

# **The Raffles Bulletin of Zoology**

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**An International Journal of Southeast Asian Zoology**

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**THE HYMENOSOMATIDAE  
(CRUSTACEA: DECAPODA: BRACHYURA)  
OF SOUTHEAST ASIA,  
WITH NOTES ON OTHER SPECIES**

**Peter K. L. Ng and Christina T. N. Chuang**

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**THE HYMENOSOMATIDAE  
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SOUTHEAST ASIA, WITH NOTES ON OTHER SPECIES**

**Peter K. L. Ng and Christina T. N. Chuang**

**ABSTRACT.** - The taxonomy of the Southeast Asian Hymenosomatidae is revised. Twenty-four species in 10 genera are now known from Thailand, Vietnam, Singapore, Malaysia and western Indonesia, of which two genera (*Apechocinus* and *Crustaenia*) and eight species (*Amarinus crenulatus*, *A. pumilus*, *Apechocinus streptophallus*, *Elamena magna*, *E. simplidenta*, *E. sundaica*, *Elamenopsis comosa* and *Neorhynchoplax prima*) are described as new. The genus *Elamenopsis* A. Milne Edwards, 1873, is revised and separated into three genera - *Elamenopsis* s. str., *Neorhynchoplax* Sakai, 1938 (previously synonymised under *Elamenopsis*), *Crustaenia*, new genus. The genus *Limnopilos* Chuang & Ng, 1991, is regarded as a junior synonym of *Hymenicoides* Kemp, 1917. The taxonomy of nine species from Madagascar, Africa, Taiwan, China, Japan and Australia is also discussed.

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## INTRODUCTION

False or Crown Spider Crabs of the family Hymenosomatidae are not particularly well studied in Southeast Asia (Singapore, Malaysia [Peninsular Malaysia, Sabah and Sarawak], Philippines, Thailand, western Indonesia [Kalimantan, Sumatra, Sulawesi, Lesser Sunda Islands and Ambon], Cambodia and Vietnam). Up to 1991, only 12 species have been reported from this region, viz. *Amarinus wolterecki* (Balss, 1934), *Cancrocaeca xenomorpha* Ng, 1991, *Elamenopsis lineata* A. Milne Edwards, 1873, *E. exigua* (Kemp, 1917), *E. mangalis* Ng, 1988, *E. palawanensis* (Serène, 1971), *Elamena globosa* Chuang & Ng, 1991, *E. mendosa* Chuang & Ng, 1991, *E. truncata* (Stimpson, 1858), *Halicarcinus coralicola* (Rathbun, 1909), *Limnopilos naiyanetri* Chuang & Ng, 1991, and *Trigonoplax unguiformis* (de Haan, 1839) (fide Lucas, 1980; Chuang & Ng, 1991; Ng, 1988, 1991). Two new species were subsequently described - *Neorhynchoplax dentata* Ng, 1995, from Sarawak (northern Borneo); and *Hymenicoides microrhynchus* Ng, 1995, from Sabah (eastern Borneo) (Ng, 1995a, b).

The present paper revises the taxonomy of all the species known thus far from Southeast Asia, provides a key to all the genera and species, and notes on their biology and ecology. The genus *Elamenopsis* sensu Lucas, 1980, is revised and split into three genera, namely, *Elamenopsis* A. Milne Edwards, 1873, s. str., *Crustaenia*, new genus, and *Neorhynchoplax* Sakai, 1938, a genus previously synonymised under *Elamenopsis*. *Limnopilos* Chuang & Ng, 1991, is synonymised with *Hymenicoides* Kemp, 1917. A new genus, *Apechocinus* and

eight species are described. A total of 24 species in 10 genera are now recognised, viz. *Amarinus crenulatus*, new species, *A. pumilus*, new species, *A. wolterecki* (Balss, 1934), *Apechocinus streptophallus*, new species, *Cancrocaeca xenomorpha* Ng, 1991, *Crustaenia palawanensis* (Serène, 1971), *Elamena cristatipes* Gravely, 1927, *E. globosa* Chuang & Ng, 1991, *E. magna*, new species, *E. mendosa* Chuang & Ng, 1991, *E. simplidentata*, new species, *E. sundaica*, new species, *E. truncata* (Stimpson, 1858), *Elamenopsis lineatus* A. Milne Edwards, 1873, *E. comosa*, new species, *Halicarcinus coralicola* (Rathbun, 1909), *H. filholi* (De Man, 1887), *Hymenocoides microrhynchus* Ng, 1995, *H. naiyanetri* (Chuang & Ng, 1991), *Neorhynchoplax exigua* (Kemp, 1917), *N. dentata* Ng, 1995, *N. mangalis* (Ng, 1988), *N. prima*, new species, and *Trigonoplax unguiformis* (de Haan, 1839).

## MATERIALS AND METHODS

Specimens examined are contained in the Zoological Reference Collection (ZRC), School of Biological Sciences, National University of Singapore; Zoological Reference Collection of the Chulalongkorn University (CUMZ), Bangkok, Thailand; Muséum national d'Histoire naturelle, Paris (MNHN), France; Rijksmuseum van Natuurlijke Historie (RMNH), Leiden, The Netherlands; Queensland Museum (QM), Brisbane, Queensland, Australia; Zoological Museum, University of Amsterdam (ZMA), The Netherlands; National Science Museum, Tokyo (NSMT), Japan; and the Sabah Museum (SBM), Kota Kinabalu, Sabah, Malaysia.

Measurements provided are of the carapace width and length respectively. The length of carapace was measured along the median line from the posterior margin to the tip of the rostrum. The width of the carapace was measured at its widest part which is usually across the branchial region. Lengths of the ambulatory leg segments were measured along the upper margins. The palm of the cheliped was measured along the dorsal edge, from the point of articulation with the carpus to that of the dactylus. Lengths of palp (dactylus, propodus and carpus) and exopod of the third maxilliped were measured along their outer margins. The abbreviations G1 and G2 are used for the male first and second gonopods respectively. The species are treated in alphabetical order. The terms used basically follow those used by Melrose (1975) and Lucas (1980). The terms 'circular', 'subcircular' and 'laterally flattened' are as shown in Figs. 1F-H.

## KEY TO GENERA AND SPECIES OF SOUTHEAST ASIAN HYMENOSOMATIDAE

1. Eyes, eyestalks absent; carapace circular; cave dwelling, freshwater species .....  
     ..... *Cancrocaeca xenomorpha* (Sulawesi)
- Eyes, eyestalks present; carapace otherwise; free-living, marine, estuarine or freshwater species ..... 2
2. Third maxillipeds narrow, not covering three-quarters of mouthfield ..... 3
- Third maxillipeds broad, covering three-quarters of mouthfield ..... 11
3. Rostrum present; dactylus of third maxillipeds not more than twice the length of propodus .... 4
- Rostrum vestigial or absent; dactylus of third maxillipeds at least twice length of propodus ....  
     ..... *Hymenocoides* ... 4
4. Rostrum completely absent ..... *H. naiyanetri* (Thailand)
- Rostrum vestigial, present only as a very small but discernible knob .....  
     ..... *H. microrhynchus* (Sabah)

5. Rostrum always unilobed; carapace laterally oval; ambulatory legs short, ambulatory dactylus without subterminal teeth ..... *Elamenopsis* .. 6
- Rostrum trilobed in known Southeast Asian species (unilobed in a few species); carapace longitudinally oval; ambulatory legs long, ambulatory dactylus with at least 2 subterminal teeth ..... 7
6. Male abdominal segments 4 and 5 fused; G1 slender, distal parts gently tapering from stouter proximal part ..... *E. lineata* (Sulawesi, Australia, New Caledonia)
- Male abdominal segments 4 and 5 free; G1 stout, distal part distinctly stouter than more slender proximal part ..... *E. comosa* (Ambon)
7. Ambulatory legs broad, strongly laterally flattened, ribbon-like; pair of posterior lobes present on first abdominal segment; male abdominal segments 2-6 fused, with remnants of a suture between segments 5 and telson ..... *Crustaenia palawanensis* (Philippines, Singapore)
- Ambulatory legs slender, not distinctly flattened laterally, rod-like; no lobes on posterior margin of abdominal segment 1; male abdominal segments 3 and 4 fused, 3-5 or 4-5 fused ..... *Neorhynchoplax* ... 8
8. Ambulatory dactylus with a row of 8 or 9 teeth; no spine on posterolateral margin; postocular tooth conspicuous; male abdominal segments 3-5 fused ..... *N. exigua* (Thailand)
- Ambulatory dactylus dentition otherwise; posterolateral spine just above coxa of first ambulatory leg; fusion of male abdominal segments otherwise ..... 9
9. Anterolateral edge of carapace unarmed; ambulatory dactylus with a row of about 5 teeth; male abdominal segments 3 and 4 fused in smaller specimens, segments 3-5 fused in larger specimens ..... *N. mangalis* (Singapore, Peninsular Malaysia)
- Anterolateral margin of carapace armed with 2 or 3 teeth; ambulatory dactylus with up to 8-9 teeth; male abdominal segments 3-5 fused ..... 10
10. Anterolateral margin with 3 teeth (one low) (including postocular tooth); G1 stout, distal part distinctly bent outwards ..... *N. prima* (Bintan, Banka)
- Anterolateral margin with 4 teeth (including postocular tooth); G1 slender, distal part curved gently outwards ..... *N. dentata* (Sarawak)
11. Rostrum unilobed; grooves on carapace delineated only at the centre not reaching to lateral margins, or if so, not well demarcated or shallow; ambulatory dactylus with 1-3 subterminal teeth .... 12
- Rostrum trilobed; grooves on carapace well delineated, deep, reaching or almost reaching to lateral margins; ambulatory dactylus with 1 subterminal tooth or more than 3 subterminal teeth ..... 23
12. Distinct groove or ridge separating rostrum from dorsal surface of carapace; intercalated plates present at articulation of male segment 5 and telson (or not known) ..... 13
- No groove or ridge separating rostrum from dorsal surface of carapace; intercalated plates not present at articulation of male segment 5 and telson ..... 16
13. Male abdominal condition not known; G1 very slender, medially twisted ..... *Apechocinus streptophallus* (Indonesia)
- Intercalated plates present at articulation of male segment 5 and telson; G1 very short and very stout; not twisted or bent ..... *Amarinus* ... 14
14. Carpace margin with about 10 small teeth ..... *A. wolterecki* (Mindanao)
- Carpace margin unarmed ..... 15
15. Carapace longer than broad; lateral edge of rostrum sloping ..... *A. pumilus* (Luzon)
- Carapace not longer than broad; lateral edge of rostrum vertical ..... *A. crenulatus* (Sulawesi)
16. Milne Edwards' apertures fused laterally for more than half their length; carapace (including rostrum) distinctly triangular ..... *Trigonoplax unguiformis* (Ambon, Japan, eastern Indian Ocean)

- Milne Edwards' apertures not fused for more than half their length; carapace otherwise ..... *Elamena* ... 17
- 17. Rostrum truncated; ventral keel forming a distinct T-shape, with rostrum rim in anterior view . ..... 18
- Rostrum triangular or rounded; ventral keel absent or not forming a distinct T-shape, with rostrum rim in anterior view ..... 20
- 18. Distal part of ambulatory dactylus with only one sharply recurved subterminal tooth; anterolateral angle not obvious ..... *E. simplidenta* (Moluccas)
- Distal part of ambulatory dactylus with 2 subterminal teeth; anterolateral angle well defined to not obvious ..... 19
- 19. Anterolateral margin with 2 distinct, well developed angles; rostral and frontal regions projecting slightly forwards tip of G1 curves gently downwards ..... *E. sundaica* (Lesser Sunda Islands)
- Anterolateral angles not prominent, rounded; rostral and frontal regions distinctly projecting forwards ..... *E. ? truncata* (Lesser Sunda Islands, Indonesia, Vietnam)
- 20. Rostrum rounded; ambulatory dactylus with a sharply recurved subterminal tooth, propodus broad, with dorsal edge highly compressed (cristiform); G1 with 3 subterminal setae ..... *E. cristatipes* (India, Peninsular Malaysia)
- Rostrum triangular; ambulatory dactylus with at least 2 subterminal teeth, propodus slender; G1 with 6 or more subterminal setae or without subterminal setae ..... 21
- 21. Carapace surface distinctly convex, inflated; grooves faint; ambulatory dactylus with 3 recurved subterminal teeth; male abdomen with segments 3 and 4 fused; G1 without subterminal setae, tip rounded ..... *E. globosa* (Singapore)
- Carapace surface flat, grooves absent or undiscernible; ambulatory dactylus with 2 subterminal teeth; male abdomen with all segments free ..... 22
- 22. Lateral margins of rostrum sloping; pterygostomial regions not distinctly raised; male abdomen triangular; G1 relatively stout, gently sinuous ..... *E. mendosa* (Singapore)
- Lateral margins of rostrum straight, subparallel; pterygostomial regions strongly raised; male abdomen broadly triangular; G1 slender, strongly sinuous ..... *E. magna* (Thailand)
- 23. Eyes visible from dorsal view; distinct groove separating rostrum from dorsal surface of carapace; ambulatory dactylus with a row of at least 4 small teeth ..... *H. coralicola* (Singapore, Peninsular Malaysia, Thailand, Japan)
- Eyes not visible from dorsal view; no groove separating rostrum from dorsal surface of carapace; ambulatory dactylus with one subterminal tooth only ..... *H. filholi* (Java)

## TAXONOMY

### HYMENOSOMATIDAE MACLEAY, 1838

Hymenosomidae Macleay, 1838: 68; Alcock, 1900: 285, 291; Borradaile, 1907: 480; Rathbun, 1925: 561; Sakai, 1938: 193; Garth, 1958: 30.

Hymenicinae Dana, 1851: 290.

Hymenosomatidae - Stebbing, 1905: 49; Barnard, 1950: 66; Balss, 1957: 1632; Holthuis, 1968: 109; Melrose, 1975: 7; Lucas, 1980: 148.

**Remarks.** - The peculiar abdominal condition unique to this family. The basic abdominal pattern of brachyuran crabs is six segments and a telson. Hymenosomatid crabs possess only five abdominal segments and a telson.

Table 1. List of the World Species of Hymenosomatidae

<i>Amarinus angelicus</i> (Holthuis, 1968)	Papua-New Guinea
<i>Amarinus crenulatus</i> , new species	Sulawesi
<i>Amarinus lacustris</i> (Chilton, 1882)	S.E. Australasia
<i>Amarinus laevis</i> (Targioni-Tozzetti, 1877)	southern Australia
<i>Amarinus latinasus</i> Lucas 1980	N.E. Australia
<i>Amarinus lutarius</i> Lucas & Davie, 1982	Queensland, Australia
<i>Amarinus paralacustris</i> (Lucas, 1970)	eastern Australia
<i>Amarinus pumilus</i> , new species	Luzon, Philippines
<i>Amarinus wolterecki</i> (Balss, 1934)	Mindanao, Philippines
<i>Apechocinus streptophallus</i> , new species	Indonesia
<i>Cancrocaeca xenomorpha</i> Ng, 1991	Sulawesi
<i>Crustaenia palawanensis</i> (Serène, 1971)	Palawan Is., Singapore
<i>Elamena abrohlensis</i> Gordon, 1940	southern Australia
<i>Elamena cimex</i> Kemp, 1915	Chilka Lake, India; Madagascar
<i>Elamena cristatipes</i> Gravely, 1927	India
<i>Elamena globosa</i> Chuang & Ng, 1991	Singapore
<i>Elamena gordonae</i> Monod, 1956	W. Africa; N.E. Australia
<i>Elamena gracilis</i> Borradaile, 1903	Maldive Archipelago
<i>Elamena longistrostris</i> Filhol, 1885	New Zealand
<i>Elamena magna</i> , new species	Thailand
<i>Elamena mathaei</i> (Demarest, 1825)	Red Sea; S.E. Africa;
<i>Elamena mendosa</i> (Chuang & Ng, 1991)	Singapore
<i>Elamena momona</i> Melrose, 1975	New Zealand
<i>Elamena producta</i> Kirk, 1879	New Zealand
<i>Elamena simplidentata</i> , new species	Lesser Sunda Islands
<i>Elamena sindensis</i> Alcock, 1900	India; Sri Lanka
<i>Elamena sundaica</i> , new species	Lesser Sunda Islands
<i>Elamena truncata</i> (Stimpson, 1858)	Indo-west Pacific
<i>Elamena umerata</i> Lucas, 1980	northern Australia
<i>Elamena vesca</i> Ng & Richer de Forges, 1996	New Caledonia
<i>Elamena xavieri</i> Kemp, 1917	Mandavi R., India
<i>Elamenopsis ariakensis</i> (Sakai, 1969)	Nagasaki Prefecture, Japan
<i>Elamenopsis comosa</i> , new species	Ambon
<i>Elamenopsis lineata</i> A. Milne Edwards, 1873	New Caledonia; Australia; Philippines;
	Sulawesi
<i>Halicarcinides nuytsi</i> Hale, 1927	South Australia
<i>Halicarcinus bedfordi</i> Montgomery, 1931	northern Australia
<i>Halicarcinus cookii</i> (Filhol, 1885b)	New Zealand
<i>Halicarcinus coralicola</i> (Rathbun, 1909)	Singapore, Thailand, Japan, Taiwan
<i>Halicarcinus hondai</i> (Takeda & Miyake, 1971)	Ryukyu Is.; Great Barrier Reef
<i>Halicarcinus innomonatus</i> Richardson, 1949b	New Zealand; Tasmania
<i>Halicarcinus keijibabai</i> (Takeda & Miyake, 1971)	New Caledonia
<i>Halicarcinus lucasi</i> Richer de Forges, 1992	Australia
<i>Halicarcinus messor</i> (Stimpson, 1858)	Japan
<i>Halicarcinus orientalis</i> Sakai, 1932	Japan
<i>Halicarcinus ovatus</i> Stimpson, 1858	southern Australia
<i>Halicarcinus planatus</i> (Fabricius, 1775)	circum-subantarctic
<i>Halicarcinus rostratus</i> (Haswell, 1882a)	southern Australia
<i>Halicarcinus setirostris</i> (Stimpson, 1858)	Japan; China
<i>Halicarcinus tongi</i> Melrose, 1975	New Zealand
<i>Halicarcinus varius</i> (Dana, 1851)	New Zealand
<i>Halicarcinus whitei</i> (Miers, 1876)	New Zealand
<i>Halimena aotearoa</i> Melrose, 1975	New Zealand
<i>Hymenicoides carteri</i> Kemp, 1917	Gangetic Delta, West Bengal, Bangladesh
<i>Hymenicoides microrhynchus</i> Ng, 1995	Sabah, Borneo
<i>Hymenicoides naiyanetri</i> (Chuang & Ng, 1991)	Thailand
<i>Hymenosoma orbiculare</i> Desmarest, 1825	southern Africa, Zanzibar
<i>Hymenosoma depressum</i> Jacquinot, 1853	New Zealand

<i>Hymenosoma hodgkini</i> Lucas, 1980	eastern Australia
<i>Micas afecundus</i> (Lucas, 1980)	northern Australia
<i>Micas falcipes</i> Ng & Richer de Forges, 1996	New Caledonia
<i>Micas minutus</i> (A. Milne Edwards, 1873)	New Caledonia
<i>Neohymenicus pubescens</i> Dana, 1851	New Zealand
<i>Neorhynchoplax alcocki</i> (Kemp, 1917)	West Coast, India
<i>Neorhynchoplax aspinifera</i> (Lucas, 1980)	N. Queensland, Australia
<i>Neorhynchoplax bovis</i> (Barnard, 1946)	South Africa
<i>Neorhynchoplax demeloi</i> (Kemp, 1917)	Goa, India
<i>Neorhynchoplax dentata</i> Ng, 1995	Sarawak, Borneo
<i>Neorhynchoplax euryrostris</i> Davie & Richer de Forges, 1996	New Caledonia
<i>Neorhynchoplax exigua</i> (Kemp, 1917)	Thailand
<i>Neorhynchoplax frontalis</i> (Lucas & Davie, 1982)	Queensland, Australia
<i>Neorhynchoplax hirtirostris</i> (Lucas & Davie, 1982)	Queensland, Australia
<i>Neorhynchoplax inachoides</i> (Alcock, 1900)	West Bengal, India
<i>Neorhynchoplax inermis</i> (Takeda & Miyake, 1971)	Palau Islands
<i>Neorhynchoplax introversa</i> (Kemp, 1917)	Kiangsu Prov., China
<i>Neorhynchoplax kempii</i> (Chopra & Das, 1930)	Basra, Iraq; Panama Canal
<i>Neorhynchoplax mangalis</i> Ng, 1988	Singapore, Peninsular Malaysia
<i>Neorhynchoplax minima</i> (Lucas & Davie, 1982)	Queensland, Australia
<i>Neorhynchoplax nasalis</i> (Kemp, 1917)	West Bengal, India
<i>Neorhynchoplax octagonalis</i> (Kemp, 1917)	Queensland, Australia
<i>Neorhynchoplax okinawaensis</i> (Nakasone & Takeda, 1994)	Japan
<i>Neorhynchoplax prima</i> , new species	Bintan and Banka, Indonesia
<i>Neorhynchoplax sinensis</i> (Shen, 1932)	Shantung Peninsula, China
<i>Neorhynchoplax thorsborneorum</i> (Lucas & Davie, 1982)	Queensland, Australia
<i>Neorhynchoplax torrensica</i> Lucas, 1980	Torres Straits, Australia
<i>Neorhynchoplax tuberculata</i> (Chopra & Das, 1930)	Cochin, Travancore, India; Sri Lanka
<i>Neorhynchoplax woodmasoni</i> (Alcock, 1900)	Andaman Islands; West Bengal, India; Sri Lanka
<i>Odiomaris estuarius</i> Davie & Richer de Forges, 1996	New Caledonia
<i>Odiomaris pilosus</i> (A. Milne Edwards, 1873)	New Caledonia
<i>Trigonoplax longirostris</i> McCulloch, 1908	southern Australia
<i>Trigonoplax spathulifera</i> Lucas, 1980	northern Australia
<i>Trigonoplax unguiformis</i> (de Hann, 1839)	Japan; Ternate; Gulf of Martaban; Andaman Is.; Natal

### *Amarinus* Lucas, 1980

*Halicarcinus* - Balss, 1934: 138 (partim), figs. 3-5; Holthuis, 1968: 109, figs. 1-3 (partim); Hale, 1927: 116 (partim) (nec *Halicarcinus* White, 1846).  
*Amarinus* Lucas, 1980: 198.

**Type species.** - *Elamena* ? *lacustris* Chilton, 1882, by original designation. Gender masculine.

**Remarks.** - *Amarinus* species inhabit fresh or low salinity waters, are pubescent, have a deflexed spade-shaped rostrum, a stout male G1 and an ambulatory dactylus with only a simple subterminal tooth (Lucas, 1980). The presence of the intercalated plates at the articulation of the fifth segment and telson is an unusual feature of the genus. *Hymenosoma hodgkini* Lucas, 1980, also has intercalated plates, but, these are absent in other congeners. In any case, *Hymenosoma* differs from *Amarinus* in many other features (see Lucas, 1980).

Seven species of *Amarinus* are known at present, viz. *A. laevis* (Targioni-Tozzetti, 1877) (southern Australia), *A. lacustris* (Chilton, 1882) (southeast Australasia), *A. wolterecki* (Balss,

1934) (Philippines), *A. angelicus* (Holthuis, 1968) (Papua New Guinea), *A. paralacustris* (Lucas, 1970) (eastern Australia), *A. latinasus* Lucas, 1980 (northeast Australia), and *A. lutarius* Lucas & Davie, 1982 (northern Australia) (Holthuis, 1968; Lucas, 1970, 1980; Lucas & Davie, 1982). Two new species, *A. crenulatus* and *A. pumilus*, are here described from Sulawesi and the Philippines respectively. Ng & Richer de Forges (1996) referred *A. pilosus* (A. Milne Edwards, 1873) to a new genus, *Odiomaris*, with Davie & Richer de Forges (1996) describing a second species from this new genus.

***Amarinus crenulatus*, new species**

(Fig. 1)

**Material examined.** - Holotype - female (4.1 by 4.0 mm) (RMNH), Menado, Sulawesi, no other data.

**Description.** - Female - Carapace flat, subcircular, slightly longer than broad; dorsal surface smooth, with distinct cervical, thoracic and gastrocardiac grooves; cervical and thoracic grooves not reaching antero- and posterolateral margins respectively; anterolateral margin gently crenulated, but without any distinct lobes or teeth. Rostrum unilobed, broad, truncate, surface gently concave, continuous with dorsal surface of carapace. Eyestalks prominent, clearly visible dorsally.

Ischium of third maxilliped longer than merus along outer lateral edge; dense setae on inner lateral edge of both merus and ischium; inner lateral margins meeting when closed; third maxillipeds cover three-quarters of mouth field when closed; palp not longer than merus; exopod much longer than merus

Chelipeds equal, slightly stouter than ambulatory legs; cutting edges of fingers not serrated, blade-like; dactylus and pollex laterally flattened, tips sharp, slightly longer than propodus, gaping slightly proximally when closed.

Ambulatory legs stout, rounded in cross-section except dactylus; dorsal and ventral edges smooth, almost glabrous; dactylus gently curved with a pronounced subterminal tooth; merus and propodus longer than carpus.

Abdomen 6-segmented, all intersegmental sutures distinct, articulating, subcircular in shape, surface highly convex, covers whole of sternum, reaching base of coxa of chelipeds; tip of telson rounded.

**Distribution.** - Known only from the type locality in Menado, Sulawesi.

**Remarks.** - The external morphology of the present specimen from Sulawesi bears a close resemblance to *A. latinasus* Lucas, 1980 and *A. lutarius* Lucas & Davie, 1982 (known only from Australia), especially with regards to the broad rostrum. Although only one specimen is available, we are regarding it as a distinct species from *A. latinasus* and *A. lutarius* because its carapace is more oval in shape (vs. round) (carapace width to length ratio ca. 1.0 vs. 0.9), the anterolateral margins are gently crenulate (vs. gently convex to almost straight) and the ambulatory dactylus is proportionately shorter. Hopefully, when the G1 (which is an important character for this genus) becomes available, it will confirm these observed differences.

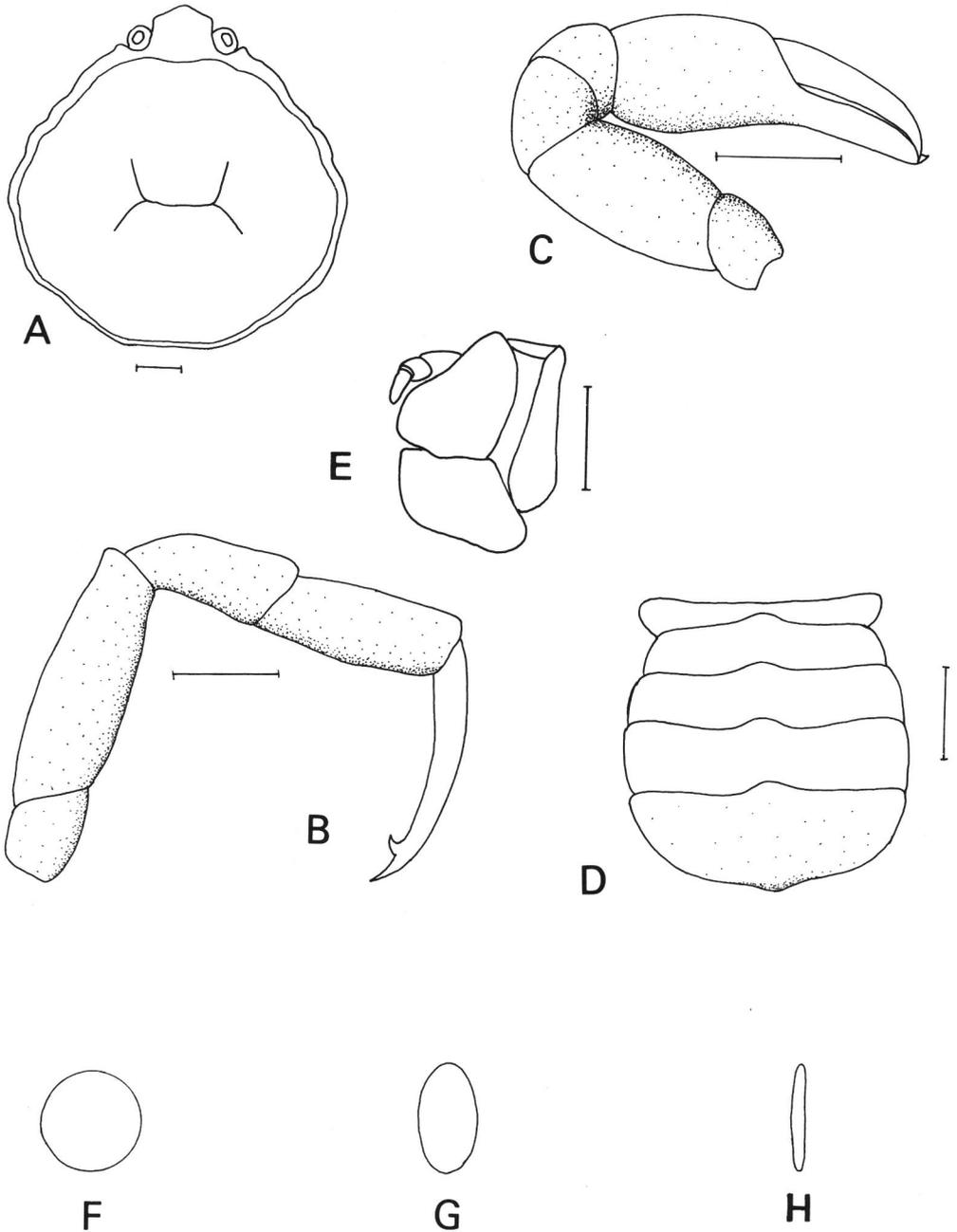


Fig. 1. *Amarinus crenulatus*, new species. A-E, holotype male (4.1 by 4.0 mm) (RMNH), Sulawesi; F-H, cross-sections of ambulatory meri. A, dorsal view of carapace; B, third ambulatory leg; C, female left cheliped; D, female abdomen, segments 2-6; E, left third maxilliped; F, circular; G, subcircular; H, laterally flattened. Scales = 0.5 mm.

*Amarinus pumilus*, new species

(Fig. 2)

**Material examined.** - Holotype - male (4.1 by 4.3 mm) (RMNH), Bicol River estuary of Balongay, Calabanga, ca. 12.5 km northwest of Naga City, Camarines Sur Province, Luzon, Philippines, coll. B. Gindelberger, 7 Jun. 1981.

Paratypes - 1 male (4.1 by 4.9 mm), 2 females (5.7 by 5.9 mm, 5.9 by 6.0 mm) (ZRC 1994.4240-4241), 2 females (5.4 by 5.8 mm, 5.3 by 5.4 mm) (RMNH), same data as holotype.

**Etymology.** - The species is named with reference to the small size as compared to other *Amarinus* species.

**Description.** - Male - Carapace flat, circular, surrounded by a distinct rim which is not disrupted at base of rostrum; dorsal surface smooth with distinct cervical, thoracic and gastroduodenal grooves; cervical and thoracic grooves approaching but never reaching anterolateral and posterolateral margins respectively, thoracic grooves shorter than cervical grooves; margin entire without tooth or spine; postocular lobes fused with base of rostrum. Rostrum unilobed, surface concave, not continuous with dorsal surface of carapace. Eyestalk prominent, distinctly visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; dense setae on inner lateral edge of both merus and ischium; inner lateral margins meeting when closed; palp not longer than merus; medial groove running down half length of merus, with sparse marginal setae on outer distal half; exopod, much longer than merus, with fine long setae lining one-third of inner margin and shorter setae lining two-thirds of outer margin.

Chelipeds equal, stouter than ambulatory legs; outer surface pubescent; fingers with cutting edges slightly serrated with minute teeth, a tooth on distal portion of dactylus, blade-like; dactylus and pollex laterally flattened, curved posteriorly, tips sharp, slightly longer than propodus, gaping proximally when closed.

Ambulatory legs stout, rounded in cross-section, dactylus not laterally flattened; dorsal and ventral edges lined with sparse long plumose setae; dactylus relatively straight with tip sharply hooked and a recurved subterminal tooth, ventral edge more densely lined with long and short setae; merus longer than carpus and propodus which are subequal in length, dactylus slightly longer than propodus.

Abdomen 6-segmented, triangular; segment 1 widest, lateral edge extends outwards into lobe; proximal half of lateral margin of telson concave, distal half of lateral margin convex; surface slightly convex; all intersegmental sutures distinct, articulating; lateral edge of segment 2 convex, segments 3-5 straight; pair of intercalated plates occupying half length of telson, at articulation of segments 5 and 6, each occupying one-third width of telson.

G1 stout, curving at base, tapering slightly along length, then tapering more abruptly to simple tip, bilobed, one terminal, other subterminal; subterminal setae on subterminal lobe of sternal side, row of setae on abdominal side.

Female. - Non-sexual features essentially similar to male. Chelipeds similar to that in males except more slender, cutting edges of dactylus and pollex only serrated at distal half

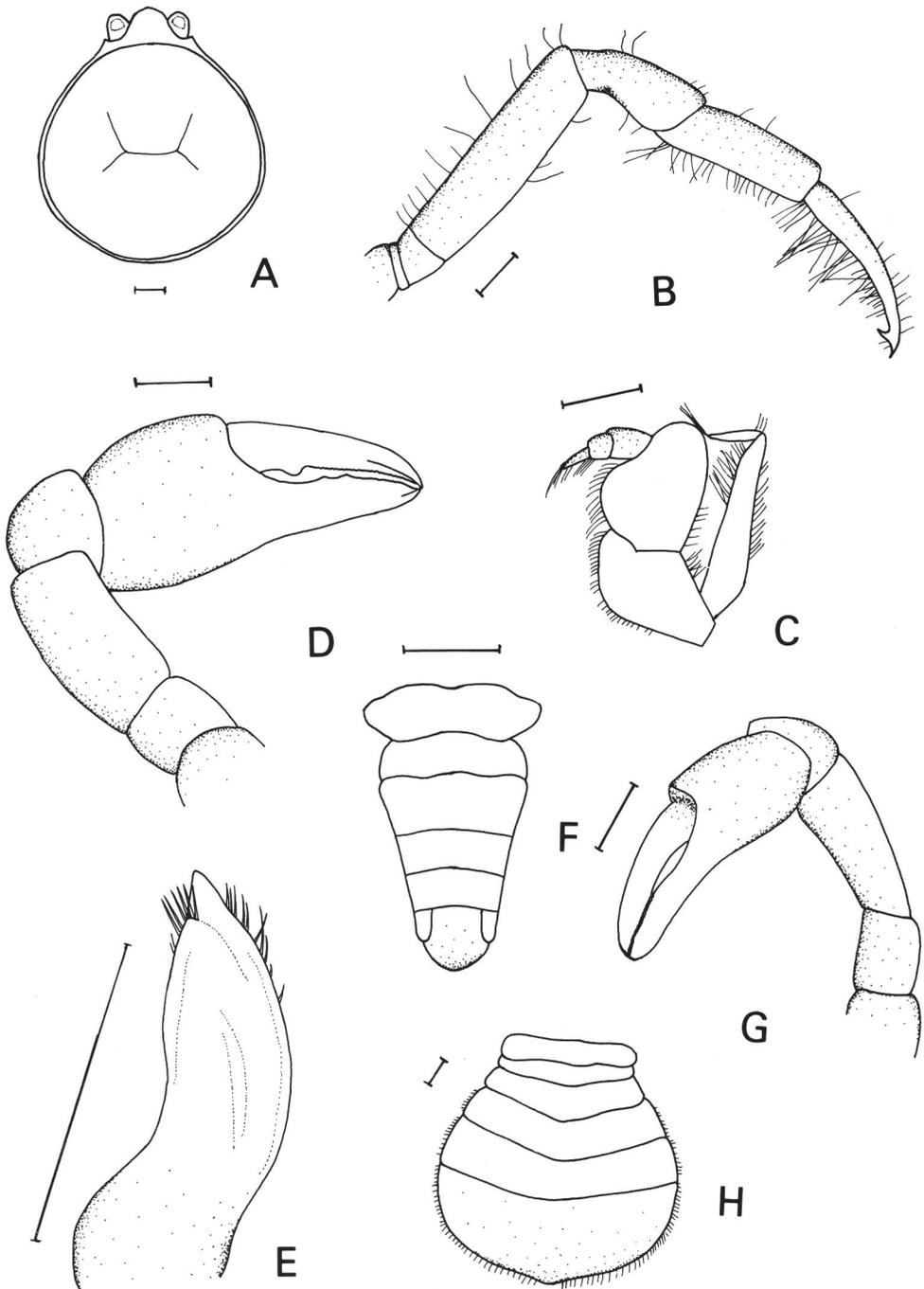


Fig. 2. *Amarinus pumilus*, new species. A-F, holotype male (4.1 by 4.3 mm) (RMNH); G, H, paratype female (5.5 by 5.6 mm) (RMNH); Luzon. A, dorsal view of carapace; B, third ambulatory leg; C, left third maxilliped; D, male left cheliped; E, left G1; F, male abdomen; G, female left cheliped; H, female abdomen. Scales = 0.5 mm.

and without any large tooth. Abdomen 6-segmented, all intersegmental sutures distinct, articulating; circular in shape, surface highly convex, covers whole of sternum, reaching base of coxa of chelipeds; segment six broadest and longest, tip rounded, not sharp.

**Distribution.** - Known only from the type locality in Luzon, Philippines.

**Remarks.** - Within the genus *Amarinus*, *A. lacustris*, *A. paralacustris*, *A. latinasus* and *A. lutarius*, easily form a group with rather similar external morphologies. These species however, can be easily distinguished by their GIs and male abdomens. In the case of *A. lacustris* and *A. paralacustris*, which have very similar external morphologies, they can only be separated by their reproductive apparatus and mechanisms (see Lucas, 1980). *Amarinus pumilus*, although bearing a general resemblance to the above species, can be separated by several significant differences. The fusion of the postocular tooth with the rostrum allies *A. pumilus* with *A. latinasus* and *A. lutarius*. However, the GI in *A. lutarius* has a terminal crest while that in *A. latinasus* is unilobed. The lateral edge of the rostrum in *A. pumilus* is also sloping rather than vertical.

The GI of *A. pumilus* differs significantly from those of *A. lacustris* and *A. paralacustris*. Compared to *A. pumilus*, the GIs of *A. lacustris* and *A. paralacustris* are less curved, more setose and the tips are blunt and closer to the subterminal lobes. The holotype of *A. pumilus* was compared with Australian specimens of *A. lacustris* (see section on non-Southeast Asian material, and Lucas, 1980; Lucas & Davie, 1982). Mature *A. lacustris* are also three times the size of the mature holotype male of *A. pumilus*. The prominent anterolateral angles present in males of *A. lacustris* and *A. paralacustris* are absent in males of *A. pumilus*. The rostrum of *A. pumilus* also has a much rounder apex and the lateral edges are more sloped.

### ***Amarinus wolterecki* (Balss, 1934)**

(Fig. 3)

*Halicarcinus wolterecki* Balss, 1934: 138, figs. 3-5; Woltereck, 1941: 140; Holthuis, 1968: 109.  
*Amarinus wolterecki* - Lucas, 1980: 198; Chuang & Ng, 1994: 86, 87.

**Material examined.** - PHILIPPINES: 1 male (6.1 by 5.6 mm), 1 female (6.9 by 6.5 mm) (ZRC), Lake Manit at San Roque, Mindanao, coll. M. Takeda, 24 Jul.1985.

**Description.** - Male - Carapace flat, circular, slightly longer than broad, surrounded by a distinct rim which is not interrupted at base of rostrum; dorsal surface smooth with distinct cervical, thoracic and gastrocardiac grooves; cervical and thoracic grooves approaching but not reaching antero- and posterolateral margins respectively; 10 teeth of unequal sizes projecting from margin on both sides immediately behind eye and ending approximately in the middle of posterolateral border. Rostrum unilobed, surface concave, not continuous with dorsal surface of carapace. Eyestalks prominent, clearly visible dorsally.

Ischium of third maxilliped shorter than merus along outer lateral edge; dense setae on inner lateral edge of both merus and ischium; inner lateral margins meeting when closed; third maxillipeds cover three-quarters of mouth field when closed; palp not longer than merus; medial groove running down half length of merus, with 4 setae on outer margin; exopod much longer than merus, with fine setae lining one-third of inner margin and two-thirds of outer margin.

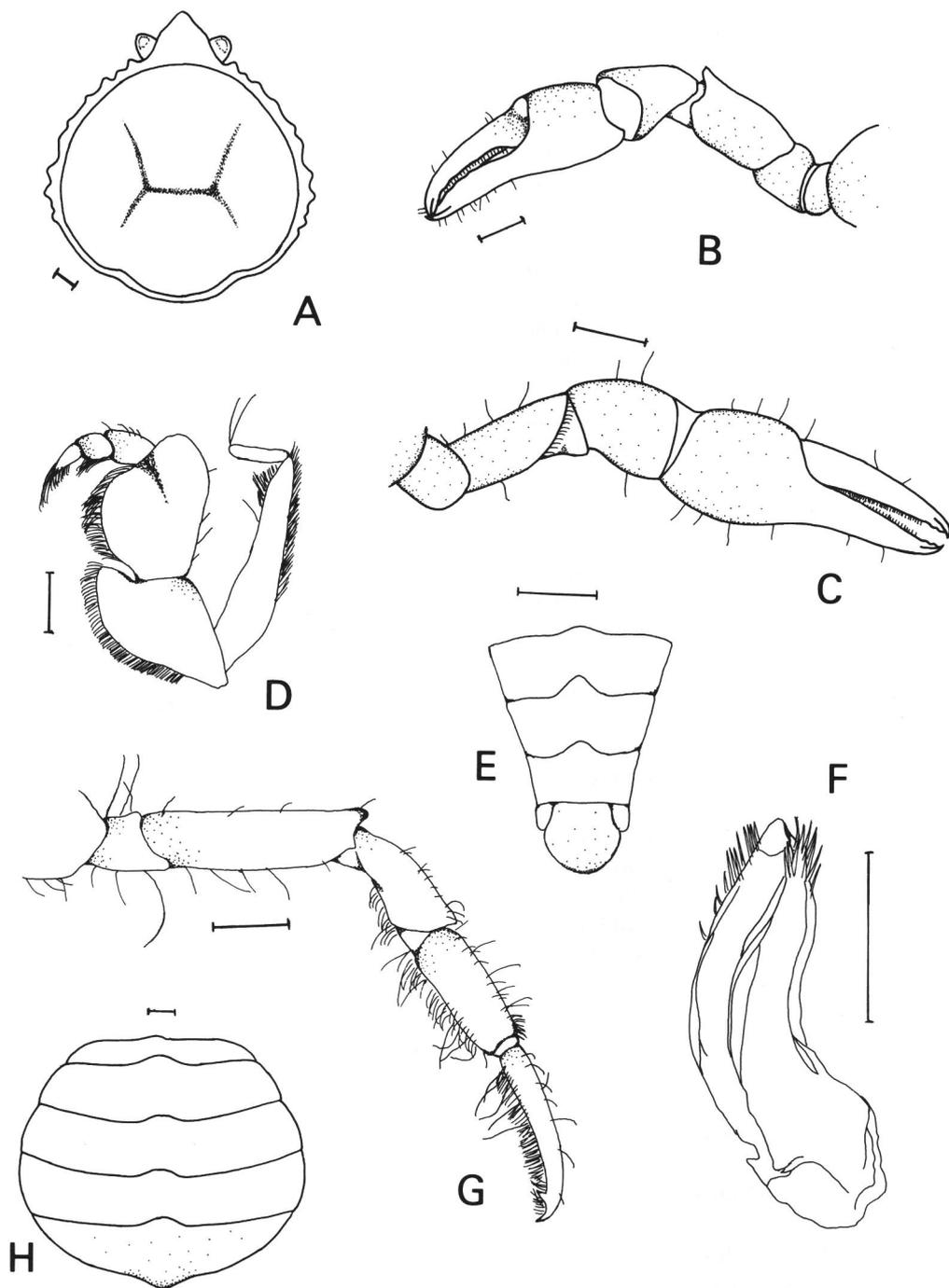


Fig. 3. *Amarinus wolterecki*. A-G, male (6.1 by 5.6 mm) (ZRC); H, female (6.9 by 6.5 mm) (ZRC); Mindanao. A, dorsal view of carapace; B, male right cheliped; C, female right cheliped; D, left third maxilliped; E, male abdomen, segments 3-6; F, left G1; G, third ambulatory leg; H, female abdomen, segments 2-6. Scales = 0.5 mm.

Chelipeds equal, slightly stouter than ambulatory legs; surfaces pubescent, with sparse setae only on outer edges of fingers; fine setae lining inner edges of fingers; cutting edges of fingers slightly serrated, blade-like; dactylus and pollex laterally flattened, curved posteriorly, tips sharp, slightly longer than propodus, gaping proximally when closed.

Ambulatory legs stout, rounded in cross-section except dactylus; dorsal and ventral edges lined with sparse long setae; ventral edge with relatively denser short setae; dactylus straight with tip sharply hooked and a subterminal tooth; merus longer than carpus and propodus, which are subequal in length.

Abdomen 6-segmented, triangular; proximal half of lateral margin of telson (segment 6) concave; distal half of lateral margin convex; surface slightly convex; all intersegmental sutures distinct, articulating; pair of intercalated plates occupying one-third total length of telson, at articulation of the segment 5 and telson.

G1 stout, straight, curving slightly at base, tapering, then more abruptly to a simple tip; subterminal tuft of setae on dorsal and ventral surfaces; edges with well defined twisted folds.

Female - Alike in non-sexual features. Chelipeds similar to that in males except cutting edges of dactylus and pollex only serrated at distal portion. Abdomen 6-segmented, all intersegmental sutures distinct, articulating, circular in shape, surface highly convex, covering whole of sternum, reaching base of coxa of chelipeds; tip of telson rounded.

**Distribution.** - Known only from the type locality in Mindanao, Philippines.

**Remarks.** - The present specimens enable a redescription of the species to be made, supplementing Balss' (1934) original text. The specimens examined were collected from the type locality. So far, the species is only known from this locality. The external features as well as the structure of the G1 (which described here for the first time) conform with the generic definition of *Amarinus*. *Amarinus wolterecki* differs from all other congeners in having conspicuous teeth on the carapace rim, with the rostrum continuous with the dorsal surface of the carapace. The folds on G1 are unusual and have not been recorded before for any known *Amarinus* species. Like most members of its genus, *A. wolterecki* is a wholly freshwater species.

### ***Apechocinus*, new genus**

**Type species.** - *Apechocinus streptophallus*, new species, by present designation.

**Diagnosis.** - Carapace rounded, only median grooves visible. Rostrum unilobed, clearly separated from rest of carapace by groove. Third maxillipeds quadrate, covering more than three-quarters mouthfield. Ambulatory legs slender, long. Chelipeds elongate, stocky. G1 sinuous, slender, strongly twisted medially.

**Etymology.** - The name is derived from the Greek "apeches" for discordant, in arbitrary combination with the genus name *Haliscarcinus*. Gender masculine.

**Remarks.** - The establishment of a new monotypic genus for *Apechocinus streptophallus*, new species, is necessary as it cannot be accommodated in any known genus. Externally, the carapace resembles many species of *Amarinus*, particularly in having the rostrum clearly separated from the rest of the carapace by a distinct groove, with the grooves present only on the median part of the carapace and the dactylus of the ambulatory leg with only a subterminal tooth. The G1s of all known members of *Amarinus* however, are very stout, very unlike the very slender, sinuous and medially twisted G1 of *Apechocinus streptophallus*.

The G1 of *A. streptophallus* is very unusual, being twisted medially, more strongly than that known from any hymenosomatid. In this respect, *A. streptophallus* resembles members of the *Elamena truncata* group of species (e.g. *E. truncata*, *E. mathaei*, *E. gracilis*, *E. sundaica*, *E. vesca*), but the G1s in none of these species are as strongly twisted. The carapaces of *A. streptophallus* and the *Elamena truncata* species group, however, are very different.

The ambulatory legs of *A. streptophallus* are very long and slender, quite unlike the proportionately shorter and stouter legs of known *Amarinus* species. The male chelae of *A. streptophallus* is somewhat stronger than that for *Amarinus* species, and resembles those of many *Elamena* or *Halicarcinus* species.

***Apechocinus streptophallus*, new species**

(Fig. 4)

*Elamena sindensis* - Yang, 1979: 12 (part) (not *Elamena sindensis* Alcock, 1900).

**Material examined.** - Holotype - male (2.0 by 2.4 mm) (ZRC 1969.11.21.1), "Djalandhi", Indonesia, coll. R. Serène, 17 Nov. 1964.

**Description.** - Male - Carapace almost flat, triangular, surrounded by a narrow rim which is not interrupted at base of rostrum; dorsal surface smooth with distinct cervical, thoracic and gastrocardiac grooves; cervical and thoracic grooves not reaching antero- and posterolateral margins respectively; anterolateral margin with one broad, low lobe, with margin appearing sinuous; pterygostomial region swollen, visible dorsally. Rostrum unilobed, slightly upturned, dorsal surface gently concave, not continuous with dorsal surface of carapace. Eyestalks prominent, clearly visible dorsally.

Ischium of third maxilliped slightly shorter than merus along outer lateral edge; inner lateral margins meeting when closed; third maxillipeds cover three-quarters of mouth field when closed; palp subequal in length to merus; exopod much longer than merus.

Chelipeds equal, relatively elongate, stouter than ambulatory legs; chela relatively swollen; cutting edges of fingers with submedian tooth on dactylus, fingers gaping slightly proximally when closed.

Ambulatory legs long, slender, rounded in cross-section except dactylus; dorsal and ventral edges lined with long setae; ventral edge with relatively denser short setae; distal part of dactylus not known (only two legs present, both with the tips broken off); merus longer than carpus, shorter than elongate propodus.

Abdomen missing.

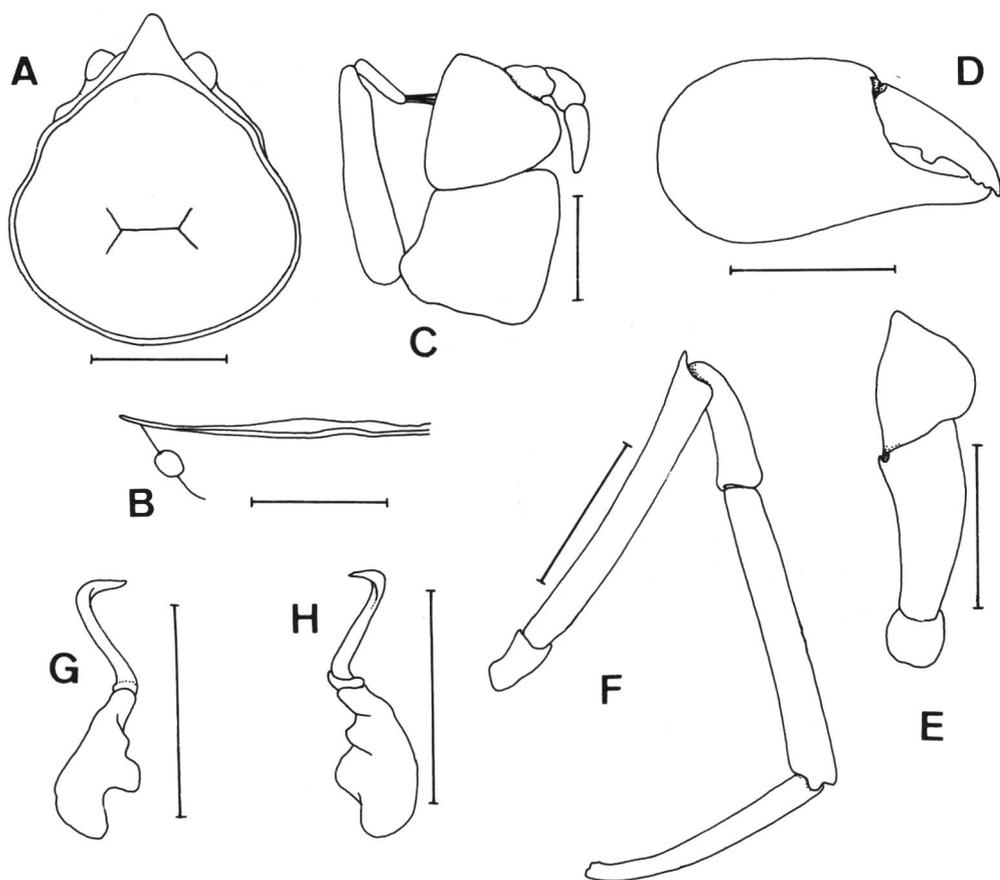


Fig. 4. *Apechocinus streptophallus*, new species. Holotype male (2.0 by 2.4 mm) (ZRC 1969.11.21.1), Indonesia. A, dorsal view of carapace; B, lateral view of carapace showing upturned rostrum; C, left third maxilliped; D, right chela; E, right chelipedal ischium, carpus and merus; F, first right ambulatory leg; G, H, left G1. Scales: A, B, D-F = 1.0 mm; C, G, H = 0.5 mm.

G1 sinuous, slender; tip tapering to sharp point; distal part bent sharply outwards, lined with very short setae; median part strongly twisted.

**Etymology.** - The name is derived from the Greek for twisted and phallus, alluding to the twisted G1 of this species. Used as a noun in apposition.

**Remarks.** - There was no detailed locality data associated with the type specimen, and it is also not known from what habitat it was collected from. The locality "Djalandhi" was typed on the label, but its precise location could not be determined, and may have been a misspelling on the label. There are specimens of *Cryptopodia angulata* and *C. fornicata* (Parthenopidae) from this same Indonesian locality. The male abdomen of *Apechocinus streptophallus* was missing.

*Cancrocaeca* Ng, 1991

*Cancrocaeca* Ng, 1991: 59.

**Type species.** - *Cancrocaeca xenomorpha* Ng, 1991, by original designation. Gender of genus feminine.

**Remarks.** - This genus has only one known species, *Cancrocaeca xenomorpha* Ng, 1991. The unique features are the total absence of eyes and rostrum, very long ambulatory legs, and the stout GI which has three main processes on the distal part. The species is also an obligate cave dweller, the only hymenosomatid known to do so. The affinities of this genus have been discussed by Ng (1991). The closest relatives of *Cancrocaeca* are probably *Hymenicoides* and *Neorhynchoplax* (previously synonymised under *Elamenopsis*), with members of all three taxa possessing narrow maxillipeds, distinct carapace grooves and long, slender legs.

*Cancrocaeca xenomorpha* Ng, 1991  
(Fig. 5)

*Cancrocaeca xenomorpha* Ng, 1991: 59, Figs. 1-7; Chuang & Ng, 1994: 86, 87.

**Material examined.** - Holotype - male (4.1 by 4.7 mm) (ZRC 1990.11971), Lubang Batu Neraka, Kappang, Maros, Sulawesi, Indonesia, coll. P. Leclerc, 4 Aug. 1990.

Paratypes - 1 male (3.9 by 4.6 mm) (MNHN-B 24450); 1 female (ovigerous with ca. 30 eggs) (5.6 by 6.2 mm); 1 female (ovigerous with 23 eggs) (4.9 by 5.7 mm) (ZRC 1990.11973); 1 young female (4.5 by 5.3 mm) (MNHN-B 24450), same data as holotype. — 1 male (3.6 by 4.0 mm) (ZRC 1990.484), Gua Tanette, Kappang, Maros, Sulawesi, Indonesia, coll. P. Leclerc, 18 Jul. 1989.

**Distribution.** - Known only from the type locality in Sulawesi, Indonesia.

**Remarks.** - *Cancrocaeca xenomorpha* is the only blind and completely troglobitic hymenosomatid known. Ng (1991) gave a detailed description and discussion for the species, and there is no necessity to elaborate further here.

*Crustaenia*, new genus

**Type species.** - *Neorhynchoplax palawanensis* Serène, 1971, by present designation.

**Diagnosis.** - Rostrum trilobate; each lobe elliptical, lined with dense, hook-shaped setae. Ambulatory legs strongly flattened laterally, ribbon-like. A distinct pair of lobes on segment one of both male and female abdomens; segments 3-5 and telson of male abdomen fused, with remnants of suture between segment 5 and telson visible; segments 2-5 of female abdomen fused with no distinct sutures. Females with brood cavities.

**Etymology.** - The genus name *Crustaenia* is a combination of two Latin words, 'crus' meaning leg and 'taenia' meaning ribbon, with reference to the flat, ribbon-like ambulatory legs. Gender feminine.

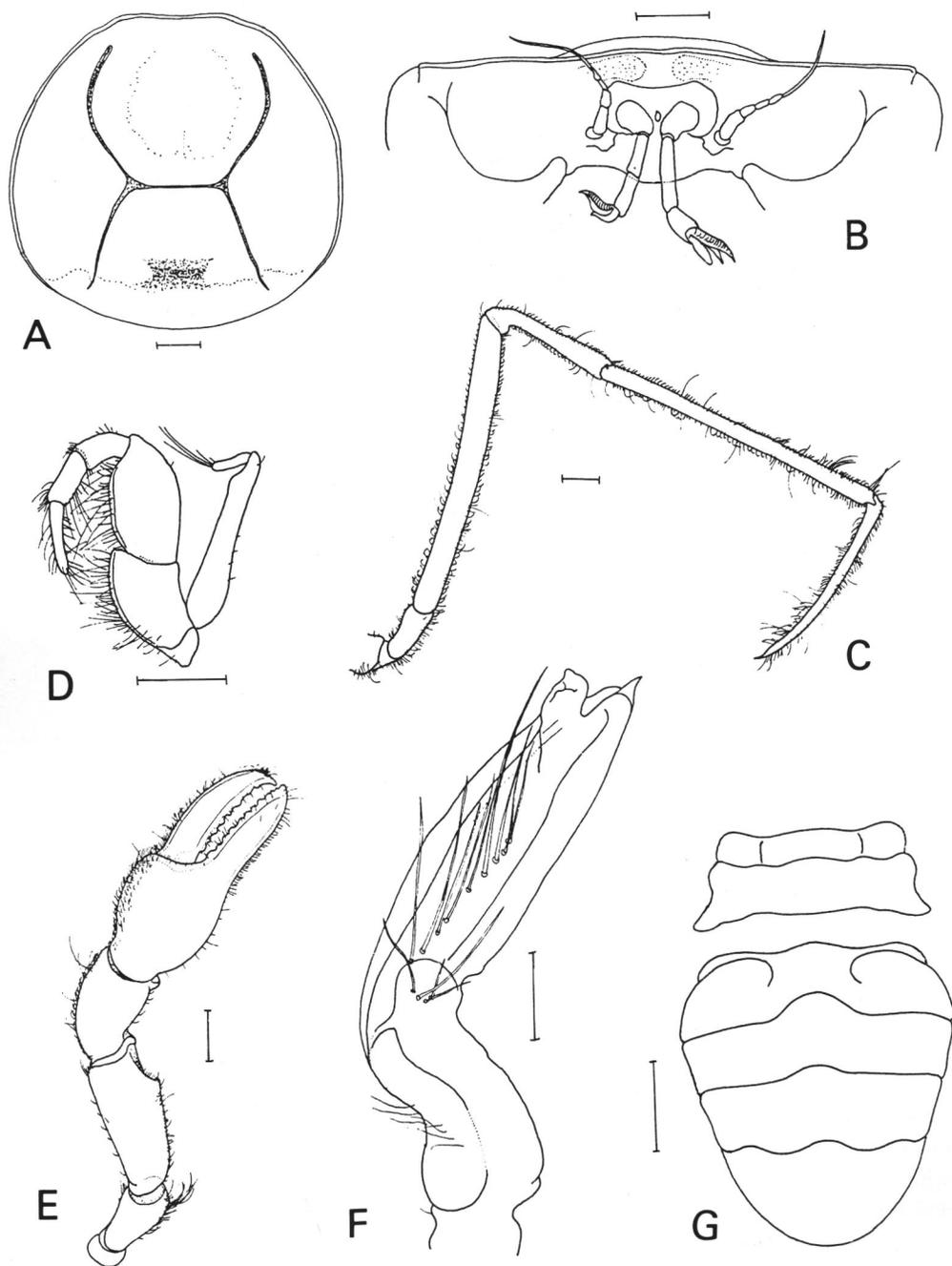


Fig. 5. *Cancrocaeca xenomorpha*. A, male paratype (3.6 by 4.0 mm) (ZRC 1990.484), Sulawesi. A, dorsal view of carapace; B, frontal view of carapace; C, third ambulatory leg; D, left third maxilliped; E, male right cheliped; F, left G1; G, male abdomen. Scales = 0.5 mm.

**Remarks.** - The presence of a pair of posterior lobes on both the male and female abdominal segment 1s is perhaps the most distinct character for this genus. The extremely laterally flattened, ribbon-like ambulatory legs are also diagnostic and is a feature possessed by few hymenosomatid species. Species reported to have a similar leg condition include *Neorhynchoplax demeloi* (Kemp, 1917), *Elamenopsis lineata* A. Milne Edwards, 1873, *Elamenopsis ariakensis* (Sakai, 1969), *Neorhynchoplax tuberculata* (Chopra & Das, 1930) and *Neorhynchoplax thorsborneorum* (Lucas & Davie, 1982) (see page 38, 55). However, the supposedly laterally flattened condition of the legs in the first three species are not as extreme as that found in *Crustaenia* - workers had previously regarded ambulatory legs as flattened as long as they are less than subcircular in cross-section. The ambulatory legs of *N. thorsborneorum* however, are indeed very flattened laterally and comparable in form to those of *Crustaenia* (see Lucas & Davie, 1982: Fig. 1; P.J.F. Davie, pers. comm.). In *N. thorsborneorum* however, the first abdominal segment is unarmed, the male telson is separated from the other segments by a suture, and the female abdominal segments 3-5 are fused (vs. segments 2-5 in *Crustaenia*). *Neorhynchoplax thorsborneorum* was originally named as "*Elamenopsis thorsbornei*", but the etymology for the species clearly stated that it was "... named after Arthur and Margaret Thorsborne" (Lucas & Davie, 1982: 406), and as such, the suffix for the species name must be corrected (P. J. F. Davie, pers. comm.). As regards *N. tuberculata*, the species closely resembles *N. thorsborneorum* and *Crustaenia palawanensis* in having laterally flattened ambulatory legs, but otherwise differs in carapace and ambulatory dactylar features (see Chopra & Das, 1930; and Lucas & Davie, 1982: 406, on the taxonomy of its subspecies).

*Crustaenia* certainly resembles *Neorhynchoplax* Sakai, 1938, closely in having well defined carapace grooves, a trilobate rostrum and narrow third maxillipeds, but differs significantly in having a pair of posterior lobes on segment one of both the male and female abdomen which is a character unique to this genus. The ribbon-like ambulatory legs are also quite diagnostic. The fusion of segments 2-5 and the telson (segment 6) of the male abdomen is also a distinctive feature of this genus as there have been no reports of other genera with a similar condition (cf. Lucas, 1980; Ng, 1990).

***Crustaenia palawanensis* (Serène, 1971), new combination**  
(Fig. 6)

*Neorhynchoplax palawanensis* Serène, 1971: 903; Yang, 1979: 12.

*Elamenopsis palawanensis* - Lucas, 1980: 191; Chuang & Ng, 1994: 87.

**Material examined.** - Holotype - male (3.2 by 2.5 mm) (ZRC 1969.12.11.1), Quezon, Palawan, Philippines, coll. R. Serène, 21 Jun.1963.

Paratype - 1 female (ZRC. 1969.12.11.2), Quezon, Palawan, Philippines, coll. R. Serène, 21 Jun.1963.

Others - SINGAPORE: 2 females (ZRC 1993.6495-6496), Siloso beach, Sentosa, coll. P. K. L. Ng, 1985. — 1 female (ZRC 1992.5946), Pulau Semakau, coll. Reef Ecology Survey Team, 1992. — 1 female (ZRC 1965.10.19.94), off Raffles Lighthouse, coll. Jul.1937.

**Description.** - Male - Carapace approximately oval; dorsal surface flat, smooth, longer than broad, with distinct gastrocardiac, cervical and thoracic grooves; cervical grooves reaching lateral margin just below spine just after the eye on anterolateral margin; thoracic grooves approaching but not reaching posterior margin; anterior lateral angle absent. Rostrum

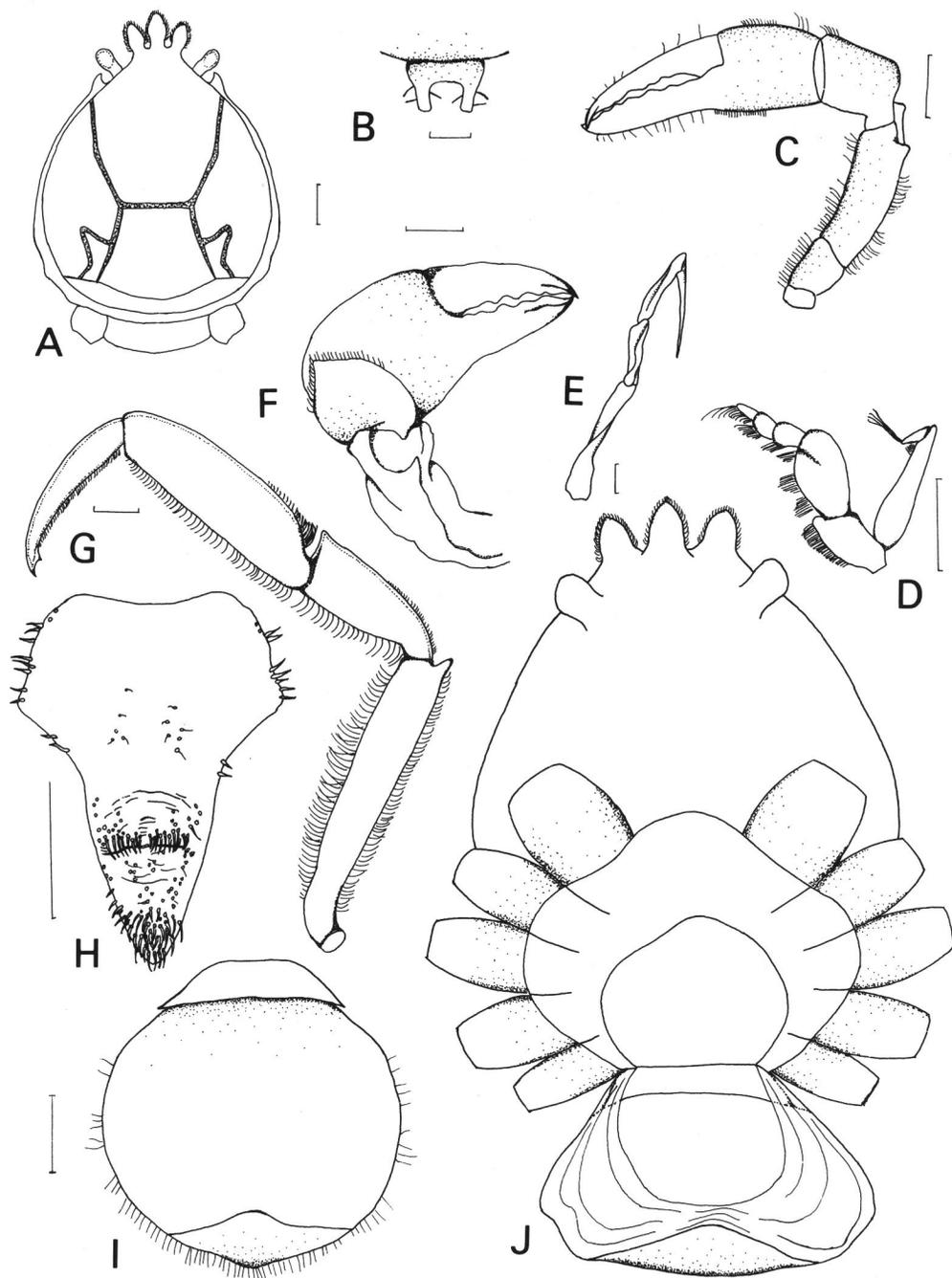


Fig. 6. *Crustaenia palawanensis*. A, B, F, H, holotype male (3.2 by 2.5 mm) (ZRC 1969.12.11.1), Palawan; I, C, female (3.3 by 4.3 mm) (ZRC 1993.6495); D, E, G, J, female (3.2 by 3.8 mm) (ZRC 1993.6496), Singapore. A, dorsal view of carapace; B, pair of lobes on male first abdominal segment; C, female left cheliped; D, left third maxilliped; E, dorsomarginal view of third ambulatory leg; F, male left cheliped; G, third ambulatory leg; H, male abdomen, segments 3-6; I, female abdomen, segments 1-6 (lobes not shown); J, ventral view of carapace showing brood pouch. Scales = 0.5 mm.

trilobate with subequal elliptical, dorso-ventrally concave lobes which are lined with fine, short setae on slightly upturned margins, not cristate. Eyes and eyestalks distinctly visible dorsally.

Third maxillipeds slender, not covering three-quarters of mouth field when closed; ischium of third maxilliped shorter than merus along outer lateral edge; dense setae present on inner lateral edge of ischium and palp; merus with three distinct groups of setae lining inner margin, a medial groove running down one-third length of ventral side; inner lateral margins not meeting when closed; palp not longer than merus; exopod much longer than merus, with short setae on inner margin of distal portion.

Chelipeds equal, stouter than ambulatory legs, surfaces smooth, without setae; fingers slightly shorter than palm, slightly curved inwards with four teeth on inner margin of dactylus and pollex, teeth broad and not sharp; tips sharply hooked; propodus inflated; fingers gape proximally with only tips meeting; carpus with row of setae on distal margin of dorsal portion; tooth arising from proximal margin of inner lateral side of carpus; distinct ridge present on dorsal side of merus (initially crenulate followed by tooth).

Ambulatory legs broad, strongly flattened laterally; ventral and dorsal edges of merus lined with uniformly spaced setae; shorter setae line proximal dorsal edge of carpus and propodus; single tooth present on dorsal surface of distal end of merus; dactylus slightly curved with tip sharply hooked, with 1 slightly recurved subterminal tooth; ventral edge of dactylus lined with a row of fine dense setae; carpus shorter than merus and propodus.

Abdomen 3-segmented, segments 3-5 fused without visible sutures, which is in turn fused with telson leaving a visible partial suture, partially covered by row of setae, region slightly convex; distal portion of telson covered by dense setae; setae in sparse groups of 2s and 3s line the proximal margins of abdomen; segment 1 of male abdomen with pair of lobes, with 2 setae on outer lateral margin and single seta on inner lateral margin.

G1 not available as only known male specimen (holotype) is dried. No trace of G2.

Female. - As for male except for chelipeds and abdominal segmentation. Cheliped more slender than that of male; 5 broad teeth lining cutting edges of fingers; fingers similarly curved inwards and tips similarly sharply hooked. Sparse setae lining outer margins of fingers; shorter, dense setae lining distal portions of palm; distal dorsal edge of carpus similarly lined with setae; lateral edges of merus and inner lateral edge of ischium lined with setae. Abdomen 3-segmented, segments 2-5 fused with no distinct sutures, all other intersegmental sutures distinct and articulating. Segmentation pattern identical to that of *E. lineata* and *N. mangalis*. Brood cavity distinct (see **Remarks** for *N. mangalis*).

**Distribution.** - Known from the type locality in Palawan, Philippines (Serène, 1971) and Singapore (present study).

**Remarks.** - This species was originally placed in the genus *Neorhynchoplax* but was reassigned to the genus *Elamenopsis* on the basis of narrow third maxillipeds and laterally compressed ambulatory legs by Lucas (1980), a character apparently also shared by *E. lineatus*, *E. ariakensis*, *N. demeloi*, *N. tuberculata* and *N. thorsborneorum*. Serène (1971) did not include the third maxillipeds in the description, but our examination of the third maxillipeds found them to be the of the type shared by other *Elamenopsis* and *Neorhynchoplax* species.

The holotype is the only male specimen known so far. Recent collections made in Singapore have obtained only female specimens. The two female specimens collected off Sentosa were found on some floating, discarded nets, overgrown with macroalgae. The third female specimen collected at Pulau Semakau was dredged from gravel at a depth of about 10 metres.

***Elamena* H. Milne Edwards, 1837**

(For synonyms and history of the genus, see Lucas, 1980: 170)

**Type species.** - *Hymenosoma mathaei* Desmarest, 1825, by monotypy. Gender of genus feminine.

**Distribution.** - Indo-West Pacific: Red Sea; Southeast Africa; Mauritius; India; Sri Lanka Maldive Archipelago Chilka Lake, India; Madagascar; Mandavi R., India; Vietnam; southern Australia; West Africa, Northeast Australia; New Zealand

**Remarks.** - Five *Elamena* species, *E. globosa*, *E. cristatipes*, *E. magna*, *E. mendosa*, *E. simplidentata*, new species, and *E. sundaica*, new species, are now recorded from Southeast Asia. *Elamena mendosa* was probably incorrectly identified as *Trigonoplax unguiformis* (de Haan, 1839) by Lanchester (1900) and this record has since been cited by many subsequent authors. Lucas (1980) gave a good review of the genus and brief descriptions of *E. truncata* (Stimpson, 1858), *E. abrolhensis* Gordon, 1940, and *E. gordonae* Monod, 1956. Gordon (1940) provided useful remarks and figures of *E. mathaei* (Desmarest, 1825), *E. sindensis* Alcock, 1900, *E. truncata*, *E. abrolhensis* and *E. gracilis* Borradaile, 1903. The characters emphasised by Gordon (1940) (dentition and the subterminal tooth on the ventral edge of dactyli of ambulatory legs, setation of the male GI and shape of the male abdomen) are very useful in separating the more truncate-looking species, and also 'intermediate species' like *E. cristatipes* Gravely, 1927.

***Elamena cristatipes* Gravely, 1927**

(Fig. 7)

*Elamena truncata* - Henderson 1893: 395 (nec *Trigonoplax truncata* Stimpson, 1858).

*Elamene* [sic] *cristatipes* Gravely, 1927: 150, pl. 21 fig. 24.

*Elamena cristatipes* - Chappgar, 1957: 409, pl. 3; Chopra & Das, 1930: 425, figs. 11-15; Lucas, 1980: 171; Yang, 1979: 12; Chuang & Ng, 1994: 87.

**Material examined.** - 1 male (4.5 by 4.0 mm) (ZRC 1969.11.21), Batu Ferringhi, Penang, Peninsular Malaysia, coll. University of Malaya, 1966.

**Description.** - Male - Carapace pear-shaped, longer than broad, not emarginated; dorsal surface smooth, with distinct gastroducardiac and faint cervical and thoracic grooves; cervical and thoracic grooves not reaching anterolateral and posterolateral margins respectively; lateral margin smooth without spines; anterior lateral carapace angle absent, posterior lateral angle obtuse. Rostrum unilobed, rounded, continuous with dorsal surface, keel on ventral surface rectangular. Eyes partially visible from dorsal view.

Third maxillipeds cover three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; dense short setae lining inner lateral margins of both merus

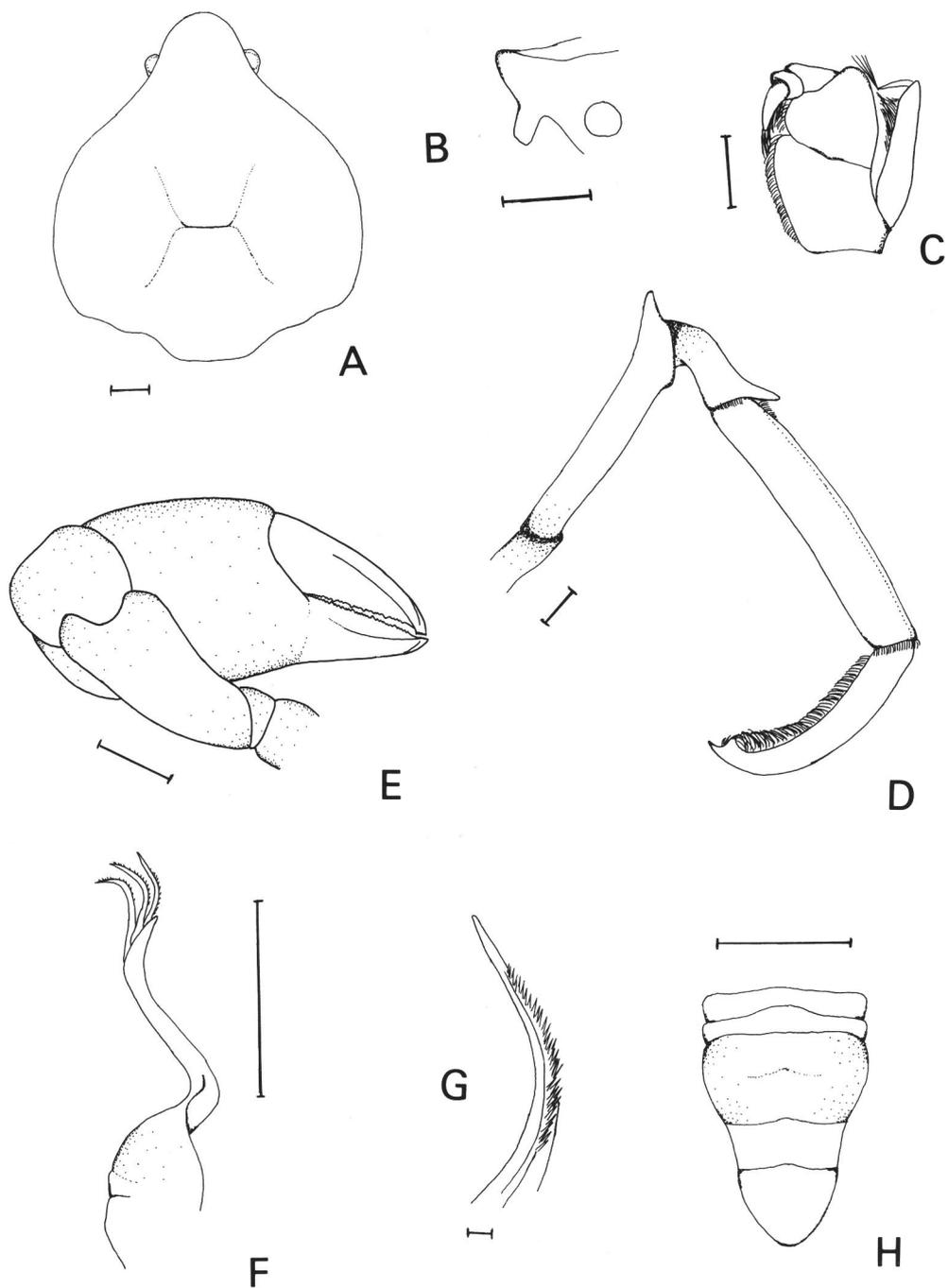


Fig. 7. *Elamena cristatipes*. Male (4.5 by 4.0 mm) (ZRC 1969.11.21), Penang. A, dorsal view of carapace; B, lateral view of carapace showing ventral keel; C, left third maxilliped; D, third ambulatory leg; E, male left cheliped; F, left G1; G, setae of G1, showing spinules; H, male abdomen. Scales: A-F, H = 0.5 mm; G = 0.14 mm.

and ischium; inner lateral margins not meeting when closed; palp not longer than merus; exopod, much longer than merus, with dense setae lining distal half of inner lateral margin.

Chelipeds equal, stouter than ambulatory legs; surfaces smooth without setae; palm massive, inflated, longer than fingers; fingers curved inwards, cutting edges with minute teeth interspersed with larger ones, gaping distally with only straight edge of tips meeting when closed; tips straight, not pointed; distal ends curved inwards.

Ambulatory legs slender, circular in cross-section except dactylus which is laterally flattened; short sparse setae on proximal portion of propodus, distal edge of both carpus and propodus; prominent tooth on distal dorsal edge of merus and carpus; dactylus straight proximally with distal portion more curved with 1 sharp, recurved subterminal tooth; tip sharply hooked, ventral edge lined with row of dense, short setae; carpus shorter than merus; propodus longer than carpus.

Abdomen 5-segmented with segments 3 and 4 fused, with visible partial suture, all other intersegmental sutures distinct, articulating; segments 1 and 2 subequal in width; surfaces of fused segments convex, lateral margins also convex, with the greatest width and length; lateral margins of segment 5 slightly concave; telson triangular with rounded apex, lateral margins slightly concave, tip rounded.

G1 slender, strongly curved, with three subterminal setae, tapering slightly along its length to a simple pointed tip; each seta lined with spinules on ventral edge, not reaching tip of seta; thin proximal portion curves through 90° at the exit from thick base; distal portion curved.

**Distribution.** - Known from India (Gravely, 1927; Chappgar, 1957) and Peninsular Malaysia (present study).

**Remarks.** - Gravely (1927) first described this species on the basis of the presence of the strong crest on the "tibiae" (= present propodus) of all legs, a character not present in *Elamena truncata*, the dactylus being bifid (not trifid) and the front being rounded (not truncated). The trifid dactylar condition in *Elamena truncata* is due to the presence of the smaller tooth arising from the base of the subterminal tooth.

Chopra & Das (1930) re-examined Gravely's type specimens (one male and one female) from Krusadai Island, and gave a detailed redescription with figures. They also commented on the "strong crest" mentioned by Gravely, describing it instead as a highly compressed upper margin of the propodus. However, the G1 was not described or figured. Chappgar (1957) subsequently collected numerous specimens from Bombay and Okha (India) among seaweeds on rocks, provided a figure of its G1 and described it as "sinuous and split to form two whip-like tips". Such a G1 however, is most peculiar, even among hymenosomatids. It seems likely that Chappgar had mistaken two of the long, stout subdistal setae on the G1 for the main G1 structure. Certainly in the G1 of the present male from Penang, such a mistake in interpretation could easily occur if the G1 was not carefully examined. The specimen from Penang agrees very well with Gravely's species. The ambulatory propodus and dactylus are indeed more flattened than other segments and the so called 'crest' is also visible. The G1 (Fig. 7F) shows a pointed tip with three subterminal setae, each lined with a row of spinules. The pyriform carapace of *E. cristatipes* closely resembles that of *E. momona* Melrose, 1975, but in all other aspects, they differ markedly.

*Elamena globosa* Chuang & Ng, 1991

(Fig. 8)

*Elamena globosa* Chuang & Ng, 1991: 366; Fig. 2a-d; Chuang & Ng, 1994: 87.

**Material examined.** - Holotype - male (2.2 by 2.7 mm) (ZRC 1993.6497), Pulau Ayer Chawan island, southern Singapore, coll. Reef Ecology Study Team, 1986.

**Description.** - Male - Carapace approximately circular, longer than broad; dorsal surface highly convex, body highly inflated when viewed laterally; dorsal surface smooth with faint cervical, thoracic and gastrocardiac grooves; cervical and thoracic grooves reaching anterolateral and posterolateral margins respectively; medial ridge running from tip of rostrum

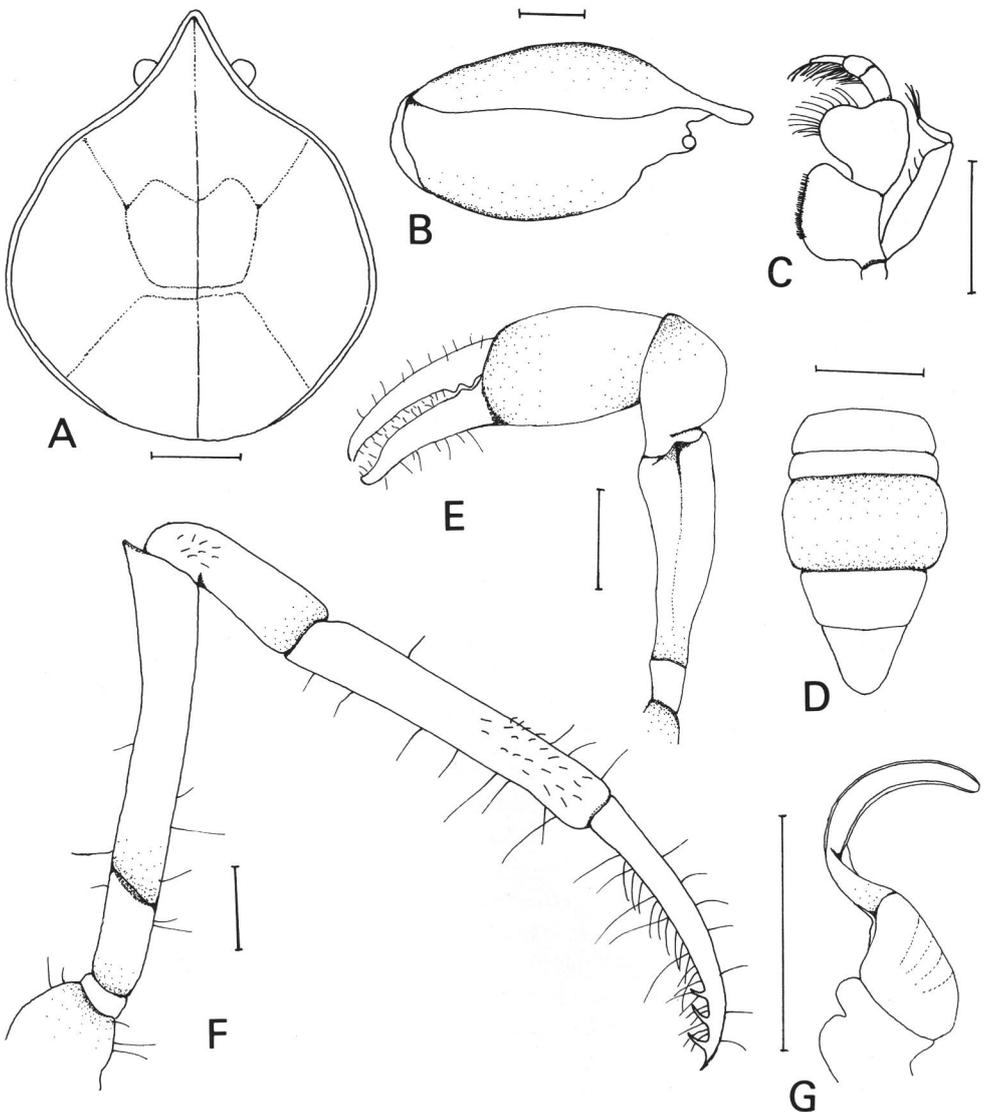


Fig. 8. *Elamena globosa*. Holotype male (2.2 by 2.7 mm) (ZRC 1993.6497), Singapore. A, dorsal view of carapace; B, lateral view of carapace; C, left third maxilliped; D, male abdomen; E, right male cheliped; F, right third ambulatory leg; G, left G1. Scales = 0.5 mm.

to base of carapace; lateral carapace margin smooth without spines; anterior lateral carapace angle obtuse. Rostrum unilobed, continuous with dorsal surface, lobed when viewed laterally. Eyes partially visible dorsally, antennae and antennules distinctly visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; dense short setae occupying middle portion, half total length of inner lateral edge; similar condition for merus except setae are longer, sparser. Inner lateral margins not meeting when closed; palp not longer than merus; a faint medial groove running down half the length of the merus; exopod much longer than merus, with 3 sparsely spaced fine setae lining distal portion of inner margin.

Chelipeds equal, slightly stouter than ambulatory legs; surfaces smooth, with sparse setae only on outer edges of fingers; shorter fine setae line inner edges of fingers; single tooth at proximal portion of pollex fits perfectly between 2 teeth on proximal portion of dactylus; palm and fingers laterally flattened, with pollex more flattened than dactylus; distal portion of pollex with sudden curvature, tip extending further than that of dactylus; fingers subequal in length with palm.

Ambulatory legs slender, circular in cross-section except dactylus; dorsal and ventral edges lined with sparse long setae; short sparse setae on proximal portion of carpus and distal portion of propodus; dactylus straight proximally with distal portion more curved, with 3 sharp subterminal teeth; tip sharply hooked, ventral edge lined with row of sparse short setae; carpus shorter than merus and propodus which are subequal in length.

Abdomen 5-segmented with segments 3 and 4 fused, without distinct sutures; surface of fused segment convex. Telson (segment 6) triangular with rounded apex, lateral margins slightly convex; all other intersegmental sutures distinct, articulating; segments 1 and 2 subequal in width, tapering starts at segment 5.

G1 slender, strongly curved, without subterminal setae; with distinctive double twist (a feature shared by few hymenosomatids), the first twist being just above base, second twist from one-third length of thin distal portion; thin distal portion curves through semicircle; tapers slightly along its length to simple rounded tip.

**Disribution.** - Known only from the type locality in Singapore.

**Remarks.** - *Elamena globosa* belongs to the group of more triangular species in the genus. Within this group, *E. globosa* has a male abdomen, G1 structure and dactylar dentition which is very different from *E. gracilis* and *E. sindensis*. The presence of more distinct areolation of the carapace of *E. cimex* immediately suggests its affinity with *E. globosa*. However, the rostrum is distinctly narrower and anterolateral margin is straighter in *E. cimex*. *Elamena xavieri*, which bears a slight resemblance to *E. globosa*, differs in having a distinct tooth on the ventral side of the rostrum and the absence of definition of the carapace regions. *Elamena globosa* resembles *E. gordonae* in having a convex dorsal carapace surface and a rostrum without a ventral keel (Lucas, 1980). However, the dactylus of *E. gordonae* bears two subterminal teeth instead of three as in *E. globosa*. The rostrum is also broader and the anterolateral angles are more prominent in *E. gordonae*. Since no male specimens of *E. gordonae* have been examined, comparisons of the G1 and male abdomen with *E. globosa* is not possible.

***Elamena magna*, new species**

(Fig. 9)

**Material examined.** - Holotype - male (7.1 by 8.1 mm) (ZRC 1994.4227), middle of mangrove river, Ranong, southern Thailand, coll. Suphot, 12 Jun.1986.

Paratype - 1 female (10.0 by 11.9 mm) (ZRC 1994.4228), same data as holotype.

**Description.** - Male - Carapace triangular, dorsal gently convex, with low longitudinal ridge on cardiac region and dorsal surface of rostrum; dorsal surface without grooves; lateral margins straight. Rostrum unilobed, triangular, tip rounded, proximal lateral margins subparallel. Eyes visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium longer than merus along outer lateral edge; inner lateral margins partially meeting when closed; palp longer than merus; exopod much longer than merus.

Chelipeds equal, slender, elongate (especially merus); surfaces smooth, without setae; palm very slender; fingers longer palm, straight with several denticles on cutting edges, tips sharply hooked

Ambulatory legs slender, elongate, circular in cross-section; merus unrammed; dactylus very long, slightly curved distally with the tip sharply hooked and 2 subterminal teeth; carpus much shorter than merus and propodus.

Abdomen broadly triangular, 6-segmented, all segments free; proximal lateral margins of telson (segment 6) subparallel; segment 5 curving outwards sharply to meet segment 4.

G1 slender, sinuous, tip pointed; with 8 subterminal setae.

Female - Similar to male in non-sexual features. Abdomen 6-segmented; covering entire sternum, reaching base of legs, subcircular.

**Etymology.** - The species is named for its relatively large size.

**Distribution.** - Known only from the type locality in Ranong, Thailand.

**Remarks.** - This interesting new species closely resembles known *Trigonoplax* species, especially the Australian taxa, but the structure of its Milne Edwards' opening (not fused for most of its length) excludes its classification there. Compared to known *Elamena* species, *E. magna* is very large. In addition, the very elongate chelipeds (with the simple, non-swollen chelae) and ambulatory legs, as well as the sinuous G1, allies *E. magna* with known *Trigonoplax* species. On the basis of Lucas's (1980) generic system, *E. magna* would probably have to be classified in a new genus, but this cannot be done until the various *Elamena* species from India described by Kemp (1917) are re-examined.

*Elamena magna* is apparently a mangal species, and is only the second hymenosomatid species known from Southeast Asian mangroves, the other being *Neorhynchoplax mangalis*. It was collected from the middle of a mangrove stream.

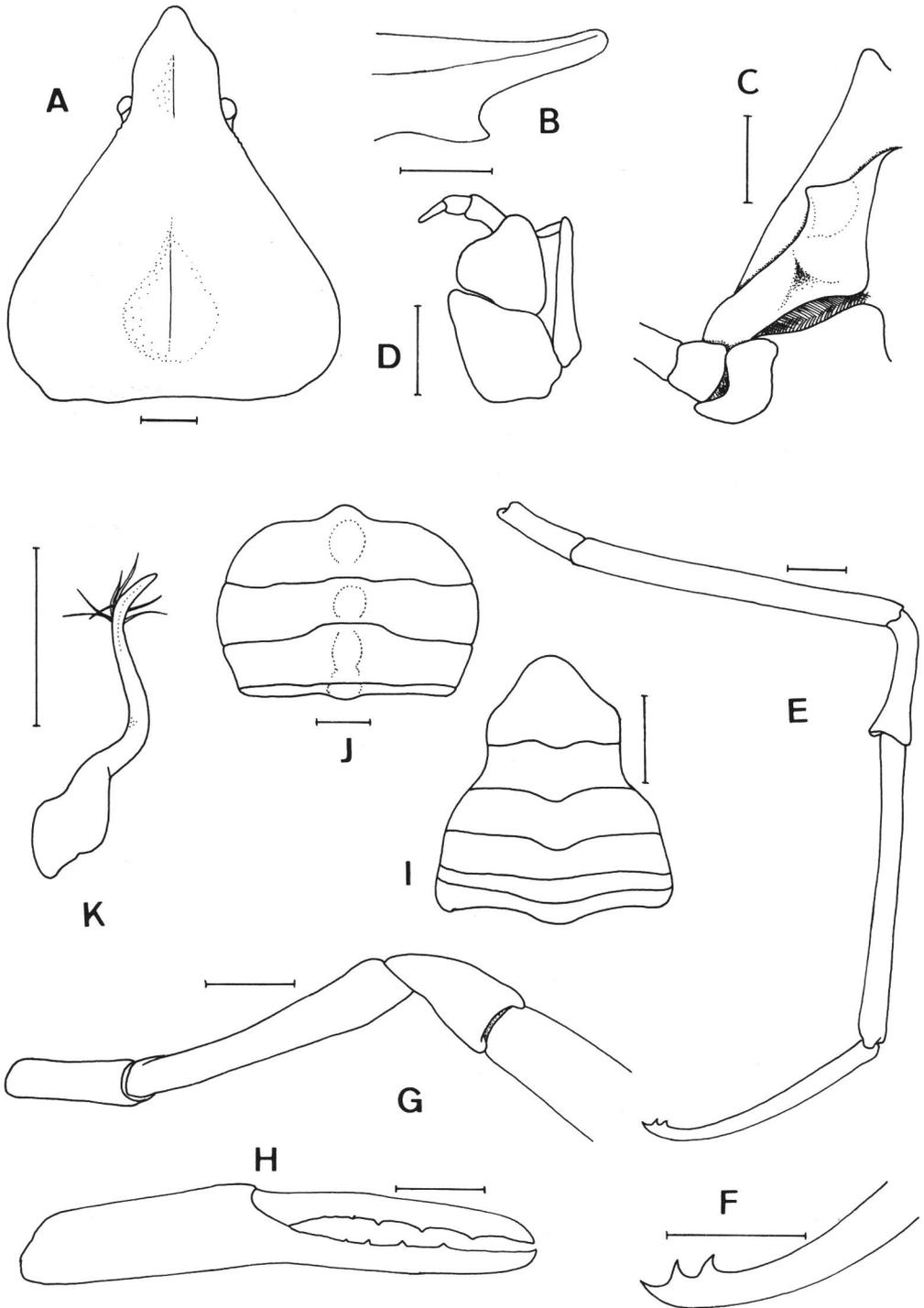


Fig. 9. *Elamena magna*, new species. A-I, K, holotype male (7.1 by 8.1 mm) (ZRC 1994.4227); J, paratype female (10.0 by 11.9 mm) (ZRC 1994.4228); Ranong. A, dorsal view of carapace; B, lateral view of rostrum; C, right Milne Edwards' opening and pterygostomial region; D, left third maxilliped; E, third right ambulatory leg; F, dactylus of third right ambulatory leg; G, right male chelipedal carpus, merus and ischium; H, right male chela; I, male abdomen; J, female abdomen, segments 3-6; K, left G1. Scales = 1.0 mm.

*Elamena mendosa* Chuang & Ng, 1991

(Fig. 10)

*Trigonoplax unguiformis* - Tesch, 1918: 25; Gordon, 1940: 63, fig. 1d; Sakai, 1938: 201; Lucas, 1980: 186 (nec *Inachus unguiformis* de Haan, 1839).

*Elamene unguiformis* - Lanchester, 1900: 761.

*Elamena sindensis* - Yang, 1979: 12 (part) (not *E. sindensis* Alcock, 1900).

? *Elamena* sp. Chopra & Das, 1930: 425.

*Elamena mendosa* Chuang & Ng, 1991: 366, Fig. 2e-g; Chuang & Ng, 1994: 87.

**Material examined.** - Holotype - male (3.4 by 4.4 mm) (ZRC 1985.1809), Sisters Islands, southern Singapore, 5 metres, coll. P. K. L. Ng, Mar.1985.

Paratype - 1 ovigerous female (7.4 by 8.8 mm) (ZRC 1985.1729), off East Coast, southern Singapore, coll. P. K. L. Ng, 1981.

Others - SINGAPORE: 1 ovigerous female (8.0 by 9.1 mm) (ZRC 1985.1445), Selat Sinki, coll. coll. A. G. Searle, 15 Feb.1954. — 2 males (4.8 by 5.8 mm, 5.2 by 6.2 mm) (ZRC 1994.4229), dredge, 22-24 m depth, Johor Shoals, coll. D. Chia et al., 29 Aug.1994.

PENINSULAR MALAYSIA: 1 ovigerous female (ZRC 1965.10.19.106), Penang Straits, coll. Apr.1935. — 1 male (ZRC 1965.10.19.105), Port Swettenham, Selangor — 1 female (ZRC), Pulau Pangkor, Selangor, coll. J.R. Hendrickson, no date.

**Description.** - Male - Carapace approximately triangular, dorsal surface flat, with gastric region slightly convex, longer than broad; dorsal surface smooth with no distinct grooves; anterior lateral carapace angle obtuse. Rostrum unilobed, triangular, slightly upturned, tapering suddenly to a tip, separated from the dorsal surface by a groove. Eyes partially visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; dense setae on inner lateral edge; longer and more sparse setae lining middle portion spanning half length of inner margin of merus; a medial groove running down half length of ventral side; inner lateral margins partially meeting when closed; palp not longer than merus; exopod much longer than merus, without setae.

Chelipeds equal, slender, slightly stouter than ambulatory legs; surfaces smooth, without setae; fingers subequal in length with palm, straight with minute teeth interspersed with few larger ones, tips sharply hooked; fingers spatulate, distal portions of fingers curved horizontally and vertically, gape distally with only tips meeting when closed.

Ambulatory legs slender, circular in cross-section; dorsal and ventral edges lined with sparse long, plumose setae; short sparse setae on surfaces of merus, carpus and propodus; single tooth on dorsal surface of distal end of merus; dactylus slightly curved with tip sharply hooked and 2 subterminal teeth; ventral edge lined with row of fine dense setae; carpus shorter than merus and propodus which are subequal in length.

Abdomen 5-segmented, segments 3 and 4 (?) fused without visible sutures, forming triangular piece, all other intersegmental sutures distinct (segments 2 and 3 sometimes fused), articulating, width narrowest at suture between segments 3 and 4; telson tapers along its length, stops at suture between segments 3 and 4, diverges until last suture reached and finally tapers gradually to tip that reaches coxa of first ambulatory leg.

G1 slender, curving slightly distally, tapering along its length to sharp pointed tip; proximal

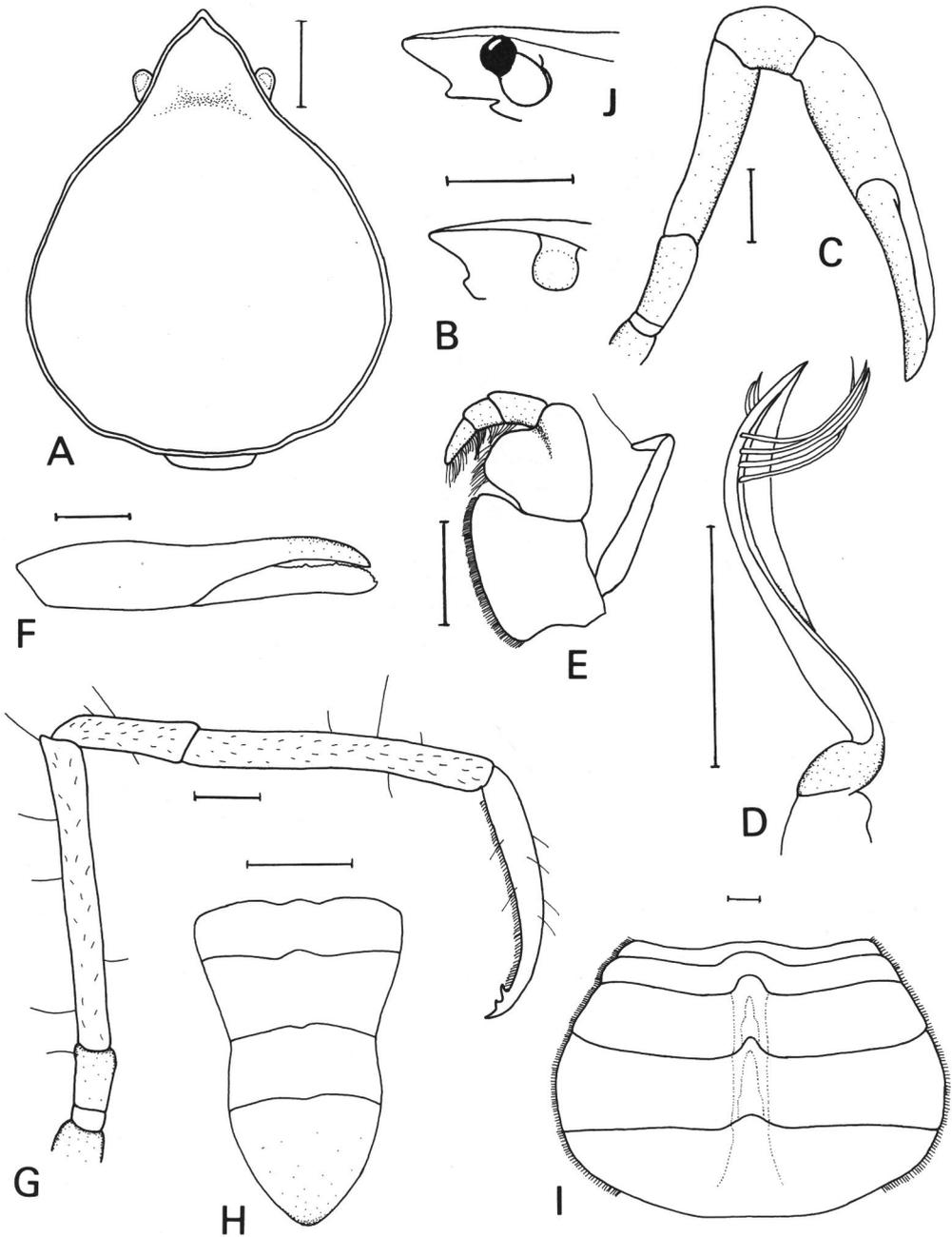


Fig. 10. *Elamena mendosa*. A-H, holotype male (3.4 by 4.4 mm) (ZRC 1985.1809); I, paratype female (7.4 by 8.8 mm) (ZRC 1985.1729); J, female (after Gordon, 1940: Fig. 1d); Singapore. A, dorsal view of carapace; B, J, lateral view of carapace showing ventral keel; C, male left cheliped; D, left G1; E, left third maxilliped; F, left chela; G, third ambulatory leg; H, male abdomen, segments 2-6; I, female abdomen, segments 1-6. Scales = 0.5 mm.

portion just above base twisted and middle portion slightly twisted; 4 long subterminal setae spanning diagonally across ventral edge, 2 shorter subterminal setae found more distally on dorsal side.

Female - Similar to males in non-sexual features. Abdomen 5-segmented, segment 5 and 6 fused with no distinct sutures, all other intersegmental sutures distinct; covering entire sternum, reaching base of legs, subcircular, longer than broad, dome-shaped, forming pronounced brood cavity; fringe of sort setae lining lateral sides.

**Distribution.** - Known from Singapore and Peninsular Malaysia.

**Remarks.** - This species has been mistaken for *Trigonoplax unguiformis* (de Haan, 1839) since 1900 when Lanchester reported *T. unguiformis* from Singapore. His record has been cited by almost all subsequent hymenosomatid workers. The external similarity between *T. unguiformis* and *E. mendosa* easily explains how Lanchester could have mistaken *E. mendosa* for *T. unguiformis*. *Trigonoplax unguiformis* is known only from areas outside continental shelf waters, with more oceanic influence. *Elamena mendosa* superficially resembles *T. unguiformis* but its carapace is not broader than long and not 'wafer thin' as in *T. unguiformis*. Most importantly, the Milne Edwards' apertures in *E. mendosa* are fused for only one-third of their length whereas in *T. unguiformis*, the fusion occurs for more than half its length. This character was used by Lucas (1980) to effectively separate *Trigonoplax* from *Elamena*. In larger male specimens, abdominal segments 2 and 3 are also fused, with only the median part of the suture still discernible. Gordon (1940) figured the rostrum of Lanchester's Singapore specimen of "*T. unguiformis*" (a female), which agrees extremely well with those of *E. mendosa*.

*Elamena mendosa* resembles *E. sindensis* from India but differs markedly in having a rostrum which has concave lateral margins (against convex), distinctly longer ambulatory legs and more slender chelae.

Chopra & Das (1930) reported a specimen collected by Kemp in the Andaman Islands which is different from other *Trigonoplax* in his collections and apparently intermediate between *E. xavieri* and *E. cimex*. This specimen (Chopra & Das, 1930: 429, fig. 17) bears a close resemblance to *E. mendosa* in carapace shape. The chelipeds and legs were described as being similar to that of *T. unguiformis* (and to *E. mendosa*). We believe that this particular specimen might well be *E. mendosa*, but in lieu of examining their specimen, we cannot confirm this.

Chuang & Ng (1991) recorded that the holotype was a male measuring 2.2 by 2.65 mm, but this was a typographical mistake. The actual measurement of the holotype is 3.4 by 4.4 mm. They also listed two paratype females, but one of them was misplaced during a move, and cannot be located at the moment.

The holotype of *E. mendosa* was dredged from a depth of five metres on sandy/muddy substrate with the green algae, *Ulva* (see Chuang & Ng, 1994). Specimens have also been obtained from trammel nets set by fishermen (depth 3-4 metres) and from dredges working at 22-24 metres depths.

*Elamena simplidenta*, new species

(Fig. 11)

**Material examined.** - Holotype - ovigerous female (8.6 by 7.0 mm), (RMNH), Haroekoe reef, Indonesia, coll. Snellius Expedition, 3-7 May.1930.

Paratypes - 1 ovigerous female (RMNH), 1 ovigerous female (ZRC 1994.4231), Ambon, Indonesia, coll. Snellius Expedition, 10-17 Sep.1930. — 1 ovigerous female (RMNH), shoreline, Ternate, Indonesia, coll. Snellius Expedition, 12 Apr.1930. — 1 ovigerous female (RMNH), Pelee, Misool Group, Indonesia, coll. Snellius Expedition, 4 Oct.1929.

**Description.** - Female - Carapace, flat, broader across posterior pair of angular lobes, than long; dorsal surface flat, smooth with no distinct cervical, thoracic and gastrocardiac grooves; anterolateral angle not distinct; posterolateral angle prominent. Rostrum truncated with ventral rostral keel partially visible dorsally; margins lined on dorsal and ventral sides with curved, short stout setae which extend along entire margin on ventral side. Eyes visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; dense short setae occupying entire length of inner lateral edge of ischium, with both sides of inner margin lined with stouter but sparser curved setae; proximal portion with longer setae and surface with a few stubby setae on distal half portion; inner lateral edge of merus lined with dense setae, longer than that found on ischium, surface interspersed with few sparse stubby setae; inner lateral margins meeting when closed; palp subequal in length with merus; exopod much longer than merus, with long setae more sparse than that found on merus lining inner lateral edge, outer edge lined with curved stubby setae.

Chelipeds equal, slightly stouter than ambulatory legs; surfaces smooth; shorter fine, but not dense setae line inner edges of fingers. Fingers of subequal length with inflated palm; fingers spatulate with both edges lined with numerous fine teeth; 5 larger equally spaced teeth present on outer edge of fingers; tips of fingers, each with large well developed subterminal tooth giving it bifurcated appearance.

Ambulatory legs slender, subcircular in cross-section; dorsal edge lined with short curved setae which are also present at mero-carpus and carpo-propodus joints, each with distinct dorsal tooth; short sparse stubby setae on surface of leg with exception of dactylus; dactylus straight proximally with distal portion more curved with subterminal tooth; tip sharply hooked, ventral edge of dactylus lined with row of short setae; carpus shorter than merus and propodus which are subequal in length.

Abdomen 6-segmented, intersegmental sutures distinct, ventral surface interspersed with short fine setae; telson with terminal tuft of setae; covering entire sternum, reaching base of legs, subcircular, longer than broad, dome-shaped, forming pronounced brood cavity.

**Etymology.** - The specific name is derived from the Latin, alluding to the single prominent subterminal tooth on its ambulatory dactylus.

**Distribution.** - Known only from the Moluccas and adjacent areas.

**Remarks.** - *Elamena simplidenta*, new species, belongs to the *E. truncata* group of species (*E. truncata*, *E. abrothensis*, *E. sundaica*, new species) and although only females are available

and the male abdominal and G1 characters are not available, it differs markedly from all members of the group in its ambulatory dactyli. It is the only species in which there is only one subterminal tooth on the ambulatory dactylus. In all the other species of the group, there are two subterminal teeth, and even if one tooth is smaller, it is nevertheless always evident. This character is not sex- or size-associated.

The distinctive carapace shape of *E. simplidentata* also easily separates it from all congeners, its lateral angles are prominent, but the anterolateral margin is hardly marked with an angle. *Elamena simplidentata* also appears to be the largest species of the *E. truncata* species group, with specimens exceeding 8.0 mm in carapace width.

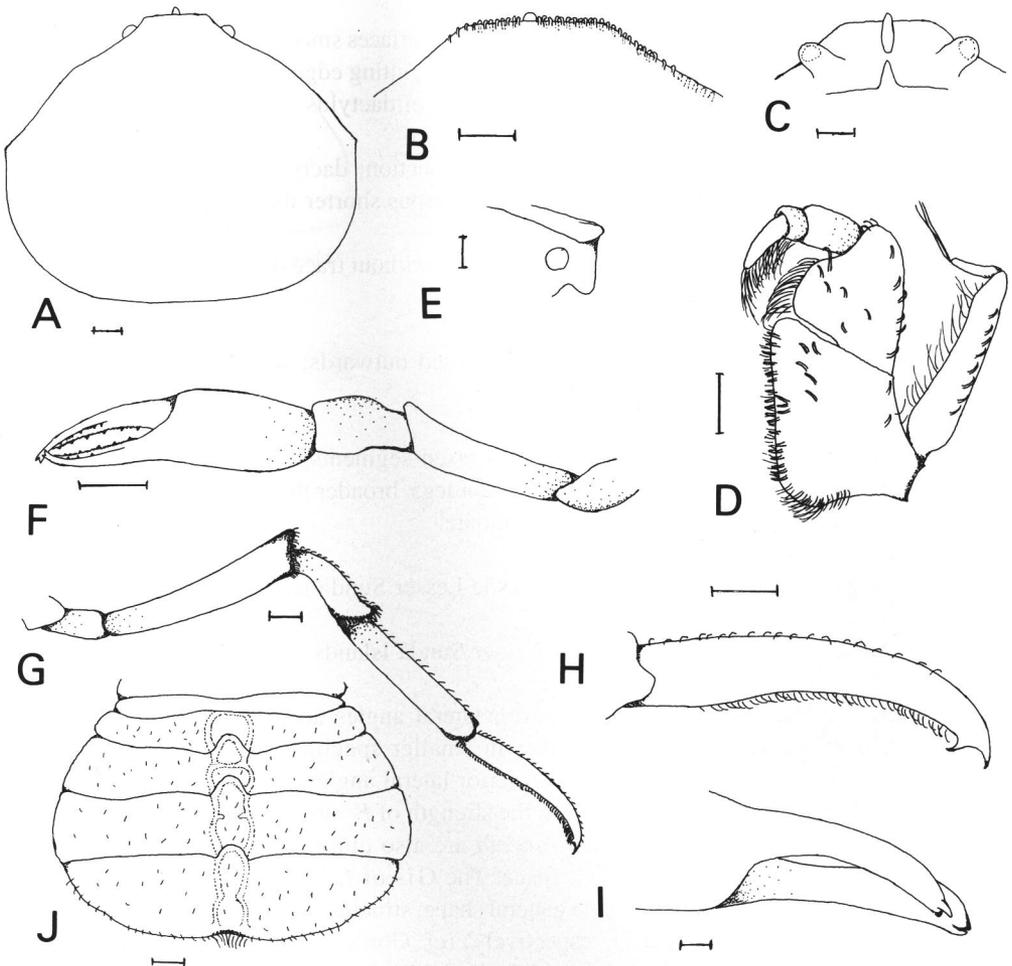


Fig. 11. *Elamena simplidentata*, new species. Holotype female (8.6 by 7.0 mm) (RMNH), Lesser Sunda Islands. A, dorsal view of carapace; B, frontal margin; C, ventral view of frontal margin; D, left third maxilliped; E, lateral view of rostrum; F, left female cheliped; G, right third ambulatory leg; H, right third ambulatory dactylus; I, fingers of left female chela; J, female abdomen. Scales = 0.5 mm.

*Elamena sundaica*, new species

(Fig. 12)

**Material examined.** - Holotype - male (4.7 by 4.2 mm) (RMNH), Kaepang, Timor, Indonesia, coll. Snellius Expedition, 22-23 Nov.1929.

Paratypes - 2 females (RMNH), 2 females (ZRC 1994.4230), same data as holotype. — 1 female (RMNH), Pelokan island, Indonesia, coll. Snellius Expedition, 20 Dec.1929.

**Description.** - Male - Carapace, broader than long, dorsal surface gently convex, smooth with cervical, thoracic and gastroducardiac grooves faint but visible; lateral angle strongly produced, dentiform; anterolateral angle well marked, lobiform. Rostrum truncated with ventral rostral keel hardly visible dorsally. Eyes visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium longer than merus along outer lateral edge; inner lateral margins meeting when closed; palp longer than merus; exopod longer than merus.

Chelipeds subequal, stouter than ambulatory legs; surfaces smooth; chelae slightly inflated; fingers shorter than palm; fingers spatulate with both cutting edges lined with numerous fine teeth, with one larger broad tooth on proximal part of dactylus.

Ambulatory legs slender, subcircular in cross-section; dactylus gently curved, with 2 subterminal teeth, proximal tooth always larger; carpus shorter than merus and propodus.

Abdomen 5-segmented, segments 3 and 4 fused, without trace of suture; telson (segment 6) semicircular, longer than segment 5.

G1 C-shaped, distal part tapering, sharp, turned outwards; subdistal surface with 11 plumose setae.

Female - Abdomen 6-segmented, with no fused segments, all intersegmental sutures distinct, covering entire sternum, reaching base of legs, broader than long. Cheliped slender, not stouter than ambulatory legs; fingers spatulate.

**Etymology.** - The species is named after the Lesser Sunda islands.

**Distribution.** - Known only from the Lesser Sunda Islands.

**Remarks.** - The well developed posterior lateral angles are very characteristic of *E. sundaica*, new species, and while weaker in smaller specimens, is nevertheless more pronounced than in *E. abrolhensis*. The posterior lateral angles are also well developed in *E. truncata* s. str. but they do not approach the strength of *E. sundaica*. The carapace shapes of *E. sundaica*, *E. abrolhensis* and *E. truncata* are also quite different, with *E. sundaica* having the proportionately broadest carapace. The G1s of *E. abrolhensis* and *E. sundaica* are very close, both possessing the same general shape, structure of the distal part and number of subterminal setae (ca. 12 and 11 respectively) (cf. Gordon, 1940: Fig. 7a; Lucas, 1980: 10I; present Fig. 12J, K). The ambulatory dactylus of *E. abrolhensis* (cf. Gordon, 1940: Fig. 7b; Lucas, 1980: Fig. 6C) however, is proportionately shorter than that of *E. sundaica* (present Fig. 12G, H).

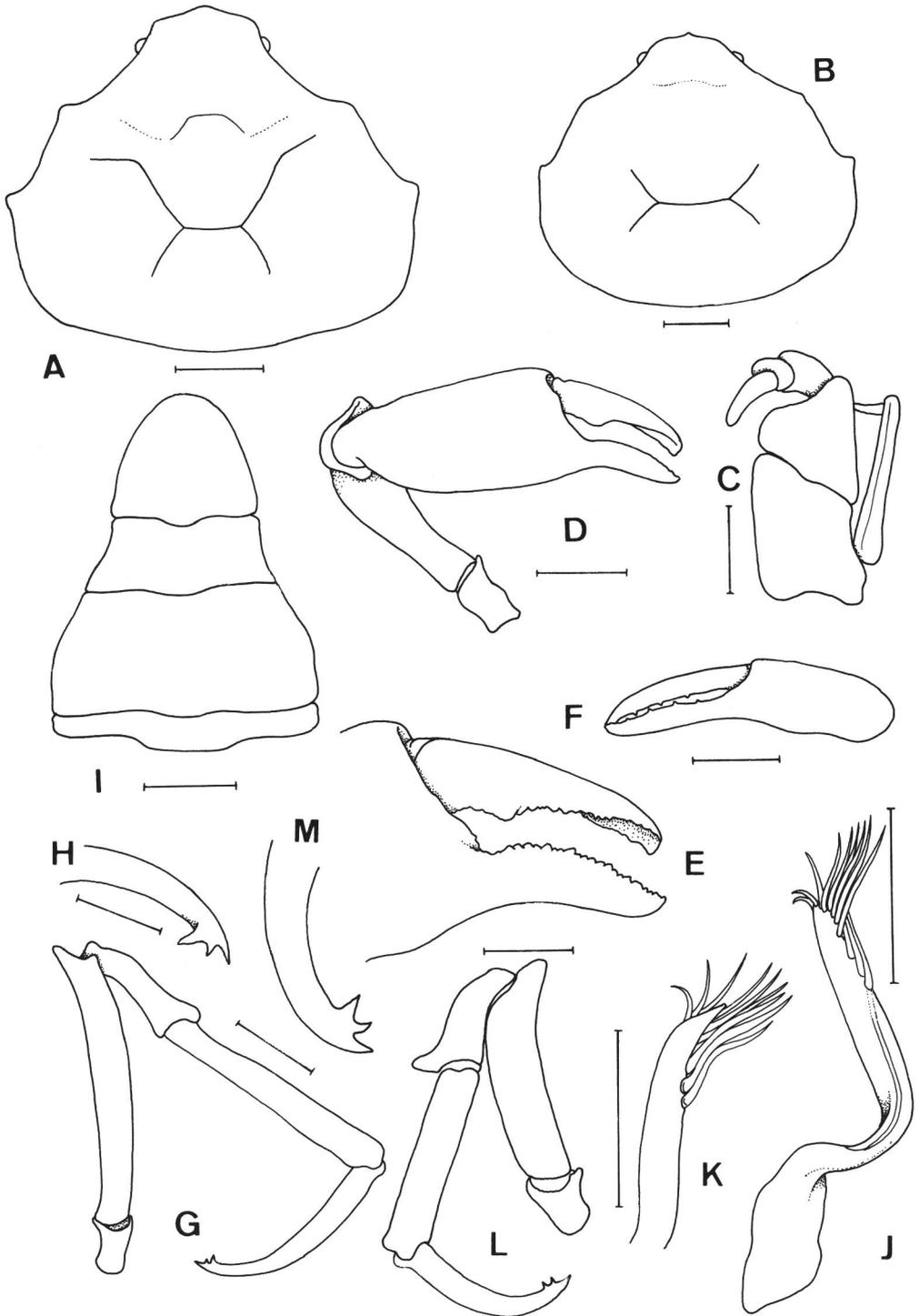


Fig. 12. *Elamena sundaica*, new species. A, C-E, G-J, holotype male (4.7 by 4.2 mm) (RMNH); B, F, L, M, paratype female (5.5 by 4.9 mm) (ZRC 1994.4230); Lesser Sunda Islands. A, B, dorsal view of carapace; C, left third maxilliped; D, male right cheliped; E, fingers of male right chela; F, left female chela; G, third right ambulatory leg; H, dactylus of third right ambulatory leg; I, male abdomen, segments 2-6; J, K, right G1 (different perspectives); L, left fourth ambulatory leg; M, left fourth ambulatory dactylus. Scales: A, B, D, F, G, L, M = 1.0 mm; C, E, H-K = 0.5 mm.

*Elamena ? truncata* (Stimpson, 1858)

(Fig. 13)

*Elamena truncata* - Tesch 1918: 22-4, pl. 1, figs. 4, 4a-c (not *Trigonoplax truncata* Stimpson, 1858).  
*Elamena mathaei* - Yang, 1979: 12 (not *Hymenosoma mathaei* Desmarest, 1825).

**Material examined.** - INDONESIA - 1 female (3.1 by 3.0 mm) (RMNH), Wotap, Tenimber island, coll. Snellius Expedition, 20-23 Oct. 1929.

VIETNAM: 1 female (ZRC 1970.8.4.5), Nhatrang Bay, coll. R. Serène, 1958.

**Remarks.** - The two specimens from Indonesia and Vietnam examined are probably not conspecific, and cannot be identified with certainty (see **Remarks** for *Elamena truncata* in non-Southeast Asian section of this paper).

Tesch's (1918) description and figures of "*E. truncata*" specimens from Ambon (2 males, 2 ovigerous females) and Ceram (2 ovigerous females) have caused some problems. Gordon (1940: 68, footnote) suggested that his specimens might belong to *E. abrolhensis* instead. Lucas (1980: 172) concurred with Gordon's suggestion, but noted that in one of Tesch's specimen(s), the "... posterior lateral carapace angles are even more pronounced and pointed". Tesch's (1918: Fig. 4, 4a; present Figs. 13J, K) figure of the Ambon male closely resembles the young female examined from Tenimber Island and the two are probably conspecific. The relatively more elongate frontal and rostral regions and the very low anterolateral angles are characters shared by both (cf. Fig. 13G, J, K) (see **Remarks** for *E. truncata*). The female figured by Tesch (1918: Fig. 4b, c; present Fig. 13H, I) (locality not stated, from Ambon or Ceram) is difficult to place. Its carapace very closely resembles that of *E. sundaica*, new species (cf. Figs. 12A, 13H), but the ambulatory legs of his specimen are very short, with the dactylus very short and sickle-shaped (Fig. 13H, I). Such proportionately short ambulatory legs and strongly falcate dactyli are not known for any described *Elamena* species. The specimens should be re-examined to ascertain the accuracy of Tesch's figures. The specimens from Ambon and Ceram were all from reefs (Tesch, 1918: 22).

*Elamenopsis* A. Milne Edwards, 1873

*Elamenopsis* A. Milne Edwards, 1873: 324; Lucas, 1980: 190 (partim).

**Type species.** - *Elamenopsis lineatus* A. Milne Edwards, 1873, by monotypy. Gender of genus feminine.

**Diagnosis.** - Carapace oval, broader than long; dorsal surface with distinct grooves, marginal rim distinct. Rostrum unilobed, strongly deflexed, not continuous with dorsal surface of carapace. Third maxillipeds narrow, not covering more than three-quarters of mouthfield when closed, merus, lobate, longer than ischium along lateral edge. Chelipeds stouter than ambulatory legs. Ambulatory legs stout, laterally compressed but not flattened, dactylus short, not armed with teeth, tip hooked. Male abdomen 6- to 5-segmented (segments 4 and 5 fused); female abdomen 4-segmented, segments 3-5 fused with only lateral parts of sutures still evident. GI sinuous.

**Distribution.** - New Caledonia, Australia, Ambon, Sulawesi, Philippines and Japan.

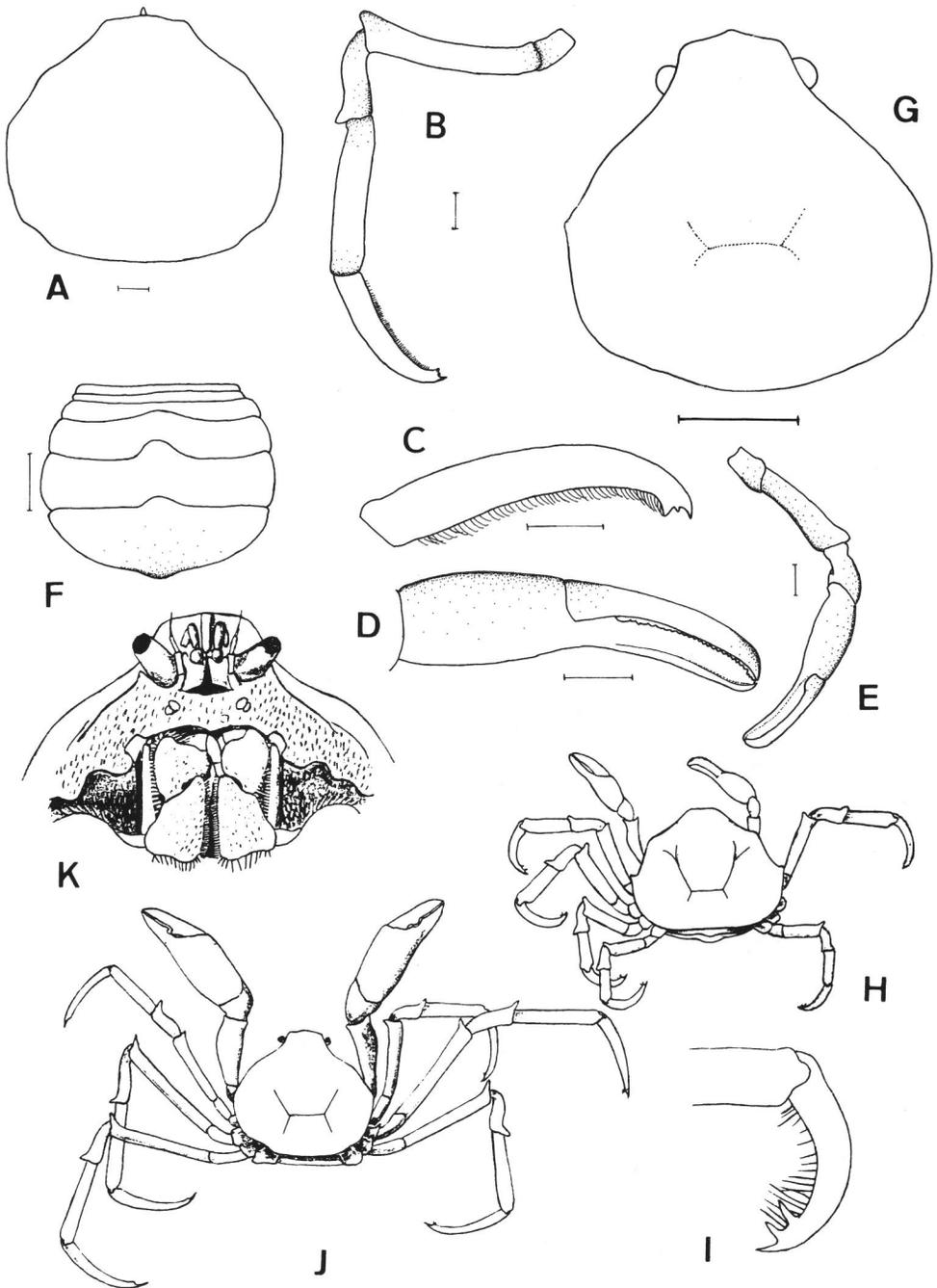


Fig. 13. *Elamena* aff. *truncatus*. A-F, female (4.5 by 4.0 mm) (ZRC 1970.8.4.5), Vietnam; G, female (3.1 by 3.0 mm) (RMNH), Lesser Sunda Islands; H, I, female, ? Ceram (after Tesch, 1918: pl. 1 fig. 4b, c); J, K, male, Ambon (after Tesch, 1918: pl. 1 fig. 4, 4a). A, G, dorsal view of carapace; B, third ambulatory leg; C, dactylus of third ambulatory leg; D, left female cheliped; E, left left chela; F, immature female abdomen, segments 2-6; H, J, overall view of specimens; I, ambulatory dactylus; K, face. Scales: A-F = 0.5 mm; G = 1.0 mm.

**Remarks.** - A number of Indian species previously attributed to *Rhynchoplax* Stimpson, 1858, were referred to *Neorhynchoplax* Sakai, 1938, on the basis of the slender third maxillipeds and male abdomen with segments three to five fused. Lucas (1980) regarded *Neorhynchoplax* synonymous with *Elamenopsis* and synonymised the two. Although the included species do share a similar kind of maxilliped, there are a number of differences, which in our view, could not be dismissed as infrageneric variation (see Table 2). The authors hereby propose to resurrect the genus *Neorhynchoplax*. *Elamenopsis ariakensis* previously attributed to *Rhynchoplax* by Sakai (1969), remains in *Elamenopsis* as it is the only other *Elamenopsis* species which closely resembles *E. lineata*. With regards to the six Australian species recently described by Lucas (1980) and Lucas & Davie (1982), as well as *E. mangalis* Ng, 1988, which have been attributed to *Elamenopsis*, they are here transferred to *Neorhynchoplax* since they resemble the Indian species more closely. Lucas (1980) also attributed *N. palawanensis* Serène (1971) to *Elamenopsis* on the basis of its narrow third maxillipeds and laterally compressed ambulatory legs. We refer *N. palawanensis* to a new genus, *Crustaenia* (see **Remarks** for *Crustaenia*) instead.

Three species are here recognised as belonging to *Elamenopsis* s. str., viz. *E. lineata* (A. Milne Edwards, 1873), *E. ariakensis* (Sakai, 1969) and *E. comosa*, new species.

Female specimens of both *E. lineata* and *E. comosa* possess brood pouches (see **Remarks** for *N. mangalis*). The condition for female *E. ariakensis* is not known.

Table 2. Morphological differences between *Elamenopsis* and *Neorhynchoplax*

	<i>Elamenopsis</i>	<i>Neorhynchoplax</i>
Carapace shape	subrectangular	subcircular
Rostrum	unilobed deflexed	usually trilobed
Ambulatory dactylar dentition	absent	usually with a row of teeth
Posterior lateral spine	absent	sometimes present
G1 setation	absent or with few sparse setae	a distinct row of subterminal setae
Ambulatory legs	short, stout, broad	long, slender

***Elamenopsis comosa*, new species**

(Fig. 14)

**Material examined.** - Holotype - male (2.7 by 2.3 mm) (ZRC 1994.4244), Negeri Lama, Ambon, Indonesia, coll. M. Takeda, 24 Jan.1993.

Paratype - 1 female (3.7 by 2.5 mm) (ZRC 1994.4245), same data as holotype.

**Description.** - Male holotype - Carapace approximately oval, dorsal surface flat, smooth, distinct gastrocardiac, cervical and thoracic grooves; both cervical and thoracic grooves branched. Rostrum unilobate, triangular, sharply deflexed. Eyes distinctly visible dorsally.

Third maxillipeds slender, not covering three-quarters of mouth field when closed; ischium much shorter than merus along outer lateral edge; long setae interspersed with shorter dense setae on inner lateral edge of ischium and merus; inner lateral margins not meeting when closed; palp subequal in length to merus; exopod slightly longer than merus.

Chelipeds equal, stouter than ambulatory legs, surfaces smooth, without long setae; palm inflated; fingers longer than palm, slightly curved; dactylus with triangular, broad tooth on subproximal part, at approximately one-third length of cutting edge; pollex with smaller triangular tooth at distal end of cutting edge; remaining cutting edges serrated; tips hooked.

Ambulatory legs broad, laterally flattened; ventral edge and dorsal edge of merus, carpus, propodus and dactylus lined with dense short setae, interspersed by longer plumose setae; ischium lined with dense short setae; dactylus straight with tip hooked, no subterminal tooth present; carpus shorter than merus and propodus; merus longer than propodus.

Abdomen 6-segmented, all segments free, articulating; posterior margins of segments 4 and 5 deeply indented.

G1 sinuous, tip directed outwards; distal half distinctly stouter than proximal part; distal part bent sharply outwards.

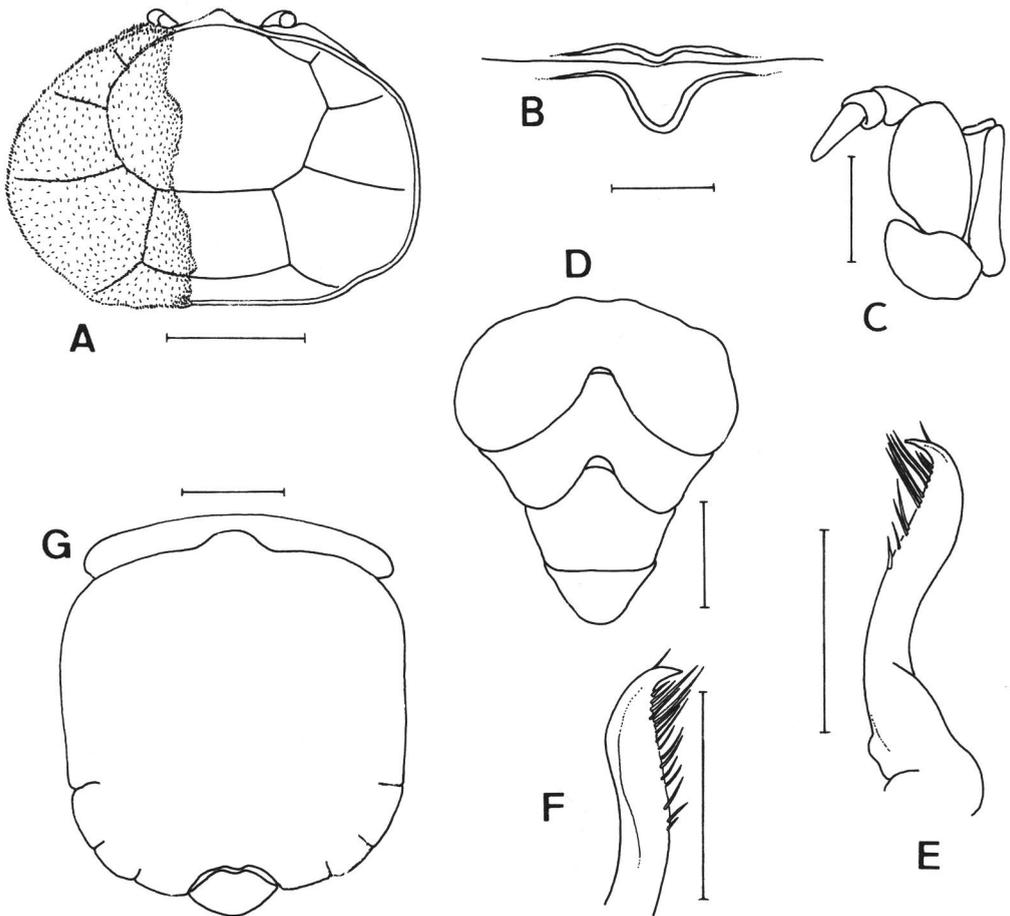


Fig. 14. *Elamenopsis comosa*, new species. A-F, holotype male (2.7 by 2.3 mm) (ZRC 1994.4244); G, paratype female (3.7 by 2.5 mm) (ZRC 1994.4245); Ambon. A, dorsal view of carapace; B, rostrum (frontal view); C, left third maxilliped; D, male abdomen, segments 3-6; E, F, left G1; G, female abdomen, segments 2-6. Scales: A = 1.0 mm, B-G = 0.5 mm.

Female - Non-sexual features essentially similar to that of male holotype, but chelae are not inflated and abdomen is rectangular, with segments 3-5 fused. The telson is semicircular in shape and much less than half the width of segment 5.

**Etymology.** - The name is derived from the Latin for shaggy, alluding to the appearance of the species before cleaning.

**Remarks.** - *Elamenopsis comosa*, new species, is superficially very similar to *E. lineata*, but differs markedly in the form of the front (appears distinctly triangular from dorsal view vs. slightly bilobed to suntruncate), the proportionately longer merus of the third maxilliped; proportionately longer palp of the third maxilliped; having all six male abdominal segments freely articulating (vs. segments 4 and 5 completely fused), the much stouter G1 which is strongly bent distally, and in the female, the telson is semicircular and not wider than half width of segment 5 (vs. broadly triangular). The lack of fusion in the male abdominal segments in *E. comosa* is unlikely to be associated with size as the holotype male is only slightly smaller than the type of *E. lineata* and the Australian specimens of *E. lineata* which have segments 4 and 5 completely fused.

***Elamenopsis lineata* A. Milne Edwards, 1873**

(Figs. 15, 16)

*Elamenopsis lineatus* A. Milne Edwards, 1873: 324, pl. 18 fig. 4; Kemp, 1917: 250; Tesch, 1918: 26, pl. 1 figs. 5, 5a-c; Serène & Umali, 1970: 58, pl. 5 fig. 11.

*Elamenopsis lineata* - Lucas, 1980: 192, figs. 3j, 5j, 8e, 10j; Chuang & Ng, 1994: 87; Ng & Richer de Forges, 1996: 263, fig. 1.

**Material examined.** - Holotype - female (2.6 by 2.0 mm) (MNHN 651), New Caledonie, coll. M. Batema.

Others - INDONESIA: 1 male (3.8 by 2.8 mm) (ZMA), Great Sangir Island, Sulawesi, between Menado and Mindanao (Philippines), coll. Siboga Expedition.

AUSTRALIA: 1 male, 2 females (QM W2341), S. Dunwich, station 3, southeast Queensland, coll. F. Vohra, 15 Jul.1962. — 1 male, 2 females (ZRC 1994.4242, ex. QM W2337), S. Dunwich, station 7, southeast Queensland, coll. F. Vohra, 12 Jul.1962.

**Description.** - Female holotype - Carapace approximately oval, dorsal surface flat, smooth, distinct gastrocardiac, cervical and thoracic grooves; both cervical and thoracic grooves give rise to branches. Rostrum unilobate, triangular, sharply deflexed, appears slightly bilobed to truncate dorsally. Eyes distinctly visible dorsally.

Third maxillipeds slender, not covering three-quarters of mouth field when closed; ischium slightly shorter than merus along outer lateral edge; sparse long setae interspersed with shorter dense setae on inner lateral edge of ischium and merus; inner lateral margins not meeting when closed; palp not longer than merus; dactylus with four setae; exopod subequal in length with merus.

Chelipeds equal, slightly stouter than ambulatory legs, surfaces smooth, without setae; palm inflated; fingers longer than palm, slightly curved; dactylus with triangular, broad tooth on subproximal part, at approximately one-third length of cutting edge; pollex with smaller triangular tooth at distal end of cutting edge; remaining cutting edges serrated; tips hooked.

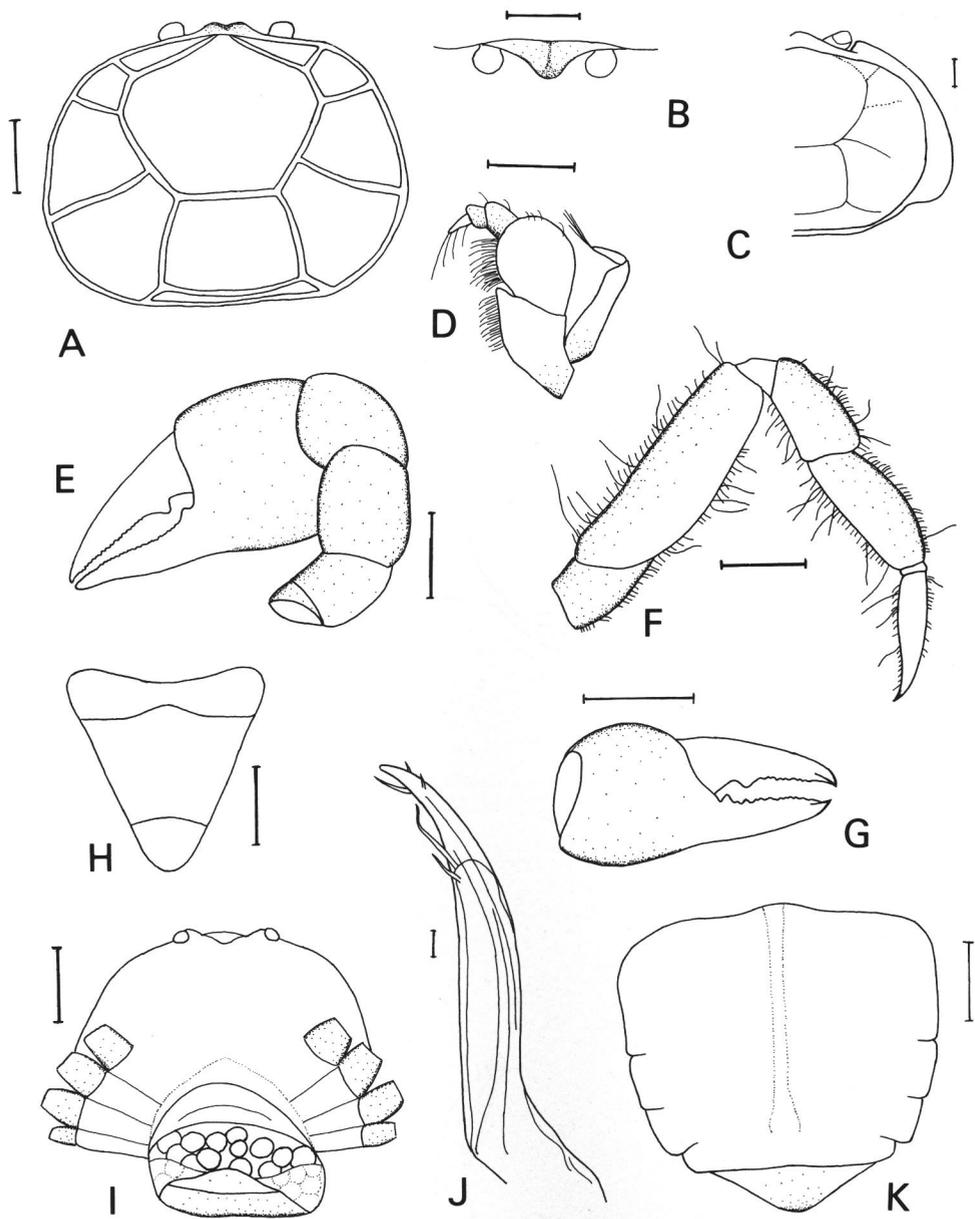


Fig. 15. *Elamenopsis lineata*. A, B, E, holotype female (MNHN 651), New Caledonia; C, D, F-H, J, male (2.7 by 2.0 mm) (QM W2341), Australia; I, K, female (3.4 by 2.5 mm) (ZRC 1994.4242), Australia. A, C, dorsal view of carapace; B, rostrum (frontal view); D, left third maxilliped; E, right cheliped; F, right third ambulatory leg; G, right chela; H, male abdomen, segments 3-6; I, female showing brood cavity, segments 2-6; J, left G1; K, female abdomen, segments 3-6. Scales: A-I, K = 0.5 mm; J = 0.05 mm.

Ambulatory legs broad, laterally flattened; ventral edge and dorsal edge of merus, carpus, propodus and dactylus lined with dense short setae, interspersed by longer plumose setae; ischium lined only with dense short setae; dactylus straight with the tip hooked, no subterminal tooth present; carpus shorter than merus and propodus; merus longer than propodus.

Abdomen 4-segmented, segments 3-5 fused with only lateral parts of sutures visible, all other intersegmental sutures distinct and segments articulating; fused piece squarish; surface slightly convex; lateral margins slightly concave; telson (segment 6) triangular, tip rounded; telson broadly triangular, widest part exceeding half width of segment 5.

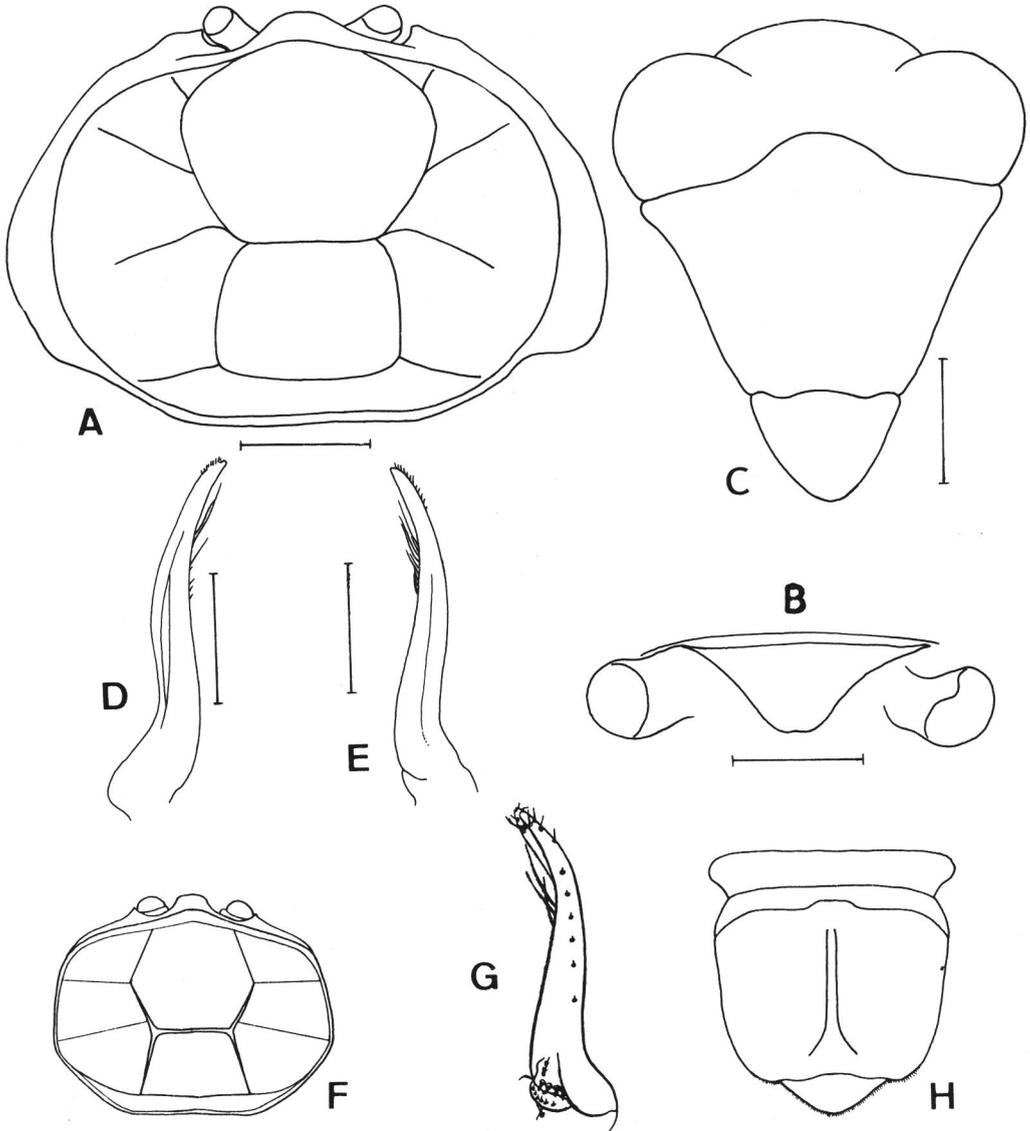


Fig. 16. *Elamenopsis lineata*. A-E, male (3.8 by 2.8 mm) (ZMA), Sulawesi; F, G, male; H, female (after Lucas, 1980: Figs. 3J, 10J, 5J respectively); Australia. A, F, dorsal view of carapace; B, rostrum (frontal view); C, male abdomen, segments 3-6; D, E, left G1; G, G1; H, female abdomen, segments 1-6. Scales: A = 1.0 mm; B-E = 0.5 mm.

Male - Non-sexual features similar to female holotype. Cheliped slightly more massive than in female, tips of fingers not as sharply hooked as in female. Pollex with proximal portion curved towards dactylus and distal portion curved slightly away from latter. Abdomen, triangular, 5-segmented, lateral margins straight, segments 4 and 5 fused with no distinct sutures. G1 straight, distal portion slightly curved, tapers gradually to simple, pointed tip, 3 subterminal setae, 2 setae on ventral side at approximately one-third length from tip.

**Remarks.** - The genus *Elamenopsis* is feminine. A. Milne Edwards (1873) incorrectly used the masculine gender for the species name "*lineatus*".

Alphonse Milne Edwards (1873) briefly described the species from one specimen, collected from Dotio, New Caledonia, and gave a figure of the whole animal. The holotype was reported to be a male by A. Milne Edwards (1873) but Lucas (1980) noted that it was in fact a female. Tesch (1918) gave a detailed description of a male specimen ostensibly collected from coral reefs at Sangir, north of Celebes (= Sulawesi) from the Siboga Expedition. Alphonse Milne Edwards (1873: 324) described the habitat as "... recouvert d'eau saumâtre" (= salty\brackish). Tesch interpreted this as being a brackish habitat, and specimens examined by Lucas (1980) were entirely from estuaries. Lucas regarded Tesch's record from "coral reefs" as being unlikely.

The authors have examined the holotype female, Tesch's specimen, and six specimens from Australia. Tesch (1918) figured the male abdomen of his specimen as being without fused segments which is incorrect. The abdomen of his specimen has segments four to five fused without any suture present. Lucas (1980) mentioned a faint suture separating segments four and five, which we could not detect. The male abdomens of the Australian and Sulawesi specimens are almost identical. The G1s of the Australian and Sulawesi specimens differ slightly, with the distal part of the G1 from the Sulawesi specimen being somewhat stouter and less tapered. The Sulawesi male specimen (not in a good condition), however, is distinctly larger than the Australian specimens examined. A good series of specimens from Sulawesi should be obtained to ascertain if the differences in the G1 structure observed are consistent and merit specific recognition. Lucas (1980: Fig. 5J; present Fig. 16H) figured the female abdomen as not having any lateral sutures between the fused segments, but the female specimens examined have lateral dents still discernible, albeit rather small (Fig. 15K). The lateral margins of the fused female abdominal segments 3-5 are interesting in this respect as there appears to be three dents (indicating four fused segments). As such, these dents may not represent real sutures. This is the same for *E. comosa*, new species.

Serène & Umali (1970) reported a 3.3 by 2.3 mm female specimen from Dagat-dagatan in the Philippines, but his figure is too poor to ascertain if it is really *E. lineata* or *E. comosa*, new species. From the geographical perspective (since Tesch's specimen is from between Sulawesi and Mindanao), it seems their specimen is likely to be *E. lineata*.

*Elamenopsis lineata* is closest to *E. comosa*, new species, from Ambon, and the differences between these two species have already been discussed under that species. The closely related *E. ariakensis* from Japan has a 4-segmented male abdomen (segments 3-5 fused) (vs. 5-segmented in *E. lineata*).

***Halicarcinus* White, 1846**

*Halicarcinus* White, 1846: 178.

*Liriopea* Nicolet, 1849: 158.

*Hymenicus* Dana, 1851: 253.

*Hombronia* Lucas, 1853: 60.

*Rhynchoplax* Stimpson, 1858: 109 (partim); Alcock, 1900: 387; Stimpson, 1907: 147 (partim); Kemp, 1917: 251; Tesch, 1918: 17; Chopra & Das, 1930: 414; Shen, 1932: 58; Sakai, 1938: 62; Barnard, 1950: 71.

**Type species.** - *Cancer planatus* Fabricius, 1775, by original designation. *Liriopea* Nicolet, 1849, type species: *Hymenosoma leachi* Guérin, 1838 [= ? *Cancer planatus* Fabricius, 1775] by subsequent designation by Rathbun (1925). *Hymenicus* Dana, 1851, type species: *Hymenicus varius* Dana, 1851, by subsequent designation by Kemp (1917). *Hombronia* Lucas, 1853, type species: *Hymenosoma ? tridentatum* Jaquinot, 1853 [= ? *Cancer planatus* Fabricius, 1775] by monotypy. *Rhynchoplax* Stimpson, 1858, type species: *Rhynchoplax messor* Stimpson, 1858, by subsequent designation by Kemp (1917). Gender of *Halicarcinus* masculine.

**Distribution.** - Circum-subantarctic; New Zealand; Australia; New Caledonia; Japan; China; Taiwan; Singapore; Malaysia.

**Remarks.** - Several species attributed to the genus *Rhynchoplax* by Sakai (1938, 1965) and Takeda & Miyake (1971b) were found to be congeneric with *Halicarcinus* (Lucas, 1980). Sakai (1938) gave a historical account of *Rhynchoplax* and a generic diagnosis and at the same time separated most species into his new genus *Neorhynchoplax*. A brief revision of this genus was done by Lucas (1980). The New Zealand species were well described and illustrated by Melrose (1975) while the Australian species were similarly treated by Lucas (1980). Only two species occur in Southeast Asia - *H. coralicola* and *H. filholi*, the latter a questionable member of the genus.

***Halicarcinus coralicola* (Rathbun, 1909)**

(Figs. 17, 18)

*Halicarcinus coralicola* Rathbun, 1909: 108; Rathbun, 1910: 316, fig. 5; Tesch 1918: 17, 19; Sakai, 1934: 289, fig. 2; Lucas, 1980: 177; Chuang & Ng, 1994: 87, 89.

*Halicarcinus septentrionalis* Yokoya, 1928: 762, fig. 2.

*Neorhynchoplax inachoides* - Yang, 1979: 12 (not *Rhynchoplax inachoides* Alcock, 1900).

**Material examined.** - SINGAPORE: 1 female (ZRC 1994.4286), Labrador Beach, coll. P. K. L. Ng, 26 Nov.1991. — 1 male, 2 females (ZRC 1994.4450), Labrador Beach, coll. P. K. L. Ng, 1982. — 3 females (ZRC 1993.6505-6507), Labrador Beach, coll. P. Ng, 1992. — 1 male, 1 ovigerous female (ZRC 1993.6508-6509), Labrador Beach, coll. P. K. L. Ng, 26 Nov.1991. — 1 female (NHM), Labrador Beach, coll. P. K. L. Ng, 16 Nov.1991. — 1 male, 1 female (ZRC 1993.6500-6501), Siloso Beach, Sentosa, coll. P. K. L. Ng, 1984. — 5 males, 1 female (ZRC 1993.3498-3511), Siloso Beach, Sentosa, coll. P. Ng, 13 Dec.1989. — 2 males, 1 female (ZRC 1993.6502-6504), Siloso Beach, Sentosa, coll. P. Ng, 1984. — 1 male (ZRC 1994.4249), Sentosa coral reef, coll. P.K.L. Ng, May.1982. — 1 male (RMNH), Siloso Beach, Sentosa Island, coll. P. K. L. Ng. — 1 female (ZRC 1984.7859), reef flat at Buran Darat, coll. D. S. Johnson, 2 Dec.1953. — 2 males, 1 female (ZRC), Pulau Kukor, coll. P. Ng, 3 Dec.1986. — 1 male (ZRC 1968.1.25.30), Pulau Pawai, coll. R. Serène, 15 Apr.1964. — 1 dried female (ZRC 1968.1.25.35), Pulau Pawai, coll. R. Serène, 15 Jun.1964.

PENINSULAR MALAYSIA: 1 female (ZRC), Port Dickson, near Negri Sembilan, coll. K. S. Tan.

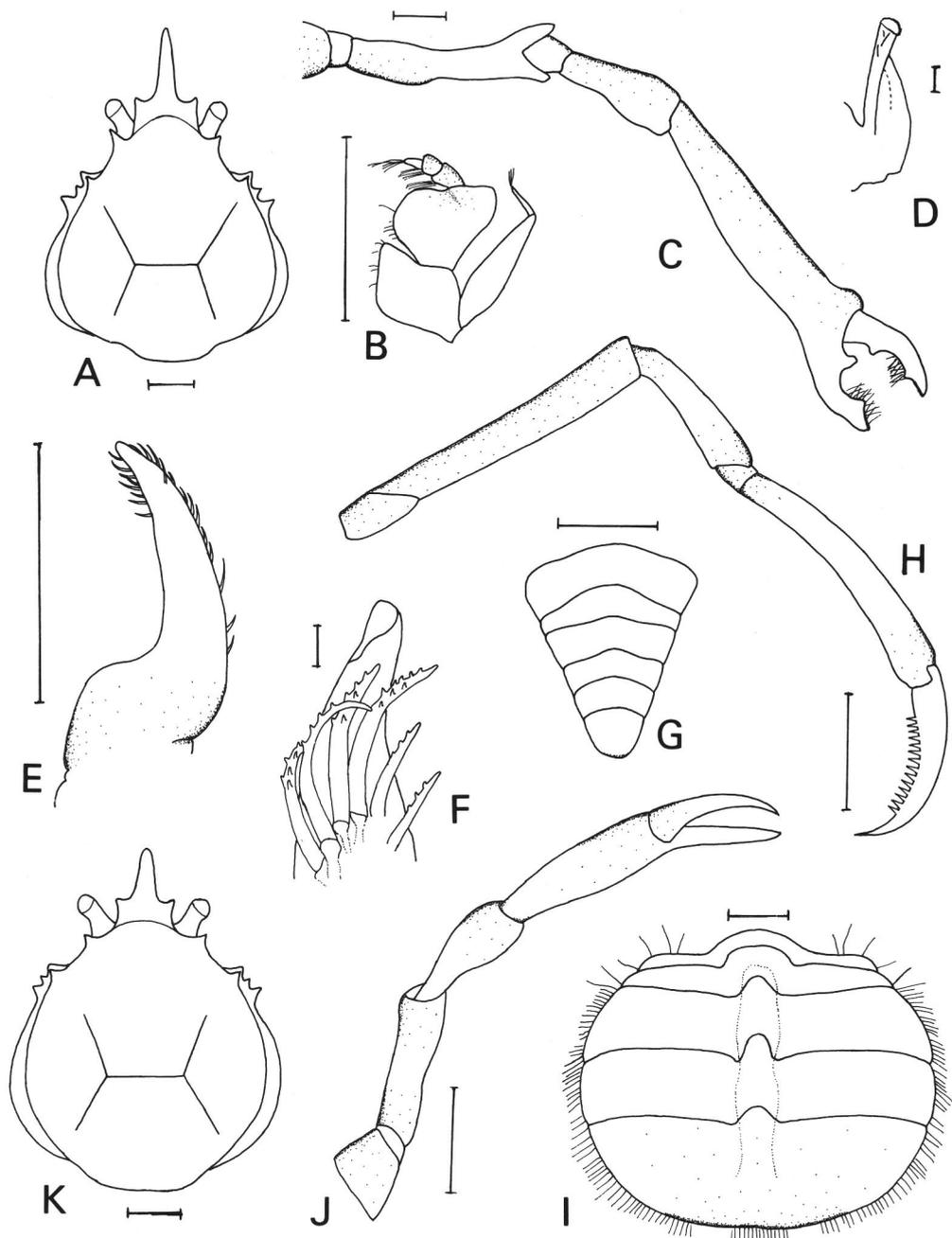


Fig. 17. *Halicarcinus coralicola*. A-H, male (2.5 by 3.5 mm) (ZRC 1993. 6502); I-K, female (2.6 by 3.2 mm) (ZRC 1993.6503); Singapore. A, K, dorsal view of carapace; B, left third maxilliped; C, male left cheliped; D, left G2; E, left G1; F, G1 apex; G, male abdomen; H, third ambulatory leg; I, female abdomen, segments 2-6; J, female left cheliped. Scales: A-K = 0.5 mm; D = 0.05 mm; F = 0.03 mm.

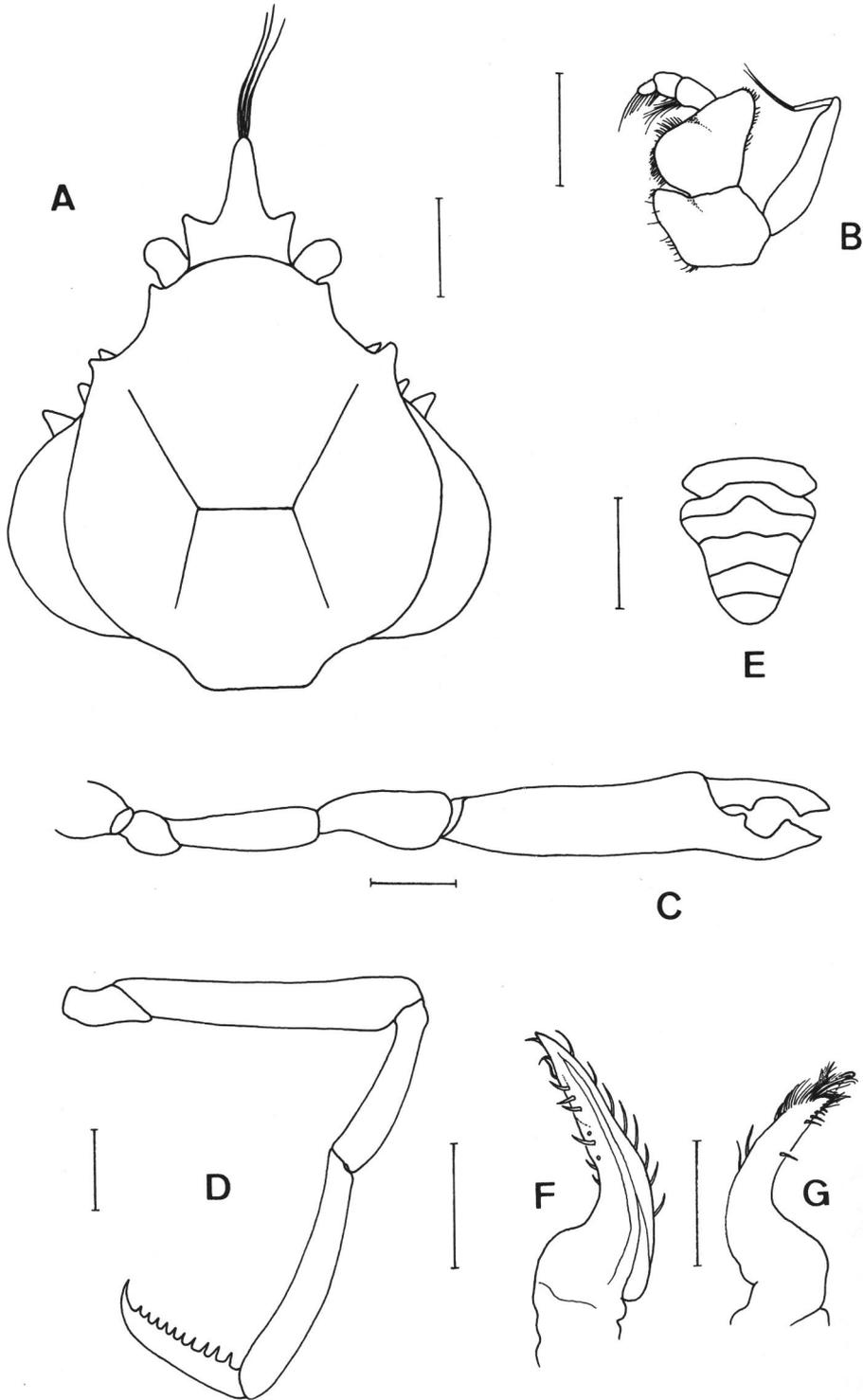


Fig. 18. *Halicarcinus coralicola*. A, E, F, G, male (3.6 by 5.0 mm) (NSMT-Cr 10410); B, C, D, male (3.0 by 3.7 mm) (ZRC 1994.4232); Japan. A, dorsal view of carapace; B, left third maxilliped; C, right cheliped; D, right third ambulatory leg; E, male abdomen; F, G, left G1. Scales = 0.5 mm.

JAPAN: 1 male (3.7 by 5.2 mm) (NSMT-Cr 10410), Aburatsubo, west coast of Miura Peninsula, Sagami Bay, Honshu, coll. N. Shikatani. — 6 males, 6 females (4 ovigerous) (NSMT-Cr 8064), Miyano-hama beach, Chichi-jima Island, Ogasawara islands, coll. M. Takeda, 1 Jul.1976. — 4 males (largest 3.5 by 3.8 mm) (ZRC 1994.4239), Miyara, Ishigaki Island, coll. T. Kosuge, 23 Mar.1993. — 1 ovigerous female (ZRC 1994.4239), Yamada, Okinawa, coll. T. Kosuge, 2 Jul.1993. — 1 female (ZRC 1994.4243), reef, Horikawa, Okinawa, coll. T. Kosuge, 31 Jul.1992. — 1 male (ZRC 1994.4232), Ishikawa Prefecture, coll. T. Kosuge, 18 Feb.1992.

**Description.** - Male - Carapace flat, triangular, longer than broad; dorsal surface smooth with distinct cervical, thoracic and gastrocervical grooves; cervical and thoracic grooves approaching but never reaching anterolateral and posterolateral margins respectively; prominent, sharp spines posterior of eyestalks; an acute spine at anterior lateral margin; three acute spines on subhepatic margin, visible dorsally; branchiostergite visible dorsally. Rostrum trilobed, medial lobe twice length of lateral lobes which are directed forward and obliquely upward, lateral and medial lobes fused at base, not continuous with dorsal surface of carapace. Eyes, eyestalks prominent, clearly visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium longer than merus along outer lateral edge; sparse setae on inner lateral edge of both merus and ischium; inner lateral margins meeting when closed; palp not longer than merus; longer setae at tip of dactylus, distal half of carpus and propodus; medial groove running down one-quarter length of merus; exopod much longer than merus.

Chelipeds equal, circular in cross-section except fingers which are slightly laterally flattened, slightly stouter and longer than ambulatory legs; surfaces smooth; inner distal portion of fingers lined with dense fine setae; cutting edges of fingers entire; propodus straight, 3 times length of fingers; fingers curved towards each other in an approximate semicircle, gape with only teeth meeting when closed; triangular, broad tooth on distal and proximal portions of both fingers, distal teeth smaller than that on proximal.

Ambulatory legs slender, cross-section rounded except dactylus which is laterally flattened; dorsal and ventral edges not lined with setae; dactylus curved, tip sharply hooked, a row of straight sharp teeth on ventral edge; carpus longer than merus and propodus which are subequal in length.

Abdomen 6-segmented, triangular, without fused segments; all intersegmental sutures distinct, articulating; lateral margins straight, tip rounded.

G1 stout, curving 90° at base, portion above base curving dorsally, tapering slightly along its length to a simple blunt tip; subterminal tuft of setae on dorsal and ventral surfaces; setae extend further down on ventral side; row of similar setae spanning across diagonally down on left side of right G1; broad spinules on ventral side of each seta.

Female. - Non-sexual features similar except carapace is subcircular rather than triangular as in male; medial lobe of rostrum is 1.5 instead of 2 times length of lateral lobes. Cheliped not longer than ambulatory legs. Propodus and dactylus morphologically very different from that of male, propodus one and a half times (cf. 3 times in male) longer than fingers; cutting edges of fingers entire without teeth, tips sharply hooked; fingers not laterally flattened, cross-section circular. Abdomen broader than long, surface convex, lateral margins of segments 4-6 lined with dense setae, longer sparse setae line the lateral margins of segments two and three.

**Remarks.** - This species was first described by Rathbun (1909) from Singapore, who gave a very brief description of the carapace and the chelipeds of the single female specimen she had. Yokoya (1928) described a new species, *H. septentrionalis*, from Japan which was later regarded as a synonym of *H. coralicola* by Sakai (1938, 1976). Yokoya (1928) correctly described the female abdomen of *H. septentrionalis* as being 5-segmented (see Fig. 13K) but his statement that the male abdomen is 7-segmented is obviously a mistake as all hymenosomatids have only six abdominal segments. The male chelipeds figured by Yokoya (1928) appear to be unarmed which was contrary to what he described in the text.

*Halicarcinus coralicola* bears a close resemblance with *H. setirostris*, but the differences between them have been aptly dealt with by Sakai (1934, 1938). *Halicarcinus keijibabai* closely resembles *H. coralicola* but differs in the rostrum, dactylus and carapace (see later; Takeda & Miyake, 1971b). *Halicarcinus coralicola* seems to have a wide distribution in Asia. It will probably be found to be even more widely distributed in Southeast Asia once more extensive collections are made. A good series of *H. coralicola* specimens from Japan were examined and compared with those collected in Singapore. Specimens from the two localities agreed very closely. There were some differences which we regard as relatively minor. One obvious difference is in size. The Japanese specimens are larger, approximately twice that of Singapore specimens. The G1s of Japanese specimens are also slightly broader near the base, but agree in all other features.

The sexual dimorphism exhibited by this species is quite extreme. The carapace of the female is circular rather than triangular in the male. The chelipeds of males are longer than the ambulatory legs whereas in females, they are shorter; the palm of the chela of the female is twice the length of the carpus whereas that in the male is three times the length of the carpus and more massive. The morphology of the fingers are also very different in the two sexes, the fingers in females are unarmed and the tips are pointed and sharp. In the males, each finger is equipped with a proximal and a distal tooth, and the tips are rounded, not sharp.

*Halicarcinus coralicola* is the only littoral species known thus far (Chuang & Ng, 1994). They are relatively abundant on rocky shores at Labrador Park and Sentosa in Singapore. These crabs usually inhabit crevices of coral rocks covered with soft mud and branching algae. They are inactive and their long, stick-like legs easily blend them into the background. They are also camouflaged by mud and sometimes small pieces of algae. Collections are made even more difficult by the fact that they are extremely small, the smallest adult male being two mm in carapace width. These crabs have been observed to feed on organic detritus in the mud.

### ***Halicarcinus filholi* De Man, 1887**

(Fig. 19)

*Elamene Filholi* De Man, 1887: 386, Pl. 17 fig. 3.

*Halicarcinus filholi* - Lucas, 1980: 178.

**Material examined.** - None.

**Description.** - Male (after De Man, 1887) - Carapace gently convex, rounded, slightly broader than long; dorsal surface smooth with distinct cervical, thoracic and gastrocardiac grooves; cervical and thoracic grooves not reaching anterolateral and posterolateral margins

respectively; posterior lateral angles of carapace with well developed, anteriorly-directed spine; branchiostegite visible dorsally. Rostrum trilobed, medial lobe slightly larger than lateral lobes, all lobes fused at base. Eyes, eyestalks completely hidden by rostrum and anterior rim of carapace, not visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium longer than merus along outer lateral edge; inner lateral margins meeting when closed; palp not longer than merus; exopod much longer than merus.

Chelipeds equal, cross-section circular except chela and fingers which are slightly laterally flattened; stouter and longer than ambulatory legs; surfaces smooth; cutting edges of fingers with several teeth; propodus straight; fingers shorter than chela; proximal gape present when fingers closed.

Ambulatory legs slender; dorsal and ventral edges not lined with dense setae; dactylus gently curved, tip hooked, with strong, sharp subterminal tooth; carpus shorter than merus; merus slightly longer than propodus.

Abdomen triangular.

**Remarks.** - This species is known only from a single male (3.75 by 4.0 mm) described from Noordwachter Island, near Jakarta, Java, Indonesia. The species was relatively well described and the figures clearly show its main features, although the important characters of the segmentation of the male abdomen and structure of the G1 were not described. The above description is based on De Man's (1887) text and figures.

The generic classification of *H. filholi* in *Halicarcinus* is provisional. The absence of both a groove or ridge separating the rostrum from the rest of the carapace and the row of ventral teeth on the ventral margin of the ambulatory dactylus, as well the ventrally placed eyes which are completely covered by the carapace rim and not visible dorsally, puts it apart from other *Halicarcinus* known thus far. Consideration of the overall morphology of the species as well as structure of the third maxillipeds however, and in lieu of examining the

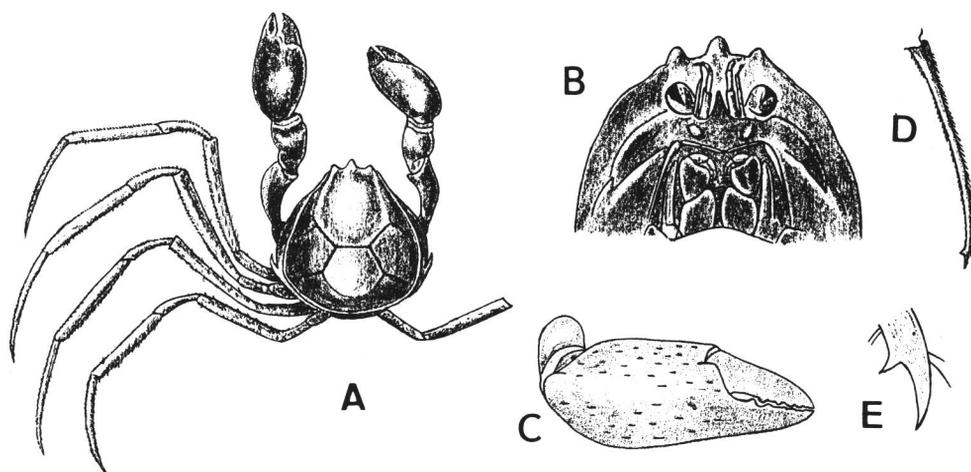


Fig. 19. *Halicarcinus filholi*. Holotype male (4.0 by 3.8 mm) (after De Man, 1887: Pl. 17 fig. 3); Noordwachter Island. A, dorsal view of carapace; B, buccal area showing third maxillipeds; C, right chela; D, ambulatory dactylus.

type male, the tentative placement of *Elamene filholi* in *Halicarcinus* is the best course of action, as was suggested by Lucas (1980: 178). When specimens do become available, this species, in all likelihood, will have to be referred to its own genus.

### ***Hymenicoides* Kemp, 1917**

*Hymenicoides* Kemp, 1917: 267; Lucas, 1980: 196.

*Limnopilos* Chuang & Ng, 1991: 363, fig. 1.

**Type species.** - *Hymenicoides carteri* Kemp, 1917, by original designation. Gender of genus feminine.

**Diagnosis.** - Carapace circular, pilose, dorsal surface concave; grooves distinct; rostrum absent or very weak; eyes, antennae and antennules visible dorsally; third maxillipeds narrow, not covering more than three-quarters of mouth field when closed, merus rectangular, dactylus styliform, approximately twice the length of propodus; merus of ambulatory legs with distinct tooth on ventral edge. Male and female abdomen without fused segments, telson of male trilobate. G1 stout, apex complex, with long subterminal setae and denticulate lobe.

**Distribution.** - India, Thailand and Borneo.

**Remarks.** - Of the free-living epigeal taxa, the absence of a rostrum allies *Limnopilos* Chuang & Ng, 1991, with *Hymenicoides* Kemp, 1917, and *Halicarcinides* Lucas, 1980, both monotypic genera. In *Halicarcinides*, the eyes are not visible dorsally, the third maxillipeds broad, covering most of mouthfield, the palp is subequal in length with the merus, the dactyl has only a sharp recurved subterminal tooth and the male G1 is simple and narrow. *Limnopilos* and *Hymenicoides* share a large number of features: pilose body, a characteristic third maxilliped with an elongate dactylus and rectangular merus, absence of a rostrum, similar dentition on the dactylus of the ambulatory leg, similar type of complex apex of the male first gonopods, with a denticulate lobe and long subterminal setae, and a trilobate telson. However, *Limnopilos* does not have the protuberance on the outer surface of palm of male cheliped, but this is probably more of an interspecific rather than an intergeneric difference. One of the main reasons for separating *Limnopilos naiyanetri* generically from *Hymenicoides carteri* was by the structures of their telsons (Chuang & Ng, 1991). In *Hymenicoides*, the telson is distinctively trilobate, with the lateral lobes large and distinctively produced. In *Limnopilos*, the trilobate condition is much less obvious, the lateral lobes being smaller and more confluent with the median part. Lucas (1980), who examined some type specimens in the British Museum (Natural History) (London), observed that the trilobate condition is to accommodate the complex apices of the G1 in *H. carteri*. The apices of the G1s in *L. naiyanetri* however, are not in contact with the lobes of the telson. After due reconsideration of this and the congruence of almost all other characters we regard as taxonomically important at the genus level, we feel that it would be better to synonymise *Limnopilos* under *Hymenicoides*.

The trilobate male telson suggests some affinity with the genus *Amarinus*, which is characterised by the intercalated plates at the articulation of the telson and segment 5. This might suggest a common ancestral line. *Hymenicoides naiyanetri* is presently known only from two isolated freshwater bodies, one in central and the other in western Thailand. *Hymenicoides carteri* is reported from freshwater localities in the Gangetic Delta, west Bengal and Bangladesh.

*Hymenicoides* resembles *Elamenopsis* in having distinct grooves on the dorsal surface of the carapace and narrow third maxillipeds (see Chuang & Ng, 1991), but in *Limnopilos*, the palp is twice the length of the merus (subequal with merus in *Elamenopsis*), and the merus is distinctively lobate (rectangular in *Elamenopsis*).

The distinct grooves on the dorsal surface of the carapace ally this genus with *Elamenopsis* and *Halicarcinus*. However the absence of a rostrum and the characteristic third maxillipeds of *Hymenicoides* suggest the two are not very closely related.

The very weak or absence of a rostrum in *Hymenicoides* immediately suggests an affinity with the genus *Cancrocaeca*. Furthermore, the GIs of the two type species share common features like a stout appearance, with a row subterminal setae and a complex apex.

### *Hymenicoides microrhynchus* Ng, 1995

(Fig. 20)

*Hymenicoides microrhynchus* Ng, 1995: 79, Figs. 13, 14.

**Material examined.** - Holotype - male (5.3 by 4.6 mm) (SBM), Kinabatangan River, at jetty to Danau Girang, Sabah, Malaysia, Borneo, coll. 10-11 Apr.1994.

**Description.** - Male - Carapace pilose, circular; dorsal surface flat, smooth with distinct cervical, thoracic and gastroduodenal grooves; cervical groove reaching anterior margin just posterior to base of eyes; thoracic groove reaching posterolateral margin; a groove arises from middle of each cervical groove reaching anterolateral margin; lateral margins unarmed. Rostrum vestigial, very small; Eyes, eyestalks, antennae and antennules prominent, clearly visible dorsally.

Third maxillipeds less than three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; dense setae lining inner lateral edge of ischium; inner lateral margins not meeting when closed; palp distinctly longer than merus; setae similar to that found on merus line inner edges of propodus and distal half of carpus; shallow medial groove running down length of merus; exopod much longer than merus.

Chelipeds equal, cross-section subcircular except fingers which are slightly laterally flattened; more robust, longer than ambulatory legs; surfaces smooth; fingers slightly longer than palm; dactylus curved towards pollex, inner cutting edge lined with short, slightly dense setae, dorsal edge lined with very dense setae of decreasing length; pollex, straight, outer cutting edge with 4-5 broad and triangular teeth; dense setae of decreasing length lining ventral edge of propodus; carpus with 2 blunt teeth on ventral edge; uniformly spaced setae line dorsal inner edge of propodus; merus subequal in length with carpus; broad triangular tooth spanning most of ventral edge; inner lateral edge lined with sparse setae, half length of that found on carpus; tuft of setae at proximal edge; inner proximal edge of ischium with tuft of setae.

Ambulatory legs slender, subcircular in cross-section except dactylus which is laterally flattened; surfaces with dense setae which are also found on dorsal and ventral edges except ventral edge of dactylus; dactylus curved, narrow, tip sharply hooked, a row of 8-9 recurved sharp teeth (increasing in size distally); carpus shorter than merus and propodus, propodus longer than merus; long, sparse setae on ventral edges of coxa, ischium and merus.

Abdomen 6-segmented, without fused segments; all intersegmental sutures distinct, articulating; lateral margins convex; segment 2 narrowest; tip rounded, surface and lateral margins convex.

G1 stout, curving about 90° medially, tapering very slightly along its length to complex flat tip, long triangular tooth projecting from centre, ventral edge of tip with approximately several very small, short spinules; subterminal tuft of approximately 10 long setae on ventral surface; minute setae spanning diagonally across left lateral side of proximal half.

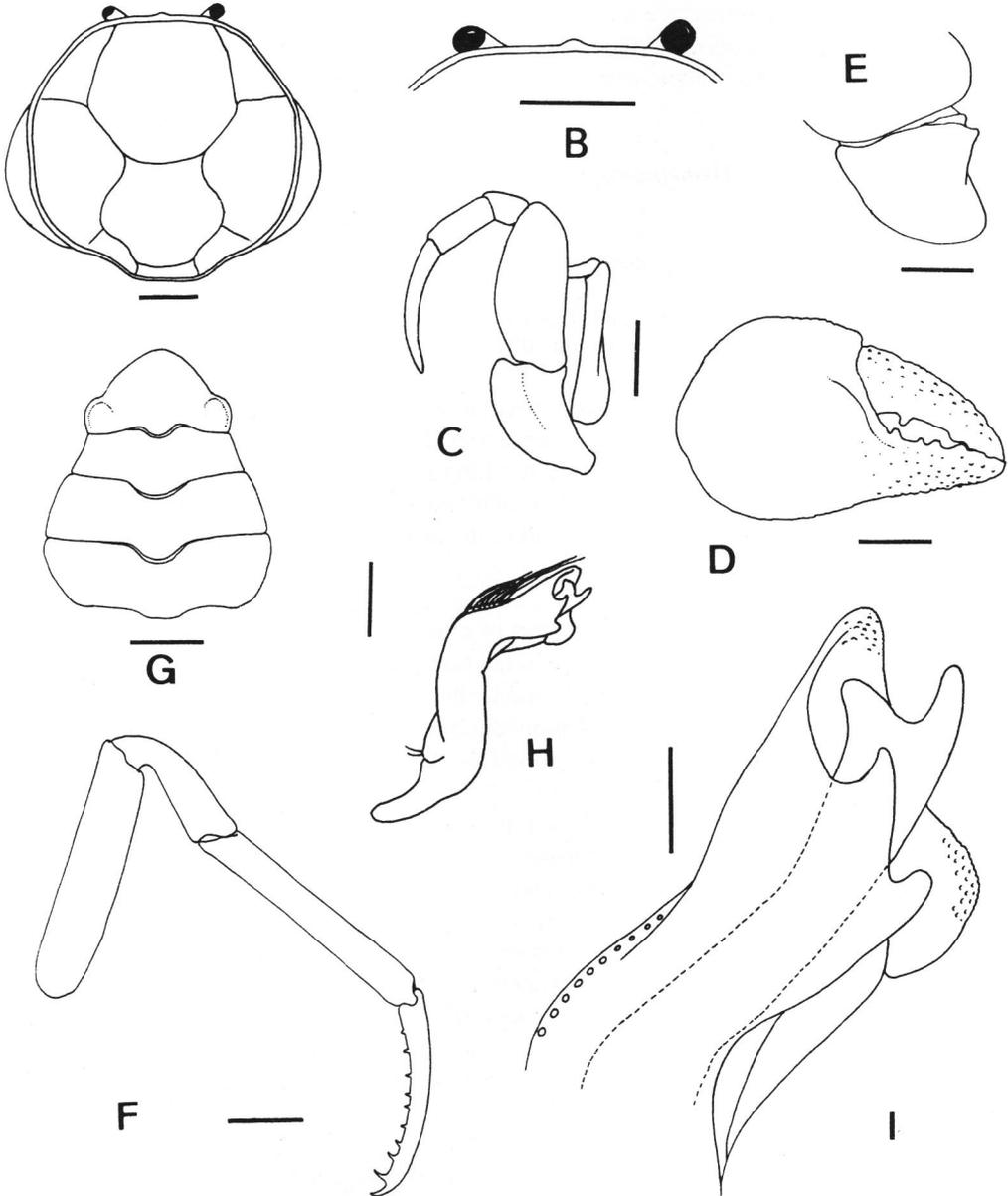


Fig. 20. *Hymenicoides microrhynchus*. Holotype male (5.3 by 4.6 mm) (SBM), Sabah. A, carapace; B, frontal margin; C, left third maxilliped; D, right carpus of cheliped (dorsal view); E, right chela; F, second right ambulatory leg; G, abdominal segments 3-6; H, left G1 (ventral view) (setae not drawn); I, tip of left G1. Setae denuded on all structures except H. Scales = 0.5 mm.

**Remarks.** - *Hymenicoides microrhynchus* closely resembles *H. naiyanetri* from Thailand, but can easily be separated by its possession of a vestigial (but visible) rostrum (vs. completely absent), a proportionately longer merus of the third maxilliped, the propodus of the third ambulatory leg is longer than the merus (vs. subequal), and a slightly more slender G1. It is remarkable that despite the wide distance separating *H. microrhynchus* and *H. naiyanetri* (central Thailand vs. eastern Sabah respectively), the two species still resemble each other so closely.

***Hymenicoides naiyanetri* (Chuang & Ng, 1991)**

(Fig. 21)

*Limnopilos naiyanetri* Chuang & Ng, 1991: 364, fig. 1; Chuang & Ng, 1994: 86, 88.

**Material examined.** - Holotype - male (6.0 by 5.9 mm) (ZRC 1993.6520), Mae Nam Nakhon Chaisi, Amphoe Nakhom Chaisi, Changwat Province, Nakhom Pathom, coll. Naunsri, 1988.

Paratypes - 24 males, 13 females (ZRC), 5 males, 5 females (CNHM), 10 males, 2 females (RMNH), same data as holotype.

Others - THAILAND: 2 males, 2 females (RMNH), Bung Borapet, N. of Nakhon Sawan, coll. W. Junk, 14 Mar. 1971.

**Description.** - Male - Carapace pilose, circular; dorsal surface flat, smooth with distinct cervical, thoracic and gastrocardiac grooves; cervical groove reaching anterior margin just posterior to base of eyes; thoracic groove reaching posterolateral margin; groove arising from middle of each cervical groove reaching anterolateral margin; branchial region highly visible dorsally; sides entire without spines; margin clearly demarcated. Rostrum absent. Eyes, eyestalks, antennae and antennules prominent, clearly visible dorsally.

Third maxillipeds cover less than three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; dense setae lining inner lateral edge of ischium; setae, more sparsely spaced, approximately thrice the length of that found on ischium lining inner lateral edge of merus, some arising from fold at distal inner edge; inner lateral margins not meeting when closed; palp twice length of merus; setae similar to that found on merus line inner edges of propodus and distal half of carpus; approximately 10 slightly shorter and more sparsely spaced setae on inner edge of dactylus; medial groove running down one-quarter length of merus; exopod much longer than merus, glabrous.

Chelipeds equal, subcircular in cross-section except fingers which are slightly laterally flattened; stouter, more robust and longer than ambulatory legs; surfaces smooth; fingers slightly longer than palm; dactylus curved towards pollex, tip rounded, inner cutting edge lined with short, slightly dense setae, dorsal edge lined with very dense setae of decreasing length; pollex, straight, spatulate, outer cutting edge with 5 broad and triangular teeth; propodus highly inflated, dorsal edge lined with approximately 6 setae, 1.6 times longer than that of on edge of dactylus; dense setae of decreasing length lining ventral edge of propodus; distal half of palm, at articulation with dactylus, lined with highly dense setae; carpus with 2 teeth on ventral edge; uniformly spaced setae of length approximately that on propodus lined dorsal inner edge; merus subequal in length with carpus; broad triangular tooth spanning two-thirds the ventral edge; inner lateral edge lined with sparse setae, half length of that found on carpus; tuft of setae at proximal edge; inner proximal edge of ischium with tuft of setae.

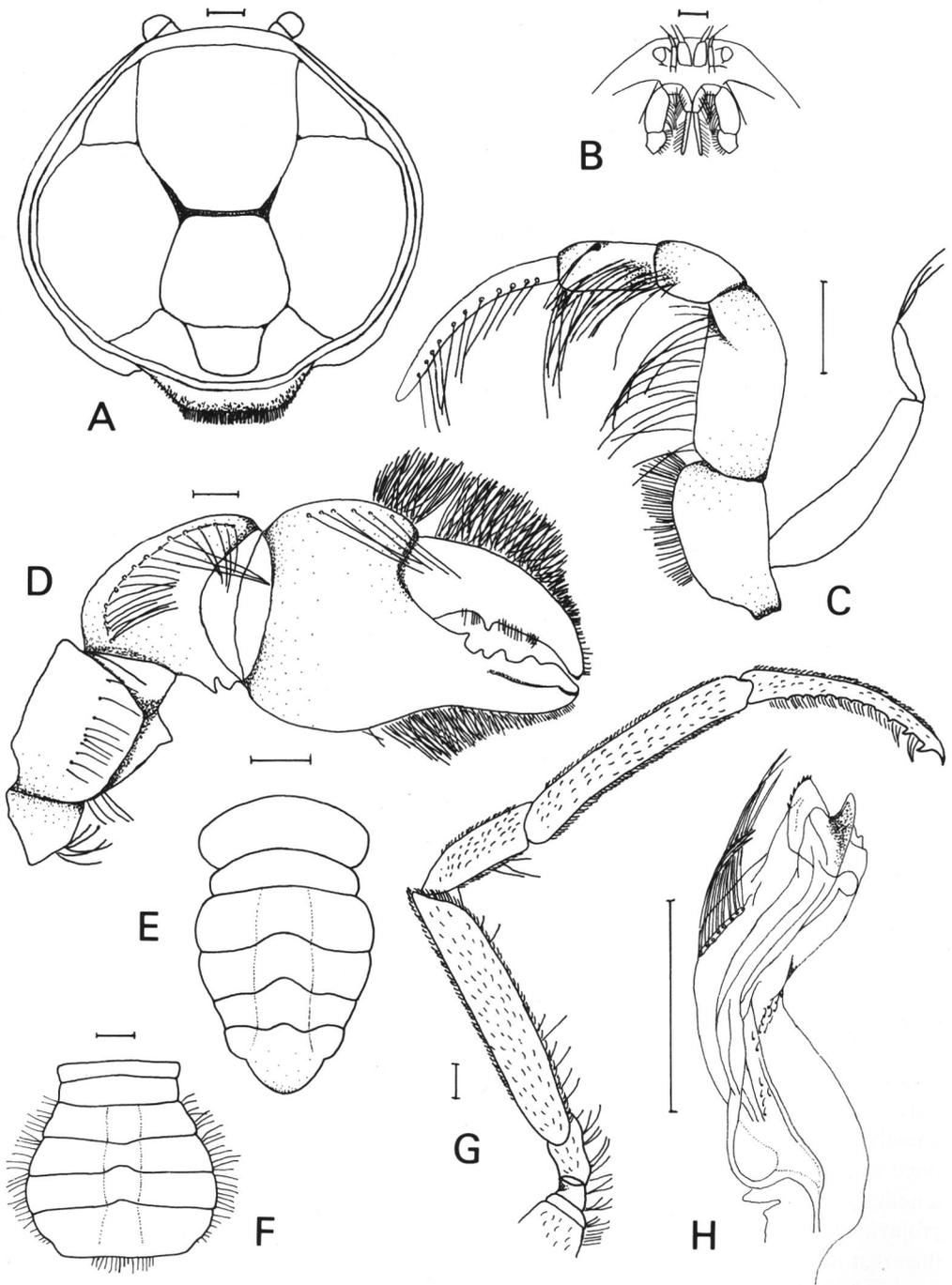


Fig. 21. *Hymenicoides naiyanetri*. Holotype male (6.0 by 5.9 mm) (ZRC 1993.6520), Thailand. A, dorsal view of carapace; B, ventral view showing length of dactylus of third maxilliped; C, left third maxilliped; D, male left cheliped; E, male abdomen; F, female abdomen; G, second right ambulatory leg; H, left G1. Scales = 0.5 mm.

Ambulatory legs slender, subcircular in cross-section except dactylus which is laterally flattened; surfaces with dense minute setae which are also found on dorsal and ventral edges except ventral edge of dactylus; dactylus curved, narrow, tip sharply hooked, row of recurved sharp teeth of decreasing height and dense setae, twice length of that on general surface, on ventral edge; carpus shorter than merus and propodus which are subequal in length; long, sparse setae on ventral edges of coxa, ischium and merus.

Abdomen 6-segmented, without fused segments; all intersegmental sutures distinct, articulating; lateral margins convex; segment 2 narrowest; tip rounded, surface and lateral margins convex.

G1 stout, curving 90° medially, tapering very slightly along its length to complex flat tip, long triangular tooth projecting from centre, ventral edge of tip with approximately 7 sharp, corneous teeth; subterminal tuft of approximately 8 long setae on ventral surface; minute setae spanning diagonally across left lateral side of proximal half.

Female - Non-sexual features similar to male, chelipeds as swollen as that in males but smaller; dentition and setation similar. Abdomen 6-segmented, all intersegmental sutures distinct and articulating, lateral edges of segments 3-6 lined with setae; segment 6 truncated, proximal half of lateral edge concave, tuft of setae at tip.

**Remarks.** - The present specimens from Bung Borapet (RMNH) extend the known range of this species slightly northwards. They agree excellently with the large type series.

### *Neorhynchoplax* Sakai, 1938

*Neorhynchoplax* Sakai, 1938: 194.

*Elamenopsis* - Lucas, 1980: 190 (partim).

**Type species.** - *Rhynchoplax introversus* Kemp, 1917, by subsequent designation by Holthuis (1968). Gender of genus feminine.

**Diagnosis.** - Carapace circular or octagonal; dorsal surface with distinct grooves. Rostrum trilobate, not continuous with dorsal surface of carapace. Third maxillipeds narrow, not covering more than half the mouthfield when closed; ambulatory legs slender, dactyli often armed with a subterminal tooth or a row of teeth; Chelipeds stouter than ambulatory legs, especially in males. Male abdomen 4-segmented, segments 3-5 (sometimes 4-5) fused with no distinct sutures, lateral edge of fused segment with proximal half straight and distal half concave. G1 with stout base, distal portion curved, tapers to simple tip, with subterminal setae.

**Distribution.** - Andaman Islands; West Bengal, India; West Bengal, India; Iraq; Panama Canal; India; Sri Lanka; China; South Africa; Palau Island; Australia.

**Remarks.** - The genus *Neorhynchoplax* Sakai, 1938, was synonymised with *Elamenopsis* A. Milne Edwards, 1873, by Lucas (1980). We have resurrected *Neorhynchoplax* because it possesses sufficient distinct characters to recognise it as a distinct taxon (see Table 2 and **Remarks** for *Elamenopsis*). Sakai (1938) did not name a type species for *Neorhynchoplax*, and Holthuis (1968) subsequently designated *Neorhynchoplax introversus* (Kemp, 1917) as the type species. Sakai (1976) however, apparently unaware of Holthuis' action, identified

*Neorhynchoplax alcocki* (Kemp, 1917) as the type species. Holhuis' type designation has precedence over Sakai's.

All *Neorhynchoplax* species exhibit a distinct pattern of grooves on the dorsal surface of the carapace; and most possess the following characters: posterior lateral angle usually has a forward directed tooth positioned just above the first ambulatory leg; a trilobate rostrum and the dactylus of the ambulatory leg is armed with teeth. There are however, exceptions. *Neorhynchoplax demeloi*, *N. exigua*, *N. introversus*, *N. nasalis*, *N. frontalis*, *N. thorsborneorum*, *N. minima*, *N. bovis*, *N. inermis* and *N. inachoides* do not possess a posterolateral tooth. Two species, *N. nasalis* and *N. minima*, have unilobate, narrow, triangular rostrums. The ambulatory dactyli of *N. thorsbornei*, *N. demeloi* and *N. inermis* are unarmed, the ambulatory legs being also slightly broader than other congeners, but not as broad or stout as those of *Elamenopsis* s. str. species. Most *Neorhynchoplax* species are euryhaline in habit, with three species, *N. introversa*, *N. kempii* and *N. inermis* inhabiting fresh waters.

The genus *Neorhynchoplax* bears a close resemblance to *Halicarcinus*, and several *Neorhynchoplax* species had in fact been described under *Rhynchoplax* (see Stimpson, 1858; Sakai, 1938; Takeda & Miyake, 1971b; Kemp, 1918; Chopra & Das, 1930). The genus *Rhynchoplax* Stimpson, 1858 s. str. was synonymised under *Halicarcinus* White, 1846, with many of the species transferred to *Neorhynchoplax* by Sakai (1938). The two features that distinguish *Neorhynchoplax* and *Halicarcinus* are the structures of the third maxillipeds and segmentation of the male abdomen. *Halicarcinus* species have broad third maxillipeds and six male abdominal segments whereas *Neorhynchoplax* species have narrow third maxillipeds and the male abdominal segments three to five are fused (with the exception of *N. mangalis* which has segments three and four fused).

Lucas (1980) briefly discussed the unusual abdomino-sternal morphology of mature females in *Neorhynchoplax* (under *Elamenopsis*). Of the four Australian species he examined: *E. lineata*, *N. octagonalis*, *N. torrensica* and *N. aspinifer* examined do not bear pleopods and have the abdomino-sternal cavity reduced. As noted by Lucas, this feature is apparently unique to the family Hymenosomatidae in the Brachyura. Lucas stated that female abdomen bears no pleopods but this is not correct. Mature females of *N. mangalis*, *E. lineata* and *Crustaenia palawanensis* (previously in *Elamenopsis*) we examined possess three, three and four pairs of pleopods respectively. The eggs in *Neorhynchoplax*, *Elamenopsis* and *Crustaenia* are not on the pleopods as in other crabs but contained in a special internal brood cavity. Additions to the description of the female abdominal structure and attempts to resolve some issues raised by Lucas (1980) are discussed under *N. mangalis*.

### *Neorhynchoplax dentata* Ng, 1995

(Fig. 22)

*Neorhynchoplax dentata* Ng, 1995: 13, Fig. 1.

**Material examined.** - Holotype - male (6.0 by 5.8 mm) (ZRC 1994.4284), Sungai Pahlawan, tidal freshwater stream in sago plantation, on road from Mukoh to Dalat, Sarawak, Malaysia, Borneo, 2°49'08.4"N 111°54'16.8"E, coll. T. H. T. Tan & M. Kottelat, 15 Jun.1994.

**Description.** - Carapace flat, subcircular, surrounded by a distinct, complete rim; grooves on dorsal surface distinct. Rostrum distinctly trilobed, with 3 large, sharp teeth, median one largest. Junction of antero- and posterolateral margin with well developed sharp tooth, just

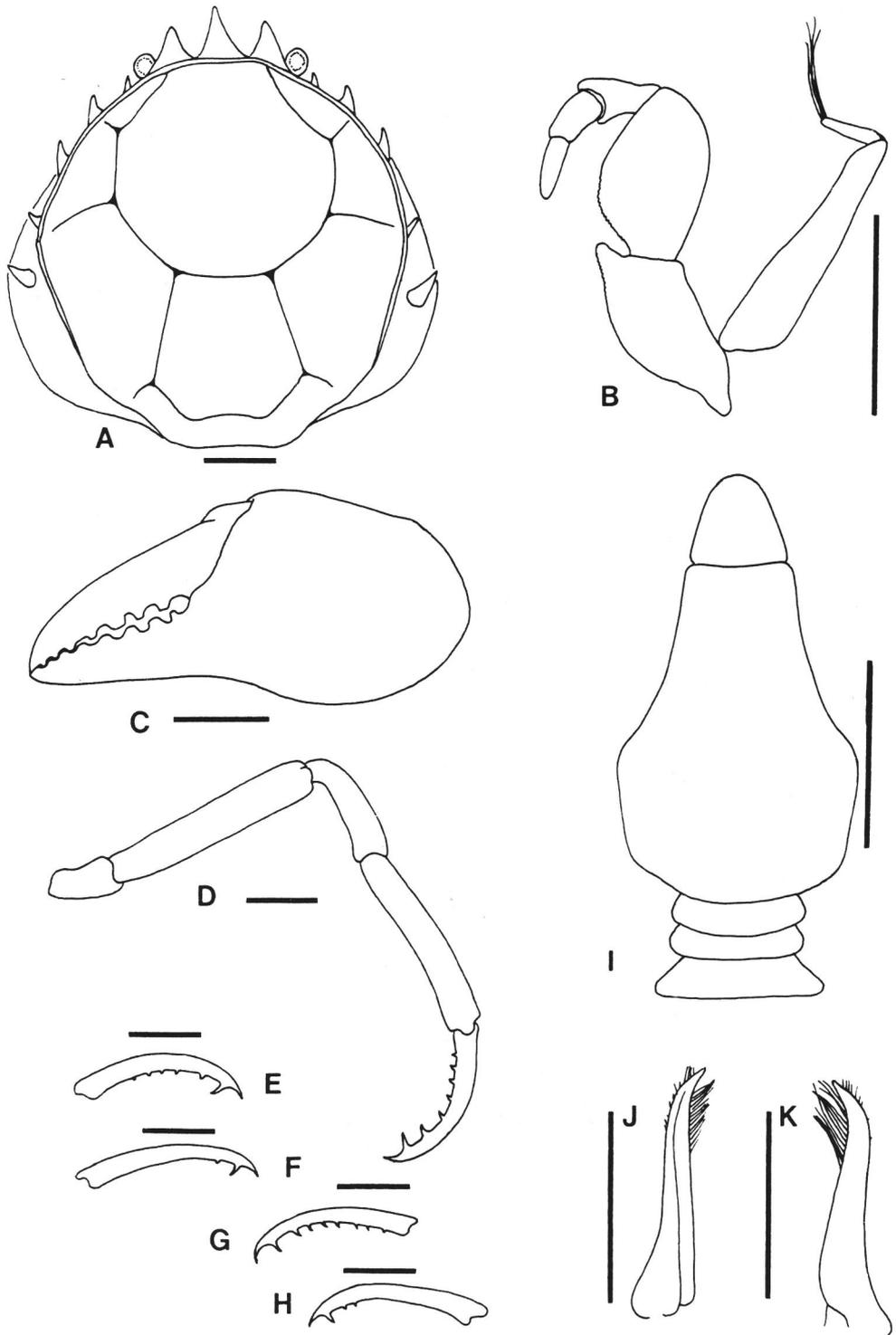


Fig. 22. *Neorhynchoplax dentata*. Holotype male (6.0 mm by 5.8 mm) (ZRC 1994.4284), Sarawak. A, carapace; B, left third maxilliped; C, left chela; D, right fourth ambulatory leg; E, right second ambulatory dactylus; F, left first ambulatory dactylus; G, left fourth ambulatory dactylus; H, right first ambulatory dactylus; I, abdomen; J, G1 (ventral view); K, G1 (dorsal view). Setae denuded for all structures except J and K. Scales = 1.0 mm.

outside carapace rim; rest of anterolateral margin with 3 small but distinct sharp teeth; infraorbital margin with sharp spine. Eyestalks well developed, visible dorsally. Ischium of third maxilliped subequal in length with merus.

Chelipeds equal, outer surfaces pubescent; fingers shorter than palm, cutting edges with numerous small teeth.

Ambulatory legs slender, outer surfaces pubescent; dactylus laterally flattened, ventral margin lined with 2-8 sharp teeth.

Abdomen triangular, surface setose, especially along margins, 5-segmented, segments 4 and 5 completely fused, segments 1-3 relatively narrow.

GI slender, tapering towards tip, proximal part almost straight, distal part gently curving outwards, outer margin of distal part with long subterminal setae.

**Remarks.** - *Neorhynchoplax dentata* is easily distinguished from all congeners in possessing three sharp, well spaced anterolateral teeth with a prominent sharp tooth at the junction of the antero- and posterolateral margin. The trilobate rostrum and sharp tooth at the junction of the antero- and posterolateral margin of *N. dentata* gives the species a superficial resemblance to *N. woodmasoni* and *N. alcocki*. There are however, only two teeth on the anterolateral margin in *N. woodmasoni*, while only one tooth is present in *N. alcocki*. Their male abdomens are also quite different in shape. All known members of *Neorhynchoplax* have male abdominal segments 3-5 fused, but in *N. dentata*, only segments 4 and 5 are fused.

The number of teeth present on the ambulatory dactylus varies somewhat, from 2 to 8. Both the fourth dactylus have the highest number of teeth (seven and eight).

The single specimen of *N. dentata* was obtained from a freshwater stream which was under tidal influence. The waters were tea-coloured, with a pH of 5.6. The palaemonid prawn, *Macrobrachium equidens*, a common freshwater to brackish water species, as well as two female sesarminae crabs, *Pseudosesarma bocourti*, were also obtained.

### ***Neorhynchoplax exigua* (Kemp, 1917)**

(Fig. 23)

*Rhynchoplax exiguus* Kemp, 1917: 260-2, fig. 10.

*Elamenopsis exigua* - Lucas, 1980: 190; Chuang & Ng, 1994: 87.

**Material examined.** - THAILAND: One damaged specimen collected among water hyacinths in river waters near the sea near Bangkok, coll. L. Deharveng, 1989.

**Remarks.** - The single very badly damaged specimen we examined was inadvertently lost subsequently. From our notes, the specimen agrees with Kemp's (1917) description of the species very well. Kemp's (1917) specimens were Tale Sap in southern Thailand and the present specimen extends its range northwards.

**Distribution.** - Known only from Thailand.

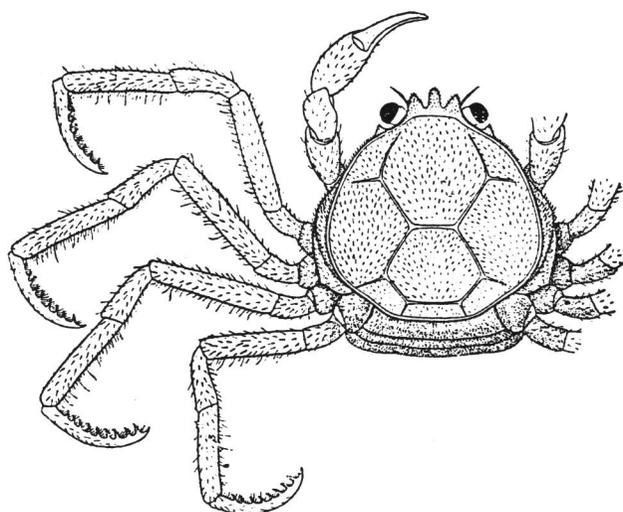


Fig. 23. *Neorhynchoplax exigua*. Syntype female (after, Kemp, 1917: Fig. 10), Peninsular Thailand.

***Neorhynchoplax mangalis* (Ng, 1988)**

(Figs. 24-26)

*Elamena sindensis* - Yang, 1979: 12 (part) (not *Elamena sindensis* Alcock, 1900).

*Elamenopsis mangalis* Ng, 1988: 274; Chuang & Ng, 1994: 87, 89.

**Material examined.** - Holotype - male (2.3 by 3.3 mm) (ZRC 1985.2003), Mandai mangrove swamp, Singapore (1°26'30"N 103°46'E), coll. H. K. Tan, Dec.1983.

Paratype - 1 male (2.0 by 2.7 mm) (ZRC 1985.2004), Kranji mangrove swamp, Singapore, 1°25'N 103°44'E, coll. P.K.L. Ng, 2 Feb.1982.

Others - SINGAPORE: 1 male (ZRC 1987.457), Sungei Buloh mangroves, coll. P. K. L. Ng, 2 Jun.1987. — 1 male (ZRC 1965.10.19.107), Pasir Ris, Jan.1938. — 4 males, 5 females (ZRC 1993.6558-6566), Sungei Buloh mangrove, coll. P. K. L. Ng, 23 Jun.1991. — 4 males, 4 females (ZRC 1993.6568-6572, 6575-6577), 1 male, 1 female (RMNH), Sungei Buloh East mangrove, coll. P. Ng et al., 1992. — 1 female (ZRC 1993.6567), Sungei Buloh East mangrove, coll. P. K. L. Ng et al., 30 Jan.1992. — 1 male (ZRC 1993.6578), Sungei Buloh East mangrove, coll. P. Ng et al., 31 May.1993. — 1 female (ZRC 1989.2957), mangroves at Lim Chu Kang road end, under mud covered rock, exposed shore, coll. P. Ng, Oct.1987. — 1 male (ZRC 1985.1626), Kranji mangroves, coll. P. Ng, Dec.1981. — 1 male (ZRC 1989.2935), Mandai mangroves, under log, coll. P. Ng, 18 May.1984. — 1 male, 1 female (ZRC 1991.361-362), mangrove at edge of Sentosa, coll. P. Ng, May.1991.

PENINSULAR MALAYSIA: 8 males, 2 females (ZRC 1965.10.19.95-104), Sedili River, Johor, no date.

**Description.** - Ng (1988) gave a detailed description of the male holotype and specimens collected later agree in most points with his description. One discrepancy is that in the holotype male, which although an adult, is relatively small, the male abdominal segments 4 and 5 are free, with the suture between them obvious. In the larger males examined, the suture is almost indiscernible, with segments 4 and 5 effectively fused. The fusion of these two segments is thus size-related. The type series contained only by males, and the female is described below:

Female - Chelipeds slender, with sparsely spaced setae; cutting edges of dactylus and

pollex serrated. Abdomen 4-segmented; segments 3-5 fused with no distinct sutures, squarish, surface convex, all other intersegmental sutures distinct and articulating; surface interspersed with long, sparse, plumose setae; telson, tip pointed. Brood cavity present in mature females.

**Distribution.** - Known from the type locality in Singapore (Ng, 1988) and Peninsular Malaysia (present study).

**Remarks.** - The affinities of this species with other congeneric species were discussed by Ng (1988). The species appears to be restricted to mangroves and can be found in good numbers in mangrove swamps in Singapore, and is often collected from tidal mud pools. The ovigerous females are normally found in congregations among roots of mangrove trees at the banks of fast-flowing rivers. These crabs are very cryptic and are covered by mud. One female moulted during captivity and the author observed that it collected the mud on the shedded carapace, rolled it into balls and stuck them on its body. *Neorhynchoplax mangalis* has remarkable osmoregulatory abilities, being able to survive for long periods in a wide range of seawater concentrations (Chuang & Ng, 1994).

Females of *N. mangalis* practice ovovivipary. The first zoeae hatch inside the body cavity of the female before swimming free. This is the first such report of ovovivipary in the Brachyura. The fertilised eggs are not extruded via the vulvae and not deposited on the female pleopods (which are strongly reduced in *N. mangalis*, the three pairs present on fused segments 3-6 being very small and simple) but in a special internal brood cavity. On the abdomen, this cavity is between the tergites (fused in segments 3-5) and very thin cuticle of the sternites. In the carapace, the cavity is between the sternites and fused tergites, and encompasses the space occupied by the oviduct and ovaries.

In *N. mangalis*, the fertilised eggs are too large to be extruded from the vulvae like other crabs. Late-stage eggs (eyes of zoeae distinctly visible) extracted from inside ovigerous females have a diameter of between 0.3 to 0.5 mm and are much larger than the female vulvae (diameter ca. 0.17 mm) (Fig. 26C). The fertilised eggs develop inside the internal brood cavity until they are ready to hatch (Fig. 26B-E). Examination of the body cavity of *N. mangalis* showed that the eggs occupy not only the posterior portion of the carapace and abdomen (cf. Lucas, 1980) (Fig. 26B-E) but also extend further up the carapace, reaching the level of the mouthfield (Fig. 26A). Observations of females releasing the larvae as well as preserved females which have just released their larvae show that the thinly cutinised abdominal sternal cuticle folds backwards (towards the anus) to release the larvae (Fig. 26D-F). At the same time, the thinly chitinised posterior part of the thoracic sternal cuticle also ruptures laterally, forming a pair of "pseudovulvae" (Fig. 26D). The openings of the thoracic and abdominal sternites enable the large zoeae to leave the female. Studies are now ongoing to determine the details of this novel reproductive mechanism.

The larvae were observed to "hang onto" the female abdomen just after coming out from the ruptures of the thoracic and abdominal sternites. This seems to suggest that as the inner larvae leave, they push the earlier ones away from the opening, not unlike a conveyer belt. This gave rise to the crowding effect observed on the abdomen. When a female was disturbed, it used its chelae to remove the larvae from its cavity.

Lucas (1980) noted a problem with the irrigation of the eggs during development in the brood cavity. To this effect, it is interesting to note that all ovigerous females with late-stage eggs obtained so far have been found at the side of mangrove streams with relatively rapid

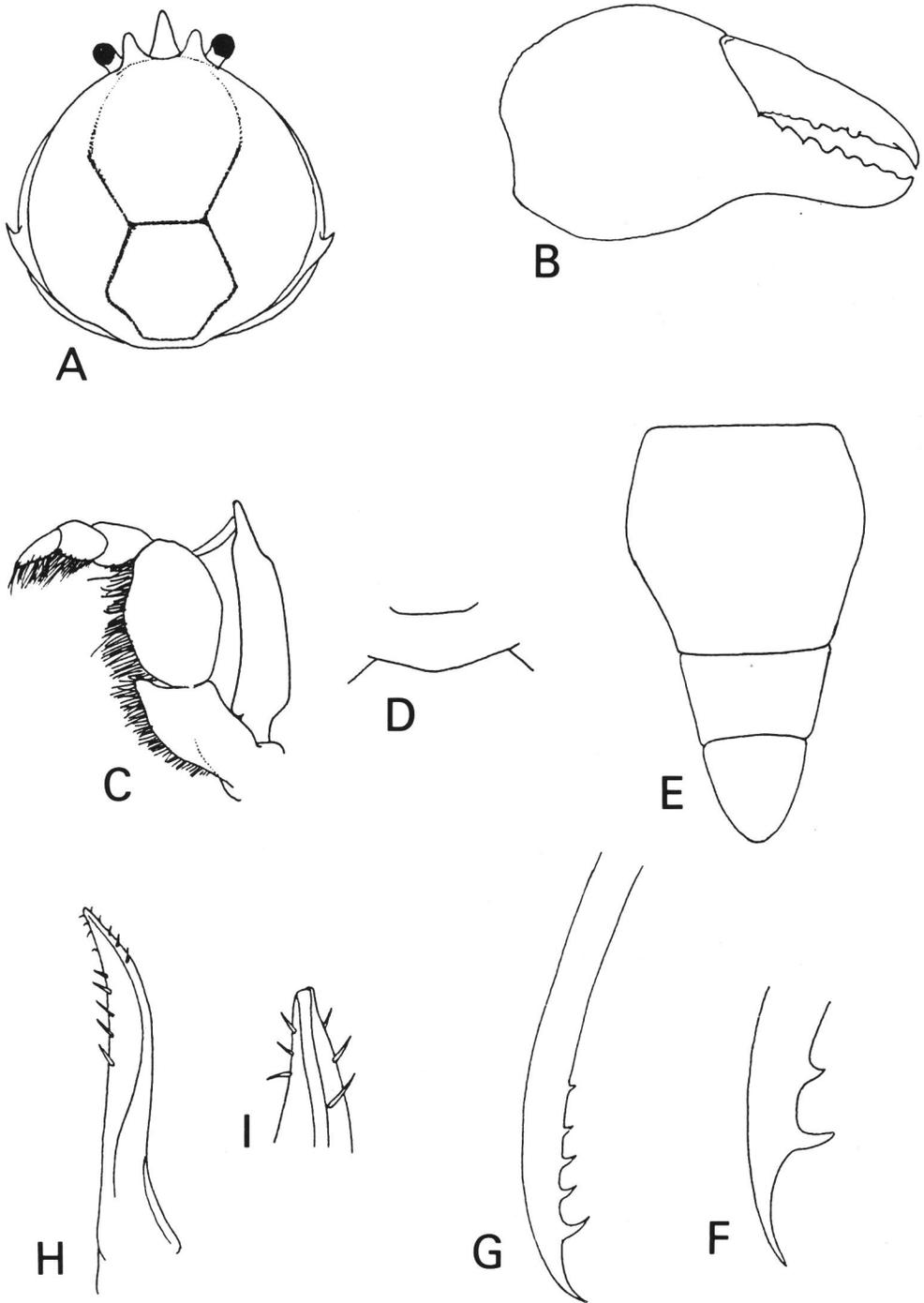


Fig. 24. *Neorhynchoplax mangalis*. Holotype male (2.3 by 3.3 mm) (ZRC 1985.2003), Singapore. A, dorsal view of carapace; B, male right cheliped; C, left third maxilliped; D, epistome; E, male abdomen, segments 3-6; F, dactylus of second ambulatory leg; G, dactylus of third ambulatory leg; H, left G1; I, left G1 apex.

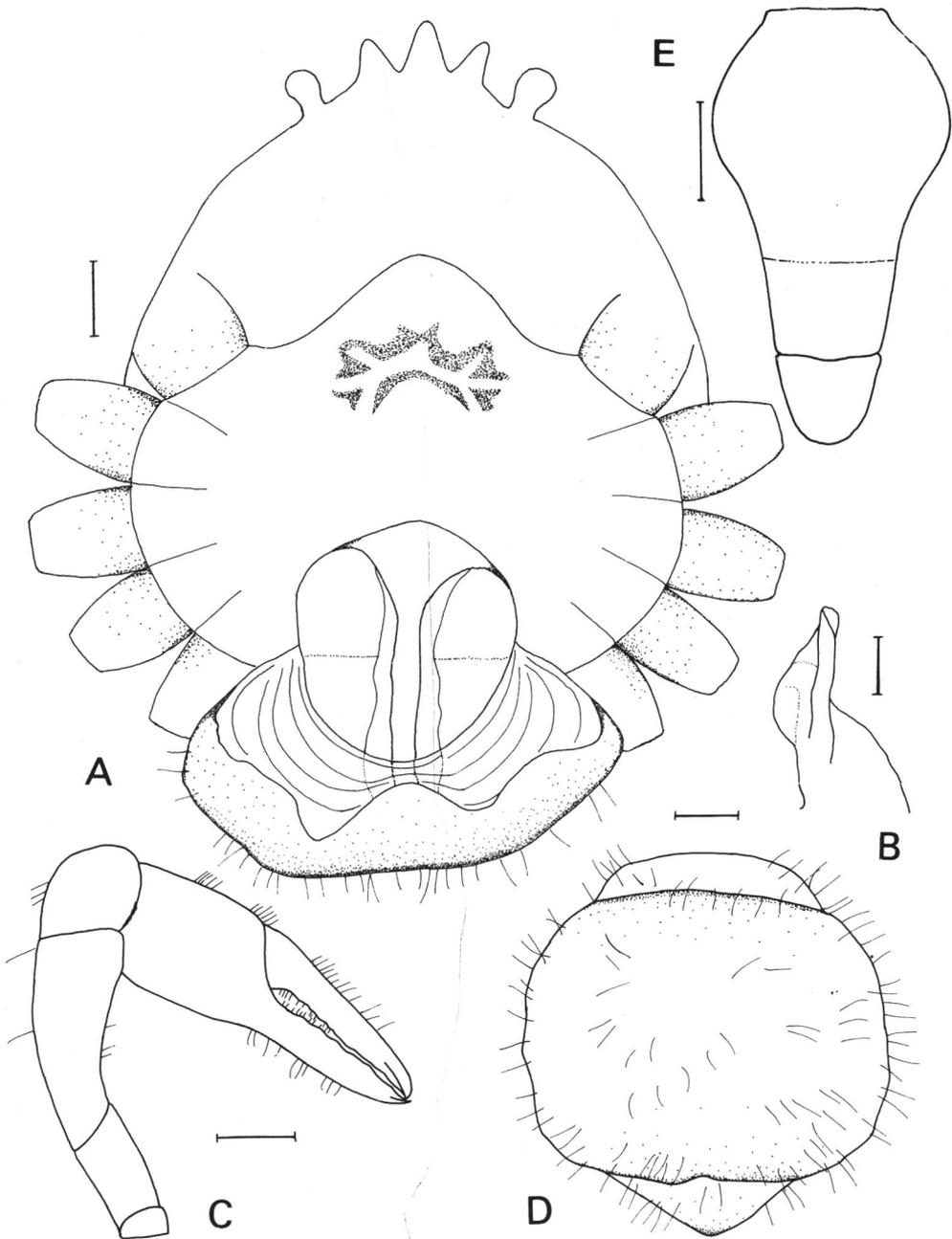


Fig. 25. *Neorhynchoplax mangalis*. A, C, D, female (3.5 by 4.2 mm) (ZRC 1993.6558); B, E, male (3.8 by 4.8 mm) (ZRC 1993.6568); Singapore. A, ventral view of carapace showing brood pouch; B, left G2; C, female left cheliped; D, female abdomen, segments 2-6; E, male abdomen, segments 3-6. Scales: A, C-E = 0.5 mm; B = 0.05 mm.

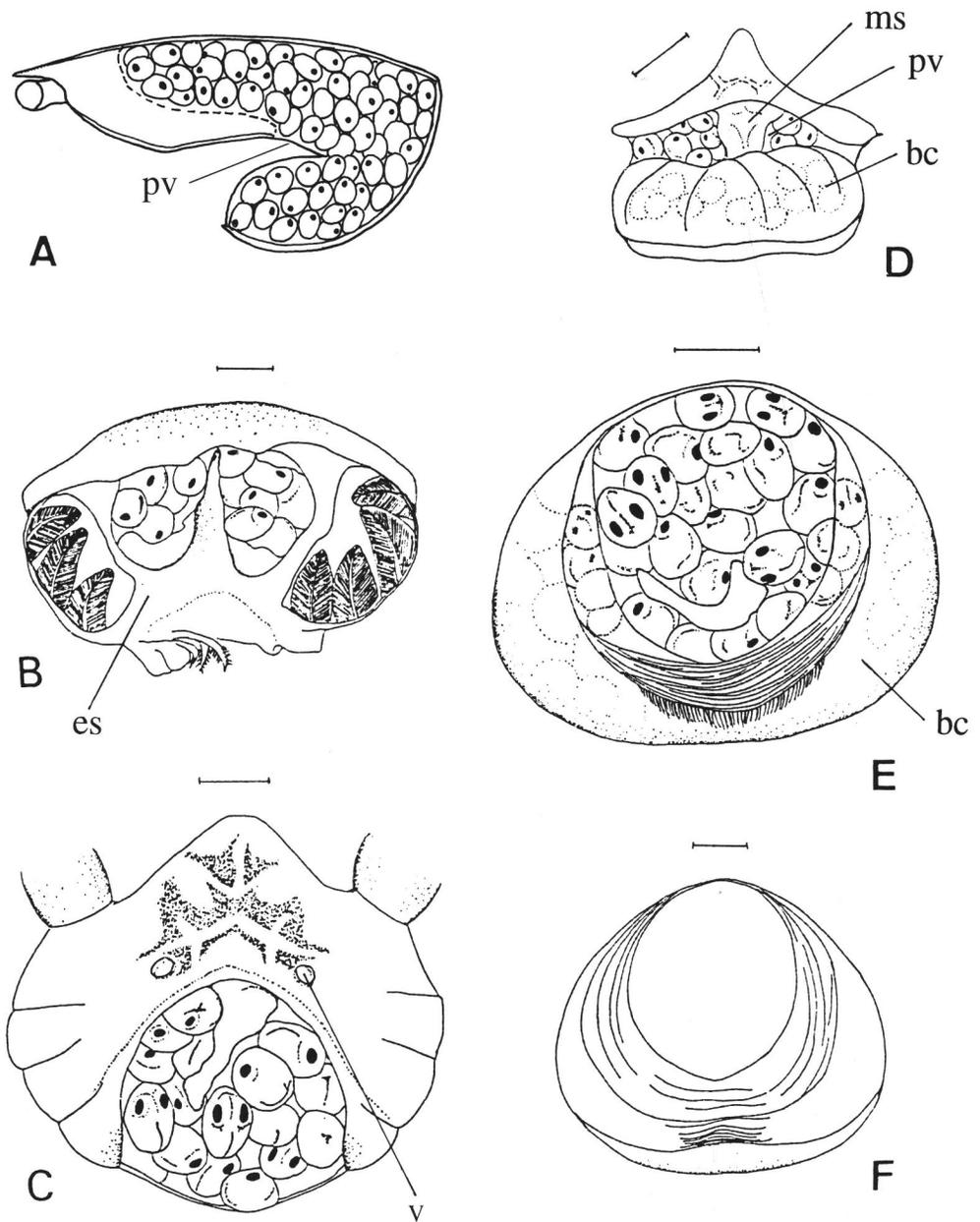


Fig. 26. *Neorhynchoplax mangalis*. A, schematic lateral section to show how far late-stage eggs extend into the carapace; B, transverse section of carapace (at level of mouth field) showing late-stage eggs in ovary; C, ventral view of sternum showing late-stage eggs in body cavity (abdomen removed); D, frontal view showing late-stage eggs at openings to pseudovulvae; E, sternal view of abdomen showing internal brood cavity with late-stage eggs and sternal cuticle folded backwards; F, sternal view of abdomen showing internal brood cavity after larval release with sternal cuticle folded backwards. Scales = 0.5 mm. Abbreviations: bc = internal brood cavity; es = endophragmal skeleton; ms = postero-medial part of thoracic sternum; pv = pseudovulvae; v = vulvae.

water flow. Females found in tidal mud pools in mangroves are either immature or ovigerous with immature eggs. How the eggs are sufficiently oxygenated inside the female (not just the brood cavity per se) is not yet known (but see Lucas, 1980:214).

The most advanced form of reproduction reported in the hymenosomatids thus far is direct larval development (Lucas, 1980). This is mainly exhibited by freshwater species, notably *Amarinus lacustris* and *A. angelicus* (Lucas, 1971, 1980). Ovigerous females of *Cancrocaeca xenomorpha* have small brood sizes with large eggs which also strongly suggest direct development in this taxon (Ng, 1991). Among marine and brackish hymenosomatids, only one species, *Neorhynchoplax bovis*, is known to have direct development (Barnard, 1950). *Halicarcinus afecundus* is also suspected of direct development (Lucas, 1980).

There is no published data on larval morphology of *Neorhynchoplax* (previously under *Elamenopsis* sensu Lucas, 1980), *Elamenopsis* s. str. and *Crustaenia*. However, there has been work done on certain species of *Elamena* and *Halicarcinus* (see Krishnan & Kannupandi, 1988; Muraoka, 1977; Lucas, 1972; Aikawa, 1929; Boshi, Scelzo & Goldstein, 1969; Hashmi, 1969; Tirmizi & Kazmi, 1987; Al Kholy, 1959; Gordon, 1966; Wear & Fielder, 1985; Terada, 1977). The larval development of *Trigonoplax unguiformis* was reported by Fukuda (1981) and that of *Hymenosoma orbiculare* by Broekhuysen (1955). Among the larvae studied, only those of *Halicarcinus australis* have a dorsal spine and a slightly longer and more conspicuous rostral spine. The rest do not have dorsal spines and only have short rostral spines which in some species, are so short that it is not obvious as a spine at all. The first zoeae of *N. mangalis* are atypical in this sense, having extremely long dorsal and rostral spines. The dorsal spine is subequal in length with the carapace and rostral spine is twice that of the carapace. The larvae of *N. mangalis* will be described elsewhere at a later date.

### *Neorhynchoplax prima*, new species

(Fig. 27)

**Material examined.** - Holotype - male (6.8 by 5.7 mm) (ZRC 1994.4233), Pengudong, Pulau Bintan, Riau Archipelago, Indonesia, 1°10'0.18"N, 104°31'50.9"E, coll. T. Tan, N. Sivasothi et al., 13 May.1993.

Paratypes - 1 male, 2 females (ZRC 1993.6579-6581), same data as holotype. — 4 females (ZRC 1993.6584-6587), 55 km to Tanjung Pinang, Pulau Bintan, Riau Archipelago, Indonesia, 1°09'11.1"N, 104°34'33.1"E, coll. T. Tan, N. Sivasothi et al., 12 May.1993. — 1 male (ZRC 1993.6583), Pulau Bintan, Riau Archipelago, Indonesia, 1°10'10.0"N, 104°23'10.6"E, coll. T. Tan, N. Sivasothi et al., 11 May.1993. — 1 male (3.5 by 3.9 mm) (ZRC 1993.6582), Banka, between Kampung Kuran and Kampung Balilik, 25 km north of Koba, off Sumatra, Indonesia, coll. M. Kottelat, T. Tan et al., 3 Mar.1993.

**Etymology.** - The species is named with reference to it being the first freshwater member of its genus found from Sundaland.

**Description.** - Male - Carapace flat, subcircular, surrounded by a distinct rim which is not disrupted at base of rostrum; dorsal surface smooth with distinct cervical, thoracic and gastrocardiac grooves; cervical grooves approaching but never reaching anterolateral margins, thoracic grooves shorter than cervical grooves; anterolateral margin with 3 blunt teeth; forward directed tooth at posterolateral margin, above coxa of first ambulatory leg; postocular lobes fused with base of rostrum. Rostrum trilobed, surface concave, not continuous with dorsal surface of carapace. Eystalks prominent, distinctly visible dorsally.

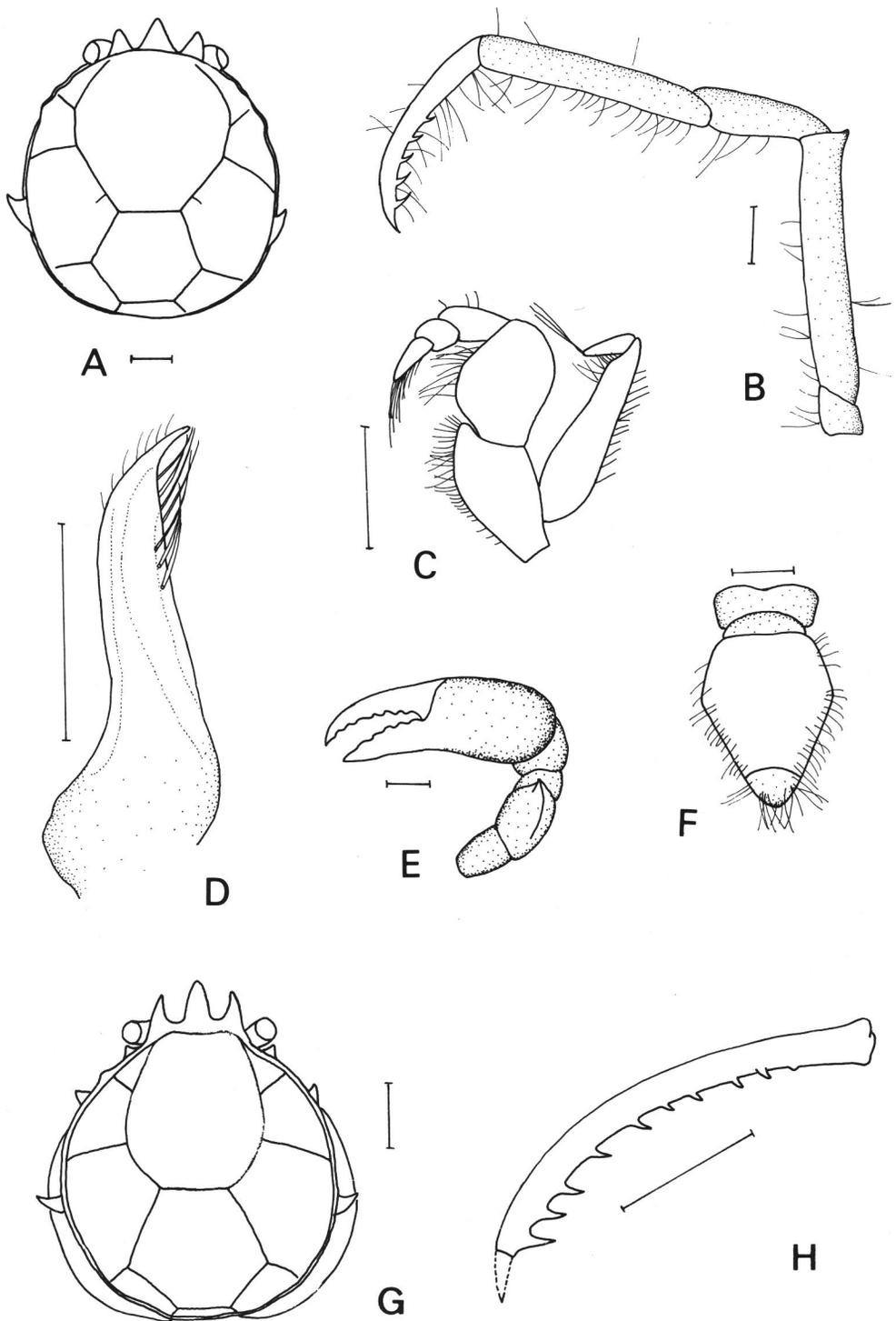


Fig. 27. *Neorhynchoplax prima*, new species. A-F, paratype male (ZRC 1993.6582); Banka; G, H, holotype male (ZRC 1994.4233); Pulau Bintan. A, G, dorsal view of carapace; B, third ambulatory leg; C, left third maxilliped; D, left G1; E, male right cheliped; F, male abdomen; H, dactylus of right third ambulatory leg. Scales: A-C, E, F = 0.5 mm; D = 0.05 mm; G, H = 1.0 mm.

Third maxillipeds cover three-quarters of mouth field when closed; ischium subequal in length with merus along outer lateral edge; dense setae on inner lateral edge of both merus and ischium, setae on merus longer than that on ischium. Inner lateral margins meeting when closed; palp not longer than merus; exopod, much longer than merus, with setae lining one-third of inner margin and two-thirds of outer margin.

Chelipeds equal, stouter than ambulatory legs; outer surface pubescent; fingers with cutting edges slightly serrated with 3 distinct teeth on proximal portion; dactylus and pollex laterally flattened, curved posteriorly, tips sharp, slightly longer than propodus, slightly gaping proximally when closed.

Ambulatory legs slender, rounded in cross-section, dactylus laterally flattened; dorsal and ventral edges lined with sparse long setae; dactylus with tip sharply hooked and row of teeth, ventral edge more densely lined with long and short setae; merus longer than carpus and propodus, dactylus not longer than propodus which is longer than carpus.

Abdomen 4-segmented, triangular; all intersegmental sutures distinct, articulating; segments 3-5 fused with no distinct sutures, lateral edge of proximal half convex, distal half concave; surface setose, telson (segment 6) lined with dense long setae.

G1 slender, tapering slightly along its length, then tapering more abruptly to simple pointed tip, with 9 subterminal setae on abdominal side and 7 shorter setae on sternal side.

**Distribution.** - Known only from the type locality in Pulau Bintan and Banka, Sumatra, both localities in Indonesia.

**Remarks.** - This freshwater species bears a superficial resemblance to *N. woodmasoni* and *N. alcocki* due to the trilobate rostrum and presence of a forwardly directed tooth on the posterolateral margin just above the coxa of the first ambulatory leg. Like *N. prima*, *N. woodmasoni* also has three teeth on the anterolateral margin (including the postocular tooth); but *N. prima* can easily be distinguished by its simple chelipedal merus which only has one tooth on its dorsal margin (vs. several teeth) and the proportionately broader male abdomen which has a broader telson (see Alcock, 1900; Kemp, 1917). *Neorhynchoplax prima* can be separated from *N. alcocki* by the structure of the chelipedal merus (one vs. several dorsal teeth), its anterolateral margin has three teeth (vs. two teeth), the proportionately longer palm, with the fingers not gaping proximally (vs. proportionately shorter palm and fingers which gape proximally when closed), and the fused abdominal segments 3-5 is proportionately shorter. The G1s of *N. woodmasoni* and *N. alcocki* are not known. *Neorhynchoplax woodmasoni* and *N. alcocki* are estuarine and brackish-water species whereas *N. prima* is a freshwater species.

The rostral lobes vary to a small degree in *N. prima*. That of the holotype is rather longer and stronger than some of the paratypes and the male from Banka, but the differences are not significant. The number of teeth on the ventral margin of the ambulatory dactylus varies from two to as high as 10. The distal part of the G1 in the holotype male is less curved (but only slightly) than the paratype male from Banka.

***Trigonoplax* H. Milne Edwards, 1853**

*Trigonoplax* H. Milne Edwards, 1853: 224; Tesch, 1918: 25; Sakai, 1938: 201; Lucas, 1980: 186.  
*Elamena* (*Trigonoplax*) - Alcock, 1900: 386; Kemp, 1918: 274; Barnard 1950: 73.

**Type species.** - *Ocypode* (*Elamene*) *unguiformes* de Haan, 1839, by monotypy. Gender of genus feminine.

**Distribution.** - Japan; Ternate; Gulf of Martaban; Andaman Islands; Natal; Ambon.

**Remarks.** - *Trigonoplax* was originally recognised as a separate genus from *Elamena* by H. Milne Edwards (1853). However, many authors regarded the differences between the two genera as trivial and preferred to recognise *Trigonoplax* as a subgenus of *Elamena*. Lucas (1980) used the Milne Edwards' openings as the main character to separate *Trigonoplax* from *Elamena* and also discussed the differences in the larval morphology as further evidence to support the separate generic status (see Wear, 1968; Aikawa, 1929). Adults of this genus are characterised mainly by the Milne Edwards' apertures being fused for more than half its length, but also by the proportionately longer epistome and straight anterolateral border.

***Trigonoplax unguiformis* (de Haan, 1839)**

(Fig. 28)

*Inachus* (*Elamene*) *unguiformis* de Haan, 1839: 75, pl. 29 fig. 1 and pl. H; Henderson, 1893: 394.

*Elamena unguiformis* - Alcock, 1900: 387; Kemp, 1917: 277.

*Trigonoplax* sp. de Man, 1902: 500.

*Trigonoplax unguiformis* - H. Milne Edwards, 1853: 224; Ortmann, 1894: 31; De Man, 1907: 396; Parisi, 1915: 281; Tesch, 1918: 25; Lucas, 1980: 186; Yamaguchi & Baba, 1993: 366, Fig. 123; Chuang & Ng, 1994: 88.

**Material examined.** - 1 female (11.9 by 10.0 mm) (RMNH), dredge, Ambon, Indonesia, coll. Rumphius Expedition, 10 Dec. 1990.

**Description.** - Female - Carapace slightly convex, distinctively triangular, longer than broad, wafer thin, branchial regions extending over ischia of ambulatory legs; dorsal surface smooth with brown pigmentation of no definite pattern, with distinct thoracic and gastrocardiac grooves, thoracic groove short, reaching only one-third the length of cardiac region; margin entire, without spines; lobe immediately posterior to eye; posterior margin straight; posterior lateral margin trilobed; anterior lateral angle absent. Rostrum unilobed, triangular, with darker brown pigmentation on dorsal surface, tip rounded, lateral margin of distal portion concave at approximately one-third length, continuous with dorsal surface of carapace. Eyes visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium longer than merus along outer lateral edge; dense short setae on inner lateral edge of both merus and ischium; inner lateral margins meeting when closed; palp not longer than merus; longer setae at tip of dactylus, inner margin of carpus and propodus; exopod much longer than merus, sparse long setae lining inner margin.

Chelipeds equal, cross-section circular except fingers, slightly stouter than ambulatory legs; surfaces smooth; palm slightly inflated; fingers curved posteriorly with proximal portion approximately one-fifth length cylindrical, remaining portion spatulate; outer surface with

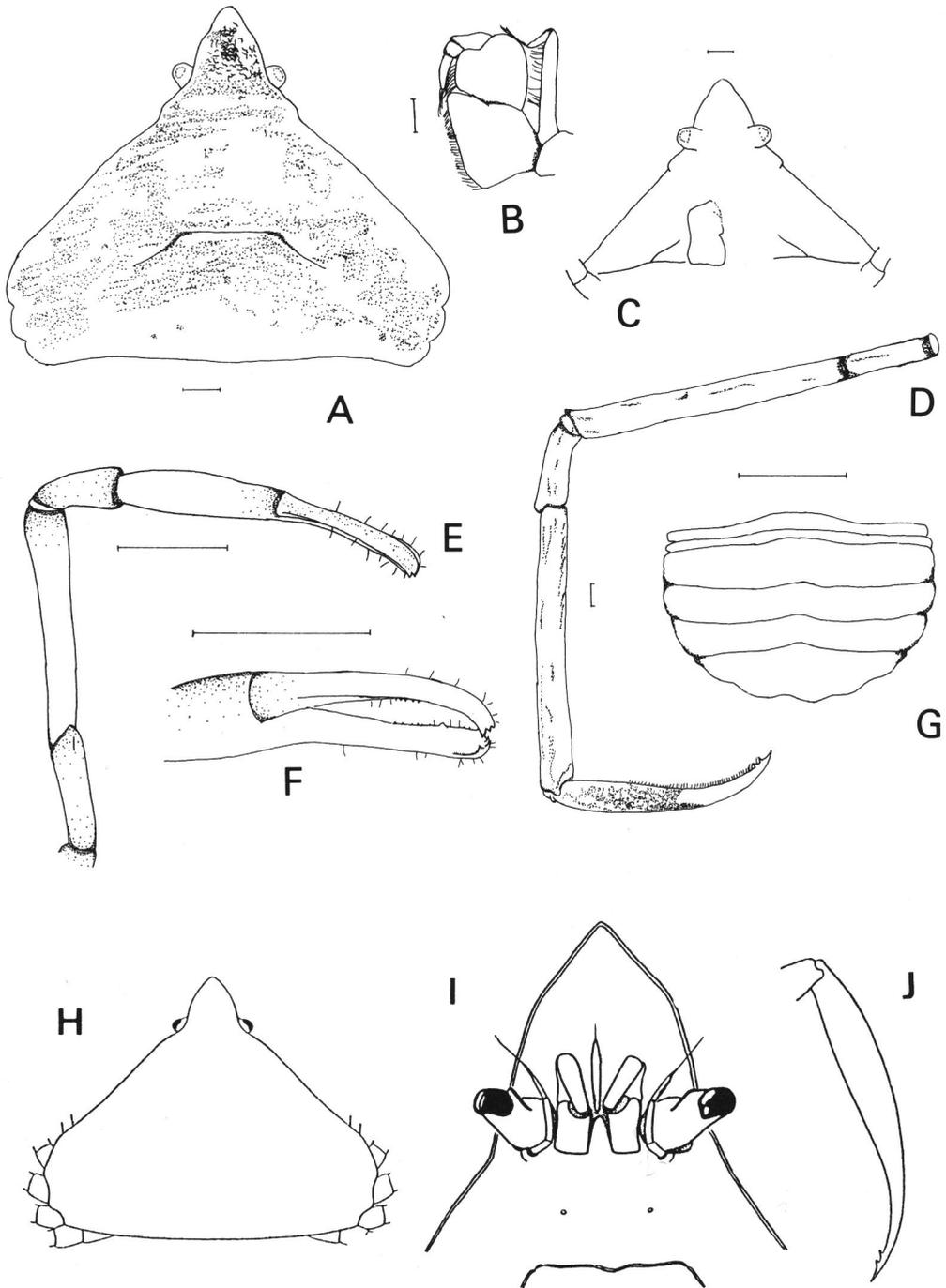


Fig. 28. *Trigonoplax unguiformis*. A-G, female (11.9 by 10.0 mm) (RMNH), Ambon; H, J, sex not specified, Andamans (after Kemp, 1917: Figs. 28, 29 respectively); I, male, Japan (after Gordon, 1940: Fig. 1e). A, H, dorsal view of carapace; B, left third maxilliped; C, ventral view of carapace showing Milne Edwards' openings; D, third ambulatory leg; E, female left cheliped; F, fingers of female left chela; G, female abdomen; I, face; J, first ambulatory dactylus. Scales = 0.5 mm.

sparse setae; outer cutting edges of fingers serrated, interspersed by 2 triangular sharp teeth; 2 similar subterminal teeth flanking sharply hooked tip, giving trifurcated appearance.

Ambulatory legs slender, circular in cross-section except dactylus which is laterally flattened; dorsal and ventral edges not lined with setae; random short lines of pigmentation on dorsal surface; dactylus long, approximately subequal in length with propodus; proximal half pigmented; distal half curved; tip sharply hooked; 2 subterminal teeth; short setae on ventral edge; carpus shorter than merus and propodus which are subequal in length.

Abdomen 6-segmented, without fused segments; all intersegmental sutures distinct, articulating; lateral margins convex; surface convex; segments 1 and 2 narrower than other segments; lateral margin of telson (segment 6) wavy.

**Remarks.** - The female specimen examined clearly belongs to this species (cf. Alcock, 1900; Sakai, 1965, 1976). Chopra & Das (1930) noted that several authors had adequately described this species, which is not entirely true. The GI of *Trigonoplax unguiformis* has never been described or figured, the male abdomen was described by Kemp (1917) but not figured, and the trilobate posterolateral border was not mentioned but is very evident in the illustrations of the species by Alcock (1900), Kemp (1917) and Sakai (1965, 1976). As such, the present female specimen is figured in detail. Lucas (1980) while mentioning the characters of this species, also did not elaborate or provide figures. The occurrence of this species in Singapore reported by Lanchester (1900) is probably incorrect (see **Remarks** for *Elamena mendosa*). As yet, *Trigonoplax unguiformis* has not been reported from Sundaic Southeast Asia.

*Trigonoplax unguiformis* has a wide distribution, occurring both in eastern Indian and western Pacific waters. Yamaguchi & Baba (1993) checked on the type series in the RMNH and designated a lectotype. All the types are dried. The carapace of the eastern Indian Ocean specimens from the Gulf of Martaban and Andamans (Henderson, 1893; Kemp, 1917, respectively) agree well with that from Ambon, although the ambulatory dactylus of the Indian Ocean specimen(s) appear proportionately stouter proximally and tapering suddenly to a narrower distal part (cf. Kemp, 1917: Fig. 29; present Fig. 27D, J). Direct comparisons will be needed to ascertain the conspecificity of the Indian and Pacific specimens.

## NOTES ON SPECIES FROM OUTSIDE SOUTHEAST ASIA

### *Amarinus lacustris* (Chilton, 1882)

**Material examined.** - AUSTRALIA: 2 males, 3 females (ZRC 1993.6513-6517), northeastern Tasmania, Scamander River, Scamander, coll. M. Takeda, 10 Feb. 1977.

**Remarks.** - This freshwater species occurs from southeastern Australia to New Zealand, and while there appear to be some differences between the two populations, Lucas (1980: 202) does not regard them major enough to warrant separation. The present specimens from Tasmania agree very well with Lucas' (1980) detailed descriptions and figures of *A. lacustris*.

*Elamena mathaei* (Desmarest, 1825)

(Fig. 29)

**Material examined.** - AFRICA: 1 female (MNHN), Mombasa, east African coast, coll. A. J. Bruce, 14 Mar.1972. — 1 male (MNHN), Madagascar, northwest coast, Nosy Be, coll. A. Crosnier, 1958. — 1 female (ZRC), Mombasa, Andromache reef, east African coast, coll. A. J. Bruce, 11 Jan.1974. — 1 female (ZRC 1994.4237), Somalia, coll. M. Vannini, 1979. — 1 young male (ZRC 1994.4234), Somalia, coll. M. Vannini, Oct.1981. — 3 females (ZRC 1994.4235), Somalia, coll. M. Vannini, Oct.1981. -1 female (ZRC 1994.4236), station 20/1-2, Somalia, coll. M. Vannini, Oct.1981.

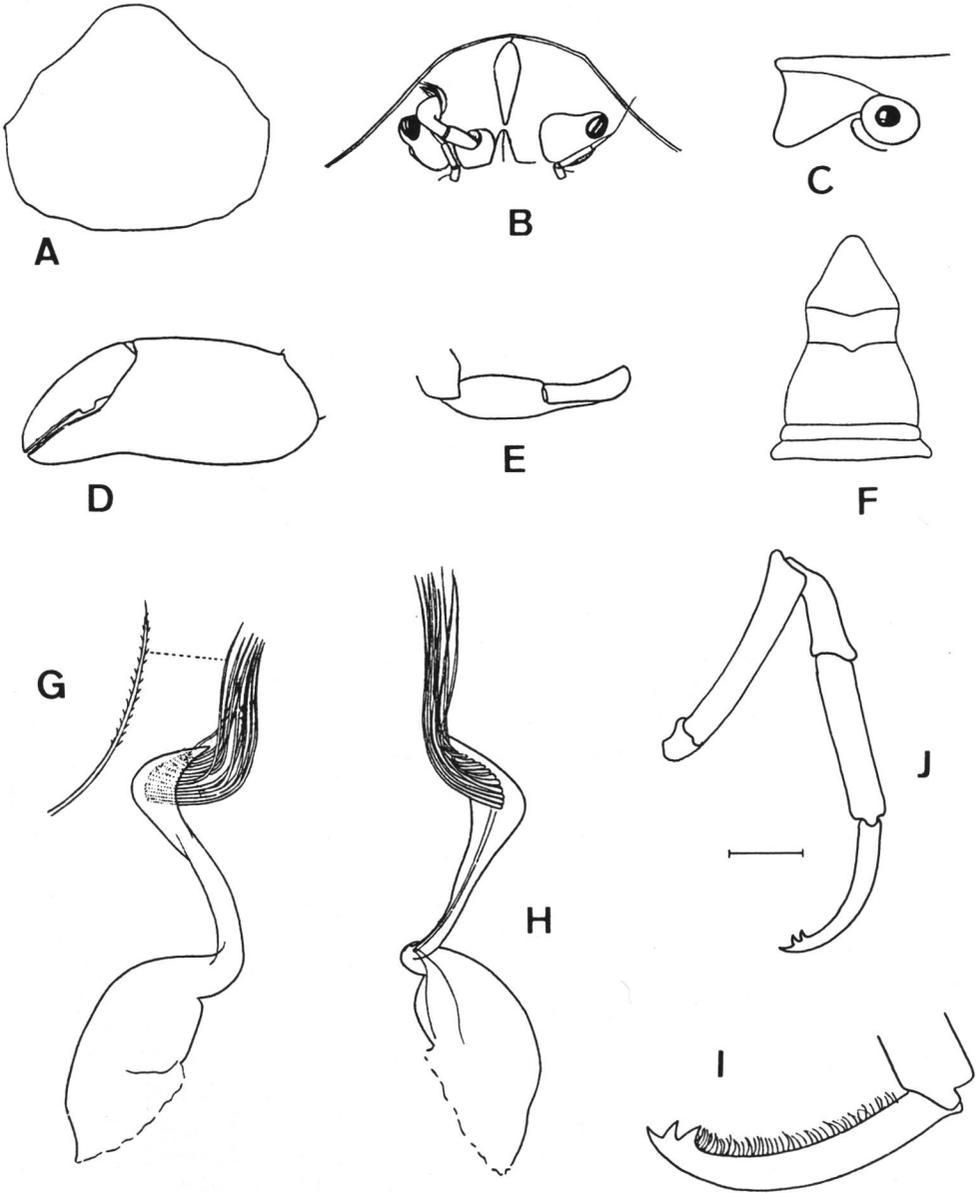


Fig. 29. *Elamena mathaei*. A, female; B-I, male; Red Sea (after Gordon, 1940: Figs. 2, 3a-c); J, male (4.8 by 4.5 mm) (MNHN), Madagascar. A, dorsal view of carapace; B, face; C, rostral keel (lateral view); D, left male chela; E, left male chela (marginal view); F, male abdomen; G, H, G1; I, third ambulatory dactylus; J, right third ambulatory leg. Scale: J = 1.0 mm.

**Remarks.** - The present series of specimens agree with those described by Gordon (1940), the carapace shape, male chelipeds, ambulatory legs, male abdomen and G1s matching very well. The C-shaped G1 with the dilated distal part and 10-12 subterminal plumose setae is particularly diagnostic, and is a character shared only with *E. sunndaica*. The carapaces of these two species however, are very different (see **Remarks** for *E. sunndaica*).

***Elamena truncata* (Stimpson, 1858)**

(Fig. 30)

*Trigonoplax truncata* Stimpson, 1858: 109; Stimpson, 1907: 146.

*Elamena truncata* - Sakai, 1932: 44, fig. 2; Sakai, 1938: 201, pl. 20, fig. 3; Sakai, 1976: 152, pl. 47, fig. 2; Miyake, 1983: 192, pl. 64 fig. 7; Nagai & Nomura, 1988: 20; Chuang & Ng, 1994: 87.

**Material examined.** - Neotype - male (6.2 by 5.7 mm) (ZRC 1994.4281a), Taipei area, Taiwan, coll. P. H. Ho, 25 Jun.1992.

Others - 1 male, 2 ovigerous females (larger 7.5 by 6.8 mm) (ZRC 1994.4281b), same data as neotype.

**Description.** - Male - Carapace slightly broader than long, dorsal surface gently convex, smooth with very faint or no cervical, thoracic and gastrocardiac grooves; lateral angles distinct but not dentiform; broad angle at anterolateral margin low but visible. Rostrum truncated with ventral rostral keel partially visible dorsally. Eyes visible dorsally.

Third maxillipeds cover three-quarters of mouth field when closed; ischium shorter than merus along outer lateral edge; inner lateral margins meeting when closed; palp longer than merus; exopod longer than merus.

Chelipeds equal, stouter than ambulatory legs; surfaces smooth; fingers approximately one-quarter length of inflated palm; fingers laterally flattened, slightly curved inwards; cutting edges with many small denticles, quadrangular tooth at proximal portion of dactylus; tips of fingers sharp, pointed.

Ambulatory legs slender, subcircular in cross-section; distinct tooth at distal dorsal edge of both merus and carpus; dactylus laterally flattened, gently curved, with 2 subterminal teeth, the proximal one being larger; ventral edge of dactylus lined with row of short setae; carpus shorter than propodus and merus, which are subequal in length.

Abdomen triangular, 5-segmented, segments 3 and 4 fused with no distinct suture; all other intersegmental sutures distinct; telson (segment 6) triangular, lateral margins almost straight; lateral margins of segment 5 concave.

G1 long, slender, broadly C-shaped, tapers to pointed tip; about 9 subterminal setae (all with spinules).

Female - The posterior lateral angles are slightly stronger. Abdomen with no fused segments, all intersegmental sutures distinct, covering entire sternum, reaching base of legs, broader than long. Cheliped slender, not stouter than ambulatory legs; fingers spatulate, outer cutting edges serrated, tip of fingers sharp.

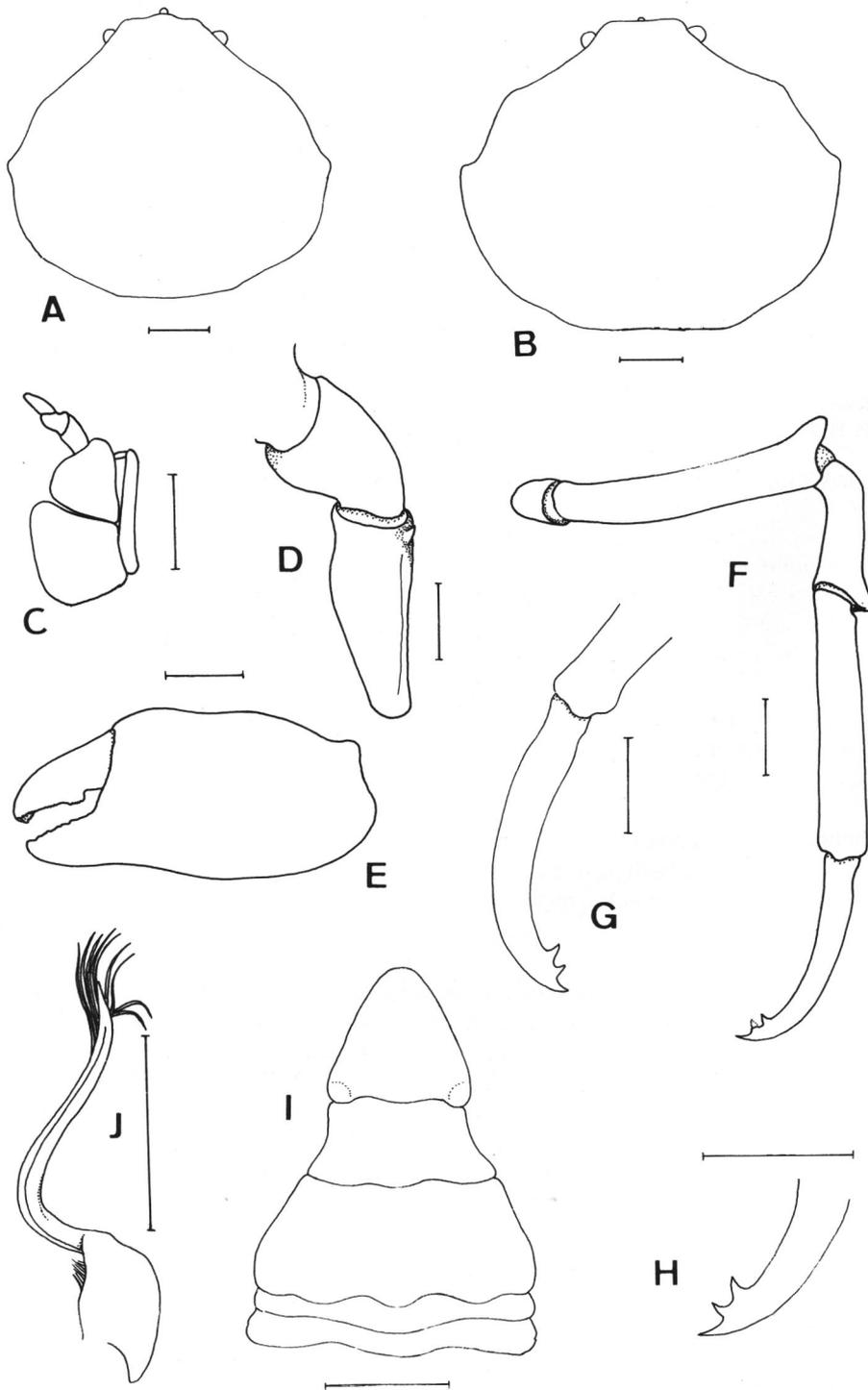


Fig. 30. *Elamena truncata*. A, C-J, neotype male (6.2 by 5.7 mm) (ZRC 1994.4281a); B, female (7.5 by 6.8 mm) (ZRC 1994.4281b); Taiwan. A, B, dorsal view of carapace; C, left third maxilliped; D, left chelipedal merus and carpus; E, left chela; F, right third ambulatory leg; G, left ambulatory leg dactylus; H, left fourth ambulatory leg dactylus; I, male abdomen; J, left G1. Scales = 1.0 mm.

**Distribution.** - Known for certainty only from Japan and Taiwan (present new record).

**Remarks.** - This species is known from a wide area in the Indo-West Pacific region, although many records probably refer to other closely allied species (see Gordon, 1940; Lucas, 1980). Species belonging to the *E. truncata* group include *E. mathaei*, *E. gracilis*, *E. albrohensis*, and *E. gordonae*, as well as the two new species described earlier above, *E. simplidenta* and *E. sundaica*. The G1 of *E. truncata* s. str. was illustrated by Gordon (1940) and Lucas (1980), both from eastern Australian specimens. The G1s figured by both of them are simple, C-shaped, and has only five subterminal setae on the inner margin. *Elamena truncata* was originally described by Stimpson (1858, 1907) from "Oushima" and "off Napa, Loo Choo" in Japan, and Japanese specimens have been figured by Sakai (1932, 1938, 1976), Miyake (1983) and Nagai & Nomura (1988). The G1 of a Japanese specimen has not been figured before.

*Elamena truncata* was described but not figured by Stimpson. Stimpson (1907: 146) observed that the "Lateral margin [has] two or three equidistant inconspicuous angles, better marked in the female than in the male, but seldom dentigerous". He provided measurements for a male and a female, but he did not indicate how many specimens he had altogether. The specimens drawn in Sakai (1932, 1938, 1976) are more rounded than those photographed in Miyake (1983) and Nagai & Nomura (1988) which have more angular margins, but it cannot be ascertained if Sakai's figures are accurate or if they represent another species.

In the course of the present study, we examined four specimens of *Elamena truncata* from northern Taiwan, a locality which is very close to southern Japan, the type locality of the species. They also agree very well with those figured by Miyake (1983) and Nagai & Nomura (1988) from Japan. The photograph of the Japanese specimen by Miyake (1983: pl. 64 fig. 7) does not show the lateral margins well, but the proportions of the ambulatory legs (especially the dactylus) agree well with what is here regarded as *E. truncata* s. str. These Taiwanese specimens are externally similar to other specimens we have examined from New Caledonia and Vietnam, as well as those figured by previous authors. The anterolateral margins of the carapace, structure of the adult male chela, length of the ambulatory dactyli, male abdomens and G1s of the Taiwanese and New Caledonian specimens, however, are quite different, and indicate that the Taiwanese and New Caledonian populations represent different species. The New Caledonian species is described as new (*Elamena vesca*) in a separate paper on the New Caledonian Hymenosomatidae (Ng & Richer de Forges, 1996).

Australian specimens previously referred to *E. truncata* by Gordon (1940), McNeill (1968) and Lucas (1980) might well be another undescribed species. Gordon (1940) and Lucas (1980) provided excellent figures of the carapace, male abdomen and G1 of the Australian specimens. The carapace and male abdomen of the Australian specimens agree resemble those from New Caledonia, but there are minor differences. The anterolateral margin of the Australian specimens are straight and completely without any angle (Fig. 31D) (vs. slight angle present), and the male abdominal segment 5 is distinctly shorter than the telson (Fig. 31E, F) (vs. subequal in length). There are also differences in the structure of the G1. The distal part of the G1 of the New Caledonian *E. vesca* is more strongly upcurved and has more stiff setae (8 vs. 4-5) (Fig. 31G-I) (Ng & Richer de Forges, 1996). Whether these differences are due to variation cannot be ascertained until more specimens are examined.

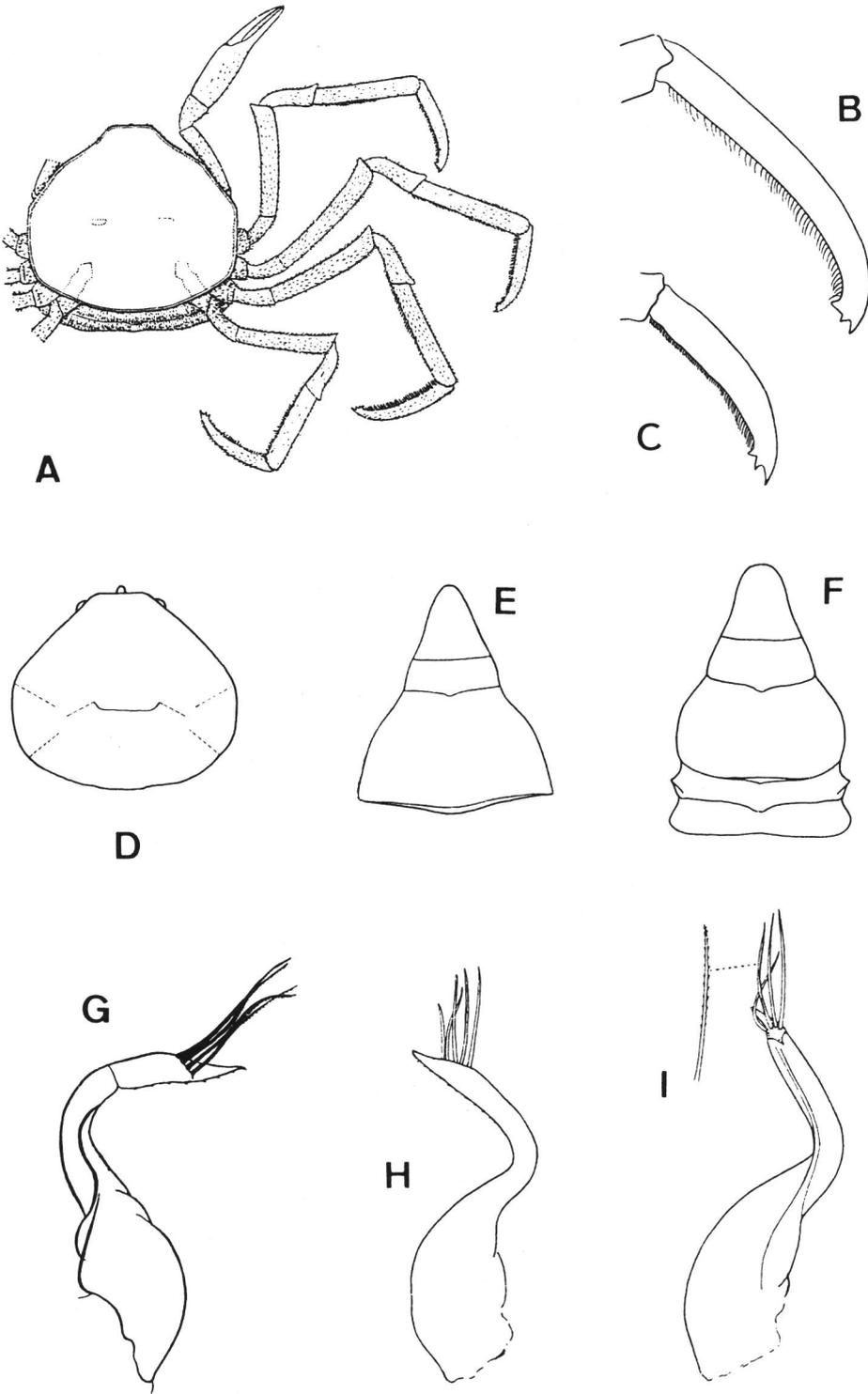


Fig. 31. A, *Elamena* aff. *truncata*, female, Andamans (after Kemp, 1917: Fig. 22); B-I, *Elamena vesca*; B, E, H, I, males (after Gordon, 1940: Fig. 5); C, D, F, G, males (after Lucas, 1980: Figs. 6D, 2D, 8B, 10H respectively); Australia. A, whole view; B, C, ambulatory dactylus; D, dorsal view of carapace; E, F, male abdomens; G-I, G1s.

The Vietnamese specimen is a not fully mature female, and its identity is uncertain. The carapace features seem closer to the New Caledonian and Australian ones, although from the geographical perspective, it is closer to Japan and Taiwan. The Indonesian specimen (a young female) has a rather more elongate rostrum which seems to suggest that it might not be a real *E. truncata* and is hence not listed here. Both the Vietnamese and Indonesian specimens are here regarded as *incerta sedis* (see next taxon).

In view of the complicated taxonomy of this group of species, and the fact the current taxonomy and identities of the various species hinges a great deal on what is the "real" *E. truncata*, a neotype designation for the species is desirable. Stimpson's specimens are lost in the Great Chicago Fire. The neotype specimen chosen (male, 6.2 by 5.7 mm, ZRC 1994.4281a) from northern Taiwan agrees well with what Stimpson described and generally accepted as the species. The location is also very close to the type locality of *E. truncata*, which is southern Japan.

The identities of the specimens reported by Henderson (1893: 395), Alcock (1900: 386) and Kemp (1917: 272, figs. 22, 23) from the eastern Indian Ocean cannot be ascertained until they can be re-examined or fresh specimens from these areas collected. Neither their male abdomens or G1s are known. The specimens from Samoa and Fiji reported by Alcock (1900) should probably be referred to *E. vesca*, described from New Caledonia (Ng & Richer de Forges, 1996). The specimens from Andamans and Nicobars (all females, one of which was figured by Kemp, 1917, see present Fig. 31A) closely resemble the present specimen from Vietnam here referred to *Elamena ? truncata* (see earlier), their anterolateral margins possessing a low angle.

### ***Halicarcinus orientalis* Sakai, 1932**

**Material examined.** - JAPAN: 21 juveniles (NSMT-Cr 8112), 3 juveniles (ZRC 1994.4247), off Kisami, tip of Izu Peninsula, Sizuoka Prefecture, Honshu, 33-41 m depth, coll. K. Nakamura.

**Remarks.** - The present series of specimens seem to agree with Sakai's (1932) description of this species. The G1 of this species has not been figured before, but unfortunately, all the specimens are juveniles.

### ***Halicarcinus ovatus* Stimpson, 1853**

**Material examined.** - AUSTRALIA: 1 male, 1 female (ZRC 1993.6518-6519), Durras, New South Wales, 1 Apr.1977.

**Remarks.** - The present specimens of this south Australian species agrees very well with Melrose's (1975: 39) and Lucas (1980: 179) descriptions and figures.

### ***Halicarcinus planatus* (Fabricius, 1775)**

**Material examined.** - 1 female (MNHN), cruise MD 08, station 53, DC 233, 46°7.5'N 50°20.6'E, Archipel Crozet, between Ile de la Possession and Ile des Conchons, depth 110 m, coll. R.V. Marion Dufresne, 16 Apr.1976.

**Remarks.** - This is a well known circum-subantarctic species, and has been well described and figured by Melrose (1975).

***Hymenosoma orbiculare* Desmarest, 1825**

**Material examined.** - MADAGASCAR: 1 ovigerous female (MNHN), intertidal zone, northwest coast, Nosy Be, coll. A. Crosnier, 7 Sep.1974.

**Remarks.** - This species has been previously reported from southern Africa and Zanzibar. The present female, a first record for Madagascar, agrees well with published descriptions of the species.

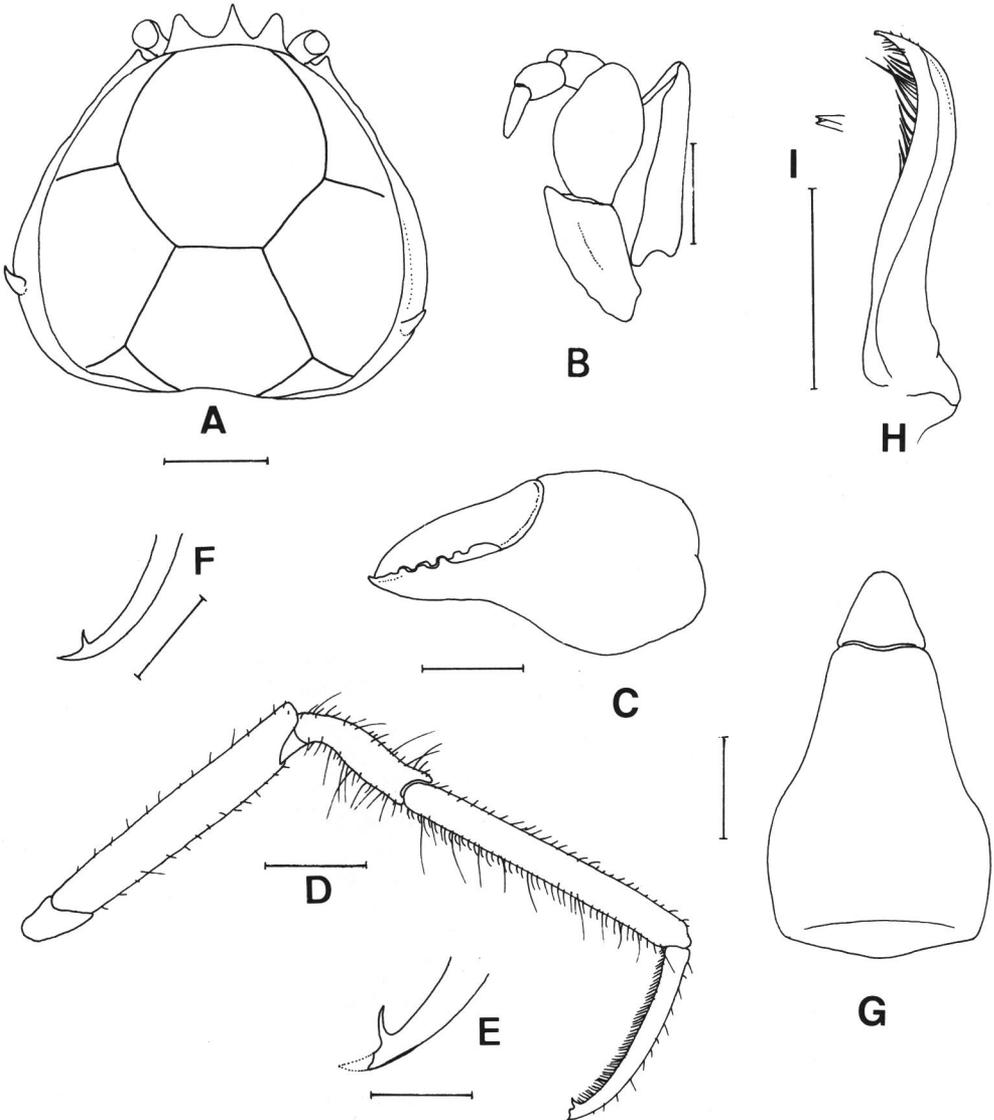


Fig. 32. *Neorhynchoplax okinawaensis*. Male (3.6 by 4.0 mm) (RMNH). A, carapace; B, left third maxilliped; C, left chela; D, right third ambulatory leg; E, right third ambulatory dactylus; F, right fourth ambulatory dactylus; G, male abdomen, segments 3-6; H, left G1; I, tip of G1 showing bifurcated tip. Scales: A, C, D, F = 1.0 mm; B, E, G, H = 0.5 mm.

*Neorhynchoplax okinawaensis* (Nakasone & Takeda, 1994)

(Fig. 32)

**Material examined.** - JAPAN: 1 male (3.6 by 4.0 mm) (RMNH), Shirahama, Wakayama Prefecture, Honshu, coll. S. M. Shiino, Aug.1958. — 7 males, 1 female (ZRC 1994.4246), Shiira-gawa (River), Iriomote Island, Yaeyama Group, Ryukyus Islands, Okinawa Prefecture, coll. K. Nakamura. — 1 male, 1 juvenile (ZRC 1994.4248), Goga, Okinawa Prefecture, coll. T. Kosuge, 16 Aug.1993.

**Remarks.** - This recently described species is very close to *N. octogonalis* but can easily be separated by the more lateral oval carapace, rostral lobes which are fused at the base (vs. separate), and the proportionately much longer ambulatory legs. The specimens referred to *N. octogonalis* by Lucas (1980) and Lucas & Davie (1982) from Australia seem closer to the new Japanese species than *N. octogonalis* s. str., their G1s being similar in appearance (cf. Lucas & Davie, 1982).

The species was described from one heterogeneous pair from Okinawa in the Ryukyus. The present specimen from Honshu, which agrees very well with Nakasone & Takeda's (1994) description and figures, extends the species' range northwards. The rostral lobes of the Honshu specimen is fused at the base, unlike the types which are free. The smaller specimens from Shiira-gawa differ from the larger one from Honshu in having the dorsal surfaces of their carapaces more convex. These, however, are only minor differences.

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