically truncate with a terminal aperture.

Remarks. — *Sunipea indicus* was considered congeneric with *Aepinus septemspinosus* (A. Milne Edwards) from the Atlantic Ocean by Alcock (1895) and Rathbun (1925) but, as discussed previously (Griffin, 1974), the two differ from each other in several important features. In *Aepinus septemspinosus* the rostrum is extremely short and rounded, the basal antennal article is truncate, there is no suborbital lobe or tubercle, the abdomen of the male is six segmented and the first pleopod of the male is hardly expanded apically. In addition the palm of the cheliped of the male of *A. septemspinosus* has rows of granules or tubercles, while that of *S. indicus* is smooth and dorsally and ventrally carinate. We consider these differences to be sufficient to separate these species at the generic level; we have accordingly established the new, presently monotypic genus *Sunipea*. The name is an anagram of *Aepinus* and of masculine gender as is *Aepinus*.

Distribution. — Indo-West Pacific.

Sunipea indicus (Alcock, 1895) new combination (Fig. 15a, d)

Apocremnus indicus Alcock, 1895: 188-189, pl. 4 figs. 2, 2a.
Aepinus indicus. — Griffin, 1972: 68-69, fig. 3; 1974: 6-7. — Griffin & Tranter, 1974: 164-165. — Takeda, 1977: 122, fig. 4B.

Material examined. — 6 ♂♂, 12 ♀♀ (7 ovig.) 4.5-8.5 mm, smallest ovig. ♀, 6.0 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a, Sapeh Strait, 08°23.5′S 119°4.6′E, 69 m, dredge, coral and shells, 14 April 1899; 11 specs. — Stn. 260, Kai Is., 2.3 miles (∿3.7 km) N63°W. from N. point of Nuhu Jaan, 05°36.5′S 132°55.2′E, 90 m, dredge, sand, coral and shells, 16/18 December 1899; 4 specs.

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Danish Kei Islands Expedition: Stn. 24, Kai Is, 05°37′S 132°56′E, 100 m, trawl, hard bottom, 15 April 1922; 2 specs. — Stn. 53, Kai Is., 05°36′S 132°55′E, 85 m, trawl, sand, 9 May 1922; 1 spec.

Remarks. — In general these specimens agree with those recently discussed. The rostral spines are outwardly curved distally with spinules on the margins. In some specimens the apex of the rostral spines is knobbed while in other specimens the apex is sharp and finely bifid. There is a mesogastric spine or tubercle. The cardiac region is weakly elevated and smooth or with a small tubercle.

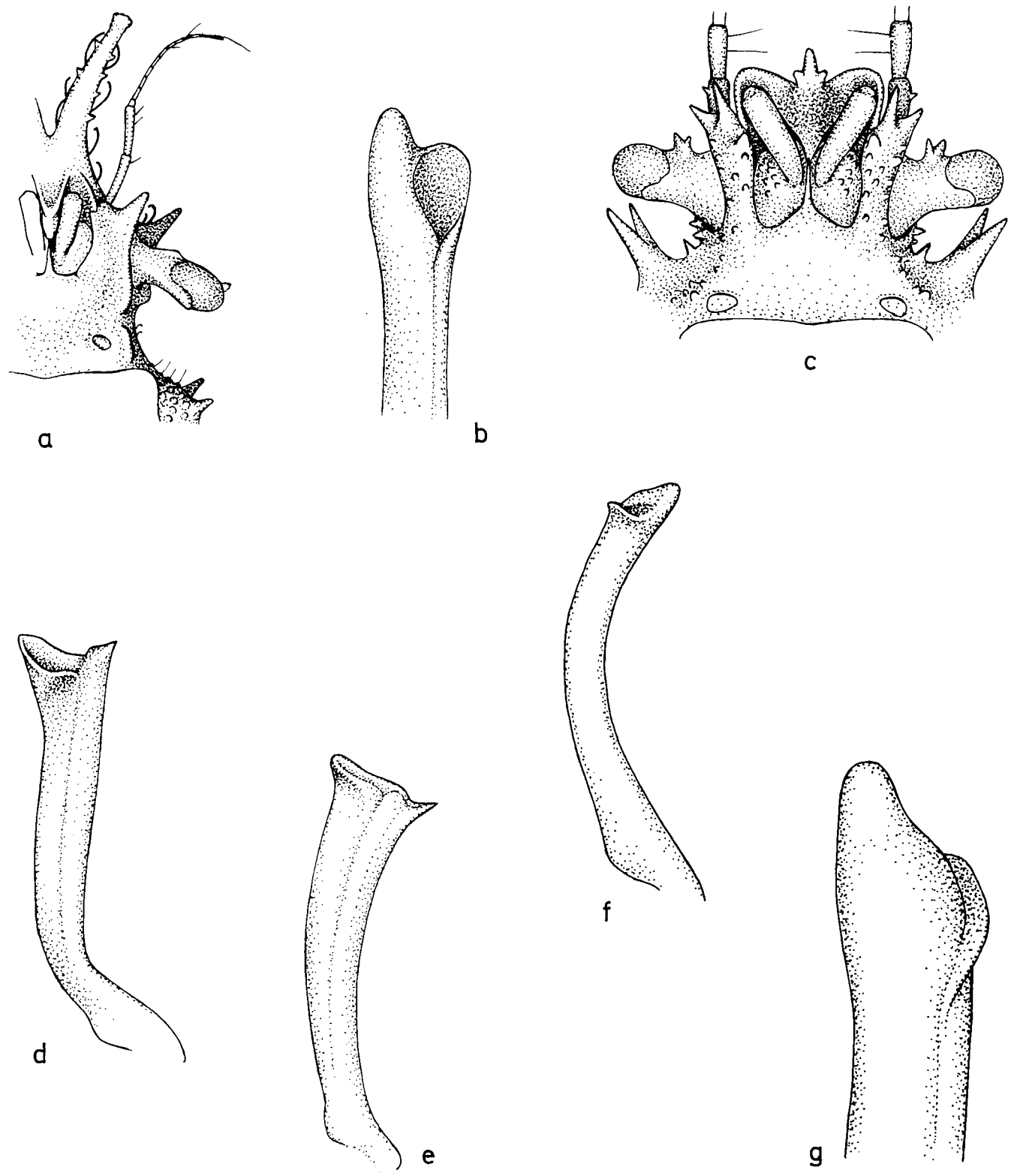

Fig. 15. *Sunipea indicus* (male, 8.5 mm, Sapeh Strait, ZMA) (a) left orbit, ventral view; *Rhinospinosa demani* (male, 9.5 mm, Japan, ZMC) (b) left first pleopod, sternal tip; (c) orbits, ventral view; *Sunipea indicus* (as above) (d) left first pleopod, abdominal-medial view; *Chorinachus dolichorhynchus* (male, 6 mm, Red Sea, AM P. 25237) (e) left first pleopod, abdominal view; *Physachaeus ctenurus* (male, 6.5 mm, Japan, ZMC) (f) left first pleopod, abdominal view, (g) sternal tip of same.

The first pleopod of the male is broad, straight and apically truncate. There is a widely gaping terminal aperture on the medial two thirds of the apical margin.

Distribution. — Indo-West Pacific: from East Africa and Red Sea to Sumbawa, N. Australia, Kai Is., Philippine Is., and Ogasawara Is.

Trichoplatus A. Milne Edwards, 1876

Type species. — *Trichoplatus huttoni* A. Milne Edwards, 1876, by monotypy.

Remarks. — The unusual spider crab restricted to New Zealand and now returned to *Trichoplatus* is distinguished by its unusual orbit, narrow straight-sided basal antennal article, strongly expanded ambulatory propodi, six segmented abdomen in the male and female and crested third maxilliped. In addition, the first pleopod of the male is quite unlike that in any species of *Naxia*.

T. huttoni was, as reported by Griffin (1966d) included within *Naxia* Latreille (herein transferred to the Majinae) by Richardson although, under the names *Halimus hectori* and *Halimus rubiginosus* it was in effect regarded as congeneric with the species now placed in *Naxia*. Bennett (1964) retained *Trichoplatus* as an independent genus; Griffin (1966d) subsequently argued against that. Bennett has also suggested that *T. huttoni* is related to *Eurypodius*.

Distribution. — Restricted to New Zealand.

SUBFAMILY TYCHINAE

Tychinae Dana, 1851b: 431. — Williams, Shaw & Hopkins, 1977: 885.
Stenocionopinae Miers, 1879: 652.
Maiinae Alcock, 1895: 161, 166, 246 (in part: the Stenocionopoida)
Ophthalmiinae Balss, 1929: 6 (name substituted for Stenocionopinae Miers to conform with substitution of *Ophthalmias* for *Stenocionops* (Rathbun, 1897: 157)). — Garth, 1958: 161. — Griffin, 1966b: 264.

The orbit consists, if complete, of a supraocular eave and a postocular spine, while the intercalated spine is lacking ... Longer spinous outgrowths on the supraocular eave and on the postocular spine are for the most part present. The shape of the body is elongate, somewhat truncate in front, often provided behind with a median spine or outgrowth (Balss, as quoted by Garth).

Pleopod 1 generally slender, weakly curved, sometimes adjacent about a third from base, apices outcurved (lyrate), aperture terminal or subterminal with at most poorly developed flaps or lobes.

Basically, tychines are majids with extravagant orbits: they were, in Alcock's time, classified with the majines and the mithracines. However, the Indo-West Pacific species — *Stilbognathus*, *Criocarcinus* and probably *Picroceros* — differ from the east Pacific and Atlantic genera — *Tyche*, *Pytho*, *Picroceroides* and others — in the degree of expansion of the basal antennal article and absence of a postorbital lobe. In Indo-West Pacific species the basal antennal article is relatively narrow and the postorbital lobe is lacking or is small and remote from the eye. New world species, on the other hand, often have broad basal antennal articles which partially close the orbit below through approximation to the postorbital lobe. Whether there are differences in the first pleopods of the male which would substantiate separation at the subfamily level awaits further study.

We have removed from the subfamily the genera *Pseudomicippe* (including *Zewa*) and *Microhalimus* to the Majinae and *Cyclocoeloma* to the Mithracinae. *Stilbognathus* has been expanded to include those species previously recognised as the distinct *Ophthalmias*.

KEY TO INDO-WEST PACIFIC GENERA OF TYCHINAE

1		Orbit without a postorbital lobe (a broad lobe on posterior part of eave in *S. tycheformis*); branchial margin with one spine anteriorly; posterior carapace margin with a broad based medial lobe or spine ..... *Stilbognathus*
—		Slender postorbital lobe remote from eyestalk; branchial margin with two to three spines; posterior carapace margin with one or two cylindrical spines 2
2	(1)	Rostral spines short and strongly deflexed; supraorbital eave with three short spines on lateral margin; hepatic margin without a spine ..... *Criocarcinus*
—		Rostral spines long, horizontal; supraorbital eave with a single antorbital spine; hepatic margin with a long spine ..... *Picroceros*

Criocarcinus H. Milne Edwards, 1834

Type species. — *Cancer superciliosus* Linnaeus, 1767, by later designation of H. Milne Edwards

Remarks. — This monotypic genus is distinguished by the extraordinarily produced orbit and very short rostrum. The eave is a ventrally open tube, the lateral margin dorsally bearing three spines.

Distribution. — Andaman Sea, western Pacific from Japan south through Indonesia to eastern Australia.

Criocarcinus superciliosus (Linnaeus, 1767)
(Fig. 16c, d)

Cancer superciliosus Linnaeus, 1767: 1047. — Herbst, 1790: 227, pl. 14 fig. 89.
Criocarcinus superciliosus. — A. Milne Edwards, 1872: 242-243, pl. 12 figs. 3, 3a-e. — Alcock, 1895: 247. — Sakai, 1938: 251-252, text fig. 26; 1976: 191-192, text fig. 101, pl. 67 fig. 1. — Griffin, 1966b: 277 (in key). — Dai et al., 1978: 225-226, 230, text fig. 2a, b, pl. 1 fig. 2.

Material examined. — 6 ♂♂, 8 ♀♀ (2 ovig.), 8-37.5 mm, smaller ovig. ♀, 32.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 37, Flores Sea, Paternoster Is., Sailus Ketjil, close to reef, up to 27 m, dredge, coral and coral sand, 30/31 March 1899; 1 spec. — Stn. 78, Borneo Bank, Lumu-Lumu shoal, 34 m, shore exploration, coral and coral sand, 10/11 June 1899; 1 spec. (ZMA De.100.821, det. Ihle). — Stn. 131, N. Sulawesi, Karakelong Is., anchorage off Beo, 13 m, reef exploration, mud and sand, 24/25 July 1899; 1 spec. — 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.100.724, det. Ihle as *Micippa philyra*). — Stn. 174, north coast of Ceram, Waru Bay, 18 m, dredge, townet and reef exploration, mud, 28/29 August 1899; 1 spec. (ZMA De.100.791, det. Ihle). — Stn. 193, Moluccas, Sanana Bay, east coast of Sula Besi, 22 m, reef exploration, mud, 13/14 September 1899; 1 spec. (ZMA De.100.822, det. Ihle). — Stn. 206, S. Sulawesi, Buton Strait, 04°58′S 122°42′E, 51 m, trawl, fine green mud, 21 September 1899; 1 spec. (ZMA De.100.864, det. Ihle). — Stn. 277, Banda Sea, Damar I., Kulewatti Bay, 45 m, reef exploration, sand, white, black and mixed, 9/11 January 1900; 1 spec. — Kai Is., Elat Reef; 1 spec. (ZMA De.100.640, det. Ihle). — Haingsisi Reef; 2 specs. (ZMA De.100.823, det. Ihle).

Off Sumatra, Pulu Hinako, 00°52′N 97°20′E, coll. De Ewaan; 1 spec. (ZMA De.100.863, det. Ihle).

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Ex. Natural Science Foundation: Irian Jaya, Padaido Is., $^1/_2$ mile (0.8 km) east of Oerif Isle, Mios Woendi Lagoon, 6-9 m, coll. Ostheimer, Orr and Powell, Stn. 465-4, 1956; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland, Lizard I., off Research Station, at low tide, coll. H. Tranter, 5 May 1977; 1 spec. (AM P.29929).

Remarks. — These specimens agree well with those described and figured by A. Milne Edwards and by Sakai. In younger animals (cl. 8-10 mm) the dorsal spine of the supraorbital eave is much longer than the ventral spines which are hardly produced at all. Our specimens have a tubercle or short spine on the margin of the orbit between the postorbital spine and the eave. There are two or three tubercles on the anterior margin of the postorbital spine, but in small specimens (cl. 8-16 mm) these tubercles are very low.

There is a spine on the anterior submargin of the branchial region, and a large tubercle or short spine on the submargin below the epibranchial spine. The spines of the carapace are knobbed. The spine on the posterior margin of the carapace is directed upward and backward, but is very short in smaller specimens.

As well as the medial and lateral spines on the anterior margin of the basal antennal article there is usually a tubercle of variable size on the lateral margin.

The outer margin of the ischium of the third maxilliped is more strongly concave in our specimens than is shown in the figure given by A. Milne Edwards.

Segments four, five and six of the female abdomen are fused.

The first pleopod of the male has not been figured previously. The tip is rounded on the medial margin and the lateral margin is produced to form an acute apex.

Distribution. — Andaman Sea, western Pacific from Japan and China through Sulawesi, Moluccas, Kai Is. and Timor to NE. Australia and New Caledonia.

Picroceros A. Milne Edwards, 1865

Type species. — *Picroceros armatus* A. Milne Edwards, 1865, by monotypy.

Remarks. — There is but one species in this genus confined to the western Pacific. It is distinguished by its orbit of eave, intercalated spine and postorbital lobe, the eave enormously expanded at the antorbital angle. The pleopod is very unusual.

Distribution. — Western Pacific from Japan south to NE. Australia and Lord Howe Island.

Picroceros armatus A. Milne Edwards, 1865 (Fig. 16e, f)

Picroceros armatus A. Milne Edwards, 1865: 137, pl. 3 figs. 1, 1a, b; 1872: 244-246, pl. 12 figs. 2, 2a-c, pl. 13. — Sakai, 1938: 247-249, text fig. 24, pl. 35 fig. 2; 1976: 190-191, pl. 66 fig. 2. — Griffin, 1966b: 277 (in key).

Material examined. — 1 ♀, postrostral cl. 11 mm.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas: Stn. KN IV, Kai Is., E. side of Mitduan Reef, W. coast of Nuhu Thut, 05°32′S 133°E, 36-56 m, dredge hauls 3-4, sand, coral rubble and sponge, 13 June 1970; 1 spec.

Remarks. — This immature specimen agrees well with those previously figured. The first pleopod of an adult male of *Picroceros armatus* from Lord Howe Island (AM P.14027) is figured. On the medial edge of the tip of the pleopod there are two lobes, of which the posterior is the longer; the apex is rounded.

Distribution. — Western Pacific: Japan, Kai Is., New Caledonia, Vanuatu, NE. Australia and Lord Howe Island.

Stilbognathus von Martens, 1866

Type species. — *Stilbognathus erythraeus* von Martens, 1866 by monotypy.

Remarks. — Miers (1879c), Alcock (1895), Balss (1929), and Garth (1958) placed together a number of genera of spider crabs with an expanded supraorbital eave but relatively narrow lower orbital floor, long eyestalks, anteriorly contricted carapace and, often, truncate front. This group known now as the Tychinae (from *Tyche* Bell) but previously as the Ophthalmiinae (from *Ophthalmias* Rathbun substituted for *Stenocionops* Latreille) includes a number of genera in the east Pacific, west Atlantic and Indo-Pacific. Among these are the genera *Tyche*, *Ophthalmias* and *Stilbognathus* von Martens.

Species of each of these genera were described as early as the mid 1800's by Bell, White, A. Milne Edwards, Miers and von Martens. By the time Rathbun (1925) published her monographic treatment of the American oxyrhynchs the genus *Tyche* included two species in the western hemisphere

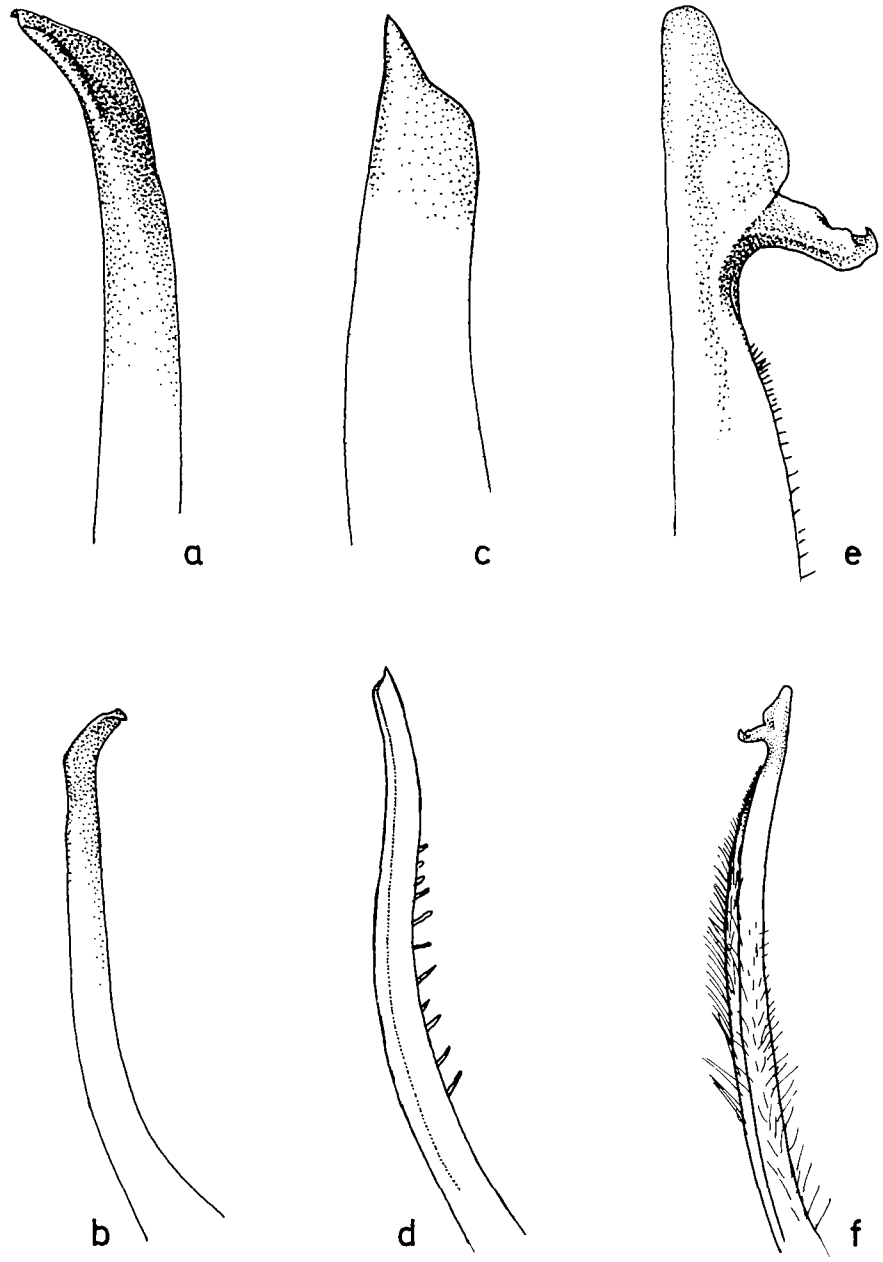

Fig. 16. Left first pleopod of male of *Stilbognathus martensii* (21.4 mm, Mauritius, ZMC) (a) sternal tip of pleopod, (b) abdominal view of same; *Criocarcinus superciliosus* (37.5 mm, AM P.29929) (c) sternal tip of pleopod, (d) abdominal view of same; *Picroceros armatus* (150 mm, AM P.14027) (e) sternal tip of pleopod, (f) abdominal view of same.

characterized by (1) a supraorbital hood comprising an eave produced anteriorly into a stout, forwardly directed spine and separated behind by a narrow fissure from an expanded hepatic lobe; (2) short subparallel rostral spines; (3) a peculiar third maxilliped in which a process of the exognath projected posteriorly from the base or curved round and fitted into a groove in the ischium of the endognath; (4) a carapace produced and flattened posteriorly; (5) a variously elevated branchial margin; and (6) an abdomen of seven free segments in both sexes.

The genus *Stilbognathus* included by 1925, three species from the western Indian Ocean. These were characterized by (1) a supraorbital hood comprising only an eave produced into a spine; (2) moderately long subparallel rostral spines (except in one species — see below); (3) a third maxilliped with the ischium and merus elevated at their junction as an almost circular glistening boss; (4) a carapace produced posteriorly as a short spine; (5) normal branchial margin; and (6) an abdomen of seven free segments in the male but only five in the female (segments 4-6 fused). One of these three, *Stilbognathus*

tycheformis from Mauritius, described by Bouvier (1915a), has a prominent flattened lobe on the posterior part of the supraorbital hood; this has been regarded as a postorbital lobe and this feature has been considered to ally this species with those of *Tyche*. The endognath of the third maxilliped in *S. tycheformis* is elevated and shiny as in other species of *Stilbognathus* and the rostral spines are short. By 1925 the genus *Ophthalmias* included two species, one confined to the Red Sea and one occurring as far east as Japan, differing from *Stilbognathus* in having longer rostral and orbital spines and lacking an elevation on the third maxillipeds.

Seven species of these three genera have been described since 1925. Monod (1939) described a species from Guadeloupe, *Tyche margaritifera*, which differed from other *Tyche* species in having a strong epibranchial spine, a prominent elevation on the merus of the third maxilliped and a rostrum fused for the basal two thirds. Garth (1952) described *Stilbognathus burryi* from off Florida as being similar to *Tyche margaritifera* but with the abdomen of the female possessing only five free segments. Because of this the species was placed in *Stilbognathus* and not *Tyche*. Williams, Shaw & Hopkins (1977) have shown that Garth's species is conspecific with Monod's and placed it in a new genus, *Stilbomastax*.

At the present time the four genera contain 14 species. The largest genus, *Tyche*, contains five species confined to the Americas. The genus *Ophthalmias* includes three species confined to the Indo-West Pacific. The genus *Stilbognathus* possesses four species in the western Indian Ocean. In the current classification the number of free segments in the abdomen of the female and the presence or absence of an elevation on the merus of the third maxilliped have been considered to be of almost paramount importance. The former character has been used to separate *Stilbomastax margaritifera* from other tychines from the Americas and the latter character has been used to distinguish species of *Stilbognathus* from other Indo-West Pacific species which have been placed in *Ophthalmias*.

Stilbomastax margaritifera differs from species of *Tyche* in the form of the rostrum, the epibranchial spine and the excrescence of the merus of the third maxilliped and agrees with species of *Stilbognathus* in possessing an excrescence on the third maxilliped merus and in the abdomen of the female having five free segments. There are obvious differences in the nature of the rostrum and the orbit.

The development of an excrescence on the third maxilliped is not confined to the group of species under discussion; it occurs in several species of *Leptomithrax* but not all of them. Its significance is doubtful; it is hardly a sufficiently important character to separate species into different genera. The prolongation of the exognath is not found in any group of species other than those now placed in *Tyche*.

The fusion of segments of the abdomen is a feature found in several subfamilies. Within the Indo-Pacific genus *Hyastenus* the females of the species usually possess seven free abdominal segments but *H. diacanthus* possesses only five. There is thus no reason to consider the reduction in the number of abdominal segments a character sufficiently important to count against those of the rostrum and orbit.

Numerical taxonomic analysis of the 13 species using up to 96 characters reveals the existence of two distinct groups and possibly four subgroups. In the groupings species of *Stilbognathus* are mixed in with *Opthalmias* species. The characters contributing to this grouping are mainly those classically used in the classification of majid spider crabs and especially those concerned with the carapace.

There is, in our view therefore, no good reason to continue with the anomalous situation outlined above. Clearly, the species at present separated into *Stilbognathus* and *Ophthalmias* should, with the possible exception of *S. tycheformis* be in the one genus.

Distribution. — One species (*S. cervicornis*) widespread throughout the Indo-West Pacific, the remaining species known only from the western Indian Ocean and Red Sea.

KEY TO SPECIES OF *STILBOGNATHUS*

1		Posterior angle of eave produced as a large lobe; rostrum short ..... *S. tycheformis*
—		Posterior angle of eave not produced; rostrum half as long as postrostral carapace length or longer 2
2(	1)	Ischium of third maxilliped anteriorly elevated, round and shiny 3
—		Ischium of third maxilliped with anterior margin flat 5
3(	2)	Notch on medial margin of merus of third maxilliped with a tooth or lobe (i.e. medial margin trilobed); ischium with long, very narrow groove ..... *S. martensii*
—		Notch on medial margin of merus of third maxilliped lacking a tooth or lobe; ischium with a broad groove 4
4(	3)	Merus of third maxilliped strongly arched, only outer blunt corner flat; groove of ischium short ..... *S. erythraeus*
—		Merus of third maxilliped with flat triangular anterolateral angle; groove of ischium long ..... *S. soikai*
5(	2)	Rostral spines straight and divergent; anterior marginal branchial spine long; posterior carapace margin with a medial spine ..... *S. longispinus*
—		Rostral spines subparallel or incurved; anterior marginal branchial spine of moderate length; posterior carapace margin with a medial lobe 6
6(	5)	Medial lobe on posterior carapace margin with apex acute or subacute ..... *S. curvirostris*
—		Medial lobe on posterior carapace margin with apex blunt, rounded ..... *S. cervicornis*

Stilbognathus cervicornis (Herbst, 1803) new combination

Cancer cervicornis Herbst, 1803: 49-50, pl. 58 fig. 2.
Ophthalmias cervicornis. — Guinot, 1962a: 46, fig. 33. — Griffin, 1974: 22, figs. 5, 7a-c.

Material examined. — 1 ♀, 32 mm.

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Mariel King Memorial Expedition — Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15′S 128°8′E, 25-63 m, dredge hauls 8-19, coarse sand, rubble, *Lithothamnion*, 2 June 1970; 1 spec. (prev. det. Serène).

Remarks. — This specimen agrees with others recently discussed (Griffin, 1974). The supraorbital spines are very slightly longer than the eyestalks; the medial lobe on the posterior carapace margin is blunt; on the third maxilliped the surface of the ischium is flat, not grooved, and the medial margin of the merus is bilobed.

Distribution. — Indo-West Pacific from eastern Africa through Sri Lanka, southeast India, Indonesia and Japan to Hawaii.

Stilbognathus martensii Miers, 1884
(Fig. 16a, b)

Stilbognathus martensii Miers, 1884: 521-522, pl. 46 fig. B, b, b′. — Garth, 1952: 252 (in key). — Griffin, 1974: 22 (in discussion).
Ophthalmias martensi. — Guinot, 1962a: 49, 51 (in discussion).
Ophthalmias cervicornis. — Rathbun, 1911: 254-255. (Not *Cancer cervicornis* Herbst, 1803.)

Material examined. — 1 ♂, 1 ♀, 21.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Mortensen Java-S. Africa Expedition: Stn. 45, Mauritius, between Gunner's Quoin and Flat I., ca. 54 m, trawl and dredge, sand and corals, 16 October 1929; 2 specs.

Remarks. — These specimens agree with those described by Miers. The supraorbital spine is shorter than the eyestalk; there is a large tuberculate lobe submarginally on the hepatic region; on the posterior carapace margin there is a dorsoventrally flattened medial lobe which is apically narrow.

The ischium of the third maxilliped is elevated and shiny on the anterior margin and produced forward into the posterior margin of the merus. The fused basis is elevated and produced towards the midline, separated from the rest of the ischium by a transverse extension of the very narrow longitudinal groove. There is a small rounded posterolateral lobe on the ischium. The merus is only moderately elevated on the posterior margin; the medial margin is trilobed and the anterolateral angle is produced into a flat triangular lobe.

The first pleopod of the male has not been figured before. It is almost straight, curving weakly laterally only near the truncate apex. There is a small process on the medial edge of the apex and the lateral margin is curved sternally just behind the tip.

Distribution. — Known only from the western Indian Ocean: Amirante Is., Providence I., and Mauritius.

SUBFAMILY EPIALTINAE

Epialtidae Macleay, 1838: 56.
Acanthonychinae Alcock, 1895: 160, 164, 190. — Rathbun, 1925: 140. — Garth, 1958: 181-182. — Griffin, 1966b: 264.
Epialtinae. — Manning & Holthuis, 1981: 255.

Eyes without true orbits; the eyestalk very short or sometimes even obsolescent, either concealed beneath a forwardly-produced supraocular spine, or sunk in the sides of a huge beak-like rostrum; a postocular spine or process sometimes present, but not excavated for the reception of the retracted eye. Basal antennal article truncate triangular. External maxillipeds with the merus as broad as the ischium. Dactyli of the ambulatory legs prehensile or subchelate; the last three pairs of legs often disproportionately short compared with the (first) pair. (Alcock, as quoted by Garth.)

Pleopod 1 usually slender, weakly curved, aperture usually terminal, apex simple, curved or expanded into lobes, rarely with a slender process.

The majids contained in this subfamily are characterized by a sunken orbit and short, often immobile, eyestalks and many species have a prominent beaked rostrum. That the group is a diverse one is confirmed by the different first pleopods of the male; there are four distinct types exemplified by *Pugettia* with two elongate apical lobes, both medial (scyriform); *Menaethiops* with two triangular apical lobes, one lateral and one medial; *Acanthonyx* with the apex rounded medially and produced laterally; and *Xenocarcinus* with no apical lobes but with a slender, forwardly produced, process. Garth has already drawn attention to the diversity of male pleopods both in the subfamily and within several genera and to the similarity of some species previously placed in this subfamily to species of Pisinae — also a diverse group. At this time we have removed from the Epialtinae *Cyphocarcinus* to the Mithracinae and *Sphenocarcinus* and some species previously placed in *Pugettia* to the Pisinae, the latter being placed within the genus *Rochinia*. From the Pisinae we have withdrawn *Perinia*.

KEY TO INDO-WEST PACIFIC GENERA OF EPIALTINAE

1		Anterior part of carapace ahead of orbits strongly produced laterally completely concealing antennae, anterior margin broad, convex, entire (lacking any rostral lobe or spine) ..... *Cyclonyx*
—		Anterior part of carapace ahead of orbits not produced laterally, flagellum of antenna usually visible dorsally, anterior margin with a single rostrum or with two spines or lobes 2
2(	1)	Rostrum single or secondarily bifurcate 3
—		Rostrum of two spines or lobes, spines generally divergent but sometimes contiguous (*Menaethiops*) 6
3(	2)	Carapace ovate-cylindrical; postorbital lobe close to eye, anteriorly 'cupped'; rostrum stout, cylindrical (except in *X. truncatifrons*) ..... *Xenocarcinus*
—		Carapace pyriform to subtriangular, sometimes with large lateral lobes; postorbital lobe absent or small and simple; rostrum rarely cylindrical, or if so very slender 4
4(	3)	Preorbital angle of eave not produced or dorsoventrally flattened; rostrum large and beak-like, subrectangular to subtriangular in cross-section (short in some females) ..... *Simocarcinus*
—		Preorbital angle of eave dorsoventrally flattened, produced as a spine or lobe or at least a blunt right angle; rostrum usually slender, laterally or dorsoventrally flattened, narrowly ovate in cross-section 5
5(	4)	Branchial margin with two small lobes or tubercles; a small lateral lobe just behind the eye; propod of first ambulatory leg ventrally smooth without lobe or tuft of setae; sexes similar ..... *Menaethius*

— Branchial margin with one lobe, often very large; no lateral lobe just behind the eye; propod of first ambulatory leg with a ventral tuft of setae and sometimes a lobe, in the distal half; sexes dissimilar ..... *Huenia*

6(2) Hepatic lobe laterally produced and expanded in both sexes and separated from a similarly expanded branchial lobe by a shallow concavity or closed fissure; carapace broader than long ..... *Sargassocarcinus*

— Hepatic lobe of variable size but, if present, quite distinct from any branchial lobe or spine; carapace at least as long as broad 7

7(6) Orbit comprising a continuous rim around the eye without hiatus or suture above or below; eye retractile against the rim; meri of first two pairs of ambulatory legs with two blade-like lobes or high tubercles on dorsal margin and tubercles on outer face ..... *Perinia*

— Orbit not comprising a continuous rim, a distinct hiatus present above and below or else eye not retractile against a postorbital lobe; meri of ambulatory legs smooth or with only a terminal tubercle or lobe 8

8(7) Postorbital lobe either a small tubercle or absent or, if large, fused to supraorbital eave 9

— Postorbital lobe well developed, distinct from eave, sometimes fused to hepatic-spine or lobe 10

9(8) Carapace pyriform; hepatic and branchial margins with tubercles or short spines; postorbital lobe fused to supraorbital eave; ambulatory legs not subchelate, sixth segment cylindrical ..... *Menaethiops*

— Carapace subrectangular or suboval; hepatic and branchial margins with lobes; postorbital lobe small or absent, antorbital angle of eave not produced; ambulatory legs subchelate, sixth segment with ventral setiferous projection ..... *Acanthonyx*

10(8) Rostral spines slender, at least $^1/_4$ postrostral carapace length, hepatic lobe directed laterally, slender or dorsoventrally flattened but never laterally flattened; dorsal carapace usually with a few tubercles or short spines ..... *Pugettia*

— Rostral and hepatic lobes both very short (about $^1/_8$ postrostral carapace length) or both broad and dorsoventrally flattened or, if rostral spines long and slender (*A. lappacea*), hepatic lobes laterally flattened and directed straight forward; carapace dorsally usually smooth ..... *Antilibinia*

Acanthonyx Latreille, 1825

Type species. — *Maja lunulata* Risso, 1816, by monotypy.

Remarks. — A complete review of this genus is required to resolve several taxonomic difficulties. We have examined only a few of the described species and have followed previous authors, such as Ortmann (1894), Stephensen (1945), Tirmizi & Serène (1971), in including species of the genus *Dehaanius* Macleay in the genus *Acanthonyx*. Where the degree of fusion of the segments of the male abdomen is not distinct or consistent, such a character is not sufficient on its own as a distinction between genera. However, if future examination shows that among the species included in *Acanthonyx* there are some in which there are always two abdominal segments clearly fused and others in which there is never any indication of fused segments then it could be appropriate to recognise two distinct genera to contain the species. In *A. lunulatus* the fourth and fifth segments are clearly fused and Garth (1958), Chace (1966) and Manning & Holthuis (1981) have described the other five known Atlantic species as also having the fourth and fifth segments fused. In the four Indian Ocean species (*A. elongatus*, *A. quadridentatus*, *A. limbatus*, *A. euryseroche*) that we have examined the sutures between the segments are often indistinct. However, on the basis of the orbit, first pleopod of the male as well as other characteristics we presently consider these four species and *A. lunulatus* to be congeneric. Barnard (1950) states that in *A. scutellatus*, *A. dentatus* and *A. undulatus* the male abdomen has seven segments but does not say if the sutures are equally distinct.

Ten of the species, including the type species *A. lunulatus*, have no postorbital lobe, while in five species a postorbital lobe is present. All the species have a preorbital lobe except *A. simplex* Dana (1855: pl. 5 fig. 4a-d) which has been recorded only once from Hawaii, the only record of this genus from the western Pacific. One species, *A. petiveri*, occurs on both the Pacific and Atlantic coasts of America; five species occur in the eastern Atlantic and Mediterranean; and eight species, including one newly described, are known from the Indian Ocean.

Distribution. — East and west Atlantic, Mediterranean Sea, Indian Ocean, west and east Pacific Ocean.

KEY TO INDO-WEST PACIFIC SPECIES OF *ACANTHONYX*
(modified from Tirmizi & Serène (1971))

1 Carapace without a preorbital spine ..... *A. simplex*[11])

— Carapace with a distinct preorbital spine 2

2(1) Carapace without a distinct postorbital tooth 3

— Carapace with a distinct postorbital tooth 6

3(2) Three large triangular teeth on lateral border of carapace 4

— Two or only one large triangular tooth on lateral border of carapace 5

4(3) Hepatic lobe elongate, apex truncate or subacute, directed obliquely upwards; carapace tubercles well marked; rostrum about $^1/_4$ postrostral carapace length ..... *A. limbatus*

— Hepatic lobe broad triangular, horizontal; carapace tubercles indistinct; rostrum less than $^1/_5$ postrostral carapace length ..... *A. euryseroche*

5(3) Posterolateral tooth of carapace triangular, nearly as large as anterolateral tooth, and separated from one another by a deep concavity ..... *A. elongatus*[12])

— Posterolateral tooth feeble, lateral borders of carapace slightly concave, nearly subparallel ..... *A. scutellatus*[11])

6(2) Lateral teeth of carapace salient, triangular, pointed and separated from one another by concavities 7

— Lateral teeth of carapace short, truncate, not separated from one another by concavities 8

7(6) Carapace with two lateral teeth, a third medial one faintly indicated ..... *A. dentatus*[11])

— Carapace with four lateral teeth ..... *A. quadridentatus*

8(6) Outline of carapace oval, lateral border convex *A. consobrinus*[11,13])

— Outline of carapace sub-rectangular, lateral borders nearly straight and subparallel ..... *A. undulatus*[11,13])

Acanthonyx euryseroche new species
(Figs. 17, 18a, b, Pl. 7)

Material examined. — 14 ♂♂, 7 ♀♀ (1 ovig.), 8-18.5 mm, ovig. ♀, 18 mm.

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[11]) From the literature. (Dana, 1852; Barnard, 1950; Tirmizi & Serène, 1971)

[12]) Includes *A.* aff. *elongatus* Tirmizi & Serène;

[13]) These two very similar species never properly compared.

THE AUSTRALIAN MUSEUM, SYDNEY

Holotype. — Male, cl. 16.5 mm, Western Australia, south of Northwest Cape, Warroora, 23°29′S 113°48′E, shore reef, low tide on algal covered limestone, coll. N. Coleman, 28 June 1972; The Australian Museum, Sydney (AM P.29842).

Paratypes. — Western Australia, data as for holotype; 1 spec. (AM P.19418); 3 specs (AM P.19419); 16 specs. (AM P.29843).

Description. — Carapace broad, width equal to about three quarters (0.74) postrostral carapace length; surface smooth but not shiny, a few small tubercles, each surmounted by a group of setae.

Rostral spines weakly deflexed, basally broad, each tapering to a narrow apex, sometimes apically incurved; a row of curled hairs dorsally on proximal third of each spine; length less than a fifth (0.16) postrostral carapace length.

Orbital eave moderately expanded, surmounted by tuft of stout setae; preorbital spine blunt, directed forward and slightly outward, but hardly upward; lateral margin of eave concave with sometimes a very small swelling posteriorly. Eyestalks short, slender, and except for terminal cornea, concealed under eave.

Hepatic margin produced into a flat, broad, triangular, apically blunt lobe, length about half basal width, posterior margin weakly convex, longer than anterior margin and subparallel to midline of carapace. Branchial margin with three lateral lobes, anterior one very small, sometimes indistinct, two posterior lobes subequal, short, blunt, less than half size of hepatic lobe. All marginal lobes surmounted by a tuft of stout setae. A smooth ridge on lateral carapace margin.

Gastric regions weakly elevated; a small protogastric tubercle surmounted by a tuft of stout setae opposite hepatic lobe, a row of curled hairs in front of tubercle; a small posterior mesogastric tubercle.

Cardiac region only very weakly elevated, with a small medial tubercle; intestinal region with a low central tubercle; a low ridge along posterior carapace margin, continuous with that on lateral margin.

Branchial regions dorsally smooth except for a very small tubercle midway between cardiac tubercle and posterior branchial lobe.

Basal antennal article smooth, a central depression in proximal half; basally broad, narrower distally, anterolateral angle not produced.

Pterygostomian region smooth, margin with a tubercle in distal half. Third maxilliped smooth, anteromedial angle of ischium slightly overlapping posteromedial border of merus; merus broad, subquadrate, anterolateral angle produced and rounded, notch anterior, shallow.

Cheliped about three quarters postrostral caparace length. Merus of adult male smooth, a proximal seta dorsally and a small, blunt, terminal tubercle surmounted by a group of stout setae; carpus with a blunt ridge dorsally; palm smooth, length about one and a half (1.4) times height; fingers short, hardly gaping proximally, less than two thirds palm (0.62), uniform small teeth along cutting edge of both fingers.

Ambulatory legs smooth, merus of first leg with a seta midway dorsally, and a group of setae on a low terminal tubercle; propod with a compressed, obtusely triangular lobe about midway along ventral margin, setae along distal margin of lobe; a similar lobe on propodi of second to fourth pairs of legs; dactyli of ambulatory legs with a double row of about ten small teeth ventrally along their length. First ambulatory leg slightly greater (1.1) than postrostral carapace length, fourth leg less than two thirds (0.6) length of first.

Male sternum smooth, a pair of small, circular, submedial pits just behind anterior margin, a shallow central depression in front of abdominal fossa.

Male abdomen of seven segments, junctions visible between all segments, sixth segment less than half width of third segment; sixth and seventh segments both about as wide as long. In half the males junctions between fourth and fifth segments are less pronounced.

Female abdomen smooth, segments four to six fused with no suture lines visible.

First pleopod of male straight, broad, slightly narrowed before broad apex; anterior margin recurved ventrally, medial angle rounded, lateral angle subacute; aperture subterminally on sternal surface.

Female gonopore a narrow slit opening anteriorly.

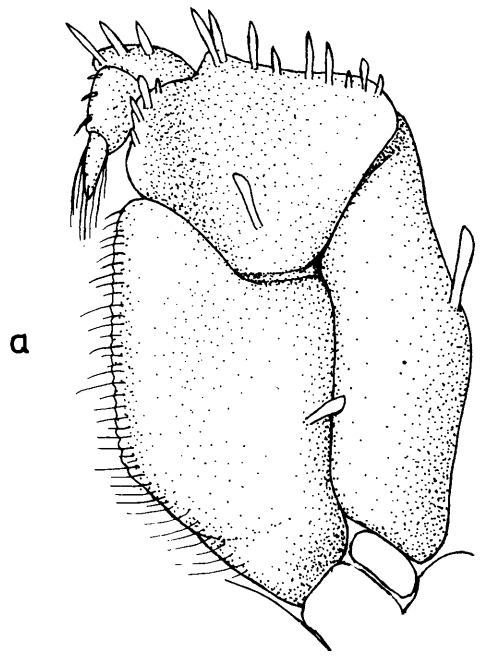
Remarks. — This species resembles *A. limbatus* A. Milne Edwards in lacking a postorbital spine and in having three well developed lateral lobes on the carapace. However, it differs from *A. limbatus* as figured by A. Milne Edwards (1862: pl. 17 fig. 4), *A.* (*limbatus*?) figured by Stephensen (1945: fig. 19) and our specimen of *A. limbatus* from India in having a flat, broad, triangular hepatic lobe rather than a truncate or subacute, elongate tooth.

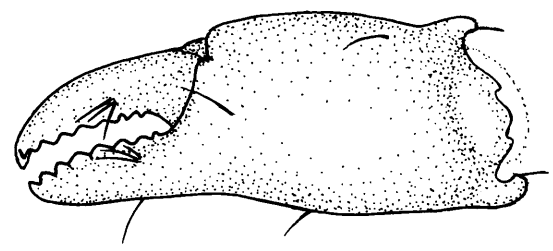
A. limbatus and the new species can be distinguished by the following additional points:

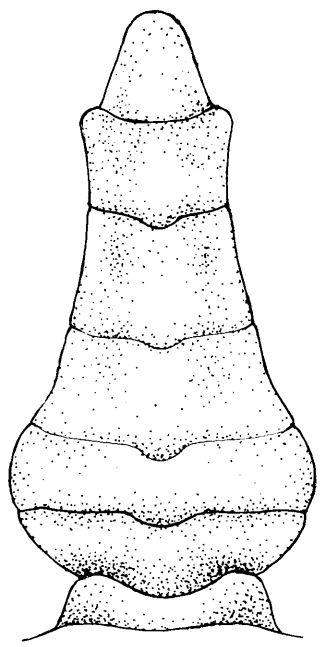
(1) the carapace tubercles are small and indistinct (well marked in *A. limbatus*);
(2) the rostral spines are less than one fifth postrostral carapace length (about a quarter postrostral carapace length in *A. limbatus*);
(3) the preorbital spine and hepatic lobe are horizontal (directed obliquely upwards in *A. limbatus*);
(4) the basal antennal article has a central depression proximally (absent in *A. limbatus*);
(5) the cheliped is shorter than, and first ambulatory leg equal to, the postrostral carapace length (cheliped slightly greater than, and first ambulatory leg one and a half times postrostral carapace length in *A. limbatus*).

Even in our largest male of *A. euryseroche* (cl. 18 mm), which appears to be adult, there are uniform teeth along the dactyl of the cheliped, whereas there is a large low tooth on the dactyl of our adult male of *A. limbatus*.

The name is derived from the Greek *eurys* — broad and *exochos* — projecting, referring to the broad lobes on the lateral margins.







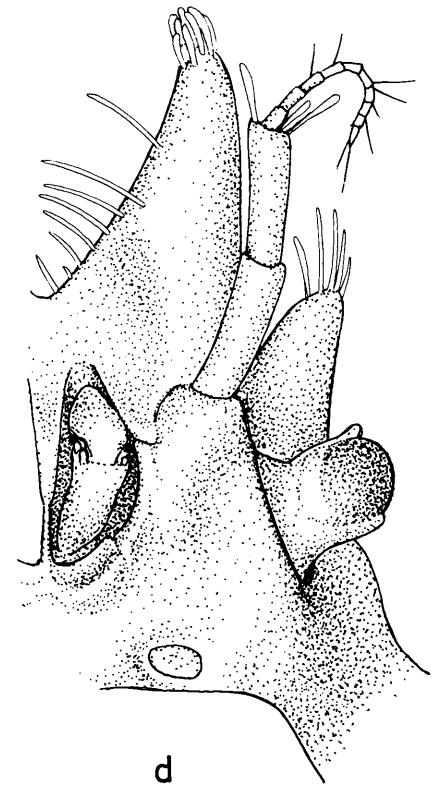


Fig. 17. *Acanthonyx euryseroche* (holotype) (a) left third maxilliped; (b) left chela of male; (c) male abdomen; (d) left orbit, ventral view.

Distribution. — Known only from Warroora, Western Australia.

Acanthonyx limbatus A. Milne Edwards, 1862

Acanthonyx limbatus A. Milne Edwards, 1862: 7-8, pl. 17 figs. 4, 4a-b. — Tirmizi & Serène, 1971: 23 (in key).
Acanthonyx (*limbatus?*). — Stephensen, 1945: 102-105, figs. 19A-H.

Material examined. — 1 ♂, 17 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

South India, Pamban Passage, 3.6 m, April 1889; 1 spec.

Remarks. — This specimen agrees well with that from the Gulf of Iran figured in detail by Stephensen (1945) and with the specimen described and figured by A. Milne Edwards (1862).

The rostral spines are a quarter postrostral carapace length. There are two very small convex lobes posteriorly on the orbital eave. The hepatic lobe is narrow, truncate, about as long as it is wide basally. The cheliped of this adult male is slightly longer (1.2) than the postrostral carapace length; there is a large low tooth on the dactyl in the narrow gape between the fingers. The first ambulatory leg is one and a half times the

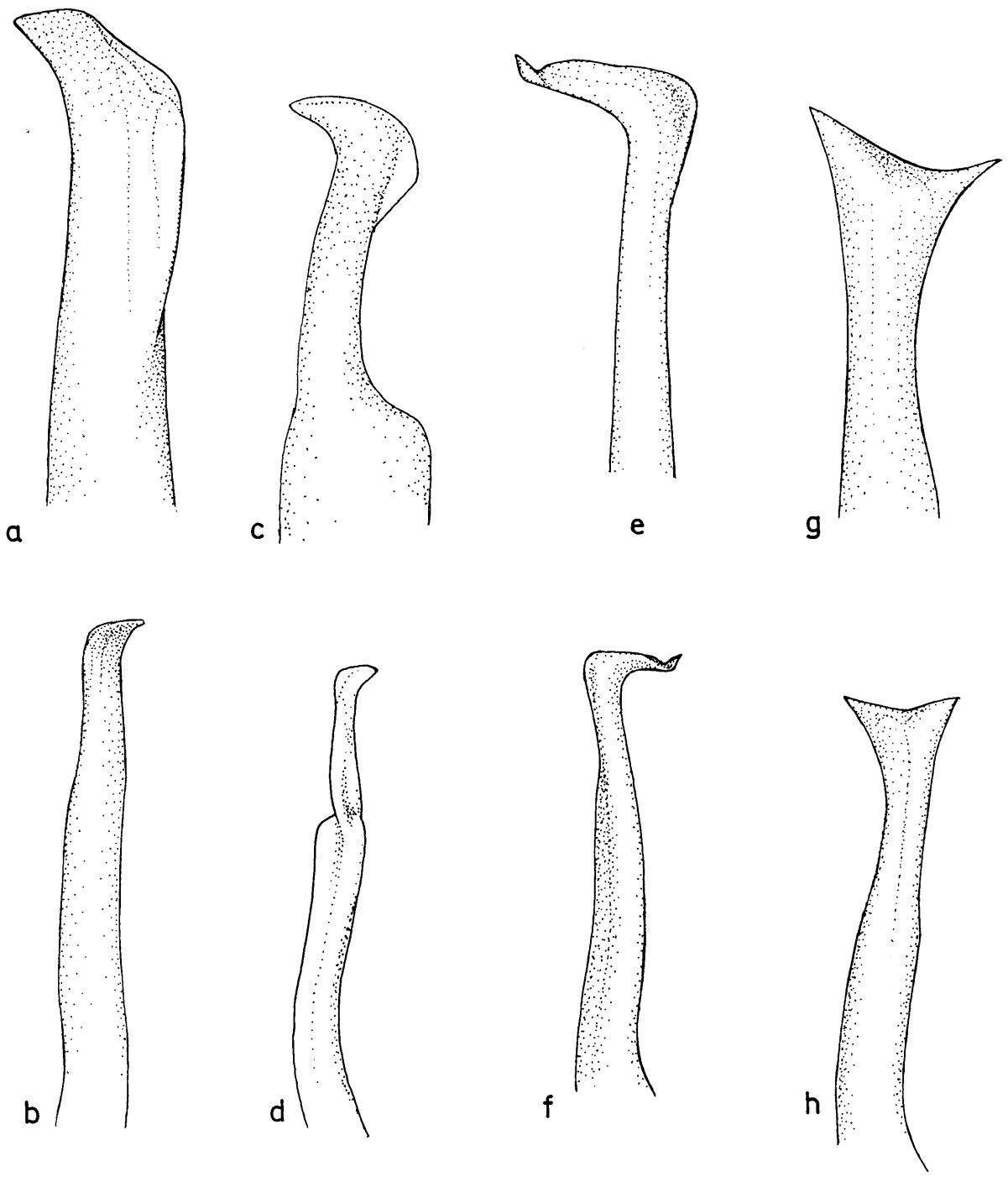


Fig. 18. Left first pleopod of male of *Acanthonyx euryseroche* (holotype) (a) sternal tip of pleopod, (b) abdominal view of same; *Menaethius orientalis* (8.5 mm, Roti I., ZMA) (c) sternal tip of pleopod, (d) abdominal view of same; *Sargassocarcinus sublimus* (7.5 mm, Japan, USNM 48248) (e) sternal tip of pleopod, (f) abdominal view of same; *Menaethiops xiphias* (holotype) (g) sternal tip of pleopod, (h) abdominal view of same.

postrostral carapace length and the fourth leg is about two thirds (0.66) the first.

In our specimen the segments of the male abdomen are not as clearly separated as in that figured by Stephensen (his fig. 19), the junctions between both segments four and five, and segments five and six, are very indistinct and barely visible. On the first pleopod of the male the aperture is on the sternal surface just before the anterior margin; there is a small, rounded lobe on the proximal edge of the aperture.

A. limbatus and *A. euryseroche* are distinguished from other known species of *Acanthonyx* by the absence of a postorbital spine together with the presence of three well developed lateral lobes on the carapace. The differences which distinguish *A. limbatus* from *A. euryseroche* are discussed under that species.

Distribution. — Indian Ocean: Ile de la Réunion, Gulf of Iran, NE. and southern India.

Antilibinia Macleay, 1838

Type species. — *Antilibinia smithii* Macleay, 1838, by monotypy.

Remarks. — The type species of this genus is a large, shallow water crab from the eastern coast of southern Africa. The other three species, including one newly described here, are small species found at depths of 200 m or more in the western Pacific.

The first pleopod of the male of *A. smithii* has been figured by Barnard (1950: fig. 7d): it is similar to that of some species of *Acanthonyx*. The pleopod of the adult male is "not known" for any of the western Pacific species so we are unable to compare it with that of the type species.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *ANTILIBINIA*

1	Carapace subcircular; a tubercle or short spine on branchial margin at point of greatest width; a large (up to 70 mm cl.), shallow water species ..... *A. smithii*
—	Carapace suboval, branchial margin smooth or with an indistinct tubercle or tubercles; small (about 14 mm cl.), deep water species 2
2(1)	Rostrum about 1/6 postrostral carapace length; postorbital and hepatic lobes very short and subequal ..... *A. gilloloensis*
—	Rostrum at least 1/3 postrostral carapace length; hepatic lobe much longer than postorbital lobe 3
3(2)	Rostral spines slender; preorbital, postorbital and hepatic spines narrow and laterally compressed; carapace with numerous long, straight hairs ..... *A. lappacea*
—	Rostral spines broad, dorsoventrally flattened; preorbital, postorbital and hepatic lobes broad and dorsoventrally flattened; carapace with few hairs ..... *A. polita*

Antilibinia lappacea Rathbun, 1918

Antilibinia lappacea Rathbun, 1918: 12-14, fig. 3, pl. 7 fig. 3. — Hale, 1927: 133-134, fig. 133. — Griffin, 1966b: 267-268, 277 (in key).

Material examined. — 1 ♀, 13.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Danish Kei Islands Expedition: Stn. 56, Kai Is., 05°30′20″S 132°51′E, 345 m, trawl, mud, 10 May 1922; 1 spec.

Remarks. — This specimen agrees very well with the holotype (ovig. ♀, postrostral cl. 13 mm, AM E.3659) from the Great Australian Bight. The only differences are very slight. The preorbital spine and the postorbital lobe are slightly shorter and broader than in the holotype and the tubercles on the pterygostomian margin are not as strongly developed. Our specimen is infected with a sacculina parasite, but the abdomen is the same as in the holotype (an ovigerous female); the fifth and sixth segments appear fused but the line between them is still visible.

This species has previously been known only from the holotype.

There is no good reason as far as we can see to regard *Pisidarum* sp., figured and briefly described by Serène & Vadon (1981: 128, pl. 4 fig. F), as anything other than an *Antilibinia* and most probably *A. lappacea*.

Distribution. — Great Australian Bight; Kai Islands.

Antilibinia polita new species
(Fig. 19, Pl.8)

Material examined. — 1 ♂, 6.5 mm, 1 ♀, 14 mm.

Holotype. — Female, adult, cl. 14 mm, Mindanao, Moro Gulf, 07°25′N 123°14′E, 450 m, Sigsbee trawl, 9 March 1914, Mortensen Pacific Expedition 1914-16; Zoological Museum, University of Copenhagen.
Paratype. — Male, cl. 6.5 mm, data as for holotype.

Description. — Carapace broad, width equal to 0.8 postrostral carapace length, anteriorly elevated, smoothly sloped, regions not defined at all; surface shiny, no tomentum, a small protogastric group of curled hairs and curled hairs along subbranchial region.

Rostral spines broad, dorsoventrally flattened, fused in proximal half, lateral edges parallel, separated in distal half by a broad V-shaped hiatus, length about one third (0.3) postrostral carapace length; spines apically blunt in holotype, acute in small male.

Orbital eave moderately expanded, preorbital lobe broad, about as long as basal width, directed obliquely forward and outwards, apex blunt (acute in small male); no antorbital lobe; postorbital lobe short, about as long as basal width, subequal to preorbital lobe, apex blunt (acute in small male).

Hepatic margin produced laterally into a broad, triangular lobe, dorsoventrally flattened, posterior margin longer than anterior. Subhepatic region smooth. Branchial margin with a very small convex lobe, almost continuous with posterior margin of hepatic lobe. Branchial submargin with a row of five small tubercles on epimeral ridge; a low posterolateral ridge just above carapace margin, epibranchial tubercle very small, indistinct.

Highest elevation of carapace in posterior mesogastric region, carapace sloping evenly to posterior carapace margin which is slightly thickened; cardiac region marked only by indistinct lines.

Basal antennal article smooth, flat except for a very shallow depression centrally in proximal half; broad basally and narrowing slightly distally; anterolateral angle produced forward to a sharp spine in small male, but to a short blunt tooth in adult female; a small tubercle just lateral to green gland.

Pterygostomian region smooth except for a lateral tubercle near margin and about halfway along; margin with four or five blunt tubercles. Third maxilliped smooth, a low ridge close and parallel to lateral margin of ischium; anterolateral angle of merus only slightly produced and rounded, notch shallow.

Merus of cheliped of adult female (holotype) dorsally sharp, with two small compressed lobes proximally and a blunt terminal spine; a small proximal tubercle ventrally; carpus with a large convex carinate ridge dorsally. Palm with dorsal and ventral margins rounded, length one and a half times height; fingers shorter (0.8) than palm with a narrow gape between them in proximal half; two or three large teeth on each finger in gape and broad low teeth on both fingers where they meet in distal half.

Ambulatory legs smooth, meri with a blunt terminal spine; carpus of second to fourth pairs of ambulatory legs with a small proximal tubercle dorsally; dactyl of fourth leg with three very small distal teeth ventrally and a long curved terminal spine. First leg about one and a half times postrostral carapace length, fourth leg about three quarters length of first leg.

Male sternum smooth, small triangular area elevated on anterior margin.

Male abdomen of seven segments, smooth; sixth segment about one and a half times as wide as long, seventh segment about as wide as long; third segment more than one and a half times (1.7) wider than sixth segment.

Abdomen of adult female smooth, fifth and sixth segments fused, junction between them visible only on midline.

First pleopod of juvenile male straight with a simple blunt apex.

Female gonopore a simple, circular aperture, opening ventrally.

Remarks. — This species is very similar to *A. lappacea* Rathbun, especially in the shape of the carapace, but it can be distinguished from that species by the following features: —

(1) the rostral spines are broad and dorsoventrally flattened, fused in the proximal half; in *A. lappacea* the rostral spines are slender and fused only in the proximal quarter to third;
(2) the preorbital, postorbital and hepatic spines are short, broad and dorsoventrally flattened (as in *Huenia*); in *A. lappacea* these spines are long and narrow or laterally flattened;
(3) the carapace with very few hairs; in *A. lappacea* there are numerous long, straight hairs on the carapace.

A. gilloloensis Rathbun is distinguished from *A. polita* by having: (1) much shorter rostral spines (about one seventh or less of postrostral carapace length); (2) the regions clearly defined on the carapace; (3) the carapace covered with a short tomentum; and (4) by the absence of a terminal spine on the merus of the ambulatory legs.

The female of *A. gilloloensis* is unknown, and the first pleopod of the male has not been described or figured. The male of *A. lappacea* is unknown and the male of *A. polita* is only a juvenile, so we are unable to make any comparison between the pleopods of the western Pacific species of this genus and that of *A. smithii* Macleay from East Africa figured by Barnard (1950: fig. 7). As previously observed (Griffin, 1966b) a new genus may be required for the western Pacific species.

In both *A. lappacea* and *A. polita* the fifth and sixth segments of the female abdomen are fused. In these two species it is interesting to note the form of the adult female cheliped which has a strongly carinate carpus, a short, high palm and a gape between the fingers as in adult males of species of other genera.

The name of the new species refers to the characteristic polished appearance (from *polio*, *-itus* (L.) make smooth).

Distribution. — Known only from the type locality, Moro Gulf, Mindanao, Philippine Islands.

Cyclonyx Miers, 1879

Type species. — *Huenia frontalis* White, 1847, by monotypy.

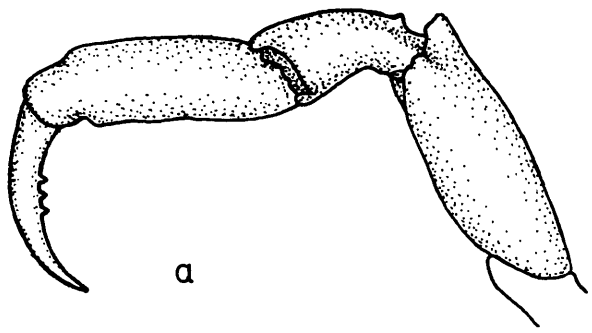
Remarks. — The single species of this genus has not been reported since its original description and Miers (1879a) has commented on the poor condition of the holotype. In *Cyclonyx frontalis* the carapace is expanded in front of a narrow orbital recess and completely conceals the antennae. There is no preorbital angle. While this species resembles *Huenia brevifrons* Ward in the broad lateral lobes on the carapace, the anterior of the carapace is quite distinct from that seen in species of *Huenia*. As our knowledge of this species is so poor we cannot comment further on its relationship to other species and genera.

Distribution. — Locality unknown.

Huenia De Haan, 1839

Type species. — *Maja* (*Huenia*) *proteus* De Haan, 1839, by monotypy.

Remarks. — The members of this genus are sexually dimorphic and mimic the algae amongst which they live. Early authors, such as De Haan (1839) Adams & White (1848) and Dana (1852), described several species in this genus and also varieties of *H. proteus* De Haan based on the various carapace shapes. Miers (1879a, 1879c) removed from this genus, to genera of their own, those species which lacked a preorbital spine and he also described a new species, *H. pacifica*, distinct from the similar *H. proteus* and *H. grandidierii* A. Milne Edwards. Miers (1884) later suggested that the varieties *heraldica*, *elongata* and *tenuipes* were all forms of *H. proteus*. Some recent authors, including Barnard (1950), Takeda (1973a) and Sakai (1976), have regarded *H. pacifica* and *H. grandidierii* as synonyms of *H. proteus* but the present treatment recognises the three species described by Miers as distinct. Two other distinct species, *H. bifurcata* Streets and *H. brevifrons* Ward, are recognised by us. *H. proteus* is widespread in the Indo-west Pacific, *H. pacifica* occurs in the western Pacific and *H. grandidierii* appears to be restricted to the western Indian Ocean.



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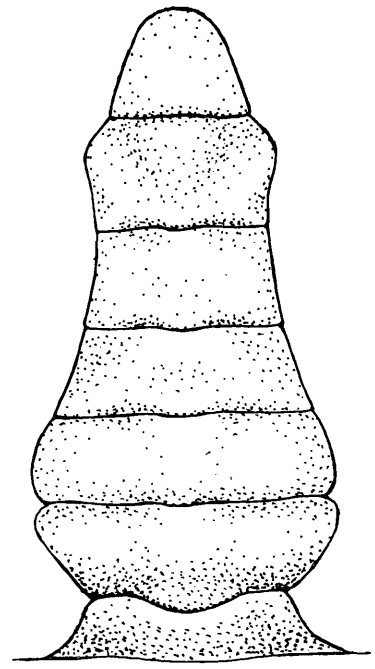

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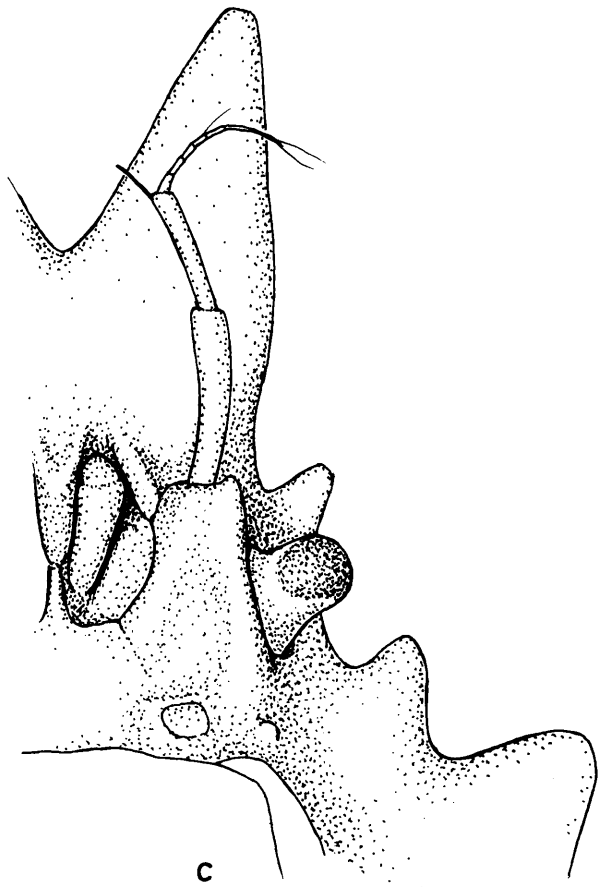

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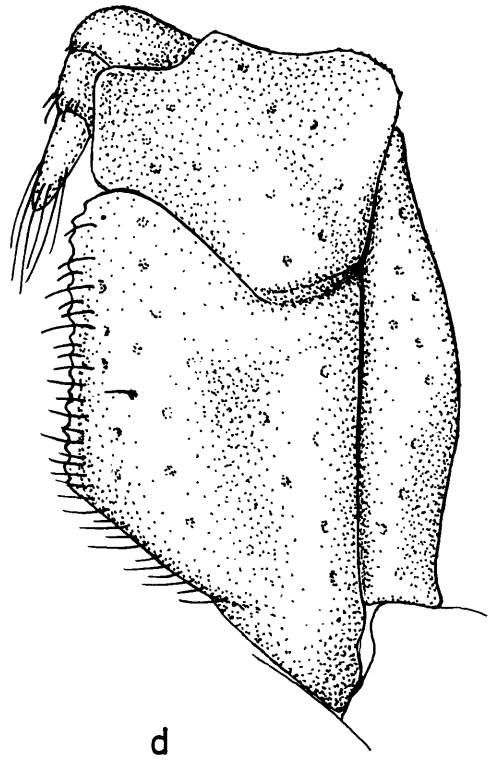


d

Fig. 19. *Antilibinia polita* (holotype) (a) left fourth ambulatory leg; (male, 6.5 mm, Mindanao, ZMC) (b) male abdomen; (holotype) (c) left orbit, ventral view; (d) left third maxilliped.

In southern Australian waters where *H. proteus* and *H. pacifica* are absent the genus is represented by three species — *H. bifurcata* off the coast of New South Wales and *H. australis* and *H. halei* around the southern coastline and in Tasmania. A third new species, *H. keelingensis*, is described from the Cocos Keeling Islands. This genus is apparently closely associated with particular kinds of algae, notably *Halimeda*, and it is probable that the distribution of the species of *Huenia* is correlated with the distribution of species of algae.

The first pleopod of the male in most species is weakly

broadened at the tip and curves slightly outwards, but in the Australian species the tip is more strongly expanded and quite strongly curved outwards.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *HUENIA*

1	Preorbital angle narrow, a laterally flattened or cylindrical spine	2
—	Preorbital angle broad, dorsoventrally flattened	4
2(1)	Posterior margin of carapace convex; branchial lobe of female subacute	*H. grandidierii*
—	Posterior margin of carapace straight; branchial lobe of female truncate or extremely broad	3
3(2)	Carpus of first ambulatory leg carinate	*H. proteus*
—	Carpus of first ambulatory leg lacking any carina	*H. pacifica*
4(1)	Preorbital lobe weakly developed, very broad, angle obtuse or a short spine projecting forward from lobe	5
—	Preorbital lobe strongly developed and projecting forward, angle acute or subacute	7
5(4)	Rostrum distally very narrow; carpus of ambulatory legs dorsally flattened	*H. keelingensis*
—	Rostrum evenly tapering, distally blunt or rounded; carpus of ambulatory legs cylindrical or carinate	6
6(5)	Ambulatory legs strongly carinate	*H. brevifrons*
—	Ambulatory legs cylindrical	*H. aff. brevifrons*
7(4)	Rostrum distally flattened dorsoventrally, bifurcate	*H. bifurcata*
—	Rostrum cylindrical or subcylindrical, at most weakly notched apically	8
8(7)	Ambulatory legs cylindrical; rostrum narrowed distinctly in distal quarter	*H. australis*
—	Ambulatory legs with at least carpus prominently carinate dorsally; rostrum evenly tapering distally	*H. halei*

Huenia australis new species
(Figs. 20, 22f, 25c, d, h)

Material examined. — 5 ♂♂, 5 ♀♀, 10-26 mm.

Holotype. — Male, cl. 21.5 mm, west coast of South Australia, Whittlebee Point, 28 February 1975 coll. W. Zeidler. South Australian Museum SAM C3877.

Paratypes. — As listed below:

SOUTH AUSTRALIAN MUSEUM, ADELAIDE

South Australia, Port Willunga; 1 spec. (SAM C1107, prev. det. as *H. proteus*). — W. coast South Australia, (as for holotype); 1 spec. (SAM C3878).

MUSEUM OF VICTORIA, MELBOURNE

Victoria, Westernport, Shoreham, intertidal, 5 March 1967; 1 spec. — Bass Strait, Deal I., 10-30 m, coll. S. Shepherd, 7 May 1974; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Tasmania, Port Arthur; 1 spec. (AM P.4479); 1 spec. (AM P.6044). — Southwest Tasmania, dredged in shallow water; 1 spec. (AM P.29856). — Western Australia, Rob I., off Cape le Grande, 15 m, coll. A. Kuiter, 20 March 1978; 1 spec. (AM P.29857). — Western Australia, Perth, Carnac I., 6 m, reef, living on algae, coll. N. Coleman, 23 January 1972; 1 spec. (AM P.23814).

Description. — Carapace broad, lateral margin produced on each side into two lobes, carapace width between lobes about two thirds postrostral carapace length, surface smooth, minutely pitted.

Rostral spine a quarter to a third postrostral carapace length, narrow basally and tapering slightly to a deep, blunt apex; weakly deflexed; slightly deeper basally than distally, dorsal surface narrow just behind apex (sometimes almost triangular in cross-section); curled setae on basal half.

Preorbital spine large, dorsoventrally flattened, apically blunt; length equal to or greater than the basal width of the rostrum.

Mesogastric region with a low tubercle posteriorly. Protogastric regions each with a low tubercle forward of the mesogastric tubercle and forming with it an inverted triangle. Cardiac region with a low tubercle. Intestinal region smooth, posterior margin of carapace convex, curved downward over abdomen.

Hepatic margin produced laterally to form a subacute triangular lobe of variable size, small and narrow to broad and blunt, sometimes with a small lobe on anterior margin. Branchial margin in both sexes produced to form a broad triangular lobe with a small lobe on anterior margin.

Basal antennal article smooth, laterally rounded (not with a sharp ridge as in *H. bifurcata*), no anterolateral tubercle. Third maxilliped smooth, anterolateral angle of merus weakly produced and rounded.

Pterygostomian region and margin smooth, without tubercles. Sternum smooth.

Merus of cheliped of adult male smooth, with a strong, blunt, terminal spine; carpus with a well developed lateral ridge and a small dorsal tubercle; palm smooth, not carinate, fingers short, gaping for proximal half, coarsely toothed distally, dactyl with prominent tooth in gape. Merus of first ambulatory leg smooth, cylindrical with a strong, blunt terminal spine; carpus with a small dorsal tubercle midway, not carinate; propod with a small lobe ventrally, bearing a small tuft of setae at about distal third. Second to fourth pairs of ambulatory legs not carinate, meri with a terminal tubercle, carpi sometimes with a small dorsal lobe, propodi with a small tuft of setae surmounting a weak lobe at distal half or third. (One adult female (AM P.4479, Tasmania) has a small group of setae dorsally on cheliped palm, and also on some segments of ambulatory legs.)

Male abdomen smooth, sixth and seventh segments both about as long as wide.

First pleopod of male expanded distally, anterior margin with a transparent crest produced laterally, hook-like.

Female abdomen smooth, segments four to six fused. Female gonopore a slit, opening anteromedially.

Remarks. — None of our preserved or dried specimens have retained any colour, but a colour slide from the Tasmanian Museum of an adult male of this species (about 36 mm, Tasmania, due east of Schouten I., 110 m, dredged, on seaweed, coll. H. J. Rattenbury, 20 February 1977, photo N. R. Kemp) shows it to be red with a large medial white patch, extending from just in front of the anterior gastric tubercles to the posterior carapace margin.

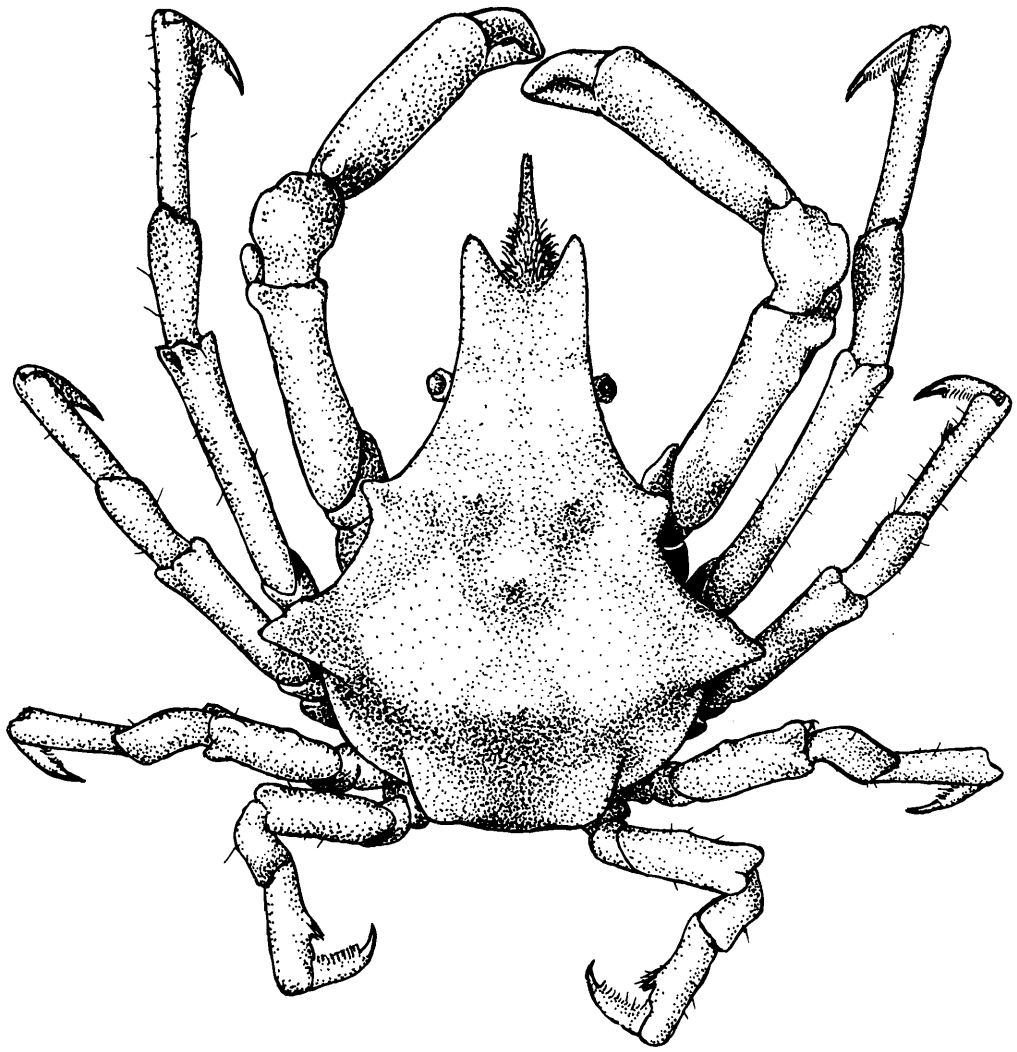


Fig. 20. *Huenia australis* (holotype) whole animal, dorsal view.

This species resembles *H. halei* and the characters of the rostrum and the ambulatory legs which distinguish it are discussed under that species.

Distribution. — Southern Australia: Southern Western Australia, South Australia, Victoria and Tasmania.

Huenia bifurcata Streets, 1870
(Fig. 25a, b, g)

Huenia bifurcata Streets, 1870: 107. — Haswell, 1882: 8-9. — Griffin, 1966b: 278 (in key), pl. 15 figs. d, e.

Material examined. — 28 ♂♂, 15 ♀♀ (9 ovig.), 4.0-28.5 mm, smallest ovig. ♀, 13.5 mm.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Holbourne I., 19°44′S 148°22′E; 1 spec. (AM P.6759). New South Wales: Off Woody Head, 29°22′S 153°22′E, in prawn trawl, 1962; 1 spec. (AM P.27145). — Iluka Bluff, near mouth of Clarence R., intertidal, coll. A. A. Cameron, 16 August 1966; 1 spec. (AM P.16002). — Off entrance to Clarence R., in prawn trawl net; 1 spec. (AM P.11895). — Port Stephens, 6-12 m; 1 spec. (AM P.4921). — Broken Bay, near Sandy Point, March 1926; 3 specs. (AM P.8620). — Collaroy, Long Reef; 4 specs. (AM P.8621). — Collaroy Beach, in sponge, coll. P. Colman, 30 August 1969; 1 spec. (AM P.27146). — Port Jackson; 1 spec. (AM P.288); 3 specs. (AM P.1911); 1 spec. (AM P.1912). — Port Jackson, Bottle and Glass Rocks; 3 specs. (AM P.8614). — Bottle and Glass Rocks, intertidal, under stones, 27 May 1926; 1 spec. (AM P.9226). — Port Jackson, off Sow and Pigs Shoal, 4-5 m; 1 spec. (AM P.9350). — Sow and Pigs Reef, 5 m, coll. F. A. McNeill, 1926; 1 spec. (AM P.8716). — Between Sow and Pigs Reef and Green Point, dredged, 25 August 1923; 1 spec. (AM P.6484). — North Bondi, 5 m, in brown algae, coll. R. H. Kuiter, 1 October 1978; 1 spec. (AM P.29853). — Near Sydney, La Perouse, Bare I., coll. A. Healy, 17 September 1968; 1 spec. (AM P.16346). — Shellharbour; 3 spec. (AM P.6306). — Shellharbour, intertidal; 2 specs. (AM P.8432). — Bass Point, 7 m, coll. A. Kuiter, 10 February 1979; 1 spec. (AM P.29854). — Montague I., 36°15′S 150°14′E, 15 m, algal washings, coll. A. Kuiter, December 1978; 10 specs. (AM P.29855).

Remarks. — These specimens agree well with the brief description given by Streets (1870) and the specimens previously figured (Griffin, 1966b). In this series, as is usual, the rostrum is short, one fifth to one quarter postrostral carapace length and similar in both sexes, basally deep but distally shallow and bifurcate, distally much wider than deep and rostral length about twice (1.7 to 2.5) the distal width.

Ventrally the rostrum is narrowest about halfway along. The preorbital spine is large, broad and dorsoventrally (but not laterally) flattened.

The lateral hepatic lobe is absent from the male, broad and blunt with a small lobe on the anterior margin in the female, truncate in adult females, subacute in juveniles. The branchial lobe is broad, truncate and weakly bilobed in both sexes. The posterior margin of the carapace is smooth, convex, projecting backward, laterally slightly raised but without tubercles.

The cheliped merus is smooth, with a strong, blunt terminal spine; the carpus is very strongly carinate laterally, the palm is not carinate. The merus of the first ambulatory leg has a strong, compressed terminal spine, the carpus bears a small, dorsal, compressed triangular lobe, the propod is compressed and widened at about the distal third to form a small ventral lobe which bears a tuft of setae. Ambulatory legs two to four are somewhat compressed, the meri being carinate with a terminal lobe; the carpi are carinate; the propodi weakly carinate with a tuft of setae at the distal third or half (referred to as a 'spine' by Streets).

The male abdomen is smooth the sixth and seventh segments each being about as wide as long. The first pleopod of the male is expanded distally, with a transparent crest across the anterior margin.

This species is distinguished from all other known species of *Huenia* by the distally broad and bifurcate rostrum.

Distribution. — East Australian coast from Townsville (Queensland) to Bega (N.S.W.).

Huenia brevifrons Ward, 1941
(Fig. 21b, c)

Huenia proteus. — Borradaile, 1903: 686 (in part), fig. 124, pl. 47 fig. 2. — Sankarankutty, 1961: 132-133, fig. 2, C, D. (Not *Maja* (*Huenia*) *proteus* De Haan, 1839.)

Huenia brevifrons Ward, 1941: 3, figs. 3, 4. — Sakai, 1976: 208-209, pl. 71 fig. 5. — Takeda, Okamoto & Fukuda, 1976: 103-108, figs. 1-6, pl. 1. — Chen, 1980: 122-123, fig. 6.

Material examined. — 1 ♀, 14.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 144, South Moluccas, anchorage north of Salomakiaee (Damar) I., reef exploration, 7-9 August 1899; 1 spec.

Remarks. — This specimen, an adult female, agrees with the holotype (a small immature female, 9.7 mm, Gulf of Davao, Philippines, 1936; AMNH 8328, no ambulatory legs) which has been examined by one of us (D.J.G.G.). In our specimen the hepatic lobe is strongly convex anteriorly and produced forward and the branchial lobe is posteriorly rounded. (In the holotype the hepatic lobe is convex but not produced forward and the branchial lobe has a sharp posterior angle.)

In our specimen the carapace width (15 mm) is greater than the postrostral carapace length (11.5 mm). The rostrum is short, triangular, its length (3 mm) subequal to basal width (3.2 mm), not deflexed; the dorsal surface is concave, the apex broad and rounded, apical depth about half apical width. The supraorbital region is broad, width (4.75 mm) greater than twice the length (2 mm). The preorbital spine is small, acute and directed forwards. The gastric regions have three broad tubercles in a triangle, apex posteriorly; the cardiac region bears a low tubercle. The intestinal region has the posterior margin produced backwards and the posterolateral margin weakly upturned. Only the cheliped and first ambulatory leg are present with the specimen. The cheliped merus is carinate dorsally and ventrally, with three lobes on each edge; the carpus is carinate; the palm is strongly carinate dorsally and sharp ventrally. The first ambulatory leg is short (about three quarters cl.), the merus and carpus compressed and carinate; the propod is strongly compressed, about one and a half times as long as high, with a small tuft of setae on the distal ventral angle. The abdomen of the female has segments 4-6 fused.

Sakai (1976) suggests that because the 'leaf-like' specimen figured by Borradaile (1903: 686 (in part), fig. 124, pl. 47 fig. 2) doesn't have a preorbital spine it is not a *Huenia*. In Borradaile's specimen the preorbital angle is a blunt right angle and not produced into a spine, but this cannot be regarded as the same thing as 'lacking a preorbital spine' (e.g. as in *Simocarcinus*). It seems clear, as noted by Takeda et al. (1976), that these 'leaf-like' specimens are not Huenia proteus but *Huenia brevifrons* Ward (or a closely related species) as is also the specimen figured as *H. proteus* by Sankarankutty (1961: 132-133, fig. 2, C. D). The pleopod of the male of *H. brevifrons* figured by Takeda et al. (1976: fig. 6) is similar to the pleopod of *Huenia proteus*.

The specimens described by Sakai (1976) and Takeda et al. (1976) are all from Ishigaki I. in the Ryukyu Islands. It seems reasonable to assume that Sakai's specimen (cw. 12 mm) is an adult of the same species as Takeda's specimen (cw. 5 mm). If this is so, then there is a marked increase in the carination of the ambulatory legs with increasing size.

We have also examined a specimen from Heron I., Queensland, (immature female, cl. 9.5 mm, reef, August 1962, AM P.29848) which resembles *H. brevifrons* in many features, but the differences (particularly in the legs) from our other specimen make us doubt that they are conspecific. In carapace shape the Heron I. specimen resembles the immature males described by Takeda et al; However, the ambulatory legs are cylindrical in the Heron I. specimen and not even weakly carinate as in Takeda's specimen. The holotype of *H. brevifrons* is an immature female only slightly larger than the Heron I. specimen, but according to Ward, the ambulatory legs (now missing) are short and compressed. The carapace width (8 mm) of the specimen from Heron I. is nearly equal to the postrostral carapace length (8.5 mm). The rostrum is short (1 mm), triangular, as long as it is wide basally with a flat dorsal surface, and weakly deflexed from the supraorbital region; the apex is blunt, slightly deeper than

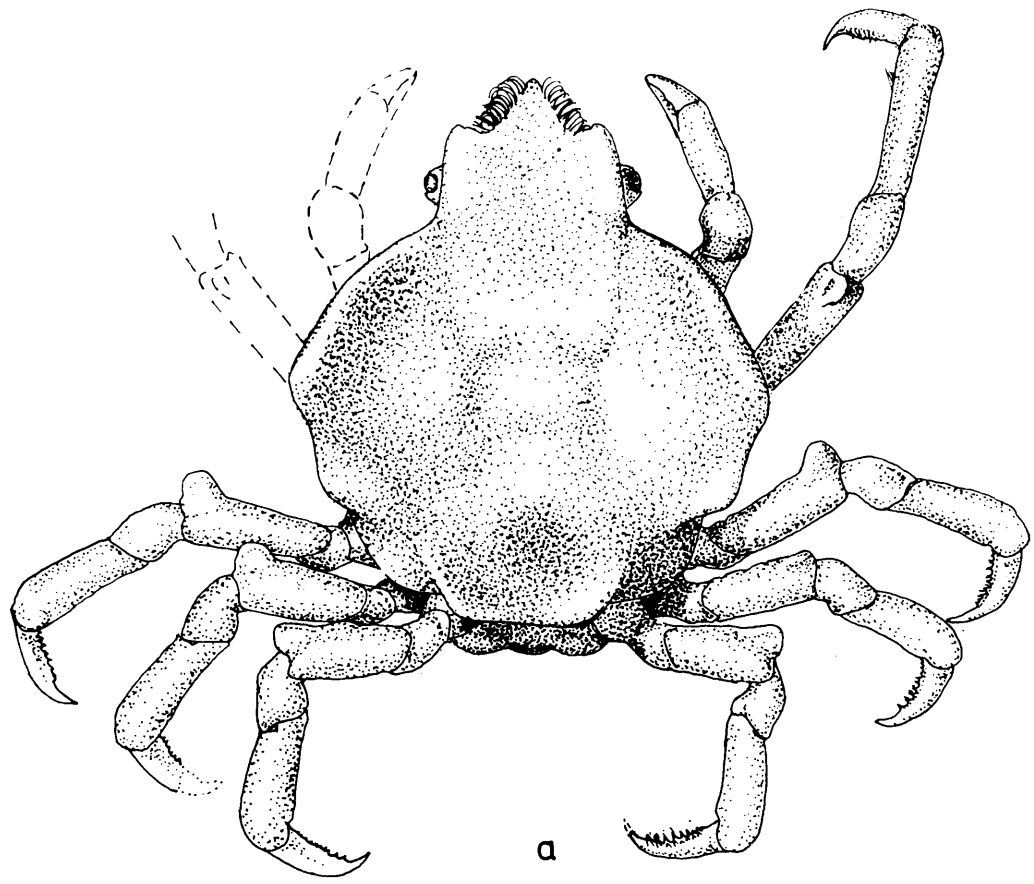


Fig. 21. *Huenia* aff. *brevifrons* (female, imm., 9.5 mm, AM P.29848) (a) whole animal, dorsal view; *Huenia brevifrons* (female, ad., 14.5 mm, South Moluccas, ZMA) (b) right first ambulatory leg; (c) carapace, dorsal view.

wide, but not compressed. The preorbital angle is sharp but not produced into a spine. The cheliped is smooth, not compressed or carinate. The first ambulatory leg is about as long as the carapace, the propod (length = 3 x height) bearing a small tuft of setae (but no lobe) ventrally at about the distal third. The meri of the ambulatory legs each bear a large, blunt, terminal spine, decreasing in size from legs 1-4. The abdomen has segments 4-6 fused.

The specimen of *H. brevifrons* figured by Chen (1980) seems to agree with that figured by Takeda et al. The merus of the cheliped is not carinate.

Distribution. — Maldive and Laccadive Islands, South Moluccas, Philippine Islands (Mindanao), China, Japan.

Huenia grandidierii A. Milne Edwards, 1865 (Fig. 24e)

Huenia grandidierii A. Milne Edwards, 1865: 143-144, pl. 4 fig. 2.
Huenia grandidieri. — Ortmann, 1894: 39.
Huenia proteus. — Barnard, 1950: (in part) fig. 9F. (Not *Maja* (*Huenia*) *proteus* De Haan, 1839.)

Material examined. — 5 ♂♂, 6 ♀♀ (4 ovig.), 4.5-22 mm, smallest ovig. ♀, 12 mm.

ZOOLOGICAL MUSEUM, COPENHAGEN
'Galathea' Expedition: Stn. 255, Kenya, Mombasa, 04°05'S 39°41'E, 0 m, corals, 22 March 1951; 4 specs. — Stn. 256, Kenya, Mombasa, 04°05'S 39°41'E, 1-2 m, triangle dredge, corals, 22 March 1951; 7 specs.

Remarks. — The females of our series agree quite well with the holotype figured by A. Milne Edwards except that the hepatic lobes in our specimens are directed more laterally than anterolaterally. The rostrum is short, about $^1/_3$ or less of the postrostral carapace length (males 0.33-0.37, females 0.2-0.31), weakly deflexed, not increasing in depth distally. The preorbital spine is more strongly developed and the rostrum is narrower basally than in *H. proteus*, the preorbital spine being approximately half as long as the basal width of the rostrum (approx. $^1/_4$ basal rostral width in *H. proteus*).

In the males in our series the marginal hepatic lobe is small and rounded or only a tubercle in the two smallest specimens (sometimes very small indeed in specimens from Somalia). The branchial lobe in males is subacute with a smaller lobe on the anterior margin (approaching bilobed in a few specimens). In females the marginal hepatic lobe is almost quadrangular, truncate, the lateral edge crenate, or nearly entire in adult specimens, directed outwards and slightly forwards and upwards; the lobe is sometimes rounded in specimens from Somalia. The branchial lobe in females is acute to subacute, with a smaller lobe on its anterior border. All specimens, both male and female, have a tubercle on the lateral margin halfway between the branchial and hepatic lobes.

There are three tubercles on the gastric regions forming an inverted triangle, one tubercle on the cardiac region and a very small medial tubercle on the posterior margin. The posterior margin of the carapace is convex, the margin is slightly expanded on each side of the midline.

The merus of the cheliped of the adult male is cylindrical (not carinate), with a moderately sized terminal tubercle or spine; the carpus has a sharp ridge laterally; the chela is somewhat compressed but not dorsally sharp; there is an extremely wide gape between the fingers in large males with a truncate tubercle on the dactyl in the gape, only the distal third of the fingers being toothed and adjacent. In our series the merus of the first ambulatory leg (the holotype is without ambulatory legs) is cylindrical with a blunt, compressed terminal spine (more pronounced in the female); the carpus has a longitudinal ridge or tubercle on the anterior edge; the propod is expanded slightly distally, with a tuft of setae ventrally at the distal quarter, but is not produced into a definite lobe; there is no tuft of setae dorsally on the propod. The meri of the second to fourth ambulatory legs have one or two small dorsal lobes and a short, compressed terminal lobe; the carpi sometimes have a tubercle but are not carinate dorsally; the propodi have a tuft of setae on the ventral surface (on second leg at the distal third, on third and fourth legs nearer the distal half), but are not produced as a lobe.

The first pleopod of the male is of the same kind as in *Huenia proteus* which has been figured by Takeda (1973a: fig. 2A, B).

We have also examined a large series of this species from Somalia (30 ♂♂, 20 ♀♀ (6 ovig.), 7.5-20 mm) collected by Dr. M. Vannini of the Istituto di Zoologia dell'Università, Florence.

Huenia grandidierii is distinguished from *H. proteus* and *H. pacifica* by the branchial lobe of the female which is subacute (not truncate); the lack of carination on the ambulatory legs, particularly the carpi and propodi of the second to fourth ambulatory legs which are not at all carinate or dorsally sharp; and the posterior margin of the carapace which is convex (not straight).

Distribution. — East African coast: Tanzania, Kenya, Somalia.

Huenia halei new species (Figs. 22a-e, g, 25e, f, i)

Huenia proteus. — Hale, 1927: 133, fig. 132. (Not *Maja* (*Huenia*) *proteus* De Haan, 1839.)

Material examined. — 6 ♂♂, 12 ♀♀ (1 ovig.), 9.5-21 mm, ovig. ♀, 20 mm.

Holotype. — Male, cl. 20 mm, Victoria, Western Port, Hastings, north of French I., 5-9 m, dredge, 5 September 1914; Mortensen Pacific Expedition 1914-16. Zoological Museum, University of Copenhagen. Donated to The Australian Museum, Sydney (AM P.34580).
Paratypes. — As listed below:

ZOOLOGICAL MUSEUM, COPENHAGEN
Mortensen Pacific Expedition: Victoria, Western Port, 9-18 m, algae, 6 September 1914; 1 spec.

SOUTH AUSTRALIAN MUSEUM, ADELAIDE
South Australia: St. Vincent's Gulf; 7 specs. (SAM C1105). — Backstairs Passage; 2 specs. (SAM C1106). — Encounter Bay; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY
Victoria, Port Phillip; 1 spec. (AM G.612, prev. det. *H. bifurcata*). — Victoria; 1 spec. (AM G.5947). — South Australian coast; 2 specs. (AM P.155).

WESTERN AUSTRALIAN MUSEUM, PERTH
Western Australia: 2 miles (∿ 3 km) NW. of Busselton Jetty, 22-23 m, on *Posidonia* and sand, coll. B. R. Wilson on 'Lancelin', 12 April 1963; 1 spec. (WAM 98-67). — W. of Garden I., 32°13.01'S 115°31.05'E, to 32°10.5'S 115°33.45'E, 27-33 m, coll. L. Marsh and M. H. Shepherd, F. R. V. 'Flinders', 8 March 1972; 1 spec. (WAM 71-72).

Description. — Carapace broad, lateral margin produced on each side into two lobes, carapace width between lobes about two thirds postrostral carapace length in males and 0.8-0.9 postrostral carapace length in females, surface smooth, minutely pitted.

Rostral spine 0.2-0.3 postrostral carapace length, tapering from base to an acute point, deflexed, much deeper basally than distally, narrow and uniformly rounded (i.e. circular in cross-section) behind apex, curled setae on basal half.

Preorbital spine broad, dorsoventrally flattened, apically acute or subacute.

Mesogastric region with a small tubercle posteriorly. Protogastric regions with two smaller tubercles forward of mesogastric and forming with it an inverted triangle. Cardiac region with a low tubercle. Intestinal region smooth, posterior margin of carapace convex, sometimes produced backwards over abdomen, posterolateral angles rounded, raised.

Hepatic lobe in males broad and rounded (sometimes truncate), branchial lobe larger and less rounded than hepatic, weakly bilobed. Hepatic lobe in females very broadly rounded, posteriorly not distinctly separated from base of branchial lobe which, as in males, is weakly bilobed. (In some females the hepatic lobe is nearly as large as the branchial lobe and the lateral edges of the two are continuous.)

Basal antennal article smooth with a moderately sharp lateral ridge and a small anterolateral tubercle.

Pterygostomian region and margin smooth, without tubercles.

Merus of cheliped of adult male dorsally sharp with a blunt compressed terminal spine; carpus with a well developed ridge and a tubercle; palm dorsally sharp, fingers short, gaping in proximal half, coarsely toothed distally, dactyl with prominent tooth in gape.

Merus of first ambulatory leg weakly compressed, or at least dorsally sharp, with a strong, blunt, compressed terminal spine; carpus carinate or at least with a compressed dorsal lobe; propod hardly widening distally, with a tuft of setae ventrally at about distal third and usually a very small dorsal lobe just proximal to tuft. Ambulatory legs 2-4 at least weakly compressed, merus, carpus and propod carinate, merus with a strong blunt terminal lobe, propod with a tuft of setae ventrally at about distal half.

Male abdomen smooth, sixth segment about as long as wide, length of seventh segment slightly less (about 0.8) than width.

First pleopod of male expanded distally, anterior margin with a broad transparent crest.

Remarks. — This species resembles *H. australis* but is distinguished from it in that the ambulatory legs are at least weakly compressed and the carpi are carinate (in *H. australis* the legs are cylindrical and the carpi are not carinate); the rostrum is uniformly rounded (i.e. circular in cross-section) just behind the apex (in *H. australis* the rostrum is dorsally narrowed near the apex); the hepatic lobe is broader and much more rounded in both sexes of this species and the tip of the first pleopod of the male is not produced laterally to form a hook as it is in *H. australis*.

In some (four) specimens the apex of the rostrum is minutely bifurcate, but not nearly to the same extent as in *H. bifurcata* in which the apex of the rostrum is broadly and deeply bifurcate, several times wider than deep and the rostrum narrow ventrally midway along. The rostrum of this species is similar to that of *H. keelingensis* but it is distinguished from that species by the much larger preorbital spines and the carinate carpus of the ambulatory legs (carpus dorsally flattened in *H. keelingensis*).

Adult females of this species often have a very broad carapace as do females of *H. brevifrons*. However, the much larger preorbital spines and the narrow rostrum distinguish the new species from *H. brevifrons*.

This species is named for H. M. Hale, Director of the South Australian Museum from 1931 to 1960, author of the comprehensive handbook 'The Crustaceans of South Australia' and many other studies on Australian Crustacea.

Distribution. — Southern Australia: from Westernport, Victoria through South Australia to Garden I., southern Western Australia.

Huenia keelingensis new species
(Fig. 23)

Material examined. — 1 ♂, 12.5 mm, 1 ♀, 12 mm.

Holotype. — Male, 12.5 mm, 'Cocos Is., Sumatra', 6 May 1926, dry. South Australian Museum, SAM C1140, prev. det. as *Huenia proteus*.
Paratype. — Female, 12 mm, data as for holotype, South Australian Museum, SAM C 3880, prev. det. as *Huenia proteus*.

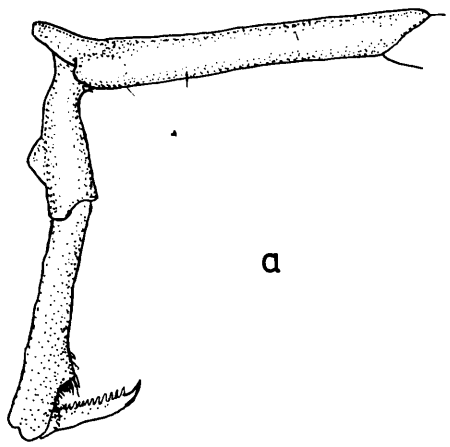
Description. — Carapace broad, width behind hepatic lobes nearly three quarters postrostral carapace length, surface smooth, minutely pitted (as in other species).

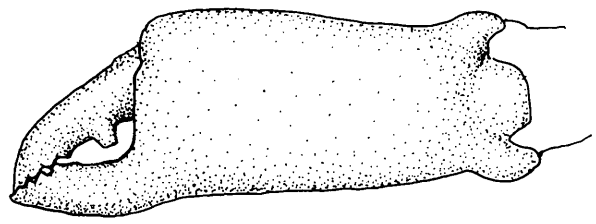
Rostral spine short, less than one fifth postrostral carapace length, basally a broad triangle with marginal curled hairs, weakly depressed medially; distal half at lower level, narrow, tapering to an acute, slightly upcurved apex (i.e. apex similar to *H. halei*). Preorbital spine small in the male; preorbital angle in the female only sharp, not produced to a spine.

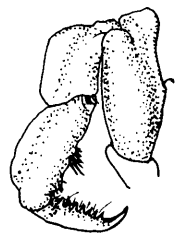
Mesogastric region with a small distinct tubercle posteriorly in male. Protogastric regions with a submedial tubercle just forward of mesogastric tubercle. Gastric tubercles indistinct in female. Cardiac region with a low tubercle. Intestinal region smooth, no medial tubercle, posterior margin of carapace curved, convex, produced backwards.

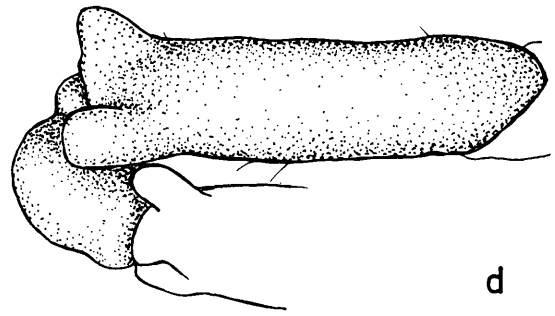
Hepatic margin in both sexes produced into a rounded lobe (slightly larger in female). Branchial margin produced as a rounded lobe, smaller than hepatic lobe.

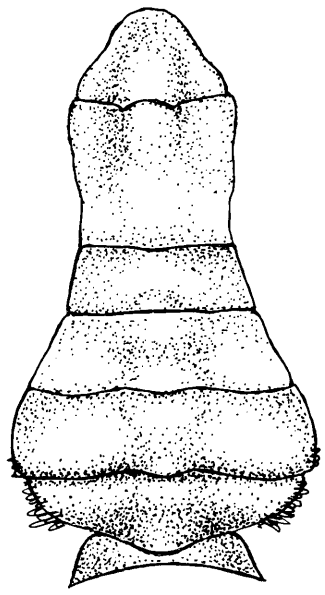
(As the specimens are glued to a card the basal antennal article, abdomen and other ventral characters were not seen.).

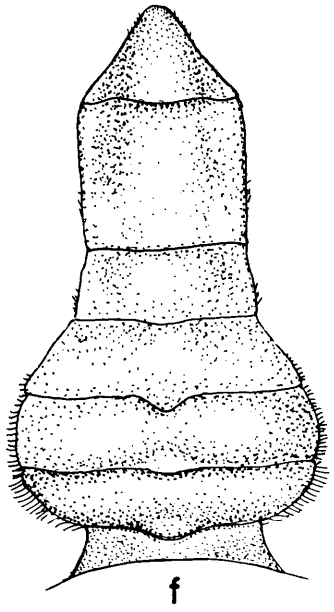












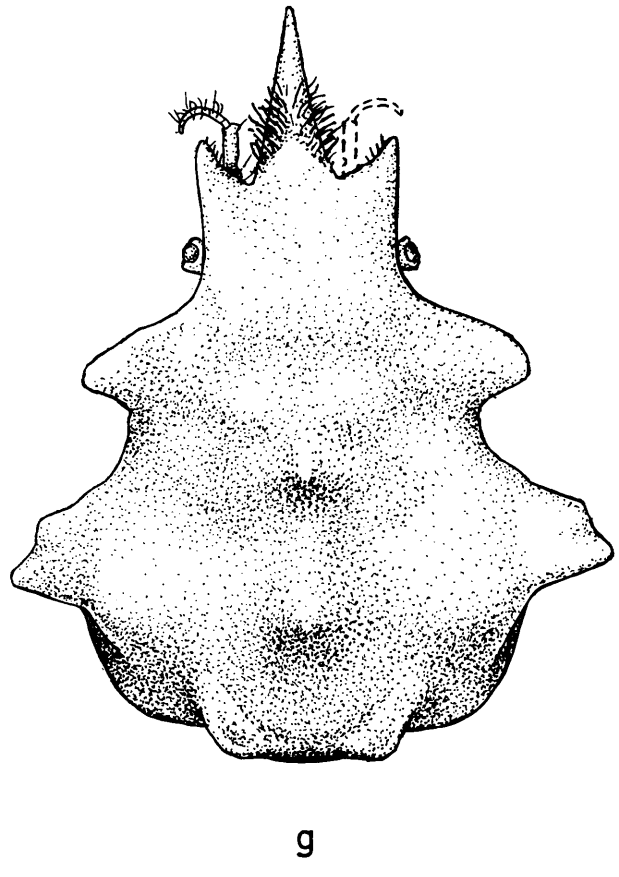


Fig. 22. *Huenia halei* (holotype) (a) left first ambulatory leg; (male, 21 mm, AM G. 612) (b) left fourth ambulatory leg; (holotype) (c) left chela; (d) left cheliped, merus and carpus; (e) male abdomen; *H. australis* (holotype) (f) male abdomen; *H. halei* (holotype) (g) carapace, dorsal view.

Merus of cheliped of adult male smooth, broad, no terminal spine or tubercle; carpus with indistinct ridge, not carinate; palm dorsally sharp only in proximal half, no tubercles on inner face; fingers gaping, a large tubercle on dactyl in gape.

First ambulatory leg as long as postrostral carapace length, smooth, not carinate, low terminal ridge or tubercle on merus; carpus strongly flattened on dorsal surface; propod weakly compressed, a tuft of setae on distal third on ventral surface. Ambulatory legs two to four very similar to each other, approximately same length (nearly $^3/_4$ postrostral carapace length); merus carinate; carpus dorsally flattened; propod cylindrical with a small tuft of setae at about distal half.

Remarks. — This species resembles *Huenia brevifrons* Ward in several features:
(1) there is a broad carapace in both sexes;
(2) the hepatic lobe is larger than the branchial lobe;
(3) the rostrum is basally a short broad triangle;
(4) preorbital spine short or only a sharp angle;
(5) posterior margin of carapace produced backwards.
It differs from *H. brevifrons* as follows:
(1) the rostrum is produced distally, the distal half narrow and tapering, with an acute apex;
(2) the carpus of each of the ambulatory legs is dorsally flattened, not compressed or carinate.

In our specimen of *H. brevifrons* from the South Moluccas the cheliped merus is carinate dorsally and ventrally with three lobes on each edge but in the present species the cheliped merus is smooth, broad, dorsally rounded, without any terminal tubercle or spine. In the specimen (female, 9.5 mm, AM P.29848) similar to *H. brevifrons* from Heron I. (and discussed under that species) the ambulatory legs are cylindrical with a strong terminal lobe on the meri; in the present species the meri of legs two to four are carinate and the carpi dorsally flattened.

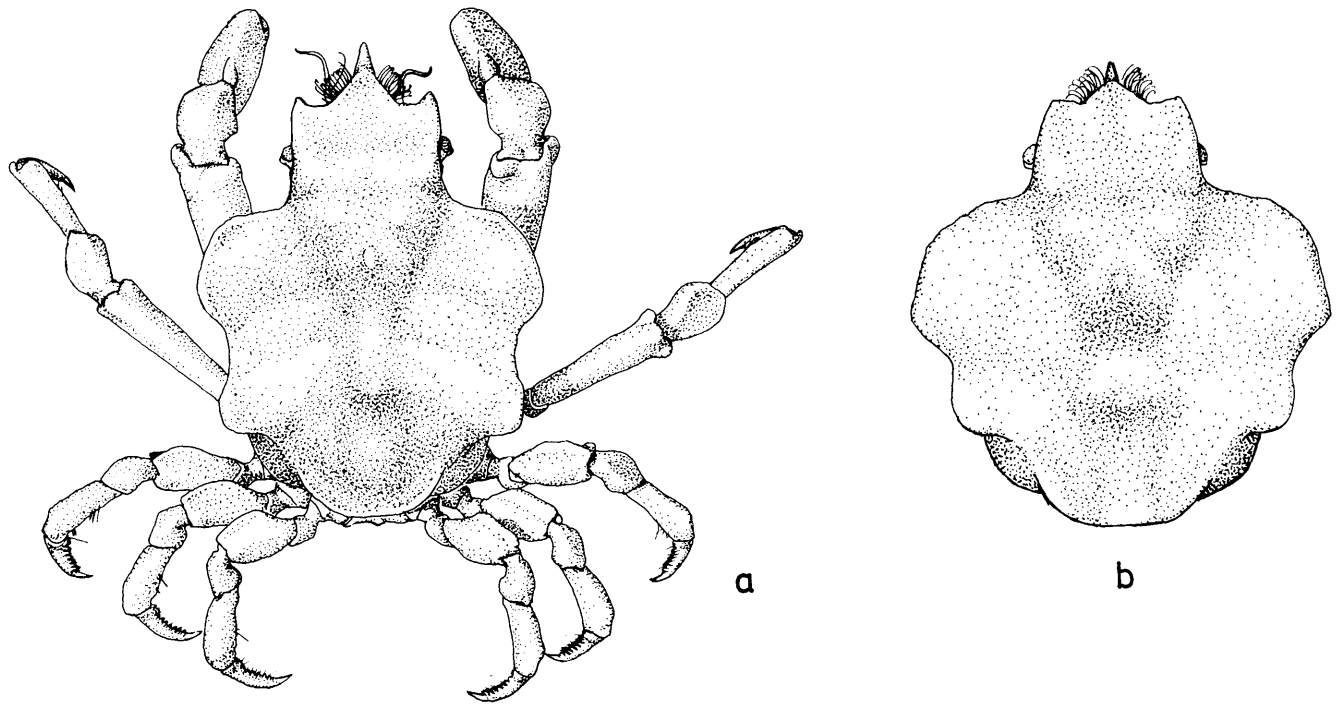


Fig. 23. *Huenia keelingensis* (holotype) (a) whole anaimal, dorsal view; (paratype, female) (b) carapace, dorsal view.

With the specimen on the card are two small branches of *Halimeda*-like weed, and there is also some attached to the rostrum of the female.

The name of this new species refers to the type locality, Cocos Keeling Islands, Indian Ocean (12°05′S 96°53′E).

Distribution. — Known only from 'Cocos Is., Sumatra'.

Huenia pacifica Miers, 1879
(Fig. 24a, b)

Huenia pacifica Miers, 1879a: 5-6, pl. 4 fig. 3.

Material examined. — 14 ♂♂, 15 ♀♀ (5 ovig.), 8.5-19 mm, smallest ovig. ♀, 14 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 37, Flores Sea, Paternoster Is., Sailus Ketjil, close to reef, 27 m, dredge, coral and coral sand, 30/31 March 1899; 8 specs. (ZMA De.100.832 in part, det. Ihle as *H. proteus*). — Stn. 64, Flores Sea, Tanah Djampeah, Kambargi Bay, 32 m, trawl, dredge and shore exploration, coral and coral sand, 4/5 May 1899; 3 specs. (ZMA De.100.796, det Ihle as *H. proteus*). — Stn. 99, Sulu Archipelago, anchorage off North Ubian, 06°7.5′N 120°26′E, 16-23 m, dredge, townet, *Lithothamnion* bottom, 28/30 June 1899; 9 specs. — Stn. 253, Kai Is., 05°48.2′S 132°13′E, 304 m, trawl, grey clay, hard and crumbly, 10 December 1899; 1 spec. —

Stn. 313, Sumbawa, Saleh Bay, anchorage east of Dangar Besar, 36 m, dredge, trawl, and reef exploration, sand, coral and mud, 14/16 February 1900; 1 spec. (ZMA De.100.707, det. Ihle as *H. proteus*).

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: N. end of Albany Passage, dredged, coll. M. Ward, August-September 1928; 1 spec. (AM P.19475). — dredged off Lindeman I., coll. M. Ward, December 1928; 1 spec. (AM P.13996). — Between Bundaberg and Gladstone, found in nets; 1 spec. (AM P.17108). — Lady Elliot I., coll. C. Wright, 1964; 1 spec. (AM P.17250). — Whitsunday Group, Black I., near Langford Reef, shallow water, coll. N. Coleman, November 1969; 2 specs. (AM P.19523), (AM P.19504).

Remarks. — These specimens agree well with the syntypes of *Huenia pacifica* (BMNH 56.105, 1 ♂, 20.1 mm, 1 ovig. ♀, 13.4 mm, Fiji Is.) examined by one of us (D.J.G.G.).

In our series the rostrum is slightly less broad and less deep basally than in *H. proteus*. In adult males the rostrum is about $^2/_3$ postrostral carapace length but in smaller males (e.g. 11 mm cl.) only about $^1/_2$ postrostral carapace length. In females the rostrum is about $^1/_3$ postrostral carapace length. Again in males the rostrum is horizontal or weakly deflexed and the distal depth is subequal to the proximal depth, but in adult females it is up to twice as deep distally. The preorbital spine is about $^1/_4$ basal rostral width and directed forwards and slightly outwards.

There are three tubercles on the gastric regions but often only the posterior medial one is distinct. There is a cardiac tubercle and in some specimens a small medial tubercle on the posterior margin. The posterior margin of the carapace is straight rather than convex and not produced backwards over the abdomen. The lateral hepatic lobe in males is very small, but usually present, and the branchial lobe is triangular and subacute. (There are no specimens that we have seen that have the large hepatic lobe sometimes found in males of *H. proteus*.) The lateral hepatic lobe in females is broadly rounded anterolaterally, but more sharply angled posteriorly; there is a small anterior tubercle on the lobe. The branchial lobe is smaller than the hepatic lobe and truncate or occasionally weakly bilobed.

The cheliped merus of adult males is cylindrical with a low terminal tubercle; there is a low ridge on the carpus; the palm of the chela is not strongly compressed or carinate (length approximately twice height) and sometimes there are one or two small tubercles on the inner face of the palm, the fingers gape moderately and there is a large truncate tooth on the movable finger in the gape. The merus of the first ambulatory leg is cylindrical, slender (length about nine times height), with a short blunt terminal spine, longer in females: the carpus is not carinate and dorsally there is a small tubercle at about the distal third on the anterior edge. The propod is widened at the distal third to about $1^1/_2$ times its proximal width and at the widest point there is a ventral tuft of setae (but not a strong ventral lobe as in *H. proteus*), and dorsally there is a group of several setae just proximal to the ventral tuft. Ambulatory legs two to four are weakly compressed, the meri bearing two small (sometimes indistinct) dorsal tubercles and a laterally compressed terminal lobe; the carpi are weakly carinate; the propodi are carinate (but not as strongly as in *H. proteus*), about three times as long as high, the ventral margin bearing a tuft of setae midway along (but no ventral lobe) and another smaller tuft proximally.

The first pleopod of the male is curved outward distally, anteriorly truncate, anterior margin recurved.

In this series, additional to the specimens listed above, there are two lots of specimens which differ significantly from *H. pacifica* but the number of specimens is too small to justify describing them as new species so we have included here a brief description of them. In these specimens the rostrum is more slender basally than in *H. proteus* and the legs are not strongly carinate as in that species.

In the first group there are four male specimens, as follows:

ZMC: Mortensen Pacific Expedition: Mindanao, Zamboanga, 5-9 m, sand, 1 March 1914; 1 spec. (adult) 13 mm; Danish Kei Is. Expedition: Banda, off Neira, about 5 m, sand, 9 June 1922; 1 spec. (adult) 10.5 mm.

ZMA: 'Siboga' Expedition: Stn. 37, Flores Sea, Paternoster Islands, Sailus Ketjil, close to reef, 27 m, dredge, coral and coral sand, 30-31 March 1899; 1 spec. 13 mm (De.100.832 in part). — Stn. 80, Makassar Strait, Borneo Bank, 02°25′S 117°43′E, 50 m, trawl, fine coral sand, 13 June 1899; 1 spec., 12 mm (De.100.629 in part).

These specimens, although small, are adult or subadult. The branchial lobe is subacute as in males of *H. pacifica* and the rostrum is longer than half the postrostral carapace length as in adult males of *H. pacifica* but there is no hepatic lobe, which, even if small, is always present in males of *H. pacifica*. The ambulatory legs are slender, not at all compressed or carinate and on the meri the terminal tubercle is very small or absent. In typical *H. pacifica* ambulatory legs 2-4 have the meri weakly compressed with a distinct terminal lobe and the carpi and propodi are moderately carinate. In the specimens from Zamboanga and Makassar Strait there is no terminal tubercle on the merus of the cheliped as there is in typical *H. pacifica*. There are two small tubercles on the inner face of the cheliped palm only in the largest male.

The second group is also of four male specimens —

ZMA: 'Siboga' Exped.: Stn. 37, Flores Sea, Paternoster Islands, Sailus Ketjil, close to reef, 27 m, dredge, coral and coral sand, 30/31 March 1899; 1 spec., 13 mm (De.100.832 in part). — Stn. 282, Anchorage between Nusa Besi and NE. point of Timor, 08°25.2′S 127°18.4′E, 27-54 m, trawl, dredge and reef exploration, sand, coral and lithothamnion, 15/17 January 1900; 1 spec., 10.5 mm. — Stn. 315, Flores Sea, Anchorage E. of Sailus Besar, Paternoster Is., up to 36 m, dredge, coral and lithothamnion, 17/18 February 1900; 1 spec. (adult), 13 mm.

WAM: Sulu Archipelago, $1^1/_2$ miles (∼ 2.4 km) W. of Doc Can I., B. R. Wilson on 'Pele', 2 February 1964; 1 spec., 12.5 mm.

The rostrum in these specimens is slender, only about half the postrostral carapace length; distally slightly deeper (by about $^1/_4$) than proximally. The preorbital spines are directed straight forward so that their lateral edges are parallel to one another, not directed slightly outwards as in typical *H. pacifica*. The carapace shape is less triangular than in typical *H. pacifica*, the hepatic width is about two thirds branchial width. There is a small, broad, rounded hepatic lobe, slightly smaller or equal to the branchial lobe which is also broad, not triangular and subacute as in the typical *H. pacifica*. On the

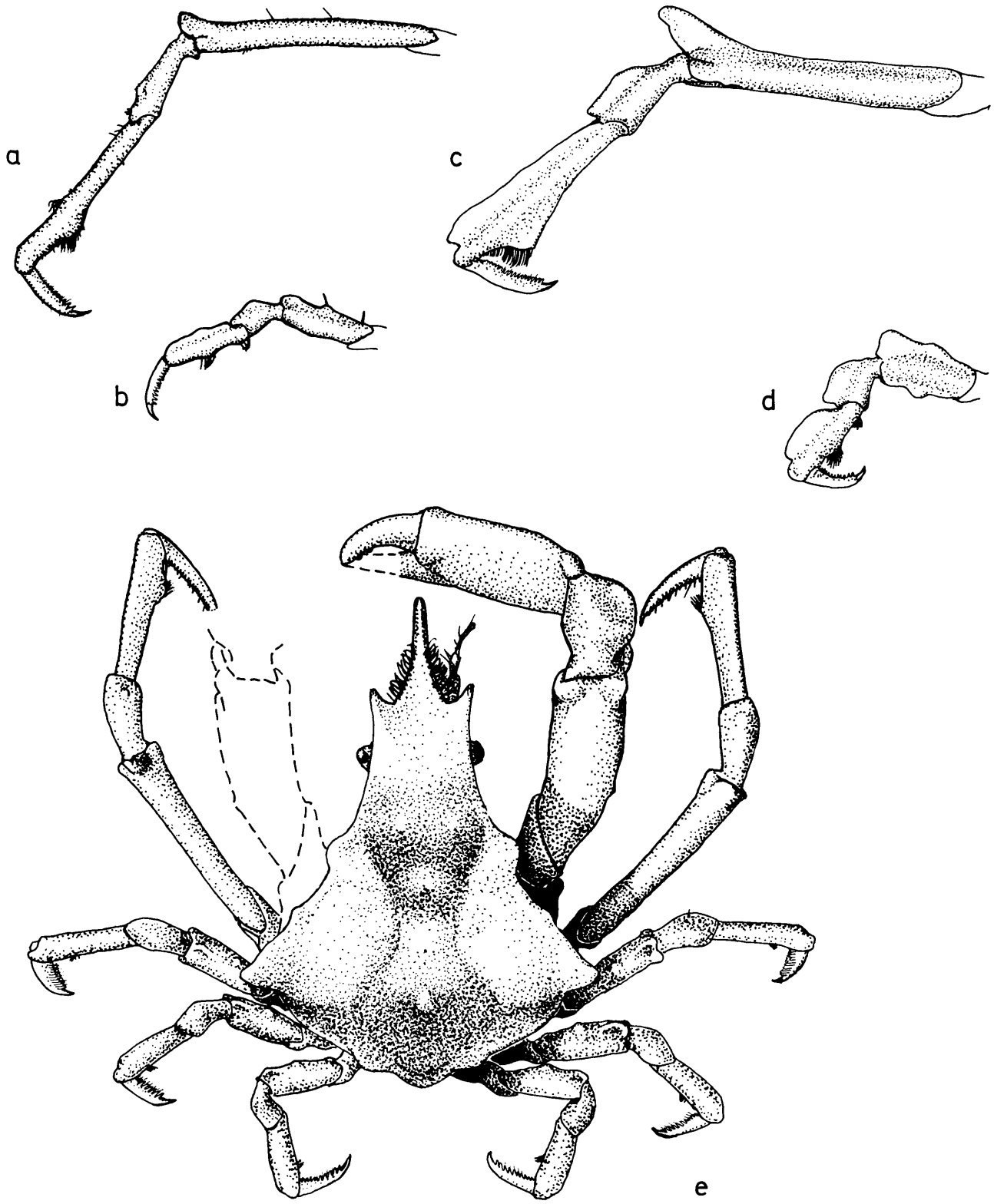


Fig. 24. *Huenia pacifica* (male, 17.5 mm, Sulu Archipelago, ZMA) (a) left first ambulatory leg; (b) left fourth ambulatory leg; *H. proteus* (male, ca. 26 mm, Japan, ZMC) (c) left first ambulatory leg; (d) left fourth ambulatory leg; *H. grandidierii* (male, 22 mm, Mombasa, ZMC) (e) whole animal, dorsal view.

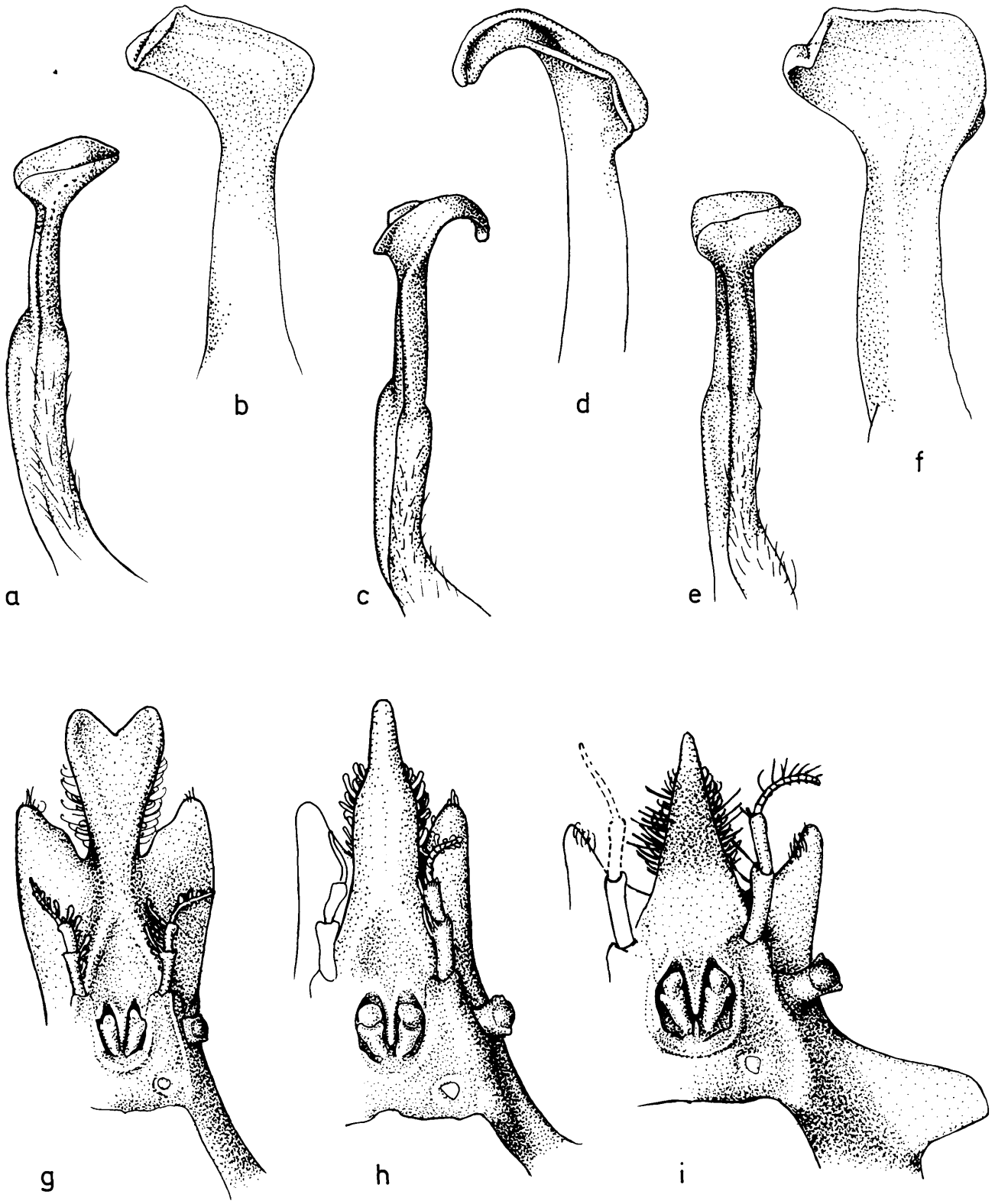


Fig. 25. Left first pleopod of male of *Huenia bifurcata* (30 mm, AM P.1912) (a) abdominal view of pleopod (b) sternal tip of same; *H. australis* (holotype) (c) abdominal view of pleopod, (d) sternal tip of same; *H. halei* (holotype) (e) abdominal view of pleopod, (f) sternal tip of same. *H. bifurcata* (AM P. 1912) (g) left orbit, ventral view; *H. australis* (holotype) (h) left orbit, ventral view; *H. halei* (holotype) (i) left orbit, ventral view.

cheliped there is no terminal tubercle on the merus and no ridge on the carpus (both present in the typical form of *H. pacifica*), and there is a very small tubercle on the inner face of the palm. Only the specimen from Paternoster I. has ambulatory legs with it, but the first ambulatory leg is missing. The legs, as in typical *H. pacifica*, are weakly carinate, the propod having tufts of setae proximally and at the distal third on the ventral margin but no ventral lobe. The shape of the lateral lobes and the rostrum which deepens distally distinguish these specimens from males of typical *H. pacifica*, *H. proteus* and *H. grandidierii*.

We also have a single specimen from Singapore (Hamburg Museum, Ex. K240, ♂, 25 mm) probably adult, without any legs (which makes the identification of this specimen difficult), but in the long, slender rostrum it resembles *H. pacifica*. The rostrum is basally very narrow, less than half the supraorbital width; about $^2/_3$ the length of the carapace behind the rostrum, no deeper distally than proximally and weakly deflexed in the distal half. The preorbital spines are long (approx. 1.5 mm), directed forward and slightly outward. There are three distinct tubercles on the gastric region and a cardiac tubercle. The posterior margin of the carapace is convex (rather than straight as it is in *H. pacifica* and *H. proteus*), with a medial tubercle and a small triangular lobe at the posterolateral angle. Both lateral lobes are subacute, the hepatic lobe about half the size of the branchial lobe and between them on the margin there is a small tubercle (not present in *H. pacifica*). Like *H. grandidierii* but unlike *H. proteus* and other *H. pacifica*, the posterior margin of the carapace is convex in this specimen.

It was suggested by Miers (1884: 520) and by Ortmann (1894: 39) that *H. pacifica* may be synonymous with *H. grandidierii* A. Milne Edwards, because both have a relatively narrow rostrum and three distinct gastric tubercles. However, both these characters vary within our series. In *H. pacifica* the ambulatory legs are weakly compressed or carinate (not cylindrical), there is no tubercle midway on the lateral margin, and the posterior margin of the carapace is straight (not convex). In the females of *H. pacifica* the branchial lobe is truncate (not subacute as in *H. grandidierii*).

We have distinguished *H. pacifica* from *H. proteus* by the much less carinate legs, particularly the absence of any carination on the carpus of the first ambulatory legs, and by the propod of the first ambulatory leg which is only moderately widened distally (width at distal third = $1^1/_2$ times proximal width not twice width as in *H. proteus*). There is a great deal of variation within each species of this genus some of which is due to age and sex and the separation of young or incomplete specimens of this species from *H. proteus* remains difficult.

Distribution. — Fiji Is., Sulu Archipelago, Flores Sea, Kai Is., NE. Australia.

Huenia proteus De Haan, 1839
(Fig. 24c, d)

Maja (*Huenia*) *proteus* De Haan, 1839: 95-96, pl. 23 figs. 4-6(a) (b).
Huenia proteus. — Adams & White, 1848: 21-23, pl. 4 figs. 4-6. — Takeda, 1973a: 98-99, fig. 2A, B. — Griffin, 1976: 190. — Sakai, 1976: 207-208, text fig. 112a-c, pl. 71 figs. 1, 2.

Material examined. — 7 ♂♂, 9 ♀♀ (4 ovig.), 15.5-29 mm, smallest ovig. ♀, 16 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 43, Flores Sea, Postillon Is., anchorage off Pulu Sarassa, 30 m, dredge, coral, 4/5 April 1899; 1 spec. (ZMA De.100.706, det. Ihle). — Stn. 96, Sulu Archipelago, SE. side of Pearl Bank, 15 m, dredge, townet, *Lithothamnion*, 27 June 1899; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, Misaki, 36 m, dredge, sand, 25 May 1914; 1 spec. — Misaki, Amburatsubo, ca. 9 m, sand, 6 June 1914; 1 spec. — Misaki, Amburatsubo, 24 June 1914; 1 spec.

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: off NW. coast, Maud's Landing, 18 m, Honolulu dredge, weed, sand and rock, coll. Royce on 'Davena', 20 May 1960; 1 spec. (WAM 234-67). — 10 miles (16 km) W. of Gordon Bay (N.W. Australia), 27 m, coral and sponge, coll. R. W. George on 'Dorothea', 14 October 1962; 1 spec. (WAM 172-67). — Dampier Archipelago, Kendrew I. (N.W. Australia), 20°28′30″S 116°32′E, weed washings from Boat Bay, Crown of Thorns Survey, 23 October 1974: 1 spec. (WAM 67-77).

Sulu Archipelago: NE. of Siasi, 21 m, on *Lithothamnion* and algae, coll. B. R. Wilson on 'Pele', 17 February 1964; 1 spec. (WAM 34-67). — Tawi Tawi Bay, about 9 miles (∿ 14 km) from Bongao Light, 16-30 m, dredge, sand, coll. B. R. Wilson on 'Pele', 29 February 1964; 2 specs. (WAM 11-67).

THE AUSTRALIAN MUSEUM, SYDNEY

Western Australia: Broome, dredged off Gantheaume Point, 7 m, coll. A. A. Livingstone, August 1929; 1 spec. (AM P.13995). — northern side of Point Cloates (N.W. Australia), 22°41′S 113°39′E, 4 m, lee side of reef, 'Ningaloo' Expedition, 23 August 1968; 1 spec. (AM P.27144).

Queensland: (locality unknown), coll. M. Ward; 1 spec. (AM P.13997). — Heron I., under rocks near reef edge, 12 August 1960; 1 spec. (AM P.27142).

Remarks. — Because of the considerable variation in this genus with age, sex and possibly also with location, previous authors have determined that *H. grandidierii* A. Milne Edwards and *H. pacifica* Miers were only variants of *H. proteus*. Our study of this series of specimens from several localities in the Indo-Pacific region indicates consistent differences not related to sex, age or location which lead us to distinguish *H. grandidierii* and *H. pacifica* from *H. proteus*; the differences are discussed under the former two species.

The specimens of *H. proteus* in our series agree well with the type material as figured by De Haan. The rostrum of the males is 0.35-0.5 postrostral carapace length and that of the females 0.3-0.4 postrostral carapace length. In the males the rostrum is no deeper distally than basally, but in females it is up to twice as deep distally as basally. The preorbital spine is short, about $^1/_4$ or less of the basal rostral width, directed forward and slightly outward, and sometimes has a small proximal dorsal tubercle.

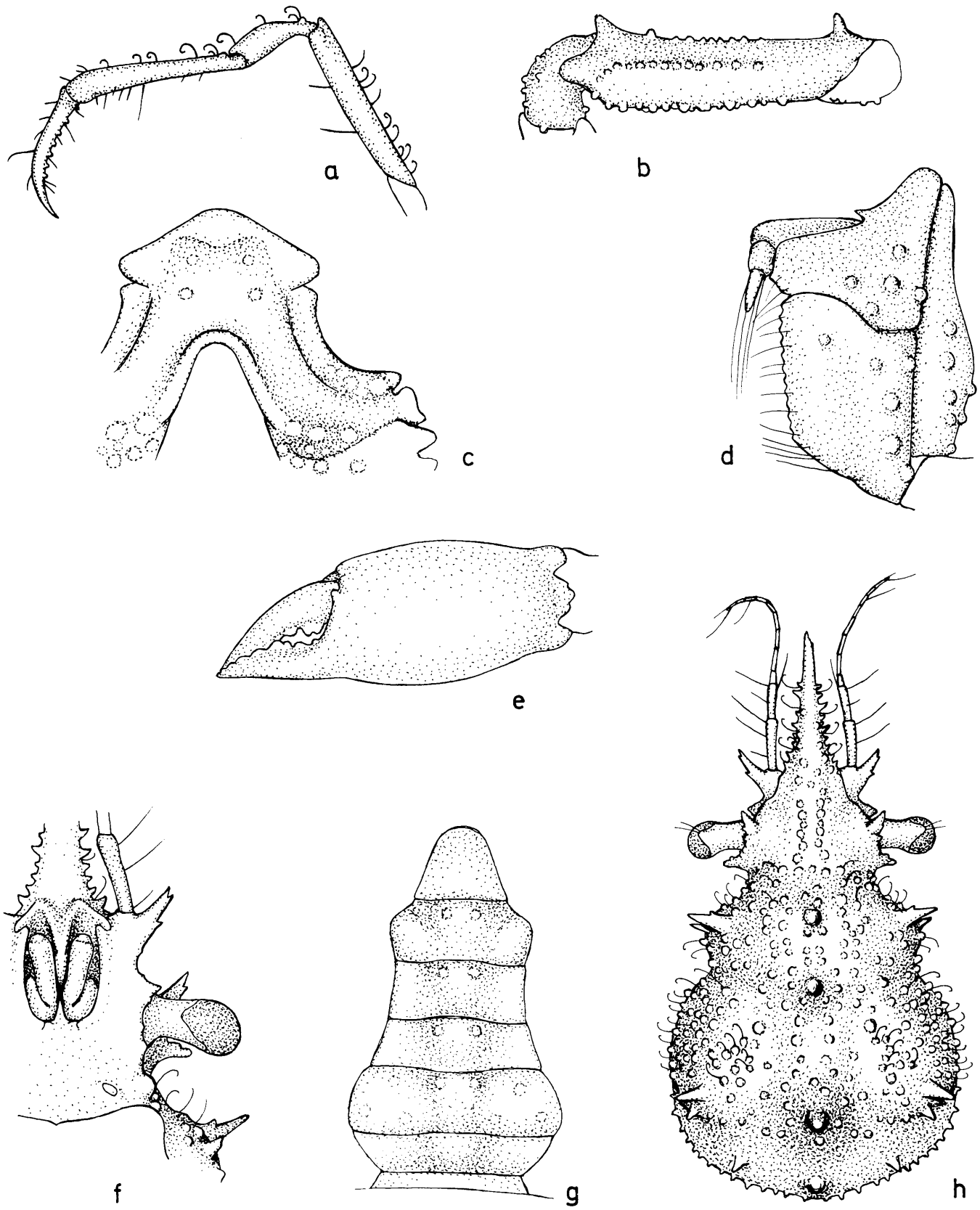


Fig. 26. *Menaethiops xiphias* (female, ovig., 4 mm, Sapeh Strait, ZMA) (a) left fourth ambulatory leg; (male, 4 mm, Sapeh Strait, ZMA) (b) left cheliped, merus and carpus; (holotype) (c) male sternum; (d) left third maxilliped; (male, as above) (e) left chela; (holotype) (f) left orbit, ventral view; (g) male abdomen; (h) carapace, dorsal view.

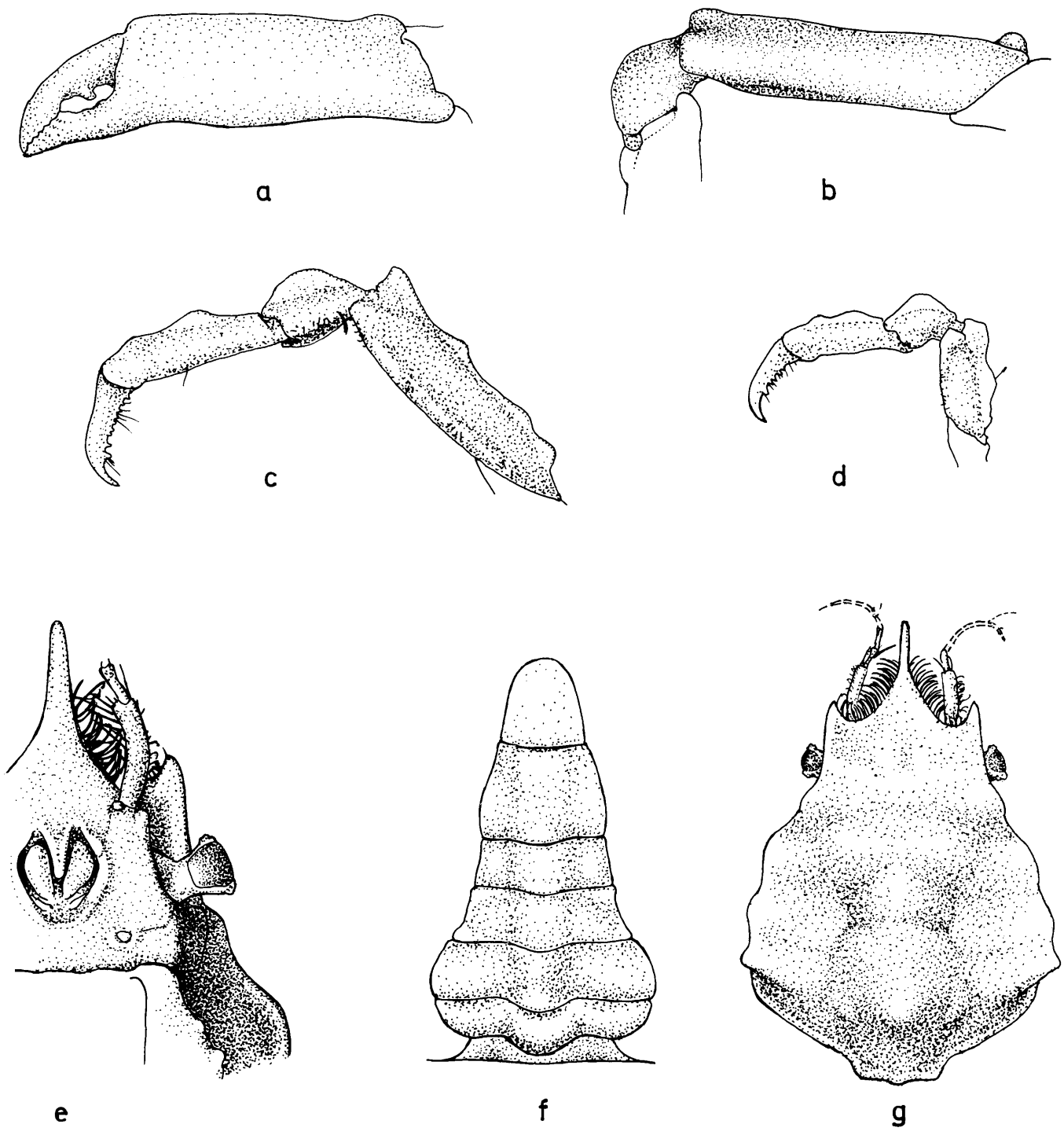


Fig. 27. *Menaethius orientalis* 8.5 mm, Roti I. (a) left chela; (b) left cheliped, merus and carpus; (c) left first ambulatory leg; (d) left fourth ambulatory leg; (e) left orbit, ventral view; (f) male abdomen; (g) carapace, dorsal view.

In the males the lateral hepatic lobe is small and blunt or of moderate size and truncate although sometimes only a tubercle even in adults; the branchial lobe is either truncate or subacute, and there is often a small tubercle on the margin between the lobes. In the female the hepatic lobe is rounded, sometimes elongate longitudinally; the branchial lobe is truncate and often the two lobes meet or overlap. There is no tubercle on the margin between the lobes in the female.

In most specimens the three gastric tubercles are small and indistinct, in some the posterior (mesogastric) tubercle is distinct, and in two specimens all three are well developed. The posterior margin of the carapace is straight (not convex), usually smooth but sometimes with a small tubercle on the midline and one at each posterolateral angle.

The cheliped merus of the male has a laterally compressed terminal spine and the carpus is carinate; the palm of the

chela is carinate with two compressed dorsal lobes, one midway and one distally; there are 1-3 tubercles on the inner face of the palm.

The merus of the first ambulatory leg is usually compressed (sometimes weakly), with a compressed terminal spine, the carpus is carinate with one or two dorsal lobes, the propod is strongly compressed, widened strongly at the distal third to about twice the proximal width to form a ventral lobe with a tuft of setae; dorsally there is usually a much smaller lobe just proximal to the ventral lobe. Ambulatory legs 2-4 are compressed, the meri carinate and produced to a terminal lobe; carpi carinate; propodi carinate, more than half as wide as long, the ventral margin with a small tuft of setae on the proximal angle and a larger tuft halfway along (only sometimes on a lobe on leg four).

The first pleopod of the male has been figured by Takeda (1973a); the apex is curved outwards and grooved, the sternal side of the groove is produced into a broad lobe on the medial margin.

Distribution. — Japan, Sulu Archipelago, Flores Sea, North Western Australia, Queensland. (Other localities previously listed by several authors for this species cannot be confirmed. The following records of *H. proteus* are now considered invalid:

Maldive and Laccadive Islands: Borradaile, 1903: fig. 124, pl. 47 fig. 2. Sankarankutty, 1961: fig. 2C = *H. brevifrons.*
Delagoa Bay: Barnard, 1950: fig. 9f = *H. grandidierii.*
South Australia: Hale, 1927: fig. 132 = *H. halei*, n.sp.
Red Sea: Griffin & Tranter, 1974: 169 = *Menaethius orientalis.*)

Menaethiops Alcock, 1895

Type species. — *Menaethiops bicornis* Alcock, 1895, by monotypy.

Remarks. — In *Menaethiops* the eave, particularly the postorbital region, is modified. Alcock considered that this genus lacked a postorbital lobe but later authors, including Balss (1929) and Guinot (1962a), regarded the postorbital lobe as fused with the supraorbital eave. This can be seen in *M. dubia* Balss in which the posterior part of the eave is continued around behind the eye. In *M. nodulosa* (Nobili) and *M. okai* Sakai the posterior part of the eave is clearly at an angle to the rest of the eave. In this genus the basal antennal article is broad and the anterolateral angle is produced, often as a large spine visible dorsally. In this respect it differs from other genera in the subfamily in which the article is without distal expansions. The first pleopod of the male is apically produced into two lobes, one lateral and one medial: these may be subequal or one lobe may be up to twice as large as the other.

In this genus there are a number of similar species, some of apparently restricted distribution, from the east coast of Africa, Madagascar, the Red Sea, Iranian Gulf and Arabian Sea. One species, *M. okai*, is known only from Japan. From the present collection we describe a new species from Sapeh Strait in Indonesia which is similar to *M. okai* and thus extend the known range of the genus.

Distribution. — Indo-West Pacific,? west Atlantic.

KEY TO THE INDO-WEST PACIFIC SPECIES OF *MENAETHIOPS*

1	Dorsal hepatic region with a prominent slender spine directed principally outwards 2
—	Dorsal hepatic region with a tubercle, short spine, or blunt, forwardly directed lobe 3
2(1)	Carapace with only a few tubercles as well as spines; posterior angle of eave directed obliquely backwards; branchial and cardiac regions equally elevated ..... *M. okai*
—	Carapace with many sharp tubercles as well as spines; posterior angle of eave directed laterally; cardiac region more elevated than branchial regions ..... *M. xiphias*
3(1)	Preorbital angle of eave not produced, smooth ... *M. fascicularis*[14])
—	Preorbital angle of eave produced (or with a tubercle) 4
4(3)	Rostral spines contiguous to apex 5
—	Rostral spines at least apically separate 8
5(4)	Lateral margin of basal antennal article with 2 subequal teeth in distal half, one of them anterolateral; proximal part of margin concave 6
—	Lateral margin of basal antennal article with single tooth in distal half, rest of margin straight or with small notch or concavity midway along 7
6(5)	Hepatic region with a large, blunt, forwardly directed lobe; branchial region with 3 or 4 tubercles or spines ..... *M. contiguicornis*[14])
—	Hepatic region with 2 short spines; branchial region with one tubercle ..... *M. bicornis*
7(5)	Posterior angle of supraorbital border (eave) produced, narrow, subacute, the anterior margin forming an angle with lateral margin of eave; rostrum exceeding second segment of peduncle of flagellum only in some adult males ..... *M. dubia*
—	Posterior angle of supraorbital border (eave) produced, broad, blunt, the curved margin confluent with lateral margin of eave; rostrum exceeding second segment of peduncle of flagellum except in juveniles ..... *M. ninnii*
8(4)	Preorbital spine directed obliquely forward, margin of supraorbital eave concave; eyestalk smooth, without a spine; first sternite of male with a granular ridge 9
—	Preorbital spine directed straight forward; margin of supraorbital eave almost straight; eyestalk with a distal spine near cornea; first sternite of male smooth 11
9(8)	Rostral spines divergent distally; anterolateral angle of basal antennal article with slender acute spine ..... *M. delagoae*[14])
—	Rostral spines separate distally but lateral margins parallel; anterolateral angle of basal antennal article with a stout, subacute spine 10
10(9)	Rostrum of about 1/2 postrostral carapace length; first sternite of male with a very strong oblique granular ridge between chelipeds ..... *M. acutifrons*[15])
—	Rostrum of about 1/3 postrostral carapace length; first sternite a moderate oblique granular ridge between chelipeds ..... *M. brevicornis*[14,15])
11(8)	Lateral margin of basal antennal article with small tooth behind anterolateral spine, proximal part of margin concave. *M. nodulosa*
—	Lateral margin of basal antennal article behind anterolateral spine straight or weakly concave ..... *M. natalensis*[14])

Menaethiops xiphias new species
(Figs. 18g, h; 26)

Material examined. — 2 ♂♂, 1 ovig. ♀, 4 mm.

Holotype. — Male, cl. 4 mm, Indonesia, Lesser Sunda Islands, Sapeh Strait, 08°23.5′S 119°4.6′E, 69 m, dredge, coral and shells, 'Siboga' Ex-

[14]) From the literature (see Guinot, 1962a).
[15]) These two species may prove to be synonymous.

pedition, Stn. 49a, 14 April 1899. Zoological Museum, Amsterdam. Paratypes. —

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 49a (as for holotype); 2 specs.

Description. — Carapace narrow pyriform, width about two thirds (0.66) postrostral carapace length; surface with many small sharp tubercles and a few short spines.

Rostrum of a single spine, broad basally then tapering rapidly to a slender spine; lateral margin with about five to seven small sharp ventral spinules in proximal two thirds; length about one third (0.33) postrostral carapace length.

Orbital eave moderately expanded, an upright spine midway along eave and a laterally directed spine on posterior angle of eave (corresponding to postorbital spine); margin of eave crenulate. Eyestalks moderately long, slender, cornea terminal and obliquely ventral.

Hepatic region weakly produced and rounded; a sharp, slender spine anteriorly on margin, directed outward and slightly upward and forward, bearing a small accessory proximal spinule on anterior margin; subhepatic region with two short spines (anterior larger) directed obliquely downward.

A small sharp spine on branchial submargin just above cheliped base, posterolateral branchial region smooth above carapace margin; margin spinulous.

Gastric regions only weakly elevated on midline; protogastric region with scattered sharp tubercles; two short, slender mesogastric spines, weakly directed backward and two pairs of submedial tubercles between them; urogastric region with three pairs of submedial tubercles.

Cardiac region strongly elevated bearing a long slender spine on summit, longer than other carapace spines; several tubercles at base of spine.

Intestinal region smooth except for a central spine and a short posterolateral spine. Posterior carapace margin spinulous.

Dorsal branchial region tuberculate, a slightly larger tubercle near anteromedial angle; a short, slender epibranchial spine.

Basal antennal article smooth, flat, elongate; anterolateral angle produced as a large spine, a small accessory spine proximally on posterior margin; a short spine midway along lateral margin, a small lateral tubercle basally. Epistome smooth, a tubercle lateral to green gland.

Pterygostomian region smooth, three large tubercles on margin. Ischium of third maxilliped with a row of three tubercles near lateral margin; junction with merus curved in medial half and overlapping merus; merus with row of three tubercles near lateral margin, one proximal tubercle on lateral margin and one midway along posterior margin; anterolateral angle strongly produced, lobe rounded apically. Exognath with a longitudinal row of five tubercles in proximal half, two small proximal tubercles on lateral margin.

First sternite of male smooth except for two pairs of submedial tubercles just behind anterior margin and a diagonal ridge of three to four tubercles near posteromedial angle; a narrow ridge around anterior margin of abdominal fossa and a ridge on lateral margin terminating in a few tubercles posteriorly. Sternal segments two to four each with three to four tubercles and also a ridge on edge of abdominal fossa in segments three and four.

Merus of cheliped of adult male with four longitudinal rows of small tubercles, one dorsally, two ventrally and one midway on outer face, dorsal margin bearing also a large proximal tubercle and a sharp, curved, terminal spine; carpus with two ridges of small sharp tubercles, one lateral and one medial and ventral; palm somewhat compressed, dorsal and ventral margins weakly convex, sharp, with a few small proximal tubercles; length about one and a half times greatest height; fingers short, about half as long as palm, a moderate gape between them in proximal half, large teeth on both fingers in gape — dactyl with a double proximal tooth and a smaller tooth distal to it, fixed finger with two proximal teeth and a large distal tooth; tip of dactyl behind that of fixed finger. Length of cheliped about one and a quarter times postrostral carapace length.

First ambulatory leg about one and two thirds postrostral carapace length, merus slender, smooth with a low terminal tubercle; carpus with a tubercle dorsally in proximal half, propodus and dactyl slender. Fourth ambulatory leg about half as long as first, dactyl of fourth leg with six very small, well spaced teeth ventrally along its length.

Male abdomen of seven segments, a pair of submedial tubercles near anterior margin of each segment except seventh; tubercles laterally in segments three to six; third segment about one and a half times as wide as sixth segment; sixth segment about twice as wide as long; seventh segment about as wide as long.

First pleopod of male straight, slightly narrower just before apex which is produced into two short triangular lobes, medial lobe slightly longer and narrower than lateral lobe.

Female abdomen smooth, segments four to six fused. Female gonopore a circular aperture opening anteriorly and slightly medially.

Remarks. — We have compared these specimens of *M. xiphias* with specimens of *M. okai* Sakai (1 ♂, 1 ♀, Japan, AM P.10558) in the Australian Museum and they resemble each other in the following points:

(1) the contiguous rostral spines with lateral spinules;
(2) the slender hepatic, cardiac and epibranchial spines;
(3) the spinules on the posterior carapace margin (small in *M. okai*);
(4) the shape of the basal antennal article;
(5) the female abdomen with five free segments.

M. xiphias is distinguished from *M. okai* by the presence of numerous sharp tubercles on all of the carapace except the intestinal region while in *M. okai* there are only a few tubercles; also the spine on the posterior angle of the eave is directed

laterally in *M. xiphias* but obliquely backward in *M. okai*; and the branchial regions are lower than the cardiac region in *M. xiphias* while in *M. okai* they are rounded and as elevated as the cardiac region.

These two species of *Menaethiops* differ from the species we have examined from the Red Sea and Somalia (*M. acutifrons*, *M. nodulosa*, *M. ninnii*, *M. dubia*) in having spinules laterally on the rostrum and the abdomen of the female with five rather than seven free segments.

The specific name refers to the similarity of the spined rostrum to the 'sword' of a swordfish (genus *Xiphias*).

Distribution. — Known only from the type locality Sapeh Strait, Indonesia.

Menaethius H. Milne Edwards, 1834

Type species. — *Pisa monoceros* Latreille, 1825, by monotypy.

Remarks. — This genus is widespread and common throughout the Indo-west Pacific. There is some geographic variation and early authors described several species which have since been synonymized with *M. monoceros* (listed by Sakai, 1976). We have here included as a new species of this genus a series of specimens from a wide range of localities in the Indo-west Pacific which while they have a strong similarity to *M. monoceros* in a number of characters, including the orbit and the first pleopod of the male, are consistently distinguished from *M. monoceros* by the carinate ambulatory legs. Sakai (1969) described a species *Epialtus orientalis* from Japan which closely resembles this series of specimens: the only differences appear to be the absence of a tooth on the dactyl of the cheliped in Sakai's specimen (present in ours) and a male abdomen with 6 free segments rather than 7 free segments as in our specimens. On this basis we do not consider our series of specimens to be a new species but at most probably conspecific with *Epialtus orientalis*. However, we believe from examination of our specimens and taking into consideration the first pleopod of the male, that they belong in the genus *Menaethius* rather than *Epialtus*. We have given a description and figures of our specimens.

The first pleopod of the male of *M. monoceros* has been figured by Forest & Guinot (1961). The pleopod is broad and from about the distal quarter is flattened laterally rather than dorsoventrally and so appears to narrow abruptly; the broad apex is laterally subacute. There is a similar male pleopod in *Huenia* and *Simocarcinus*.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *MENAETHIUS*

1 Rostrum a slender stylus, basally narrow; dorsal branchial region with rounded elevations and sometimes a tubercle; ambulatory legs not carinate ..... *M. monoceros*

— Rostrum with a broad triangular base and distally slender; dorsal branchial region flat and smooth; ambulatory legs carinate ..... *M. orientalis*

Menaethius monoceros (Latreille, 1825)

Pisa monoceros Latreille, 1825: 139-140.
Menaethius monoceros. — Forest & Guinot, 1961: 14, figs. 9a-b. — Griffin, 1974: 21; 1976: 200. — Sakai, 1976: 205-206, pl. 70 fig. 1.

Material examined. — 70 ♂♂, 63 ♀♀ (41 ovig.), 5.5-27.5 mm, smallest ovig. ♀, 9 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 37, Flores Sea, Paternoster Is., Sailus Ketjil, close to reef, 27 m, or less, dredge, coral and coarse sand, 30/31 March 1899; 1 spec. (ZMA De.100.832 (in part)). — Stn. 43, Flores Sea, Postillon Is., anchorage off Pulu Sarassa, 0.3 m, coral, 4/5 April 1899; 1 spec. (ZMA De.100.690, det. Ihle). — Stn. 71, near Makassar, Pulu Barang, May 1899; 1 spec. — Stn. 127, Celebes Sea, Great Sangir I., Taruna Bay, reef exploration, 20/21 July 1899; 2 specs. (ZMA De.100.839, det. Ihle). — Stn. 131, Karakelang Is., anchorage off Beo, 13 m, reef exploration, mud and sand, 24/25 July 1899; 8 specs. — Stn. 133, Salibabu I., anchorage off Lirung, up to 36 m, trawl, dredge and reef exploration, mud and hard sand, 25/27 July 1899; 2 specs. — Stn. 144, Halmahera Sea, anchorage N. of Damar I., reef exploration, coral, 7/9 August 1899; 2 specs. — Stn. 162, W. coast of Salawatti, between Loslos and Broken Is., 18 m, dredge, south island reef, coarse and fine sand with clay and shells, 18 August 1899; 3 specs. — Stn. 169, W. coast of Irian Jaya, anchorage off Atjatuning, 57 m, trawl, dredge and reef exploration, mud, 23/25 August 1899; 1 spec. — Stn. 172, Ceram Sea, anchorage between Gisser I. and Ceram Laut, 18 m, reef exploration, coral and *Lithothamnion* bottom, 26/28 August 1899; 9 specs. (ZMA De.100.795, det. Ihle). — Stn. 174, N. coast of Ceram, Waru Bay, reef, 28/29 August 1899; 1 spec. — Stn. 229, Banda Sea, 04°23′S 128°45.5′E, townet, brown and grey mud with sand, 14 November 1899; 2 specs. — Stn. 282, anchorage between Nusa Besi and NE. point of Timor, 08°25.2′S 127°18.4′E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 1 spec. — Stn. 315, Flores Sea, Paternoster Is., anchorage E. of Sailus Besar, up to 36 m, coral and *Lithothamnion*, 17/18 February 1900; 1 spec. — Ambon, reef, 1899; 1 spec. — Ambon, reef, 1899; 2 specs. (ZMA De.100.689, det. Ihle). — Banda, shore, 1899; 2 specs. — Banda, reef, 1899; 1 spec. (ZMA De.100.710, det. Ihle). — Savu Sea, Seba I., 1899; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Philippine Islands, Mindoro, Puerto Galero, 9 m, dredge, 1 February 1914; 1 spec. — Philippine Islands, Mindoro, Puerto Galera, ca. 9 m, 3 February 1914; 2 specs. — Hawaii, Hilo, 7 April 1915; 1 spec.

Danish Kei Islands Expedition: Ambon, Saparoea Bay, 18-27 m, 9 March 1922; 1 spec. — Banda, Lantor, shore at low tide, 7 June 1922; 1 spec.

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

Mortensen Java-South Africa Expedition: Mauritius, Cannonier's Point, collecting on the reef and beach, 17 September 1929; 1 spec. — Mauritius, off Black River, 9-18 m, dredge, 21 September 1929; 1 spec. — Mauritius, Flat I., 17 October 1929; 2 specs. — Mauritius, Grand Bay, ca. 3-5 m, dredge, sand, 25 October 1929; 2 specs. — Mauritius, off Cannonier's Point, ca. 2-5 m, dredge, sand, 26 October 1929; 2 specs.

'Galathea' Expedition: Stn. 224, Madagascar, Diego Suarez, Bay at Cape Diego, 0.3 m, hand collecting, rocks with corals, 3 March 1951; 1 spec.

South India, Pamban Pass, 5 m, coll. H. Lemche, Stn. 24, 9 October 1951; 1 spec.

Tonga: Nukualofa, tidal zone, ebb tide, coll. S. Mielche, January 1956; 2 specs. — N. Tonga, Niuatobutabu, 15°58′S 173°48′W, tidal flat with coral and mud, coll. T. Wolff, 1 June 1965; 1 spec.

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE, LEIDEN

Irian Jaya, Biak I., naval barracks W. of Sorido village, on coral reef off the shore, coll. L. D. Brongersma and W. J. Roosdorp, 28 April 1952; 1 spec.

Netherlands New Guinea Expedition: Stn. N628, Irian Jaya, N. of Jayapura, Pacific O. coast, beach at Base G, slow spider crabs from among corals fished up from reef and carried to shore, coll. L. B. Holthuis, 12 November 1954; 1 spec. — Irian Jaya, N. of Jayapura, reef (by Base G), crabs among coral, coll. L. B. Holthuis, 27 November 1954; 3 specs. — Stn. 683, Irian Jaya, Biak I., W. of Sorido, reef in front of naval barracks, in coral, January 1955; 21 specs. — Biak, W. of Sorido, reef near naval barracks, February 1955; 20 specs. — Stn. 743, N. Irian Jaya, Jayapura, surroundings Base G, coll. G. van Hout, March 1955; 1 spec. — Biak I., W. of Sorido, reef near naval barracks, April 1955; 1 spec. — Biak, I., W. of Sorido, reef near naval barracks, 2 May 1955; 1 spec.

Ex Natural Science Foundation: Stn. 490, Irian Jaya, Padaido Group, Wamsoi Lagoon, 1 mile (1.6 km) E. of Dauwi, 54-90 m, coll. Ostheimer, Orr, Powell, 4 February 1956; 1 spec. — Stn. 576, Irian Jaya, Supiori I., 1 mile (1.6 km) W. of Sowek, 6 March 1956; 1 spec. (AM P.27148).

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition — Moluccas, 1970: Stn. TS IV, Tanimbar, Selaru, N. side of Labuan Olendir, 08°07′S 130°59′E, reef collecting, 26 June 1970; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Heron I., under coral head, 12 August 1960; 1 spec. (AM P. 27147). — Heron I., reef, coll. R. Manning, August 1962; 1 spec. (AM P.27148).

Lord Howe Island: southern end of lagoon, coll. J. Booth, May 1962; 1 spec. (AM P.27149); 1 spec. (AM P.27150). — Sylph's Hole, Old Settlement, found in dead coral, coll. J. Booth, October 1962; 2 specs. (AM P.27151). — coll. J. Booth, 29 March 1963; 1 spec. (AM P.27152). — Ned's Beach, 0-1 m, reef flat, under coral rubble, coll. S. C. Oldfield, 26 January 1979; 2 specs. (AM P.29844). — Ned's Beach, low tide, coll. N. Coleman, 17 February 1979; 1 spec. (AM P.29845).

Hawaii, reef at Waikiki, under stones near shore, coll. M. Ward, 24-30 August 1927; 4 specs. (AM P.31030).

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: Shark Bay, approx. 2 miles (∿ 3 km) N. of Denham in clumps of pearl shell on exposed sand flat, low tide, coll. B. R. Wilson, 28 July 1959; 1 spec. (WAM 89-71). — Shark Bay, near bar of South Passage, 11 m, Honolulu dredge, sand and weed, coll. R. W. George, 'Davena', 14 May 1960; 5 specs. (WAM 96-71). — Shark Bay, 1 mile (1.6 km) W. of Cape Peron, coll. R. McKay, 30 June 1962; 1 spec. (WAM 78-71). — Rottnest I., NW. Point, 18 November 1963; 1 spec. (WAM 235-73). — Barrow I., Shark Point, intertidal rock flat, WAM and USNM Barrow I. Expedition, Stn. 8, 17 September 1966; 1 spec. (WAM 81-71).

Remarks. — The length of the rostrum in this series is variable, from a quarter to two thirds postrostral carapace length. In most specimens there is a small blunt tooth at the anterolateral angle of the basal antennal article. Specimens in this series from Hawaii have a much more slender, more prominent preorbital lobe than in other specimens, also the rostrum is wider basally and the anterolateral angle of the basal antennal article is obtuse.

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

Menaethius orientalis (Sakai, 1969) new combination
(Figs. 18c, d, 27)

Epialtus orientalis Sakai, 1969: 252-253, text fig. 4a; 1976: 206, text fig. 111.

Material examined. — 4 ♂♂, 6 ♀♀ (4 ovig.) 5.5-11 mm, smallest ovig. ♀, 7.5 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. — Stn. 133, Molucca Sea, Salibabu I., anchorage off Lirung, 36 m, trawl, dredge and reef exploration, mud and hard sand, 25/27 July 1899; 1 spec. — Stn. 282, Timor Sea, anchorage between Nusa Besi and NE. point of Timor, 08°25.2′S 127°18.4′E, 27-54 m, trawl, dredge and reef exploration, sand, coral and *Lithothamnion*, 15/17 January 1900; 2 specs. — Stn. 301, Timor Sea, E. coast of Roti I., Pepela Bay, 10°38′S 123°25.2′E, 22 m, dredge, reef exploration, mud, coral and *Lithothamnion*, 30 January 1900; 1 spec. — Stn. 315, Flores Sea, Paternoster Is., anchorage E. of Sailus Besar, up to 36 m, dredge, coral and *Lithothamnion*, 17/18 February 1900; 2 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Java-S. Africa Expedition: Stn. 44, N. of Mauritius, between Gunner's Quoin and Flat I., 45 m, trawl, coral, 15 October 1929; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY

Tasman Sea, Middleton Reef, 54-72 m, triangle dredge, coll. R. J. MacIntyre, CSIRO Stn G3/280/60, 26 November 1960; 1 spec. (AM P.29846).

Queensland, Lizard Island, 36 m, in coral blocks, coll. P. Hutchings and P. Weate, 9 January 1975; 1 spec. (AM P.29847).

Description. — Carapace broad, width 0.8 to 0.9 postrostral carapace length, hepatic region as wide as branchial region, lateral margins produced into three small lobes, carapace surface smooth.

Rostrum a single short spine, one sixth to nearly one third (0.16 to 0.3) postrostral carapace length, base broadly triangular, distal half uniformly slender.

Preorbital spine triangular, dorsoventrally flattened, ventral surface smooth and flat; no antorbital lobe; postorbital lobe low, rounded. Eyestalks short, movable; cornea terminal, lateral margin truncate.

Hepatic margin with a broad rounded lobe; branchial margin with two small lobes, posterior one triangular, anterior one also triangular or blunt and rounded. All three lobes equally produced laterally beyond lateral margin of carapace; lobes with a pair of apical setae in some specimens.

Gastric regions with a weak, trilobed, medial elevation, broader anteriorly (or three indistinct tubercles in a few specimens). Cardiac region more strongly elevated than gastric regions. Intestinal region with a weak central elevation, posterior margin truncate, posterolateral angles blunt. Branchial regions dorsally flat and smooth.

Basal antennal article smooth, flat, anterolateral angle with a small triangular spine directed forward; first movable segment of antenna about twice as long as following segment; tip of antenna reaching or exceeding apex of rostrum.

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

Margin of pterygostomian region with two tubercles.

Merus of cheliped of largest male (probably adult) cylindrical, a large proximal tubercle dorsally, another smaller tubercle in front of it on inner face and a low terminal tuber-

cle; carpus smooth; palm moderately compressed, more than twice as long as high, a moderate gape between fingers with a large tooth on dactyl and a few small teeth along fixed finger in gape. In females and subadult males cheliped merus similar to that of ambulatory legs — carinate with four dorsal lobes (including terminal lobe), but carpus not carinate.

Merus of first ambulatory leg carinate with four dorsal lobes (including terminal lobe), carpus strongly carinate, propod carinate midway along dorsal border, otherwise sharp. Second and third ambulatory legs shorter and with only three dorsal lobes on merus; fourth ambulatory leg with only two dorsal lobes on merus. Dactyl of fourth leg with a pair of very small subterminal teeth and four or five similar teeth more proximally.

Male abdomen smooth, seven free segments, sixth and seventh segments both about as long as wide.

First pleopod of male narrowed abruptly at distal third, curved outwards at tip to a subacute lateral apex; medial border of tip broadly curved with a transparent crest.

Female abdomen smooth, segments four to six fused. Gonopore of female is a simple oval which opens anteromedially.

Remarks. — Included in this species are the specimens from the Red Sea (2 ovig. ♀♀, 7, 12 mm) with a narrow rostrum and carinate legs previously identified as *Huenia proteus* by Griffin & Tranter (1974).

This species has the following characters in common with *M. monoceros*:

(1) there is a prominent preorbital lobe and a small lateral lobe just behind the eye;
(2) the eyes are movable on short eyestalks;
(3) the rostrum is slender, at least distally, and dorsoventrally not laterally flattened;
(4) there are two subequal lobes or tubercles (anterior and posterior) on the branchial margin;
(5) the propod of the first ambulatory leg is smooth ventrally (there is no tuft of setae as in *Huenia* species);
(6) the male abdomen consists of seven free segments, while in the female segments three to six are fused;
(7) the shape of the carapace is the same in both sexes;
(8) the first pleopod of the male has a similar form in both species.

These specimens are very similar to that described by Sakai (1969, 1976) as *Epialtus orientalis*. The major difference is in the male abdomen which has seven segments in our specimens while in *Epialtus orientalis* there are only six abdominal segments and on this basis Sakai included his species in the genus *Epialtus*. However, our specimens also differ from east Pacific species of *Epialtus* in the very slender rostrum, the well developed preorbital spine and in the form of the first pleopod of the male, so we would not include them in the genus *Epialtus*. While we believe that this series of specimens is most probably conspecific with Sakai's species, we feel they are better placed in the genus *Menaethius*. The major difference between *M. orientalis* and *M. monoceros* is the presence in *M. orientalis* of carinate ambulatory legs but the legs are not compressed and there is no prominent tuft of setae ventrally on the propod as in *Huenia* or *Epialtus*.

In this series the eyestalks are short but movable and the carapace shape is similar in both sexes.

These specimens resemble *Menaethius inornatus* Dana, (Dana, 1852: 125; 1855: pl. 5) from Hawaii in carapace shape. However, we are not sure of the status of that species: the original description is brief — the male abdomen is not described — and there were no legs with Dana's specimen.

Distribution. — Tasman Sea, NE. Australia, Timor, Moluccas, Sulu Archipelago, Mauritius, Red Sea, Japan.

Perinia Dana, 1852

Type species. — *Perinia tumida* Dana, 1852, by monotypy.

Remarks. — This monotypic genus was included in the Pisinae by Balss (1929) and subsequent authors have also included it in that subfamily. However, *Perinia* does have characters in common with some genera of the Epialtinae i.e. *Acanthonyx*, *Menaethius* and *Huenia*. In *Perinia* the margin of the orbit is continuous, enclosing the eyestalk, with no hiatus or suture above or below. The eyestalk is short and stout, the eye almost immovable and the small postorbital elevation does not afford any protection for the eye. In the Pisinae there is a cupped postorbital lobe into which the eye retracts; the postorbital lobe is usually separated from both the supraorbital eave and the basal antennal article by a distinct hiatus or, in the few species where there is no hiatus there is always a slit or suture. Peyrot-Clausade & Serène (1976) figured the first pleopod of the male of *P. tumida* and remarked on its similarity to the pleopod of *Menaethius monoceros* and suggested that perhaps this species belonged in the Acanthonychinae (now Epialtinae) rather than the Pisinae. Despite the fact that the male first pleopod also resembles that of pisines such as *Rochinia*, we take the view that because of the orbital features, *Perinia* is most appropriately placed in the Epialtinae. In general carapace form it resembles *Menaethius* species.

Distribution. — Indo-West Pacific.

Perinia tumida Dana, 1852

Perinia tumida Dana, 1852: 114-115; 1855: pl. 4 fig. 1a-f. — Sakai, 1938: 294-296, text-fig. 40; 1976: 233-234, pl. 81 fig. 2. — Peyrot-Clausade & Serène, 1976: 1349-1350, pl. 1 D, pl. 4A. — Chen, 1980: 124-125, text fig. 8, pl. 1 fig. 4.

Material examined. — 3 ♂♂, 9 ♀♀ (7 ovig.), 5-9.5 mm, smallest ovig. ♀, 5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Hawaii, Hilo, 15 April 1915; 1 spec. — Honolulu, April 1915; 5 specs.

Mortensen Java-S. Africa Expedition: Mauritius, Flat I., 17 October 1929; 1 spec.

Fiji Islands, lagoon at Wailangilala I., 16°45′S 179°06′W, 1-2 m, in corals, coll. T. Wolff, 14 May 1965; 3 specs.

MUSÉUM NATIONAL D'HISTOIRE NATURELLE, PARIS

'Calypso' Red Sea Expedition: Red Sea, Abulot, on corals, 1952; 2 specs.

Remarks. — These specimens agree with others previously examined. The rostrum is short, about a tenth postrostral carapace length, comprising two broad dorsoventrally flattened lobes separated by a U-shaped hiatus. The apices of the lobes are subacute and slightly incurved. The meri and carpi of the ambulatory legs are armed with a dorsal spine and there are tubercles on the outer face of the meri.

Distribution. — Throughout the Indo-West Pacific from East Africa and Red Sea to Japan, Australia and the Central Pacific.

Planotergum Balss, 1935

Type species. — *Planotergum mirabile* Balss, 1935, by monotypy.

Remarks. — The relationships of this monotypic genus were discussed in detail by Serène (1965). We agree with Serène that this species probably does not belong to the Majidae — the form of the orbit, especially the suborbital lobe; the absence of an epistome; the form of the ambulatory legs and the very small seventh segment of both the male and female abdomen distinguish it from any other majid. The first pleopod of the male is unknown, as the only male reported on so far is that figured by Balss (1935b). In the collection at the Australian Museum there are two specimens of *Planotergum mirabile*, one from Roebuck Bay, Western Australia, the other from Keppel Islands, Queensland; both are females.

Distribution. — Northwest and northeast Australia, Java Sea.

Pugettia Dana, 1851

Type species. — *Pugettia gracilis* Dana, 1851, by subsequent designation of Miers (1879).

Remarks. — This genus is one of the few with species present in both the east and west Pacific; it appears to be confined to the north Pacific. There are six species of *Pugettia* in the east Pacific (*P. producta* (Randall) occurring as far north as Alaska), all with scyriform first pleopods in the male. There are 12 species in the west Pacific (*P. quadridens* (De Haan) occurring in northern Japan), of which six have a scyriform first pleopod in the male, whilst in four we do not know what the pleopod is like and in one (*P. kagoshimensis* Rathbun) the first pleopod of the male is truncate (B. Kensley, pers. comm.).

In the present revision two species with a truncate first pleopod in the male have been removed from the genus — *P. sagamiensis* Gordon with large carapace tubercles and *P. mosaica* Whitelegge with long carapace spines. It is possible that *P. kagoshimensis* with long carapace spines and bifid cardiac and intestinal spines should also be removed from this genus. So far only females are known of the Philippine species. *P. leytensis* Rathbun and *P. mindanaoensis* Rathbun: the latter differs from other *Pugettia* species in several important characteristics.

Sakai (1976) has suggested that *P. elongata* Yokoya may be a variety or even a synonym of *P. minor* Ortmann and also that *P. marissinica* Takeda & Miyake is a synonym of *P. similis* Rathbun. However, as descriptions of both *P. elongata* and *P. similis* are very brief and we have not examined either of these two species we are unable to comment on their validity and we have included them in the key.

Distribution. — East and west Pacific.

KEY TO WEST PACIFIC SPECIES OF *PUGETTIA*

1	Rostrum longer than 1/2 postrostral carapace length, spines strongly divergent; hepatic and branchial spines very long and slender; cardiac process bifid ..... *P. kagoshimensis*[16])
—	Rostrum generally less than 1/2 postrostral carapace length, spines moderately divergent; hepatic and branchial spines short; cardiac region smooth or with single spine or tubercle 2
2(1)	Carapace smooth with regions poorly defined; postorbital lobe not keeled or laterally flattened; hepatic spine smaller than postorbital lobe; branchial submargin with flat suboval plate just above carapace margin ..... *P. mindanaoensis*
—	Carapace with regions well defined, usually with tubercles or short spines; postorbital lobe keeled or laterally flattened; hepatic spine at least equal to postorbital lobe; branchial submargin with tubercles but without a flat plate 3
3(2)	Hepatic and postorbital lobes partly or completely fused 4
—	Hepatic and postorbital lobes distinct 8
4(3)	Hepatic and postorbital lobes completely fused to form a winglike plate; meri of ambulatory legs trigonal ..... *P. incisa*
—	Hepatic and postorbital lobes not completely fused nor forming a wing-like plate; meri of ambulatory legs not trigonal 5
5(4)	Postorbital lobe much smaller than hepatic spine 6
—	Postorbital lobe and hepatic spine subequal 7
6(5)	Rostrum more than 1/3 postrostral carapace length; hepatic and branchial margin each with a slender, acuminate spine; dorsal surface of carapace even and smooth ..... *P. quadridens pellucens*[16])
—	Rostrum no more than 1/4 postrostral carapace length; hepatic and branchial margins each with a broad triangular lobe; dorsal surface of carapace usually with at least six tubercles ..... *P. quadridens quadridens*
7(5)	Postorbital tooth and hepatic spine both small, lateral margin in front of hepatic spine straight; dorsal branchial region without any tubercle anteriorly; merus of male cheliped with irregularly dentate carina on dorsal margin ..... *P. elongata*[16])
—	Postorbital tooth and hepatic spine both prominent, separated by a definite concavity; dorsal branchial region with a tubercle anteriorly; merus of male cheliped with three to four dorsal tubercles and a terminal spine ..... *P. intermedia*
8(3)	Rostral spines strongly divergent, about 1/4 postrostral carapace

[16]) From the literature

	length; hepatic spine long and subcylindrical, branchial spine shorter, stouter and more conical than hepatic spine	*P. leytensis*[16])
—	Rostral spines divergent or weakly divergent, 1/3 to 1/2 postrostral carapace length; hepatic spine smaller than or subequal to branchial spine	9
9(8)	Branchial region with anteromedial tubercles	*P. nipponensis*
—	Branchial region without anteromedial tubercles	10
10(9)	Cardiac region elevated, smooth; rostrum about 1/3 postrostral carapace length	*P. minor*
—	Cardiac region with a short spine on summit; rostrum about 1/2 postrostral carapace length	11
11(10)	Antorbital angle of eave produced to a small, obtuse lobe	*P. marissinica*
—	Antorbital angle of eave not produced	*P. similis*[16])

Pugettia incisa (De Haan, 1850)
(Fig. 28g, h)

Pisa (*Menoethius*) *incisus* De Haan, 1850: 98, pl. 24 fig. 3.
Pugettia incisa. — Ortmann, 1893: 44-45. — Yokoya, 1933: 148. — Sakai, 1938: 254-255, text-fig. 27; 1965a: 72, pl. 32 figs. 1, 2; 1976: 195-196, text-fig. 102, pl. 68 fig. 3. — Takeda & Miyake, 1969: 505-506. — Takeda, 1973b: 39-40.
Pugettia cristata Gordon, 1931: 555-557, text-figs. 33b, 34d, e.

Material examined. — 7 ♂♂, 2 ♀♀ (1 ovig.), 6.5-20 mm, ovig. ♀, 20 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Mortensen Pacific Expedition: Japan, 33°51′N 130°03′E, 47 m, dredge, 18 May 1914; 2 specs.
Japan: Hirado, 33°10′N 129°18′E, 72 m; 1 spec. — Nagasaki, coll. James Jordan: 1 spec. — Off Nagasaki, 32°48′N 129°37′E, 72 m, Capt. Christensen, "Store Nordiske", 23 April 1912; 2 specs.
Formosa Strait, 63 m; 3 specs.

Remarks. — In this species the postorbital lobe and hepatic spine are fused to form a single plate with a straight lateral margin. This character distinguishes it from all other species in the genus.

There is a posterior medial tubercle on the mesogastric region. In four specimens there is a small lateral tubercle anterior to that and in four specimens there is a very small anterior medial tubercle. The large cardiac spine is subequal to the epibranchial spine, each arising from a conical elevation. There is sometimes a low tubercle on the anterior branchial region and a very small tubercle anteriorly on the branchial submargin. There is a medial tubercle on the intestinal region.

There are three tubercles on the margin of the pterygostomian region and a similar tubercle in line with them on the anterior angle of the epimeral ridge.

The basal antennal article has a small tooth on the anterolateral angle, the lateral margin curves outward slightly at the base and the proximal angle is rounded. The narrow ridge near the medial margin extends a short way onto the epistome.

The merus of the cheliped is trigonal with a terminal spine, the dorsal carina is entire and the ventral ridges are each armed with three low teeth. In one specimen (♂, 20 mm, Japan), the dorsal ridge is armed with three low teeth and the inner ventral ridge is entire. The outer face of the merus is slightly raised, but smooth, in the lower half. It is not ridged as in *P. intermedia*. The carpus of the cheliped in the male has two crests dorsally and another on the inner margin. In the two female specimens only one crest, the dorsal, is distinct. The palm of the chela in the male is laterally compressed (ht = 3/4 l), there is a dorsal carina and the ventral margin is sharp.

The meri of the ambulatory legs are trigonal and laterally compressed. The carpi are widened with two ridges, and the propodi laterally compressed with a rounded dorsal ridge.

The first pleopod of the male has not been figured before. At the tip there is a broad triangular lateral lobe, a long slender medial lobe, and a small triangular lobe on the ventral surface. In most other species of *Pugettia* there are two medial lobes on the pleopod. In *P. quadridens* the ventral medial lobe of the pleopod is about half as long as the dorsal lobe, but in *P. intermedia*, *P. minor*, *P. nipponensis* and *P. marissinica* the two medial lobes of the pleopod are subequal.

Gordon (1931) has considered *P. cristata* as being close to *P. incisa* but differing from it by the presence, in the former, of crests on the meri of the ambulatory legs. In *P. incisa*, as figured by De Haan (1850: pl. 24 fig. 3), the merus of the first ambulatory leg is clearly sharp. Of our specimens, the male (17 mm) from Nagasaki has a blunt ridge on the dorsal margin of the merus, while the male (20 mm) from Hirado and the specimens from Formosa Straits have a distinct carina on the merus. Thus it seems that *P. cristata* is a synonym of *P. incisa* as noted by Sakai.

Distribution. — Japan, East China Sea, Formosa Strait, Amoy.

Pugettia intermedia Sakai, 1938 new status
(Fig. 28a, b)

Pugettia minor. — Shen, 1937: 287-289, text-fig. 5a, d, f, g. (Not *Pugettia minor* Ortmann, 1893.)
Pugettia quadridens intermedia Sakai, 1938: 258-259, pl. 36 fig. 2; 1965a: 72-73, pl. 32 fig. 3; 1976: 197, text-fig. 103b.

Material examined. — 1 ♂, 4 ♀♀ (2 ovig.), 7-32.5 mm, smaller ovig. ♀, 27 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Formosa Strait: 23°57′N 118°33′E, 50 m, April 1897; 2 specs. — 23°08′N 117°30′E, 43 m, 23 January 1912; 2 specs.
Japan, S. of Goto Retto, 32°48′N 129°37′E, 72 m, Capt. Christensen, 'Store Nordiske', 23 April 1912; 1 spec.

Remarks. — This species is very close to *Pugettia quadridens*. The two species have been compared by Shen (1937), who figured this species under the name *Pugettia minor*, and by Sakai (1938) who gave it only subspecific status. As the geographic range of both the nominate form of *P. quadridens* and *P. intermedia* includes Japan and North China, the two

[16]) From the literature.

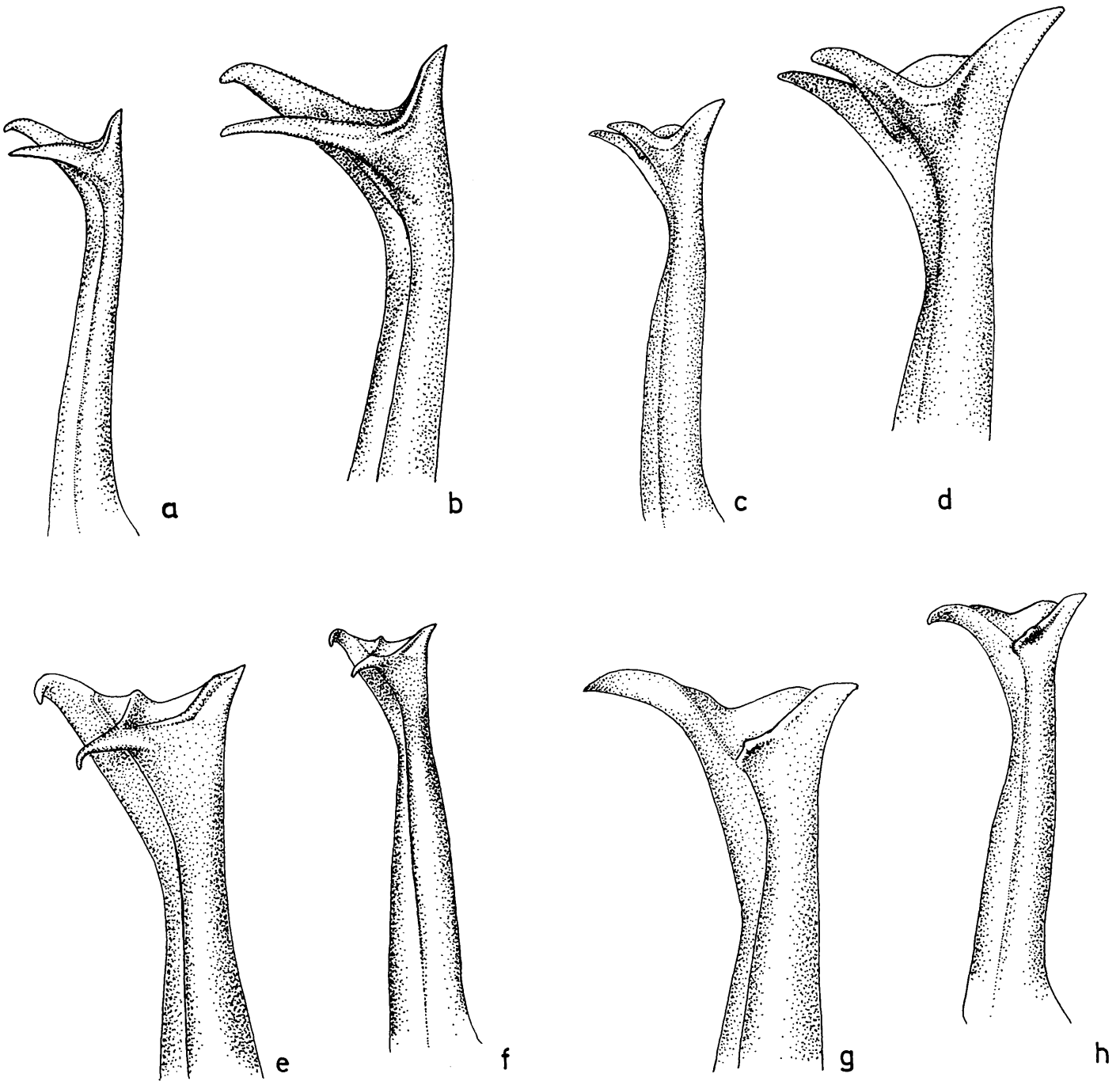


Fig. 28. Left first pleopod of male of *Pugettia intermedia* (32.5 mm, Formosa Strait, ZMC) (a) abdominal view of pleopod, (b) abdominal tip of same; *P. marissinica* (12 mm, Japan, ZMC) (c) abdominal view of pleopod, (d) abdominal tip of same; *P. quadridens* (21 mm, Nagasaki, ZMC) (e) abdominal tip of pleopod, (f) abdominal view of same; *P. incisa* (17 mm, Nagasaki, ZMC) (g) abdominal tip of pleopod, (h) abdominal view of same.

cannot be regarded validly as separate subspecies of the same species: they must be considered specifically distinct.

P. intermedia can be distinguished from *P. quadridens quadridens* by the following points (characters of *P. intermedia* given first):

(1) The two medial lobes of the first pleopod of the male are subequal; in *P. quadridens* the ventral lobe is only about half the length of the dorsal lobe (Shen, 1937: text fig. 5g, h).

(2) The postorbital lobe and the hepatic spine are subequal; in *P. quadridens* the postorbital lobe is much smaller than the hepatic spine.

(3) There are four small tubercles on the branchial submargin above the epimeral ridge; in *P. quadridens* there is only one or two such tubercles.

(4) The lateral gastric tubercles, if present, lie just in front of the posterior medial tubercle; in *P. quadridens* they lie just behind the anterior medial tubercle.

(5) There is a strong ridge or row of tubercles halfway down the outer face of the merus of the cheliped; in *P. quadridens* this ridge if present is very low and smooth.

The differences in the basal antennal article and sternal plate, figured by Shen, have not been found to be consistent. These are characters which, in this genus, generally show considerable variability.

Distribution. — Japan, N. China, Formosa Strait.

Pugettia marissinica Takeda & Miyake, 1972
(Fig. 28c, d)

Pugettia marissinica Takeda & Miyake, 1972b: 260-262, fig. 4. — Takeda, 1973b: 40.

Material examined. — 1 ♂, 5 ♀♀ (2 ovig.), cl. 11 — postrostral cl. 14 mm, smaller ovig. ♀, 13.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Formosa Straits, 45 m, 23 May 1897; 1 spec.
Mortensen Pacific Expedition: SE. of Goto, 32°15′N 128°12′E, 162 m, dredge, 15 May 1914; 1 spec.
Japan: SE. of Goto, 32°15′N 128°20′E, 180 m, Capt. H. Christensen, 17 April 1926; 3 specs. — 32°21′N 128°41′E, 177-198 m, 8 July 1928; 1 spec.

Remarks. — These specimens agree well with those figured and described by Takeda & Miyake as *P. marissinica*. Sakai (1976: 200, text fig. 107a, b) includes, without discussion, *P. marissinica* as a synonym of *P. similis* Rathbun, and this appears probable from the sketch of the type (fig. 107a). However, that sketch does not show the small, blunt antorbital angle present in our specimens and figured by Takeda & Miyake (as fig. 4A). Since *P. similis* has never been adequately described and Sakai has given no reasons for regarding the two species as synonymous, we will continue, for the present, to regard these specimens as *P. marissinica* and we include some descriptive notes on them.

The preorbital angle of the eave is sharp and produced forward, and the antorbital angle is produced to a small obtuse lobe. In lateral view the postorbital lobe is about as long as its basal width and curved downwards distally.

In most specimens the gastric regions are smooth, but in one specimen (male, 12 mm, 32°15′N 128°12′E) there are four very small tubercles, and in another (imm. ♀, 11 mm) there are two small medial tubercles. The hepatic spine is more slender than the postorbital lobe and smaller than the epibranchial spine.

There is a small tubercle on the branchial region, halfway between the epibranchial spine and the cardiac region and, in one specimen, there is also a tubercle on each side of the posterior margin of the cardiac region. There is a row of two to four small tubercles anteriorly on the branchial submargin.

On the intestinal region there is a medial tubercle, and on either side a low ridge just above the posterior margin of the carapace.

There is a blunt anterolateral tooth on the basal antennal article, the lateral margin is straight and without a proximal tooth.

On the pterygostomian margin there are three or four compressed tubercles and a similar tubercle in line with them on the anterior angle of the epimeral ridge.

The cheliped merus has a terminal spine and four ridges. The dorsal ridge is armed with two short proximal teeth and a longer distal tooth. Halfway down the outer face there is a low roughened ridge. Ventrally, the outer ridge is sharp with three short teeth, and the inner ridge is low with three granules.

The ambulatory legs are as described by Takeda & Miyake. The first ambulatory leg is as long as the cheliped and the carapace, not longer than them, as in *P. nipponensis*. The specimen from Formosa Straits has a more pronounced terminal spine on the meri of the ambulatory legs.

The first pleopod of the male has not been figured or described for either *P. similis* or *P. marissinica*, so we take this opportunity to figure the pleopod of one of our adult male specimens (12 mm, 32°15′N 128°12′E). The pleopod is scyriform like that of *P. minor* and *P. nipponensis*, that is, there is a broad triangular lateral lobe and two slender medial lobes.

This species was previously known only from the type locality, Tsushima Islands.

Distribution. — Japan: Tsushima Islands, SE. of Goto, Formosa Straits.

Pugettia mindanaoensis Rathbun, 1916
(Fig. 29)

Pugettia mindanaoensis Rathbun, 1916: 538-539. — Griffin, 1976: 210.

Material examined. — 1 ♀, 9 mm.

SMITHSONIAN INSTITUTION, WASHINGTON
'Albatross' Expedition: Stn. 5172, Sulu Archipelago, near Jolo, 06°03′15″N 120°35′30″E, 572 m, 5 March 1908; 1 spec., USNM 48244, det. Rathbun.

Remarks. — This small female was reported on previously (Griffin, 1976) but not figured. It agrees well with the holotype (♀, 15 mm, off N. Mindanao, USNM 48208). In this specimen there is a sharp preorbital spine, a very weak antorbital convexity and a broad postorbital lobe, in lateral aspect the length about equal to the basal width. The hepatic region is elevated, distinct from the postorbital lobe, with a small, sharp dorsal spine. The branchial region has a very small epibranchial spine, not 'moderate sized' as in the holotype, and there is no tubercle on the inner angle of the branchial region as in the holotype. Rathbun described 'a tubercle on the anterior part of the subbranchial region' of the holotype which in this specimen is in the form of a flat suboval plate, broader anteriorly, carinate on the anterior and dorsal edges. The male of this species is unknown.

This species is distinguished from others in the genus, except *P. quadridens pellucens*, by the absence of any spines or

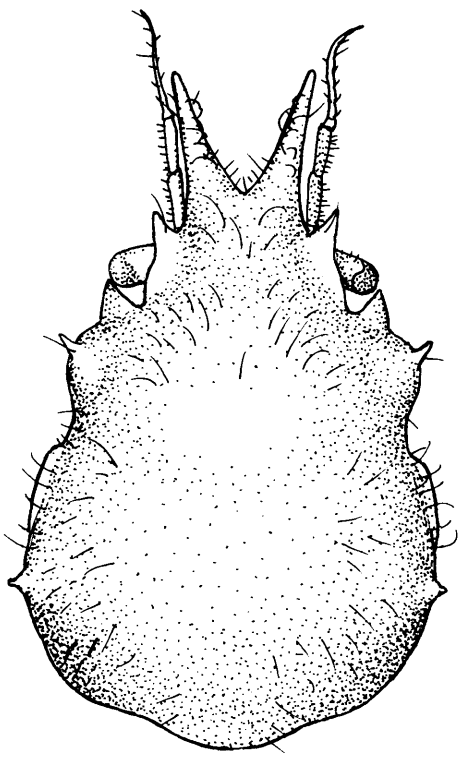


Fig. 29. *Pugettia mindanaoensis* (female, 9 mm, Sulu Archipelago, USNM 48244) carapace, dorsal view.

tubercles on the gastric, cardiac or intestinal regions. It is distinguished from *P. quadridens pellucens* by the much smaller hepatic and branchial spines.

Distribution. — Southern Philippine Islands.

Pugettia minor Ortmann, 1893

Pugettia minor Ortmann, 1893: 44. — Gordon, 1931: 555-556, text figs. 33a, 34a-c. — Sakai, 1938: 260, pl. 25 fig. 2, text fig. 29; 1965a: 72, pl. 31 fig. 4; 1976: 199, pl. 68 fig. 2. — Takeda & Miyake, 1969: 506-507. — Takeda, 1973b: 40, fig. 5. (Not *Pugettia minor* Shen, 1937 = *Pugettia intermedia* Sakai.)

Material examined. — 11 ♂♂, 8 ♀♀ (3 ovig.), 6.5-18.5 mm, smallest ovig. ♀, 9 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Japan, 32°49′N 128°14′E (23 miles NW. 3/4W. of Goto), 207 m, trawl, sand, 14 May 1914; 1 spec. — NW. of Shimonoseki, 34°20′N 130°10′E, 108 m, dredge, 18 May 1914; 1 spec. — off Misaki, 144-180 m, 19 June 1914; 6 specs. — Okinose, Sagami Sea, 180 m, 23 June 1914; 2 specs. — Okinose, Sagami Sea, 540 m, 28 June 1914; 1 spec. — Sagami Bay, 540 m, 29 June 1914; 8 specs.

Remarks. — This species is close to *P. nipponensis* and *P. marissinica* but can be distinguished from them by the presence of a spine (not a tubercle) on both the cardiac and the intestinal region.

The rostral spines are approximately 1/3 the postrostral carapace length and divergent or weakly divergent. The preorbital angle of the eave is produced forward in a sharp spine, but the antorbital angle is, at most, only very weakly produced and rounded. The postorbital lobe is larger than the hepatic spine and, in lateral view, the length is about 1 1/2 to 2 times the basal width.

On the gastric region there is a posterior medial tubercle (very low in some small specimens), and in 7 specimens a very low lateral tubercle just in front of it. On the branchial region there is an epibranchial spine, and a row of two to three tubercles laterally on the submargin, but no anterior branchial tubercles as in *P. nipponensis*. There is a very strong spine on the conically elevated cardiac region. On the intestinal region there is a long medial spine but no pronounced ridge above the posterior margin of the carapace (as there is in the other two species).

On the basal antennal article there is a small anterolateral tooth (which varies in size); the lateral margin is straight and there is sometimes a very small proximal lateral tooth. There are three tubercles on the margin of the pterygostomian region and a similar tubercle in line with them on the anterior angle of the epimeral ridge.

The merus of the cheliped has three or four ridges and a terminal spine. The cheliped of the male as figured by Sakai (1938: pl. 25 fig. 2) and Takeda (1973b: fig. 5) has an uninterrupted carina dorsally on the merus. However, in all except two of our specimens the dorsal crest is made up of two low proximal teeth and a longer distal one, often sharp. Midway down the outer face there is a low smooth ridge (more marked in larger specimens) and ventrally there is a crest with three low teeth. Ventrally on the inner face, the ridge has a low unbroken carina or is armed with three low teeth or granules. On the carpus there are two sharp crests, one dorsal, and one on the inner edge, and between them a lower diagonal crest.

The ambulatory legs are without a ridge or a terminal spine. The first ambulatory leg is subequal to the cheliped and the carapace length.

The first pleopod of the male is similar to that of *P. nipponensis* and *P. marissinica* and has been figured by Sakai (1938: text fig. 29); it is scyriform.

The specimen figured as *P. minor* by Shen (1937) is actually *P. intermedia* and is discussed under that species.

Distribution. — Japan and Yellow Sea.

Pugettia nipponensis Rathbun, 1932

Pugettia nipponensis Rathbun, 1932: 31. — Yokoya, 1933: 152-153. — Sakai, 1938: 261-262, pl. 26 fig. 2, text fig. 30; 1965a: 73, pl. 33 fig. 1; 1976: 200-201, text-fig. 108a, b, pl. 69 fig. 1. — Takeda & Miyake, 1969: 507.

Material examined. — 3 ♂♂, 1 ♀ (ovig.), 15-19 mm, ovig. ♀, 16.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Sagami Bay, Misaki, off the station, 144-216 m, swabs, 10 June 1914; 1 spec. — off Misaki, 360 m, dredge, 30 June 1914; 1 spec.

Japan, 32°19′N 128°12′E, 146-346 m, 'Store Nordiske', 17 May 1931; 1 spec.

Danish Kei Islands Expedition: Ambon, Ambon Bay, 234-180 m, stones, 25 February 1922; 1 spec.

Remarks. — This species is close to *P. minor* and *P. marissinica* but is distinguished from them by the presence of tubercles on the anterior branchial region, longer ambulatory legs, and the low dense tomentum on the carapace.

The rostral spines are slender, divergent, and vary in length from $^1/_3$ to $^1/_2$ the postrostral carapace length. The preorbital angle of the eave is produced forward in an acuminate spine but there is no antorbital lobe. The postorbital lobe is longer than broad (l = $1^1/_2$ w approx.), in lateral view.

On the mesogastric region there is a posterior medial tubercle and, with one exception, a small lateral tubercle just in front of it. On the specimen from Ambon there is also a small anterior medial tubercle. The short hepatic spine is about as long as the postorbital lobe and, in all except one specimen, has a small tubercle just above it.

There is a group of two to three tubercles anteriorly on the branchial region. There is a short epibranchial spine, a tubercle medial to it and another elongate tubercle near the rounded cardiac region. Laterally there are three tubercles on the branchial submargin. There is a rounded medial tubercle on the intestinal region, and on either side, a low ridge just above the posterior margin of the carapace.

On the basal antennal article there is a blunt anterolateral tooth, a small proximal lateral tooth (which varies in size), and the margin between them is straight or weakly concave.

There are three tubercles on the margin of the pterygostomian region and in line with them, a similar tubercle on the anterior angle of the epimeral ridge.

The cheliped of the male (18.5 mm) from off Misaki has two ventral teeth on the ischium. On the merus there is a terminal spine, three toothed ridges, and a low smooth ridge midway on the outer face. The dorsal ridge has two proximal teeth and there are three teeth on each of the ventral ridges. There are two sharp crests on the carpus. These teeth and crests are all much blunter and lower on the specimen (♂, 15 mm) from Ambon. The ambulatory legs are long and slender and covered with a low tomentum. The meri lack both a carina and a terminal spine. The first ambulatory leg is longer than the cheliped and up to one and a half times the carapace length.

The first pleopod of the male has been figured by Sakai (1938: text-fig. 30b): it is scyriform.

One specimen (♂, 19 mm, 32°19′N 128°12′E) is noticeably less tuberculate. There is only one distinct tubercle on the gastric region, none above the hepatic spine or just medial to the epibranchial spine.

This species has previously been recorded only from Japan.

Distribution. — Japan, Ambon.

Pugettia quadridens (De Haan, 1850)
(Fig. 28e, f)

Pisa (*Menoethius*) (sic) *quadridens* De Haan, 1850: 97-98, [and as *P.* (*Halimus*) *quadridens* in] pl. 24 fig. 2.
Pugettia quadridens. — Stimpson, 1907: 24-25. — Yokoya, 1933: 148. — Shen, 1937: 287-289, text fig. 5b, c, e, h. — Sakai, 1938: 255-257, pl. 26 fig. 1, text fig. 28; 1965a: 73, pl. 32 figs. 4, 5.
Pugettia quadridens quadridens. — Sakai, 1976: 196-197, text fig. 103a, pl. 68 fig. 1.

Material examined. — 2 ♂♂, 19, 21 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Japan, Nagasaki, coll. James Jordan; 1 spec. — Nagasaki, coll. James Jordan, 1 July 1911; 1 spec.

Remarks. — Our specimens agree with those described and figured by Sakai (1976) as *P. quadridens quadridens*. This species is close to *P. intermedia* (previously considered a subspecies of *P. quadridens*) and the differences in the first pleopod of the male, the postorbital lobe and the carapace tubercles which distinguish them, are discussed under *P. intermedia*.

P. quadridens pellucens Rathbun has subspecific status but as Sakai states it differs from *P. quadridens quadridens* in having the dorsal surface of the carapace smooth, the rostral spines longer and widely divergent in the distal half and the spines on the hepatic and branchial margins are narrow, not laminar. The first pleopod of the male of *P. quadridens pellucens* has not been figured or described. It seems that *P. quadridens pellucens* may prove to be a distinct species but we are unable to comment further without seeing specimens.

Distribution. — Japan, Korea, North China.

Sargassocarcinus Ward, 1936

Type species. — *Sargassocarcinus foliatus* Ward, 1936 (= *Peltinia sublimis* Rathbun, 1916), by monotypy.

Remarks. — Three very similar species have been described by different authors under different names from the Philippine Islands, Japan and Australia. It seems probable that there is, in fact, a single western Pacific species.

Sakai (1965a: 75-76) explained that the name *Sargassocarcinus* must replace the *Peltinia* of Dana which is no longer valid and also why the specimen described by Balss (1924) as *Mimulus cristatus* does not belong in that east Pacific genus. We would add that *Mimulus foliatus* Stimpson differs from *Sargassocarcinus* in having a well developed postorbital lobe and the first pleopod of the male is scyriform. The pleopod of *Sargassocarcinus sublimis* is similar to that of *Huenia proteus* De Haan. The presence of two rostral lobes distinguishes *Sargassocarcinus* from the broad carapaced species of *Huenia* such as *H. brevifrons* in which there is a single rostrum.

Distribution. — Western Pacific.

Sargassocarcinus sublimis (Rathbun, 1916)
(Fig. 18e, f)

Peltinia sublimis Rathbun, 1916: 536-537.
Mimulus cristatus Balss, 1924: 28, pl. 1 figs. 4, 5.

Sargassocarcinus foliatus Ward, 1936: 9, pl. 3 figs. 4-6.
Sargassocarcinus sublimis. — Sakai, 1965a: 75-76, text fig. 11c. — Griffin, 1976: 211.
Sargassocarcinus cristatus. — Sakai, 1965a: 77, text figs 11a, b, pl. 34 fig. 3; 1976: 205, pl. 71 fig. 3; new synonymy.

Material examined. — No new material. 2 ♂♂, 7.5, 8 mm.

SMITHSONIAN INSTITUTION, WASHINGTON
'Albatross' Expedition: Stn. 3730, Japan, off Honshu I., 61-66 m, 16 May 1900; 1 spec. (USNM 48248, det. M. Rathbun, *Peltinia sublimis*).

THE AUSTRALIAN MUSEUM, SYDNEY
Queensland, near Lindeman I., Seaforth Reef, coll. M. Ward, July 1935; 1 spec. (AM P.16297, Paratype, *Sargassocarcinus foliatus* Ward).

Remarks. — We have examined these two specimens and consider them conspecific. They agree in the form of the rostrum, the preorbital lobe, general carapace shape, carapace tubercles, basal antennal article and ambulatory legs. The anterior margin of the hepatic lobe is less sinuous in the Australian specimen than in the specimen from Japan. The paratype of *S. foliatus* (8 mm) is apparently adult, the palm of the chela is one and a half times as long as high and there is a well developed gape between the fingers with a single large tooth on the dactyl. The chela on the Japanese specimen (7.5 mm) is more slender with no gape between the fingers.

These two specimens also agree with the holotype of *S. sublimis* (male, 12 mm, USNM 48247) from Sulu Archipelago, examined by one of us (Griffin in 1970). The specimens do not appear to differ from that figured by Sakai (1965a: text fig. 11a, b, pl. 34 fig. 3) as *S. cristatus* Balss and Sakai has given no distinguishing characters to separate *S. sublimis* and *S. cristatus*. It seems most likely that there is one species *S. sublimis* present in Japan, Philippine Islands and northern Australia.

The first pleopod of the male has not been described or figured before. The pleopod is similar to that of *Huenia proteus*, it is slender, straight, slightly broader where it curves outward near the tip, and then tapers to a narrow apex. The male abdomen has seven free segments.

Distribution. — Japan, Philippine Islands, northern Australia.

Simocarcinus Miers, 1879

Type species. — *Huenia simplex* Dana, 1852, by subsequent designation of Miers (1879).

Remarks. — Miers (1879a, c) removed from the genus *Huenia* the species which lacked a preorbital spine and placed them in two new genera *Trigonothir* and *Simocarcinus*. Laurie (1906) regarded the distinction made by Miers between these two genera as insufficient and, as *Simocarcinus simplex* was quite well known while *Trigonothir* was 'formed for a single male specimen', Laurie chose *Simocarcinus* as the name for the genus. Balss (1938) agreed with Laurie that there should be one genus but regarded *Trigonothir* as the correct name on the basis of page priority. However, the name to be used depends not on page priority but on the first revisor. As Laurie clearly qualifies as the first revisor under Article 24 of the International Rules of Zoological Nomenclature, *Simocarcinus* Miers, 1879 is adopted here.

Although we consider that there are three species in this genus, differentiating between them is sometimes extremely difficult. Discrimination is not assisted by the remarkably similar first pleopods of the males.

Distribution. — Widespread throughout the Indo-West Pacific.

KEY TO SPECIES OF *SIMOCARCINUS*

1	Rostrum length equal to or greater than postrostral carapace length; rostrum in males strongly compressed laterally in distal half, apex deeper than basal portion and without ventral lobes; neither males nor females with hepatic lobes ..... *S. pyramidatus*
—	Rostrum length less than postrostral carapace length; apex of rostrum in males expanded into two lateral lobes ventrally; females with distinct hepatic lobes 2
2(1)	Rostrum with dorsal face tapering towards apex; rostrum in females greater than one fifth postrostral carapace length; length of hepatic lobe of female from anterior to posterior margin about one fifth postrostral carapace length; first ambulatory leg of adult female about 1.5 times as long as cheliped ..... *S. simplex*
—	Rostrum with dorsal face not tapering towards apex; rostrum in females no more than one fifth postrostral carapace length; length of hepatic lobe of female from anterior to posterior margin about one third postrostral carapace length; first ambulatory leg of adult female about as long as cheliped ..... *S. obtusirostris*

Simocarcinus obtusirostris (Miers, 1879)

Trigonothir obtusirostris Miers, 1879a: 4-5, pl. 4 figs. 2, 2a. — Forest & Guinot, 1961: 14-15. — Takeda, 1973a: 100-101, fig. 2D, E, pl. 3 fig. B.
Simocarcinus obtusirostris. — Griffin, 1974: 28-29.

Material examined. — 2 ♂♂, 6 ♀♀ (5 ovig.), 10-22.5 mm, smallest ovig. ♀, 16.5 mm.

MUSEUM OF VICTORIA, MELBOURNE
Queensland, Capricorn Group, Masthead I., coll. J. A. Kershaw, October 1920; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY
Queensland: Capricorn Group, Heron I., on *Halimeda*, coll. I. Bennett, August 1962; 3 specs (AM P.19645). — Heron I., 12 October 1962; 1 spec. (AM P.17019). — Heron I., coral reef flat, January 1955; 1 spec (AM P.12918). — Heron I., on *Halimeda*, coll. D. Henderson, November 1966; 1 spec. (AM P.31032, dry). — Herald Group, Northeast Cay, dead coral washings, coll. D. F. McMichael and J. C. Yaldwyn, 9 November 1964; 1 spec. (AM P.17001).

Remarks. — In the two males of this series the rostrum is about two-thirds the postrostral carapace length while in the females the rostrum varies from a short lobe extending for-

ward about one fifth postrostral carapace length to a lobe which is nearly vertical and hardly produced forward beyond the preorbital region. The rostrum is not strongly compressed and the dorsal surface, especially in the males, is nearly as broad just behind the apex as it is at the base; the apex is blunt. On the other hand, in males of *S. simplex* and *S. pyramidatus* the dorsal surface of the rostrum is tapered and very narrow at the apex.

The hepatic lobe of our female specimens is very broad and the lateral margin of the lobe is inflated. The branchial lobes are not as broad as the hepatic but they are also inflated so that in some specimens they are almost bulbous. In two of our females the hepatic lobes are not extended as far laterally as is usual in this species so that the width across the hepatic lobes is noticeably less than that across the branchial lobes. However, the hepatic lobe is still much broader than it is in *S. simplex*. In our specimens of *S. obtusirostris* the anterior margin of the hepatic lobe is just behind the orbit and the length of the lobe from anterior to posterior margin is about a third of the postrostral carapace length. In *S. simplex* the anterior margin of the lobe is always well behind the orbit and the length of the lobe is about one fifth the postrostral carapace length.

The relationship between the length of the cheliped and the length of the first ambulatory leg is not reliable in the male where the length of the cheliped changes so much with age, but in the adult females of each of these three species of *Simocarcinus* we have found a consistent relationship.

In our adult females of *S. obtusirostris* the first ambulatory leg is stouter and it is also shorter in relation to the cheliped than in *S. simplex* and *S. pyramidatus*. The first ambulatory leg is equal to or only slightly longer (1.0 to 1.2) than the cheliped and the propod of the first leg is about twice (2 to 2.3) as long as high. In adult females of *S. simplex* the first leg is about one and a half times as long as the cheliped and the propod four to five times as long as high; in adult females of *S. pyramidatus* the first leg is twice as long as the cheliped and the propod is very slender, about seven times as long as high.

Balss (1938) considered *Xenocarcinoides rostratus* Borradaile from Funafuti (Kirabati) a synonym of *Trigonothir obtusirostris*. Sakai (1976) considers it a distinct species of *Trigonothir*. *X. rostratus* differs from the present series most noticeably in having the rostrum apically concave dorsally and in apparently possessing a tubercle surmounting the lateral branchial angle. Borradaile states that the abdomen of the male possesses only six segments but his illustration shows seven with the sixth fissured. The figure of *X. rostratus*, as *T. rostratus*, given by Sakai (1976: pl. 70 fig. 2) agrees quite well with specimens of *S. obtusirostris* that we have examined. In our opinion the evidence which distinguishes *X. rostratus* as a distinct species is inadequate and we agree with Balss that it should be regarded as a synonym of *S. obtusirostris*.

These records are the first of this species from Australia.

Distribution. — Indo-West Pacific: Cocos Keeling Islands, NE. Australia (Queensland), Palau, Mariannas, Kirabati, Tuvalu, Tahiti.

Simocarcinus pyramidatus (Heller, 1861)

Huenia pyramidata Heller, 1861: 307-309, pl. 1 fig. 9.
Simocarcinus pyramidatus. — Griffin, 1974: 29. — Griffin & Tranter, 1974: 182.

Material examined. — 6 ♂♂, 1 ♀, 23.5-39 mm.

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: Barrow I., 2-5.5 m, dredge, sand, 5 August 1966; 1 spec. (WAM 239-73). — Exmouth Gulf, 12-18 m, trawl, coll. R. McKay, winter 1960; 1 spec. (WAM 64-77). — Shark Bay, near bar of South Passage, coll. R. W. George on 'Davina', 14 May 1960; 3 specs. (WAM 348-73, in part). — Lancelin I., in craypot, coll. C. Jeffrey, January 1961; 1 spec. (WAM 351-73).

THE AUSTRALIAN MUSEUM, SYDNEY

Western Australia, 14 miles (~ 22 km) N. of Point Cloates, 22°30′S 113°42′E, 1.5-3.5 m, box dredge, sand, 'Ningaloo' Expedition, 9 September 1968; 1 spec. (AM P.17870).

Remarks. — In this series of specimens the rostrum is equal to or greater than (up to 1.3 times) the postrostral carapace length. In the males the rostrum is strongly compressed laterally especially in the distal half and ventrally is not expanded into lateral lobes apically. The rostrum is deeper near the apex than in the basal portion and sometimes weakly curved downwards in the distal half. The rostrum of the immature female is not so strongly compressed, the apex is not deepened and there are small lateral lobes on the ventral margin apically.

On the hepatic margin of these specimens (male and female) there is a weak convexity but no hepatic lobe. The anterior margin of the branchial lobe is long and gently curved while the posterior margin is short and nearly at right angles to the midline of the carapace. The branchial lobe is strongly pronounced in five of the males, weak and rounded in the other male and in the immature female.

We have also examined an adult female (cl. 31.5 mm, Mauritius, dry spec.) in the collection of the Australian Museum. It agrees with the immature female of this series in the absence of hepatic lobes and in the shape of the rostrum which is one and a half times the postrostral carapace length.

The specimen described and figured by Sakai (1976) as *Trigonothir longirostris* agrees with specimens of *S. pyramidatus* in the length of the rostrum and absence of hepatic lobes, but the oblique angle of the rostrum and the presence of ventral lobes at its apex would seem to indicate *S. simplex* or a species other than the three dealt with here.

Distribution. — Indian Ocean: Aldabra, Mauritius, Seychelles, Sri Lanka, Nicobar, Cocos Keeling Islands, Western Australia.

Simocarcinus simplex (Dana, 1852)

Huenia simplex Dana, 1852: 133-134, 1855: pl. 6 figs. 3a-c.
Simocarcinus simplex. — Griffin & Tranter, 1974: 182, 185. — Tirmizi, 1978: 311-312, figs. 1-8.
Trigonothir simplex. — Sakai, 1976: 209-210.
Trigonothir camelus. — Sakai, 1976: 211-212, text figs. 114a, b.

Material examined. — 11 ♂♂, 18 ♀♀ (7 ovig.) 10-31 mm, smallest ovig. ♀, 13 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Mortensen Pacific Expedition: Hawaii, Hilo, 7 April 1915; 1 spec. — Honolulu, April 1915; 5 specs.

South India, Pamban Passage, 5 m, coll. H. Lemche, 9 October 1951; 1 spec.

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: Sharks Bay, near bar of South Passage, coll. R. W. George on 'Davina', 14 May 1960; 5 specs. (WAM 348-73, in part). — Abrolhos Islands, East Wallaby I., NE. side of island, on shore platform, coll. E. P. Hodgkin, 5 February 1964; 1 spec. (WAM 326-67).

THE AUSTRALIAN MUSEUM, SYDNEY

Hawaii, reef at Waikiki, amongst weed and under stones, coll. M. Ward, 24-30 August 1927; 16 specs. (AM P.31031).

Remarks. — In most of the males of this series the rostrum is less than half (about 0.4) the postrostral carapace length, but in a few of the larger males it is greater than half (about 0.6). In all the males the distal end of the rostrum is narrow and tapering on the dorsal surface but on the ventral surface is expanded into two horizontal lobes.

In this series the females from Hawaii and one of those from Western Australia have a rostrum that is about one fifth to one third postrostral carapace length, but in the other females from the Indian Ocean the rostrum is about half the postrostral carapace length. In all our females the apex of the rostrum has two horizontal lobes ventrally.

In all our females there is a moderately sized hepatic lobe, the length of the lobe from the anterior to posterior margin being about one fifth the postrostral carapace length.

The branchial lobe in both males and females is blunt and triangular, directed laterally or very slightly forwards, the anterior and posterior margins being subequal.

Distribution. — Indo-West Pacific: Red Sea, Arabian Sea, South India, Western Australia, Japan, Hawaii.

Xenocarcinus White, 1847

Type species. — *Xenocarcinus tuberculatus* White, 1847, by monotypy.

Remarks. — Gordon (1934) clarified the characters distinguishing *X. tuberculatus* White from *X. depressus* Miers and listed the two synonymies, but only commented that *X. conicus* (A. Milne Edwards) was probably a distinct species. The present revision confirms *X. conicus* as a valid species and lists the synonymy of this species. *X. conicus* and *X. tuberculatus* are widespread in the Indo-West Pacific while *X. depressus* appears to be restricted to the West Pacific and *X. monoceros* Sakai to Japan. Species of this genus are distinguished by the single, stout, uncompressed rostrum which is bifurcate or abruptly narrowed apically. The sexes of species of *Xenocarcinus* are not dimorphic. The first pleopod of the male in all known species bears a long slender apical process and is quite different from that of *Acanthonyx*, *Huenia* or *Simocarcinus* species. A pleopod of this kind is found in *Hoplophrys* and the *Hyastenus diacanthus* — *H. aries* group of species within the Pisinae. The pleopod of *X. monoceros* is unknown. There is a very small preorbital lobe in *X. conicus* and *X. monoceros*; the intercalated spine is defined by sutures in *X. conicus*, *X. depressus* and *X. monoceros* but not in *X. tuberculatus*.

X. truncatifrons Balss (1938) is known only from the holotype from the Gilbert Islands but the form of the preorbital region and the position of the curled hairs have more in common with species of *Huenia* such as *H. halei* or *H. australis* than with other species of *Xenocarcinus*. We retain this species in *Xenocarcinus* with reservations.

Distribution. — Widespread in the Indo-West Pacific.

KEY TO SPECIES OF *XENOCARCINUS*

1	Rostrum with apex slender, undivided and on a plane lower than preorbital region 2
—	Rostrum with apex broad, bifid and in the same plane as preorbital region 3
2(1)	Carapace dorsally smooth, width about $^2/_3$ postrostral carapace length; supraorbital eave, intercalated lobe and postorbital lobe not defined; preorbital region truncate, rostrum minute ..... *X. truncatifrons*[17])
—	Carapace dorsally with several low tubercles, width about $^1/_2$ postrostral carapace length; supraorbital eave, intercalated lobe and postorbital lobe well defined by sutures; rostrum about $^1/_4$ postrostral carapace length, broad proximally and tapering abruptly to a medial style ..... *X. monoceros*[17])
3(1)	Rostrum broad, of almost uniform width, divided in the distal third; gastric regions with eight small tubercles ..... *X. depressus*
—	Rostrum markedly narrower distally (about $^1/_3$ basal width), divided only at apex; gastric regions smooth or with two large tubercles 4
4(3)	Gastric region with two large tubercles in the midline; ambulatory legs smooth; anterolateral angle of basal antennal article produced but unarmed ..... *X. tuberculatus*
—	Gastric region elevated but smooth; ambulatory legs armed with spines; anterolateral spine on basal antennal article ..... *X. conicus*

Xenocarcinus conicus (A. Milne Edwards, 1865) (Fig. 30c, d)

Huenioides conica A. Milne Edwards, 1865: 145-146, pl. 4 fig. 3.
Xenocarcinus tuberculatus. — Alcock, 1895: 192. — Alcock & Anderson, 1898: pl. 33 fig. 3, 3a. — Rathbun, 1911: 248-249. — Stephensen, 1945: 109-110, fig. 21C, D. (Not *Xenocarcinus tuberculatus* White, 1847.)
Xenocarcinus tuberculatus var. *alcocki* Laurie, 1906: 371-372.
Xenocarcinus conicus. — Gordon, 1934: 70 (in discussion).
Xenocarcinus nakazawai Sakai, 1938: 325-327, text fig. 52; 1976: 213-214, text fig. 116. — Takeda & Koyama, 1974: 106-107, figs. 1, 2; new synonymy.
Xenocarcinus alcocki. — Sakai, 1965a: 92 (in discussion).

[17]) From the literature.

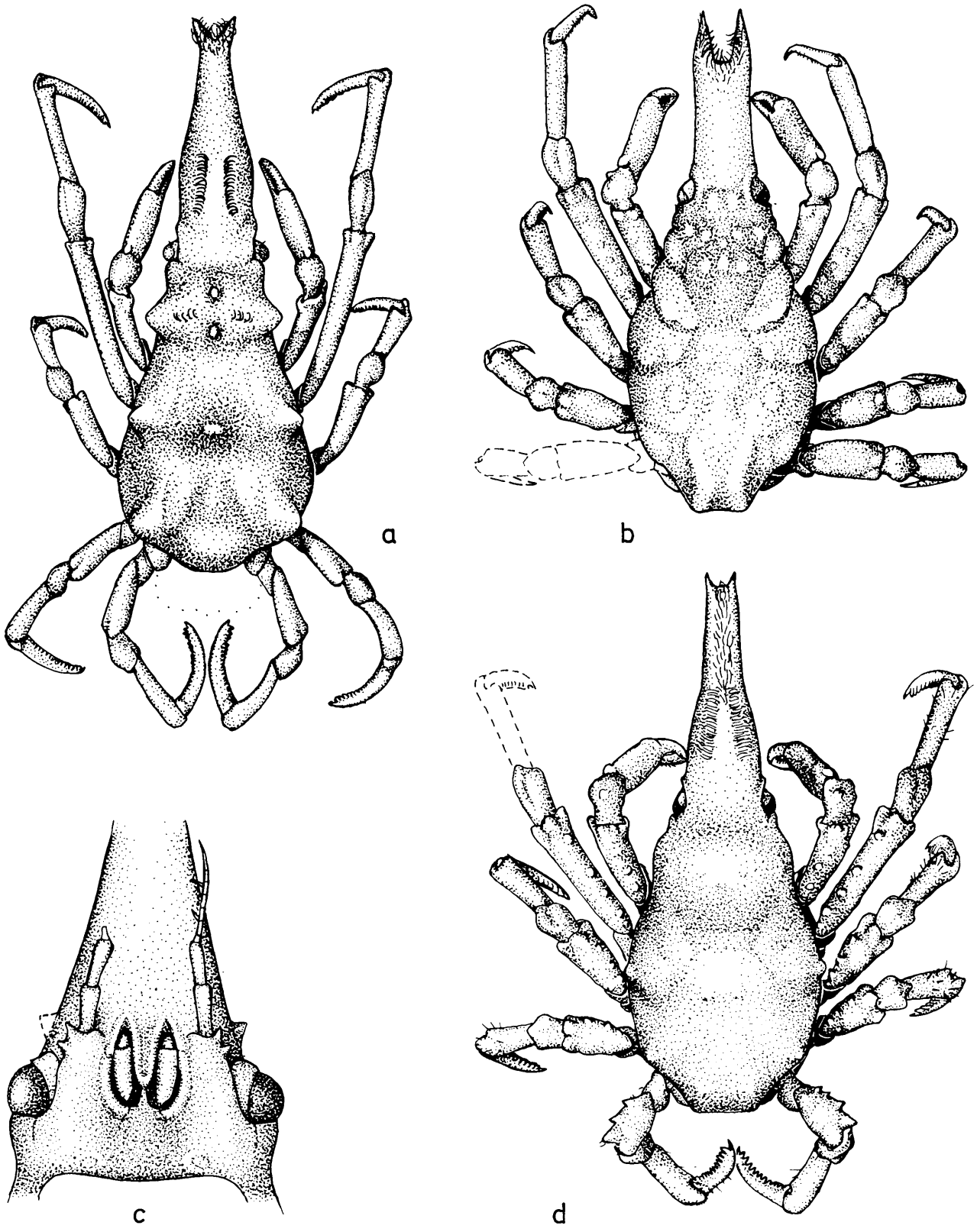


Fig. 30. *Xenocarcinus tuberculatus* (female, ovig., 35 mm, AM P. 11460) (a) whole animal dorsal view; *X. depressus* (female, ovig., 22 mm, Banda, ZMC) (b) whole animal, dorsal view; *X. conicus* (female, ovig., 22 mm, Ile de la Réunion, MNHN) (c) orbits, ventral view; (d) whole animal, dorsal view.

Material examined. — 11 ♂♂, 16 ♀♀ (6 ovig.), 1 juv., 6.5-39.5 mm, smallest ovig. ♀, 13.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

Danish Kei Islands Expedition: Stn. 43, Kai Is., 05°30′S 132°45′E, 35 m, trawl, sand, coral, 27 April 1922; 1 spec. — off Neira Banda, ca. 13 m, dive, sand, 12 June 1922; 1 spec. — Kai Is., coll. Th. Mortensen, 1922; 1 spec.

5 Thai Danish Expedition: Stn. 1000, West Malay Peninsula, 07°40′N 98°23′E, 45 m, trawl, 6 January 1966; 1 spec.

Danish Expedition to Iran: Stn. 42 D, Iranian Gulf, 24 nautical miles NE. of Bahrein, 33 m, shells and gravel, 30 March 1937; 16 specs. (det. K. Stephensen (1945) as *X. tuberculatus*).

MUSÉUM NATIONAL D'HISTOIRE NATURELLE, PARIS

'Calypso' Red Sea Expedition: Red Sea, on gorgonid, 27 January 1952; 3 specs.

Aldabra, between main passage and Johnny Channel, 42 m, 13 May 1954; 2 specs.

Ile de la Réunion, 70-80 m, coll. Grueze, 1965; 1 spec.

ZOOLOGICAL SURVEY OF INDIA, CALCUTTA

Off Sri Lanka, 61 m; 1 spec. (ZSC 5454/9, det. Alcock (1895) as *X. tuberculatus*).

THE AUSTRALIAN MUSEUM, SYDNEY

Off Sri Lanka, Pedro Bank; 1 spec. (AM P.29851, dry).

Remarks. — There has certainly been some confusion about the identity of previously described material. On four occasions this species has been recorded as *X. tuberculatus*. Further, it is our view that *X. nakazawai* is in fact a synonym of *X. conicus*.

This species is distinguished from *X. tuberculatus* by the gastric region which is smooth, rather than armed with two large tubercles, by the presence in *X. conicus* of a preorbital tubercle, a tooth on the anterolateral angle of the basal antennal article and a smaller spine or tubercle just behind it, and spines on the meri of the ambulatory legs, features which are all absent in *X. tuberculatus*. It is distinguished from *X. depressus* by the lack of any tubercles anteriorly on the branchial region, by the tapering rostrum (of almost uniform width in *X. depressus*), and the presence of spines not tubercles on the meri of the ambulatory legs. It differs from both these species in having two or three (not one) tubercles on the pterygostomian margin.

Our three specimens from the Red Sea (2 ♂♂, 21.5, 39.5 mm; 1 ovig. ♀, ca. 30 mm), differ from the other specimens only in the longer rostrum, which in the males is equal to, or one and a third times, the postrostral carapace length and in the female three quarters postrostral carapace length. The tubercle behind the anterolateral spine of the basal antennal article, while less pronounced than in other specimens, is still present. In the larger male some of the teeth on the dactyl of the first ambulatory leg have double points.

In all our specimens the intercalated spine is only separated from the orbital eave and the postorbital lobe by fine sutures. The rostrum is covered with a dense tomentum, and tapers distally to an apex of only a quarter to a third the basal width. There are no tubercles anteriorly on the branchial region and the tubercles on the cardiac region are very low.

The dactyl of the first ambulatory leg is armed with eight to fifteen short teeth and the terminal tooth is about the same size. In adult males (17, 39.5 mm) the cheliped carpus is armed with three tubercles; the palm is inflated, there is a strong gape between the fingers and a large tooth on the dactyl in the gape. Segments four to six of the female abdomen are fused. The first pleopod of males agrees with that figured by Stephensen (1945) as *X. tuberculatus*; distally very slender with long setae.

Our specimens from Kai Is. and Malaya agree with those described by Rathbun (1911) as *X. tuberculatus*. It is surprising that Rathbun described her specimens as *X. tuberculatus*, when Laurie (1906), perhaps in insufficient detail, had already recognised his own material and that described by Alcock (1895) as a distinct 'variety'.

Sakai (1965a) has included the specimens recorded by Rathbun with those described by Alcock, Laurie, and Stephensen (1945) in *X. alcocki* Laurie (giving Laurie's 'variety' specific status). Sakai (1976) suggests that Stephensen's specimens may be *X. depressus*; in our opinion they belong to *X. conicus*.

The two specimens described by Alcock and the specimen described by Laurie all have a tapering rostrum and the meri of the ambulatory legs are armed. We have examined the specimen (ovig. ♀, 15.5 mm) from off Sri Lanka, reported on by Alcock and it is conspecific with ours. So also is a specimen (♀, 18 mm) from Pedro Banks, off Sri Lanka (AM P.29851, dry). The sharp tubercle present on the hepatic region in these two specimens is present also on two of the other females we have examined.

We have examined the specimens from the Iranian Gulf (8 ♂♂, 8 ♀♀ (2 ovig.), 10.5-20 mm) which Stephensen identified with some reservations as *X. tuberculatus*, and they are also conspecific with our specimens of *X. conicus*. In all of Stephensen's specimens there is a preorbital tubercle, two spines laterally on the basal antennal article and three tubercles on the pterygostomian margin. The gastric region is almost smooth, slightly elevated, and in five of the specimens there is a pair of very low submedial tubercles. (The large tubercles on the gastric region of *X. tuberculatus* are both in the midline.) There are spines on the meri of the ambulatory legs and the dactyls are armed with up to 14 short teeth and a subequal terminal tooth. The rostrum in all but one of the males is approximately half the postrostral carapace length; in the largest male (cl. 20 mm) it is $^2/_3$ the postrostral carapace length. In the females the rostrum is slightly less than, or equal to, half the postrostral carapace length. In two of the females there is a small sharp tubercle on the hepatic region.

Our specimens also agree quite well with the specimens of *X. nakazawai* described by Sakai (1938; 1976) and by Takeda & Koyama (1974). Sakai has distinguished his species from *X. conicus* on the presence, in *X. nakazawai*, of spines on the meri of the ambulatory legs and a shorter broader rostrum. One of us (D.J.G.G.) has examined the holotype of *X. conicus* (A. Milne Edwards), (Mus. Natn Hist. Nat., Paris, ♂, 17 mm, ?

Indian Ocean): that specimen possesses spines on the meri of the ambulatory legs. Four of our female specimens (11 mm, Banda; 10.5, 11 mm, Aldabra; 22 mm (ovig.), Ile de la Réunion), like the Japanese specimens (both female), have a rostrum equal in length to about half the postrostral carapace length. In the male (17 mm) from West Malay Peninsula, however, the rostrum is like that of the holotype of *X. conicus*, about three quarters postrostral carapace length and very slender distally. The teeth (most commonly nine or ten) on the dactyls of the ambulatory legs are as figured by Sakai (1938). In the Japanese specimens there is an indistinct tooth on the anterolateral angle of the basal antennal article. We therefore regard *X. nakazawai* as conspecific with *X. conicus*.

Distribution. — Western Indian Ocean, Red Sea, Sri Lanka, Malaya, Banda Islands, Kai Islands, Japan.

Xenocarcinus depressus Miers, 1874
(Fig. 30b)

Xenocarcinus tuberculatus. — A. Milne Edwards, 1872: 253-254, pl. 12 fig. 1, 1a-g. (Not *Xenocarcinus tuberculatus* White, 1847.)
Xenocarcinus depressus Miers, 1874: 1-2. — Calman, 1900: 34. — Gordon, 1934: 70-73, figs. 36a-d, 37a. — Balss, 1938: 20. — Takeda, 1973a: 101. — Sakai, 1976: 213, text-fig. 115, pl. 73 fig. 2. — Takeda & Nunomura, 1976: 67.

Material examined. — 1 ♂, 4 ♀♀ (3 ovig.), 13-27 mm, smallest ovig. ♀, 17 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Danish Kei Islands Expedition: off Neira Banda, ca. 20 m, dive, sand, 1 June 1922; 1 spec. — Banda, ca. 20 m, dive, sand, 8 June 1922; 1 spec.

THE AUSTRALIAN MUSEUM, SYDNEY
Queensland: Bowen, Gould Reef, 8 m, coll. N. Coleman, September 1969; 2 specs. (AM P.29849). — Heron I., 15 m, on gorgonid, coll. N. Coleman, 15 July 1976; 1 spec. (AM P.29850).

Remarks. — These specimens agree well with those figured as *X. tuberculatus* by A. Milne Edwards (1872) and as *X. depressus* by Gordon (1934).

This species can be distinguished from *X. tuberculatus* and *X. conicus* by the shape of the rostrum, the many low tubercles on the carapace, and the presence of tubercles on the meri of the ambulatory legs.

The rostrum is broad, of almost uniform width, and about half the postrostral carapace length, divided in the distal third and the medial edges of the rami are fringed with long setae. In *X. conicus* and *X. tuberculatus*, on the other hand, the rostrum is markedly narrower distally (about $^1/_3$ the basal width), and divided only at the apex.

The intercalated spine is separated from the orbital eave and the postorbital lobe by fine sutures.

Between the orbits there is a pair of small submedial tubercles. In our specimens the 8 small tubercles on the gastric region are not as precisely arranged in two transverse rows as is figured by A. Milne Edwards (pl. 12 fig. 1). In the anterior row of five tubercles, the medial tubercle lies slightly behind the four lateral tubercles and in the posterior row of three tubercles, the medial tubercle lies slightly ahead of the two lateral tubercles.

In *X. tuberculatus*, however, the gastric regions have only two large tubercles and in *X. conicus* the gastric regions are elevated but smooth. In *X. depressus* there are three groups of tubercles, placed anteriorly, centrally, and posteriorly, on the lateral branchial region (none of the other species of *Xenocarcinus* have anterior branchial tubercles), there are two submedial tubercles on the cardiac region and two longitudinal submedial ridges on the intestinal region and there is one small tubercle on the pterygostomian margin.

The basal antennal article narrows evenly from the base and the anterolateral angle is not produced as in *X. tuberculatus*, or armed as in *X. conicus*.

The meri of the ambulatory legs are armed with tubercles, not spines as in *X. conicus*; the ambulatory meri are smooth in *X. tuberculatus*. The dactyl of the first ambulatory leg is as figured by Gordon (1934: fig. 36c): There are about four small distal teeth and a much longer terminal tooth.

The first pleopod of the male has been figured by Gordon.

Distribution. — West Pacific: Okinawa, Palau, Banda. New Caledonia, north and east Australia and Fiji.

Xenocarcinus tuberculatus White, 1847
(Fig. 30a)

Xenocarcinus tuberculatus White, 1847a: 336; 1847c: 119. — Miers, 1874: 1, pl. 2 fig. 1, 1a-e. — Gordon, 1934: 72, figs 37b, c. — Barnard, 1950: 36, fig. 7a, b. — Buitendijk, 1950: 63. — Sakai, 1965a: 91-92 (in part), text fig. 13, pl. 42 fig. 5; 1976: 212-213, pl. 73 fig. 4. — Griffin & Tranter, 1974: 186.

Material examined. — 1 ♂, 12 mm, 1 ovig. ♀, 22 mm.

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

THE AUSTRALIAN MUSEUM, SYDNEY
Off Zanzibar, 02°37′S 40°44′E, 150 m, trawl, coll. B. Benbow, 9 February 1976; 1 spec. (AM P.29852).

Remarks. — This species is distinguished by the presence of two strong mesogastric tubercles, a high cardiac elevation and by the completely smooth meri of the ambulatory legs.

The rostrum varies from less than half to two-thirds the postrostral carapace length, narrows distally to about quarter its basal width and is bifid only at the apex. As well as a low tomentum there are two rows of curled hairs in the proximal half and some short hairs at the apex.

The intercalated spine is not defined by sutures in the margin of the upper orbit as in *X. depressus*, *X. conicus* and *X. monoceros*, but appears to be fused with the postorbital lobe.

There is a blunt triangular tubercle on the hepatic region, another laterally on the branchial region, level with the car-

diac spine, and a third on the posterolateral angle of the carapace. The cardiac tubercle varies within the species; it is truncate and weakly bilobed in our specimen from the Sulu Archipelago but sharp and undivided in our specimen from Zanzibar. The specimens described by Sakai (Japan) and Buitendijk (Singapore) have a double cardiac spine, while the holotype, other specimens from the Queensland coast (Aust. Mus.), that figured by Barnard (1950), and those previously examined from the Red Sea have a single conical cardiac spine. There are two submedial tubercles on the intestinal region. There is a single large tubercle on the pterygostomian margin.

The basal antennal article narrows distally and the anterolateral angle is weakly produced but unarmed.

The meri of the ambulatory legs are completely smooth, not armed with tubercles as in *X. depressus*, or spines as in *X. conicus*. The dactyl of the first ambulatory leg is armed with more than twenty small teeth and the terminal tooth is short, as figured by Gordon (1934).

The first pleopod of the male has been figured by Sakai (1965a). The first and second pleopod figured by Stephensen (1945: figs. 21C, D) as *X. tuberculatus* are not of that species but are of *X. conicus* (see remarks under *X. conicus*).

An ovigerous female from Kennedy Sound near Lindeman I., Queensland (35 mm, AM P.11460) was selected for the figure of this species.

Distribution. — Indo-West Pacific: Red Sea and east coast of Africa; Singapore, Sulu Archipelago, Hong Kong, Japan and NE. Australia.

SUBFAMILY PISINAE

Pisinae Alcock, 1895: 165, 200. — Balss, 1929: 11.
Pisinae, sensu restr., + Hyasteniinae Balss, 1929: 11, 14.
Pisinae. — Garth, 1958: 248-249. — Griffin, 1966b: 264.

Eyes with commencing orbits, one of the most characteristic parts being a large, blunt, usually isolated and cupped postocular tooth or lobe into which the eye is retractile, but never to such an extent as to completely conceal the cornea from dorsal view; almost always a prominent supraocular eave, the anterior angle sometimes produced forwards as a spine. Eyestalks short. Basal antennal article broad, at any rate at the base, its anterior angle generally produced to form a tooth or spine. Merus of the external maxillipeds, owing to the expansion of its anteroexternal angle, broader than the ischium, and carrying the palp at its anterointernal angle. Rostrum (except in some *Rochinia* species and in *Neodoclea* among New World forms) two-spined. Legs often very long. (Alcock, as quoted by Garth.)

Pleopod 1 usually slender, rarely stout, at most weakly curved, apical portion sometimes extremely slender, apex simple, truncate or sometimes provided with lobes, aperture usually terminal.

This subfamily contains the largest number of genera and species of any of the majid subfamilies and is one of the few subfamilies well represented in the Indo-west Pacific, east Pacific and east and west Atlantic. Garth has already commented on the fact that there are several types of first pleopods in the males. Yet in other characters, especially those of the orbit, there is surprisingly little diversity, one of the most characteristic features being the 'cupped' postorbital lobe: a number of species possess, on the upper orbital border, an intercalated spine between the eave and postorbital lobe. We find, as did Garth, that this is a feature not correlated with other characters. So far as the diversity of pleopods is concerned we consider that *Scyra* and other forms with a truncate male first pleopod with widely flared tips are probably best considered a separate subfamily but further investigation is required of this point.

We have withdrawn from the Pisinae the genera *Eurynome* (to the Majinae) and *Perinia* (to the Epialtinae). Drastic reorganisation of a number of genera has been undertaken. *Hyastenus*, by far the largest genus in the Indo west Pacific, has been split up with a number of species being placed in three other genera — *Lahaina*, *Giranauria* and *Thusaenys*; *Acanthophrys* has been resurrected as a distinct genus; *Naxioides* has been redefined to include *Chlorinoides tenuirostris* — the species most recently placed in *Chlorinoides* have been placed in a new genus, *Thacanophrys* in the Majinae — and *Sphenocarcinus* along with some species of *Pugettia* now placed in *Rochinia* have been removed from the Epialtinae to the Pisinae. *Encephaloides armstrongi*, retained at this time in the Inachinae, may prove to be placed more appropriately in the Pisinae. *Eurynolambrus australis* is a strange species known only from New Zealand; superficially resembling a parthenopid but lacking a long second pleopod in the male, it has a first pleopod resembling some species of *Tumulosternum* of the Majinae.

KEY TO INDO-WEST PACIFIC GENERA OF THE PISINAE

1		Carapace wider (1.5) than long ..... *Eurynolambrus*
—		Carapace no wider than long 2
2(	1)	Carapace subcircular; rostrum short (up to 0.2 postrostral carapace length) or if longer, spines fused for at least the basal half 3
—		Carapace pyriform; rostrum of varying lengths (0.16 to 1.3 postrostral carapace length) generally separate from base, rarely fused 5
3(	2)	Upper orbit hiatus with an intercalated spine ..... *Phalangipus*
—		Upper orbital hiatus lacking an intercalated spine 4
4(	3)	Anterolateral angle of buccal cavity with a conical tubercle or lobe; pterygostomian margin with a high tubercle ..... *Doclea*
—		Anterolateral angle of buccal cavity rounded, smooth; pterygostomian margin with two to three tubercles ..... *Pisoides*
5(	2)	Orbit closed above (eave, intercalated spine and/or postorbital lobe adjacent); carapace surface with numerous tubercles or spines . 6
—		Orbit open above with a distinct hiatus, hiatus rarely slit-like, if so, then carapace surface with only a few spines or tubercles or else with large flattened plates 8
6(	5)	Upper orbit with an intercalated spine ..... *Tylocarcinus*

— Upper orbit lacking an intercalatad spine 7
7(6) Carapace widened posteriorly, surface with many acuminate spines ..... *Hoplophrys*
— Carapace not widened posteriorly, surface with numerous tubercles but no spines ..... *Leptomaia*
8(5) Rostrum lyre-shaped (lateral edges convex proximally, spines parallel to divergent distally, apices curved outwards) (fig. 55) ..... *Lyramaia*
— Rostrum not lyre-shaped 9
9(8) Supraorbital eave strongly expanded, sometimes bilobed; rostral spines usually less than half postrostral carapace length, divergent from near base; basal antennal article relatively broad, the spine or lobe on the anterolateral angle separated from the base of the flagellum by a notch; (fig. 35) 10
— Supraorbital eave weakly to moderately expanded, rarely bilobed (if bilobed then rostral spines greater than half postrostral carapace length or else not divergent from the base); basal antennal article narrow anteriorly or subrectangular but no broader than long, anterolateral spine if present not separated from base of flagellum by a broad notch 12
10(9) Cupped postorbital lobe narrow (in lateral view), retracted eye protected only on dorsal surface, exposed ventrally (fig. 31). ..... *Acanthophrys*
— Cupped postorbital lobe moderately broad (in lateral view), retracted eye protected equally on dorsal and ventral surfaces (fig. 65) 11
11(10) Mesogastric region with three strong tubercles or short spines; cardiac region with a high tubercle or prominent cylindrical spine; anterolateral angle of basal antennal article with a blunt lobe ..... *Giranauria*
— Mesogastric region smooth or with one to three low tubercles; cardiac region smooth or with only a low tubercle; anterolateral angle of basal antennal article with a triangular spine ..... *Thusaenys*
12(9) Rostral spines with a dorsal accessory spine in distal half; upper orbit with an intercalated spine ..... *Naxioides*
— Rostral spines lacking an accessory spine; upper orbit generally without an intercalated spine 13
13(12) Pterygostomian margin with one long, blunt, conical or compressed spine; lateral margin of basal antennal article with two (distal and proximal) laterally flattened tubercles or else proximal (but not distal) part of margin produced ventrally as a long compressed spine ..... *Austrolibinia*
— Pterygostomian margin with tubercles or a low flat plate, rarely with two short spines; lateral margin of basal antennal article with spines or lobes but not with two laterally flattened tubercles or with a long compressed proximal spine 14
14(13) Rostral spines deflexed, apices upcurved ..... *Micippoides*
— Rostral spines more or less horizontal 15
15(14) Rostral spines very broad, fused in basal half, distally separate and tapering rapidly to a sharp apex ..... *Scyra*
— Rostral spines usually slender, separate from near base, if broad and basally fused then apices broad and blunt 16
16(15) Basal antennal article with a central longitudinal groove, lateral margin with a lobe extending dorsally into orbit and/or anterolateral spine spinulous (fig. 52); meri of at least first two pairs of ambulatory legs with a long terminal spine; upper orbit sometimes with a small intercalated spine ..... *Lahaina*
— Basal antennal article lacking a central longitudinal groove, if lobe present on lateral margin then not extending dorsally into orbit, anterolateral spine if present never spinulous (except rarely in juveniles); meri of ambulatory legs with a terminal tubercle or short spine; upper orbit lacking an intercalated spine 17
17(16) Supraorbital eave with at least a weakly developed antorbital lobe and a hiatus present (keyhole shaped, narrow U-shaped or slit-like) between posterior margin of eave and base of anterior margin of postorbital lobe (fig. 40); postorbital lobe usually convex laterally, never in the form of a plate nor confluent with hepatic spine nor subacute anteriorly in lateral view; ventral margin of postorbital lobe in about the same plane as the basal antennal article; eyestalk with diameter of cornea greater than that of preceding part of eyestalk ..... *Hyastenus*
— Supraorbital eave with a flattened plate or islet or else without an antorbital lobe and a hiatus present (narrow to broad U-shaped) between lateral margin of eave and anterior margin of postorbital lobe (fig. 57); postorbital lobe often flattened laterally, sometimes in the form of a plate and/or confluent with hepatic spine or subacute anteriorly in lateral view; ventral margin of postorbital lobe in a plane well dorsal to that of basal antennal article (fig. 61); eyestalk with diameter of cornea no greater than that of preceding part of eyestalk (fig. 57) 18
18(17) Carapace surface with many small tubercles and a few short spines; lateral margin of basal antennal article with a proximal spine as well as a slender spine at anterolateral angle; first pleopod of male scyriform ..... *Chorilia*
— Carapace surface variously with flattened plates, round islets, long spines or with few tubercles and spines; lateral margin of basal antennal article lacking a proximal spine or lobe, anterolateral angle unarmed or with a short spine; first pleopod of male apically truncate ..... *Rochinia*

Acanthophrys A. Milne Edwards, 1865

Type species. — *Acanthophrys cristimanus* A. Milne Edwards, 1865, by later designation by Miers (1879c).

Remarks. — *Acanthophrys cristimanus* was validly designated type species of the genus by Miers (1879c). However, Bouvier (1906b) stated that *A. cristimanus* belonged to the genus *Lahaina* (type species — *L. ovata* Dana, 1851). *A. cristimanus* and *L. ovata* agree generally in the form of the upper orbital border, the basal antennal article and the third maxilliped. These similarities are also typical of species included in the genus *Hyastenus* s.l. and on that basis *A. cristimanus* and *L. ovata* were transferred to that genus (see Balss, 1935a). By virtue of this, *Acanthophrys* had to be regarded as a synonym of *Hyastenus* and the former name was not available for *Chorinus aculeatus* and similar species despite the strenuous efforts of Bouvier and subsequent authors. For that reason *Chlorinoides* Haswell was, incorrectly as is now realised, applied to that group (Griffin, 1966a). This study reinstates *Acanthophrys* (and *Lahaina*) and redefines the genus *Hyastenus* to exclude species which have relatively extravagantly expanded orbits either dorsally, ventrally or both.

Comparison of the holotype of *Acanthophrys paucispina* Miers (1879a) (♂, cl. 15 mm, Fiji Is., BMNH 56.105), examined by one of us (D.J.G.G.), with *Parazewa bocki* Balss as described and figured by Balss (1938) shows that they are congeneric, perhaps even conspecific. *Parazewa* therefore becomes a junior synonym of *Acanthophrys*. A new species of this genus is described from Lord Howe Island.

Distribution. — Western Pacific.

KEY TO SPECIES OF *ACANTHOPHRYS*

1 Supraorbital eave bilobed, antorbital lobe produced nearly as far laterally as preorbital lobe; cheliped merus of male with a dorsal row of tubercles ..... *A. costatus*
— Supraorbital eave with a strong preorbital lobe but antorbital angle only weakly produced; cheliped merus of male smooth dorsally. 2
2(1) Branchial regions with two spines; cardiac region with a medial spine; intestinal region with a prominent medial spine and a tubercle ..... *A. paucispina*[18])

[18]) Not distinguished here from *A. bocki*

— Branchial regions with tubercles but no spines; cardiac region with submedial tubercles; intestinal region with a medial tubercle only ..... *A. cristimanus*

Acanthophrys costatus new species
(Figs. 31, 32a, b)

Material examined. — 2 ♂♂, 4, 7 mm.

Holotype. — Male, 7.0 mm, Lord Howe I., between Comet Hole and reef, 2-3 m, red and brown algae with some corals, coll. J. K. Lowry, 10 May 1977; The Australian Museum, Sydney, AM P.29920.
Paratype. — Male, 4.0 mm, data as for holotype (AM P.29919).

Description. — Carapace pyriform, width more than three quarters (0.8) postrostral carapace length; surface smooth, two lateral spines and a few well separated tubercles.

Rostral spines short, divergent, fused for less than basal third (0.3), dorsoventrally flat, tapering to a sharp apex, length less than half (0.4) postrostral carapace length.

Orbital eave moderately expanded, bilobed, preorbital lobe broad, triangular, upturned, apex subacute; antorbital lobe a smaller triangle, horizontal; postorbital lobe separated from eave by a narrow U-shaped hiatus, narrow, apex blunt, anterior margin with a process in proximal half. Eyestalks short, moderately slender; cornea small, terminal and ventral.

Hepatic region not elevated, two to four small tubercles on margin and about three small subhepatic tubercles.

Branchial submargin with a high tubercle anteriorly, another tubercle above it near margin; behind these tubercles a row of about four small tubercles each surmounted by curled hairs: anterior branchial margin with two pairs of small adjacent tubercles, surmounted by curled hairs; a blunt spine midway on margin; another blunt spine on posterolateral angle.

Gastric regions elevated, protogastric region with about eight small tubercles in an irregular, longitudinal, double row, each surmounted by curled hairs; a small posterolateral protogastric tubercle, two mesogastric tubercles, one central and one posterior. Urogastric region smooth, flat.

Cardiac region elevated with a transversely elongate tubercle on summit. Branchial regions smooth and flat dorsally. Intestinal region with a medial tubercle near posterior carapace margin. Carapace margin produced, weakly recurved posteriorly.

Basal antennal article broad, smooth, a longitudinal groove centrally; anterolateral angle produced forward into a blunt triangular lobe; distal two thirds of lateral margin straight, produced dorsally, proximal third weakly convex and more strongly produced dorsally; a proximal tubercle in from margin, in line with anterolateral lobe. A high, laterally compressed tubercle lateral to green gland. Postorbital lobe not excavate ventrally, only a low ridge on lower orbit margin.

Pterygostomian region smooth, margin with three large blunt tubercles. Ischium of third maxilliped with a central groove with ridges along its margins, ridge on lateral margin with a few small tubercles; merus with a ridge on posterior margin and a diagonal ridge from posterolateral angle, each ridge with a small tubercle; anterolateral angle produced and rounded. Anterolateral angle of mouthfield produced and rounded.

Cheliped of male slightly longer (1.2) than postrostral carapace length; merus tuberculate, dorsally a small proximal tubercle, three compressed triangular tubercles and a blunt terminal tubercle; midway on outer face a row of four or five low tubercles; ventrally a row of four tubercles on outer face and a row of three tubercles on inner face; carpus with two dorsal ridges, outer ridge with two tubercles, inner ridge entire. Length of palm about twice height, dorsal and ventral margins sharp, dorsal margin with two low lobes; fingers about three quarters length of palm, moderately gaping in proximal half, three small teeth on dactyl in gape, two slightly larger teeth on fixed finger.

Ambulatory legs slender, club setae laterally each arising from a small basal tubercle, groups of curled hairs dorsally; first leg about one and a half (1.5) times postrostral carapace length, merus with a low terminal tubercle; fourth leg about two thirds (0.64) postrostral carapace length, less than half (0.43) length of first leg, dactyl with four very small spines ventrally along its length.

Sternum with marked segmental pits, borders of pits high, a high narrow ridge around anterior margin of abdominal fossa.

Male abdomen of seven segments, smooth, third segment about one and a third (1.3) as wide as sixth segment; sixth segment twice as wide as long; seventh segment about as wide as long.

First pleopod of male narrowing slightly at about distal third, distal quarter strongly curved outwards, aperture terminal and abdominal.

Female of this species is as yet unknown.

Remarks. — *A. costatus* is similar to other species of *Acanthophrys* in having the postorbital lobe with a prominent process on the anterior margin and not excavate ventrally; and the basal antennal article with a blunt anterolateral spine separated by a notch from the base of the flagellum. *A. costatus* is distinguished from other species of *Acanthophrys* by having the supraorbital eave bilobed and the antorbital lobe distinct and produced almost as far laterally as the preorbital lobe. In the other species the edge of the eave is unnotched and in *A. paucispina* and *A. bocki* the preorbital lobe is produced much further laterally than the antorbital angle. In *A. costatus* the exognath of the third maxilliped is less than half as wide as the ischium while in the other species of *Acanthophrys* the exognath is at least half as wide, or equally as wide as the ischium. The merus of the cheliped of the male in *A. costatus* has a dorsal row of compressed tubercles, while in *A. cristimanus* the cheliped merus is smooth.

The postorbital lobe which is not excavate ventrally

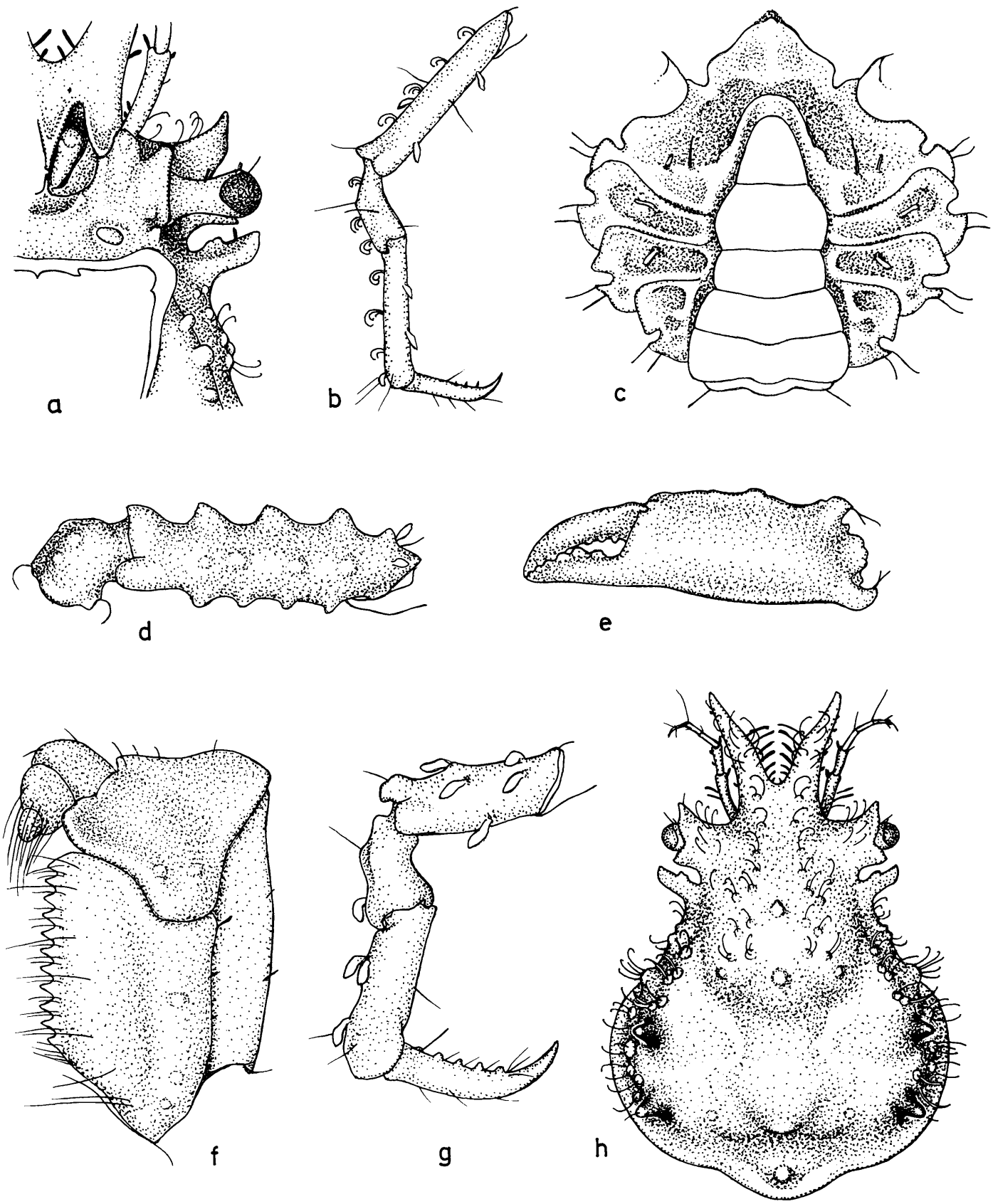


Fig. 31. *Acanthophrys costatus* (holotype) (a) left orbit, ventral view; (b) left first ambulatory leg; (c) male sternum; (d) left cheliped, merus and carpus; (e) left chela; (f) left third maxilliped; (g) left fourth ambulatory leg; (h) carapace, dorsal view.

distinguishes this species from species of *Giranauria* and *Thusaenys* and from *Lyramaia elegans*.

Distribution. — Known only from Lord Howe Island.

Austrolibinia Griffin, 1966

Type species. — *Chorilibinia gracilipes* Miers, 1879, by original designation.

Remarks. — This genus has been discussed recently (Griffin, 1966b). A new species is here described from the east coast of Australia.

The first pleopod of the male of species of *Austrolibinia* is slender and tapers to a simple apex.

Distribution. — Western Indian Ocean, western Pacific.

KEY TO SPECIES OF *AUSTROLIBINIA*

1 Rostrum basally fused, spines strongly divergent distally; cardiac region with one long spine and a small posterior tubercle; lateral margin of basal antennal article with a long compressed proximal lobe directed ventrally ..... *A. gracilipes*

— Rostrum basally fused, spines contiguous to weakly divergent distally; cardiac region with two subequal medial spines; lateral margin of basal antennal article with a short, blunt proximal lobe 2

2(1) Rostral spines separate in distal 1/2 to 1/4, parallel or weakly divergent; hepatic region with a dorsal tubercle; dorsal branchial region with a central tubercle anterior to epibranchial spine ..... *A. andamanica*

— Rostral spines distally contiguous; hepatic region with two tubercles, one above the other; dorsal branchial region with a central spine anterior to epibranchial spine ..... *A. capricornensis*

Austrolibinia andamanica (Alcock, 1892) (Fig. 33e, f)

Chorilibinia andamanica Alcock, 1895: 222, pl. 5 figs. 2, 2a. — Alcock & Anderson, 1896: pl. 20 fig. 4, 4a.
Austrolibinia andamanica. — Griffin, 1966b: 268-269 (note only).

Material examined. — 2 ♂♂, 4 ♀♀, 11.5-25 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Danish Kei Islands Expedition: Stn. 64, Sunda Strait, 05°51′S 106°22′E, 35 m, trawl, sandy mud, shells, 26 July 1922; 1 spec. — Stn. 82, Sunda Strait, 06°38′S 105°17′E, 35 m, trawl, sandy mud, 30 July 1922; 1 spec. — Stn. 106, Sunda Strait, 05°50′S 106°16′E, 32 m, trawl, sand, 5 August 1922; 3 specs.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA
Mariel King Memorial Expedition — Moluccas: Stn. AM II, Aru, Maikoor, approx. 8 miles (∿ 13 km) SW. of Tg Ratoe, 06°07′S 133°57′E, 45 m, dredge hauls 4-5, 18 June 1970; 1 spec.

Remarks. — A new species *A. capricornensis* from North West Islet, Queensland, very similar in general form and appearance to *A. andamanica*, is described elsewhere; the differences which distinguish the two species are discussed under *A. capricornensis*.

A. andamanica and *A. gracilipes* differ from each other in a number of important features. These include the rostral spines which in both are basally fused but are distally straight in *A. andamanica* and strongly outwardly curved in *A. gracilipes*; the orbit in both lacks an intercalated spine but the shape of the postorbital lobe is different, *A. gracilipes* having a sharp keel on the posterior surface whereas *A. andamanica* has a flat elevated lobe on the curved anterior edge.

The basal antennal article in *A. gracilipes* is expanded laterally and at the base strongly produced into an outwardly and ventrally directed lobe, whereas in *A. andamanica* there is a small flattened tubercle on the anterolateral angle and a similar one proximally.

There are differences in the spines on the carapace but the most obvious difference concerns the flattened extension of the posterior margin of the carapace on *A. gracilipes*, lacking in *A. andamanica*.

The chelae of the adult male are not inflated in *A. andamanica* and the length of the palm is six to eight times the height, whereas in *A. gracilipes* the palm is inflated and the length is only two to three times the height. The ambulatory legs of *A. andamanica* have few, if any hairs, whereas in *A. gracilipes* there are closely spaced tufts of curled hairs dorsally on merus, carpus and propod and very closely spaced stout hairs in a line along the anterior and posterior surfaces.

The male first pleopod of *A. andamanica* is distally very slender and straight, whereas in *A. gracilipes* it only tapers at the outwardly curved tip.

The main features in which *A. andamanica* and *A. capricornensis*, differ from *A. gracilipes* are listed in the following table.

	A. andamanica and *A. capricornensis*	*A. gracilipes*
Rostral spines	basally fused, distally weakly divergent or contiguous.	basally fused, distally strongly divergent
Upper orbit hiatus	U-shaped, widening at orbit edge	U-shaped, narrower or closed at orbit edge
Postorbital lobe (laterally)	a flattened plate, bilobed on posterior edge	narrow keel posteriorly, continuing forward ventrally.
Hepatic region	1 dorsal tubercle, or 2 tubercles one above other (short spine in immature animals)	a lateral, longitudinal ridge of 3-4 small tubercles
Protogastric region (at level of first mesogastric spine or tubercle)	a flat, subcircular tubercle	a small, blunt tubercle
Cardiac region	a medial pair of subequal, divergent spines	1 long spine and a small posterior tubercle
Intestinal region	posterior margin of carapace not produced; 1 large medial spine.	posterior margin of carapace produced backward; a compressed, triangular lobe ending in sharp erect spine in the midline.

Branchial region	no spine on carapace margin behind epibranchial spine above amb. leg 3	a short spine on carapace margin behind epibranchial spine above amb. leg 3.
Basal antennal article	small flat tubercle on anterolateral and posterolateral angles	lateral edge expanded; a small anterolateral tooth; a large, blunt, compressed posterolateral lobe, produced laterally and ventrally.
Maxilliped 3	antero-external angle of merus moderately produced, rounded or bluntly angled	antero-external angle of merus strongly produced to a blunt lobe.
Pterygostomian margin	with a strong spine	with a blunt lobe, anteroposteriorly compressed.
Sternum	single spine posteriorly on first sternite, otherwise smooth	single spine posteriorly on first sternite, a pair of flattened plates at base of amb. legs 1-3.
Adult male chela (not known in *A. capricornensis*)	palm slender, length at least 6 x height	palm somewhat inflated, length about 2 x height.
Male abdomen	segment 1 with medial spine or broad lobe; seg. 3 with rounded lateral swelling	segments 2 and 3 with transverse lateral ridge and medial ridge.

In a young male from the Kai Islands and two immature females from the Sunda Strait (Danish Kei Islands Expedition Stn. 106) there is a short spine rather than a tubercle on the hepatic region and anteriorly on the mesogastric region there is not a tubercle, as in the adults, but a short spine, about half the height of the posterior spine.

Distribution. — Andaman Islands, Sunda Strait, Kai Islands.

Austrolibinia capricornensis new species
(Fig. 33a, b, g, h)

Material examined. — 1 ♂, 2 ♀♀, 16.5-20.5 mm.

Holotype. — Female, immature, cl. 20.5 mm, Queensland, Capricorn Group, 12 miles (∿ 20 km) NW. of North-West Islet, about 14 m, January 1931; Australian Museum, Sydney, AM P.10056.
Paratypes. — Male, cl. 16.5 mm, female, immature, cl. 17 mm, Queensland, Capricorn Group, North-West Islet, about 16 m, December 1930-January 1931; Australian Museum, Sydney, AM P.10044.

Description. — Carapace broad, width about four fifths (0.83-0.88) postrostral carapace length; surface covered by a low tomentum; several prominent spines.

Rostral spines slender, parallel, weakly deflexed distally, fused in proximal half, contiguous distally, only separate apically (about distal eighth).

Orbital eave only slightly expanded, preorbital angle produced into a broad, upturned lobe, lateral face of lobe vertical, smooth; antorbital lobe similarly upturned, broad, posterolateral face of lobe vertical, smooth; postorbital lobe separated from antorbital lobe by a narrow U-shaped hiatus; postorbital lobe broad, truncate, a rounded lobe on posterolateral angle.

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

Hepatic region weakly elevated, two blunt tubercles, one above other on margin. Branchial margin with four spines, increasing in size posteriorly, the fourth (epibranchial) more dorsally placed.

Gastric regions elevated, two long mesogastric spines, a small tubercle in front of each of them; a small protogastric tubercle level with anterior mesogastric tubercle, two protogastric tubercles level with first mesogastric spine, lateral one larger, circular and flat on upper surface; a very small tubercle surmounted by a group of curled hairs level with second mesogastric tubercle.

Cardiac region elevated with two large, blunt, medial spines one behind the other, first directed slightly forward and second slightly backward. Branchial region with a very small tubercle at anteromedial angle, another behind it near cardiac region, a small tubercle laterally on anterior margin and a long spine (subequal to epibranchial spine) just behind it.

Intestinal region with a long, backwardly directed, apically sharp, spine on posterior margin, longer than other carapace spines.

Basal antennal article with anterolateral angle produced into a blunt lobe, laterally flattened and subcircular in lateral view; a subrectangular, flattened lobe on proximal half; a small tubercle just lateral to green gland. Postorbital lobe separated from basal antennal article by a long narrow U-shaped hiatus, ventral surface of postorbital lobe with a flat, triangular plate.

Pterygostomian region very narrow, a large, blunt, conical spine on margin.

Third maxilliped covered with tomentum, anterolateral angle of merus produced, rounded. Anterolateral angle of mouthfield with an oblique, flattened plate.

(Chelipeds are missing from the male paratype.) Cheliped of immature female (holotype) smooth, slender, about one and a half times postrostral carapace length, no terminal spine on merus; carpus smooth; palm very slender, length about ten times height; fingers about one third length of palm, a very narrow, unarmed gape between fingers in proximal half, small teeth on cutting edge of both fingers distally.

Ambulatory legs smooth, very slender, first leg more than four times (4.3) postrostral carapace length, merus without a terminal spine; fourth leg about one and a half times postrostral carapace length and about one third of first leg.

Sternum of male smooth except for a short conical spine on posterior ridge of first sternite, near abdominal fossa; shallow intersegmental grooves between remaining segments.

Male abdomen of seven segments, first segment with a short medial spine, remaining segments smooth; third segment with rounded swelling laterally, more than twice (2.3) as

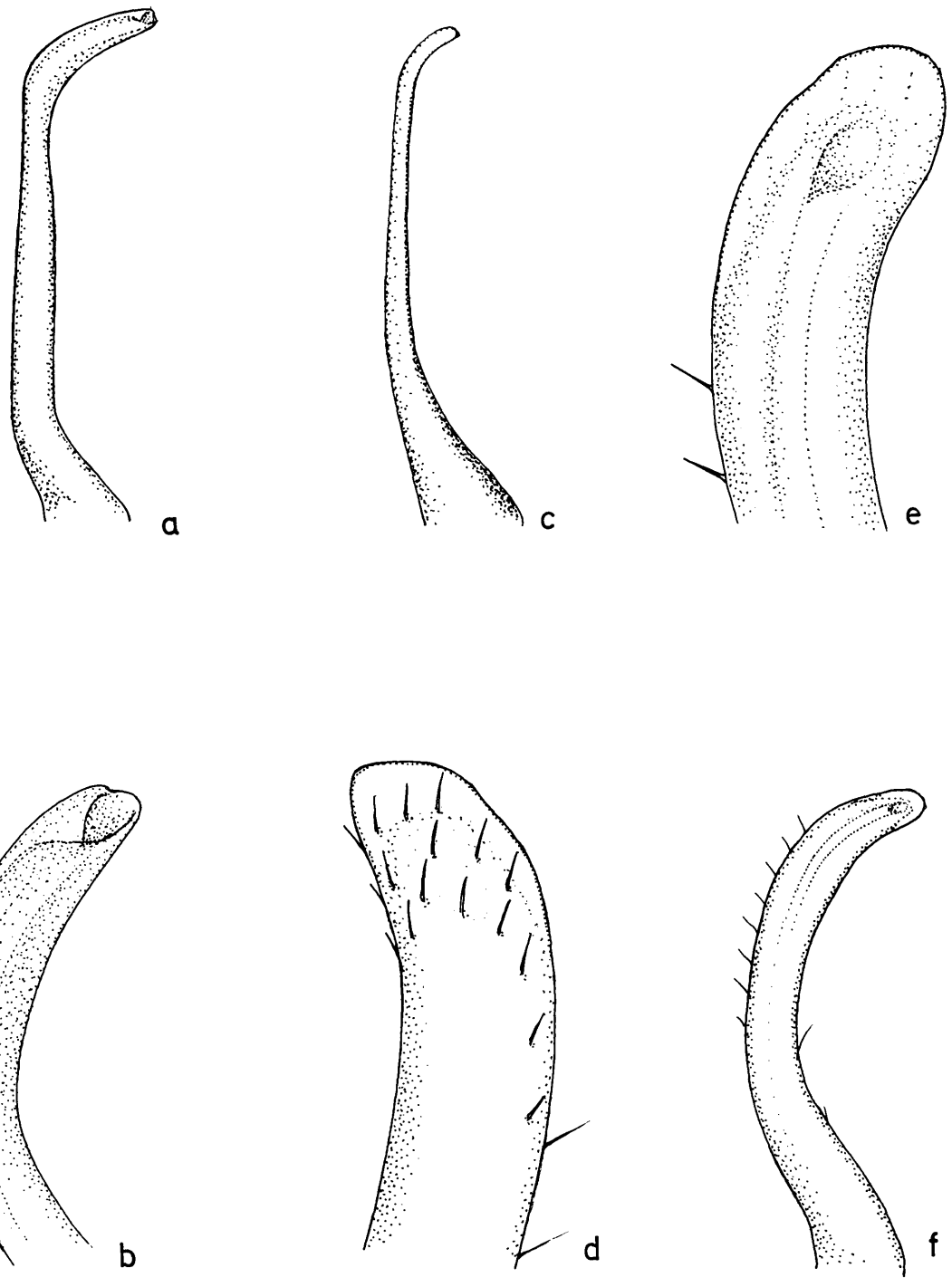


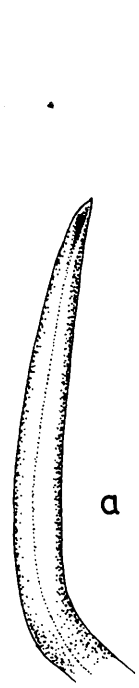
Fig. 32. First left pleopod of male of *Acanthophrys costatus* (holotype) (a) abdominal view of pleopod, (b) abdominal tip of same; *Lyramaia elegans* (13.5 mm, AM P.29949) (c) abdominal view of pleopod; *Leptomaia tuberculata* (11 mm, Kermadec Is., ZMC) (d) sternal tip of pleopod, (e) abdominal tip of same, (f) abdominal view of same.

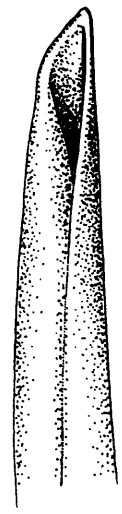
wide as sixth segment; sixth and seventh segments both as wide as long.

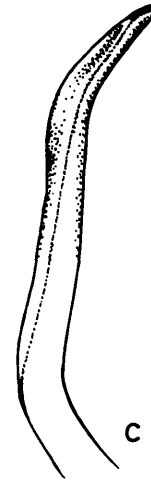
First pleopod of male straight, broad, tapering in distal half to a subacute apex, aperture subterminal on abdominal surface.

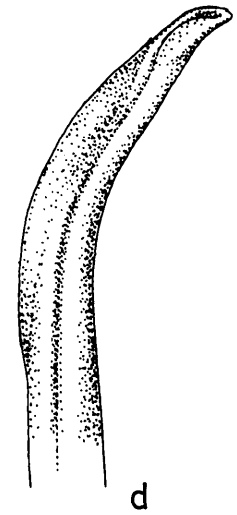
Remarks. — This species is very similar to *Austrolibinia andamanica* (Alcock) and is distinguished from it by the following points:

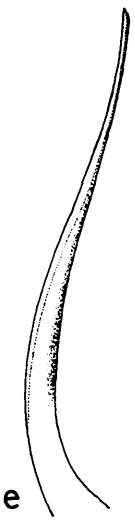
(1) the rostral spines are distally contiguous; parallel but separate in *A. andamanica*;
(2) the hepatic region has two rounded tubercles, one above the other; there is only a dorsal hepatic tubercle in *A. andamanica*;
(3) the mesogastric region has two long spines; there is one long spine and one short spine in *A. andamanica*;
(4) the branchial region has a long dorsal spine in addition to the epibranchial spine; there is only a long epibranchial spine in *A. andamanica*;

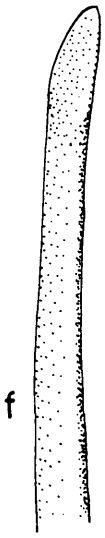


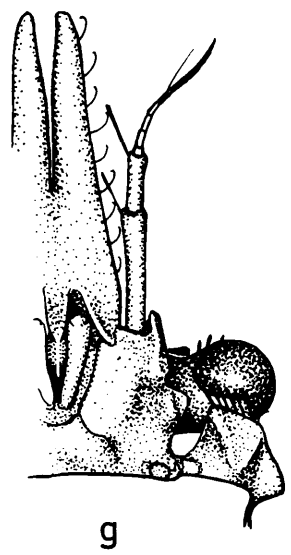












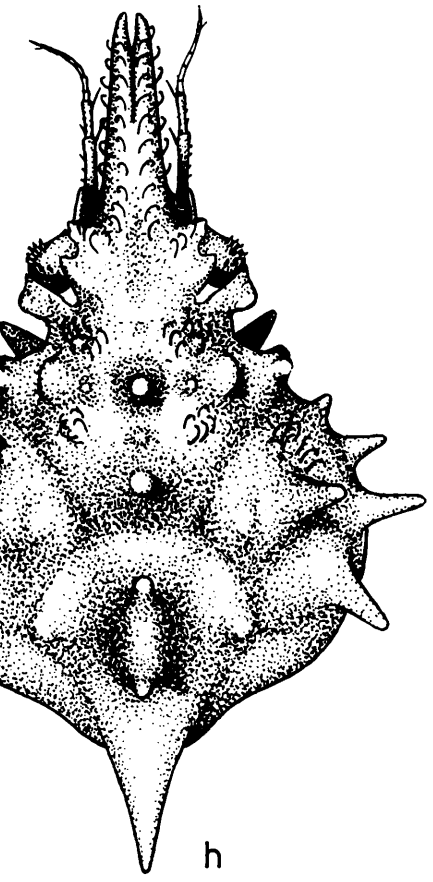


Fig. 33. Left first pleopod of male of *Austrolibinia capricornensis* (16.5 mm, AM P.10044) (a) abdominal view of pleopod, (b) abdominal tip of same; *A. gracilipes* (17 mm, Kai Is., ZMA De.100.830, in part) (c) abdominal view of pleopod, (d) abdominal tip of same; *A. andamanica* (25 mm, Sunda Strait, ZMC) (e) abdominal view of pleopod, (f) sternal tip of same. *A. capricornensis* (holotype, female, imm.) (g) left orbit, ventral view; (h) carapace, dorsal view.

(5) the instestinal spine is larger and more robust than the other carapace spines; the intestinal spine is subequal to the other spines in *A. andamanica*.

This species is distinguished from *A. gracilipes* (Miers) by the rostral spines which are contiguous (strongly divergent in *A. gracilipes*) by the backwardly directed, conical intestinal spine (an erect, compressed spine in *A. gracilipes*); and by the flat subrectangular, proximal lobe on the basal antennal article (a long, ventrally directed, compressed lobe on *A. gracilipes*). The differences between *A. gracilipes* and *A. capricornensis* and *A. andamanica* are considered in more detail under *A. andamanica*.

This species, and to a lesser extent, *A. andamanica*, bear a superficial resemblance to some species of *Phalangipus*, especially *P. hystrix*; however, there are fundamental differences in orbital structure.

Distribution. — Known only from North-West Islet, Capricorn Group, Queensland.

Austrolibinia gracilipes (Miers, 1879)
(Fig. 33c, d)

Chorilibinia gracilipes Miers, 1879a: 7-8, pl. 4 fig. 4; 1884: 192; 1886: 46.
Chlorolibinia gracilipes. — Haswell, 1880b: 439-440.
Austrolibinia gracilipes. — Griffin, 1966b: 269, 283 (in key).

Material examined. — 13 ♂♂, 15 ♀♀ (6 ovig.), 8-20.5 mm, smallest ovig. ♀, 11.0 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM

'Siboga' Expedition: Stn. 274, vicinity of Kai Islands, 05°28.2′S 134°53.9′E, 57 m, Blake dredge, sand and shells, stones, 26 December 1899; 2 specs. (ZMA De.100.830, det. Ihle).

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA

Mariel King Memorial Expedition-Moluccas: Stn. AT II, 7-12 miles (11-19 km) W. of Toba I., N. of Aru, 05°23′S 134°17′E, 54-63 m, dredge hauls 3-4, mud, 14 June 1970; 1 spec. — Stn. AW IV, Aru, Wokam, off W. end Udjir I., 05°37′S 134°10′E, 54-65 m, dredge hauls 1-3, mud and fine shelly grit, 16 June 1970; 1 spec. — Stn. AW IV (as above), 68-93 m, dredge hauls 4-7, mud and rubble, 16 June 1970; 2 specs. — Stn. B I, Northern Territory, S. of Bathurst I., Clarence Straits, 12°01′S 130°08′E, dredge, 30 June 1970; 2 specs.

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: Torres Strait, Albany Passage, 16-21 m, dredged, September 1929; 1 spec. (AM P.29925, dry). — Kennedy Sound, 20°28′S 149°03′E, 3 specs. (AM P.29926, dry). — Cape York, 3 miles (∿ 5 km) E. of Turtle Head I., 18 m, trawl, coll. J. Paxton, 15 February 1979; 4 specs. (AM P.29927).

WESTERN AUSTRALIAN MUSEUM, PERTH

Western Australia: North W.A., near Delambre I., coll. R. W. George, 'Dorothea', 8 October 1962; 1 spec. (WAM 197-67). — North W.A., 36 miles (∿ 57 km) SW. of Adele I., 80 m, coll. R. W. George, 'Dorothea', 17 October 1962; 9 specs. (WAM 297-67). — New Year I., 33°52′S 124°06′E, 72 m, dredge, coll. W. Goode, November 1962; 2 specs. (WAM 214-67).

Remarks. — There are very considerable differences between this species and *A. andamanica* which are dealt with under that species.

Distribution. — NE to NW. Australia, Kai Islands, Aru, Papua-New Guinea.

Chorilia Dana, 1851

Type species. — *Chorilia longipes* Dana, 1851, by monotypy.

Remarks. — This genus which has been discussed in detail recently by Garth (1958) contains a single boreal species with two subspecies — *Chorilia longipes turgida* Rathbun in the eastern Pacific and *C. l. japonica* (Miers) in the western Pacific.

The first pleopod of the male is scyriform.

Distribution. — Northern Pacific.

Doclea Leach, 1814

Type species. — *Doclea rissonii* Leach, 1814 by monotypy.

Remarks. — Many species of this genus have been described more than once under different names. Although all the species of *Doclea* have a similar general appearance, the first pleopods of the males show a range of different forms from simple tapered to elaborately lobed.

D. japonica Ortmann is considered by us as a distinct species and not as a synonym of *D. ovis* (Herbst). *D. profunda* Rathbun (a synonym of *Pugettia mosaica* Whitelegge) is removed to the genus *Rochinia* and discussed under *R. mosaica*. A new species is described here from China. The genus contains eleven species.

In species of *Doclea* the supraorbital eave is only weakly expanded and the preorbital angle is only prominent in one species. The basal antennal article is triangular or subrectangular and the lateral margin is smooth behind the anterolateral spine. There is a high tubercle, usually conical, on the anterolateral angle of the mouthfield and a similar large tubercle on the pterygostomian margin. In seven of the species there is a longitudinal channel edged with long hairs on the pterygostomian region.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *DOCLEA*

1	Pterygostomian region canaliculated	2
—	Pterygostomian region flat	8
2(1)	Epibranchial spines long, at least 1/4 carapace width	3
—	Epibranchial spines short, less than 1/6 carapace width or represented by a tubercle	6
3(2)	Rostrum exceeding peduncle segments of antenna	4
—	Rostrum not exceeding peduncle segments of antenna ..... *D. macracantha*[19])
4(3)	Meri of ambulatory legs with four longitudinal rows of fringing hairs; anterior margin of dorsal branchial region with an acuminate spine; medial spine on posterior carapace margin with an acuminate accessory spine on its base ..... *D. calcitrapa*	

[19]) From the literature, Balss, 1929.

— Meri of ambulatory legs with a uniform tomentum; anterior margin of dorsal branchial region smooth or with tubercles; medial spine on posterior carapace margin lacking an accessory spine 5

5(4) Epibranchial spine with a tubercle just medial to it; intestinal region with two conical, medial spines ..... *D. simeti*

— Epibranchial spine lacking a tubercle just medial to it; intestinal region with one slender spine on posterior carapace margin ..... *D. canalifera*

6(2) Rostrum not exceeding peduncle segments of antenna; intestinal region with a distinct spine ..... *D. brachyrhyncha*

— Rostrum exceeding peduncle segments of antenna; intestinal region with a low tubercle 7

7(6) First pleopod of adult male with a narrow terminal process; female genital openings oval and opening anteriorly ..... *D. ovis*

— First pleopod of adult male with two broad, blunt contiguous lobes; female genital openings subcircular and opening anterolaterally ..... *D. japonica*

8(1) Carapace discoid; length of first ambulatory leg more than twice postrostral carapace length 9

— Carapace globular; length of first ambulatory leg less than twice postrostral carapace length 10

9(8) Lateral carapace margin with three spines; anterior dorsal branchial region smooth or with a low tubercle ..... *D. gracilipes*

— Lateral carapace margin with two spines; anterior dorsal branchial region with a spine ..... *D. rissonii*[20])

10(8) Preorbital angle of eave produced to a short spine; intestinal spine much longer than other carapace spines, deflexed ..... *D. alcocki*

— Preorbital angle of eave not produced at all; intestinal spine no longer than other carapace spines, horizontal ..... *D. muricata*

Doclea alcocki Laurie, 1906
(Fig. 34d, e)

Doclea alcocki Laurie, 1906: 381-382, pl. 1 fig. 5, pl. 2 fig. 2.

Material examined. — 1 ♂, 51 mm, 1 ♀ (ovig.), 53 mm.

ZOOLOGICAL SURVEY, CALCUTTA
Sri Lanka, Pearl Banks, coll. T. Southwell; 2 specs.

Remarks. — These specimens agree well with the holotype from Sri Lanka (BMNH 1907: 5: 22: 129, ♀, cl. 56.5 mm). The strong spine on the posterior margin of the carapace is directed downwards as in the holotype but lacks any tubercles at the base; this form of deflexed posterior spine is characteristic of the species.

The male has not previously been described. The chelae are smooth and bare, moderately robust, the length of the palm is less than twice its distal height and slightly greater than the dactyl. The dactyl bears a large low tooth in the weak proximal gape and both fingers have small teeth distally. The sternum is smooth with well developed marginal ridges on the first sternite and the remaining segments are covered in a dense tomentum. The abdomen is tomentose, smooth and with rounded lateral elevations on the third segment. The first pleopod is broad, straight and curves outward only at the tip which has a broad flap on the anterior edge.

Distribution. — Sri Lanka, Pearl Banks; Gulf of Manaar.

[20]) From the literature, Leach, 1815.

Doclea calcitrapa White, 1847

Doclea calcitrapa White, 1847b: 56. — Adams & White, 1848: 7, pl. 1. fig. 2, 2a-c. — Griffin, 1974: 10; 1976: 190.

Material examined. — 9 ♂♂, 2 ♀♀, 9-16.5 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Danish Kei Islands Expedition: Stn. 66, Java, Pulo Balu, 05°54′S 106°12′E, 24 m, trawl, sandy mud, shells, 27 July 1922; 3 specs. — Stn. 76, Sunda Strait, 06°08′S 105°44′E, 29 m, Sigsbee trawl, mud, 29 July 1922; 1 spec. — Stn. 110, Sunda Strait, 05°25′S 105°53′E, 12 m, trawl, sandy mud, 12 August 1922; 1 spec. — Stn. 116, Sunda Strait, 05°57′S 106°34′E, 22 m, trawl, sand and shells, 7 August 1922; 1 spec. — Stn. 118, Sunda Strait, 05°54′S 106°40′E, 27 m, trawl, sand and shells, 7 August 1922; 3 specs.
'Galathea' Expedition: Stn. 451, Makassar Strait, 01°25′S 117°05′E, 50-60 m, Sledge trawl 300, mud, 23 August 1951; 1 spec. — Stn. 455, Java Sea, 05°32′S 112°41′E, 66 m, Sledge trawl 100, corallised clay, 26 August 1951; 1 spec.

Remarks. — These immature specimens show some variation from the adults in the relative size of the carapace spines. The cardiac spine is larger and varies from half to three quarters of the epibranchial spine. The anterior cardiac spine, which in the adult is as long as the mesogastric spines, is only a tubercle or small spine. Similarly the accessory spine at the base of the intestinal spine and the anterior marginal branchial spines are much smaller and generally covered by the tomentum.

Distribution. — Bay of Bengal, Andaman Sea, Indonesia, Gulf of Thailand, Philippine Islands.

Doclea gracilipes Stimpson, 1857

Doclea gracilipes Stimpson, 1857: 216; 1907: 6-7, pl. 1 fig. 1. — Chopra, 1935: 470, text-fig. 1c. — Chhapgar, 1957: 412, pl. 3 figs. o, p.

Material examined. — 10 ♂♂, 5 ♀♀ (1 ovig.), 23-38.5 mm, ovig. ♀, 30 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM
Indonesian Archipelago, in the sea. coll. H. M. Tromp, 1909; 1 spec. (unreg., det. J. Roux as *Doclea rissonii*).

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Singapore, 27 November 1907; 1 spec.
'Galathea' Expedition: Malay Peninsula, Pulo Penang, 1951; 13 specs.

Remarks. — The last marginal spine in these specimens varies from slightly shorter than, to about twice as long as the anterior marginal spines.

A specimen from the Zoological Museum Amsterdam indentified as *Doclea rissonii* Leach by J. Roux is clearly conspecific with the other specimens. *Doclea rissonii* as figured by Leach (1814: pl. 74) has two (not three) anterior marginal spines and a spine dorsally on the anterior branchial region; the type material of *D. rissonii* at the British Museum has not been examined. Therefore we can give no useful opinion on the status of Leach's species.

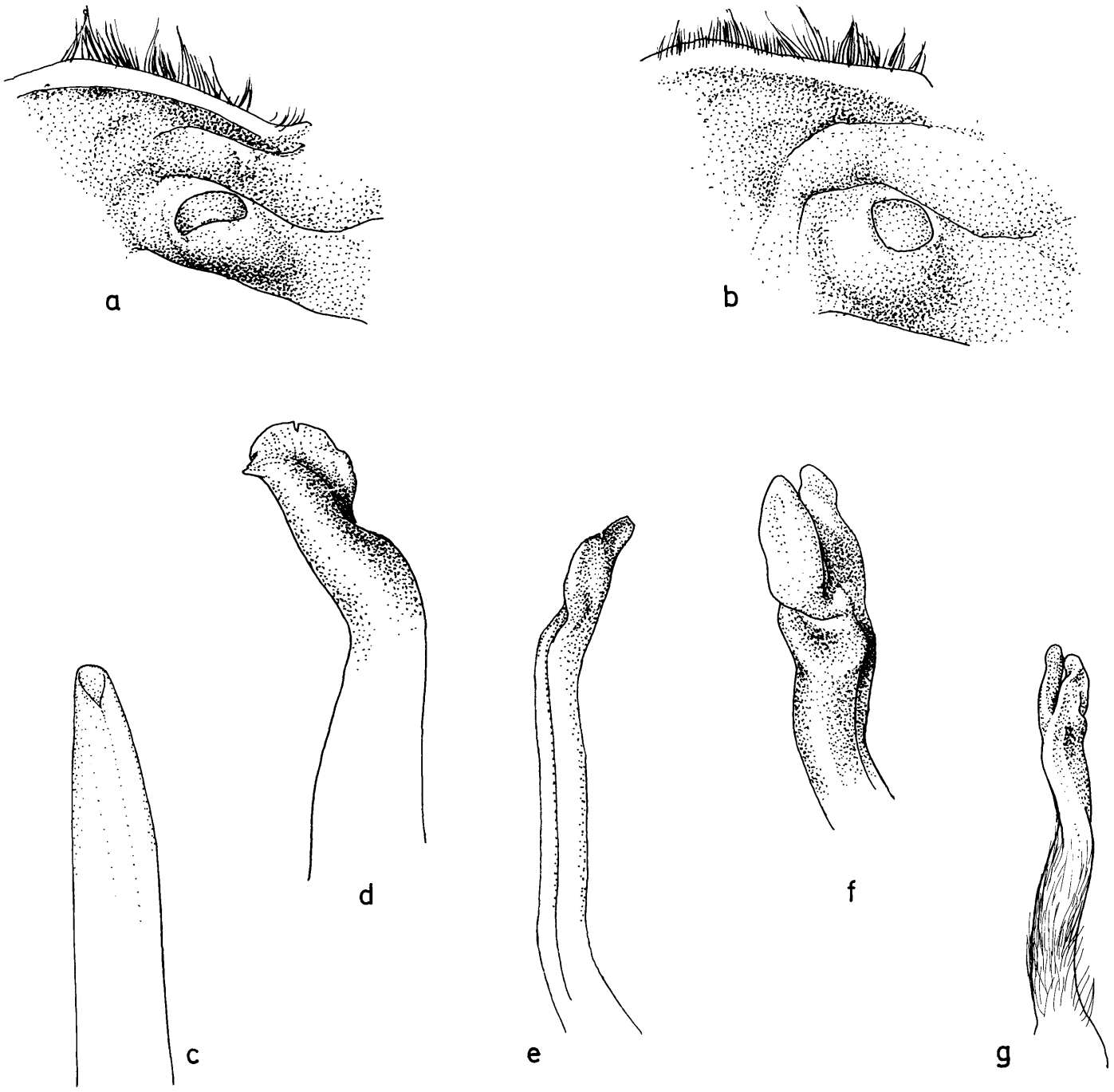


Fig. 34. Female of *Doclea ovis* (ovig., 45 mm, Malay Peninsula, ZMC) (a) left gonopore; *D. japonica* (ovig., 53 mm, USNM 62027) (b) left gonopore. Left first pleopod of male of *D. simeti* (30.5 mm, USNM 57840, in part) (c) abdominal tip of pleopod; *D. alcocki* (51 mm, Pearl Banks, ZSC) (d) sternal tip of pleopod, (e) abdominal view of same; *D. japonica* (64 mm, USNM 58743) (f) sternal tip of pleopod, (g) abdominal view of same.

Distribution. — East and west coasts of India, Andaman Sea, Malay Peninsula, Indonesia, Hong Kong.

Doclea japonica Ortmann, 1893
(Fig. 34b, f, g, Pl. 9)

Doclea japonica Ortmann, 1893: 46-47, pl. 3 fig. 4. (Not *Doclea japonica* Alcock, 1895.)

Doclea canalifera. — Rathbun, 1902b: 29. (Not *Doclea canalifera* Stimpson, 1857.)

Material examined. — 9 ♂♂, 5 ♀♀ (3 ovig.), 26.5-64 mm, smallest ovig. ♀, 51.5 mm.

SMITHSONIAN INSTITUTION, WASHINGTON

Japan, Kii, Wakanoura, coll. Jordan & Snyder, Stanford Univ., 1900; 4 specs. (USNM 26271). — China, Amoy Harbour, S. F. Light, June 1923; 1 spec. (USNM 62028). — China, Chekiang Province, Yenting, exch. National Southeastern Univ. (C. Ping), 18 July 1923; 1 spec. (USNM 59168). — China, Amoy, S. F. Light, 6 June 1924; 3 specs. (USNM 62026-7). — China, Foochow (Fuchou), coll. and don. C. R. Kellogg, 1924; 1 spec. (USNM 58743). (All det. M. J. Rathbun as *D. canalifera*.)

ZOOLOGICAL MUSEUM, HAMBURG

Formosa, Takao, 1 February 1908; 2 specs. (ZM Hamb. K411). — China, Fukien Province, Futschau (?Fuchou), coll. Consul G. Siewssen, 4 September 1913; 2 specs. (ZM Hamb. K430).

Remarks. — These specimens are part of a Smithsonian Institution series from China and Japan identified by Rathbun as *Doclea canalifera* Stimpson (Griffin, 1974: 10), but they lack the long slender epibranchial and intestinal spines of that species.

The type material of *D. japonica* Ortmann comes from Kochi, Japan, very close to where some of these specimens (USNM 26271) were obtained. The figure of *D. japonica* given by Ortmann (1893: pl. 3 fig. 4) shows insufficient detail, and the differences he described in the lengths of the first ambulatory leg and the arrangements of tubercles on the carapace are not adequate to provide a specific distinction from *D. ovis* (Herbst).

Chopra (1935: 467-469, text fig. 1a) has included all the specimens from the Indian coast and the Bay of Bengal previously identified as *D. japonica*, in *D. ovis* and all the males have the characteristic pleopod (with a narrow terminal process) of the latter species.

Our specimens are very close to those of *D. ovis* from the Bay of Bengal and Singapore in carapace shape and ornamentation and form of the legs, but the first pleopod of the male and genital openings of the female are quite different from those of *D. ovis*. The pleopod is broad, almost straight, with a few long setae; the tip consists of two broad, blunt, contiguous lobes (fig. 34f); some immature males (USNM 59168, cl. 43.7 mm; ZM Hamb. K430 cl. 26.4, 33.8 mm) have only the medial lobe fully developed. The female genital openings are round and obliquely laterally placed on the swelling (fig. 34b) while in *D. ovis* they are oval and situated on the anterior face of the swelling.

On the basis of the relatively large number of specimens that we have examined there is no doubt at all that there are two distinct species with the same general appearance but differing markedly in the form of the male first pleopod and shape of the female gonopore; the two are geographically separated — one occurring in the Indian Ocean east to Singapore and one species occurring around Japan and off China. The former species is clearly *D. ovis*. On this basis Ortmann's specimens from Japan must be considered as a separate valid species and Japanese and Chinese animals can be known as *Doclea japonica*. Whilst much of the published information concerning Japanese specimens does not unequivocally confirm this there is nothing to show that the specimens described by Ortmann, and by Sakai (1938: 293, pl. 37 fig. 2; 1976: 231, pl. 80 fig. 2) belong to *D. ovis* as now understood.

Distribution. — Southern Japan, East China Sea to Formosa Strait.

Doclea ovis (Herbst, 1790)
(Fig. 34a)

Cancer ovis Herbst, 1790: 210-211, pl. 13 fig. 82.
Doclea ovis. — Alcock, 1895: 227. — Chopra, 1935: 467-469, text fig. 1a. — Griffin, 1974: 11.

Material examined. — 1 ♀ (ovig.) 45.0 mm.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

5 Thai-Danish Expedition: Stn. 1039, west Malay Peninsula, trawl haul just after leaving station, 24 February 1960; 1 spec.

Remarks. — Our specimen has been compared with a female of *Doclea ovis* from the Bay of Bengal (AM P.17780, cl. 48 mm) and in both the gonopore is oval and situated on the anterior face of the swelling. The gonopore in the very similar species *D. japonica* is round and obliquely laterally placed on the swelling. The differences which separate these two species are discussed further under *D. japonica*.

On the anterior margin of the carapace there are two small spines and a blunt tubercle slightly more dorsally. There is a low tubercle on the intestinal region.

The type locality for this species is given as 'East Indien' (Herbst, 1790).

Distribution. — Malay Peninsula, Singapore, Bay of Bengal.

Doclea simeti new species
(Fig. 34c, Pl. 10)

Material examined. — 1 ♂, 2 ♀♀, 27.5-34.5 mm.

Holotype. — Female, adult, cl. 34.5 mm, China, Tsimei, collected and donated S. F. Light, University of Amoy, June 1923, United States National Museum, Washington, USNM 57840 (1 specimen of 3) previously determined M. J. Rathbun as '*Doclea* near *muricata* and *tetraptera*.'
Paratypes. — Male, cl. 30.5 mm, female cl. 27.5 mm, data as for holotype, USNM 57840 (2 specimens of 3).

Description. — Carapace broad, width nearly equal (0.9) to postrostral carapace length; surface covered with a short dense tomentum of clubbed setae, some low tubercles under tomentum and a few distinct tubercles and spines.

Rostral spines short, length about one fifth (0.2) postrostral carapace length, straight, parallel, apex blunt, fused for proximal half.

Orbital eave slightly expanded, edges of orbital eaves sloping outwards posteriorly; preorbital angle not produced; antorbital angle weakly produced and blunt; postorbital lobe separated from eave by a narrow slit-like hiatus, lobe directed forward, basally broad, apically subacute. Eyestalks short, slender; cornea terminal and ventral.

Hepatic region smooth, not elevated, a low tubercle dorsally on margin.

Branchial submargin with two blunt, conical tubercles anteriorly; an acuminate epibranchial spine, about one quarter width of carapace, directed outward and slightly upward.

Gastric regions elevated, four mesogastric tubercles, first and third small, fourth largest; a group of four low protogastric tubercles on either side of second and third mesogastric tubercles; two low protogastric tubercles on either side of space between third and fourth mesogastric tubercles; a tubercle on urogastric region. Cardiac region with a blunt conical spine; anterior branchial region indistinctly tuberculate near medial angle, a round tubercle laterally; a high tubercle just medial to epibranchial spine; a low tubercle posterolateral of cardiac spine; a small upright spine centrally on intestinal region and a large spine (about half length of epibranchial spine) directed backwards on posterior carapace margin. A narrow band of longer clubbed setae, just above and parallel to posterior carapace margin.

Basal antennal article narrow triangular, a blunt ridge on lateral margin; anterolateral angle produced forward as a short, blunt tooth ventral to first peduncle segment. A tubercle between base of basal antennal article and conical tubercle on anterolateral angle of mouthfield.

Pterygostomian region with a longitudinal channel and a blunt conical tubercle on the margin; channel edged with long hairs, hairs of inner edge on exognath of third maxilliped, and hairs on outer edge of conical tubercle and carapace margin.

Third maxilliped covered with tomentum, anterolateral angle of merus only weakly produced, angular rather than rounded.

Cheliped of male about equal (0.98) to postrostral carapace length, merus smooth, no terminal spine; carpus smooth; palm about twice as long as high; fingers less than three quarters (0.73) length of palm, curved slightly inwards distally, a narrow gape between fingers in proximal third, a few small teeth on fingers in gape and larger teeth on both fingers in distal two thirds.

Ambulatory legs smooth, first leg more than twice (2.3) postrostral carapace length, merus without a terminal tubercle; fourth leg slightly longer (1.2) than postrostral carapace length and about half length of first leg.

Male sternum smooth, a narrow ridge bordering apex of abdominal fossa, ending in a spinule on each side; just behind this spinule and more laterally, on posterior ridge of first sternite, a spine almost covered by tomentum.

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

Female abdomen of seven segments, second and third segments with a broad, medial tubercle; a low anterior tubercle on segments four to six.

First pleopod of male straight, broad basally but tapering gradually to a narrow, blunt apex; a simple aperture opening terminally on abdominal surface.

Female gonopore a keyhole shaped aperture, narrower medially, opening anteriorly from a broad swelling.

Remarks. — These specimens do not agree with any previously described species of *Doclea*. They are similar to *D. calcitrapa* and *D. canalifera* in having a canaliculated pterygostomian region, the rostrum longer than the peduncle segments of the antennae, large epibranchial and intestinal spines and the first ambulatory legs about equal to twice the carapace length. They can be distinguished from these two species by the tubercles and spines on the carapace which, except for the epibranchial spine, are blunt and conical rather than slender and apically sharp (these spines are covered by tomentum in *D. calcitrapa*); and by the conical tubercle just medial to the epibranchial spine which is absent in the other two species. In addition it is distinguished from *D. calcitrapa* by the rostral spines which are fused for the proximal half and parallel distally instead of being fused for more than the proximal half (0.66) and strongly divergent distally as in *D. calcitrapa*, and from *D. canalifera* by the presence of two spines rather than one on the intestinal region. The species name is an anagram of Tsimei.

Distribution. — Known only from the type locality, Tsimei, China.

Eurynolambrus H. Milne Edwards & Lucas, 1841

Type species. — *Eurynolambrus australis* H. Milne Edwards & Lucas, 1841.

Remarks. — This genus has been dealt with in detail previously (Griffin, 1966d). The study of the post-larval stages of *E. australis* by Krefft (1952) suggested that this genus belonged in the Pisinae. However, the larvae of the oxyrhynchs are so inadequately known that the place of this genus is probably still to be determined. The first pleopod of the male is outwardly curved distally and the aperture is subterminal between the widely expanded lateral part of the apex and the slender medial process which curves over it. This pleopod resembles that of *Tumulosternum parvispinosus* (Ward).

Distribution. — Restricted to New Zealand.

Giranauria new genus

Type species. — *Chorinus verrucosipes* Adams & White, 1848, by present designation.

Description. — Carapace pyriform, surface with many tubercles and some lobes and or spines. Rostrum little more than one third carapace length, of two slender divergent spines. Orbit comprising above an eave separated by a narrow hiatus from postorbital lobe; no intercalated spine. Supraorbital eave expanded, bilobed, both preorbital and antorbital lobes broad. Postorbital lobe strongly produced, apically truncate with a strong apical lobe on posterior margin, a weak proximal lobe on anterior margin. Basal antennal article moderately broad with a broad, blunt

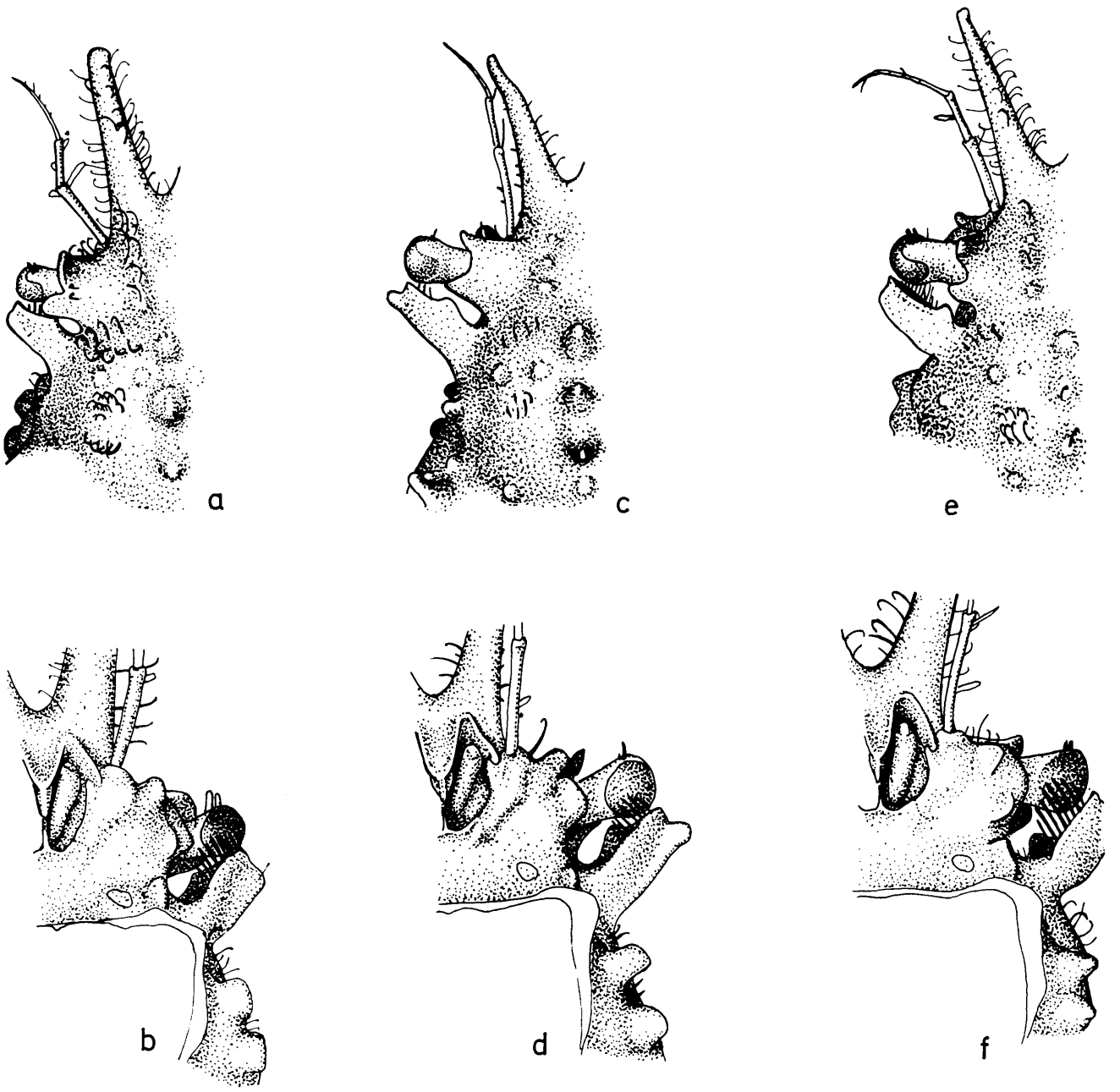


Fig. 35. *Giranauria verrucosipes* (male, 13 mm, Tawi Tawi Bay, WAM 53-67) (a) left orbit, dorsal view, (b) ventral view of same; *G. gracilirostris* (female, ovig., 11 mm, Tamilnadu, ZSC 4533/7) (c) left orbit, dorsal view, (d) ventral view of same; *G. tinaktensis* (male, 10 mm, Ceram, NIO Jakarta) (e) left orbit, dorsal view, (f) ventral view of same.

anterolateral lobe and a strongly produced lateral margin extending dorsally, and sometimes a proximal lobe; separated from postorbital lobe by a broad U-shaped hiatus. Abdomen of seven segments in male.

First pleopod of male moderately stout, distally twisted and apically tapering.

Remarks. — This genus contains three species *G. gracilirostris* (Miers), *G. tinaktensis* (Rathbun) and *G. verrucosipes* (Adams & White) previously included in *Hyastenus*. The species of the new genus are distinguished from all others in the '*Hyastenus*' group by the broad, prominently bilobate eave and broad lobate basal antennal article. A stout twisted pleopod in the male is shared by the three species. Although *Thusaenys pehlevi* has an expanded and bilobed supraorbital eave, it lacks the large cardiac spine and expansion of the basal antennal article typifying *Giranauria* species.

The distribution of this group of species is currently centred on Indonesia and the Philippines.

The name of the genus is derived from letters of the component species; the gender is masculine as is *Hyastenus*.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *GIRANAURIA*

1 Preorbital lobe of supraorbital eave narrow; basal antennal article lacking a lateral lobe proximally, the more dorsal lateral lobe clearly visible in ventral view ..... *G. gracilirostris*

— Preorbital lobe of supraorbital eave broad; basal antennal article with a prominent proximal lateral lobe partly concealing the more dorsal lateral lobe from ventral view 2

2(1) Cardiac spine broadly conical; intestinal spine broad-based, depressed, ridge-like; branchial region posteriorly with a transverse row comprising a small tubercle submedially, a prominent spine and, laterally and below the spine, a small tubercle. *G. verrucosipes*

— Cardiac spine truncate and compressed anteroposteriorly; intestinal spine erect, as long as broad; branchial region posteriorly with a transverse row comprising a prominent tubercle submedially, a prominent spine and, laterally and below the spine, another subequal spine ..... *G. tinaktensis*

Giranauria gracilirostris (Miers, 1879) new combination (Figs. 35c, d, 36a, b)

Hyastenus (*Chorilia*) *gracilirostris* Miers, 1879a: 12, pl. 4 fig. 7.
Hyastenus gracilirostris. — Alcock, 1895: 215.

Material examined. — 4 ♂♂, 3 ♀♀ (2 ovig.), 7.1-11 mm, smaller ovig. ♀, 7.3 mm.

ZOOLOGICAL SURVEY OF INDIA, CALCUTTA
South India, Tamilnadu Coast, Marine Survey; 2 specs. (ZSC 4533/7).

ALLAN HANCOCK FOUNDATION, S. CALIFORNIA
Marshall Islands, Eniwetok Atoll, coll. J. W. Knudsen; 5 specs.

Remarks. — This species is compared with *G. tinaktensis* and *G. verrucosipes* under those species. This species has an unusual disjunct distribution.

Distribution. — Fiji Islands, Marshall Islands, South India.

Giranauria tinaktensis (Rathbun, 1916) new combination (Figs. 35e, f, 36c, d)

Hyastenus tinaktensis Rathbun, 1916: 547-548. — Griffin, 1976: 196, fig. 5(a).

Material examined. — 5 ♂♂, 8 ♀♀ (5 ovig.), 7.5-11.5 mm, smallest ovig. ♀, 9.5 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM
'Siboga' Expedition: Stn. 313, Sumbawa, Saleh Bay, anchorage E. of Dangar Besar, to 36 m, dredge, trawl and reef exploration, sand, coral and mud, 14/16 February 1900; 2 specs. — Sulu Archipelago; 3 specs.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, off Marungas, ca. 27 m, 19 March 1914; 1 spec.
Danish Kei Islands Expedition: Stn. 35, Kai Is., Bay N. of Noehoe-Roa, 32 m, trawl, sand, 23 April 1922; 1 spec. — Stn. 40, Kai Is., N. of Doe Roa, 25 m, trawl, sand, 25 April 1922; 1 spec.

NATIONAL INSTITUTE OF OCEANOLOGY, JAKARTA
Mariel King Memorial Expedition-Moluccas: Stn. CP I, Ceram, Piru Bay, off Tg. Tutuhuhur, 03°15′S 128°08′E, 25-54 m, dredge hauls, 8-19, coarse sand, *Lithothamnion* and rubble or foramniferal sand, 1 June 1970; 3 specs. — Stn. KR VI, Kai Is., N. of Nuhu Rowa, N. of Du Rowa I., 05°32′S 132°41′E, 27-36 m, dredge hauls 3-10, sand and rubble, 11 June 1970; 1 spec. — Stn. A III, Aru, Trangan, 3-4 miles (∿ 5-6.5 km) W. of Tg. Lelar, 06°46′S 133°58′E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 1 spec.

Remarks. — This species is distinguished by the large truncate cardiac spine which is compressed antero-posteriorly and by the intestinal spine which is broad, triangular and erect. The three species are compared and further differences from *G. gracilirostris* and *G. verrucosipes* discussed under the latter species.

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

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

Giranauria verrucosipes (Adams & White, 1848) new combination (Figs. 35a, b, 36e, f)

Chorinus verrucosipes Adams & White, 1848: 13, pl. 2 fig. 3.
Hyastenus verrucosipes. — Calman, 1900: 36-37, pl. 2 figs. 23-24. — Griffin, 1966b: 281 (in key); 1976: 198.

Material examined. — 21 ♂♂, 19 ♀♀ (15 ovig.), 8-14.5 mm, smallest ovig. ♀, 10 mm.

ZOOLOGICAL MUSEUM, AMSTERDAM
'Siboga' Expedition: Stn. 209, S. Sulawesi, anchorage off S. point of Kabaena I., 22 m, dredge, reef exploration, coarse sand, 23 September 1899; 1 spec. — Stn. 301, S. of Timor, E. coast of Roti I., Pepela Bay, 10°38′S 123°25.2′E, 22 m, dredge, mud, coral and *Lithothamnion*, 30 January 1900; 1 spec. — Sulu Archipelago; 1 spec.

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN
Mortensen Pacific Expedition: Sulu Archipelago, off Jolo, 36-54 m, dredge, *Lithothamnion*, 17 March 1914; 4 specs. — Sulu Archipelago, off Jolo, off Marungas, 27-54 m, dredge, 19 March 1914; 5 specs.
Danish Kei Islands Expedition: Stn. 15, Kai Is., S. of Doe Roa, ca. 20-5 m, trawl, sand, 10 April 1922; 1 spec. — Banda, off Kombir, ca. 70-90 m, dredge, sand, 7 June 1922; 2 specs.

WESTERN AUSTRALIAN MUSEUM, PERTH
Sulu Archipelago, Tawi Tawi Bay, about 9 miles (∿ 14.5 km) from Bangao Light, 16-23 m, sand and *Lithothamnion*, coll. B. R. Wilson on 'Pele', 29 February 1964; 1 spec. — (as above), 16-30 m, dredge, sandy bottom, coll. B. R. Wilson on 'Pele', 29 February 1964; 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°08′E, 41-48 m, dredge haul 4, coarse Foramnifera and shell sand, 1 June 1970; 1 spec. — Stn. CP I, (as above), 54 m, dredge haul 15, grey sand, fine with shelly grit, 2 June 1970; 6 specs. — Stn. CP I (as above), 25-63 m, dredge hauls 8-19, coarse sand, *Lithothamnion* and rubble, 2 June 1970; 1 spec. — Stn. KR VI, Kai Is., N. of Nuhu Rowa, N. of Du Rowa I., 05°32′S 132°41′E, 32-36 m, dredge haul 1, sand, 10 June 1970: 4 specs. — Stn. KR VI (as above), 32-36 m, dredge haul 2, *Lithothamnion* rubble and sand, 10 June 1970; 1 spec. — Stn. KN II, Kai Is., W. coast of Nuhu Tjut, off Elat Bay, 05°40′S 132°59′E, 48-63 m, dredge hauls 3-4, rubble, fan coral, green algae and sand, 13 June 1970; 1 spec. — Stn. KN II (as above), 48-54 m, dredge haul 6, rubble,

algae and sand, 13 June 1970; 1 spec. — Stn. A III, Aru, Trangan, 3-4 miles (~ 5-6.5 km) W. of Tg. Lelar, 06°46'S 133°58'E, 11-14 m, dredge hauls 5-6, sand and rubble, 21 June 1970; 7 specs.

Remarks. — The preorbital lobe is small, and subequal to the antorbital in *G. gracilirostris* and only slightly upturned, in *G. tinaktensis* it is larger and more upturned, and in *G. verrucosipes* it is much larger than the antorbital lobe and strongly upturned.

On the branchial region in *G. verrucosipes* there is a spine near the anterior margin and an epibranchial spine with a small tubercle just below it. In *G. tinaktensis* the anterior spine is small and the epibranchial spine has a subequal spine just below it. In *G. gracilirostris* the anterior spine is large and the epibranchial spine has a subequal spine just below it. Also in this last species the anterior branchial region is more rounded and elevated.

The large cardiac spine is broadly conical in *G. verrucosipes*, almost cylindrical in *G. gracilirostris*, and truncate and anteroposteriorly compressed in *G. tinaktensis*.

The tubercle in front of the cardiac spine is connected to the last of the three medial gastric tubercles by a narrow ridge in *G. verrucosipes* and *G. gracilirostris*, but not in *G. tinaktensis*.

The intestinal spine is broad, triangular and horizontal or depressed in *G. verrucosipes*, triangular and erect in *G. tinaktensis* and cylindrical and erect in *G. gracilirostris*.

The basal antennal article is produced in a round flattened lobe on the anterolateral angle in the three species of this genus. In addition, there is a proximal lateral lobe in *G. tinaktensis* and *G. verrucosipes*. In the latter, the proximal lobe is smaller than the anterior one (not shown in Calman, 1900: fig. 24). *G. gracilirostris* has no proximal lobe. All three species have a laterally compressed suborbital tooth.

In all three species of this genus the palm of the chela of the adult male is inflated, short (length less than $1^1/_2$ times height), with a tubercle distally near the insertion of the dactyl. There is a moderate gape, a proximal tooth on the dactyl and small teeth distally where the fingers meet. In *G. gracilirostris* there is also a proximal tooth on the fixed finger.

The dactyls of the ambulatory legs are slender and armed with a few very small teeth.

The first pleopod of the male tapers very slightly towards the tip which is lightly curved outwards. The tip is narrower in *G. tinaktensis* and *G. gracilirostris* than it is in *G. verrucosipes*. This type of pleopod is similar to that in *Phalangipus* species, some *Naxioides* species and *Austrolibinia gracilipes*.

Distribution. — Sulu Archipelago, S. Sulawesi, Ceram, Banda, Kai Islands, Timor and N. Australia (Torres Straits).

Herbstia H. Milne Edwards, 1834

Type species. — *Cancer condyliatus* Fabricius, 1787, by monotypy.

Remarks. — In 1873, A. Milne Edwards described *Micropisa crassipes* from Bass Strait, Australia, very briefly and without a figure. Haswell (1882) removed this species from *Micropisa* to *Herbstia*. We have not examined the holotype and the species has not been reported again. The original description is inadequate. Neither *Micropisa* nor *Herbstia* are otherwise represented in the Indo-West Pacific and it is possible that *H. crassipes* should be placed in some other genus if indeed it is a distinct species, rather than a specimen, perhaps juvenile, of a species already known.

Hoplophrys Henderson, 1893

Type species. — *Hoplophrys oatesii* Henderson, 1893, by monotypy.

Remarks. — In this genus there is no hiatus, only a suture, between the supraorbital eave and the postorbital lobe. The basal antennal article is narrow with a long spine at the anterolateral angle and separated from the postorbital lobe by a shallow U-shaped hiatus. The first pleopod of the male is slender in the distal quarter with long setae and resembles the pleopod of some species of *Hyastenus* and *Thusaenys*.

The two described species of this genus are here considered to be conspecific confirming the new synonymy suggested previously (Griffin & Tranter, 1974).

H. oatesii is distinguished from most species in the Pisinae by its numerous carapace spines but it differs from the few other spinous pisines in having no hiatus between the eave and the postorbital lobe and also in lacking a medial intestinal spine, usually strongly developed in other spinous pisines.

Distribution. — Indo-West Pacific.

Hoplophrys oatesii Henderson, 1893 (Fig. 37a)

Hoplophrys oatesii Henderson, 1893: 347-348, pl. 36 figs. 1-4. — Alcock, 1895: 233-234. — Alcock & Anderson, 1898: pl. 34 fig. 1, 1a, 2, 2a. — Rathbun, 1911: 253-254. — Sakai, 1932: 48-49, pl. 2 fig. 4; 1938: 294. — Griffin & Tranter, 1974: 168-169.

Hoplophrys ogilbyi McCulloch, 1908: 51-53, pl. 12 figs. 2, 2a. — Balss, 1938: 22. — Buitendijk, 1939: 238. — Sakai, 1976: 233, pl. 81 fig. 1; new synonymy.

Parazewa palauensis Miyake, 1939: 195-197, text-figs. 12, 13. — Takeda, 1973a: 97; new synonymy.

Material examined. — 6 ♂♂, 4 ♀♀ (1 ovig.), 5-17 mm, ovig. ♀, 17 mm.

Holotype of *Hoplophrys oatesii*. A male cl. 11.5 mm labelled 'Gulf of Martaban, E. W. Oates Esq.' in the collections of the British Museum (Natural History), London, preserved in spirit and registered as 88.34.
Holotype of *Hoplophrys ogilbyi*. A female, cl. 9.6 mm, cw. 7.1 mm, 'Off Moreton Bay, Queensland, in a colony of *Spongodes*, coll. J. D. Ogilby (McCulloch)' in the Queensland Museum's collections, preserved in spirit and registered as W.223. The right rostral spine is broken at the base, the left cheliped carpus and chela is detached, the right cheliped carpus and chela is missing and so is the right first ambulatory, the propodus and dactyl of the right second leg and the whole of the left second leg.

Additional specimens. — 5 ♂♂, 3 ♀♀(1 ovig.).

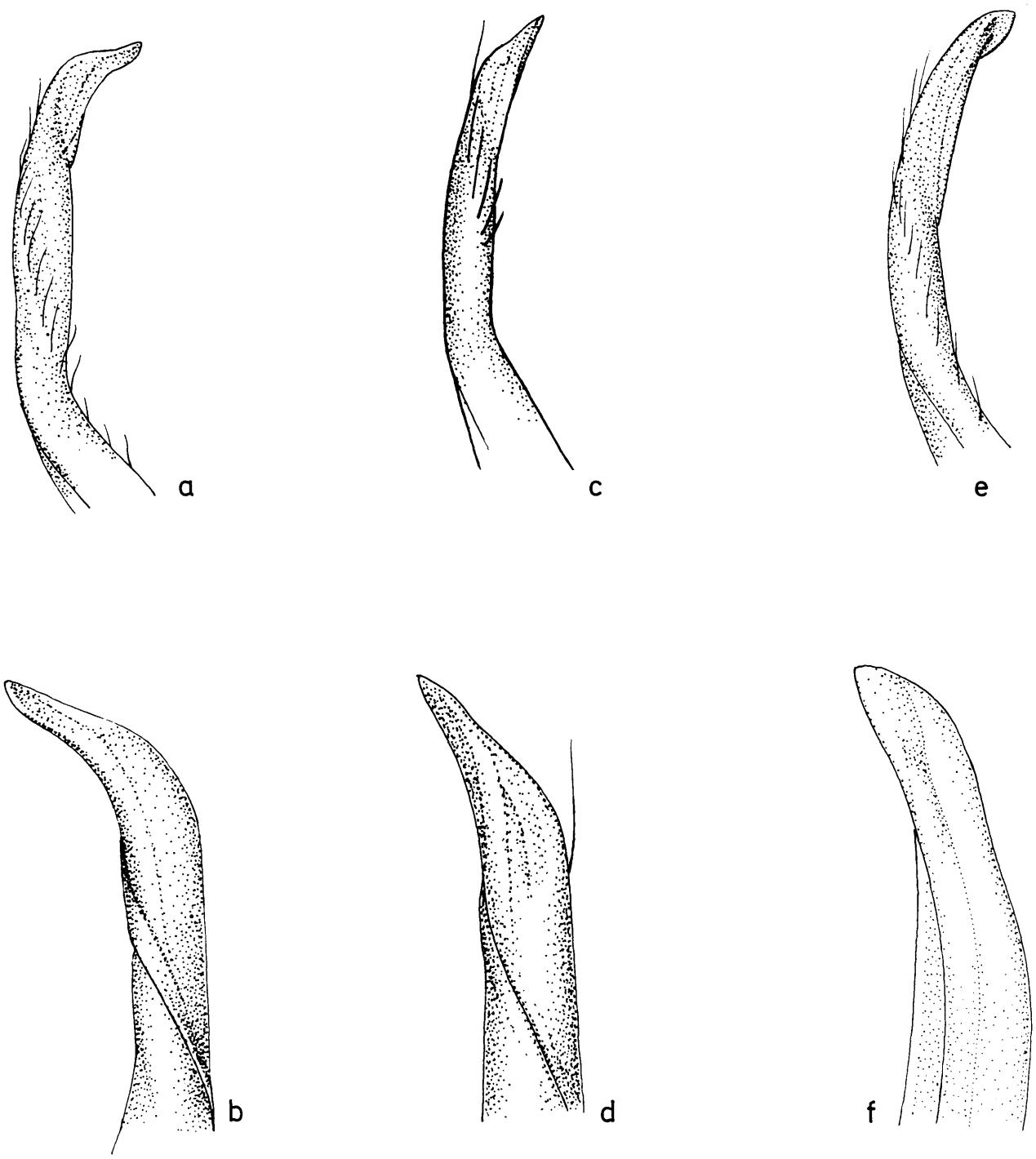


Fig. 36. Left first pleopod of male of *Giranauria gracilirostris* (9.5 mm, Tamilnadu, ZSC 4533/7) (a) abdominal view of pleopod, (b) sternal tip of same; *G. tinaktensis* (10 mm, Ceram, NIO Jakarta) (c) abdominal view of pleopod, (d) sternal tip of same; *G. verrucosipes* (13 mm, Tawi Tawi Bay, WAM 53-67) (e) abdominal view of pleopod, (f) sternal tip of same.

SMITHSONIAN INSTITUTION, WASHINGTON

'Albatross' Expedition: Stn. 5138, Sulu Archipelago, vicinity of Jolo (Jolo Light), 06°06′N 12°58′50″E, 34 m, sand, coral, 14 February 1908; 1 spec. (USNM 47347).

ZOOLOGICAL MUSEUM, UNIVERSITY OF COPENHAGEN

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

THE AUSTRALIAN MUSEUM, SYDNEY

Queensland: near Bundaberg, caught while fishing for prawns and scallops, coll. J. Booth; 1 spec. (AM P.23836). — Lizard I., Macgillivray Reef, coll. N. Coleman, 9 November 1975; 1 spec. (AM P.23820). — Lizard I., North Reef, coll. N. Coleman, 22 November 1975; 1 spec. (AM P.23819). — Lizard I., North Point, coll. N. Coleman, 25 November 1975; 1 spec. (AM P.23817).

Noumea: Fosse aux canards, 24 m, 1968; 1 spec. (AM P.23837).

Remarks. — The original description and figures of *H. ogilbyi* given by McCulloch are extremely accurate and detailed. Only the following points require comment. The anterior border of the basal antennal article is slightly more concave than shown in McCulloch's fig. 1a, there is no trace of the ir-

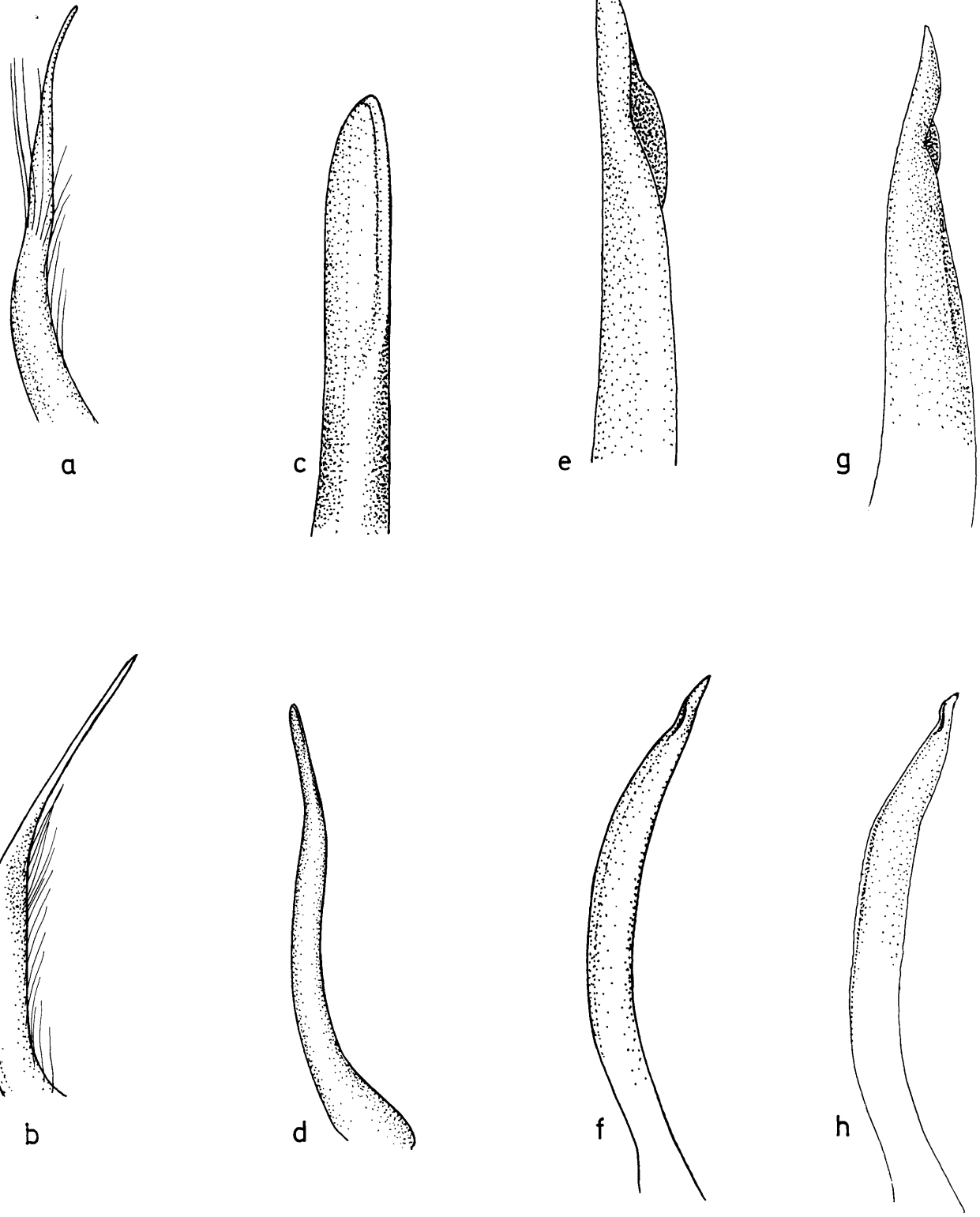


Fig. 37. Left first pleopod of male of *Hoplophrys oatesii* (11 mm, AM P.23819) (a) abdominal view of pleopod; *Lahaina agassizii* (13.5 mm, Banda, ZMC) (b) abdominal view of pleopod; *L. mauritiana* (holotype) (c) abdominal tip of pleopod, (d) abdominal view of same; *Naxioides taurus* (21 mm, Kai Is., NIO Jakarta) (e) sternal tip of pleopod, (f) abdominal view of same; *N. hirta* (34 mm, Timor, ZMA De.100.630) (g) sternal tip of pleopod, (h) abdominal view of same.

regularities on the upper border of the palm of the chela referred to in the description (however this is not typical of the species), the fingers of the chela are inwardly curved, the dactyl does not cross over the fixed finger. The fingers are coarsely toothed in the male and meet along the distal third and distal half in the female, not proximally as stated by McCulloch. The ornamentation of the ambulatory propodi is described by McCulloch as comprising elevated groups of tubercles; more correctly there are some large tubercles with smaller secondary tubercles on them dorsally and on the sides on the carpi as well as the propodi. (In the male specimen from Bundaberg these are rather worn and don't present quite the knobbly appearance of the legs of the female.) On the two anterior pairs of ambulatories the merus has dorsally one spine proximally, two side by side midway along and three side by side on the distal border, the carpus has the same arrangement and the propodus has two pairs of spines, one midway along and one distally. The dactyls of the posterior ambulatories have several small spines proximally on the ventral surface. (In the Bundaberg male (AM P.23836) the dactyls of the first ambulatories have two spines ventrally, one proximally and one midway along. The arrangement of these dactylar spines or spinules is not clearly shown in figures of *H. oatesii*.)

The abdomen is not described by McCulloch. It consists in the female of five segments, the junctions between segments three and four, four and five, and five and six being not very distinct; the abdomen is ovate and the edges are scalloped. The male abdomen consists of seven segments and is widest at the middle of the third segment from which it tapers to the last. There is a flattened subrectangular elevation in the midline of segments three to six distally.

McCulloch suggests that his species differs from *H. oatesii* Henderson in that the spines of the carapace are larger and longer, the epibranchial spine is not bifid, the basal antennal article is more slender and the third maxilliped merus possesses an extra lobe. Comparison of the holotype of *H. ogilbyi* with the holotype of *H. oatesii* and with previous descriptions and figures and present material shows these to be not justifiable as characters separating the species.

There are few consistent differences between the Australian and other specimens available to us and the Japanese female specimen described and figured by Sakai (1932) under the name *Hoplophrys oatesii* but later (1976) with further Japanese specimens, referred to *H. ogilbyi*. Thus, the rostrum is usually directed forward rather than deflexed; the tubercles on the third and fourth ambulatories are more secondarily tuberculate on the carpi and propodi; and the lobe on the dorsal border of the palm of the chela is longer than shown in Sakai's figure. Sakai also shows the postorbital lobe as apically acute but describes it as "not strong, truncated at the tip and excavate at the inner surface" which agrees with the Australian specimens of *H. ogilbyi*.

We consider the material of this genus from the western Indian Ocean and Red Sea east to Japan, Fiji and eastern Australia to represent only one species. There is nothing to suggest that any local population is characterized by differences in length of carapace spines, bifidness of spines, deflexed rostrum or tuberculation of ambulatory legs. Very small specimens lack the posterior branchial spine near the margin found in adults; the ambulatory legs are less tuberculate. These are differences from adult *Hoplophrys oatesii* shown by Miyake's *Parazewa palauensis*; Miyake's species otherwise has the same tubercles on the carapace and agrees in every other way with *Hoplophrys oatesii* as now understood. This name is now added to the synonymy of *Hoplophrys oatesii*.

The species is newly recorded from the Philippine Islands: the 'Albatross' specimen was not included in the account of Philippine Spider Crabs (Griffin, 1976).

Distribution. — Indo-West Pacific, Western Indian Ocean: Providence and Amirante, Red Sea. Off Indian coasts to Gulf of Martaban. Pacific Ocean: Japan, Indonesia, Philippine Islands (Sulu Archipelago), Fiji, eastern Australia.

Hyastenus White, 1847 redefined

Type species. — *Hyastenus sebae* White, 1847, by monotypy.

Description. — Carapace pyriform, variously tuberculate or spinous. Rostrum varying in length. Orbit comprising eave and postorbital lobe separated by a narrow hiatus. Supraorbital eave at most moderately expanded, anterolateral angle weakly produced or bearing a slender preorbital spine, antorbital only weakly, if at all, produced. Postorbital lobe not well developed, anterior margin sometimes with a proximal lobe, posterior margin convex but neither keeled nor lobed.

Basal antennal article generally narrow, anterolateral angle blunt or produced as a small spine, lateral margin usually produced as a convex or triangular lobe, which never extends dorsally; article separated from postorbital lobe by a U-shaped hiatus of varying width.

Abdomen of seven segments in male and generally of seven, but sometimes of five segments in female.

First pleopod of male simple, sometimes with a subapical lobe, sometimes slender or filiform distally.

Remarks. — The genus as redefined is still large (34 species) and contains several groups and subgroups. However, species with relatively extravagantly expanded orbits dorsally, ventrally or both are excluded and removed to the genera *Lahaina*, *Giranauria* or *Thusaenys*. There is an expanded orbit also in *Acanthophrys cristimanus* A. Milne Edwards, included in *Hyastenus* by Balss (1935a) but now removed to a separate genus. Several other species have been removed from the genus. *H. dumerilii* (H. Milne Edwards) is now considered a species of *Tylocarcinus* and *H. macrospinosus* Ward is probably synonymous with it; *H. brevirostris* Doflein has been removed to the genus *Rochinia* and *H. elegans* Miers to the genus *Nax-*

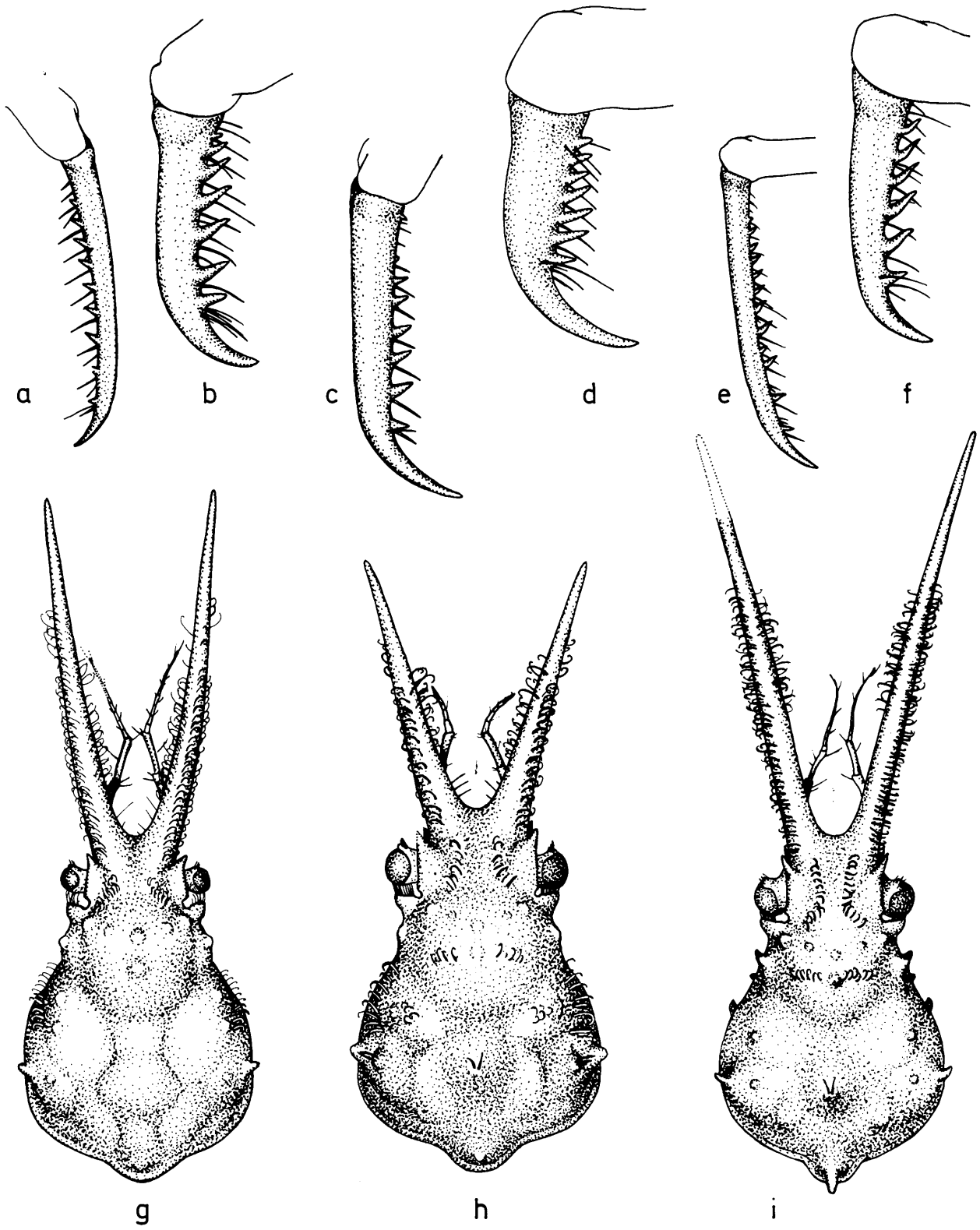


Fig. 38. (*Hyastenus* species of group 1) *Hyastenus borradailei* (male, 35 mm, AM P.29891, in part) (a) dactyl of right first ambulatory leg; (female, ovig., 30 mm, AM P. 29891, in part) (b) dactyl of left fourth ambulatory leg; *H. brockii* (male, 11.5 mm, S. Sulawesi, ZMA) (c) dactyl of left first ambulatory leg; (d) dactyl of left fourth ambulatory leg; *H. uncifer* (male, 17 mm, Haingsisi, ZMA) (e) dactyl of left first ambulatory leg; (f) dactyl of left fourth ambulatory leg; *H. borradailei* (male, as above) (g) carapace, dorsal view; *H. brockii* (as above) (h) carapace, dorsal view; *H. uncifer* (as above) (i) carapace, dorsal view.

ioides. *Pisa sinope*, briefly described but not figured by Adams & White (1848) was included in *Hyastenus* by Miers (1886) and omitted by Balss (1935a) but because the description is so brief we are unable to say anything about its status. The remaining species, including five newly described, appear to fall into three main groups:

Group 1 species

H. ambonensis n.sp.[21])
H. auctus Rathbun
H. bispinosus Buitendijk
H. borradailei (Rathbun)
H. brockii De Man
H. cornigerus Sakai[21])
H. hendersoni Laurie
H. hilgendorfi De Man
H. inermis (Rathbun)
H. kyusyuensis (Yokoya)[21])
H. minutus Buitendijk[21])
H. pleione (Herbst)
H. sebae White
H. subinermis (Zehntner)[21])
H. ternatensis Buitendijk
H. trispinosus Rathbun
H. uncifer Calman
H. whitei Griffin

Group 2 species

H. aries (Latreille)
H. campbelli n.sp.
H. convexus Miers
H. cracentis n.sp.
H. diacanthus (De Haan)
H. elatus n.sp.
H. elongatus (Ortmann)
H. planasius (Adams & White)
H. spinosus A. Milne Edwards

Group 3 species

H. biformis Rathbun
H. fraterculus Rathbun
H. mindoro n.sp.
H. scrobiculatus Rathbun

Ungrouped (insufficiently known)

H. brachychirus Nobili
H. brevicornis Ortmann
H. espinosus Borradaile

Whilst the first pleopod of the male in this genus is simple there are three recognizable types. The first kind of pleopod is one which is usually straight, apically subacute, with a convex lobe behind the apex. The aperture is subterminal near the lobe. The group of species (1) with this kind of pleopod includes the type of the genus *H. sebae*; *H. inermis* is also included in this group, although in that species there is a very large lobe on the pleopod that curves over the abdominal surface.

The second kind of pleopod is slender, often sinuous, apically truncate without a lobe or else distally filiform. The aperture is terminal. The species with this kind of pleopod are listed in group (2). *Hyastenus convexus* which has a slender, straight pleopod with a terminal aperture is included in this group with some reservations.

The third kind of pleopod is one which curves outward distally and tapers only near the apex. There are only four species (group 3) with this kind of pleopod and they are very similar to one another. In this group of species the postorbital lobe is shallow, laterally narrow, and with a proximal process on the anterior margin; the basal antennal article is moderately broad with two large subequal lobes on the lateral margin.

Within the first group (1) there is a set of three very similar species. — *H. borradailei*, *H. brockii* and *H. uncifer* — which are distinguished from other species in this group by their very long slender rostral spines, weakly expanded orbital eave, narrow basal antennal article and short shallow postorbital lobe. However, we have included them in the first group because the pleopods of the males are similar to those of the other species in the group.

We have included in the key three of the species we know only from the literature, though *H. cornigerus* is not distinguished from *H. sebae*. *H. brachychirus* Nobili and *H. brevicornis* Ortmann are omitted from the key. There is only a brief description of the former and possibly it may be a synonym of *H. sebae*, while the latter, although figured, may not be a species of *Hyastenus*. We have also omitted *H. subinermis* Zehntner for while it is more adequately described and would probably key out near *H. trispinosus*, we don't have enough information to distinguish it.

Distribution. — Indo-West Pacific.

KEY TO SPECIES OF *HYASTENUS*

1 Carapace strongly tuberculate; protogastric and mesogastric regions with 13 or more tubercles; cardiac region with six or more tubercles 2
— Carapace moderately or weakly tuberculate or smooth; protogastric and mesogastric regions with 0-7 tubercles; cardiac region with 0-5 tubercles 3
2(1) Preorbital angle of eave not produced, rounded; anterolateral angle of basal antennal article not produced (fig. 40e); tubercles on dorsal part of hepatic region subequal to dorsal branchial tubercles; epibranchial tubercle subequal to branchial tubercle medial to it ..... *H. whitei*
— Preorbital angle of eave sharp, weakly produced or sometimes a short spine; anterolateral angle of basal antennal article produced as a blunt lobe or spine (fig. 40f); tubercles on dorsal part of hepatic region smaller than dorsal branchial tubercles; epibranchial tubercle or spine higher than branchial tubercle medial to it ... *H. sebae* *H. cornigerus*[22])
3(1) Upper orbital hiatus very narrow, U-shaped (almost slit-like), shallow; lower orbital hiatus a shallow slit (fig. 45e) 4
— Upper orbital hiatus U-shaped or keyhole-shaped, not particularly narrow or shallow; lower orbital hiatus broad U-shaped 6
4(3) Mesogastric region with a large tubercle at the summit and a spine or large tubercle on the anterior slope ..... *H. aries*
— Mesogastric region with a tubercle at the summit and the anterior slope smooth or with a low tubercle 5
5(4) Branchial region with a short epibranchial spine (0.1cw) and a tubercle medial and anterior to it ..... *H. auctus*
Branchial region with a robust epibranchial spine ($^1/_6$ to $^1/_4$ cw) but lacking a tubercle medial to the spine (fig. 45g) ..... *H. elatus*
6(3) Lateral margin of basal antennal article with two lobes of similar shape and size (fig. 50d-f), sometimes, but not always, parallel . 7
— Lateral margin of basal antennal article with anterolateral lobe narrow (or lacking) and margin behind it with a broad, weak to strong, convexity or lobe, or else nearly straight 10
7(6) Rostral spines fused for basal third; intestinal region with a strong, blunt posterior spine (fig. 49f) ..... *H. mindoro*
— Rostral spines separate from the base; intestinal region with a rounded tubercle, sometimes very low 8
8(7) Rostral spines very short, about $^1/_6$ postrostral carapace length; dorsal branchial margin with five to nine tubercles, epibranchial tubercle hardly higher than other tubercles ..... *H. fraterculus*
— Rostral spines $^1/_4$ to $^1/_2$ postrostral carapace length; dorsal branchial margin with two to four tubercles and an epibranchial spine higher than the tubercles 9
9(8) Cardiac region with a pair of submedial tubercles; lobes on lateral

[21]) Pleopod unknown or inadequately known.

margin of basal antennal article apically rounded (fig. 50f) ..... *H. biformis*
— Cardiac region with a medial tubercle; lobes on lateral margin of basal antennal article subacute (fig. 50e) ..... *H. scrobiculatus*
10(6) Anterior half of branchial region with at least one dorsal tubercle (sometimes low) 11
— Anterior half of branchial region devoid of tubercles 19
11(10) Urogastric region with a wide tubercle; mesogastric and protogastric regions with six prominent tubercles arranged in a 'Y' ..... *H. pleione*
— Urogastric region smooth; mesogastric and protogastric regions with low tubercles or no more than four prominent tubercles .. 12
12(11) Branchial submargin with a tubercle above cheliped base and two to five submarginal tubercles behind it ..... *H. hilgendorfi*
— Branchial submargin with a tubercle above cheliped base but no other tubercles 13
13(12) Postorbital lobe long, slender ..... *H. ternatensis*
— Postorbital lobe, short, broad 14
14(13) Basal antennal article with a deep notch on the margin behind the anterolateral spine (fig. 40h); protogastric tubercle behind orbit generally low 15
— Basal antennal article with a shallow concavity on the margin behind the anterolateral spine (fig. 44e); protogastric tubercle behind the orbit generally prominent 16
15(14) Intestinal region with a medial spine; branchial region with a strong epibranchial spine and a tubercle medial to it ..... *H. trispinosus*
— Intestinal region smooth or with a low tubercle; branchial region with a low epibranchial tubercle without a tubercle medial to it ..... *H. convexus*
16(14) Rostral spines $^1/_2$ to $^2/_3$ postrostral carapace length; gastric regions strongly elevated with two prominent mesogastric tubercles; branchial region with a strong epibranchial spine directed laterally (fig. 39d) ..... *H. ambonensis*
— Rostral spines $^2/_3$ to $1^1/_3$ postrostral carapace length; gastric regions weakly to moderately elevated, mesogastric tubercles low or distinct but not prominent; branchial region with a very short epibranchial spine, sometimes curved forwards (fig. 38g-i) 17
17(16) Hepatic margin and intestinal region each with a spine; anterior branchial region with one dorsal tubercle (fig. 38i) ..... *H. uncifer*
— Hepatic margin and intestinal region each with a tubercle; anterior branchial region with two dorsal tubercles 18
18(17) Preorbital spine of eave horizontal; anterior margin of postorbital lobe weakly sinuous; first pleopod of male with a medial lobe behind the apex (fig. 42a) ..... *H. borradailei*
— Preorbital spine of eave slightly upturned; anterior margin of postorbital lobe nearly striaght; first pleopod of male with a lateral lobe behind the apex (fig. 42c) ..... *H. brockii*
19(10) Rostral spines very short, $^1/_6$ to $^1/_4$ postrostral carapace length ... . *H. planasius*
— Rostral spines at least $^1/_3$, more usually $^1/_2$ postrostral carapace length or more 20
20(19) Mesogastric region with one to three tubercles or spines 21
— Mesogastric region smooth 25
21(20) Branchial region with an epibranchial spine 22
— Branchial region with an epibranchial tubercle or smooth but not with a spine 24
22(21) Mesogastric region with a large tubercle or spine at the summit and a spine or large tubercle on the anterior slope ..... *H. spinosus*
— Mesogastric region with a tubercle at the summit, anterior slope smooth or with a very low tubercle 23
23(22) Rostral spines subparallel; carapace narrow posteriorly (cw = 0.6 postrostral carapace length) ..... *H. espinosus*[22])
— Rostral spines divergent; carapace broad posteriorly (cw = 0.7-0.75 postrostral carapace length) ..... *H. diacanthus*[23])
24(21) Rostral spines parallel or weakly divergent (distance between tips about $1^1/_2$ times basal width); anterolateral angle of basal antennal article not produced (fig. 46f) ..... *H. elongatus*[24])
— Rostral spines strongly divergent from base (distance between tips about 3 times basal width); anterolateral angle of basal antennal article with a slender spine ..... *H. kyusyuensis*[22])
25(20) Anterolateral angle of basal antennal article sharp, with a short to moderate spine, sometimes bifid 26
— Anterolateral angle of basal antennal article not produced, rounded, blunt 29
26(25) Preorbital angle of eave produced further laterally than almost obsolete antorbital angle ..... *H. bispinosus*
— Preorbital and antorbital angles of eave about equally produced laterally 27
27(26) Rostral spines abqut $^2/_3$ postrostral carapace length or more; hepatic region with a small tubercle (fig. 44g) ..... *H. cracentis*[25])
— Rostral spines half postrostral carapace length or less; hepatic region smooth 28
28(27) Antorbital angle of eave rounded; anterolateral angle of basal antennal article with one spine; epibranchial spine lacking or very small ..... *H. inermis*
— Antorbital angle of eave acute; anterolateral angle of basal antennal article with two spines; epibranchial spine small but distinct ..... *H. minutus*[26])
29(25) Epibranchial spine robust about $^1/_6$ to $^1/_3$ carapace width; teeth on dactyl of fourth ambulatory leg very small ..... *H. campbelli*
— Epibranchial spine short about $^1/_{12}$ carapace width; teeth on dactyl of fourth ambulatory leg robust ..... *H. hendersoni*

[22]) From the literature.
[23]) *H. elatus* juveniles may key out here.
[24]) Indian O. specimens have a spine on the article — see species account.

Hyastenus ambonensis new species
(Fig. 39d-f)

Material examined. — 2 ♀♀ (1 ovig.), 21, 24 mm, ovig. ♀, 24 mm.

Holotype. — Female, ovigerous, 24 mm, Ambon, Ambon Bay, 90 m, dredge, stones, sand, 3 March 1922, Danish Kei Islands Expedition; Zoological Museum, University of Copenhagen.
Paratype. — Female, adult, 21 mm, data as for holotype; Zoological Museum, University of Copenhagen.

Description. — Carapace pyriform, widening posteriorly, width about two thirds (0.7) postrostral carapace length, surface smooth with a low tomentum, a few tubercles, an epibranchial spine and a posterior intestinal spine.

Rostral spines straight, slender, divergent, apically sharp, length more than half (0.55 to 0.6) postrostral carapace length.

Orbital eave weakly expanded, preorbital angle produced into a short spine directed obliquely forward and upward; antorbital angle produced into a small blunt lobe; postorbital lobe separated from eave by an almost circular hiatus; postorbital lobe short, a proximal lobe on anterior margin. Eyestalks short, moderately slender; cornea terminal.

Hepatic region weakly elevated, a tubercle on margin. Branchial submargin with a small tubercle anteriorly; a strong epibranchial spine directed laterally.

Gastric regions strongly elevated; two strong mesogastric tubercles, posterior on summit of gastric region; a strong lateral protogastric tubercle anteriorly and a very small tubercle just medial to it; urogastric region flat, smooth.

Cardiac region elevated with a low tubercle at summit. Intestinal region with a medial, conical spine, directed upwards and slightly backwards, just above posterior carapace margin.

[25]) Also less tuberculate specimens of *H. trispinosus*, but see fig. 40d.
[26]) Juveniles of some other species may also have a bifid spine on the article.