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SWIMMING CRABS OF THE GENERA *CHARYBDIS* DE HAAN, 1833, AND *THALAMITA* LATREILLE, 1829 (CRUSTACEA: DECAPODA: BRACHYURA: PORTUNIDAE) FROM PENINSULAR MALAYSIA AND SINGAPORE

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SWIMMING CRABS OF THE GENERA *CHARYBDIS* DE HAAN, 1833, AND *THALAMITA* LATREILLE, 1829 (CRUSTACEA: DECAPODA: BRACHYURA: PORTUNIDAE) FROM PENINSULAR MALAYSIA AND SINGAPORE

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ABSTRACT. - The taxonomy of the swimming crabs of the genera *Charybdis* and *Thalamita* in the Malay Peninsula (Peninsular Malaysia and Singapore) is revised and 36 species are recognised. Of the 19 species of *Charybdis* now known from this area, three are new records, namely *Charybdis (Charybdis) brevispinosa, Charybdis (Charybdis) granulata* and *Charybdis (Goniohellenus) vadorum*. The status of *C. (C.) granulata*, frequently regarded as a synonym of *C. (C.) natator*, is clarified and regarded as a good species. *Charybdis (C.) brevispinosa*, previously regarded as only a variety or synonym of *C. (C.) variegata*, is raised to the species level. Of the 17 species of *Thalamita, T. chaptali* is a new record. Two new species are described from Singapore, *T. spinicarpa* and *T. cerasma*. The synonymy of the *T. admete* species complex is discussed in detail and the identities of several of its members clarified. A replacement name, *Thalamita borradailei*, is proposed for *Thalamita admete* var. *intermedia* Borradaile, 1903 (preoccupied by *T. intermedia* Miers, 1886), which had previously been incorrectly regarded as synonymous with *T. quadrilobata* Miers, 1884. *Thalamita stimpsoni* is confirmed to be a synonym of *T. danae* - the taxonomy of these two common taxa having caused many problems in the past. Neotypes are designated for three poorly understood species - *T. danae, T. prymna* and *T. crassimana*, with the latter becoming a junior synonym of *T. prymna*. The taxonomy of *T. prymna* is revised and *T. pelsarti*, previously regarded as a synonym of *T. prymna*, is resurrected. A checklist and key to the genera and species of *Charybdis* and *Thalamita* known from Singapore and Peninsular Malaysia is provided. The ecology of the various species are also enumerated and discussed.

CONTENTS

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INTRODUCTION

The family Portunidae Rafinesque, 1815, is a distinctive group of marine crabs which are well represented in Southeast Asia. The genus *Charybdis* De Haan, 1833, and *Thalamita* Latreille, 1829, are two of the largest genera in the subfamily Portuninae Rafinesque, 1815. Forty-seven species of *Charybdis* and 66 species of *Thalamita* are known to date from the

Indo-West Pacific region. The combined species numbers of these two genera far exceed any others within the family. This is certainly true for the waters of the Malay Peninsula (Peninsular Malaysia and Singapore).

Early accounts of these crabs in Malayan waters have been few and scattered (see Walker, 1887; Lanchester, 1900, 1901; De Man, 1929; Buitendijk, 1947; Tweedie, 1950). No discrete study of the group in Malayan waters as a whole have been conducted until Shen (1937) and Gordon (1938). Part of an unpublished thesis on the systematics of the Malayan Portunidae by Ow-Yang (1963) attempted to consolidate these previous works, and the keys and figures were extracted in verbatim for a guide to Malayan decapods by Lovett (1981).

In other parts of the Indo-West Pacific, works on the Portunidae have been more extensive. Comprehensive accounts were made in Madagascar (Crosnier, 1962), South Africa (Barnard, 1950) and Tanzania (Heath, 1973). The Indian fauna was treated by Chhapgar (1957), Sankarankutty (1966) and Chopra (1935), the latter emphasising on the genus *Charybdis*. Several documentations of the family were done from the seas of China, Taiwan and Hong Kong (Gordon, 1930, 1931; Shen, 1932, 1934; Dai et al., 1986; Yang and Dai, 1991). Valuable contributions were made to the knowledge of Japanese portunids by Sakai (1939, 1965, 1976), Takeda (1975, 1989), Takeda et al. (1974, 1976) and Miyake (1983). Descriptions of several Indonesian and Philippine species were done by Moosa (1980) and those from Hawaii by Edmondson (1954).

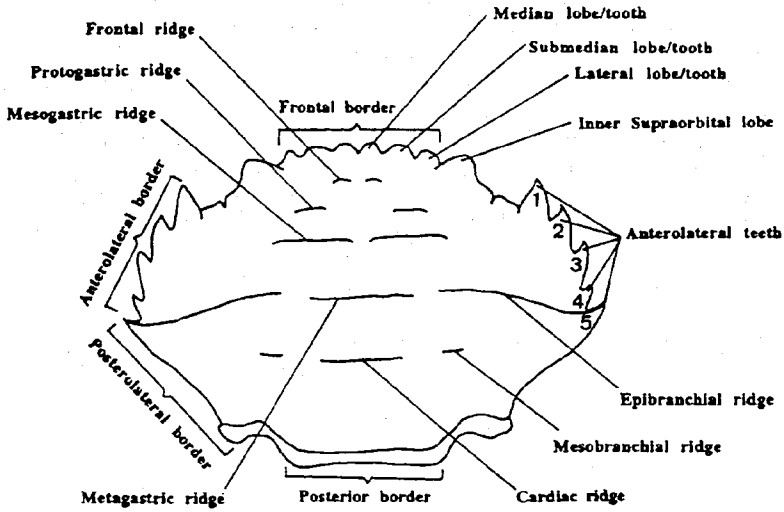
Leene (1938) revised *Charybdis*, introducing two new subgenera to the previous three recognised. Her work has generally been accepted by subsequent authors. Stephenson et al. (1957) revised the Australian *Charybdis*, with greater emphasis on the characters of the first male gonopod. The genus *Thalamita* from Australia was studied by Stephenson & Hudson (1957). Subsequent publications by Stephenson & Rees (1967, 1968) and Stephenson (1961, 1965, 1976) have continued to update the taxonomy established for the two genera. A complete checklist and key to all the portunid species in the Indo-West Pacific was done by Stephenson (1972).

In the present study, 19 species of *Charybdis* and 17 species of *Thalamita* are recognised. All the species belonging to the two genera in the Malay Peninsula are treated.

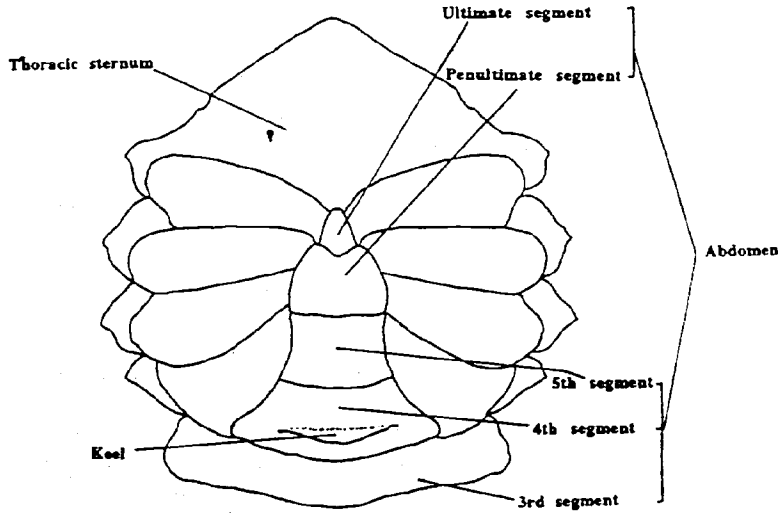
MATERIALS AND METHODS

Materials used for the present study were based upon freshly collected as well as museum specimens in the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore. Part of its portunid collection comes from the Singapore Regional Fisheries Research Station (S.R.F.R.S.) dating back to 1938. Recent specimens collected in Singapore waters have been accumulated from various collecting trips, as well as the ASEAN Australian Living Coastal Resource Project over the past six years. Additional specimens examined were from the Nationaal Naturhistorisches Museum (former Rijksmusuem van Natuurlijke Historie, RMNH), Leiden, The Netherlands; British Museum (Natural History) (BMNH), London, U.K.; University of Cambridge Zoology Museum (CMZ), Cambridge, U.K.; and Muséum Nationale d'Histoire Naturelle (MNHN), Paris, France.

Diagnosis were based on mature males and females unless otherwise specified. Descriptions are made only in the event whereby previous works have been poor or a redefining of the

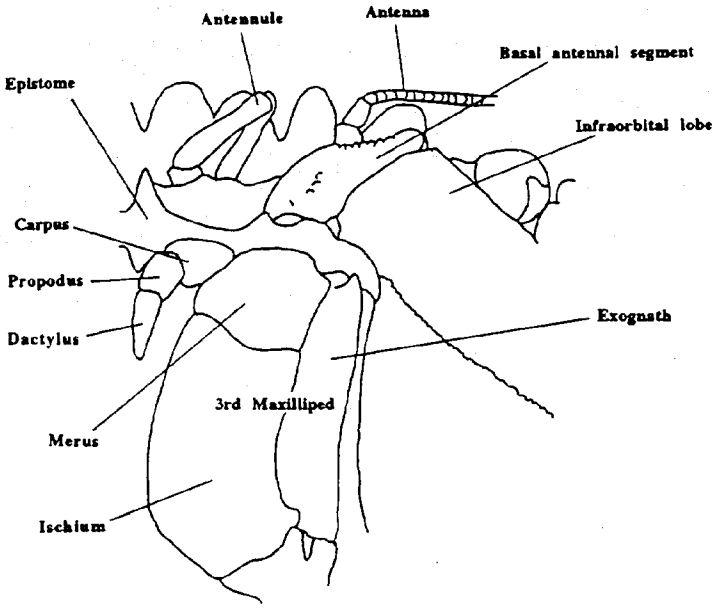


Dorsal Surface of Carapace



Ventral Surface of Carapace

Fig. 1. Terminology: dorsal and ventral surfaces of carapace (adapted from Crosnier, 1962).



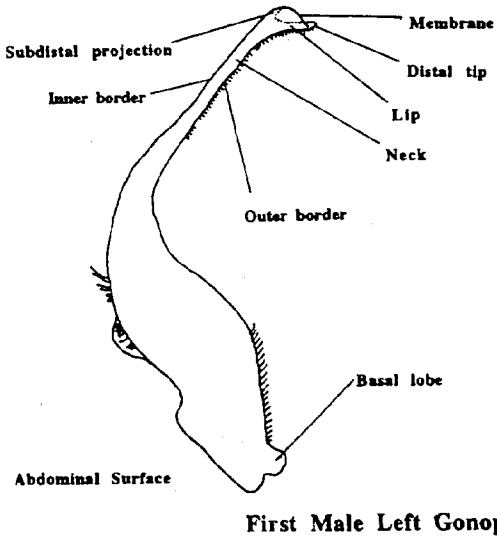
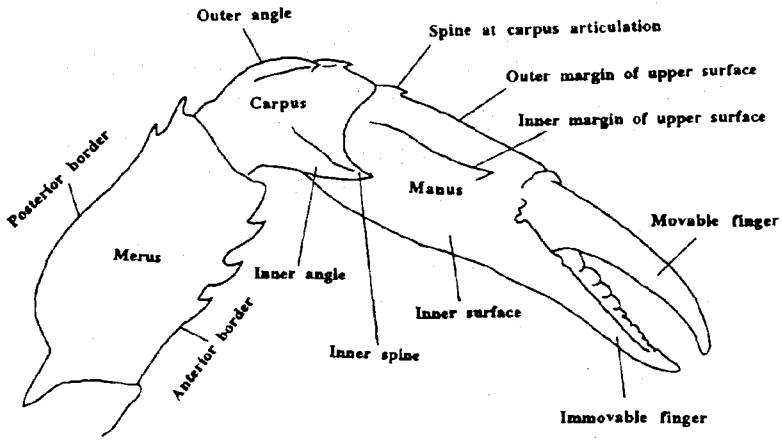
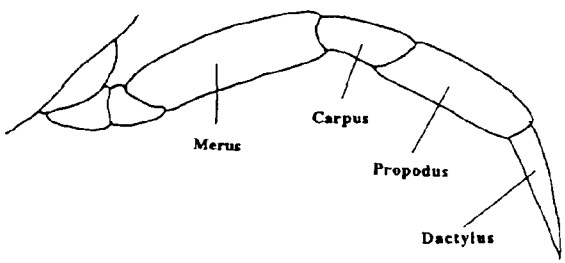


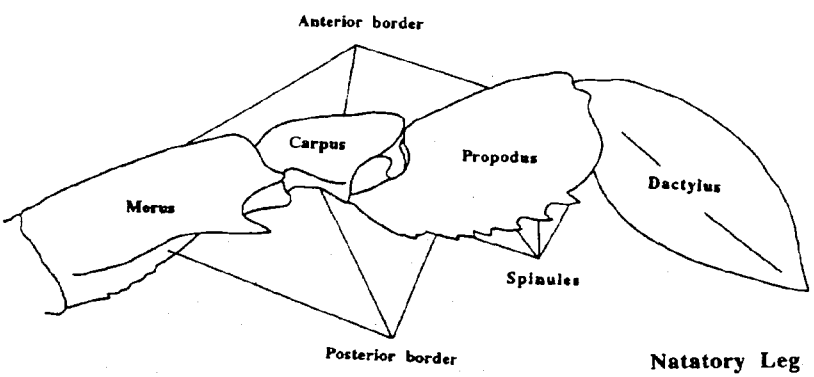
Fig. 2. Terminology: ventral surface of frontal half (adapted from Crosnier, 1962) and G1.



Left Cheliped



Ambulatory Leg



Natatory Leg

Fig. 3. Terminology: left cheliped, ambulatory leg and natatory leg (adapted from Crosnier, 1962).

species is required. Synonyms and references listed in the descriptions of each species have been selective (based on area relevance and taxonomic data). The reader is referred to Stephenson (1972) for a complete list of the synonyms.

The measurements provided are of the carapace length and breadth respectively. The length was measured from the tips of the median frontal teeth, along the median axis to the posterior border of the carapace. The breadth was measured across the widest points, usually between the last pair of antero lateral spines.

Terms used in descriptive accounts are as in Figs. 1-3. The word pilose represents a dense covering of short hairs, easily rubbed off with one's fingers, and the words pubescent or hairy represent relatively longer hairs which are less easily scraped off. The following abbreviations are used throughout the text: G1, first male gonopod; G2, second male gonopod.

KEY TO KNOWN MALAYAN SPECIES OF *CHARYBDIS* AND *THALAMITA*

1. Extent of the frontal-orbital border distinctly less than greatest breadth of carapace; anterolateral border of carapace oblique and arched, cut into six or seven teeth .... Genus *Charybdis* 2

– Extent of the frontal-orbital border not much less than greatest breadth of carapace; anterolateral border of carapace not markedly arched, cut into five teeth (some with first anterolateral tooth bearing an accessory denticle) ..... Genus *Thalamita* 20

2. Posterior border of carapace forming a curve with posterolateral border; merus of cheliped with distal spine on posterior border 3

– Posterior border of carapace forming an angular junction with posterolateral border; merus of cheliped without distal spine on posterior border ..... Subgenus *Goniohellenus* 4

3. Anterolateral border divided into five large and two very small teeth..... Subgenus *Goniosupradens* 6

– Anterolateral border divided into six teeth of which at least five are large ..... Subgenus *Charybdis* 7

4. Cardiac region with group of Y-shaped granules; merus of cheliped with two spines on anterior border; carpus of second and third pair of ambulatory legs without distal spine on upper border ..... *Charybdis (Goniohellenus) vadorum*

– Cardiac region with two granular patches; merus of cheliped with three spines on anterior border; carpus of second and third pair of ambulatory legs with distal spine on upper border 5

5. Last anterolateral teeth directed laterally, projecting beyond preceding tooth; G1 distal tip stout, partly covered by lip membrane ..... *Charybdis (Goniohellenus) hongkongensis*

– Last anterolateral teeth directed forwardly, not projecting beyound preceding tooth; G1 distal tip slender and elongate, not covered by lip membrane ..... *Charybdis (Goniohellenus) truncata*

6. Six frontal teeth sharply pointed; merus of third maxillipeds with outer distal angle not produced; basal antennal segment bearing two sharp spines ..... *Charybdis (Goniosupradens) acutifrons*

– Six frontal teeth truncate; merus of third maxillipeds with outer distal angle produced; basal antennal segment bearing granular ridge ..... *Charybdis (Goniosupradens) obtusifrons*

7. Carapace with distinct ridges or granular patches behind level of last pair of anterolateral teeth 8

– Carapace without distinct ridges or granular patches behind level of last pair of anterolateral teeth 12

8. Mesobranchial ridges absent; merus of chelipeds with two spines on anterior border; propodus of natatory leg with smooth posterior border ..... *Charybdis (Charybdis) callianassa*

– Mesobranchial ridges present; merus of chelipeds with three spines on anterior border; propodus of natatory leg with spinules on posterior border 9

9. Median and submedian frontal teeth prominent beyond laterals; two pairs of mesobranchial ridges present; penultimate segment of male abdomen with convex lateral borders 10

– Median and submedian frontal teeth not prominent beyond laterals; three pairs of mesobranchial ridges present; penultimate segment of male abdomen with parallel lateral borders for greater half 11

10. Median frontal teeth triangular, projecting anteriorly to same level as inner infraorbital angle; G1 with lip membrane distinctly lobed and separated from tip ..... *Charybdis (Charybdis) variegata*

– Median frontal teeth blunt, behind level of inner infraorbital angle; G1 with lip membrane indistinct and not separated from tip ..... *Charybdis (Charybdis) brevispinosa*

11. Orbit with strong dorsal inclination; manus of cheliped without longitudinal sulcate on lower surface; G1 distal tip stout, bristles on outer surface begin at apex of tip .... *Charybdis (Charybdis) granulata*

– Orbit without strong dorsal inclination; manus of cheliped with longitudinal sulcate on lower surface; G1 distal tip slender and elongate, bristles on outer surface begin a distance away from apex of tip ..... *Charybdis (Charybdis) natator*

12. Merus of cheliped with two spines on anterior border; manus with two spines on the upper surface ..... *Charybdis (Charybdis) anisodon*

– Merus of cheliped with three to four spines on anterior border; manus with more than two spines on the upper surface 13

13. First anterolateral tooth truncate or notched 14

– First anterolateral tooth not truncate or notched 17

14. Manus of cheliped with four spines on upper surface; fourth segment of abdomen keeled 15

– Manus of cheliped with five spines on upper surface; fourth segment of abdomen not keeled 16

15. Merus of cheliped with four spines on anterior border; frontal teeth sharply acute; propodus of natatory leg with two to four spinules on posterior border; carapace densely pilose with granular patches on frontal, cardiac and mesobranchial regions ..... *Charybdis (Charybdis) miles*

– Merus of cheliped with three spines on anterior border; frontal teeth blunt; propodus of natatory leg with smooth posterior border; carapace without hair or granular patches on frontal, cardiac and mesobranchial regions..... *Charybdis (Charybdis) feriatus*

16. Manus of cheliped with well developed spines; penultimate segment of male abdomen with convex lateral borders; last anterolateral tooth smallest and spiniform, not projecting beyond preceding tooth ..... *Charybdis (Charybdis) japonica*

– Manus of cheliped with poorly developed spines; penultimate segment of male abdomen with lateral borders parallel for proximal half; last anterolateral tooth elongate, projecting laterally beyond preceeding tooth ..... *Charybdis (Charybdis) affinis*

17. Carpus of natatory leg with spine on posterior border; merus of cheliped with spinule at distal corner of anterior border ..... *Charybdis (Charybdis) hellerii*

– Carpus of natatory leg without spine on posterior border; merus of cheliped without spinule at distal corner of anterior border 18

18 Second anterolateral tooth rudimentary or distinctly smaller than first; carapace densely pilose, transverse granular ridges distinct ..... *Charybdis (Charybdis) orientalis*

– Second anterolateral tooth not smaller than first; carapace smooth and without hairs, transverse ridges faintly granular 19

19. First and second anterolateral teeth closely set, frontal and metagastric ridges absent; purple bandings on ambulatory and natatory legs.. *Charybdis (Charybdis) annulata*

– First and second anterolateral teeth not closely set, frontal and metagastric ridges present; no purple bandings on ambulatory and natatory legs ..... *Charybdis (Charybdis) lucifera*

20. Frontal border cut into two lobes excluding inner supraorbital lobes 21

– Frontal border cut into more than two lobes excluding inner supraorbital lobes .. 25

21. G1 distal tip broadly flared; manus of cheliped with squamiform markings on lower surface ..... *Thalamita sima*

– G1 distal tip not broadly flared; manus of cheliped with smooth lower surface ... 22

22. Basal antennal segment with row of granules on sharp ridge; cardiac ridge distinct and unbroken 23

– Basal antennal segment with smooth or minutely granular crest; cardiac ridge absent or widely separate if present 24

23. Inner supraorbital lobe slightly arched, as broad as frontal lobe; G1 with distal tip bilobed ..... *Thalamita admete*

– Inner supraorbital lobe straight, narrower than frontal lobe; G1 with distal tip spoon shaped and slightly recurved ..... *Thalamita gatavakensis*

24. Inner supraorbital lobes straight, as broad as frontal lobe; protogastric ridge absent; G1 tapering to straight distal tip ..... *Thalamita integra*

– Inner supraorbital lobes arched, narrower than frontal lobe; protogastric ridge present; G1 tapering to strongly recurved tip ..... *Thalamita chaptali*

25. Frontal border cut into four teeth excluding inner supraorbital lobes 26

– Frontal border cut into six teeth excluding inner supraorbital lobes 27

26. Lateral lobe of frontal border convex on anterior border; manus with four spines on upper surface; propodus of natatory leg without spinules on posterior border ..... *Thalamita sexlobata*

– Lateral lobe of frontal border with shallow concavity on anterior border; manus with five spines on upper surface; propodus of natatory leg with spinules on posterior border ..... *Thalamita malaccensis*

27. Anterolateral border cut into four teeth, last smallest; frontal and mesogastric ridges absent ..... *Thalamita mitsiensis*

– Anterolateral border cut into five teeth, last not the smallest; frontal and mesogastric ridges present 28

28. Basal antennal segment with smooth or granulated ridge 29

– Basal antennal segment with several sharp spine 33

29. Mesogastric ridge widely separated; submedian lobes broader than median lobes; G1 distal tip flared, directed laterally 30

– Mesogastric ridge not broken; submedian lobes not distinctly broader than median lobes; G1 distal tip tapering, not directed laterally 31

30. Basal antennal segment with granulated ridge; first anterolateral tooth bearing a subsidiary basal spinule; G1 with long bipinnate bristles on outer surface .... *Thalamita spinifera*

– Basal antennal segment with smooth crest; first anterolateral tooth without a subsidiary basal spinule; G1 without long bipinnate bristles on outer surface .... *Thalamita picta*

31. Manus of cheliped smooth with single costa running to immovable finger on outer surface; fourth anterolateral tooth large ..... *Thalamita crenata*

– Manus of cheliped granular with three costae on outer surface; fourth anterolateral tooth smallest or rudimentary 32

32. Carpus of cheliped with four spines; cardiac and mesobranchial ridges absent; G1 basal lobe rounded with convex lateral border ..... *Thalamita danae*

– Carpus of cheliped with five spines; cardiac and mesobranchial ridges present; G1 basal lobe truncate with slightly concave lateral border .... *Thalamita spinicarpa*, new species

33. Carapace ridges faint; manus of cheliped smooth with single costa running to immovable finger on outer surface; epistomal ridge with straight ventral border .... *Thalamita cerasma*, new species

– Carapace ridges distinct and granular; manus of cheliped granular with three costae on outer surface; epistomal ridge with curved ventral border 34

34. Fourth anterolateral tooth large; carpus of cheliped with six to seven spines .... *Thalamita spinimana*

– Fourth anterolateral tooth rudimentary; carpus of cheliped with four spines..... 35

35. Frontal lobes closely set, lateral lobes not widely separated from submedians; basal antennal segment with two fused spines; manus of cheliped with inner to lower surface smooth; G1 with distal tip sharply bent, basal lobe with concave lateral border .... *Thalamita prymna*

– Frontal lobes widely separated, laterals separated from submedians by a deeper notch; basal antennal segment with three to five spines; manus of cheliped with inner to lower surface strongly granular; G1 with distal tip not sharply bent, basal lobe with slightly convex lateral border ..... *Thalamita pelsarti*

TAXONOMY

Genus *Charybdis* De Haan, 1833

Charybdis De Haan, 1833: 10; Alcock, 1899: 47; Leene, 1938: 15; Barnard, 1950: 165; Stephenson et al., 1957:491; Crosnier, 1962: 73; Sakai, 1976: 354.
Goniosoma A. Milne Edwards, 1860: 263; A. Milne Edwards, 1861: 367 (preoccupied by *Goniosoma* Perty, 1833 - Arachnoidea).

Type species. - *Cancer sexdentata* Herbst, 1783, designated by Glaessner (1929). Gender feminine.

Diagnosis. - Carapace hexagonal, broader than long; ridges distinct; front cut into six lobes, excluding inner supraorbital lobes; upper orbital border with two fissures, lower border notched; posterolaterals form an even curve or meet in a distinct projecting angle with posterior border; six anterolateral teeth (rarely with seven to eight teeth). Basal antennal segment short, excluding flagellum from orbital hiatus, ornamentations on crest smooth to granular. Merus of third maxilliped with outer distal angle produced sideways. Chelipeds unequal; merus with spines; carpus with large spine on inner angle and three spines on outer angle; manus with spines on upper surface, and one proximal spine near wrist articulation, outer suface costate; fingers grooved. Ambulatory legs compressed; merus of natatory leg with strong spine at posterior border; dactylus and propodus foliaceous, propodus generally with small spinules. Ultimate segment of male abdomen triangular, third to fifth segment fused. G1 slender and elongate, with terminal bristles on inner and outer borders.

Remarks. - There are 19 species known from the Malay Peninsula, of which three are new records.

The genus *Charybdis* was subdivided into five subgenera by Leene (1938: 18). Below are the diagnosis of three subgenera found in the Malay Peninsula:

Subgenus *Charybdis* Alcock, 1899 - Posterior and posterolateral borders of carapace form a curve. Four median frontal teeth as broad as lateral frontal teeth. Anterolateral border cut into six teeth. No spine on posterior border of merus of cheliped.

Subgenus *Goniohellenus* Alcock, 1899 - Posterior border of carapace straight, forms a right angled junction with posterolateral border. Four median frontal teeth broader than lateral frontal teeth. Anterolateral border cut into six teeth. Posterior border of merus of cheliped with distal spinule.

Subgenus *Goniosupradens* Leene, 1938 - Posterior and posterolateral border of carapace forms a curve. Four median frontal teeth as broad as lateral frontal teeth. Anterolateral border cut into five large and two or three very small teeth. No spine on posterior border of merus of cheliped.

Alcock (1899) proposed that the genus *Charybdis* be divided into three subgenera, namely *Charybdis, Goniohellenus* and *Gonioneptunus*. A. Milne Edwards (1861) chose to replace *Charybdis* with *Goniosoma*, but was later reinstated by Leene (1938), who noted that the name *Goniosoma* cannot be used as it had already been previously occupied for a genus of the Arachnoidea established by Perty (1833). In any case, *Charybdis* is an older name to which A. Milne Edwards had incorrectly replaced. Leene (1938) added two other subgenera

Goniofradens and *Goniosupradens* to the genus. The characters used to separate the species within the genus into the five subgenera have been satisfactory and have been retained in this study.

Charybdis (Charybdis) affinis Dana, 1852
(Fig. 4A-F)

Charybdis affinis Dana, 1852:286, pl. 17, figs. 12a-c.
Goniosoma affine - A. Milne Edwards, 1861: 384; De Man, 1888: 80, pl. 15, fig. 2; Lanchester, 1901: 545
Charybdis (Goniosoma) affinis - Alcock, 1899: 56; Rathbun, 1910: 364, pl. 2, fig. 11; Kemp, 1918: 250; Shen, 1937: 119, fig. 11.
Charybdis (Charybdis) affinis - Leene, 1938: 35, fig. 8, 9; Leene, 1940: 180; Ow-Yang, 1963: 55, pl.11, figs. A-F; Lovett, 1981: 127, figs. 276a-b; Dai et al., 1986: 216, pl. 29(1), fig. 128(1); Dai & Yang, 1991: 235, pl. 29(1), fig. 128(1).
Charybdis (Goniosoma) barneyi Gordon, 1931:536, figs. 13a-b; Shen, 1934: 42, figs. 6-8.

Material examined. - SINGAPORE - 5 males, 3 females (ZRC 1965.10.19.109-116), Siglap, coll. M.W.F. Tweedie, Jun-Jul.1933. — 1 female (ZRC 1985.752), Siglap B69, coll. S.R.F.R.S.. — 2 males (ZRC 1985.753-754), Siglap, coll. M.W.F. Tweedie, May.1935. — 1 male (ZRC 1985.755), Siglap, coll. A.G. Searle, 30 Mar.1955. — 3 males, 1 female (ZRC 1985.756-759), Bedok Beach, coll. students, 21 Mar.1953. — 1 male, 1 female (ZRC 1984.5610-5611), East Coast, coll. P.K.L. Ng, 29 May.1982. — 2 males, 1 female (ZRC 1965.10.19.117-119), Fish Market, Singapore, coll. M.W.F. Tweedie, 1934. — 3 males, 2 females (ZRC 1993.442-446), Sentosa reef, coll. P.K.L. Ng, Jun.1986. — 1 male, 1 female (ZRC 1993.7476-7492), Tuas, 1985. — 1 male (ZRC), Changi, coll. C.M. Yang, 19 Jan.1987. — 1 male (ZRC), Singapore.

PENINSULAR MALAYSIA - 1 male (ZRC 1985.1909), Muar River, Johor, coll. K.L. Yeo, 11 Jun.1983. — 2 males (ZRC 1985.1612-1613), Muar River, Johor, coll. K.L. Yeo, 24-25 Jun.1983. — 9 males, 8 females (ZRC), Pontian, Johor, coll. P.K.L. Ng, Feb.1993. — 1 male (ZRC 1965.10.19.120), Morib, Selangor, Dec.1934.

Size. - The largest specimen is a male measuring 37.4 by 54.1 mm (ZRC 1993.7476) from Pontian, Johor.

Diagnosis.- Carapace pilose; frontal, cardiac and mesobranchial ridges absent, metagastric ridge interrupted medialy; six frontal teeth, all triangular, medians most prominent, separated by wide V-shaped notch, submedians on a higher plane; inner supraorbital lobe triangular, inner infraorbital lobe with denticulate border and ending in a sharp tooth; six anterolateral teeth, first tooth notched, second to fifth gradually increasing in size, last elongate and spiniform, projecting laterally beyond preceding tooth. Basal antennal segment bearing sharp granular ridge. Chelipeds swollen, surface finely pubescent; anterior border of merus with three spines; carpus with strong spine on inner angle and three spinules at outer angle; manus with five spines on upper surface, outer surface three smooth costae, upper most faint, inner surface with median costa, lower surface smooth; fingers slender, slightly longer than manus. Propodus of natatory leg smooth on posterior border. Penultimate segment of male abdomen broader than long, lateral borders parallel for distal half, gently converging distally. G1 distal tip stout, inner surface with row of long bristles starting some distance behind tip and terminating as shorter bristles along edge of sternal surface, abdominal surface bearing row of short spinules on the lip, outer border with row of long bristles starting from tip and ending at distal third of G1.

Colour. - Dorsal surface dark brownish-green.

Habitat. - This species is found on sandy to muddy beaches.

Distribution.- India, China, Hong Kong, Taiwan, Thailand, Malaysia, Singapore and Indonesia (fide Dai et al., 1986; Dai & Yang, 1991). De Man (1888) first recorded this species from Malaysia and Dana (1852) for Singapore.

Remarks. - Leene (1938) examined one male specimen of *Charybdis (Goniosoma) Barneyi* Gordon, 1931, and confirmed it to be a synonym of this species. In the present collection, there appears to be no trace of a cardiac ridge which Alcock (1899) mentioned for the species. A re-examination of his specimen would be necessary to see if it is really *C. affinis*.

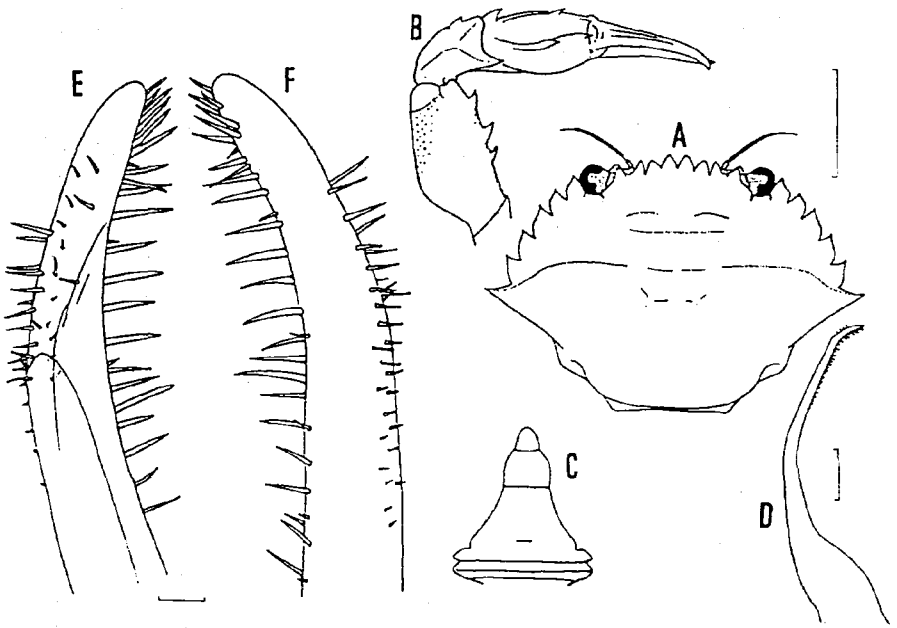


Fig. 4. *Charybdis affinis* Dana, 1852. A-F - ZRC 1985.753, male, 20.6 by 32.4 mm (after Ow-Yang, 1963). A, carapace dorsal surface; B, left cheliped; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface. Scales: A-C = 10.0 mm, D = 1.0 mm, E-F = 0.1 mm.

Charybdis (Charybdis) anisodon De Haan, 1835
(Fig. 5A-H)

Portunus anisodon De Haan, 1835: 42.
Goniosoma anisodon - A. Milne Edwards, 1873: 167
Charybdis anisodon - Stimpson, 1858: 39; Stimpson, 1907: 80, pl. 2, fig. 1; Rathbun, 1910: 364; Balss, 1922: 105; Sakai, 1939: 405.
Charybdis (Goniosoma) anisodon - Nobili, 1906: 198; Shen, 1932: 43, fig. 9, pl. 9, fig. b; Shen, 1937: 117.
Charybdis (Charybdis) anisodon - Leene, 1938: 198; Leene, 1940: 183; Buitendijk, 1947:281;

Stephenson et al., 1957: 493, fig. 1, pl. 1; Crosnier, 1962: 81, figs. 141-142, pl. 4, fig. 1; Ow-Yang, 1963: 58, pl. 12, figs. A-F; Sankarankutty, 1966: 356; Stephenson, 1972: 132; Stephenson, 1975: 177; Sakai, 1980: 76; Moosa, 1980: 70, fig. 5A; Lovett, 1981: 127, figs. 275a-b.

Material examined. - SINGAPORE - 8 males, 5 females (ZRC 1965.10.20.1 -10), Siglap, Jun.1993. — 1 female (ZRC 1977.7.25.6), Siglap, Jun.1933. — 1 female (ZRC 1977.7.25.7), Siglap, Jun.1933. — 1 male, 1 female (ZRC 1977.7.25.8-9), Siglap, 1934. — 1 male, 2 females (ZRC 1977.7.25.10-12), Siglap. — 1 male, 1 female (ZRC 1984.5612-5613), Changi Point, 9 May.1982. 1 male (ZRC 1985.762), Changi B39, coll. S.R.F.R.S., 1955-1956. — 1 female (ZRC 1985.760), B26, coll. S.R.F.R.S., 1955-1956. — 1 female (ZRC 1985.761), off Tanjong Rhu B50, coll. S.R.F.R.S.,1955-1956. — 1 male, 1 female (ZRC 1981.7.24.190-191), Tuas, coll. H.K. Voris, 4 Mar.1981. — 1 female (ZRC 1984.245), Tuas, coll. W.M. Lee, 11 Nov.1982. — 15 males (ZRC 1984.5909-5923), Tuas, coll. W.M. Lee, 15 Dec.1984. — 3 females (ZRC 1984.5924-5926), Tuas, coll. W.M. Lee, 15 Feb.1984. — 3 males (ZRC), Tuas, 4 Sep.1985. — 1 female (ZRC), Sembawang, coll. P. Ng, Oct.1987. — 3 males (ZRC), Tuas; coll. W.M. Lee, 20 Mar.1984.

PENINSULAR MALAYSIA - 1 male (ZRC), Pontian, Johor, coll. P.K.L. Ng, Feb.1993. — 2 males (ZRC 1965.10.20.11-12), Morib, Selangor, coll. Dec.1934. — 1 male, 1 female (ZRC 1985.763-764), Morib, Selangor, coll. M.W.F. Tweedie, Dec.1934. — 1 female (ZRC 1984.7874), Tanjong Panaru, coll. D.S. Johnson, 5 Nov.1956.

THAILAND - 4 males, 3 females (ZRC 1992.10323-10329), Thailand off Pattaya; coll. P.K.L. Ng & L.B. Holthuis, 25 Dec.1991.

Size. - The largest specimen is a male measuring 42.5 by 75.8 mm (ZRC 1984.5909).

Diagnosis. - Carapace smooth; marked by faintly granular transverse carapace ridges, frontal, cardiac and mesobranchial ridges absent; six frontal lobes, medians truncate, on lower plane, projecting beyond laterally directed submedians, laterals bluntly triangular, separated from submedians by deep V-shaped notch; inner supraorbital lobe triangular, bearing a smooth ridge, inner infraorbital lobe obtuse; six anterolateral teeth, first obtusely triangular, second smaller than third, last elongate and large, projecting laterally beyond preceding tooth. Basal antennal segment bearing fine granular ridge. Chelipeds smooth and slightly unequal; anterior border of merus with two spines, posterior border granulated; carpus with strong spine on inner angle and three spinules at outer angle; manus with two spines on upper surface, outer surface two indistinct costae and a distinct third running to immovable finger, inner surface with smooth median costa, lower surface smooth; fingers longer than manus. Propodus of natatory leg smooth on posterior border in larger specimens. Penultimate segment of male abdomen with lateral borders parallel then converging distally. G1 abruptly bent, membrane distant from tip, inner surface with a short row of terminal bristles, abdominal surface with a row of spinules on the lip, outer surface with longer row of bristles starting from tip and terminating lower than inner row as small spinules.

Colour. - Pale green on dorsal surfaces, whitish on the ventral surfaces (fide Stimpson, 1907).

Habitat. - This species is found on muddy substrate at depths of up to 15 meters and may also be found on sandy beaches.

Distribution. - Madagascar, Red Sea, China, Taiwan, Hong Kong, Japan, Philippines, Thailand, Malaysia, Singapore, Indonesia, Sulawesi, Australia and New Caledonia (fide Crosnier, 1962; Stephenson et al., 1957; Leene, 1938). This species was first recorded in Malaysia and Singapore by Buitendijk (1947) and Shen (1937) respectively.

Remarks. - Crosnier (1962) mentioned that amongst the adult specimens, the second anterolateral tooth was larger than the first. However this has not been observed in the present collection. This species is further distinct in having only two spines on the merus and on the manus of the cheliped. The outer border of the upper surface of the manus bears a costa that ends in a blunt notch just before the single spine on the inner border of the same.

The smooth posterior border of the propodus in the natatory leg is seen only in larger specimens, smaller sized ones possess instead several denticles. The G1 as illustrated by Dai & Yang (1991: 229, fig. 123) is truncated at the tip unlike the typical form.

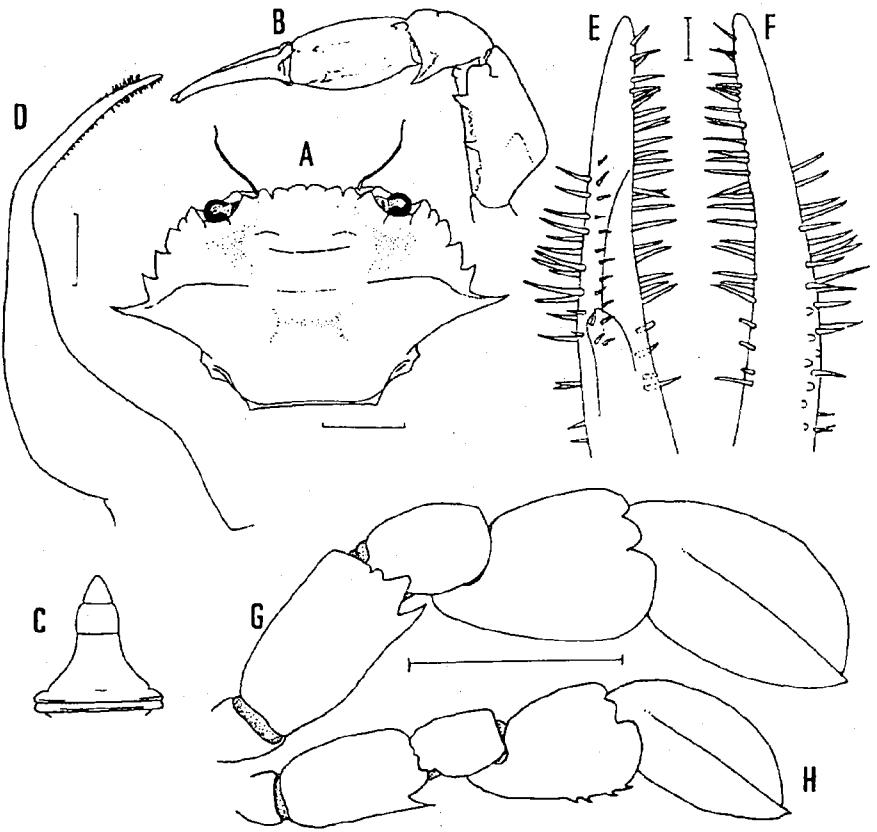


Fig. 5. *Charybdis anisodon* De Haan, 1835. A-C - ZRC, male, 27.5 by 49.4 mm; D-F - ZRC, Morib 12/1934, male, 24.5 by 34.6 mm (after Ow-Yang, 1963); G - ZRC 1992.10323, male, 29.3 by 48.0 mm; H - ZRC 1992.10324, male, 22.5 by 38.0 mm. A, carapace; B, right cheliped; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface; G, right natatory leg; H, right natatory leg. Scales: A-C, G-H = 10.0 mm, D = 1.0 mm, E-F = 0.1 mm.

Charybdis (Charybdis) annulata (Fabricius, 1798)
(Fig. 6A-H)

Portunus annulatus Fabricius, 1798: 364.
Goniosoma annulatum - A. Milne Edwards, 1861: 374; De Man, 1895: 561, fig. 10.
Charybdis annulata - Gordon, 1931: 537, fig. 13d; Sakai, 1939: 402; Barnard, 1950: 169, fig. 32h.
Charybdis (Goniosoma) annulata - Alcock, 1899: 54; Rathbun 1910: 364; Balss, 1922: 106; Balss, 1938:32; Leene, 1937:169, fig. 1; Chhapgar, 1957: 22, pl. 6, figs. h-k.
Charybdis (Charybdis) annulata - Leene, 1938: 60; Leene, 1940: 182; Tweedie, 1950;84; Crosnier, 1962: 78, figs. 136-139, pl. V, fig. 2; Heath, 1973: 2; Sakai, 1976: 356, fig. 129; Stephenson, 1976: 14; Dai et al., 1986: 210, pl. 28(2), fig. 124(1); Dai & Yang, 1991: 230, pl. 28(2), fig. 124(1).
Thalamita annulata - H. Milne Edwards, 1834: 463.
Goniosoma orientale - Heller, 1865: 29, pl. 3, fig. 3.

Material examined. - SINGAPORE - 1 female (ZRC 1993.7376), Labrador Beach, coll. P.K.L. Ng, May.1986. — 1 female (ZRC), Labrador Beach, coll. P.K.L. Ng, 21 Aug.1993. — 1 male (ZRC), East Coast, coll. P.K.L. Ng, 22 Jun.1981.

PENINSULAR MALAYSIA - 1 male (ZRC 1965.10.20.13), Pulau Aor, coll. M.W.F. Tweedie, Jun.1938.

Size. - The largest specimen is a female measuring 48.0 by 70.0 mm (ZRC 1993.7376).

Diagnosis. - Carapace smooth and convex; protogastric, mesogastric and epibranchial ridges faintly marked; six frontal teeth, separated by V-shaped notches, medians and submedians broadly triangular, former projecting beyond latter; laterals narrowest, acutely triangular, lying on a lower plane; inner supraorbital lobe bluntly triangular, inner infraorbital lobe with a stout tooth; six anterolateral teeth, first and second smaller, third largest, gradually decreasing in size to spiniform sixth. Basal antennal segment bearing smoothly rounded crest. Chelipeds stout and unequal; anterior border of merus with three spines and a spinule at distal end; carpus with strong spine on inner angle and three spinules at outer angle; manus with three spines and distal two reduced to tubercles on upper surface, outer surface two smooth costae, inner to lower surface smooth; fingers of major cheliped shorter than manus, but longer in minor. Propodus of natatory leg serrated on posterior border; merus and carpus with spine on posterior border. Penultimate segment of male abdomen with lateral borders parallel for three-quaters of the length, then converging distally. G1 distal tip sharply bent, inner surface with short bristles along curvature of tip, outer surface with row of long bristles starting at tip and terminating at distal third of G1.

Colour. - Carapace bluish grey, legs and chelipeds with circular purple and creamy bands. Lim et al. (1994: 152) provided a colour figure of a Singapore specimen.

Habitat. - This species is found on rocky shores near the low tide mark to the sublittoral zone. The present specimens were collected under overturned rocks.

Distribution. - Tanzania, Madagascar, Pakistan, India, Sri Lanka, China, Taiwan, Japan, Thailand, Malaysia, now Singapore, Indonesia and Tahiti (fide Crosnier, 1962; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded in Malaysia by Alcock (1899). It is a new record for Singapore.

Remarks. - *Charybdis annulata* is characteristic in having the purplish bandings on the legs and chelipeds, which are still retained after preservation. The first and second anterolateral

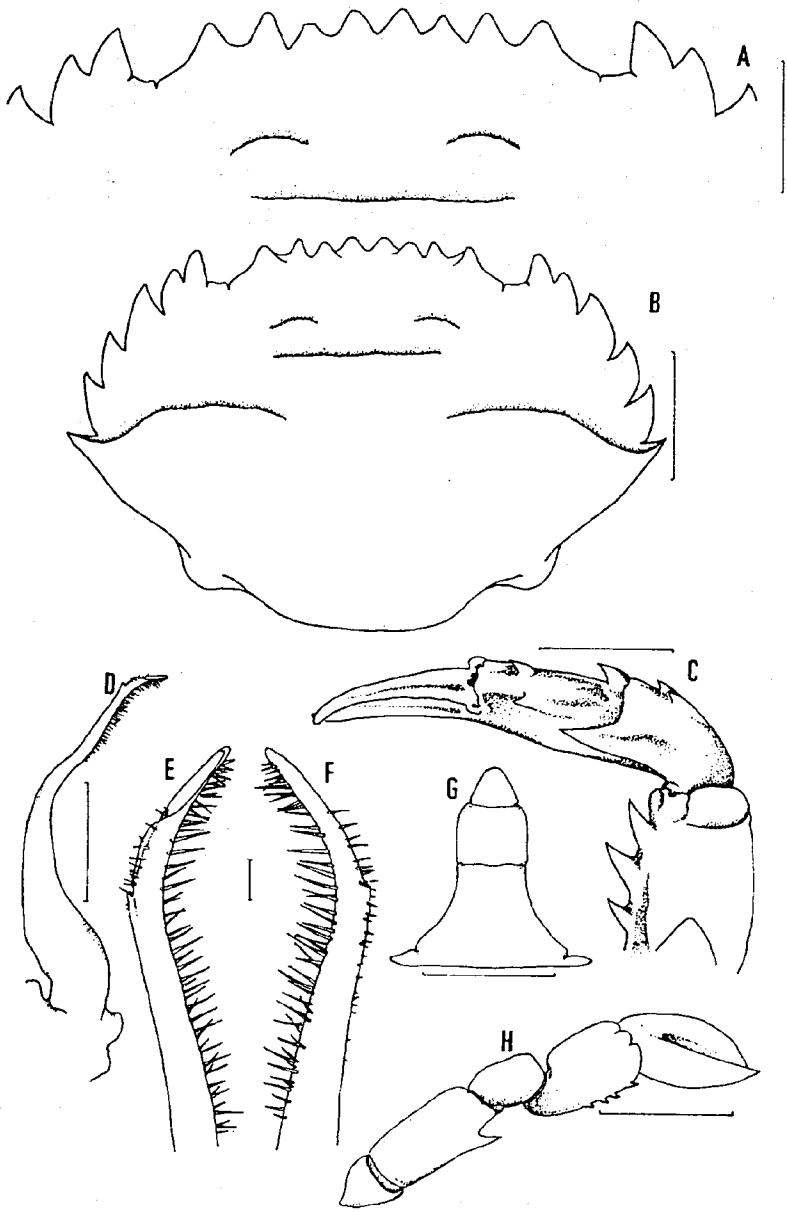


Fig. 6. *Charybdis annulata* (Fabricius, 1798). A - ZRC, Labrador Beach 5/1986, female, 48.0 by 70.0 mm; B-H - ZRC 1965.10.20.13, male, 31.4 by 46.3 mm. A, front dorsal surface; B, carapace dorsal surface; C, right cheliped; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface; G, male abdomen; H, right natatory leg. Scales: A-C, G-H = 10.0 mm, D-F = 1.0 mm.

teeth of the largest female specimen were sharper than that of the other smaller ones in the present specimens, however all were observed to have the lateral frontal teeth set on a lower plane with respect to the medians and submedians. This is a character that is constant and reliable in distinguishing this species.

With regards to the report of *Goniosoma annulata* by Henderson (1893), Leene (1938) showed that it was *C. (C.) callianassa* instead.

Charybdis (Charybdis) brevispinosa Leene, 1937
(Fig. 7A-I)

Charybdis (Charybdis) variegata var. *brevispinosa* Leene, 1937: 170, figs. 2, 4a, b; Leene, 1938: 88, figs. 46,47a, b; Dai et al., 1986: 218, pl. 29(4), fig. 129(2); Dai & Yang, 1991: 238, pl. 29(3), fig. 129(1).

Charybdis (Charybdis) variegata - Shen, 1937: 127, figs. 15a-c; Ow-Yang, 1963: 85, pl. 18, figs. A-F, pl. 19, figs. A-D.

Material examined. - SINGAPORE - 7 males, 3 females (ZRC 1965.7513-7523), Siglap, coll. Jul.1934. — 1 male, 3 females (ZRC 1968.1.27.1), Siglap, coll. M.W.F. Tweedie, 1934. — 2 males, 1 female (ZRC 1985.837-839), Siglap, coll. M.W.F. Tweedie, Jul.1934. — 1 male, 1 female (ZRC 1985.840-841), Siglap; coll. M.W.F. Tweedie, May.1935.

PENINSULAR MALAYSIA - 1 male (ZRC 1985.833), Batu Maung, Penang, coll. S.R.F.R.S., 1955-1956.

Size. - The largest specimen is a male measuring 23.5 by 37.8 mm (ZRC 1985.837).

Diagnosis. - Carapace pilose; all anterior carapace ridges present and granular, two pairs of mesobranchial ridges, cardiac interrupted; six frontal teeth, medians bluntly round, projecting beyond laterally directed submedians, laterals acute and narrowest, separated from submedians by deeper notch; inner supraorbital lobe triangular and ridged, outer infraorbital angle lobed; orbits with strong dorsal inclination; six anterolateral teeth, first slightly notched, last spiniform and directed laterally, projecting beyond preceding tooth. Basal antennal segment bearing sharp granular ridge. Chelipeds finely pubescent, lower surface with squamiform markings; anterior border of merus granular, with three spines, distal widely separated from proximal two; carpus with strong spine on inner angle and two spinules at outer angle; manus with four spines on upper surface, outer surface three granular costae, inner surface with two granular costae; fingers shorter than manus. Propodus of natatory leg with one to two spinules on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders strongly convex. G1 stout, distal half bent, tip bluntly round, inner surface with short bristles, at proximal end of lip, abdominal surface with row of short spines on lip, outer surface with row of bristles starting from tip and terminating a short distance away from from lip.

Colour. - Not known.

Habitat. - *Charybdis (C.) brevispinosa* inhabits on muddy, sandy bottoms of approximately 30 meters in depth (fide Dai et al., 1986; Dai & Yang, 1991).

Distribution. - China (Dai et al., 1986; Dai & Yang, 1991) and Indonesia (Leene, 1938). This species is a new record for Malaysia and Singapore.

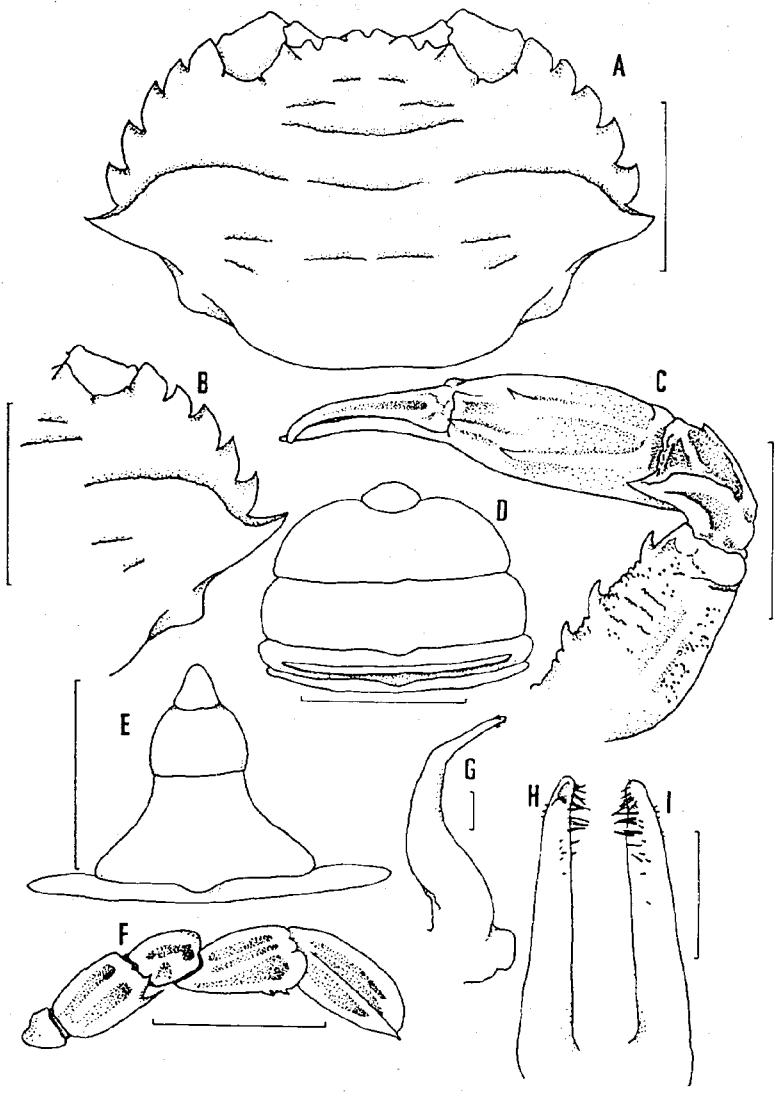


Fig. 7. *Charybdis brevispinosa* Leene, 1937. A, C, E, F, G-I - ZRC 1985.837, male, 20.5 by 32.1 mm; B, D - ZRC 1985.838, male, 18.3 by 31.5 mm. A, carapace dorsal surface; B, right half of carapace dorsal surface; C, right cheliped; D, female abdomen; E, male abdomen; F, right natatory leg; G, left G1 abdominal surface; H, apex of left G1 abdominal surface; I, apex of left G1 sternal surface. Scales: A-F = 10.0 mm, G-I = 1.0 mm.

Remarks. - Stephenson (1972) did not recognise the two new varieties of *Charybdis (Charybdis) variegata* recorded by Leene (1938), but did not provide any explanation for his decision. After examining the specimens at hand and the descriptions provided by Leene (1938), there is sufficient evidence to recognise the two varieties as distinct. In the present collection, the majority were found to conform to the description of *C. (C.) variegata* var. *brevispinosa* Leene, 1937. Leene stated that her species differed from *C. (C.) variegata* in having a relatively stouter and shorter sixth anterolateral tooth, which was "..... only somewhat longer than the preceding teeth" (Leene, 1937: 90). This character however is unreliable, as present specimens show variations in its length. This tooth is relatively longer than the preceding fifth tooth in female and juvenile specimens as compared to the male specimens. The spines on the chelipeds were noted by Leene (1937) to be blunter in var. *brevispinosa* but this character is also not constant due to the varying degrees of wear and tear in the specimens.

On the other hand, two other characters clearly distinguish var. *brevispinosa* from *C. (C.) variegata* sensu stricto. The sub-distal projection near the distal tip of the G1 of *C. (C.) brevispinosa* is not separated as a distinct lobe from the tip. This sub-distal projection is separated and clearly visible from the abdominal surface in *C. (C.) variegata* (fide Leene, 1938: fig. 45). This character is constant for the series of specimens presently examined. The strength of the protruding sub-distal projection is not an artifact resulting from different angles of orientation. From the dorsal view, the frontal teeth of the carapace in this species are bluntly round, less prominent and not protruding beyond the infraorbital lobe. *Charybdis (C.) variegata* has a sharper and triangular frontal median lobes, the frontal border is prominent, protruding as far as the infraorbital lobes. As such, we have chosen to raise *C. (C.) brevispinosa* to the species level based on the two characters mentioned.

Charybdis (C.) variegata var. *salehensis* Leene, 1938, differs from the two species mentioned in having the sixth anterolateral tooth distinctly smaller than the preceding tooth (fide Leene, 1938). The distal tip of the G1 in var. *salehensis* is also more elongate compared to the other two species. It should be regarded as a distinct species, i.e. *Charybdis (Charybdis) salehensis* Leene, 1938.

Charybdis (Charybdis) callianassa (Herbst, 1789)
(Fig. 8A-E)

Cancer callianassa Herbst, 1789: pl. 54, fig. 7.
Goniosoma callianassa - A. Milne Edwards, 1861: 382; Lanchester, 1901: 545.
Charybdis callianassa - Rathbun, 1910: 364; Kemp, 1918: 250.
Charybdis (Goniosoma) callianassa - Alcock, 1899: 57; Chopra, 1935: 489; Shen, 1937: 125, figs. 14a-d; Chhapgar, 1957: 421, pl. 7, figs. a-c.
Charybdis (Charybdis) callianassa - Leene, 1938: 81, fig. 41-43; Stephenson et al., 1957: 493, figs. 1B-D; Ow-Yang, 1963: 62, pl. 13, figs. A-E; Stephenson, 1972: 132; Stephenson, 1975: 177; Stephenson, 1976: 14; Moosa, 1980: 68, fig. 4C; Lovett, 1981: 128, figs. 272a, b; Dai et al., 1986: 219, pl. 29(5), figs. 130(1-3); Dai & Yang, 1991: 239, pl. 29(5), fig. 130.
Goniosoma variegatum - Miers, 1884: 232; Henderson, 1893: 376.
Goniosoma annulatum - Henderson, 1893: 375 (part).

(non *Charybdis callianassa* - De Man, 1925:324, fig. 1)

Material examined. - SINGAPORE - 1 male, 1 female (ZRC 1965.7.5.2-3), Changi, 31 Jan.1926. — 2 females (ZRC 1965.7.5.4-5), Siglap, Jul.1934. — 1 female (ZRC 1984.7875), B77, coll. S.R.F.R.S., 7 Apr.1955. — 1 male (ZRC 1985.798), C5/6, coll. S.R.F.R.S., 24 Nov.1955.

PENINSULAR MALAYSIA - 7 males, 3 females (ZRC), Pontian, Johor, coll. P.K.L. Ng, Feb.1993. — 2 females (ZRC 1965.7.5.10-11), Morib, Selangor, Dec.1934. — 3 males (ZRC 1965.7.5.6-9), Penang Strait, Apr.1935. — 2 females (ZRC 1977.7.25.13-14), Batu Maung, Penang, coll. S.R.F.R.S., 16 Sep.1955. — 2 males, 6 females (ZRC 1985.765-772), Batu Maung, Penang, coll. S.R.F.R.S., 19 Jun.1955. — 3 males, 9 females (ZRC 1985.773-784), Batu Maung, Penang, coll. S.R.F.R.S., 18 Mar.1955. — 2 females (ZRC 1985.785-786), Batu Maung, Penang, coll. S.R.F.R.S., 16 Sep.1955. — 3 males, 7 females (ZRC 1985.787-796), Batu Maung, Penang, coll. S.R.F.R.S., 19 Jul.1955. — 2 males, 5 females (ZRC 1993.378-384), near Kuala Lumpur, coll. S. Lim, Jan.1993. — 1 female (ZRC 1985.797), Off Tanjong Stupa, B77, coll. S.R.F.R.S., 1955-1956.

Size. - The largest specimen is a male measuring 24.9 by 38.3 mm (ZRC 1993.378).

Diagnosis. - Carapace convex, surface shortly pilose; frontal and mesobranchial ridges absent, cardiac ridge faintly granular; six frontal teeth, medians eliptical, projecting beyond laterally directed submedians, laterals narrowest, separated from submedians by deep notch; inner supraorbital lobe triangular; six anterolateral teeth with serrated borders, first tooth notched, second to fifth increasing in size, last spiniform, projecting laterally beyond preceding tooth. Basal antennal segment bearing low granular ridge. Chelipeds swollen and slightly unequal, surface finely pubescent; anterior border of merus with two spines, posterior border finely granular; carpus with strong spine on inner angle and three spinules at outer angle; manus with three spines on upper surface, outer surface three smooth costae, inner surface with median costa, lower surface smooth; fingers slender, slightly longer than manus. Propodus of natatory leg smooth on posterior border. Penultimate segment of male abdomen with lateral borders evenly convex, second to fourth segment keeled. G1 short and stout, distal tip sharply bent outwards, forming right angle to main axis, inner surface bear row of sparse tiny bristles, starting near tip and ends near bend, outer surface with slightly larger bristles, starting at tip and ends sparsely apart along region proximal to bend.

Colour. - Dirty white or light grey throughout.

Habitat. - *C. (C.) callianassa* is found on sandy to muddy and shelly bottoms of 5-11 meters in depth (fide Dai et al., 1986; Dai & Yang, 1991).

Distribution. - India, Karachi, China, Thailand, Malaysia, Singapore and Australia. (fide Dai et al., 1986; Dai & Yang, 1991). This specimen was first recorded from Malaysia and Singapore by Lanchester (1901) and Shen (1937) respectively.

Remarks. - This species is close to *Charybdis (Charybdis) affinis*. It differs from *C. (C.) affinis* in having a cardiac ridge, bears only two spines on the anterior border of the merus, has a keeled fourth abdominal segment and a sharply bent distal portion of the G1.

The specimens referred to *Goniosoma vareigatum* by Miers (1884) were re-examined by Leene (1938) and found to match the present species. Leene also noted that part of Henderson's specimens were misidentified. The *Charybdis callianassa* of De Man (1925) proved to be a different species, *C. (C.) demani* Leene, 1937, differing markedly in the distal tip of the G1 (Leene, 1937).

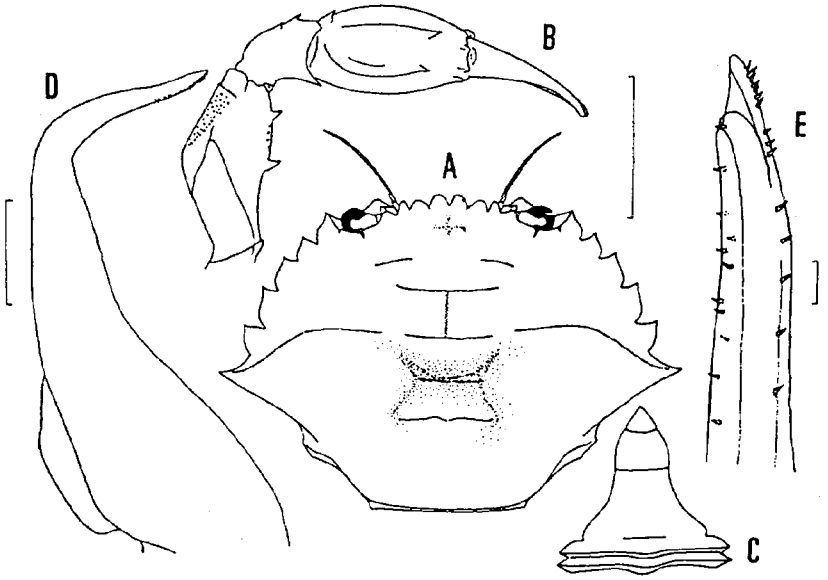


Fig. 8. *Charybdis callianassa* (Herbst, 1789). A-C - ZRC 1985.798, male, 23.4 by 34 mm; D-E - ZRC, Angler Buoy off Changi, male, 22.8 by 31.5 mm (after Ow-Yang, 1963). A, carapace dorsal surface; B, left cheliped; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface. Scales: A-C = 10.0 mm, D = 1.0 mm, E = 0.1 mm.

Charybdis (Charybdis) feriatus (Linnaeus, 1758)
(Fig. 9A-F)

Cancer feriatus Linnaeus, 1758: 627.
Cancer sexdentata Herbst, 1783: 153 (part), pl. 8, fig. 53.
Cancer cruciata Herbst, 1789: pl. 38, fig. 1.
Portunus crucifer - Fabricius, 1798: 364.
Goniosoma cruciferum - A. Milne Edwards, 1861: 371; De Man, 1887: 334; De Man, 1888: 79, pl. 5, fig. 1; De Man, 1895: 559; Lanchester, 1901: 545.
Goniosoma crucifera - Walker, 1887: 110.
Charybdis crucifera - Dana, 1852: 286, pl. 17, figs. 11a-c; Stimpson, 1858: 39; Stimpson, 1907: 80; Rathbun, 1907: 80; Kemp, 1918: 250; Balss, 1922: 104.
Charybdis (Goniosoma) crucifera - Alcock, 1899: 51; Gordon, 1931: 357, fig. 13e.
Charybdis cruciatus - Stebbing, 1902: 9.
Charybdis (Goniosoma) cruciatus - Chopra, 1935: 482, fig. 7.
Charybdis cruciata - Rathbun, 1910: 363; McNeill, 1929: 149, pl. 37, fig. 5; Shen, 1932: 38, fig. 6, pl. 8; Sakai, 1939: 403, pl. 82, fig. 3; Sakai, 1965: 123, pl. 62, fig. 1; Barnard, 1950: 166, fig. 32a; Takeda & Miyake, 1969: 451.
Charybdis (Goniosoma) cruciata - Delsman & De Man, 1925: 311; Shen, 1937: 117; Chhapgar, 1957: 419, pl. 5.
Charybdis (Charybdis) cruciata - Leene, 1938: 24, figs. 1, 2; Leene, 1940: 180; Stephensen, 1945: 114, fig. 24a; Stephenson et al., 1957: 495, figs 2E,3F, pl. 1, fig. 3, pl. 4B; Crosnier, 1962: 75, figs. 130-132; Ow-Yang, 1963: 66, pl. 14, figs. A-F.
Charybdis feriatus - Holthuis, 1962: 234; Campbell & Stephenson, 1970: 273; Lovett, 1981: 128, figs. 281a-b.
Charybdis (Charybdis) feriatus - Stephenson & Rees, 1967: 10; Stephenson, 1967:10; Stephenson, 1972: 132; Stephenson, 1975: 177; Sakai,1976: 357, pl. 122; Dai et al., 1986: 212, pl. 28(4), fig. 125(1); Dai & Yang, 1991: 232, pl. 28(4), fig. 125(1).

Material examined. - SINGAPORE - 3 males, 4 females (ZRC 1965.10.20.14-20), Siglap, Jun,Jul,Oct,Dec.1933. — 1 male (ZRC 1985.800), Bedok, coll. Chea, 27 Feb.1952. — 1 male (ZRC 1965.10.20.21), Singapore, 1939. — 1 male (ZRC 1965.10.20.22), Changi, Jun.1934. — 1 male (ZRC 1985.1607), East Coast, Singapore, coll. P.K.L. Ng, Jun.1981. — 1 male (ZRC 1985.804), Angler Buoy off Changi; coll. S.R.F.R.S., 2 Nov.1956. — 2 females (ZRC 1981.8.14.7-8), Tuas, coll. H.K. Voris, 26 Jan.1981. — 1 female (ZRC 1981.8.14.125), Tuas, coll. C.M. Yang, 1 Apr.1981. — 1 male (ZRC 1984.5614), Tuas, coll. W.M. Lee, 20 May.1982. — 4 females (ZRC 1984.246-249), Horsburgh Lighthouse; coll. H. Huat, 19 Aug.1983. — 5 males, 10 females (ZRC 1984.250-264), Horsburgh Lighthouse; coll. H. Huat, 26 Nov.1982, 15 Dec.1982. — 1 female (ZRC 1985.801), Raffles Lighthouse, coll. D.S. Johnson, 6 Mar.1955. — 4 males, 1 female (ZRC 1984.5375-5379), South China Sea, 150 miles off Singapore, coll. H. Huat, 28 Aug.1983. — 1 male (ZRC), Singapore or Malaysia. — 1 male, 1 female (ZRC), Singapore or Malaysia. — 1 male (ZRC), Singapore or Malaysia. — 1 female (ZRC), Singapore or Malaysia.

PENINSULAR MALAYSIA - 1 female (ZRC 1973.11.20.10), Johor Straits, 11 Sep.1967. — 1 male (ZRC 1985.803), East of Johor Çl/13, coll. S.R.F.R.S., 18 Sep.1955. — 1 male (ZRC), Johor Straits, KE10, 28 Mar.1967. 11 males, 9 females (ZRC), Pontian, Johor, coll. P.K.L. Ng, Feb.1993. —1 male, 5 females (ZRC), Pontian, Johor, coll. D. Wee, 13 Jul.1993. — 1 female (ZRC 1985.805), near Pulau Tioman, Pahang, coll. S.R.F.R.S., 13 Jan.1955. — 1 male (ZRC 1985.799), west coast of Penang, coll. D.S. Johnson, 1 Oct.1952. — 2 males, 3 females (ZRC 1992.10503-10509), Andaman Sea, between Penang and Langkawi, coll. C.P. How & C.O. Lau, 12 Nov.1991. —1 male (ZRC 1985.802), Off Tanjong Stapa B79, coll. S.R.F.R.S., 1955-1956.

Size. - The largest specimen is a male measuring 78.2 by 115.9 mm (ZRC 1985.805).

Diagnosis. - Carapace convex and smooth; protogastric, mesogastric, metagastric and epibranchial ridges faintly granular; six frontal teeth, medians slightly projecting beyond submedians, both subequal and blunt; laterals triangular, separated from submedians by deeper notch; inner supraorbital lobe acutely triangular; six anterolateral teeth, first truncate and strongly notched, second to fifth increasing in size broadly, last spiniform and directed laterally. Basal antennal segment bearing low granular ridge. Chelipeds smooth and unequal; anterior border of merus with three strong spines; carpus with strong spine on inner angle and three spinules at outer angle; manus with four spines on upper surface, outer surface two smooth costae, inner surface with median costa, lower surface smooth; fingers slender as long as manus. Propodus of natatory leg smooth on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen broader than long with lateral borders evenly convex, fourth segment keeled. G1 distal portion slender and elongate, sternal surface with short bristles, starting at lip region and ending midway down G1, abdominal surface with two rows of bristles on lip, outer surface bears a row of longer bristles, starting from tip and terminating at distal third of G1.

Colour. - Carapace cream coloured, mottled with red patches. Ventral surface pale yellow or whitish. Chelipeds and ambulatory legs mottled red. This species usually has a characteristic yellowish cross on the gastric region of the carapace.

Habitat. - It inhabits on sandy to muddy subtratum at depths of 10-30 meters. Young specimens have been collected from and observed on the bell of large Scyphozoa (jellyfish) in Singapore waters.

Distribution. - East Africa, Madagascar, India, China, Hong Kong, Taiwan, Japan, Philippines, Thailand, Malay Peninsular, Singapore and Australia (fide Rathbun, 1910; Shen, 1932; Stephenson, 1972; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded in Malaysia by Lanchester (1901) and from Singapore by Dana (1852).

Remarks. - The type species of the genus *Charybdis* De Haan, 1833, is *Cancer sexdentata* Herbst, 1783, which is now considered to be a junior synonym of *Cancer feriatus* Linnaeus, 1758. *Cancer sexdentata* is a composite species (Holthuis, 1962) and its original identity is now untraceable. Holthuis (1962) selected a lectotype, using the specimen figured by Rumphius (1705: pl 6, fig P), which was referred to by Herbst in his description of *Cancer sexdentata*. This specimen was however first described by Linnaeus as *Cancer feriatus*. *Cancer sexdentata* Herbst, 1783, thus becomes an objective junior synonym of *Cancer feriatus* Linnaeus, 1758.

The juveniles of this species have been noted by many workers to differ from the adult in several features. The frontal lobes project markedly beyond the inner supraorbital angles and the basal antennal segment have been found not to touch the front in the juveniles (Leene, 1938; Stephenson & Rees, 1967). It must be noted however, that this species can grow up to very large sizes. A specimen measuring 110 by 181 mm was recorded from Karachi, Pakistan (Ali, 1992).

Fishery note. - This is the only species of *Charybdis* in local waters which has any commercial value. It is however, not common enough in Malaysian waters to be harvested to any degree. The species is gaining popularity in recent years, and most local stocks are

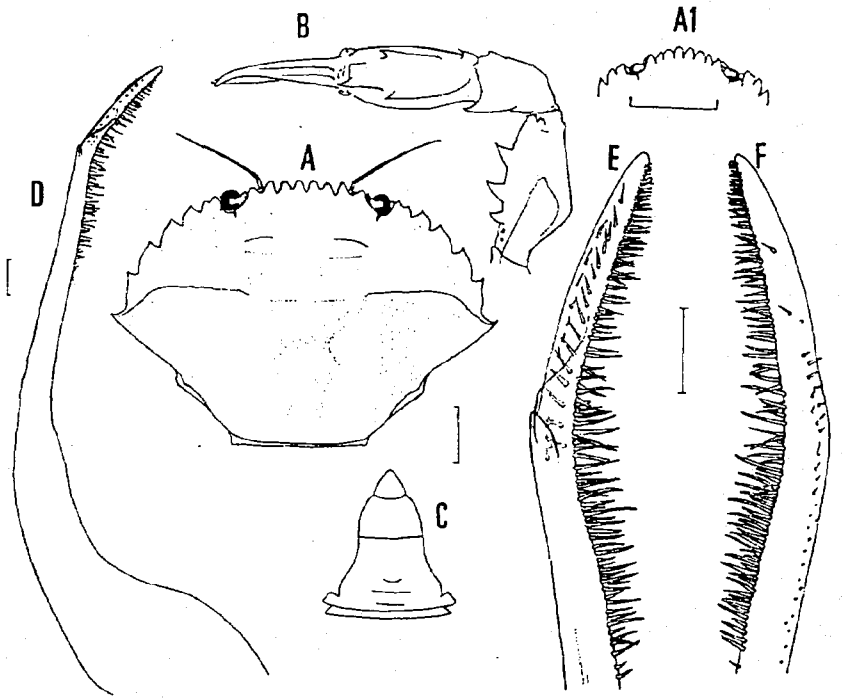


Fig. 9. *Charybdis feriatus* (Linnaeus, 1758). A-F - ZRC 1985.803, male, 63.7 by 97.0 mm; A1 - ZRC 1985.802, male (juvenile), 17.0 by 24.5 mm (after Ow-Yang, 1963). A, carapace dorsal surface; A1, front dorsal surface; B, right cheliped; C, male abdomen; D, left G1 abdominal surface; E, apex of right G1 abdominal surface; F, apex of right G1 sternal surface. Scales: A, A1-C = 10.0 mm, D-F = 1.0 mm.

imported. In Hong Kong and more northern waters, *C. feriatus* is an important commercial species.

Charybdis (Charybdis) granulata (De Haan, 1833)
(Figs. 10A-C, 11A-C, 12A-D, 13A-G)

Portunus (Charybdis) granulatus De Haan, 1833:42, pl. 1, fig. 1a.
Charybdis granulatus - Stimpson, 1858:39; 1907:82.
Charybdis (Charybdis) granulata - Sakai, 1976: 360, figs. 194a-c, pl. 127, fig. 2; Miyake, 1983: 89, pl. 30(3).
Charybdis natator - Barnard, 1950: 169.
Charybdi (Charybdis) natator - Ow-Yang, 1963:80(part), pl. 17, fig. E1.
Charybdis beauforti Leene & Buitendijk, 1949: 293, figs. 2, 4b (fide Crosnier, 1984: 406).

Material examined. - SINGAPORE - 2 males, 1 female (ZRC 1973.10.30.32-34), Siglap, Jul.1934. — 1 female (ZRC 1977.7.25.15), Siglap, coll. M.W.F. Tweedie, Jul.1934.

Size. - The largest specimen is a male measuring 45.7 by 67.0 mm (ZRC 1973.10.30.32).

Description. - Carapace surface convex, covered unevenly with dense pile. Ratio of carapace breadth to length approximately 1.45 times. Frontal ridges short and granular. Protogastric and mesogastric ridges with markedly granular outlines. The latter straight and uninterrupted. Epibranchial ridges curving anteriorly from the last anterolateral teeth and separated by unbroken metagastric ridge. Presence of three pairs of short mesobranchial ridges, the median pair longest. Cardiac ridge sinuous and may be interrupted in the middle.

Front cut into six narrow lobes. Medians slightly protruding, separated by a V-shaped notch and lying on a lower plane. Submedians of equal size, bluntly pointed, directed anterolaterally and set on a much higher plane than the other frontals. Lateral lobes narrowest, sharp and separated from submedians by a deeper notch. Orbit with a strong dorsal inclination, borders finely granular. Supraorbital border divided into three lobes by two incisions. The inner supraorbital lobe is bluntly triangular, distinctly broader than lateral frontal teeth. Infra orbital border with a lateral incision, inner infraorbital angle not prominent and dentiform.

Six anterolateral teeth, first to fifth tooth stout, increasing in size from front to rear. The outer borders of each tooth convex and forms an acute tip with the anterior border. The sixth tooth smallest and narrowest, not more prominent than preceding teeth.

Basal antennal segment short, excluding flagellum from orbit and bearing a low granular ridge. Third maxillipeds covered with tomentum on surface, outer distal angle of merus slightly produced sideways.

Chelipeds unequal, strongly granular and pubescent. Anterior border of merus bears three sharp spines and several spiniform tubercles, in between spines and near proximal end of border. Posterior border with vertical granulated rows. Carpus bears a granulated costae ending in a strong stout spine at the inner angle, three spines on the outer surface of which the upper and lower most bears each a granular costa running backwards. Upper surface with dispersed granules arising from amongst pubescence. Outer surface of the manus bears an indistinct upper and distinct two lower costae, all bordered by rounded tubercles. Upper surface bears four spines, an additional spinule found at the distal end of the outer edge. Inner surface bears a granulated median costa. Lower surface with transverse squamiform markings,

occasionally with scattered granules. Remainder of surfaces covered with bold rounded granules arising from amongst fine hair. Fingers slender and deeply grooved, movable finger two upper most costae granulated at proximal end.

Ambulatory and natatory legs with shallow grooves bearing fine hairs on the surface. Posterior border of the natatory leg with the usual spine on the merus and with serrations on the propodus.

Surface of abdomen and sternum pubescent and finely granular on the anterior segments of the latter. Penultimate segment of the male abdomen with lateral borders convex distally giving it a swollen appearance. Ultimate segment triangular, slightly longer than broad. Second to fourth segment keeled.

G1 thin and elongate for distal half, terminating in a short stout lip. Inner edge of sternal surface with a row of widely spaced bristles which start at proximal end of lip and terminating a short distance below. Abdominal surface of lip bears two rows of stout bristles near the proximal end. Outer surface with row of elongate bristles starting at distal end of tip and continues downwards toward distal third of the G1 as sparsely arranged bristles, occasionally interspersed with shorter ones.

Colour. - Carapace mosaic green, mottled reddish or crimson fingers of cheliped. Maroon red basally, blackish apically, denticles on finger mostly blackish (Barnard, 1950).

Habitat. - This species show a similar habitat to *C. (C.) natator*, inhabiting bottoms of rock or sand at depths of 15-35 meters (fide Sakai, 1976).

Distribution. - East Africa (Barnard, 1950), Hong Kong (Stimpson, 1858), Japan (De Haan, 1833) and now Singapore. It is a new record for the Malay Peninsula.

Remarks. - This species is regarded by many as synonymous with *Charybdis (Charybdis) natator*. They are similar in many aspects but differ in the following aspects. The dorsal surface of the carapace of *C. (C.) granulata* is covered with uneven and coarser tomentum, the penultimate segment of the male abdomen has convex and somewhat rounded lateral borders near the distal end, whilst that of *C. (C.) natator* is parallel for the greater part of its length. Aside from these characters mentioned, Sakai (1976) further noted that the lower surface of the manus of *C. granulata* is without a longitudinal sulcus.

Three specimens identified previously as *C. (C.) natator* by Ow-Yang (1963) were re-examined and found to be *C. (C.) granulata* instead. In addition to Sakai's characters, the submedian frontal lobes in *C. (C.) granulata* are also elevated on a much higher plane, the first anterolateral tooth is not truncate or straight in its anterior border but convex and curved, the absence of a lateral keel across the fifth abdominal segment in both sexes, and it has a pair of frontal carapace ridges. The G1 in *C. (C.) granulata* appears shorter and more rounded off at the tip and the outer row of bristles start at the very tip itself, instead of some distance away from tip as in *C. (C.) natator*.

According to Barnard (1950), his *C. natator* from East Africa has the above features which agree well with *C. (C.) granulata* rather than *C. (C.) natator* (see Sakai, 1976). Crosnier (1984) illustrated the carapace of *C. beauforti* and synonymized it under *C. (C.) granulata*. He further noted that *Portunus (Charybdis) granulata* Krauss, 1843, and *C. moretonensis* Rees & Stephenson, 1966, may be possible synonyms.

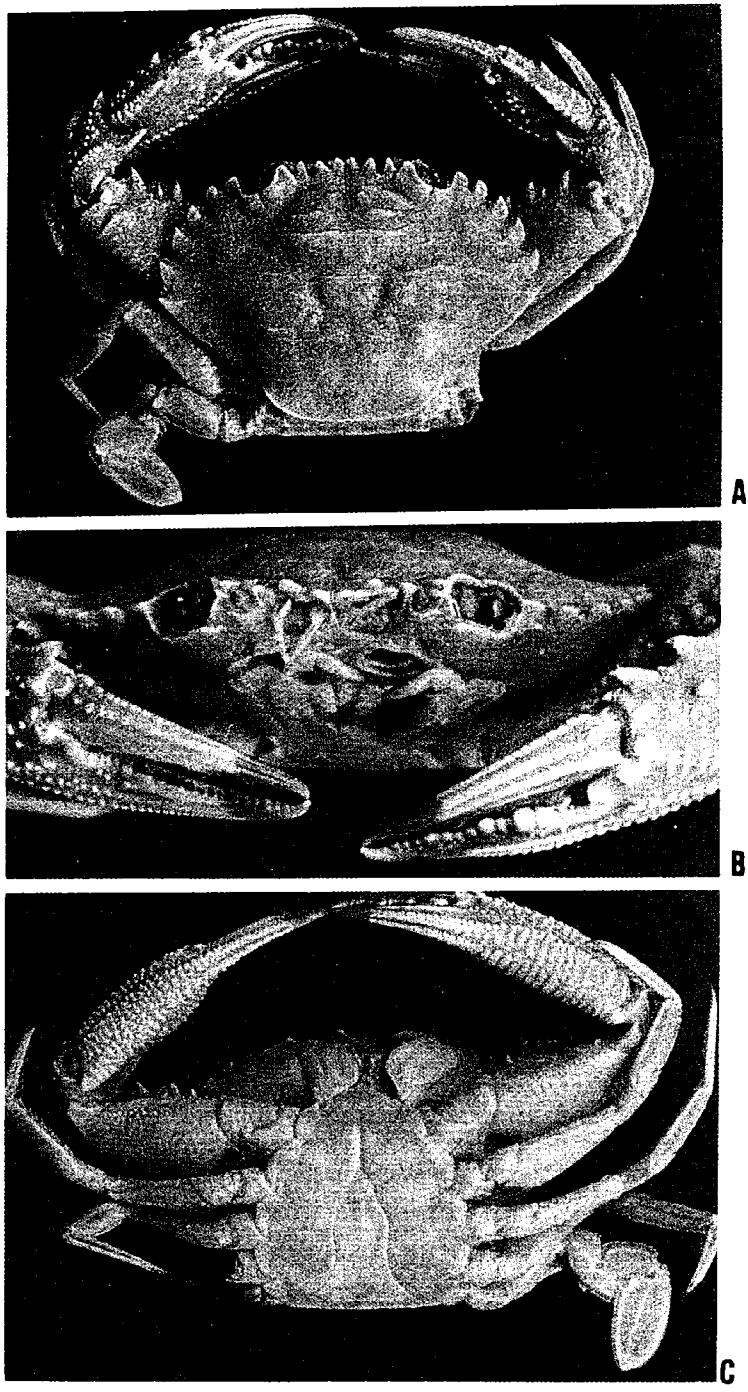


Fig. 10. *Charybdis granulata* (De Haan, 1833). ZRC 1973.10.30.32, male, 45.7 by 67.0 mm. A, dorsal view; B, frontal view; C, ventral view.

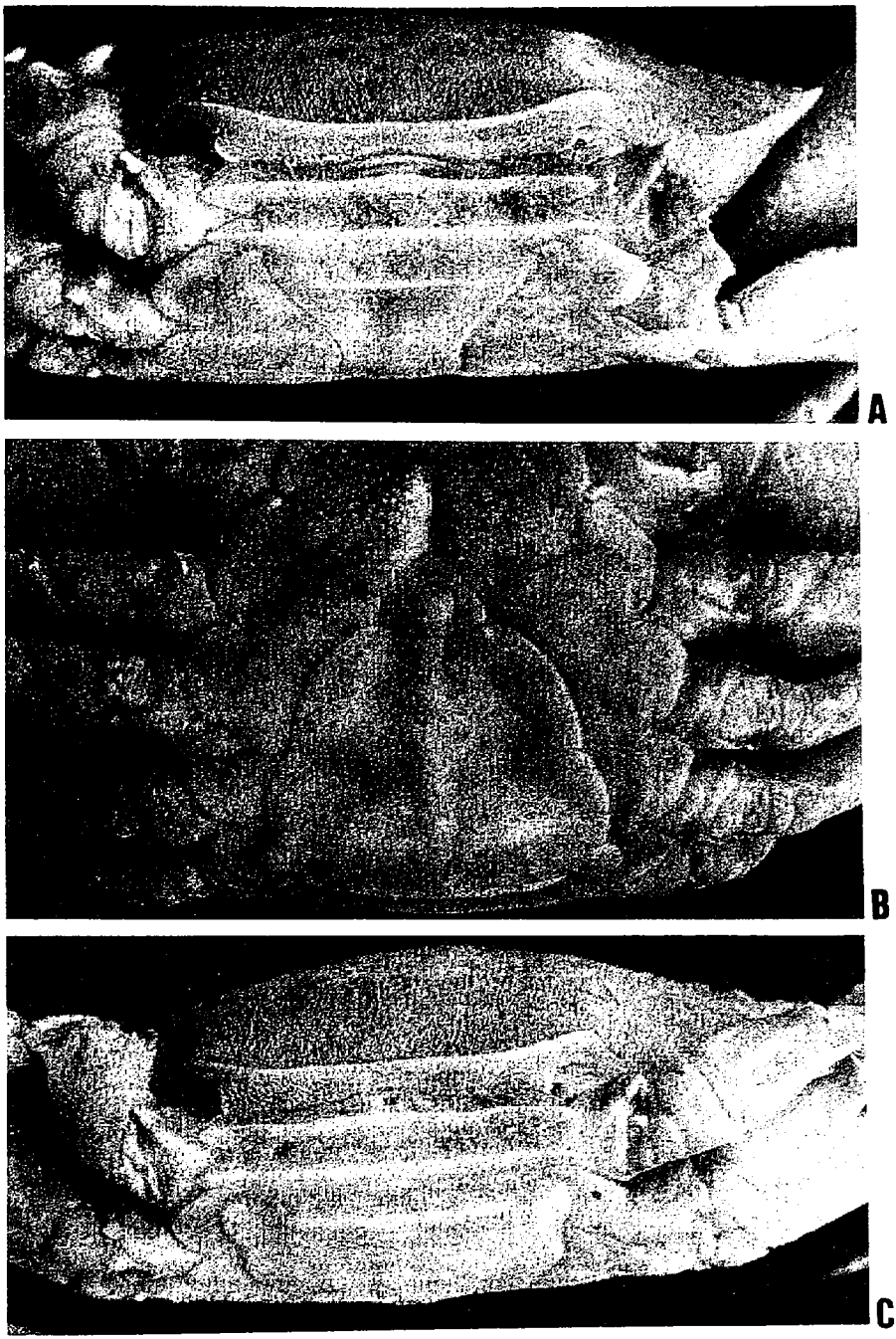


Fig. 11. *Charybdis granulata* (De Haan, 1833). A, ZRC 1973.10.30.32, male, 45.7 by 67.0 mm, posterior view; B, ZRC 1973.10.30.33, female, 43.2 by 63.2 mm, ventral view; C, ZRC 1973.10.30.33, female, 43.2 by 63.2 mm, posterior view.

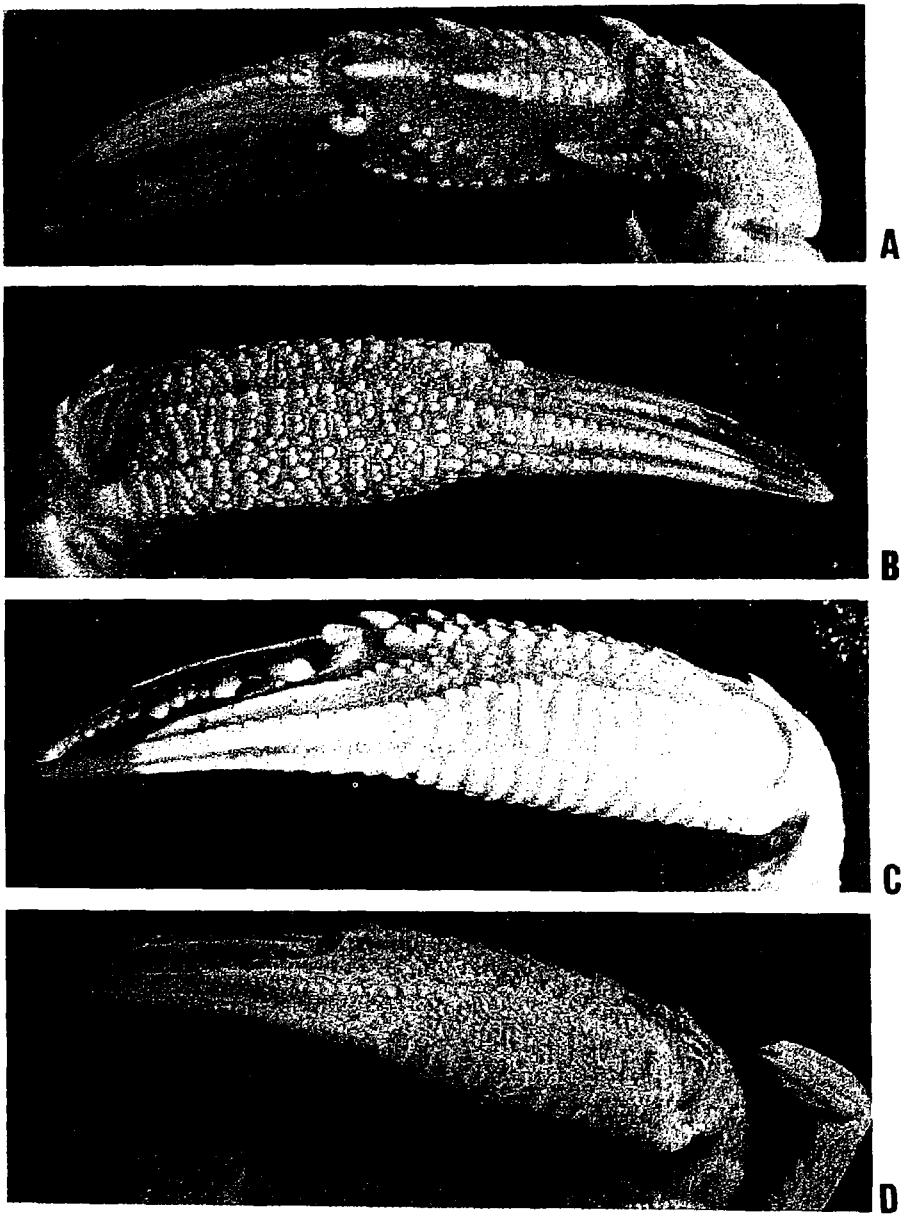


Fig. 12. *Charybdis granulata* (De Haan, 1833). A-C, ZRC 1973.10.30.32, male, 45.7 by 67.0 mm; D, ZRC 1973.10.30.33, female, 43.2 by 63.2 mm. A, upper surface of right cheliped manus; B, lower surface of right cheliped manus; C, lower surface of left cheliped manus; D, lower surface of left cheliped manus.

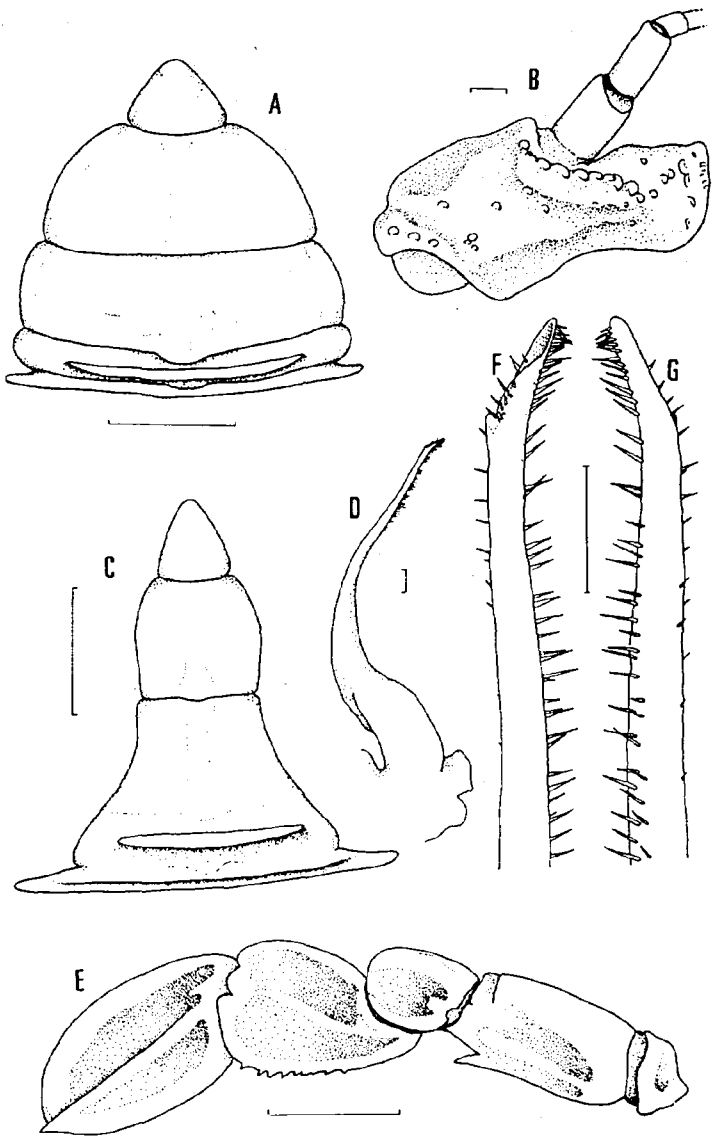


Fig. 13. *Charybdis granulata* (De Haan, 1833). A - ZRC 1973.10.30.33, female, 43.2 by 63.2 mm; B-G - ZRC 1973.10.30.32, male, 45.7 by 67.0 mm. A, female abdomen; B, left basal antennal segment; C, male abdomen; D, left G1, abdominal surface; E, left natatory leg; F, apex of left G1 abdominal surface; G, apex of left G1 sternal surface. Scales: A-B, D, F-G = 1.0 mm, C, E = 10.0 mm.

Charybdis (Charybdis) hellerii (A. Milne Edwards, 1867)
(Fig. 14A-G)

Goniosoma hellerii A. Milne Edwards, 1867: 282; A. Milne Edwards, 1873: 167; Henderson, 1893: 375.
Charybdis hellerii - Edmondson, 1954: 247, figs. 32a-f.
Charybdis (Charybdis) hellerii - Leene, 1938: 44, figs. 15, 16a-d, 17a-c; 1940: 182; Stephensen, 1945:117; Buitendijk, 1947: 281; Stephenson et al., 1957: 497, figs. 1A, 2I, 3J, pl. 1, fig. 4, pls. 4C,5B; Crosnier, 1962: 77, figs. 133-135, pl. V, fig. 1; Ow-Yang, 1963: 70, pl. 15, figs. A-F; Stephenson, 1972: 132; Stephenson, 1975: 177; Stephenson, 1976: 14; Lovett, 1981: 127, figs. 278a-c; Dai et al., 1986: 213, pl. 28(6), fig. 126(1); Dai & Yang, 1991: 233, pl. 28(6), fig. 126(1).
Goniosoma merguiense De Man, 1888: 82, pl. 5, fig. 3,4; De Man, 1895: 560.
Charybdis merguiensis - Sakai, 1934: 303; Barnard, 1950: 168, figs. 27d, 32b; Guinot, 1962: 6.
Charybdis (Goniosoma) merguiense - Alcock, 1899: 55; Nobili, 1906: 196; Chopra, 1935: 484, fig. 8; Leene, 1937: 165; Shen, 1937: 121, fig. 12.
? *Charybdis vannamei* Ward, 1941: 4, figs. 5, 6.

Material examined. - SINGAPORE - 6 males, 6 females (ZRC 1965.10.20.23-32), Siglap, Jun.1932, Jun-Jul.1933, Jun-Jul.1934. — 1 male, 1 female (ZRC 1984.5660-5661), East Coast, coll. K.L. Yeo, 15 Oct.1982. — 4 males, 1 female (ZRC 1993.127-131), Changi point, coll. T.M. Sin, 20 Nov.1992. — 3 males, 1 female (ZRC 1965.10.20.33-36), Pulau Sakudok, Changi, Jun.1934. —1 female (ZRC), Labrador Beach, coll. P. Ng, 10 Jan.1992. — 2 males (ZRC 1985.810-811), kelong off Ponggol. — 2 males (ZRC 1981.9.2.5-6), Tuas, coll. H.K. Voris, 9 Mar.1981. — 5 males (ZRC), Tuas, 8 Apr.1982. — 2 males (ZRC 1981.8.14.123-124), Tuas, coll. C.M. Yang, 1 Apr.1981. — 32 males, 4 females (ZRC 1981.8.14.65-100), Tuas, coll. H.K. Voris, 9 Mar.1981. — 2 males (ZRC 1981.8.14.115-116), Tuas, coll. K.L. Yeo, Mar.1981. — 4 males, 4 females (ZRC 1981.7.24.54-61), Tuas, coll. H.K. Voris, 26 Feb.1981. — 4 males (ZRC 1981.9.2.55-58), Tuas, coll. K.L. Yeo, 2 May.1981. — 7 males (ZRC 1984.288-294), Tuas, coll. W.M. Lee, 4 Jul.1983, 1-2 Aug.1983. — 6 males, 4 females (ZRC 1984.274-263), Tuas, coll. W.M. Lee, 6 Nov.1982. — 6 males, 1 female (ZRC 1984.267-273), Tuas, coll. W.M. Lee, 16 Oct.1982. — 4 males, 1 female (ZRC 1984.5764-5768), Tuas, coll. W.M. Lee, 8 Sep.1982. — 3 males (ZRC 1984.284-286), Tuas, coll. W.M. Lee, 20 Nov.1982. — 3 males, 1 female (ZRC 1984. 5855-5858), Tuas, coll. W.M. Lee, 9 Oct.1982. — 3 males (ZRC 1984.5657-5659), Tuas, coll. W.M. Lee, 18 Sep.1982. — 13 males, 1 female (ZRC 1984.5772-5785), Tuas, coll. W.M. Lee, 1 Oct.1982. — 3 males (ZRC 1984.5769-5771), Tuas, coll. W.M. Lee, 25 Sep.1982. — 1 male (ZRC 1993.125), Pulau Semakau, coll. P.K.L. Ng, Oct.1992. — 1 male (ZRC 1965.10.20.37), Singapore fishmarket, 1927. — 1 male, 1 female (ZRC 1984.5380-5381), South China Sea, 150 miles of Singapore, coll. Huat, 28 Aug.1983.

PENINSULAR MALAYSIA - 3 males (ZRC 1993.7248-7250), Pontian, Johor, coll. D. Wee, 13 Jul.1993. — 3 males, 3 females (ZRC 1993.7305-7310), Pontian, Johor, coll. D. Wee, 13 Jul.1993. — 2 males (ZRC), Kukup, S.W. Johor, coll. S.K. Ng, 5 Apr.1982.

Size. - The largest specimen is a male measuring 51.1 by 79.8 mm (ZRC 1993.7248).

Diagnosis. - Carapace densely pilose; all anterior carapace ridges present and granular, none behind epibranchials; six frontal teeth, medians eliptical, on lower plane, projecting beyond submedians, laterals acutely triangular, separated from submedians by deep V-shaped notch; inner supraorbital lobe broadly triangular, outer infraorbital lobe with convex border; six anterolateral teeth, first and second closer and subequal in size, last elongate and spiniform, projecting beyond preceding tooth. Basal antennal segment bearing sharp granular ridge. Chelipeds stout and unequal, surface finely pubescent; anterior border of merus with three spines and a spinule at distal end; carpus with strong spine on inner angle and three spinules at outer angle; manus with five spines on upper surface, outer surface three smooth costae, inner surface with median costa, lower surface smooth; fingers stout, deeply grooved. Propodus of natatory leg serrated on posterior border; merus and carpus with spine on posterior border. Penultimate segment of male abdomen with lateral borders parallel then converging distally.

G1 distal tip slender and elongate, inner surface with short bristles, ending as tiny spinules at base of G1, outer surface with longer bristles starting from tip and ending at distal third of it.

Colour. - This species show colour changes associated with growth. Larger specimens have a orange to cream coloured carapace and purplish legs. Smaller specimens have reddish patches on either side of median line anteriorly and on entire posterior surface of carapace. Chelipeds and legs mottled and banded, fingers red basally, dark brown distally with white tips.

Habitat. - This species is found at intertidal zones, under rocks and stones, among coral reefs and up to depths beyond 30 meters.

Distribution. - Mediterranean, East Africa, Red Sea, Persian Gulf, Pakistan, India, Andaman, China, Japan, Malaysia, Singapore, Australia and New Caledonia (fide Alcock, 1899; Sakai, 1934; Stephenson et al., 1957; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded in Malaysia and Singapore by Buitendijk (1947) and Alcock (1899) respectively.

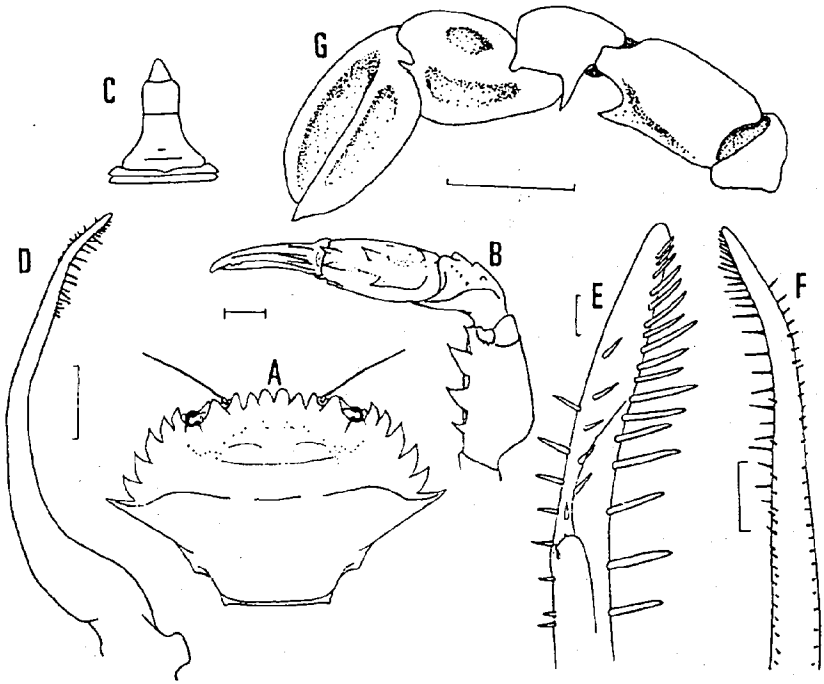


Fig. 14. *Charybdis hellerii* (A. Milne Edwards, 1867). A-C - ZRC, male, 43.0 by 67.0 mm; D-F - ZRC, male (after Ow-Yang, 1963). G - ZRC 1985.810; male, 45.0 by 68.3 mm. A, carapace dorsal surface; B, right cheliped; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface; G, right natatory leg, ventral surface. Scales: A-C, G = 10.0 mm, D = 1.0 mm, E = 0.1 mm, F = 0.5 mm.

Remarks. - Many of the specimens were found to be smooth due to the worn down surface hairs. *Charybdis vannamei* Ward, 1941, from the Philippines possesses the spine on the carpus of the natatory leg which is a characteristic feature of *C. (C.) hellerii.* Ward (1941) however did not compare his specimen with *C. (C.) hellerii.* His specimens should be re-examined to see if it similar or even conspecific to this species (Stephenson, 1972).

Charybdis (Charybdis) japonica (A. Milne Edwards, 1861)
(Fig. 15A-E)

Portunus (Charybdis) -6-dentatus De Haan, 1850: 41,pl. 12, fig. 1 (nomen preoccupum by *Cancer sexdentata* Herbst, 1783).
Goniosoma japonicum A. Milne Edwards, 1861: 373.
Charybdis japonica - Rathbun, 1902: 27; Rathbun, 1906: 872, pl. 13, fig. 2; Sakai, 1939: 400, pl. 45, fig. 5; Sakai, 1965: 121, pl. 50, fig. 1.
Charybdis (Goniosoma) japonica - Shen, 1932: 72, figs. 41-43; Leene, 1937: 168.
Charybdis (Charybdis) japonica - Leene, 1938: 30, figs. 5-7; Edmondson, 1954: 246, figs. 21b, 22d; Stephenson & Rees, 1967: 11; Stephenson, 1972: 132; Sakai, 1976: 355, pl. 123; Miyake, 1983: 83, pl. 29(3); Dai et al., 1986: 208, pl. 27(7), fig. 122(1); Dai & Yang, 1991: 227, pl. 27(7), fig. 122(1).
Charybdis sexdentata - Stimpson, 1858: 39; Stimpson, 1907: 81.
Charybdis sowerbyi Rathbun, 1929: 75, pl. 5.
Charybdis (Gonioneptunus) peichihliensis Shen, 1932: 78, figs. 44, 45; 1935: 404.

Material examined. - None.

Size. - Female type specimen of De Haan from Japan measures 55.8 by 80.0 mm (Leene, 1938).

Diagnosis. - Carapace pilose; marked by finely granular protogastrics, mesogastric, epibranchial and metagastric ridges; six frontal teeth, triangular and sharp, medians directed outwards projecting beyond narrower submedians, laterals acute and narrowest; inner supraorbital lobe broadly triangular; six anterolateral teeth, directed forwards and sharp, first with slightly sinuous outer border, second to fifth subequal, last narrowest and spiniform. Merus of third maxillipeds with outer distal angle more or less produced. Basal antennal segment bearing low granular ridge. Chelipeds pilose; anterior border of merus with three spines; carpus with strong spine on inner angle and three spinules at outer angle; manus seven costae and five spines on upper surface; fingers longer than manus. Propodus of natatory leg smooth on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen broader than long with lateral borders evenly convex. G1 distal tip curved gradually, inner surface with row of bristles near proximal end of lip, abdominal surface with smaller bristles on the lip, outer surface with row of closely set bristles beginning at tip and ending at distal third of G1 (adapted from Leene, 1938).

Colour. - Dorsal surface mottled cream and purple (Miyake, 1983).

Habitat. - It is found within the littorial zone and up to 10-15 meters in depth (Sakai, 1976).

Distribution. - Red Sea, China, Taiwan, Japan, Thailand and Malaysia (fide Rathbun, 1902; Dai et al., 1986; Dai & Yang, 1991). This species was recorded from Malaysia by Shen (1932) and Stephenson (1972).

Remarks. - Leene (1938) noted that *Charybdis sowerbyi* Rathbun, 1929, from Fukien is similar to *C. (C.) japonica*. From the literature available, there appears to be no specific differences between these two species as suggested by Leene (1938). Shen (1935) noted that *C.(G.) peichihliensis* Shen, 1932, measuring only 9.0 by 13.7 mm, is a juvenile of *C.(C.) japonica*.

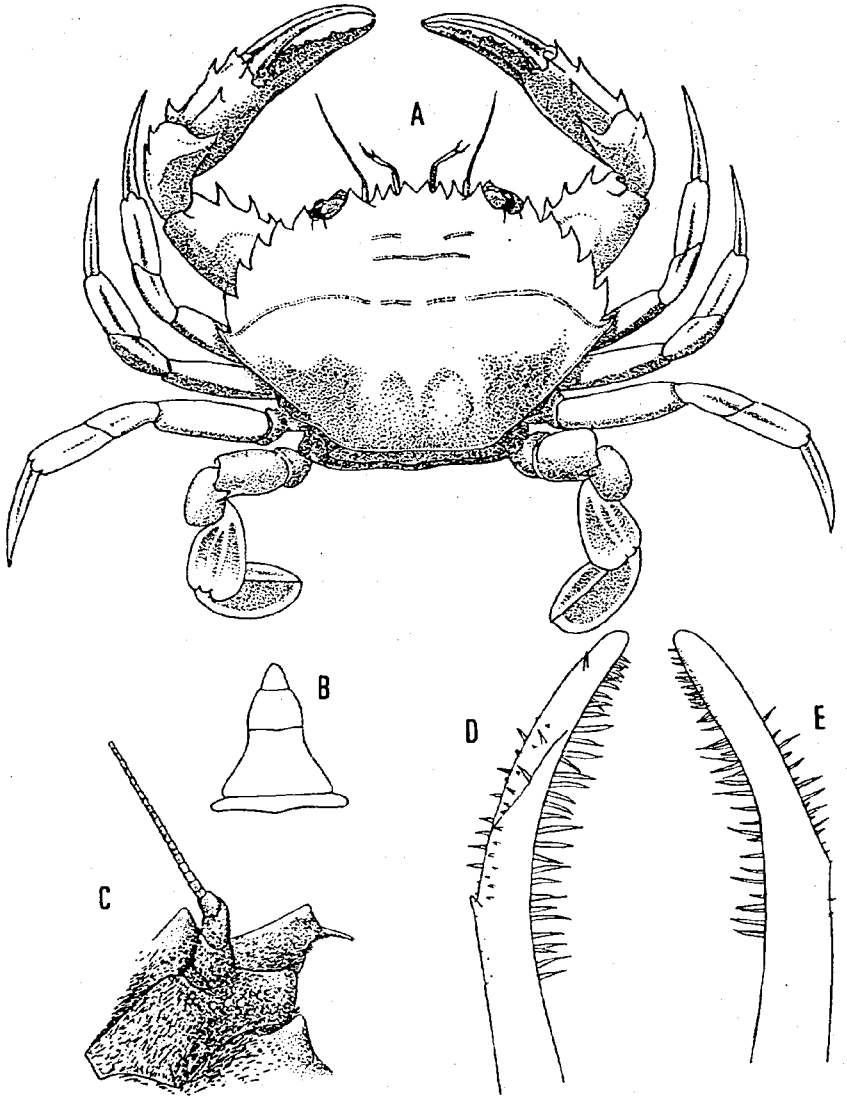


Fig. 15. *Charybdis japonica* (A. Milne Edwards, 1861). A - Japan, female, 55.8 by 80.0 mm; B, D-E - Japan, male, 54.8 by 79 mm; C - type specimen of *C. sowerbyi* Rathbun (= *C. (C.) japonica*) (all after Leene, 1938). A, dorsal view; B, male abdomen; C, basal antennal segment; D, apex of left G1 abdominal surface; E, apex of left G1 sternal surface.

Charybdis (Charybdis) lucifera (Fabricius, 1798)
(Fig. 16A-D)

Portunus lucifer Fabricius, 1798: 364.
Goniosoma luciferum - Henderson, 1893: 374.
Charybdis lucifera - Rathbun, 1910: 364; Balss, 1922: 106; Sakai, 1939: 401.
Charybdis (Goniosoma) lucifera - Delsman & De Man, 1925: 317, pl. 13, fig. b; Chhapgar, 1957: 21, pls. 6d-g, fig. A5.
Charybdis (Charybdis) lucifera - Leene, 1938: 57, figs. 23-25; Stephensen, 1945: 115; Stephenson et al., 1957: 500, figs. 2F, 3G, pl. 2, fig. 2, pl. 4E; Stephenson, 1976: 14; Moosa, 1980: 69, fig. 4D; Lovett, 1981: 127, figs. a-c; Dai et al., 1986: 215, pl. 28(8), fig. 127; Dai & Yang, 1991: 235, pl. 28(8), fig. 127.
Goniosoma quadrimaculatum A. Milne Edwards, 1861: 375, pl. 34, fig. 3.
Charybdis (Goniosoma) quadrimaculatum - Alcock, 1899: 54.

Material examined. - None.

Size. - Leene (1938) described a male specimen collected by Delsman & De Man (1925) from the Bay of Batavia measuring 61.0 by 95.0 mm.

Diagnosis. - Carapace bare; all anterior carapace ridges present and faintly granular, none behind epibranchials; six frontal teeth, medians blunter, projecting beyond more triangular and outwardly directed submedians, laterals narrowest, separated from submedians by deep V-shaped notch and more prominent than inner supraorbital lobe; six anterolateral teeth, increasing in size from first to fifth, last smallest and spiniform. Basal antennal segment bearing low finely granular crest. Chelipeds strong and unequal; anterior border of merus with three spines; carpus with strong spine on inner angle and three spinules at outer angle; manus with five short spines on upper surface, bearing seven costae; fingers of major cheliped slightly shorter than palm. Propodus of natatory leg serrated on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders parallel. G1 distal half narrow, inner surface bearing sparsely spaced short bristles, starting before tip and ending just proximal to the lip, abdominal surface bearing two rows of short bristles on lip, outer surface bearing long bristles, starting at tip and increasing in length proximally (adapted from Leene, 1938).

Colour. - Carapace yellowish brown with two large white spots on either of the branchial regions. Chelipeds scarlet pink, fingers light brown, extreme tips whitish (fide Chhapgar, 1957).

Habitat. - Rathbun (1910) provides the only record. She mentioned that this species occurs on stony and muddy substrates up to two meters in depth, along the coast of Lem Ngob and Koh Kong (Thailand).

Distribution. - India, Sri Lanka, Taiwan, Japan, Thailand, Malaysia and Indonesia (Dai et al., 1986; Dai & Yang, 1991). The only record to date in Malay Peninsula is from Penang by Balss (1922).

Remarks. - De Man (1888) examined the type specimen of *Portunus lucifer* and confirmed that *Goniosoma quadrimaculatum* is conspecific. This species is characterised by a massive and rounded cheliped. The anterolateral teeth are dark tipped (Stephenson et al., 1957).

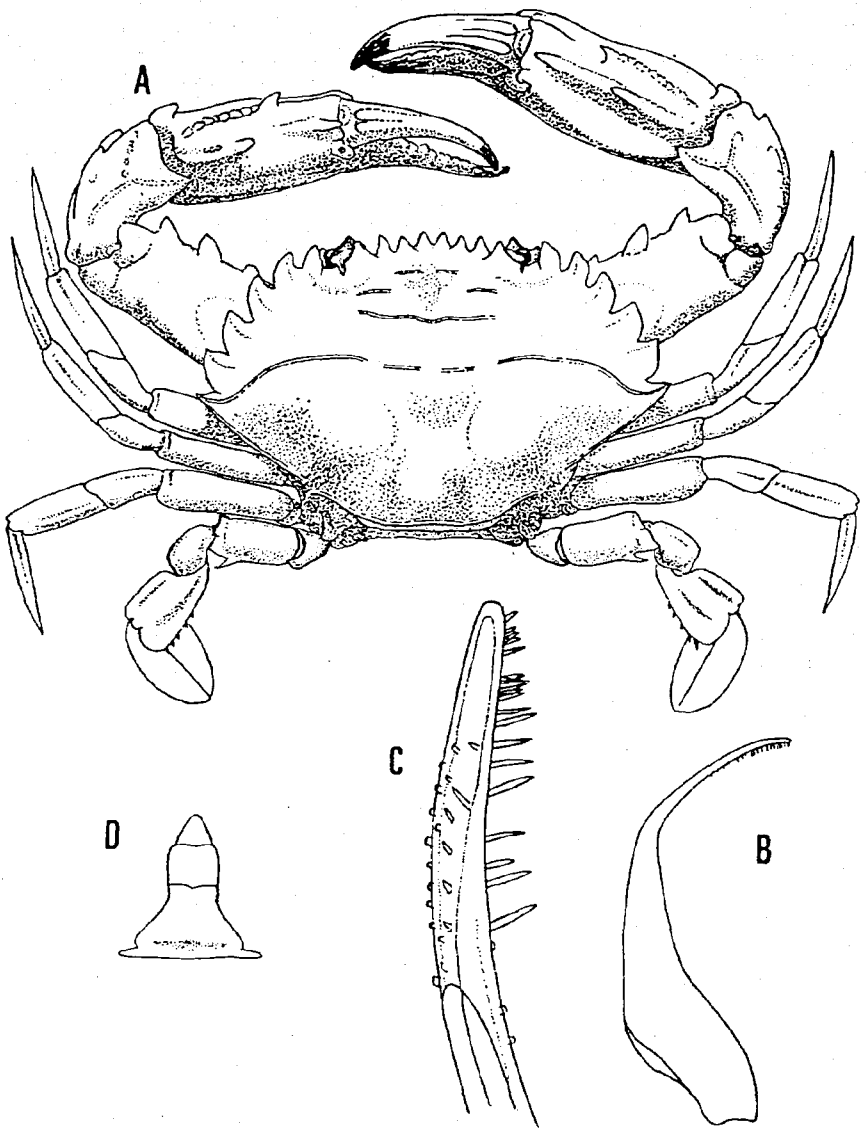


Fig. 16. *Charybdis lucifera* (Fabricius, 1798). A-D - Bay of Batavia, male, 61.0 by 95.0 mm (after Leene, 1938). A, dorsal view; B, left G1 abdominal surface; C, apex of left G1 abdominal surface; D, male abdomen.

Charybdis (Charybdis) miles (De Haan, 1835)
(Fig. 17A-G.)

Portunus (Charybdis) miles De Haan, 1835: 41, pl. 11, fig. 1.
Goniosoma miles - A. Milne Edwards, 1861: 378; Ortmann, 1893: 81; Whitelegge, 1900: 157.
Charybdis miles - Stimpson, 1858: 39; Stimpson, 1907: 82; Rathbun, 1902: 27; Yokoya, 1933: 175; Sakai, 1939: 405, pl. 46, fig. 2; Sakai, 1965: 123, pl. 61; Takeda & Miyake, 1969: 452.
Charybdis (Goniosoma) miles - Alcock, 1899: 62; Chopra, 1935: 486, fig. 13; Shen, 1937: 123, fig. 13.
Charybdis (Charybdis) miles - Leene, 1938: 38, figs. 10-13; Stephensen, 1945: 116; Stephenson et al., 1957:500, figs. 2H,3I, pl. 2, fig. 3, pl. 4F; Ow-Yang, 1963:75, pl. 16, figs. A-F; Stephenson & Rees, 1967a: 6, Stephenson & Rees, 1967b: 11; Stephenson & Rees, 1968: 92, figs. 1A, 1E, 2A, pl. 2A; Stephenson, 1972: 132; Takeda, 1975: 148; Sakai, 1976: 358, pl. 124; Lovett, 1981: 127, figs. 280a-c; Dai et al., 1986: 217, pl. 29(3), fig. 129(1); Dai & Yang, 1991: 237, pl. 29(2), fig. 128(2).
Charybdis (Gonioneptunus) investigatoris Alcock, 1899: 70.

Material examined. - SINGAPORE - 2 males, 1 female (ZRC 1985.823-825), coll. S.R.F.R.S.

PENINSULAR MALAYSIA - 1 male, 1 female (ZRC 1985.819-820), east of Johor, coll. S.R.F.R.S. — 1 male (ZRC 1965.10.20.48), East Coast, 1926. -5 males, 5 females (ZRC 1965.10.20.38-47), Pulau Tioman, Pahang, Dec.1926. — 1 female (ZRC 1985.818), east of Pulau Tioman, Pahang, coll. S.R.F.R.S. 6 Jan.1956.

Size. - The largest specimen is a male measuring 67.1 by 93.8 mm (ZRC 1985.823).

Diagnosis. - Carapace surface convex, densely pilose; anterior carapace ridges present and granular, none behind epibranchials; frontals, cardiacs and mesobranchial regions with granular patches; six frontal teeth, sharp and acute, medians projecting beyond laterally directed submedians, laterals narrowest, separated from submedians by deep U shaped notch; inner supraorbital lobe acutely triangular; six anterolateral teeth, first notched, last spiniform, slightly projecting beyond preceding tooth. Basal antennal segment bearing low granular ridge. Chelipeds elongate, surface finely pubescent; anterior border of merus with four spines and a distal spinule at ventral border; carpus with strong spine on inner angle and three spinules at outer angle; manus with four spines on upper surface, outer surface two distinct smooth costae, inner surface with median costa, lower surface with faint squamiform markings; fingers slender, deeply grooved. Propodus of natatory leg two to four denticles on posterior border. Penultimate segment of male abdomen with convex lateral borders, second to fourth segment keeled. G1 distal tip slender and elongate, abdominal surface with short bristles from tip to proximal end of lip, membrane on lip close to distal end of tip, outer surface with long bristles starting from tip and ending well below proximal end of lip.

Colour. - Red; tip of spines lighter; chelipeds mottled red; fingers banded dark and light red (fide Alcock, 1899).

Habitat. - It is known to inhabit sandy or muddy bottoms at 20-200 meters in depth (fide Stephenson, 1972).

Distribution. - Persian Gulf, India, China, Taiwan, Hong Kong, Japan, Philippines, Burma, Malaysia , Singapore, Indonesia and Australia (Stimpson, 1858; Alcock, 1899; Shen, 1937; Stephenson, 1972; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded from Malaysia and Singapore by Shen (1937).

Remarks. - Previous workers have noted differences in the shape of frontal lobes in juveniles to that of the adults. The median teeth are rounded and lobiform in the juveniles, and become sharper and acute in the adult form. For this reason, *Charybdis (Gonioneptunus) investigatoris* Alcock, 1899, described from a juvenile of 12 mm in length, could well be a synonym of this species, aside from possesing the characteristically notched first anterolateral tooth (Leene, 1938). The author however, was unable to compare this variation as the present material of this species is not represented by juveniles.

This species is distinctive in having very sharp and acutely triangular frontal teeth in the adults. Moreover the distal spinule on the ventral border of the cheliped merus is a constant and reliable character distinguishing this species (Ow-Yang, 1963).

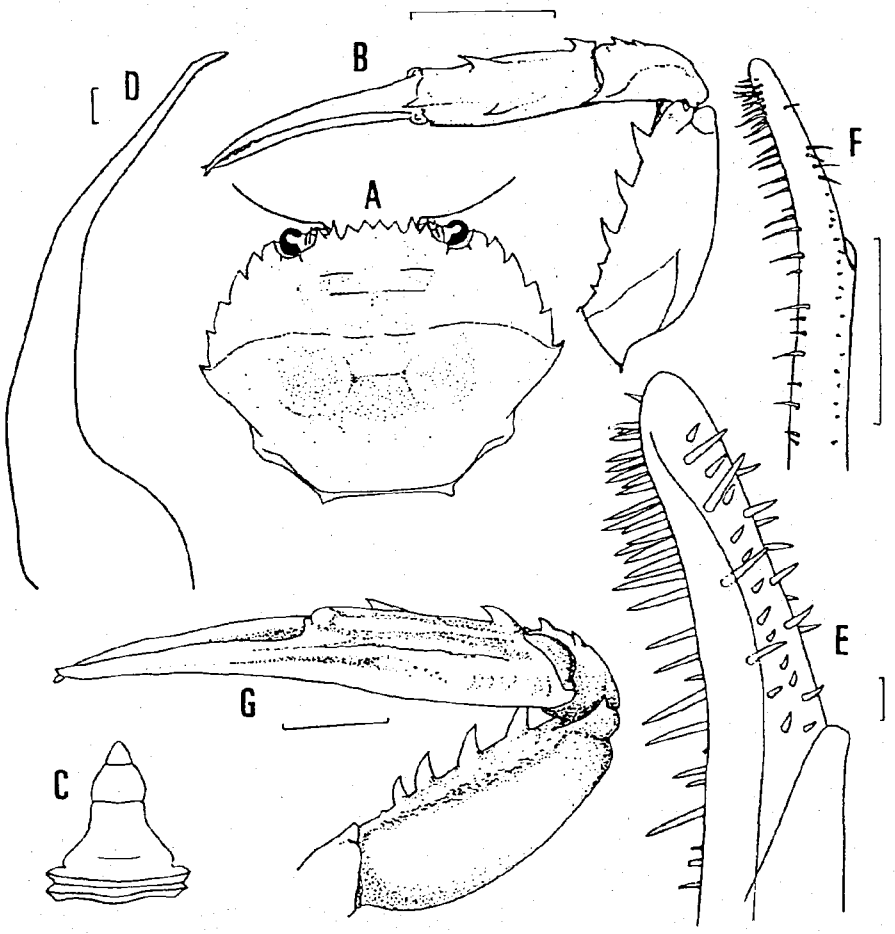


Fig. 17. *Charybdis miles* (De Haan, 1835). A-F - ZRC 1965.10.20.48, male, 67.0 by 95.0 mm (after Ow-Yang, 1963); G - ZRC 1985.819, male, 42.0 by 57.6 mm. A, carapace dorsal surface; B, right cheliped; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface; G, left cheliped, ventral surface. Scales: A-C = 30.0 mm, D, F = 1.0 mm, E = 0.1 mm, G = 10.0 mm.

Charybdis (Charybdis) natator (Herbst, 1789)
(Fig. 18A-C, 19A-C, 20A, B, 21A-G)

Cancer natator Herbst, 1789: pl. 40, fig. 1.
Thalamita natator - H. Milne Edwards, 1834: 463, pl. 17, figs. 13, 14.
Portunus (Charybdis) natator - De Haan, 1850: 10.
Goniosoma natator - A. Milne Edwards, 1861: 370; Miers, 1884: 539; Walker, 1887: 110; De Man, 1887: 334; Henderson, 1893: 374; Lanchester, 1901: 544.
Charybdis (Goniosoma) natatrix - Nobili, 1906: 196.
Charybdis (Goniosoma) natator - Alcock, 1899: 61; Laurie, 1906: 418; Rathbun, 1910: 364; Balss, 1922: 106; Rathbun, 1923: 131; Delsman & De Man, 1925: 312, pl. 13a; Shen, 1932: 40, figs. 7, 8, pl. 9, fig. 2; Shen, 1937: 125.
Charybdis natator - Sakai, 1939: 407, fig. 9b; Stephenson, 1967: 11.
Charybdis (Charybdis) natator - Leene, 1938: 93, figs. 50, 51; Stephensen, 1945: 116; Stephenson et al., 1957: 501, figs. 2G, 3H, pl. 2, fig. 4, pl. 4J; Crosnier, 1962: 82, figs. 143, 144, pl. 13, fig. 2; Ow-Yang, 1963: 80, pl. 17, figs. A-F; Stephenson & Rees, 1967a: 6, b:11; Stephenson, 1972: 132; Sakai, 1976: 360, figs. 193a, b, pl. 127, fig. 1; Moosa, 1980: 67, fig. 4B; Lovett, 1981: 128, figs. 283a,b; Miyake, 1983: 89, pl. 30(2); Dai et al., 1986: 214, pl. 28(7), fig. 126(2); Dai & Yang, 1991: 234, pl. 28(7), fig. 126(2).

Material examined. - SINGAPORE - 1 male (ZRC 1973.10.30.35), Siglap, May.1935. — 1 female (ZRC 1985.826), Siglap, coll. D.S. Johnson, 27 Apr.1955. — 1 female (ZRC 1993.7304), Sentosa, coll. P.Ng, Jun.1986. — 1 male (ZRC 1985.828), Sentosa, 22 Apr.1985. — 6 males, 1 female (ZRC 1984.5859-5865), Tuas, coll. W.M. Lee, 18 Sep.1982. — 1 female (ZRC 1984.5787), Tuas, coll. W.M. Lee, 11 Nov.1982. — 2 males (ZRC 1991.541-542), Tuas, coll. K.L. Yeo, 8-15 Jun.1990. — (ZRC 1984.5786), Tuas; 8 Sep.1982; coll. W.M. Lee, 1 male. — 3 males, 6 females (ZRC 1965.10.20.49-58), Jun.1933, vi-Jul.1934, May.1935. — 2 males, 4 females (ZRC 1984.295-300), Tuas, coll. W.M. Lee, 16,23 Oct.1982, 20 Oct.1982. — 3 males, 2 females (ZRC 1984.303-307), Tuas, coll. W.M.Lee, 3, 17 Dec.1982, 1, 10 Aug.1983. — 1 male (ZRC 1981.7.24.17), Tuas, coll. fisherman, 19 Feb.1981. — 1 male (ZRC 1981.8.14.24), Jurong Fishmarket, coll. H.K.Voris, Feb.1981. — 1 male (ZRC 1981.7.24.69), Jurong fishmarket, coll. H.K. Voris and W.B. Jeffries, 5 Mar.1981. — 1 male (ZRC 1973.10.30.36), Singapore Fishmarket, 1935. — 1 male (ZRC 1985.830), from kelong, Singapore. — 1 female (ZRC 1985.829), C5/6, coll. S.R.F.R.S.. — 1 female (ZRC 1965.10.20.59), Horsburgh Lighthouse, coll. A. Monteiro, 1939. — 1 male, 3 females (ZRC 1984.308-311), South China Sea, 150 miles off Singapore, coll. H. Huat.

PENINSULAR MALAYSIA - 1 female (ZRC), Pontian, Johor, coll. T. Tan, 4 Mar.1992. — 1 male (ZRC 1965.10.20.60), East Coast, Jun.1926. — 1 female (ZRC 1985.827), Telok Juara, Pulau Tioman, Pahang, coll. S.R.F.R.S., det. by Ow-Yang, Jun.1963. — 1 male (ZRC 1973.11.20.11), Tongkol, Sep.1926. 2 males, 1 female (ZRC 1973.10.30.29-31), Kemannan, coll. R. Serène, 8 Aug.1966.

EAST MALAYSIA - 1 male, 1 female (ZRC 1987.626-627), Pulau Tiga, Sabah, coll. Lee Nyanti, 27 Apr.1987.

Size. - The largest specimen is a male measuring 75.5 by 109.5 mm (ZRC 1985.830).

Diagnosis. - Carapace, uniformly pilose, sparse granules on anterolateral surface; anterior carapace ridges present except frontals, epibranchials interrupted by unbroken metagastric ridge, posterior with one pair of cardiac and three short pairs of mesobranchial ridges; six frontal lobes, medians on lower plane, projecting beyond equally broad submedians, laterals acute, separated from submedians by deeper V-shaped notch; inner supraorbital lobe broder than frontals, bluntly triangular; six anterolateral teeth, first tooth truncate, second to fourth subequal with acute tips, last spiniform and least prominent. Basal antennal segment bearing short granular ridge. Chelipeds unequal, granular and pilose; anterior border of merus with three to four spines; carpus with strong spine on inner angle and three spinules at outer angle; manus with four spines on upper surface and a spinule at distal end of outer border, lower

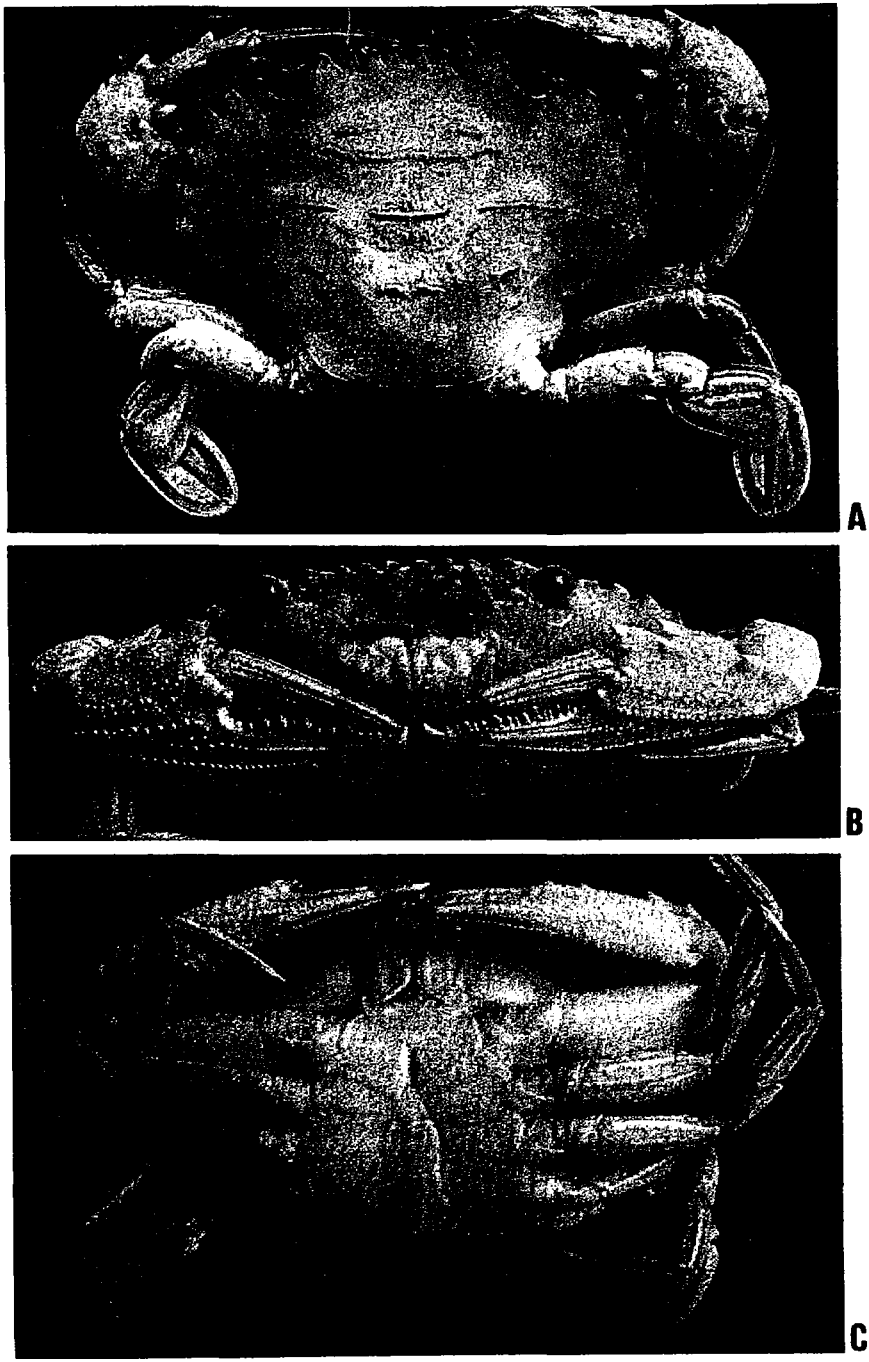


Fig. 18. *Charybdis natator* (Herbst, 1789). ZRC 1987.626, male, 38.8 by 55.4 mm. A, dorsal view; B, frontal view; C, ventral view.

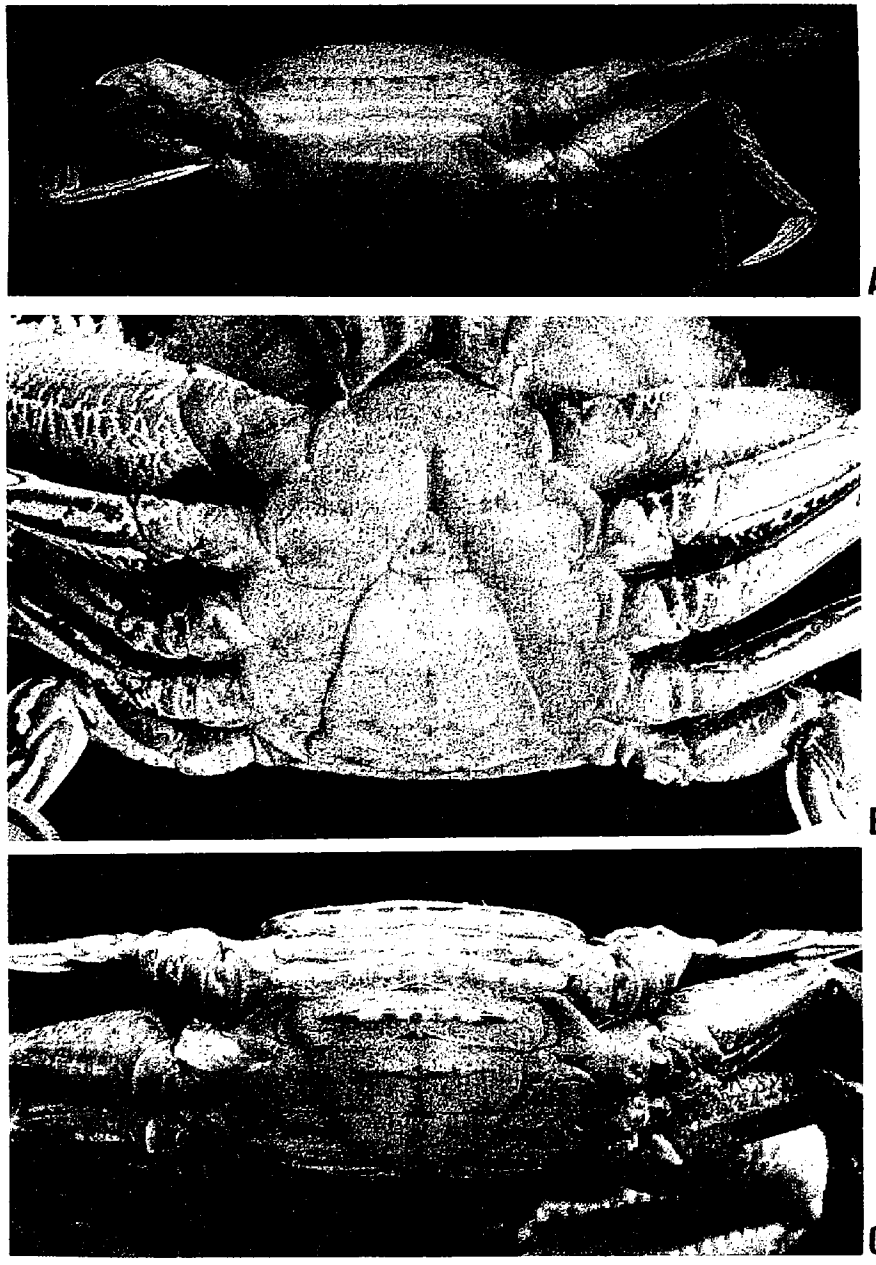


Fig. 19. *Charybdis natator* (Herbst, 1789). A, ZRC 1987.626, male, 38.8 by 55.4 mm, posterior view; B, ZRC 1993.7304, female, 36.1 by 49.5 mm, ventral view; C, ZRC 1993.7304, female, 36.1 by 49.5 mm, posterior view.

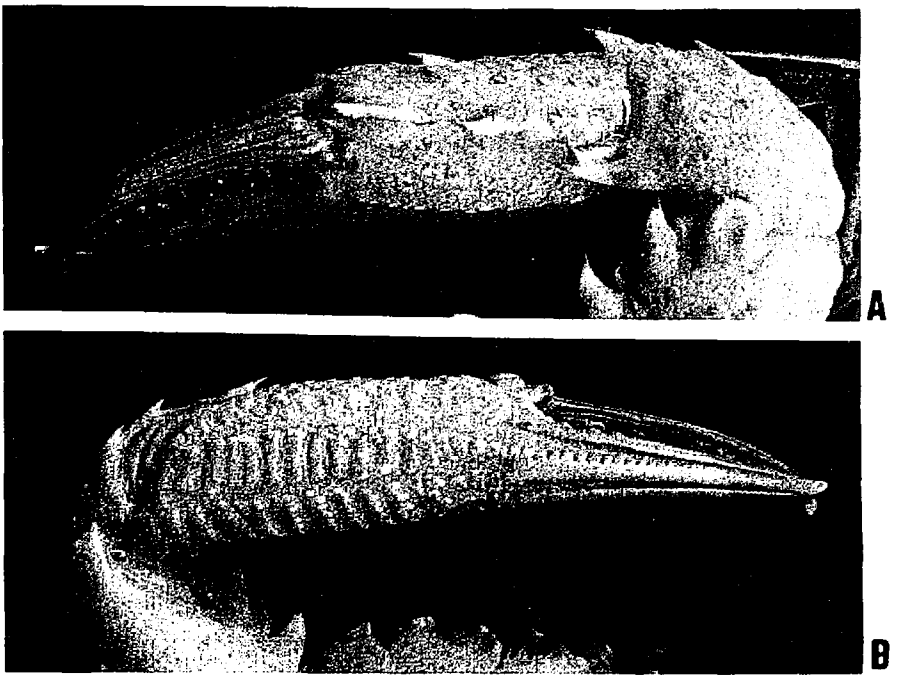


Fig. 20. *Charybdis natator* (Herbst, 1789). ZRC 1987.626, male, 38.8 by 55.4 mm. A, upper surface of cheliped manus; B, lower surface of cheliped manus.

surface with transverse squamiform ridges; fingers stout, deeply grooved. Propodus of natatory leg serrated on posterior border. Second to fifth segment of male abdomen keeled, penultimate segment with lateral borders parallel then converging distally. G1 distal tip slender and elongate, abdominal surface bears two rows of short terminal bristles ending proximal to lip region, outer suface with row of longer bristles starting near tip and extending proximally as widely spaced bristles.

Colour. - Pubescence of dorsal surface brownish, granules bright red. Ventral surface bluish, mottled with white and pale red.

Habitat. - This species is found on the bottom of rocks, pebbles or sand at depths of 15-35 meters in depth (fide Sakai, 1976).

Distribution. - East Africa, Madagascar, Red Sea, India, China, Japan, Philippines, Thailand, Malaysia, Singapore, Indonesia and Australia (fide Nobili, 1906; Stephenson et al., 1957; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded from Malaysia by Miers (1884) and from Singapore by Alcock (1899).

Remarks. - This species is easily recognised by the distinct reddish coloration of the anterolateral and frontal teeth, on the granules and transverse carapace ridges. It is similar to that of *Charybdis (Charybdis) granulata*. Leene (1938) placed the latter under the synonymy of *C. (C.) natator*, but it has since been considered as a distinct species by Sakai (1976) and Miyake (1983). The differences have been discussed under *C. (C.) granulata*.

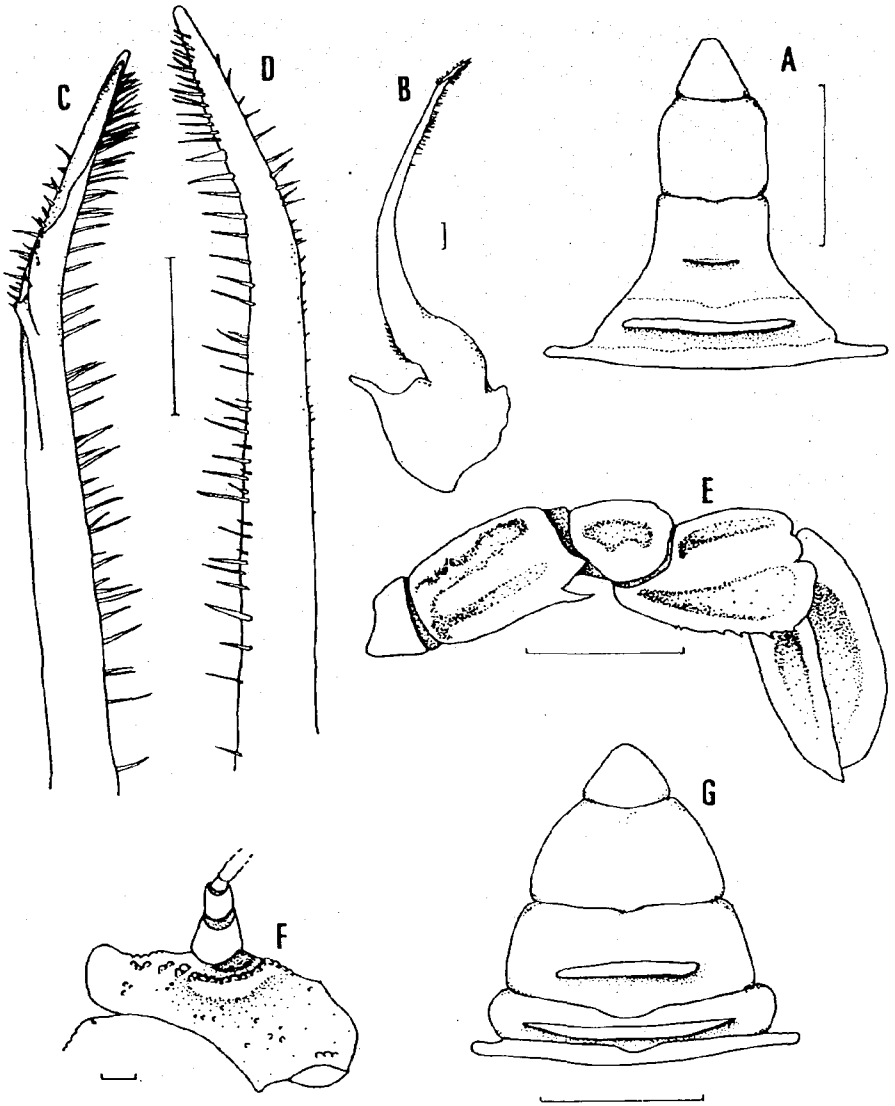


Fig. 21. *Charybdis natator* (Herbst, 1789). A-F - ZRC 1987.626, male, 38.8 by 55.4 mm; G - ZRC 1993.7304, female, 36.1 by 49.5 mm. A, male abdomen; B, left G1 abdominal surface; C, apex of left G1 abdominal surface; D, apex of left G1 sternal surface; E, right natatory leg; F, right basal antennal segment; G, female abdomen. Scales: A, E, G = 10.0 mm, B-D, F = 1 mm.

The under surface of the manus of the chelipeds vary from having a transverse squamiform arrangement to that of a surface with scattered granules. Yet, in both cases, there the characteristic longitudinal groove is present (Crosnier, 1962: pl XIII fig 2).

Charybdis (Charybdis) orientalis Dana, 1852
(Fig. 22A-I)

Charybdis orientalis Dana, 1852: 285, pl. 17, fig. 10; Stebbing, 1918: 50; Sakai, 1939: 407, pl. 83, fig. 2; Barnard, 1950: 170, fig. 32d-g.
Goniosoma orientale - A. Milne Edwards, 1861: 383; Henderson, 1893: 375.
Charybdis (Goniosoma) orientalis - Laurie, 1906: 418; Nobili, 1906: 195; Chhapgar, 1957: 23, pl. 7, figs. d-g.
Charybdis (Charybdis) orientalis - Leene, 1938: 68, fig. 32-34; Leene, 1940:183; Stephenson et al., 1957: 502, figs. 2B, 3B, pl. 3, fig. 1 pl. 4g; Crosnier, 1962:80; Stephenson & Rees, 1967a: 11, b:7; Stephenson, 1972: 133; Stephenson, 1976: 14; Sakai, 1976: 362, pl. 128, fig. 2; Dai et al., 1986: 211, pl. 28(3), fig. 124(2); Dai & Yang, 1991: 231, pl. 28(3), fig. 124(2).
Goniosoma dubium Hoffman, 1874: 11, pl. 2, figs. 6-8; De Man, 1883: 151.
Charybdis (Goniosoma) helleri - Nobili, 1906: 195.

(non *Goniosoma orientale* - Heller, 1865: 29, pl. 3, fig. 3; Alcock, 1899: 63; or *Charybdis orientalis* - Rathbun, 1906: 872; Edmondson, 1946: 281, fig. 173e.)

Material examined. - SINGAPORE - 1 female (ZRC), Labrador Beach, coll. D. Wee, 2 Jul.1993.

EAST MALAYSIA - 2 males, 1 female (ZRC 1987.27-29), Kota Kinabalu, Sabah, coll. Lee Nyanti, 5 Nov.1987.

Size. - Largest specimen is a female measuring 38.7 by 57.0 mm (ZRC 1987.27).

Diagnosis. - Carapace densely pilose except elevated ridges; all anterior carapace ridges present and granular, none behind epibranchials; six frontal teeth, medians blunt, projecting beyond triangular submedians, laterals narrowest and sharply acute; inner supraorbital lobe broadly triangular; six anterolateral teeth, spine tipped, second rudimentary attached to posterior border of first, last tooth produced slightly sideways. Basal antennal segment bearing sharp granular ridge. Chelipeds unequal, outer surface pubescent; anterior border of merus with three spines and a spinule at distal end; carpus with strong spine on inner angle and three spinules at outer angle; manus with four spines on upper surface, outer surface three costae, inner surface with indistinct median costa, lower surface smooth; fingers slender, as long as manus. Propodus of natatory leg serrated on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders parallel then converging distally. G1 distal tip slender and elongate, inner surface with short bristles spanning curvature of tip, outer surface with longer bristles starting from tip and ending at distal third of the gonopd.

Colour. - Brownish grey carapace; fingers of chelipeds dark red, extreme tips white; legs with alternate dark brown and light grey stripes.

Habitat. - The habitat of this species range from intertidal rocky shore to sandy or muddy bottoms of 20 to 50 meters in depth (fide Dai et al., 1986; Dai & Yang, 1991; Sakai, 1976).

Distribution. - East Africa, Madagascar, Red Sea, India, Sri Lanka, China, Japan, Philippines, Malaysia, now Singapore, Indonesia and Australia (fide Leene, 1938; Sakai, 1939; Dai et al., 1986; Dai & Yang, 1991). This species was recorded from Malaysia by Stephenson (1972). It is a new record for Singapore.

Remarks. - This species does not possess any carapace ridges behind the last pair of anterolateral teeth Leene (1938). Chhapgar (1957) however, mentioned that the mesobranchial

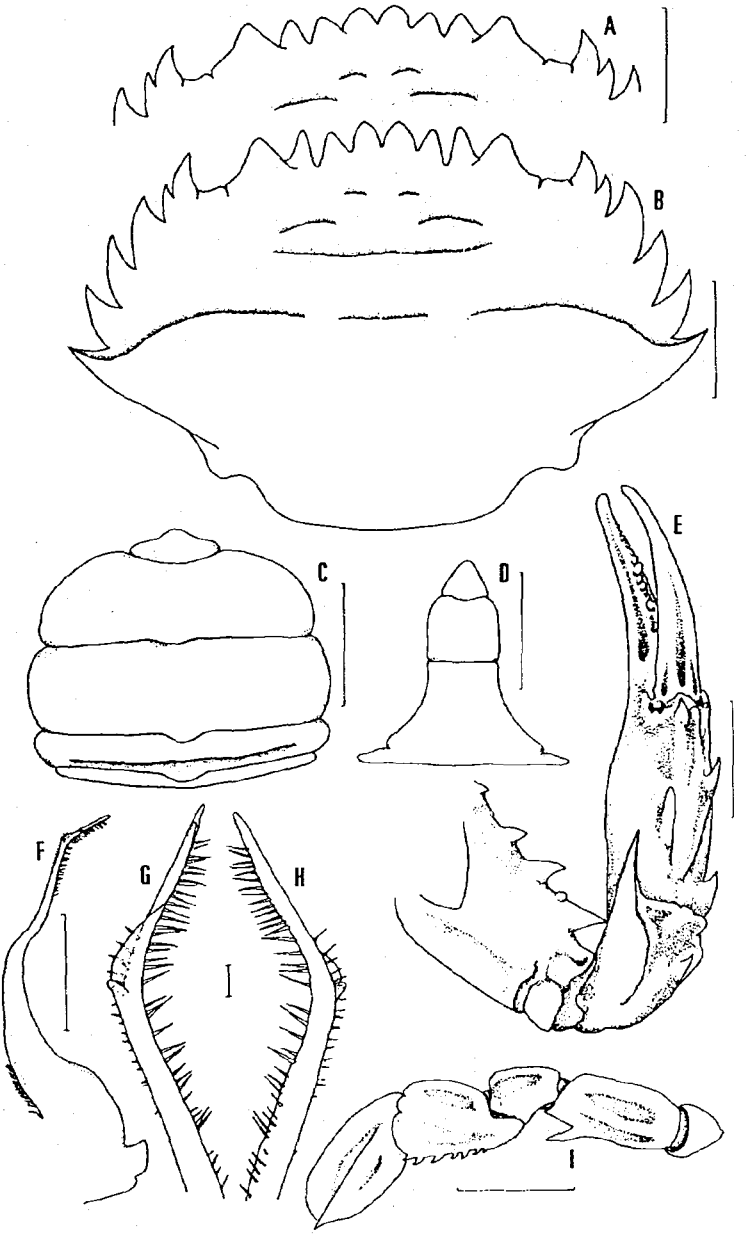


Fig. 22. *Charybdis orientalis* Dana, 1852. A - ZRC 1987.27, male, 38.2 by 56.8 mm; B, D-I - ZRC 1987.28, male, 36.0 by 55.0 mm; C - ZRC 1987.29, female, 35.2 by 54.5 mm. A, front dorsal surface; B, carapace dorsal surface; C, female abdomen; D, male abdomen; E, right cheliped; F, left G1 abdominal surface; G, apex of left G1 abdominal surface; H, apex of left G1 sternal surface; I, left natatory leg. Scales: A-E, I = 10.0 mm, F-H = 1.0 mm.

ridges are a characteristic feature of this species, but his diagram (Chhapgar, 1957: pl. 7, fig. d), does not show any ridges on the posterior half of the carapace. The median frontal lobes vary in this species from having round anterior borders to being sharp. Edmondson (1954) showed that specimens from Hawaii previously referred to *C. orientalis* by Rathbun (1906) and Edmondson (1946) actually belong to a separate species, for which he gave the name *C. hawaiensis*.

Charybdis (Charybdis) variegata (Fabricius, 1798)
(Fig. 23A-F)

Portunus variegatus Fabricius, 1798: 364.
Portunus (Charybdis) variegatus - De Haan, 1835: 42, pl. 1, fig. 2.
Charybdis variegata - Stimpson, 1858: 104; Stimpson, 1907: 81, pl. 9, fig. 7; Rathbun, 1902: 27; Rathbun, 1910: 364; Nobili, 1906: 196; Balss, 1922: 104; Yokoya, 1933: 176; Sakai, 1939: 406, pl. 47, fig. 4; Sakai, 1965: 121, pl. 59, fig. 2; Barnard, 1950: 107, fig. 32c.
Charybdis (Goniosoma) variegata - Alcock, 1899: 60; Chopra, 1935: 488, figs. 10a-b; Shen, 1935: 222; Shen, 1940: 83; Leene, 1937: 187.
Charybdis (Charybdis) variegata - Leene, 1938: 84, figs. 44, 45; Stephenson et al., 1957: 503, fig. 3c, pl. 3, fig. 2; Crosnier, 1962: 83, fig. 145; Lovett, 1981: 128, fig. 282a-c; Stephenson, 1972: 133; Sakai, 1976: 359, pl. 121, fig. 3; Dai et al., 1986: 217, pl. 29(3), fig. 129(1); Dai & Yang, 1991: 238, pl. 29(3), fig. 129(1).
Goniosoma variegatum var. *callianasa* - Henderson, 1893: 377.

Material examined. - PENINSULAR MALAYSIA - 2 females (ZRC 1985.831-832), Batu Maung, Penang, coll. S.R.F.R.S.. — 1 female (ZRC 1985.834), Batu Maung, Penang, coll. S.R.F.R.S., 1955-1956.

Size. - The largest specimen is a female measuring 30.5 by 17.6 mm (ZRC 1985.834).

Diagnosis. - Carapace densely pilose; all anterior carapace ridges present and granular, two pairs of mesobranchial ridges, cardiac interrupted; six frontal teeth, medians triangular projecting beyond laterally directed submedians, laterals acute and narrowest, separated from submedians by deeper notch; inner supraorbital lobe triangular; orbits with strong dorsal inclination; six anterolateral teeth, first notched, second smallest, last spiniform and directed laterally, projecting beyond preceding tooth. Basal antennal segment bearing sharp granular ridge. Chelipeds finely pubescent, with squamiform markings; anterior border of merus with three spines, distal widely separated from proximal two; carpus with strong spine on inner angle and two spinules at outer angle; manus seven granular costate, with four spines and a spinule on upper surface, lower surface nearly smooth; fingers shorter than or equal to manus. Propodus of natatory leg with spinules on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders strongly convex. G1 stout, distal half curved, lip membrane distinctly separate and lobed, inner surface with short bristles at proximal end of lip, abdominal surface with row of smaller bristles on lip, outer surface with row of bristles starting from tip and terminating as tiny spinules on sternal surface (adapted from Leene, 1938).

Colour. - Not known.

Habitat. - This species inhabits the bottoms of mud or sand at 30-50 meters in depth (Sakai, 1939).

Distribution. - Madagascar, Red Sea, Persian Gulf, India, China, Hong Kong, Taiwan, Japan, Philippines, Thailand, Malaysia and Australia (Rathbun, 1910; Shen, 1935; Crosnier, 1962; Dai et al., 1986; Dai & Yang, 1991). Henderson (1893) first recorded this species from Malaysia.

Remarks. - The general resemblance of this species is very close to *Charybdis (Charybdis) brevispinosa*, but can be differentiated on the basis of the frontal lobes and G1 structure. Leene (1938) noted that the type specimen was dry and its G1 cannot be examined, hence the G1 of *C. (C.) vareiegata* follows the illustration made by Leene. (Refer to the remarks of *C. (C.) brevispinosa* for their comparisons).

Shen (1937: 127), described a specimen from Siglap. However upon re-examination, his specimen was found to fit *C. (C.) brevispinosa* in the frontal border and shape of the G1,

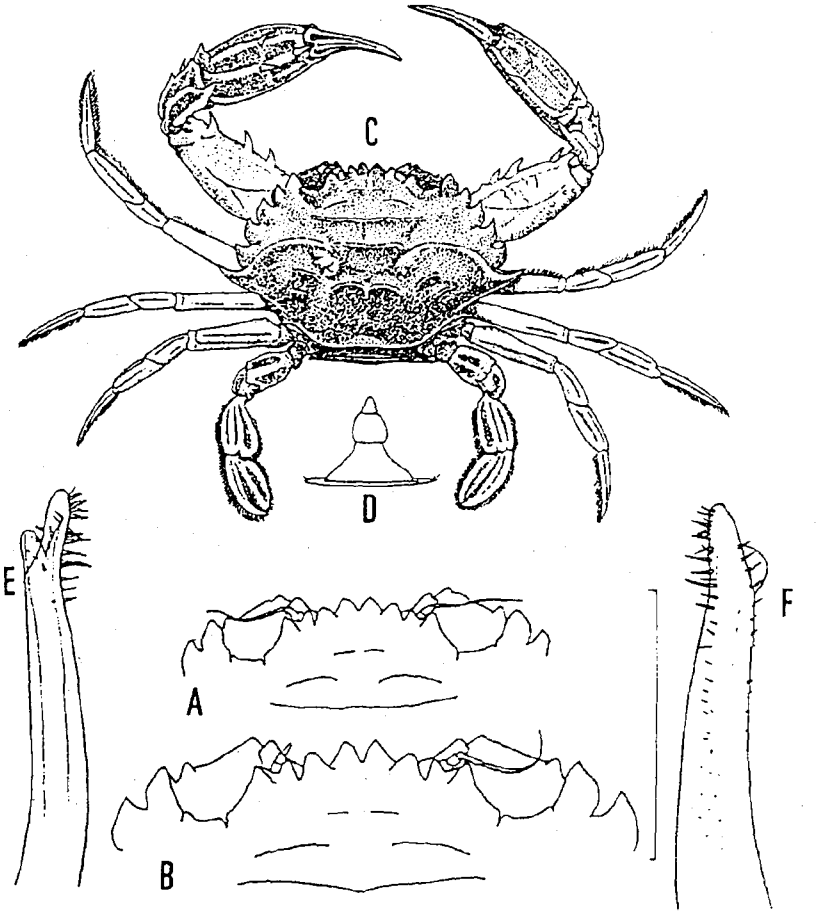


Fig. 23. *Charybdis variegata* (Fabricius, 1798). A - ZRC 1985.831, female, 8.3 by 19.0 mm; B - ZRC 1985.832, female, 12.6 by 26.2 mm; C-D - Copenhagen Museum, male, 21.0 by 36.0 mm; E-F - Amoy, male, 17.3 by 29.0 mm (C-F after Leene, 1938). A, front dorsal surface; B, front dorsal surface; C, dorsal view; D, male abdomen; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface. Scales: A-B = 10.0 mm.

aside from the other characters (see diagnosis of *C. (C.) brevispinosa)*. The three female specimens of *C. (C.) variegata* from Penang were badly damaged leaving only the carapace intact. No other features could be used for comparison or illustration.

Charybdis (Goniohellenus) hongkongensis Shen, 1934
(Figs. 24A-E)

Charybdis (Goniohellenus) hongkongensis Shen, 1934: 46, figs. 11,12; Leene, 1938: 110, figs. 61, 62; Stephenson & Rees, 1967b: 3; Stephenson, 1972: 133; Dai et al., 1986: 221, pl. 29(8), fig. 132(1); Dai & Yang, 1991: 242, pl. 29(8), fig. 132(1).

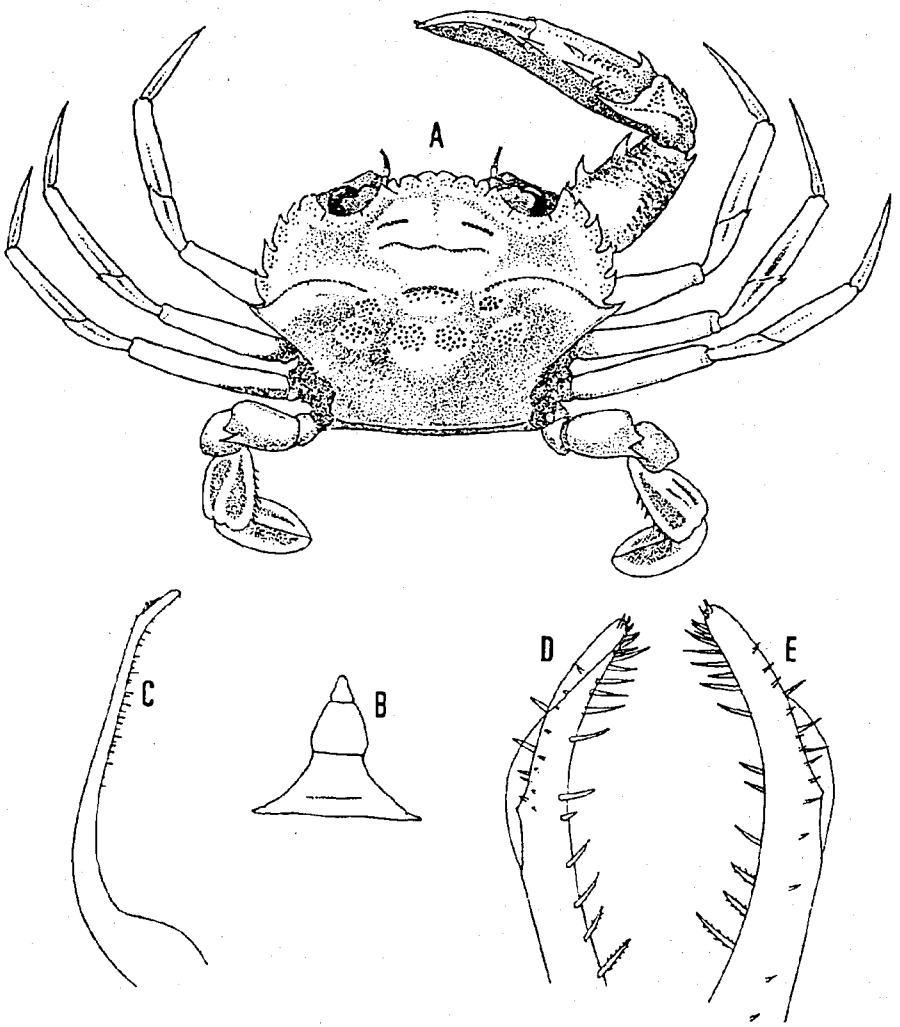


Fig. 24. *Charybdis hongkongensis* Shen, 1934. A-E -Diamantpunt, male, 16.0 by 24.9 mm (after Leene, 1938). A, dorsal view; B, male abdomen; C, left G1 abdominal surface; D, apex of left G1 abdominal surface; E, apex of left G1 sternal surface.

Material examined. - None.

Size. - The male holotype specimen (type locality: Pei Ping, Hong Kong) measures 32.7 by 51.3 mm (Shen, 1934).

Diagnosis. - Carapace pilose; anterior carapace ridges granular and distinct; metagastric, cardiac and mesobranchial regions marked with granular patches, granules on orbital borders, frontals and anterolateral teeth; six frontal teeth, medians prominent, on lower plane, separated by shallow notch, laterals acute and narrowest, separated from rounded submedians by deeper notch; inner supraorbital lobe with granular ridge; six anterolateral teeth, first two closely set, last spiniform, laterally directed, slightly larger than preceding tooth. Basal antennal segment with granular ridge. Chelipeds unequal, covered by granular squamiform markings; anterior border of merus with three spines and a spinule at distal end of posterior border; carpus with usual spines; manus seven costate with five spines on upper surface; fingers shorter than manus. Propodus of natatory leg serrated on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders convex and converging distally. G1 with long narrow neck, distal tip stout and curved, partly covered by lip membrane, inner surface with few bristles at proximal end of lip, abdominal surface with row of tiny bristles on lip, outer surface with bristles beginning at tip and terminating at distal third of G1 (adapted from Leene, 1938).

Colour. - Carapace mars brown (fide Shen, 1934).

Habitat. - Habits on sandy or sandy muddy bottoms at 30-400 meters in depth (fide Dai et al., 1986; Dai & Yang, 1991).

Distribution. - China, Hong Kong, Thailand, Malaysia, Sumatra and Banda Sea (fide Stephenson & Rees, 1967; Stephenson, 1972; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded from Malaysia by Stephenson (1972).

Remarks. - This species is very close to that of *Charybdis (Goniohellenus) truncata*. It is distinguished from the latter by several characters discussed under the remarks of *C. (G.) truncata*.

Charybdis (Goniohellenus) truncata (Fabricius, 1798)
(Fig. 25A-G)

Portunus truncatus Fabricius, 1798: 365.
Portunus (Thalamita) truncatus - De Haan, 1835: 43, pl. 12, fig. 3.
Goniosoma ornatum A. Milne Edwards, 1861: 376; Miers, 1879: 20; Henderson, 1893: 376; De Man, 1895: 562; Lanchester; 1901: 545.
Charybdis ornata - Rathbun, 1910: 365.
Charybdis (Goniohellenus) ornata - Alcock, 1899: 64; Laurie, 1906: 418.
Charybdis truncata - Stimpson, 1858: 39; Stimpson, 1907: 82; Rathbun, 1902: 27; Rathbun, 1923: 133; Sakai, 1939: 412, pl. 45, fig. 4; Sakai, 1965: 122, pl. 59, fig. 3; Stephenson, 1967: 12; Stephenson & Rees, 1968: 292; Takeda, 1989: 152.
Charybdis (Gonioneptunus) truncata - Borradaile, 1903: 200.
Charybdis (Goniohellenus) truncatus - Balss, 1922: 103; Yokoya, 1933: 176,
Charybdis (Goniohellenus) truncata - Shen, 1934: 49, figs. 13, 14; Shen, 1935: 222; Shen, 1937: 127; Leene, 1938: 118, fig. 66-67; Stephenson et al., 1957: 503, figs. 2D, 3E1, 3E2, pl. 3, fig. 3, pl. 4I; Crosnier, 1962: 87, figs. 149, 150, pl. 7, fig. 1; Ow-Yang, 1963: 91, pl. 20, figs. A-G; Stephenson, 1972: 133; Sakai, 1976: 363, fig. 3, pl. 128; Dai et al., 1986: 221, c; Lovett, 1981: 128, figs. 285a-b; Dai & Yang, 1991: 241, pl. 29(8), fig. 132(1).

Material examined. - SINGAPORE - 6 males, 4 females (ZRC 1965.7.5.25-35), Siglap, coll. M.W.F. Tweedie, Jun.1939. — 5 males, 2 females (ZRC 1969.2.20.1.7), Siglap, coll. M.W.F. Tweedie, Jun.1933. — 2 females (ZRC 1977.7.25.1-2), Siglap, Jun.1933. — 1 male, 2 females (ZRC 1977.7.25.3-5), Siglap, 1934. — 1 male (ZRC 1985.843), Siglap, coll. M.W.F. Tweedie, Jun.1933. — 1 male (ZRC 1985.844), Siglap, coll. M.W.F. Tweedie, Oct.1933. — 4 males (ZRC 1985.846-849), Siglap, coll. M.W.F. Tweedie, Jun-Jul.1934. — 22 males, 1 female (ZRC 1984.313-335), South China Sea near Horsburgh Lighthouse, coll. H. Huat, 26 Nov.1982, 15 Dec.1982. — 2 males, 1 female (ZRC 1984.5382-5384), South China Sea, 150 miles off Singapore, coll. H. Huat, 19 Aug.1983. — 1 male (ZRC 1984.6381), South China Sea, 150 miles off Singapore, coll. H. Huat, 10 Aug.1983. — 1 male (ZRC 1985.842), C6/13, coll. S.R.F.R.S., 10 Jan.1956, (det. as C. (C.) hongkongensis). — 1 male (ZRC), Singapore/Malaysia.

PENINSULAR MALAYSIA - 1 male (ZRC 1984.312), Muar River Johor, coll. K.L. Yeo, 11 Jun.1983. — 6 males, 3 females (ZRC), Pontian, Johor, coll. 13 Jul.1993. — 1 male (ZRC 1985.845), East Coast, coll. M.W.F. Tweedie, Sep.1926. — 1 male (ZRC 1965.7.5.36), Pulau Tioman, Pahang, coll. S.T., Oct.1926. — 2 males (ZRC 1985.850-851), Pulau Tioman, Pahang, coll. M.W.F. Tweedie, Sep.1926. — 1 male, 1 female (ZRC 1992.10510-10511), Andaman Sea between Penang and Langkawi, coll. C.P. How & C.O. Lau, 12 Nov.1991.

Size. - The largest specimen is a male measuring 33.5 by 49.1 mm (ZRC 1985.850).

Diagnosis. - Carapace densely pilose; all anterior carapace ridges granular and distinct; metagastric, cardiac and mesobranchial regions marked with granular patches; granules on orbital borders, frontals and anterolateral teeth; six frontal teeth, medians prominent, on lower plane, separated by shallow notch, laterals acute and narrowest, separated from rounded submedians by deeper notch; inner supraorbital lobe with granular ridge; six anterolateral teeth, borders serrated, first two closely set, third to last decreasing in size. Basal antennal segment with granular ridge. Chelipeds unequal, covered by granular squamiform markings; anterior border of merus with three spines and a spinule at distal end of posterior border; carpus with usual spines; manus seven costate with five spines on upper surface; larger cheliped fingers as long as manus, smaller cheliped fingers slightly longer than manus. Propodus of natatory leg serrated on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders convex and converging distally. G1 long narrow neck, distal tip slender and elongate, inner surface with bristles at proximal end of lip, abdominal surface with row of tiny bristles on lip, outer surface with bristles beginning at tip and terminating at distal third of G1 (adapted from Leene, 1938).

Colour. - Carapace dirty green, legs with transverse bars or patches of reddish brown, ventral surface white (fide Stimpson, 1907).

Habitat. - *Charybdis (G.) truncata* inhabits on muddy bottoms of 10-100 meters in depth (fide Dai et al., 1986; Dai & Yang, 1991).

Distribution. - Madagascar, Maldives, India, Sri Lanka, China, Hong Kong, Japan, Philippines, Burma, Thailand, Malaysia, Singapore, Indonesia, Australia and Sulawesi (fide Leene, 1938). This species was first recorded in Malaysia and Singapore by Lanchester (1901) and Shen (1937) respectively.

Remarks. - This species is remarkably close to *Charybdis (Goniohellenus) hongkongensis*. Shen (1934: 49) noted their similarity and tabulated the differences observed. In the present collection of *C. (G.) truncata*, many of the distinguishing characters mentioned by Shen were found to be variable and unreliable for separating the two. However, three other characters were found to be useful in distinguishing them.

The sixth anterolateral tooth in *C. (G.) truncata* is relatively smaller and directed forwards, not projecting beyond the preceding tooth. This results in a smaller carapace length to breadth ratio of 1.4 as compared to that of 1.6 in *C. (G.) hongkongensis*. The sixth anterolateral tooth of the latter is longer and projects laterally beyond all the preceding teeth.

The distal tip of the G1 in *C. (G.) truncata* is slender and elongate, bearing bristles with bipinnate hairs on the outer border. *Charybdis (G.) hongkongensis* on the other hand, has a shorter distal tip that is inflated into a spoon shape. The lip membrane covers a major part of the tip and the bristles are without hairs.

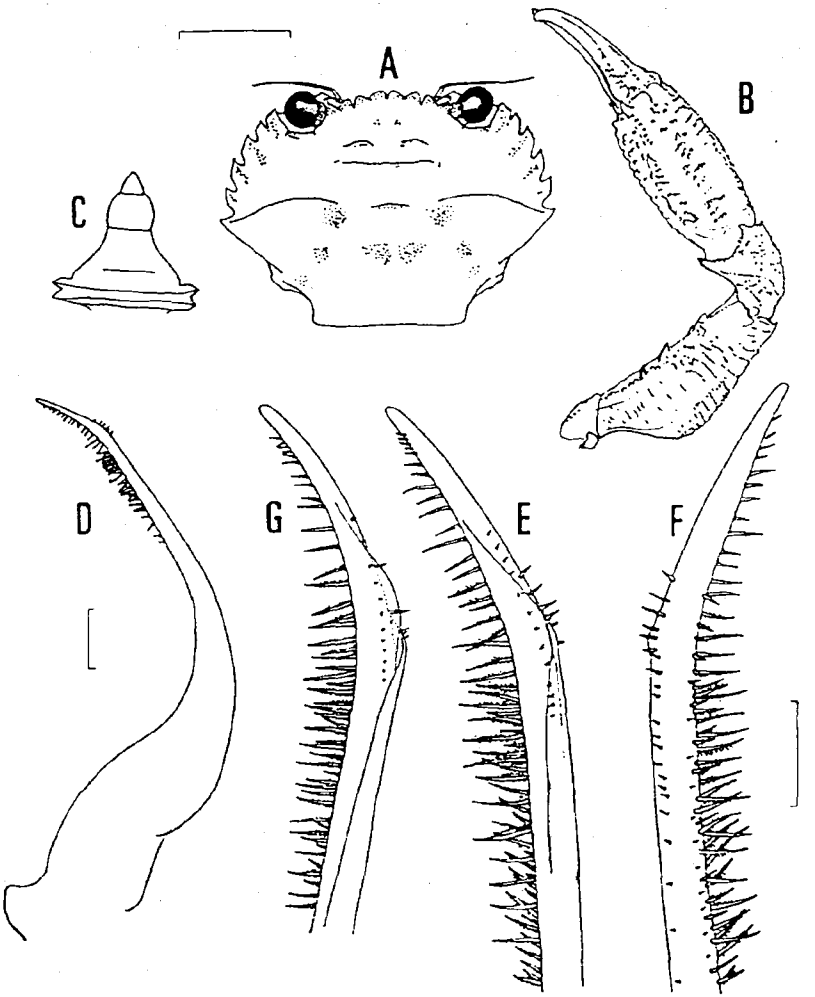


Fig. 25. *Charybdis truncata* (Fabricius, 1798). A-C - ZRC 1985.842, male, 33.5 by 49.5 mm; D-F - ZRC 1969.2.20.1.7, male, 28.5 by 41.5 mm; G - ZRC, Siglap 6/1933, male (juvenile), 21.0 by 30.5 mm (after Ow-Yang, 1963). A, carapace dorsal surface; B, right cheliped; C, male abdomen; D, right G1 abdominal surface; E, apex of right G1 abdominal surface; F, apex of right G1, sternal surface; G, apex of right G1 abdominal surface. Scales: A-C = 10.0 mm, D = 1.0 mm, E-G = 0.5 mm.

From the carapace figured by Shen (1934) *C. (G.) hongkongensis* show only two pairs of granulated patches on the mesobranchial regions. In the specimens at hand *C. (G.) truncata* has three pairs, with the largest pair closest to the epibranchial ridges. The latter also has a more robust cheliped, and its length is 2.5-3.0 times that of the carapace length, unlike that of *C. (G.) hongkongensis*, which is only twice the carapace length.

Charybdis (Goniohellenus) vadorum (Alcock, 1899)
(Fig. 26A-H)

Charybdis (Goniohellenus) hoplites var. *vadorum* Alcock, 1899: 67.
Charybdis vadorum Stephenson, 1967: 13.
Goniohellenus vadorum - Serène & Soh, 1976: 16.
Charybdis (Goniohellenus) vadorum - Chopra, 1935: 493, fig. 13, pl. 9; Shen, 1935: 222; Shen, 1940: 84; Leene, 1938: 114, fig. 63-65; Leene, 1940: 188; Stephensen, 1945: 119; Stephenson & Rees, 1967a: 12; Stephenson, 1972: 133; Dai et al., 1986: 222, pl. 30(2), fig. 133; Dai & Yang, 1991: 243, pl. 30(2), fig. 133.
Archias sexdentatus Paulson, 1875: 56, pl. 8, figs. 3a, 3b; Nobili, 1906: 198.
?*Charybdis philippinensis* Ward, 1942: 5, figs. 7,8.
Charybdis (Goniohellenus) sinensis Gordon, 1930: 522; Gordon, 1931: 534, figs. 11, 12c, d, d'; Shen, 1934: 44, figs. 9, 10.

Material examined. - PENINSULAR MALAYSIA - 1 male (ZRC 1993.385), off Kuala Lumpur, coll. S. Lim, Jan.1993. — 1 male (ZRC), D8, 25 Apr.1986, no other data. — 1 female (ZRC), no other data.

Size. - The largest specimen examined is a male measuring 18.7 by 30.7 mm (ZRC 1993.385) from Peninsular Malaysia.

Diagnosis. - Carapace pilose; granular patches on protogastrics and mesobranchial region, Y-shaped one on metagastric and cardiac region; mesogastric ridge sinuous; six frontal teeth, medians on lower plane, submedians with inner edge sloping inwards overlapping medians, laterals narrowest separated from submedians by deep notch; inner supraorbital lobe broadly triangular; six anterolateral teeth with serrated borders, first acutely pointed, second to fourth gradually increasing in size, last elongate and spiniform, projecting laterally beyond preceding tooth. Basal antennal segment bearing low granular ridge. Chelipeds covered with squamiform markings; anterior border of merus with two spines and a spinule at distal end of posterior border; carpus with strong spine on inner angle and two spinules at outer angle; manus with four spines on upper surface, outer surface three costae, inner surface with median costa, lower surface smooth; fingers shorter than manus. Propodus of natatory leg serrated on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders strongly convex; second to fourth segment keeled. G1 neck thin, distal tip curved laterally, inner surface with few long bristles, at proximal end of lip, outer surface with longer bristles starting from tip and terminating at distal half of G1; membrane broad, extending to tip.

Colour. - Not known.

Habitat. - *Charybdis (G.) vadorum* is a relatively small species and have been recorded to occur in sandy bottoms at depths of 10-80 meters (fide Dai et al., 1986; Dai & Yang, 1991).

Distribution. - Red Sea, Persian Gulf, India, China, Hong Kong, Taiwan, Philippines, Thailand, now Malaysia and Indonesia (fide Alcock, 1899; Shen, 1935; Stephenson, 1972; Dai et al., 1986; Dai & Yang, 1991). This species is a new record for Malaysia.

Remarks. - The indentation on the outer border of the first anterolateral tooth results in an acute tip which is laterally directed. This is less obvious in smaller specimens, but the last anterolateral tooth has been reported to be relatively longer (Serène & Soh, 1967). The chelipeds in the female are short and stout but elongate in the male specimens. The fingers in both however, are shorter than the manus.

Nine specimens from the Indo-Burmese coast, Bay of Bengal were identified as syntypes for this species by Chopra (1935) after examining that Alcock's specimens from several

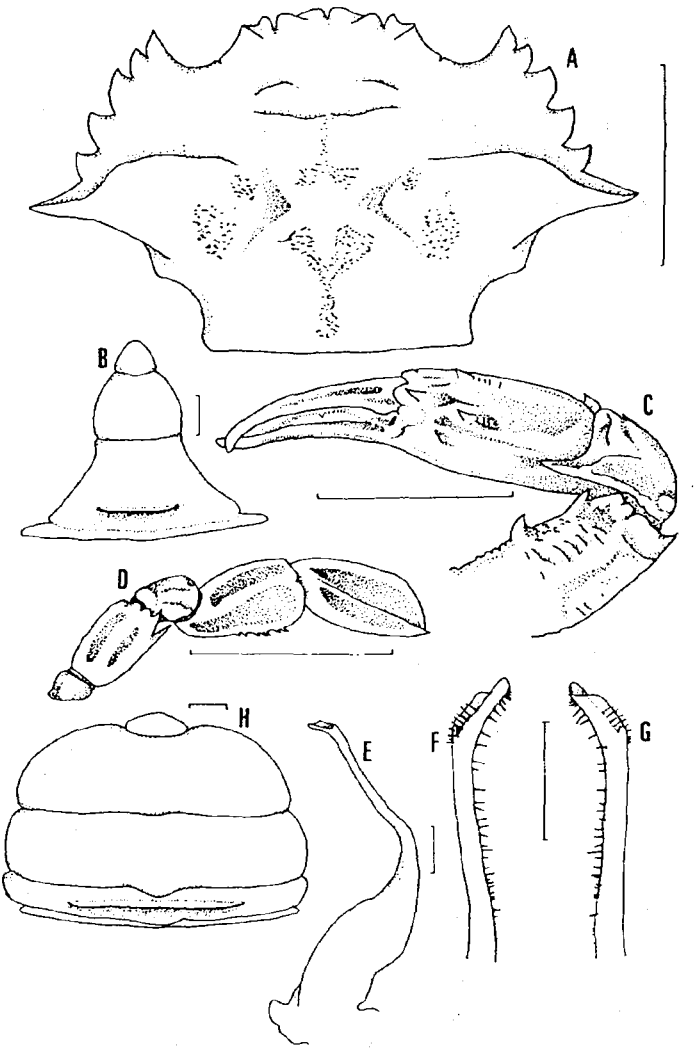


Fig. 26. *Charybdis vadorum* (Alcock, 1899). A-G - ZRC 1993.385, male, 18.7 by 30.7 mm; H - ZRC, Malaysia, female, 17.4 by 29.0 mm. A, carapace dorsal surface; B, male abdomen; C, right cheliped; D, right natatory leg; E, left G1, abdominal surface; F, apex of left G1, abdominal surface; G, apex of left G1, sternal surface; H, female abdomen. Scales: A, C, D = 10.0 mm, B, E-H = 1.0 mm.

localities were mixed up in one bottle, and the task of selecting one specimen as the type was not possible. Chopra (1935) also concluded that *Charybdis (Goniohellenus) sinensis* Gordon, 1930, is a synonym of this species. *Charybdis philippinensis* Ward (1941) resembles this species in general facies but its status remains uncertain until the types are re-examined (Stephenson, 1972). On the other hand, Leene (1938) suggested that Paulson's (1875) specimen of *Archias sexdentatus* be made a synonym of this species.

Charybdis (Goniosupradens) acutifrons (De Man, 1879)
(Fig. 27A-E)

Goniosoma acutifrons De Man, 1879: 60; De Man, 1883: 152.
Charybdis acutifrons - Leene, 1936: 121, figs. 6-10.
Charybdis (Goniosupradens) acutifrons - Leene, 1938: 138, figs. 81-84; Stephenson, 1972: 36; Sakai, 1976: 365, fig. 193.
Charybdis (Goniosoma) erythrodactyla - Delsman & De Man, 1925: 311, pl. 15a; De Man, 1929: 7.

Material examined. - None.

Size. - The male holotype specimen from Timor (RMNH) measures 21.0 by 60.0 mm (Leene, 1938).

Diagnosis. - Carapace densely pilose; all carapace ridges present, faintly granular; six frontal teeth, subequal sharp and with curving sides, medians separated from submedians by V-shaped notch, laterals projecting beyond rest, separated from submedians by deeper notch; inner supraorbital lobe acutely triangular, inner infraorbital lobe denticulate and acute; seven anterolateral teeth, second and fourth rudimentary, last smallest and narrowest. Merus of third maxillipeds with outer distal angle not produced. Basal antennal segment bearing two sharp spines. Chelipeds finely pilose; anterior border of merus with three spines and a spinule at distal end; carpus with strong spine on inner angle and three spinules at outer angle; manus with five spines on upper surface, outer surface three costae, inner surface with median costa, lower surface smooth; fingers longer than manus. Propodus of natatory leg serrated on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders parallel then converging distally. G1 with curved narrow neck, distal tip slender and elongate, inner border with dense clump of bristles at proximal end of lip, outer border with bristles starting at tip and terminating at distal half of the G1 (adapted from Leene, 1936).

Colour. - Dark olive green carapace with a large round red blot on the branchial regions; chelipeds pale flesh colour; fingers at proximal half purple red, distal half and the teeth black; spines reddish at base; legs reddish covered with red dots (fide Delsman & De Man, 1929).

Habitat. - Inhabits bottoms of rock or coral reefs at 10-30 meters in depth (fide Sakai, 1976)

Distribution. - Tanzania, Malaysia, East Sumatra, Bay of Batavia, Timor, Moluccas and Solomon Islands (fide Stephenson, 1972). This species was first recorded in Malaysia by De Man (1929) from Pulau Berhala (Straits of Malacca).

Remarks. - This species is close to *Charybdis (Goniosupradens) erythrodactyla* (Lamarck, 1818), but differs in the characters as listed by Leene (1938: 140). It also differs from *C.(G.)*

obtusifrons in this same grouping, by having an acute and sharply triangular frontal lobes instead of truncate lobes. The basal antennal segment of the present species bears two large spines instead of granules. The G1 of both species however, are similar in their general appearances.

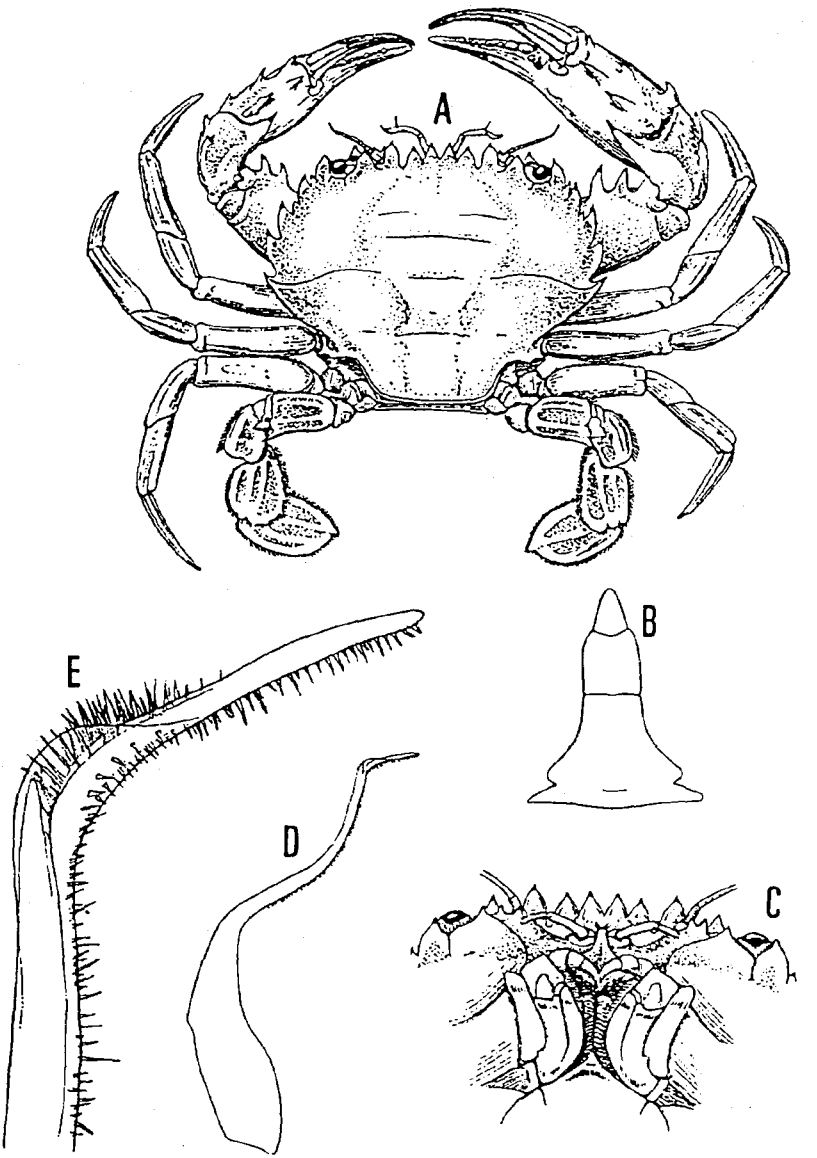


Fig. 27. *Charybdis acutifrons* (De Man, 1879). A-E - Timor, holotype male, 21.0 by 60.0 mm (after Leene, 1938). A, dorsal view; B, male abdomen; C, front ventral surface; D, left G1, abdominal surface; E, apex of left G1 abdominal surface.

Charybdis (Goniosupradens) obtusifrons Leene, 1936
(Fig. 28A-E)

Charybdis obtusifrons Leene, 1936: 124, figs. 11, 12; Sakai, 1939: 409, pl. 83, fig. 3.
Charybdis (Goniosupradens) obtusifrons - Leene, 1938: 140, figs. 85-87; Crosnier, 1962: 84, figs. 146a-c, pl. 6, fig. 2; Stephenson & Rees, 1967a:13; McNeill, 1968: 53; Stephenson, 1972: 36; Sakai, 1976: 365, pl. 129, fig. 1; Dai et al., 1986: 220, pl. 29(6), fig. 131(1); Dai & Yang, 1991: 240, pl. 29(6), fig. 131(1).
Goniosoma erythrodactylum - De Man, 1883: 152.

Material examined. - None.

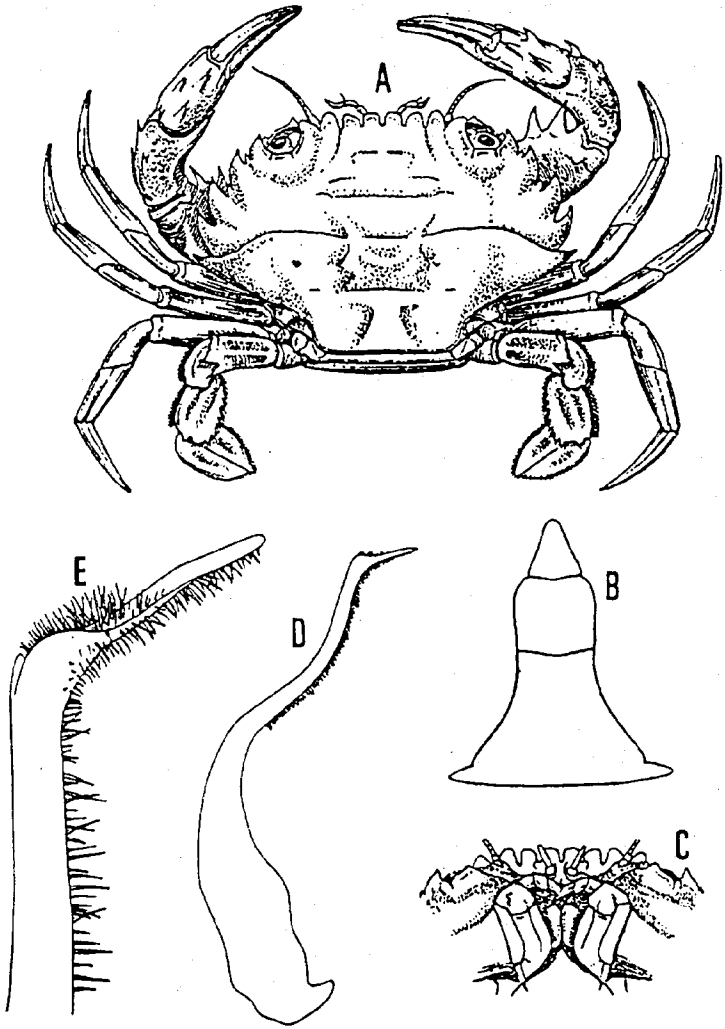


Fig. 28. *Charybdis obtusifrons* Leene, 1936. A, C - Djeddah, female, 21.0 by 32.5 mm; B - Tahiti, male, 38.0 by 58.0 mm (after Leene, 1938); D-E - Madagascar, male, 39.0 by 61.0 mm (after Crosnier, 1962). A, dorsal view; B, male abdomen; C, front ventral surface; D, left G1 abdominal surface; E, apex of left G1 abdominal surface.

Size. - The female type specimen (type locality: Djeddah) measures 21.0 by 32.5 mm, is deposited in RMNH (Leene, 1938).

Diagnosis. - Carapace pilose; all carapace ridges present and granular; six frontal teeth, medians truncate, submedians with anterior edges sloping outwards, laterals with tip bluntly round, separated from submedians by deeper V-shaped notch; inner supraorbital lobe arched, inner infraorbital angle tooth like; seven anterolateral teeth, second and fourth rudimentary, last spiniform, projecting laterally. Basal antennal segment bearing granular ridge. Chelipeds pilose; anterior border of merus with three spines, posterior border granular; carpus with strong spine on inner angle and three spinules at outer angle; manus with five spines on upper surface, outer surface three smooth costae, inner surface with median costa; fingers longer than manus. Propodus of natatory leg serrated on posterior border; merus with spine on posterior border. Penultimate segment of male abdomen with lateral borders parallel then converging distally. G1 with curved narrow neck, distal tip slender and elongate, inner border with dense clump of bristles at proximal end of lip, outer border with bristles starting at tip and terminating at distal half of the G1 (adapted from Leene, 1936).

Colour. - Not known.

Habitat. - This species is found in shallow waters on coral reef (fide Dai et al., 1986; Dai & Yang, 1991).

Distribution. - Madagascar, Red Sea, India, China, Japan, Malaysia, Australia and Melanesia (Crosnier, 1962; Stephenson & Rees, 1967a; Dai et al., 1986; Dai & Yang, 1991). This species was recorded from Malaysia by Dai et al. (1986).

Remarks. - Refer to the remarks of the previous species for comparison with this species.

Genus *Thalamita* Latreille, 1829

Thalamita Latreille, 1829: 33; A. Milne Edwards, 1861: 354; Miers, 1886: 193; Alcock, 1899: 72; Barnard, 1950: 171; Stephenson & Hudson, 1957: 314; Crosnier, 1962: 93.

Type species. - *Cancer admete* Herbst, 1803, by monotypy.

Diagnosis. - Carapace broader than long; ridges distinct; front cut in two, four or six lobes, excluding broad inner supraorbital lobes; upper orbital border two fissures; posterolaterals form an even curve with posterior border; five anterolateral teeth, in a small minority first tooth bears a small subsidiary tooth. Basal antennal segment broad, excluding flagellum from orbital hiatus, ornamentations on crest range from smooth, granular, tuberculate to spiny. Chelipeds unequal; merus typically with three spines; carpus with large spine on inner angle and three spines on outer angle; manus with spines on upper surface, and one proximal spine near wrist articulation, outer suface costate; fingers grooved. Ambulatory legs compressed; merus of natatory leg with strong spine at posterior border, dactylus and propodus foliaceous, propodus generally with small spinules. Ultimate segment of male abdomen triangular, third to fifth segment fused. G1 tubular.

Remarks. - In this region, there are 17 species in this genus, of which two new species and one new record were found.

Thalamita admete (Herbst, 1803)
(Fig. 29A-F)

Cancer admete Herbst, 1803: 40, pl. 57, fig. 1.
Thalamita admete - Calman, 1900: 23; Stimpson, 1907: 83; Sakai, 1939: 421, pl. 85, fig. 1; Sakai, 1976: 377, pl. 130, fig. 2; Barnard, 1950: 176, fig. 33c; Edmondson, 1954: 255, figs. 30a, b, 31a-e; Stephenson & Hudson, 1957: 320, figs. 2I, 3I, pl. 1, fig. 1, pl. 7A, 10A; Stephenson, 1961: 117; Stephenson, 1972: 141; 1975:188; Stephenson, 1976: 19; Forest & Guinot, 1961: 30, figs. 19a, b; Crosnier, 1962: 96, figs. 154, 157, 162-164, 168; Ow-Yang, 1963: 99, pl. 21, fig. A-F; Stephenson & Rees, 1967a: 18, Stephenson & Rees, 1967b: 56, fig. 20; McNeill, 1968: 51; Heath, 1973: 14, figs. 9a, 11b, d; Takeda & Nunomura, 1976: 68; Yang et al., 1979: 85, fig. 11; Lovett, 1981: 130, figs. 294a-d; Dai et al., 1986: 235, pl. 31(6), fig. 139(1); Dai & Yang, 1991: 256, pl. 31(6), fig. 139(1).
Thalamita admeta - Alcock, 1899: 82; Tweedie, 1950: 84, fig. 2b.
Thalamita admeta var. *admete* - Borradaile, 1903: 202.
?Thalamita admeta var. *edwardsi* - Borradaile, 1900: 579.

(non *Thalamita Savignyi* A. Milne Edwards, 1861: 357; *Thalamita admeta* var. *C Savignyi* - Borradaile, 1903: 202; *Thalamita admeta* var. *Savigny* - Nobili, 1906:202; *Thalamita admete* var. *Savignyi* - Laurie, 1915: 440; *Thalamita admeta* var. D *granosimana* Borradaile, 1903: 202; *Thalamita admete* var.*E intermedia* Borradaile, 1903: 203; *Thalamita admeta* var. *F quadrilobata* - Borradaile, 1903: 203)

Material examined. - SINGAPORE - 1 female (ZRC), Labrador Beach, coll. 19 Aug.1993.

PENINSULAR MALAYSIA - 1 female (ZRC 1985.1610), Batu Pahat, Johor, coll. P. Ng, 8 May.1985. — 23 males, 11 females (ZRC 1965.10.22.14.23), Pulau Aor, Pahang, coll. M.W.F. Tweedie, Jun.1938. — 9 males, 3 females (ZRC 1965.10.22.14-23), Pulau Aor, Pahang, coll. M.W.F. Tweedie, Jun.1938. — 1 male (ZRC1965.10.22.24), Telok Berhala, Pulau Aor, Pahang, coll. N.S, May.1927. — 2 males (ZRC 1985.1000-1001), Telok Berhala, Pulau Aor, Pahang. — 1 female (ZRC 1987.573), Pulau Tioman, Pahang, coll. P. Ng, 29 Jun.1986.

Size. - The largest specimen is a male measuring 18.2 by 31.4 mm (ZRC 1985.1000).

Diagnosis. - Carapace finely pilose, broader than long; all anterior carapace ridges present, cardiac and mesobranchial ridges less granular; two frontal lobes separated by a distinct notch, anterior border with square cut profile; inner supraorbital lobes as broad and slightly arched; five anterolateral teeth, fourth tooth rudimentary. Basal antennal segment with granulated ridge. Chelipeds unequal; merus with three to four spines on anterior border, granulated posterior border; carpus with four usual spines; upper surface of manus granulated and pilose, bearing six spines, distal two reduced to tubercles, outer surface with three costae, decreasing in degree of granulations from upper most to lowest costae, inner to lower surface smooth; fingers short and stumpy. Propodus of natatory leg with five to eight spines on posterior border. Penultimate segment of male abdomen with parallel lateral borders. G1 evenly curved and bilobed at tip, inner lobe slightly larger than outer lobe, inner border bearing four to nine terminal bristles, outer border bearing row of 15-22 terminal bristles, all backwardly directed.

Colour. - Carapace with reddish brown patches; brown and cream bandings on legs and fingers of chelipeds.

Habitat. - Tha habitat of *T. admete* include rocky shores and reef flats within the intertidal zones.

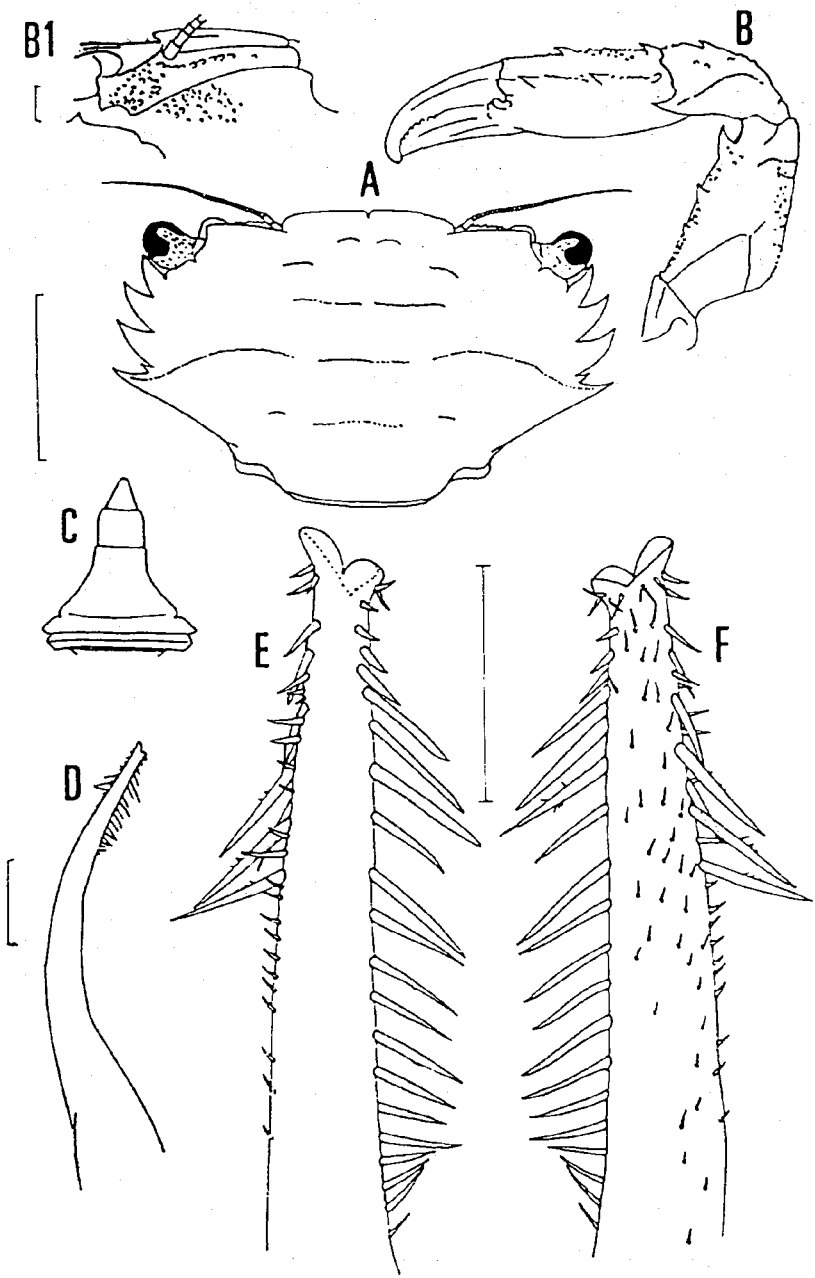


Fig. 29. *Thalamita admete* (Herbst, 1803), sensu lato. A-C, B1 - ZRC 1965.10.22.14.23, male, 18.2 by 31.5 mm; E-F - ZRC 1965.10.22.14.23, male, 16.3 by 28.0 mm (after Ow-Yang, 1963). A, carapace dorsal surface; B, right cheliped; B1, left basal antennal segment; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface. Scales: A-C = 10.0 mm, B1 = 1.0 mm, D = 1.0 mm, E-F = 0.5 mm.

Distribution. - East Africa, Red Sea, Indian Ocean, Malaysia, China, Japan, Australia, Tahiti and Hawaii (fide Dai et al., 1986; Dai & Yang, 1991). This species was first recorded from Malaysia by De Man (1929).

Remarks. - All the specimens examined in the present collection agrees with *T. admete* following the definition by Forest & Guinot (1961), especially with regards to the arrangement of the terminal bristles and distal lobes of the G1.

There has been much debate regarding the synonyms of this species, namely that of *T. savignyi* A. Milne Edwards, 1861, and the varieties of *T. admeta* by Borradaile (1900, 1903).

In the present collection, the inner surface of the manus of the cheliped is extremely smooth and without any granulations or ridges. This character is constant and differs from the strongly granulated manus of the same surface in *T. savignyi* A. Milne Edwards, 1861. There is no evidence to suggest that this character is variable, in contrast to that reported by Stephenson & Hudson (1957). Moreover, the species by A. Milne Edwards is from the Red Sea and has not been reliably recorded from elsewhere. *T. savignyi* should be regarded as a distinct species for the moment.

On the basis of a single male from Funafuti, Borradaile (1900) erected the name var. *edwardsi* for Alcock's *T. admeta* var (2), who in turn, cross-referred it to specimens identified to *'T. admeta'* by A. Milne Edwards (1861). Alcock noted that the smooth ridges on the outer surface of the manus is insignificant as a character used to differentiate A. Milne Edward's specimen from the *T. admete* of Herbst. Thus the identity of A. Milne Edward's specimen needs to be reconfirmed. No holotype has been designated for *T. edwardsi*, therefore the specimens of all the three workers remain as syntypes. In any event they must all be re-examined, to see if they are indeed distinct from *T. admete* sensu stricto, and/or if they are one species.

Thalamita admeta var. *granosimana* proved to be a distinct species from *T. admete*. Aside from the characters noted by Borradaile (1903), Crosnier (1962) in redescribing this species, listed other differences between this variety and that of *T. admete*. The G1 of *T. granosimana* has a slightly recurved, spoon-shaped tip with fewer terminal bristles, the ultimate segment of the male abdomen is narrower and acutely triangular and the cardiac ridge is widely separated.

The identity of *Thalamita admete* var. *intermedia* Borradaile, 1903, is more problematic. Borradaile (1903), had several specimens from the Maldives resembling *T. admete* in general facies. However, two groups of specimens differed from the latter in having spines on the basal antennal segment, for which he gave the name *T. admeta* var. *intermedia* for one group of specimens with a two-lobed front, and the name *T. admeta* var. *quadrilobata* for the other with a four-lobed front. The name *Thalamita admete* var. *intermedia* Borradaile, 1903, however, is preoccupied by *T. intermedia* Miers, 1886. Stephenson & Hudson (1957) saw no need for a new name because they regarded Borradaile's var. *intermedia* as a junior synonym of *T. quadrilobata* Miers, 1884. They reasoned that "..... by the distinct difference in the basal antennal joint and first male pleopods. These are sufficiently significant to remove Borradaile's *T. admeta* var.*intermedia* well away from *T. admete* and is close to the present species *(T. quadrilobata)*" (Stephenson & Hudson, 1957: 350). However, no discussion or illustrations were made with regards to the differences in the G1 of var. *intermedia* and *T. quadrilobata*. Moreover, the frontal lobes of var. *intermedia* illustrated by De Man (1926:

pl 1 fig 2) are less protruding than the frontal lobes of *T. quadrilobata* (cf. Miers, 1884: pl VIII fig B; Stephenson & Hudson, 1957: pl 4 fig 4). De Man also noted that the fourth anterolateral tooth of var. *intermedia* is small and "only half as long as the third", unlike the larger fourth anterolateral tooth in *T. quadrilobata*. The type specimens of var. *intermedia* from the Maldives (CMZ Reg. 20.6.1900; coll. J.S. Gardiner) were re-examined for us by Ray Symonds of the CMZ. On the basis of his notes and figure, var. *intermedia* differs clearly from *T. quadrilobata* in having a less protruding and broader frontal lobes and a much smaller fourth anterolateral tooth. The synonymy made by Stephenson & Hudson (1957) is thus rather unlikely, and because "*T. admeta* var. *intermedia*" is distinct from *T. admete* s. str. in having three spines on the basal antennal segment, we now propose that Borradaile's *Thalamita admete* var. *intermedia* be given a replacement name - *Thalamita borradailei.* Finally, the specimens referred to *T. admeta* var. *quadrilobata* Miers by Borradaile (1903), should be re-examined as *T. quadrilobata* s. str. possesses two frontal lobes and not four.

Thalamita cerasma, new species
(Figs. 30A-C, 31A-C, 32A-G)

Material examined. - Holotype - male, 39.3 by 61.0 mm (ZRC 1993.7201), Tuas, Singapore, coll. H.K. Voris, 10 Mar.1981.

Description. - Carapace convex and smooth. All carapace ridges finely granular. Frontal ridges straight, closely set and faintly visible. Protogastrics arched, mesogastric ridge straight. The later not interrupted in the mid line. Epibranchial curving gradually forwards from last anterolateral tooth to level above the penultimate tooth. Separated by faintly visible metagastric ridge. No posterior carapace ridges.

Front straight and cut into six lobes. Medians closely set and lying on a lower plane, separated by a short incision. Submedians broadest with inner edge slightly overlapping medians, separated from the latter by a shallow notch. Lateral lobes narrowest with rounded anterior borders and separated from submedians by a V-shaped notch. Supraorbital border divided into three lobes by two lateral incisions. Inner supraorbital lobes arched, less than combined width of submedians and laterals. Inner infraorbital border denticulate, terminating in an acute angle, visible from dorsal surface. Five anterolateral teeth, increasing in size from first to third, fourth and fifth subequal and smaller than first three teeth. Fifth tooth slightly stouter than fourth. All spines ending in a sharp black tip.

Basal antennal segment much wider than major diameter of orbit, bears a crest composed of a row of two to three sharp spines and several tubercles. Ventral border of epistomal ridge straight aside from the median V-shaped ridge.

Chelipeds unequal and swollen in larger cheliped. Anterior border of merus bears three sharp spines, with granules set in between. Two larger spines closely set, nearer to distal end and a smaller third closer to proximal end. Two additional spines near wrist on the dorsal and ventral anterior border respectively.Posterior border with minute granules on proximal half. Carpus bears a granulated costae ending in a strong stout spine at the inner angle, three spines on the outer surface of which the lower most bears a finely granular but distinct costa running backwards. Few minute granules on upper surface near anterior border. Manus bears five spines on upper surface. Two on inner border, distal most a distance away from finger joint. Two spines on the outer border, and the usual spine at the wrist articulation. Granulations confined to upper surface between the two rows of spines. Granules increasing in size towards

proximal end, resulting in spiniform tubercles arising from the ridge of the last spine on the inner border. Outer surface bears a single smooth costa running to immovable finger. Rest of surface of the manus smooth and polished. Fingers of larger cheliped stout and blunt, and of the smaller cheliped, straight and slender. All fingers deeply grooved except for lower surface of immovable fingers.

Propodus and dactylus of ambulatory legs deeply grooved on the anterior and posterior borders. Merus of natatory leg with spine at posterodistal angle in front of the usual spine at end of posterior border. Posterior border of propodus finely serrated.

Sternum and abdominal surface smooth. Penultimate segment of the male abdomen broader than long, lateral borders parallel for proximal half and then slanting gently inwards towards distal end. Ultimate segment obtusely triangular, as broad as long.

G1 stout, gradually curved near distal end to a blunt, oblique tip. Sternal surface bearing cluster of long terminal bristles at the tip, several irregular and widely spaced bristles extends downwards along curvature. Abdominal surface bears a row of irregularly spaced bristles starting near proximal end of lip and terminating before curve straightens out. Adjacent to this row, on the inner surface, are two rows of irregular but closely spaced bristles spanning the same distance as the former. Basal lobe truncate with a straight lateral border.

Colour. - Not known.

Etymology. - The name *cerasma* means mixture in Latin, it alludes to a combination of characters between two other species, namely *T. crenata* and *T. prymna*.

Habitat. - Not known.

Distribution. - Only specimen known from Singapore.

Remarks. - The specimen is quite aged as the dactylus of the ambulatory legs and the teeth on the cheliped fingers have been badly worn. Much of the hairs along the borders of the propodus and dactylus of all the legs are lost. The left natatory leg is absent. In addition, this specimen was covered with keel worms and stalked barnacles.

In general facies, *Thalamita cerasma* resembles *T. crenata* because of the faint carapace ridges and the single costa on the lower surface of the chelipeds. On the other hand, *T. cerasma* resembles *T. prymna in* several other characters. *Thalamita cerasma* bears conspicuous spines on the basal antennal segment unlike the granular crest seen in *T. crenata*. Granules on the upper surface of the manus, a small fourth anterolateral tooth, larger submedian frontal lobes and a straight ventral border of the epistomal ridge instead of a sinuous one, clearly separates it from that of *T. crenata*. Moreover the general shape of the G1 and abdominal segments are closer to the *T. prymna* group.

Thalamita cerasma however, also differs from *T. prymna*. The distinctly granular and strongly raised carapace ridges of *T. prymna* are absent. There are no lateral ridges running from the mesogastric to the first and second anterolateral teeth. Moreover the degree of granulations on the upper surface of the manus is more pronounced in *T. prymna*, whilst the two granular costae on the lower outer surface of the manus is replaced by that of a single smooth ridge running to the immovable finger in *T. cerasma*. The fourth anterolateral tooth of the latter is larger than the rudimentary fourth in similar sized specimens of *T. prymna*.

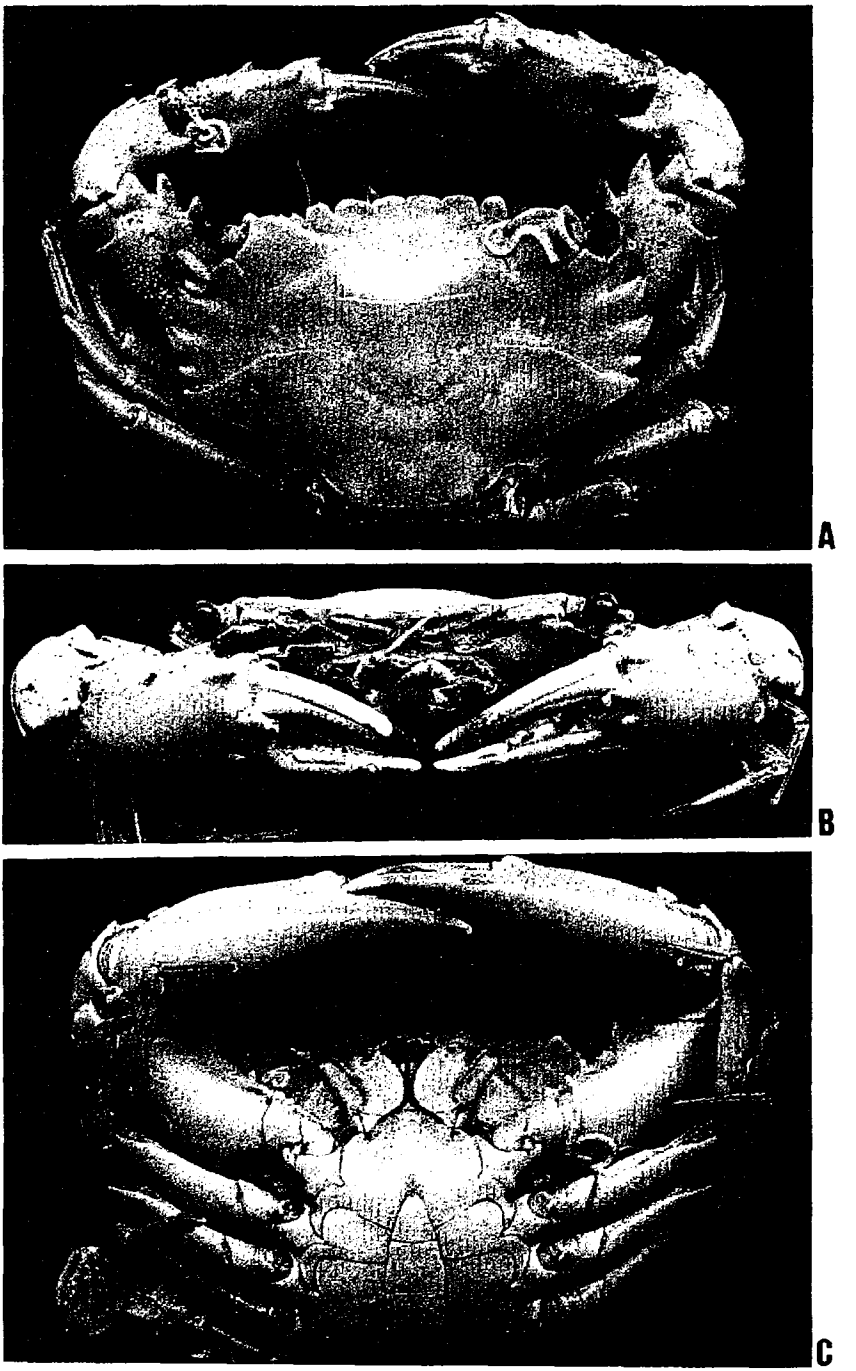


Fig. 30. *Thalamita cerasma*, new species. ZRC 1993.7201, holotype male, 39.3 by 61.0 mm. A, dorsal view; B, frontal view; C, ventral view.

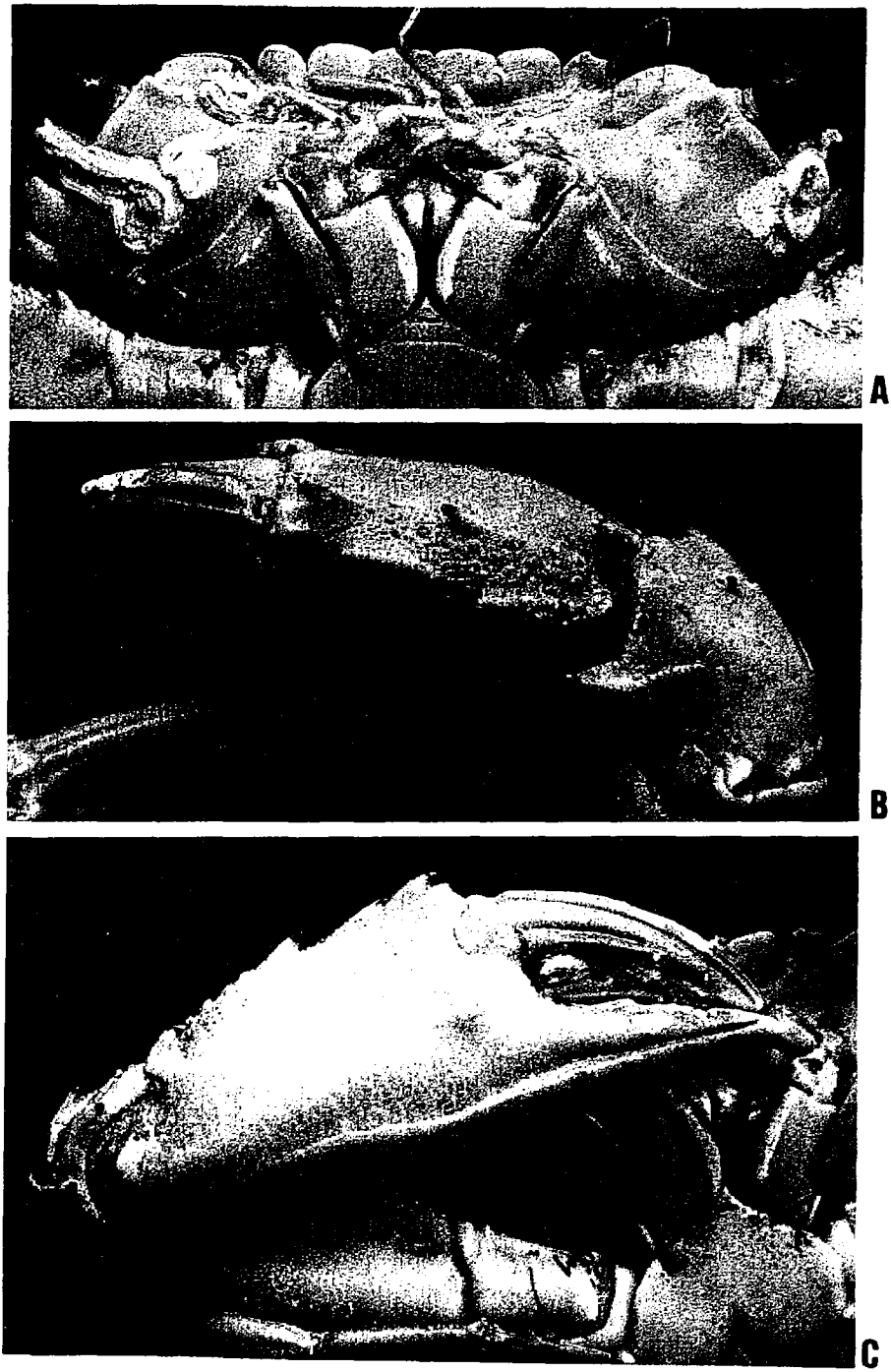


Fig. 31. *Thalamita cerasma*, new species. ZRC 1993.7201, holotype male, 39.3 by 61.0 mm. A, ventral view of front; B, upper surface of cheliped manus; C, outer surface cheliped manus.

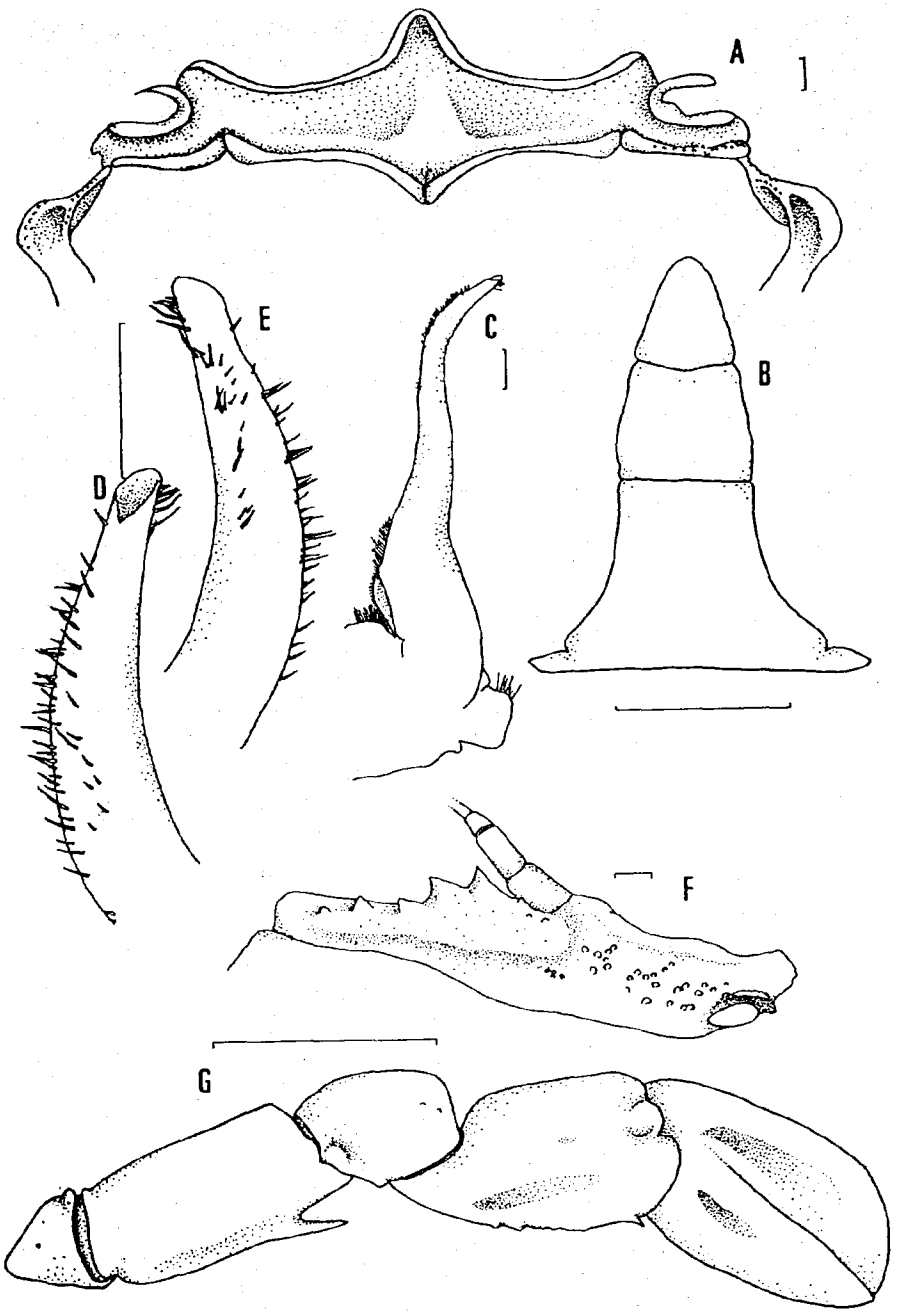


Fig. 32. *Thalamita cerasma*, new species. A-G - ZRC 1993.7201, holotype male, 39.3 by 61.0 mm. A, epistome; B, male abdomen; C, left G1 abdominal surface; D, apex of left G1 abdominal surface; E, apex of left G1 sternal surface; F, right basal antennal segment; G, right natatory leg. Scales: A, C-F = 1.0 mm, B, G = 10.0 mm.

The ultimate segment of the male abdomen of *T. prymna* is longer than broad and acutely triangular. *T. cerasma* however, possesses a relatively broader ultimate segment. The G1 differs distinctly in the lateral border of the basal lobe and in the terminal armatures. On the sternal surface, both bear a cluster of long bristles at the tip, but only *T. prymna* possesses two or more small conical spines.The abdominal to inner surface of the G1 in *T. prymna* is almost bare aside from the sparsely spaced, minute spinules. On the other hand, these surfaces are covered with conspicuous rows of bristles near the terminal end of the G1 in *T. cerasma*. The basal lobes show a concave lateral border in *T. prymna* but straight in the other.

Thalamita chaptali (Audouin & Savigny, 1825)
(Fig. 33A-F)

Portunus chaptali Audouin & Savigny, 1825: 83, pl. 4, fig. 1.
Thalamita chaptali - A. Milne Edwards, 1861: 360; Alcock, 1899: 80; Rathbun, 1910: 365, fig. 44; Stephenson & Hudson, 1957: 327, figs. 2F, 3F, pl. 1, figs. 3, pl. 7C, 10B; Crosnier, 1962: 111, figs. 184, 189, 191; Stephenson & Rees, 1967a: 64; Stephenson, 1972: 45; Dai et al., 1986: 238, pl. 32(3), fig. 140(2); Dai & Yang, 1991: 258, pl. 32(3), fig. 104A(2).

Material examined. - PENINSULAR MALAYSIA - 1 male, 1 female (ZRC 1993.7467-7468), Juara Bay, Pulau Tioman, Pahang, coll. P.K.L. Ng, 26 Jun.1985.

Size. - The male specimen (ZRC 1993.7467) is the larger measuring 8.0 by 11.7 mm. However both specimens were too small for a detailed description to be made.

Diagnosis. - Carapace sparsely pilose; all anterior ridges present including pair of mesobranchials, metagastric widely separated, cardiac ridge absent; two frontal lobes separated by faint notch; inner orbital lobes arched and about half breadth of frontal lobe; five anterolateral teeth, first three broad and square cut, fourth smallest, fifth sharpest and most protruding. Basal antennal segment bearing elevated minutely granular crest. Chelipeds unequal; merus with three spines on anterior border; carpus with strong spine on inner angle and usual three spines on outer surface; manus with five blunt spines on upper surface, distal two reduced to tubercles, outer surface smooth bearing single costae running to immovable finger, inner surface smooth; fingers stout and sharp. Propodus of natatory leg smooth along posterior border. Penultimate segment of male abdomen with lateral borders more or less parallel, ultimate segment triangular with borders slightly concave. G1 with distal tip strongly recurved, inner surface bearing long bristles along curved tip, outer surface with fewer bristles at proximal end of curve.

Colour. - The specimens were an overall dirty white with very small, scattered darker flecks.

Habitat. - In crevices of coral reef or sandy stony bottoms of 5-40 m in depth (fide Dai et al., 1986; Dai & Yang, 1991).

Distribution. - Red sea, India, Sri Lanka, China, Thailand, now Malaysia and Australia (fide Dai et al., 1986; Dai & Yang, 1991). This species is a new record for Malaysia.

Remarks. - Both specimens were small, the identification is based upon that of Stephenson & Hudson (1957). This species is difficult to distinguish from *Thalamita parvidens* (Rathbun, 1907). However, it can clearly be separated from it by a single costa on the cheliped manus and the absence of a cardiac ridge.

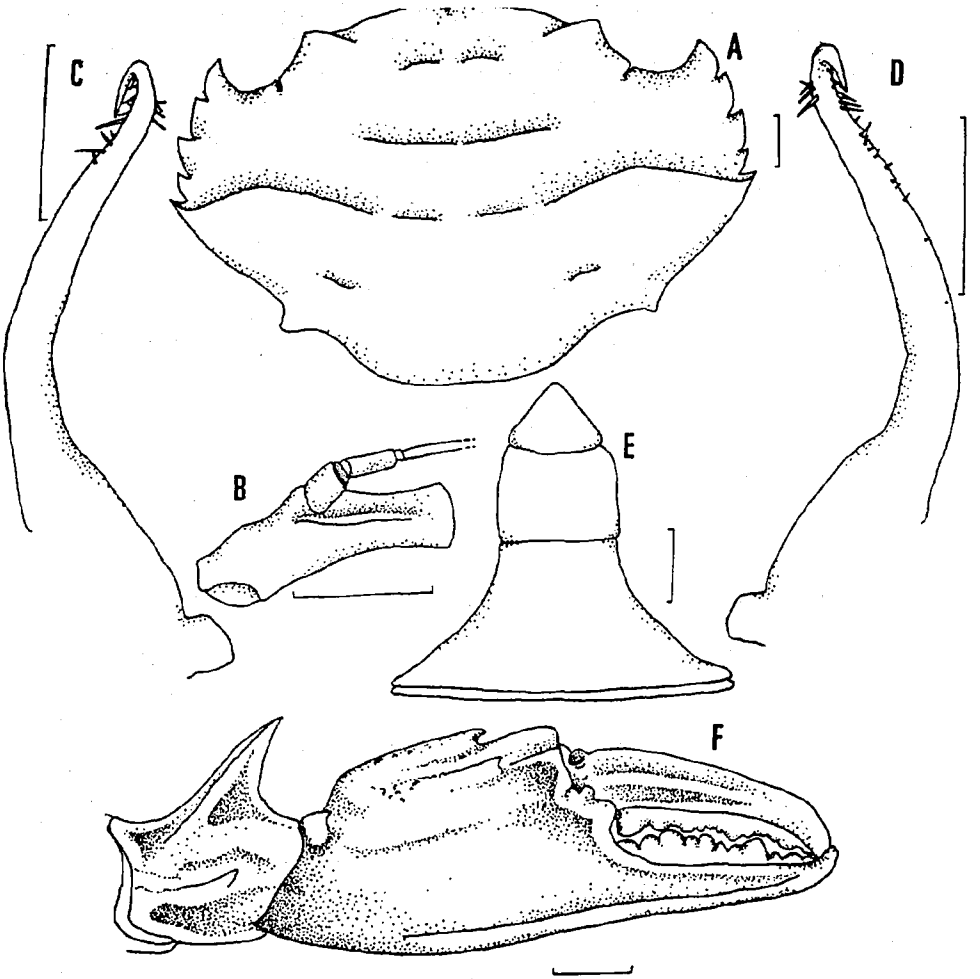


Fig. 33. *Thalamita chaptali* (Rathbun, 1907). A-F - ZRC, Juara Bay, Pulau Tioman, male, 8.0 by 11.7 mm. A, carapace dorsal surface; B, left basal antennal segment; C, left G1 abdominal surface; D, left G1 sternal surface; E, male abdomen; F, right cheliped outer surface. Scales: A-F = 1.0 mm.

Thalamita crenata (Latreille, 1829)
(Figs. 34A, B, 35 A, B, 36A-H)

Portunus crenatus Latreille, 1829, vide H. Milne Edwards, 1834: 463.
Thalamita crenata - Miers, 1884: 232; De Man, 1888: 79; De Man, 1895: 569; Alcock, 1899: 76; Lanchester, 1900: 748; Stimpson, 1907: 84, pl. 10, fig. 6a; Rathbun, 1910: 365; Balss, 1922: 111; Delsman & De Man, 1925: 313, pl. 14a; Sakai, 1939: 413, pl. 84, fig. 3; Sakai, 1976: 369, pl. 132, fig. 1; Shen, 1937: 129, figs. 16a-d; Barnard, 1950: 172, figs. 27a, 33a; Edmondson, 1954: 267, fig. 39b, 40a-f; Stephenson & Hudson, 1957: 332, figs. 2Q, 3Q, pl. 2, fig. 3, pls. 7F, 9C; Crosnier, 1962: 130, figs. 220, 226, 227, 232, 233; Ow-Yang, 1963: 105, pl. 22, figs. A-F, B1; Stephenson & Rees, 1967a: 66, Stephenson & Rees, 1967b: 19; Stephenson, 1972: 145; Stephenson, 1975: 190; Takeda & Shimazaki, 1974: 53; Moosa, 1980: 72, fig. 6C; Lovett, 1981: 128, figs. 287a-d; Dai et al., 1986: 225, pl. 30(3), fig. 134(1); Dai & Yang, 1991: 246, pl. 30(3), fig. 134(1).
Thalamita prymna var. *crenata* - Laurie, 1906: 418; Montgomery, 1931: 430; Stephensen, 1945: 125.

(non *Thalamita crenata* - Dana 1852: 282)

Material examined. - SINGAPORE - 1 male (ZRC 1965.10.22.28), Siglap, Jul.1934. — 1 female (ZRC 1977.7. 25.17), Changi, 1934. — 1 female (ZRC 1992.8379), Sentosa coral reef, coll. P.K.L. Ng. — 1 male (ZRC 1993.7233), Sentosa, 1991-1992. — 1 male (ZRC), Sentosa, 22 Oct.1985. — 2 males, 1 female (ZRC), Singapore Straits near Sentosa, coll. Lok, 30 Sep.1985. — 3 males, 8 females (ZRC 1993.6921-6932), Pulau Semakau, coll. R.E.S.T., 7 Sep.1993. — 4 males (ZRC 1993.6939-6943), Pulau Semakau, coll. R.E.S.T., 7 Sep.1993. — 3 males, 4 females (ZRC 1993.6956-6957), Pulau Semakau, coll. R.E.S.T., 7 Sep.1993. — 4 males, 1 female (ZRC 1965.10.22.29-33), Pulau Pisang, Dec.1930, Jan.1934. — 1 male (ZRC 1965.10.22.40), Pisang Island, coll. native collector, Jan.1934. — 1 female (ZRC 1965.10.22.39), Pulau Pawai, coll. M.W.F. Tweedie, Nov.1933. — 1 female (ZRC 1965.10.22.38), Sultan Shoal, coll. A. Monteiro, 27 Oct.1930. — 1 female (ZRC 1985.1025), Pulau Hantu, coll. D.S. Johnson, 21 Nov.1953, (det as T. prymna). — 1 male (ZRC 1985.1731), Pulau Hantu, coll. P.K.L. Ng, Mar.1985. — 2 female (ZRC 1985.1009-1010), Pulau Hantu, coll. D.S. Johnson, 4 Mar.1958. — 1 female (ZRC 1985.1913), Pulau Hantu, 1982. — 1 female juv. (ZRC 1965.10.22.34), Pulau Bukom, 3 Oct.1934. — 1 female (ZRC 1965.10.22.35), Pulau Senang, Nov.1934. — 1 male (ZRC 1965.10.22.46), coll. Dec.1935. — 1 male, 1 female (ZRC 1981.8.14.17-18), Pulau Sekudu, coll. C.M. Yang & H.K. Voris, 13 Feb.1981. — 1 female (ZRC 1981.7.24.15), Pulau Sekudu, coll. C.M. Yang, 13 Dec.1981. — 1 male (ZRC), Labrador Beach, coll. P. Ng, 10 Jan.1992. — 1 male (ZRC), Labrador Beach, coll. P.K.L. Ng, 21 Aug.1993. — 1 female (ZRC 1981.7.24.8), Pier at end of Ponggol, coll. H.K. Voris, 11 Feb.1981. — 1 female (ZRC 1985.1008), West Coast, 15 Jun.1961. — 2 females (ZRC), Jurong River, coll. D.S. Johnson, 23 Mar.1955. — 1 male (ZRC 1981.7.24.21), Tuas, coll. Lee, 28 Feb.1981. —2 females (ZRC 1981.7.24.22-23), Tuas, coll. Lee, Mar.1981. — 1 female (ZRC 1981.7.24.71), Tuas, coll. H.K. Voris, Apr.1981. — 3 females (ZRC 1981.8.14.48-50), Tuas, coll. H.K. Voris, 9 Mar.1981. — 1 female (ZRC 1981.8.14.114), Tuas, coll. H.K. Voris, Mar.1981. — 1 male, 1 female (ZRC 1981.7.24.188-189), Tuas, coll. H.K. Voris, May.1981. — 1 male, 1 female (ZRC), Tuas, 17 Sep.1985. — 1 female (ZRC), Singapore. — 1 male (ZRC 1985.1004), B52, coll. S.R.F.R.S.. — 1 male (ZRC 1985.1005), B26; coll. S.R.F.R.S.. — 1 male, 1 female (ZRC 1985.1002-1003), B56, coll. S.R.F.R.S.. — 2 females (ZRC 1985.1006-1007), B16, no other data.

PENINSULAR MALAYSIA - 1 male (ZRC), Stulang Laut Beach, Johor, coll. W.P. Chang, W.S. Chang & W.Y. Chang, 19 May.1991. — 2 males, 2 females (ZRC), Mersing Strip, Johor, coll. 15 Mar.1957. — 2 females (ZRC), Chendering, Kuala Trengganu, Trengganu, coll. 28 Apr.1967.

EAST MALAYSIA - 1 male, 1 female juv. (ZRC 1965.10.22.36-37), Labuan, coll. G. Nunong, 1938.

Size. - The largest specimen is a male measuring 52.0 by 80.0 mm (ZRC 1993.6939).

Diagnosis. - Carapace surface smooth, sparsely pilose; carapace ridges faintly distinct, none behind epibranchial ridges; six frontal lobes, broadly rounded, medians lying on a slightly lower plane, laterals narrowest; inner supraorbital lobe broad and arcuate; five anterolateral teeth subequal, decreasing slightly in size from front to rear. Basal antennal segment with

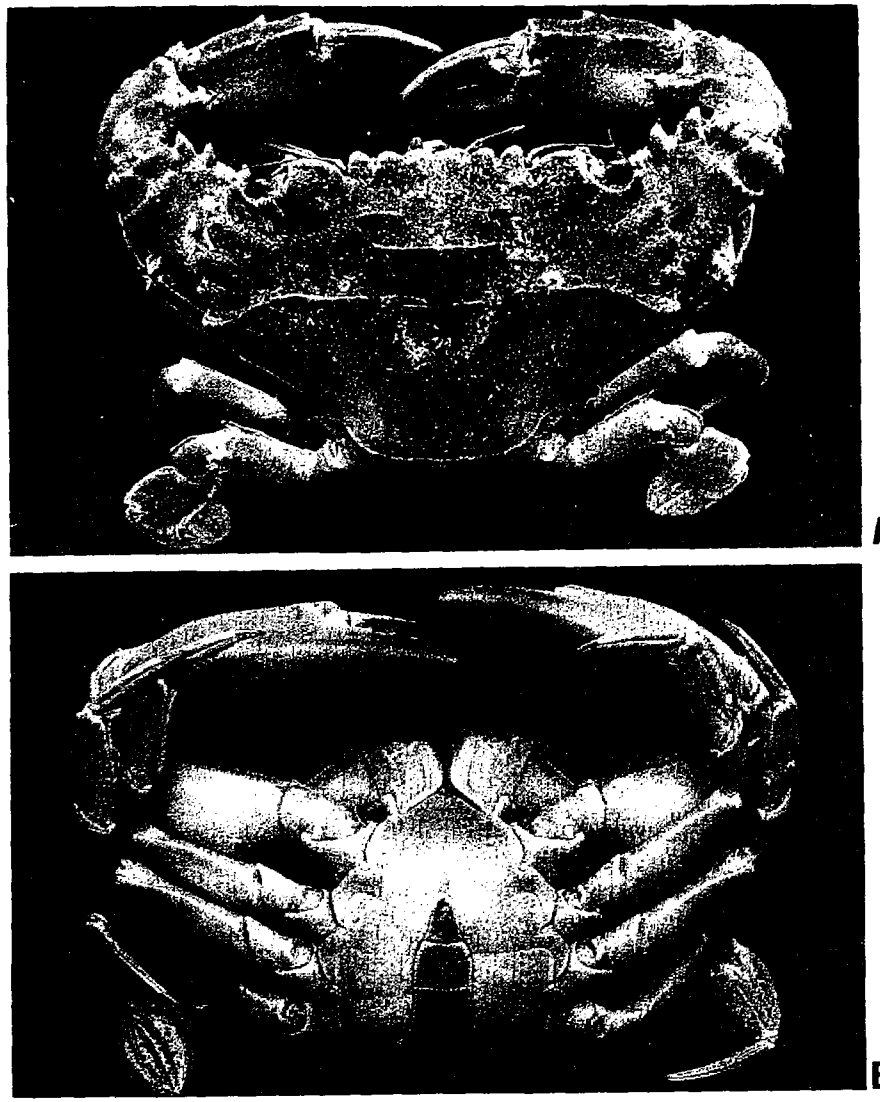


Fig. 34. *Thalamita crenata* (Latreille, 1829). ZRC 1992.8379, male, 42.3 by 63.5 mm. A, dorsal view; B, ventral view.

low granulated crest, the whole extent of segment greater than major diameter of orbit. Cheliped unequal; merus bearing three to four spines on anterior border; carpus armed with strong spine at inner angle and three spinules at outer angle; outer surface of manus smooth, bearing single crest running to tip of immovable finger, upper surface bearing five spines including spine at wrist articulation. Propodus of natatory leg with serrulations along distal half of posterior border. Penultimate segment of male abdomen with lateral borders slightly

Fig. 35. *Thalamita crenata* (Latreille, 1829). ZRC 1992.8379, male, 42.3 by 63.5 mm. A, ventral view of front; B, upper surface of cheliped manus.

convergent distally. G1 long, gradually tapering, evenly curved along distal portion, single row of bristles line inner border, terminal cluster of bristles on the sternal surface.

Colour. - The colouration of the dorsal surface is greenish brown, whilst its ventral surface is paler. The outer surface of the manus show a bluish tint with dark red fingers.

Habitat. - This species is found on rocky shores and reef flats of broken down corals within the intertidal zones.

Distribution. - South Africa, Madagascar, Red Sea, Persian Gulf, India, China, Malaysia, Singapore, Korea, Japan, Australia, Tuamotu, Tonga, Hawaii (fide Dai et al., 1986; Dai & Yang, 1991; Stephenson, 1972). This species is first recorded from Malaysia and Singapore by De Man (1895) and Lanchester (1900) respectively.

Remarks. - This species is characteristically identified by the massive, smooth cheliped, with only a single costae on the lower outer surface of the manus. Dana's (1852) description seems to indicate that his specimen has more than one costae on the manus unlike *T. crenata.* Takeda & Shimazaki (1974) noted that Dana's specimen is in fact *T. danae.* The 'plasticity' in the frontal and anterolateral teeth have previously been observed by Lanchester (1900) and Stephenson & Rees (1967). A specimen measuring 41 by 62 mm (ZRC 1993.7233), show fused first and second anterolateral teeth such that only four teeth are noticable on the left anterolateral border of the carapace.

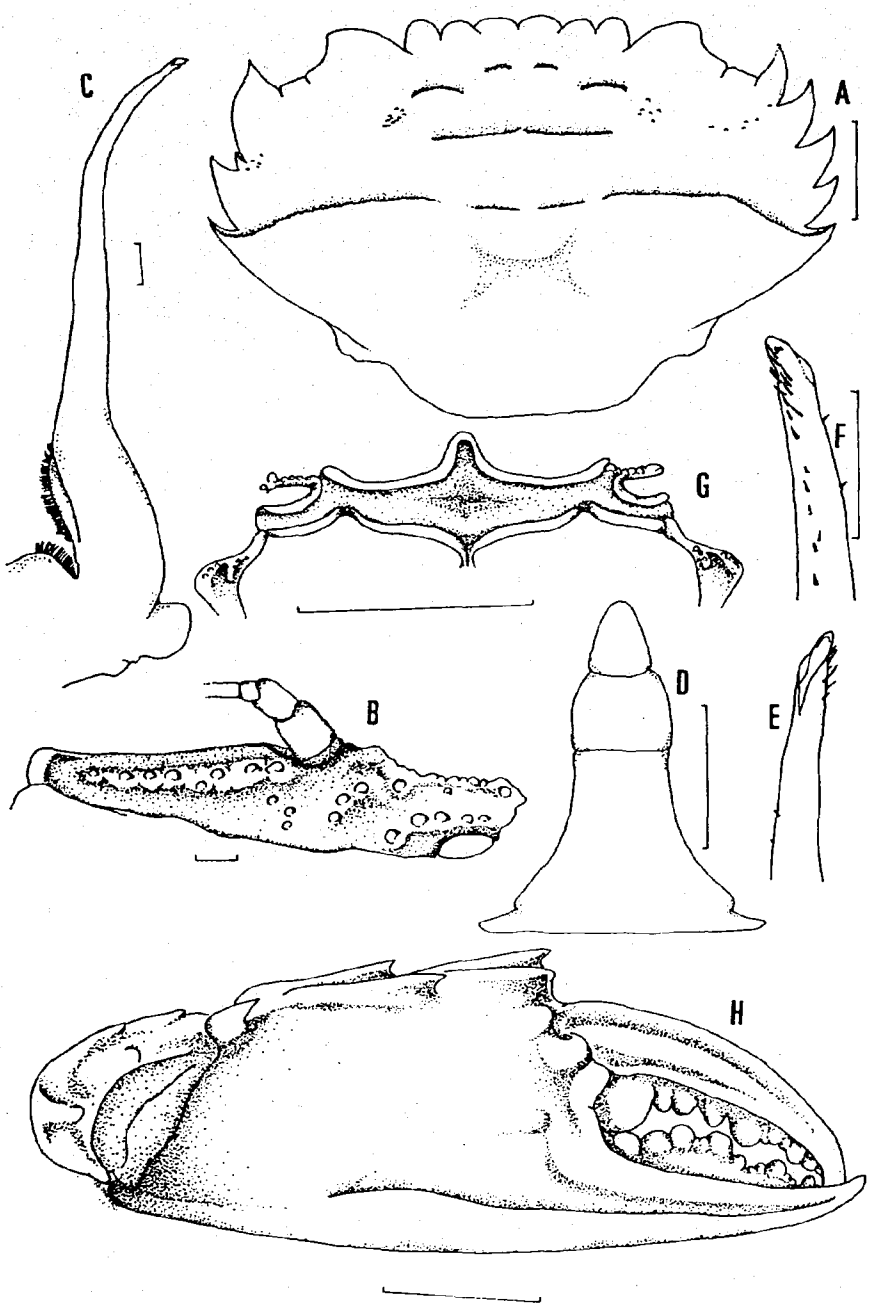


Fig. 36. *Thalamita crenata* (Latreille, 1829). A - ZRC 1993.7233, male, 41.0 by 62.0 mm; B-H - ZRC 1992.8379, male, 42.3 by 63.5 mm. A, carapace dorsal surface; B, right basal antennal segment; C, left G1 abdominal surface; D, male abdomen; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface; G, epistome; H, right cheliped manus, outer surface. Scales: A, D, G-H = 10.0 mm, B-C, E-F = 1.0 mm.

Thalamita danae Stimpson, 1858
(Figs. 37A-C, 38A-C, 39A-C, 40A, B, 41A-D, 42A-I)

Thalamita danae Stimpson, 1858: 37; Stimpson, 1907: 85, pl. 11, figs. 1,1a; A. Milne Edwards, 1861: 366, pl. 30, fig. 1; Lanchester, 1900: 749; Rathbun, 1911: 207; Shen, 1937: 129, figs. 16a-d; Sakai, 1939: 415, pl. 85, fig. 3; Sakai, 1976: 369, pl. 132, fig. 3; Tweedie, 1950: 84; Stephenson & Hudson, 1957: 335, figs. 2N, 3N, pl. 3, fig. 1, pls. 7G, 10D; Ow-Yang, 1963: 109, pl. 23, figs. A-F, B1, B2; Stephenson & Rees, 1967a: 70, figs. 25a-e, 26a-c; Stephenson, 1972: 145, fig. 6, 7; Stephenson, 1975: 191; Moosa, 1980: 73, fig. 6D; Lovett, 1981: 130, figs. 288a-c; Dai et al., 1986: 226, pl. 30(4), fig. 134(2); Yang & Dai, 1991: 247, pl. 30(4), fig. 134(2).

Thalamita stimpsoni A. Milne Edwards, 1861: 362, pl. 30, fig. 1; Alcock, 1899: 79; Nobili, 1906: 205; Sakai, 1939: 413; Sakai, 1976: 372, pl. 131, fig. 3; Stephenson & Hudson, 1957: 356, figs. 2M, 3M, pl. 6, figs. 1-3, pl. 8R, 9I; ? Stephenson & Rees, 1967a: 98, fig. 36; McNiell, 1968: 51; Takeda, 1989: 156.

Thalamita prymna var. *stimpsoni* - Borradaile, 1900: 579.

?*Thalamita prymna* b - Calman, 1900: 22.

Thalamita prymna var. *proxima* Montgomery, 1931: 429, pl. 24, fig. 1, pl. 29, fig. 1, 1a.

Thalamita crenata - Dana, 1852: 282, pl. 17, figs. 7a, b.

(non *Thalamita danae* - De Man, 1887: 78, pl. 4, figs. 8, 9; Alcock, 1899: 77; Barnard, 1950: 174)

Material examined. - Neotype - 1 male, 31.7 by 50.3 mm (BMNH 1986.848a), Tolo Harbour, Hong Kong, coll. R. Seed, 1986.

Others. - HONG KONG - 1 male, 1 female (BMNH 1986.848b), same data as neotype. — 3 males (ZRC 1993.7230-7232), Hong Kong, coll. S.Y. Lee, 15 Nov.1993.

SINGAPORE - 1 male, 1 female (ZRC 1965.10.22.69-70), Siglap, Jun.1933 (det. as *T. stimpsoni*). — 18 males, 2 females (ZRC), Labrador Beach, coll. D. Wee, 5 Aug.1993. — 3 males, 9 females (ZRC 1993.7286-7297), Labrador Beach, coll. D. Wee, 5 Aug.1993. — 5 males, 2 females (ZRC), Labrador Beach, coll. D.Wee, 21 Jul.1993. — 1 female (ZRC 1985.1895-1896), Labrador Beach, coll. P.K.L. Ng, Jun.1983. — 1 female (ZRC 1985.1915), Labrador Beach, coll. P.K.L. Ng, 18 May.1983. — 1 male, 1 female (ZRC), Labrador Beach. — 1 male (ZRC), Labrador Beach, coll. students, 16 Jan.1991. — 3 females (ZRC), Labrador Beach, 26 Feb.1981. — 2 males, 1 female (ZRC), Labrador Beach, coll. H.K. Voris & C.M. Yang, 26 Feb.1981. — 5 males, 2 females (ZRC), Labrador Beach, coll. D. Wee, 21 Jul.1993. — 2 females, 2 males (ZRC), Sentosa, coll. P.Ng, 1981. — 1 female (ZRC 1993.138), Tanjong Rong, coll. D.G.B. Chia & J.L. Koh, May.1992. — 2 males (ZRC 1989.3496-3497), Sentosa reef, coll. P. Ng, 13 Dec.1989. — 1 male (ZRC 1992.8380), Sentosa beach, coll. P. Ng, 1992. — 1 male (ZRC 1985.1914), Sentosa reefs, coll. P. Ng, 25 May.82. — 1 male (ZRC 1985.1912), Sentosa reefs, coll. P. Ng, 27 May.1982. — 1 male (ZRC 1965.10.22.76), Blakang Mati Island (= Sentosa), Mar.1934 (det. as *T. stimpsoni*). — 2 males (ZRC), Singapore Straits, near Sentosa, coll. Lok, 30 Sep.1985. — 1 female (ZRC), southern Islands, coll. D. Lane, 1992. — 1 female (ZRC), Pulau Sudong, 29 Mar.1965. — 1 female (ZRC), St John's Island, coll. D. Wee, 23 Jul.1993. — 1 female (ZRC 1965.10.22.72), Pulau Brani, coll. N.S. and W.B., 23 Oct.1927 (det. as *T. stimpsoni*). — 7 males, 1 females (ZRC 1984.7876-7883), Raffles Lighthouse, coll. Tweedie and Hendrickson, 28-29 Jul.1952 (det. as *T. danae*). — 1 male (ZRC 1985.1013), Raffles Lighthouse, coll. Lim Bee Cheng, 5 Dec.1968. — 1 male (ZRC 1965.10.22.75), Raffles Lighthouse, Jan.1932 (det. as T. stimpsoni). — 1 female (ZRC 1985.1014), Raffles lighthouse. — 1 male (ZRC 1965.10.22.48), Senang Islet, coll. M.W.F. Tweedie, Jan.1938. — 1 male (ZRC 1985.1044), Pulau Brani, coll. M.W.F. Tweedie, 23 Oct.27. — 1 female (ZRC 1985.1011), Pulau Subar Laut, coll. D.S. Johnson, 15 Dec.1956. — 1 juv. (ZRC 1985.1012), Pulau Hantu, coll. D.S. Johnson, 21 Oct.50. — 1 female (ZRC 1993.270), Pulau Hantu, coll. B. Goh, 12 Aug.1986. — 3 males, 8 females (ZRC 1965.10.22.49-58), Pulau Pisang Lighthouse, coll. R. Serène, i- Feb.1934. — 1 male (ZRC 1970.8.11.8), Pulau Paway (= Pulau Pawai), coll. M.W.F. Tweedie, Nov.1933. — 1 male, 3 females (ZRC 1965.10.22.60-63), Pulau Pawai, coll. M.W.F. Tweedie, Sep.1933 (det. as *T. stimpsoni*). — 6 males, 1 females (ZRC 1993.6991-6998), Pulau Semakau, coll. R.E.S.T., 7 Sep.1993. — 4 males, 4 females (ZRC 1993.7007-7015), Pulau Semakau, coll. R.E.S.T., 7 Sep.1993. — 1 male, 1 female (ZRC 1965.10.22.73-74), Pulau Bukom, 27 May.1931 (det. as *T. stimpsoni*). — 1 female (ZRC 1993.139), southern islands, Singapore, coll. D. Lane, 1992. — 1 male (ZRC 1985.1047), Tanjong Gul, 2 Oct.1960. — 1 male (ZRC 1993.7298), Singapore (det. as *T. stimpsoni*). — 1 male (ZRC), Singapore.

PENINSULAR MALAYSIA - 1 female (ZRC 1987.568), Pulau Tioman, Pahang, coll. P.Ng, 29 Jun.1986. — 3 females (ZRC 1987.544-546), Pulau Tioman, 26 Jun.1985. — 1 female (ZRC), Pulau Tioman, Pahang, coll. L. Tan, 9-13 Nov.1981. — 1 female (ZRC 1985.1609), Pulau Tioman, Pahang, coll. P. Ng, 20 Jun.1983. — 1 male (ZRC), Pulau Tioman, Kg. Genting, Pahang, coll. D.G.B.Chia, 8 Aug.1993. — 1 female (ZRC), Pulau Tioman, coll. Wai Ching, 29 Jun.1986. — 1 female (ZRC 1965.10.22.67), Telok Berhala, Pulau Aor, Pahang, coll. N.S., May.1927. — 2 females (ZRC), Port Dickson, Selangor, Mar.1954.

EAST MALAYSIA - 1 male (ZRC 1987.24), Kota Kinabalu, Sabah, coll. Lee Nyanti, 5 Nov.1986. — 6 males, 2 females (ZRC 1987.803-810), Pulau Tiga, Sabah, coll. Lee Nyanti, 27 Apr.1987.

AUSTRALIA - 1 male (ZRC 1965.10.22.59), Linderman Island, Jan.1935.

FIJI - 1 male (RMNH D1830), Viti island (det. as *T. stimpsoni*).

Size. - The largest specimen is a male measuring 41.8 by 66.6 mm (BMNH 1986.848, Tolo Harbour, Hong Kong).

Description. - Carapace densely pilose except for the raised transverse ridges, pilosity easily removed. Frontal ridges smooth but distinct, protogastric and mesogastric ridges with markedly granular outline. Epibranchials interrupted by metagastric ridge. Smooth ridge across cardiacs and each mesobranchial regions.

Front cut into six lobes, medians with truncate anterior borders, separated by a narrow notch and lying on a lower plane. Submedians with inner border directed obliquely inwards and overlapping medians. Laterals as broad as submedians, anterior border bluntly round and separated from submedians by a V-shaped notch. Inner supraorbital lobes broadly arched, wider than combined width of submedians and laterals.

Five anterolateral teeth, all stout, first three subequal and similar, fourth and fifth smaller than those preceding, the fourth tooth smaller than fifth.

Basal antennal segment very much wider than major diameter of orbit, bearing row of more than ten prominent granules.

Chelipeds only slightly unequal. Anterior border of merus bears three spines on distal half, several large granules on proximal half. Posterior border with granules forming a wrinkled surface. Carpus bears a strong spine at the inner angle and three spinules at its outer angle, corresponding costae well marked, upper surface densely covered with fine hairs. Manus with four spines on the upper surface, two on the inner border, one on the middle of the outer border and a reduced tubercle at the distal end. The last spine at the wrist articulation. Outer surface bearing three costae and one median costa on the inner surface.Between costae, the outer surface bears the usual hairy pile beneath which are rounded granules, more conspicuous towards the upper surface. The inner to lower surface covered with some transverse granular squamae, in others the granulations indistinct, resulting in a very smooth surface.

Merus of natatory leg bears a triangular tooth at the postero distal angle, in front of the usual spine on the posterior border. The propodus is serrated along its posterior boorder.

Penultimate segment of the male abdomen about as long as broad, with lateral borders parallel for 3/4 of the way and then converging distally. In unworn specimens the ventral surface finely pilose.

G1 smoothly curved, distal portion tapering off to a blunt obilque tip. Inner surface with a row of sparcely spaced short bristles which begins subterminally and ending near base as progressively shorter bristles. Outer surface bears a terminal clump of bristles from which a row of progressively shorter bristles runs down obiquely towards outer edge of G1. At the distal end of the terminal clump, as many as seven conical spines can be seen. Basal lobe is bluntly rounded.

Colour. - Dark purplish red or brick red above, much lighter on ventral surface (fide Stimpson, 1907). Specimens from present collections tend to have a greenish colouration throughout.

Habitat. - The habitat of *T. danae* is sandy to rocky shores in the intertidal zone.

Distribution. - Mozambique, Red Sea, India, China, Hong Kong, Japan, Philippines, Malaysia Indonesia, Australia, New Caledonia, Marshall Islands, Fiji and Samoa (fide Stephenson, 1972; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded from Malaysia and Singapore by De Man (1895) and Lanchester (1900) respectively.

Remarks. - This species shows a remarkable similarity to that of *Thalamita stimpsoni* A. Milne Edwards, 1861, and *T. foresti* Crosnier, 1962. *T. foresti* is distinguished by having a broad, distally swollen penultimate segment and a longer ultimate segment of the male abdomen (Stephenson & Rees, 1967). Based upon this character, Crosnier referred the specimens of *T. danae* by De Man (1887), Alcock (1899) and Barnard (1950) to *T. foresti.* The G1 distal tip of *T. foresti* is strongly recurved unlike the blunt oblique tip of *T. danae.*

There is much controversy regarding the status of *T. stimpsoni* due to its close resemblence with *T. danae.* Attempts used previously to separate these two species have been unsuccessful. Stephenson & Hudson (1957) chose to keep *T. stimpsoni* distinct, based on the character that the fourth anterolateral tooth is rudimentary and the distal tip of the G1 is without conical spines. Stephenson (1972) argued that the variability in the size of the fourth anterolateral tooth is a character associated with juvenility. Present specimens show the fourth tooth to be as large as the fifth in some specimens beyond 40 mm in carapace breadth, while smaller sized specimens show a very rudimentary tooth. Stephenson (1972) also noted that the absence of conical spines in the G1 do not correlate with a rudimentary fourth tooth.

There is one dried old female specimen in the Paris Museum labelled as "*Thalamita stimpsoni* A. Milne Edwards", measuring 40 by 68 mm which corresponds very well with the size of A. Milne Edwards' (1861: pl. 30, fig. 1) figure of the species. However, A. Milne Edwards (1861: 362) noted that the specimen figured measured 100 by 110 mm, which is a suspiciously large size as no *T. stimpsoni* is known to grow to this size. A. Milne Edwards did not indicate how many specimens he had, and it is unsure if he had in fact more material of the species. It would appear that the dried Paris Museum is a syntype of *T. stimpsoni*, but this cannot be ascertained with any certainty at the moment. The figure provided by A. Milne Edwards however, is quite good, and the diagnostic characters are easily discernible. From his figure of *T. stimpsoni*, the only character which is significantly different from *T. danae* is that of a rudimentary fourth anterolateral tooth, which is already shown to be unreliable. Therefore the author has chosen to agree with Stephenson (1972), and synonymise *T. stimpsoni* under the present species. Because of the confusion which has arisen between *T. danae* and *T. stimpsoni*, it is desirable to stabilise the taxonomy by

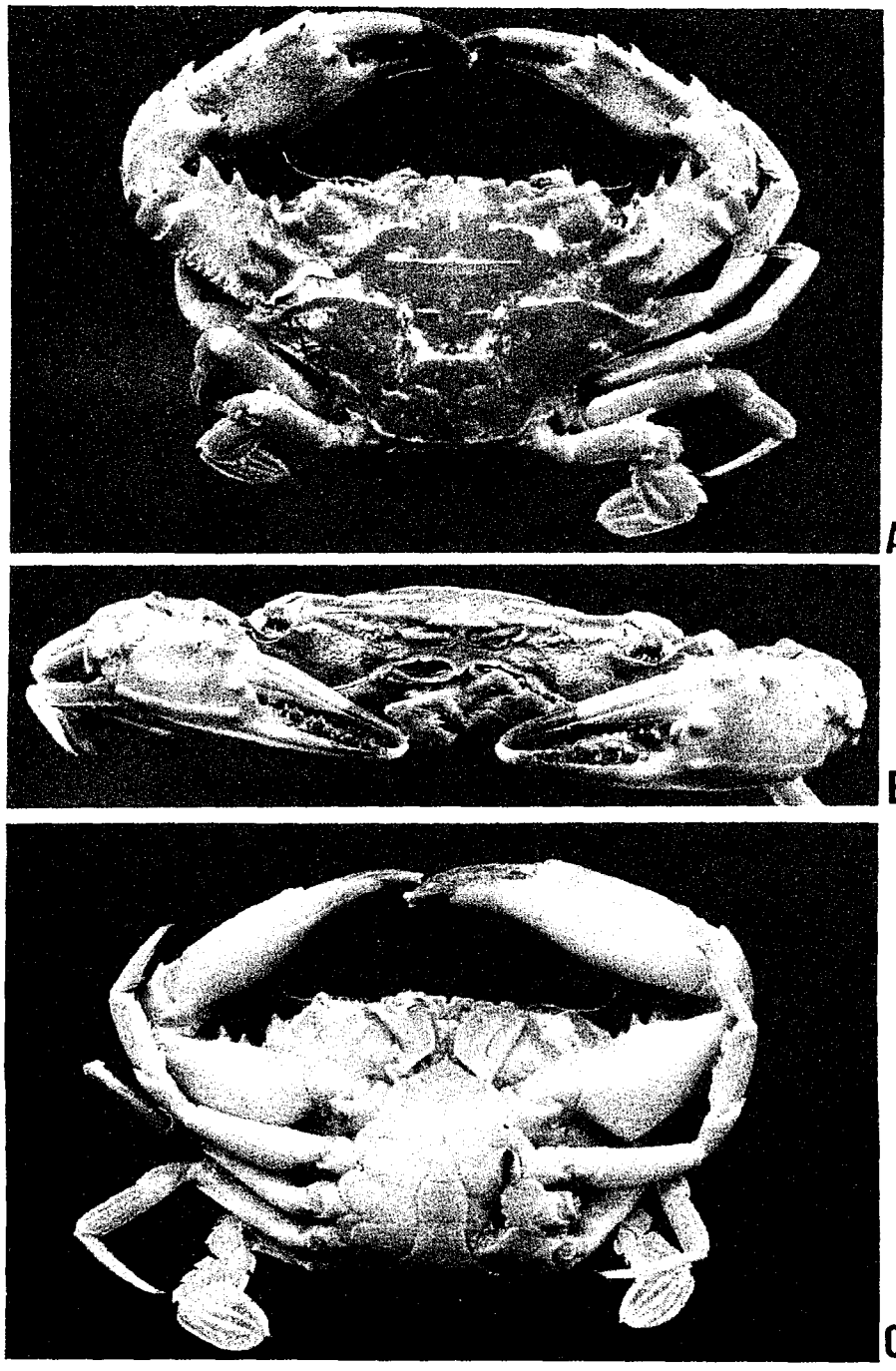


Fig. 37. *Thalamita danae* Stimpson, 1858. BMNH 1986.848a, neotype male, 31.7 by 50.5 mm. A, dorsal view; B, frontal view; C, ventral view.

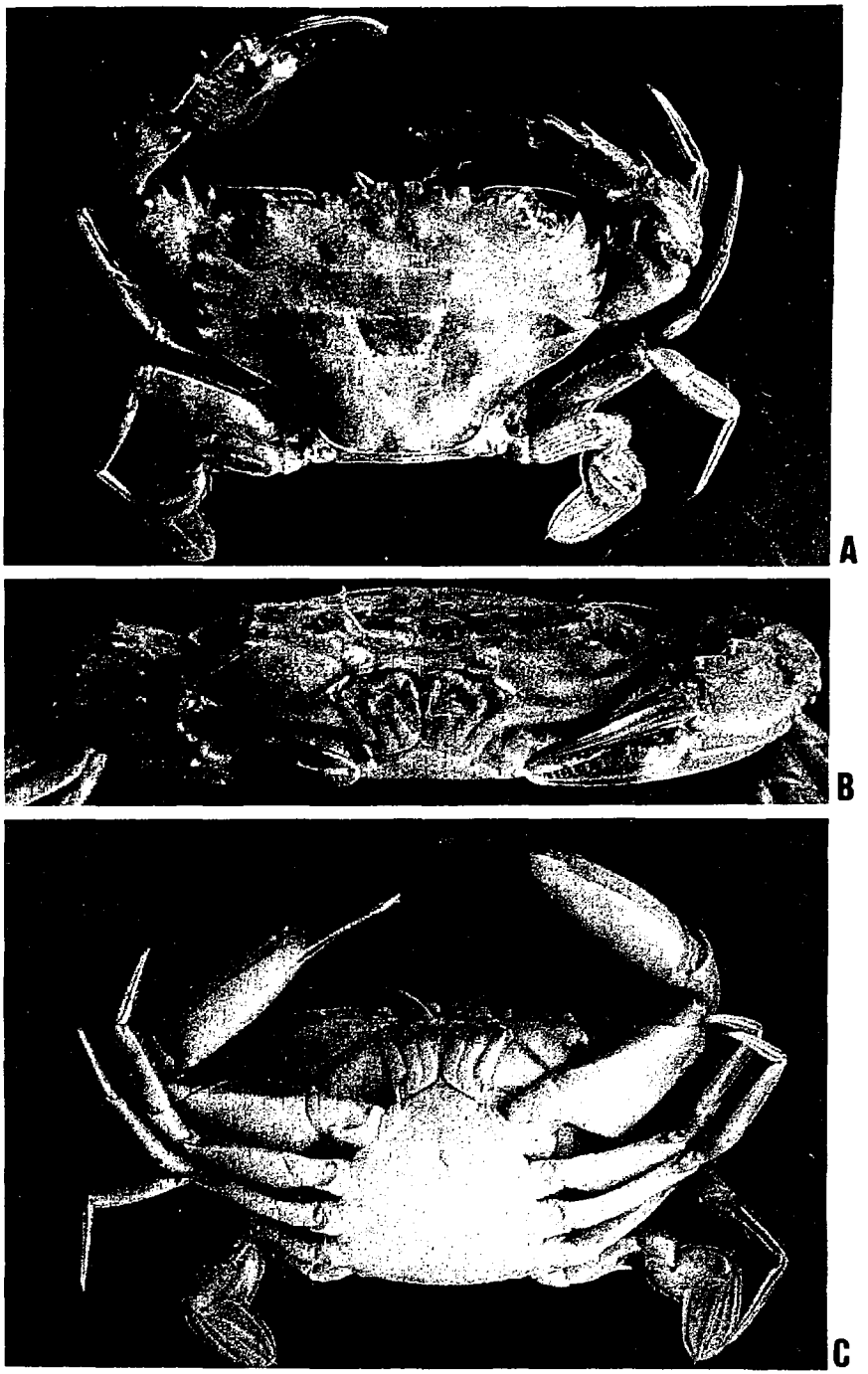


Fig. 38. *Thalamita danae* Stimpson, 1858. ZRC 1993.7286, male, 27.5 by 42.1 mm. A, dorsal view; B, frontal view; C, ventral view.

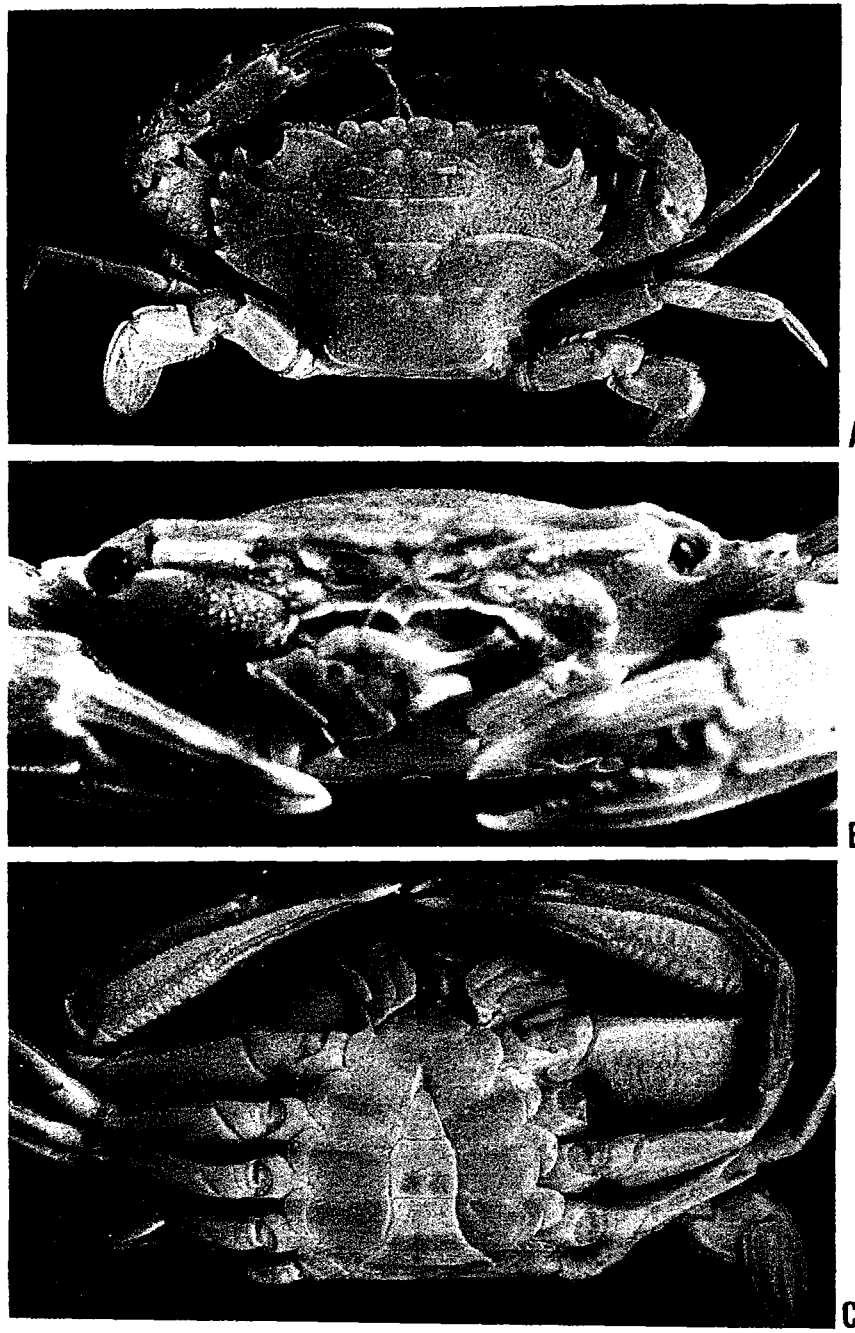


Fig. 39. *Thalamita danae* Stimpson, 1858. ZRC 1987.803, male, 28.5 by 44.3 mm. A, dorsal view; B, frontal view; C, ventral view.

Fig. 40. *Thalamita danae* Stimpson, 1858. A, ZRC 1987.804, female 39.5 by 45.5 mm, ventral view; B, ZRC 1987.803, male, 28.5 by 44.3 mm, upper surface of cheliped manus.

designating a neotype for *T. danae*. Stimpson's types were lost in the Great Chicago Fire and his figure is too schematic to be of much use. In view of this, a male specimen from Hong Kong, the type locality of *T. danae* is hereby selected as the neotype. This specimen (BMNH 1986.848a) was obtained from Tolo Harbour.

Previous authors have noted much variability in the characters of *T. danae*. Montgomery (1931) and Stephenson & Hudson (1957) noted the presence of a faint granular ridge along the border between the inner and lower surface of the manus. Specimens of *T. danae* vary from having a very granular ridge resulting in a squamose under surface to that of being totally smooth on the inner to lower surface of the manus. Intermediates were found to posess faint granules, at the proximal end of the manus. As such this character cannot be used for the separation of *T. danae* from *T. stimpsoni* and *T. prymna* var. *proxima* Montgomery.

Calman (1900) described the frontal lobes of *T. stimpsoni* as being less widely separated than in *T. danae*, but this degree of separation tends to vary with size.The frontal lobes in smaller specimens are less separated and more truncate. In larger ones, the submedians and laterals become rounder at its anterior border, the latter more widely separated from the former. Until Calman's specimen of *T. prymna* form b can be re-examined, its status remains uncertain.

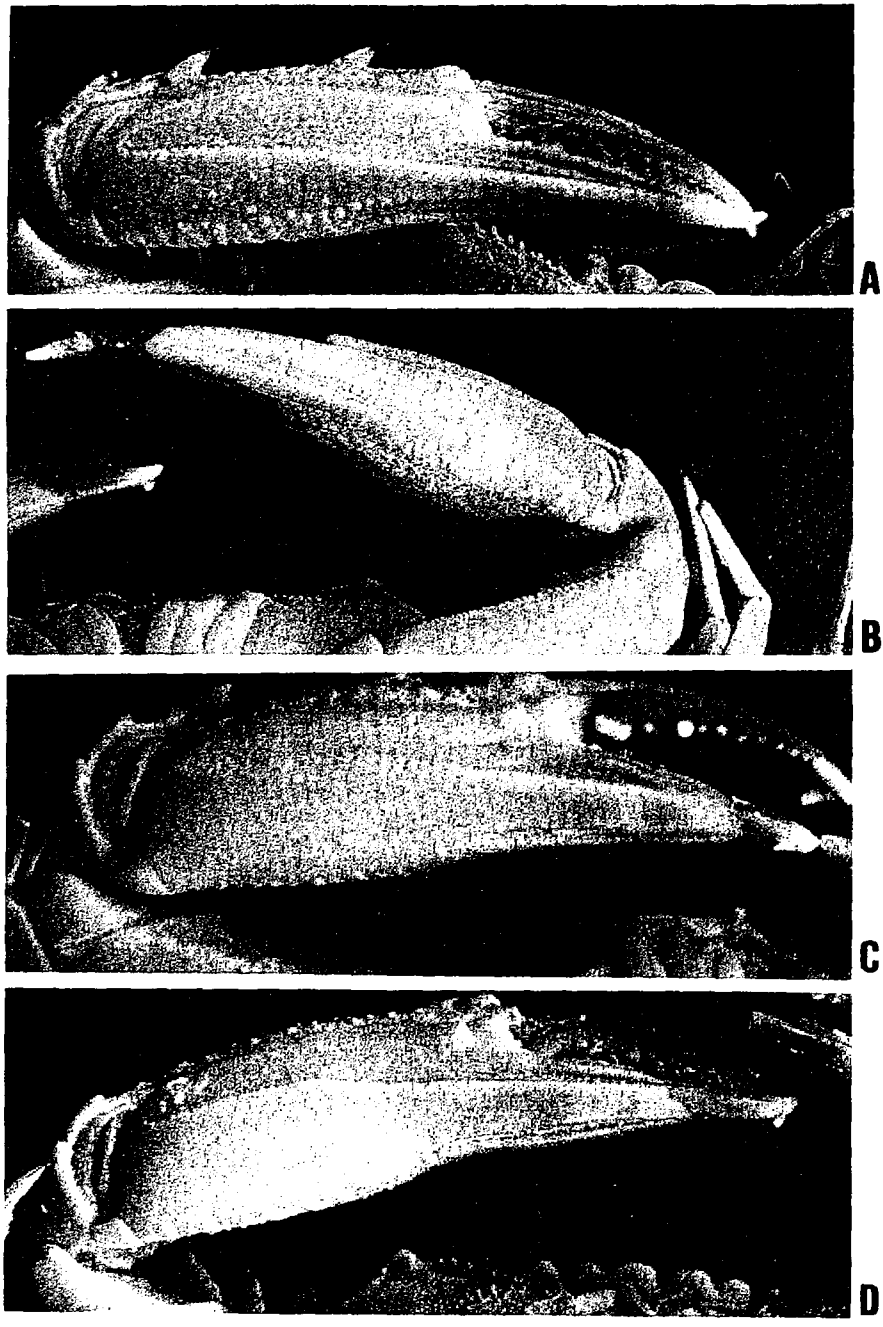


Fig. 41. *Thalamita danae* Stimpson, 1858. Lower surfaces of cheliped mani. A, ZRC 1987.803, male, 28.5 by 44.3 mm; B, ZRC 1993.7298, male, 38.5 by 59.3 mm; C, ZRC 1987.24, male, 41.5 by 63.8 mm; D, ZRC 1965.10.22.59, male, 38.7 by 59.9 mm.

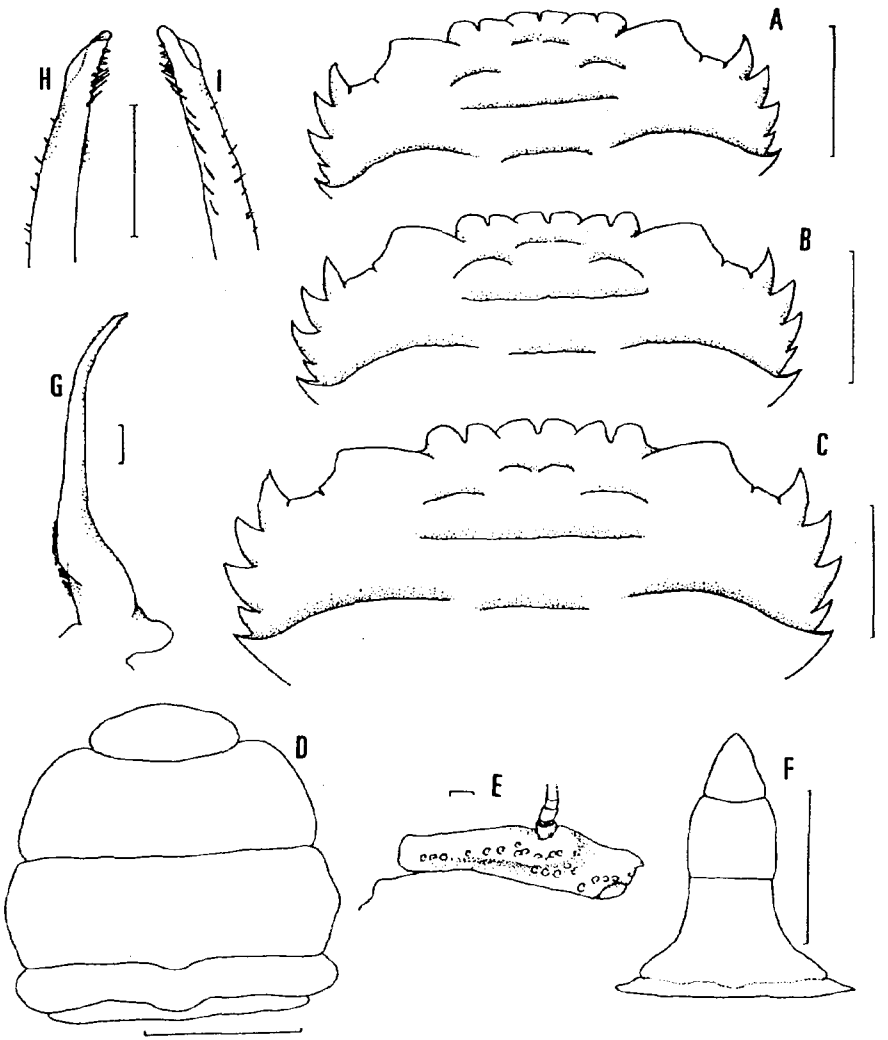


Fig. 42. *Thalamita danae* Stimpson, 1858. A - ZRC 1993.7286, female, 22.8 by 36.1 mm; B - ZRC 1993.7287, female, 25.4 by 39.4 mm; C - ZRC 1993.7288, male, 30.6 by 46.7 mm; D - ZRC 1987.804, female, 39.5 by 45.5 mm; E-I - ZRC 1987.803, male, 28.5 by 44.3 mm. A, front dorsal surface; B, front dorsal surface; C, front dorsal surface; D, male abdomen; E, right basal antennal segment; F, male abdomen; G, left G1 abdominal surface; H, apex of left G1 abdominal surface; I, apex of left G1 sternal surface. Scales: A-D, F = 10.0 mm, E, G-I = 1.0 mm.

Workers have observed differences in the shape of the ultimate and penultimate segments of the male abdomen. Variability in the arrangement of spines and bristles on the G1 have also been noted. Stephenson (1972) correlated the results of these works and concluded by recognising three major forms of *T. danae* -

Form A - Ultimate segment of male abdomen longer than broad, penultimate segment with gently converging laterals. G1 stout, outer surface bearing up to six conical spines or tubercles, overlapped and succeeded by six or more forwardly directed terminal bristles. On inner side few sparsely arranged bristles (Stephenson & Rees, 1967: 71; fig 25a, d, c and 73; fig 26a).

Form B - Ultimate segment broader than long with slightly concave sides, penultimate segment parallel for 3/4 of length, converging distally. G1 thin gradually tapering, and distinctly curved near the tip. Outer side with six stout, elongate, forwardly directed bristles. On inner side an extensive row of elongate forwardly directed bristles (Stephenson & Rees, 1967: 71; fig 25b, e and 73; fig 26c)

Form C - "*Thalamita stimpsoni* Form b" (Stephenson & Rees, 1967: 99; fig 36a, b, c and Stephenson, 1972: 147; fig 7e, f)

The present specimens examined all match that of form A - the typical *T. danae* as described by Stephenson & Hudson (1957). The specimens however vary from smooth to uniformily pilose. Form B has been raised to the species level by Stephenson (1976), as *T. holthuisi*, based upon the character of a distinct G1.

Thalamita gatavakensis Nobili, 1906
(Fig. 43A-D)

Thalamita pilumnoides var. *gatavakensis* Nobili, 1906: 262.
Thalamita pilumnoides gatavakensis - Forest & Guinot, 1961: 34, figs. 22-25.
Thalamita gatavakensis - Crosnier, 1962: 106, figs. 156a-c, e, 177a-d; Stephenson & Rees. 1967a: 75; Stephenson, 1972: 149; Stephenson, 1976: 21.
Thalamita granosimana - Stephenson, 1961: 119, figs. 2E, 4A, pls. 4J, 5G.

(non *Thalamita granosimana* Borradaile, 1903)

Material examined. - None.

Size. - A male specimen from Western Australia measures 9.1 by 15.0 mm (fide Stephenson, 1961).

Diagnosis. - Carapace surface pilose; all anterior ridges present and obvious including pair of mesobranchials, cardiac ridge as long as frontal lobes; two frontal lobes, separated by a distinct notch; inner orbital lobes broad and almost straight; five anterolateral teeth, first largest, fourth small to rudimentary. Basal antennal segment bearing an acute ridge of eight to twelve fused tubercles. Chelipeds short and stout; merus and carpus normal; manus with five spines on upper surface, distal spine on outer border reduced to a tubercle, outer surface bearing three granular costae, inner surface without distinct costa, in some cases, short row of granules present, inner to lower surface of manus smooth; fingers short and stumpy. Propodus of natatory leg with six to nine spines on the posterior border. Penultimate segment of the male abdomen with lateral borders parallel. G1 stout, slightly recurved spoon shaped

tip, terminal bristles on inner surface with two to three backwardly directed spines, outer surface with a spine on the spoon shaped tip followed by five stout backwardly directed spines whose sizes increase distally (adapted from Stephenson, 1961).

Colour. - Not known.

Habitat. - Found with coral at 10-20 meters in depth (fide Stephenson, 1972).

Distribution. - Madagascar, Seychelles, Malaysian area, Philippines, Indonesia, Western Australia, Saipan, Tuamotu (fide Stephenson, 1972, 1976). This species was first recorded in Malaysia by Stephenson (1972)

Remarks. - The type specimen of *Thalamita pilumnoides* var. *gatavakensis* Nobili, 1906, is a juvenile specimen measuring 6.5 mm in carapace breadth possessing only four anterolateral teeth. The G1 structure distinguishes the species from *T. granosimana* Borradaile, 1902, with which Stephenson (1961) misidentified it as initially. Unlike *T. gatavakensis*, the G1 of *T. granosimana* is long and thin, bearing stout bristles at right angles to the axis of the distal tip. The bristles increase in size proximally on both the outer and inner surfaces (Crosnier, 1962: fig 175, 176).

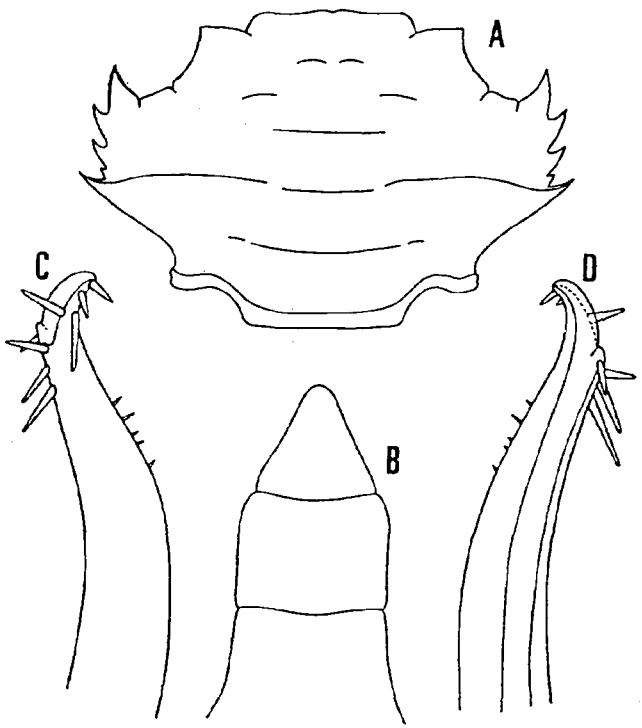


Fig. 43. *Thalamita gatavakensis* Nobili, 1906. A-D - Madagascar, male, 6.5 by 11.0 mm (after Crosnier, 1962). A, carapace dorsal surface (x 8); B, male abdomen (x 24); C, apex of G1 abdominal surface (x 106); D, apex of left G1 sternal surface (x 106).

Thalamita gatavakensis was raised to the species level by Crosnier (1962: fig 256) who illustrated the G1 of *T. pilumnoides* as having a very recurved tip and with only two noticable terminal bristles. Moreover the penultimate segment of the male abdomen of the latter is convex unlike the parallel lateral borders seen in *T. gatavakensis*.

Thalamita integra Dana, 1852
(Fig. 44A-C)

Thalamita integra Dana, 1852: 85; Stimpson, 1858: 39; Miers, 1884: 540; De Man, 1888: 74; Henderson, 1893: 373; Alcock, 1899: 85; Rathbun, 1906: 873; Sakai, 1939: 420, fig. 15, pl. 84, fig. 2; Sakai, 1976: 377, fig. 201; Barnard, 1950: 177; Edmondson, 1954: 252, figs. 27a-c, 28a; Stephenson & Hudson, 1957: 339, figs. 2H, 3H, pl. 3, fig. 3, pl. 7I, 10F; Crosnier, 1962: 103, fig. 156, 161, 170; Stephenson & Rees, 1967a: 79; Stephenson, 1972: 149; Stephenson, 1975: 197; Stephenson, 1976: 22; Takeda & Shimazaki, 1974: 54; Dai et al., 1986: 235, pl. 31(5), fig. 138(2); Dai & Yang, 1991: 255, pl. 31(5), fig. 138(2).

Material examined. - None.

Size. - A male specimen from Heron Island, Australia measures 17.8 by 28.0 mm (fide Stephenson & Hudson, 1957).

Diagnosis. - Carapace convex and smooth; frontal ridges close together, protogastric absent, mesogastric distinct, epibranchial interrupted at cervical grooves and medianly, mesobranchial short and distinct, cardiac ridges absent; two broad frontal lobes; inner orbital lobes straight, as broad as frontals; five anterolateral teeth, first tooth largest, fourth smallest. Basal antennal segment longer than major diameter of orbit, bears short, smooth or minutely granular crest. Cheliped unequal; merus bears two to three spines on anterior border; carpus with stout spine on inner angle and rounded tubercles on outer surface; manus smooth and rounded, outer surface with single costa running to immovable finger, upper surface with three blunt spines and two tubercles at distal extremity; finger of larger chela short and stout. Propodus of natatory leg bears six to nine spines on posterior border. Penultimate segment of male abdomen broader than long, lateral border convex. G1 short, stout and tapering off to tip, outer and inner surface with large backwardly directed bristles, increasing in length proximally (adapted from Stephenson & Hudson, 1957).

Colour. - Not known.

Habitat. - This species show a wide habitat distribution ranging from shallow waters at low tidal mark up to 40m in depth. They are commonly found on sandy bottoms and coral reef (fide Sakai, 1976).

Distribution. - East Africa, Madagascar, Red Sea, India, China, Japan, Malaysia, Australia, Tahiti and Hawaii (fide Dai et al., 1986; Dai & Yang, 1991). This species was first recorded in Malaysia by Henderson (1893).

Remarks. - This species show a very smooth and polished cheliped with blunt and poorly developed spines. The carapace is as smooth and relatively convex; carapace ridges are however very indistinct (Barnard, 1950).

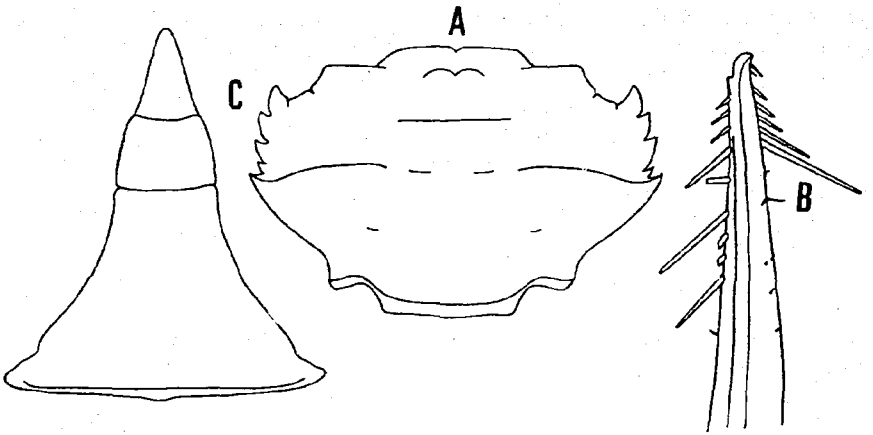


Fig. 44. *Thalamita integra* Dana, 1852 - Madagascar, male, 22.0 by 33.0 mm (after Crosnier, 1962). A, carapace dorsal surface; B, apex of left G1 abdominal surface; C, male abdomen.

Thalamita malaccensis Gordon, 1938
(Fig. 45A-C)

Thalamita malaccensis Gordon, 1938: 176, figs. 2c, d, 3a, b; Stephenson, 1972: 149.

Material examined. - None.

Size. - The female holotype from Malaysia measures 15.5 by 22.3 mm (Gordon, 1938).

Diagnosis. - Carapace surface pilose; mesogastric ridge with short median break, a pair of cardiac and mesobranchial ridges present; four frontal lobes, broad submedians with shallow concavity in the anterior border forming a narrow lobe on the outer angle; five anterolateral teeth, fourth being the smallest. Basal antennal segment less than major diameter of orbit, bears a crescentric granular ridge. Cheliped subequal; surface covered with squamiform markings; merus armed with three spines, spinule present near distal articulation on its anterior lower border; carpus with usual spines; manus bearing five spines, outer surface with three costae, middle of inner surface with faint costa. Posterior border of propodus of natatory leg with denticles. Female abdomen covers most of cephalothoracic sterna, sutures distinct, with long median crest on each of segments two to four (adapted from Gordon, 1938, based on holotype female).

Colour. - Not known.

Habitat. - The only record to date have shown that this species habits at depth of up to 60 meters amongst coral and clay (fide Stephenson, 1972).

Distribution. - Malay Peninsula and Java Sea (fide Stephenson, 1972). This species was first recorded from Malaysia by Gordon (1938).

Remarks. - *Thalamita malaccensis* is close to *T. sexlobata* but the latter differs in having convex anterior borders on the lateral frontal lobes. In addition, the terminal segments of the

female abdomens differ in shape between the two (Gordon, 1938: text fig 2c-d and 3a). A photograph of *T. malaccensis* has been provided by Stephenson (1972: 143; fig 4).

Thalamita mitsiensis Crosnier, 1962
(Fig. 45D-G)

Thalamita mitsiensis Crosnier, 1962: 127, fig. 212, 213, 216-218; Stephenson & Rees, 1967: 80, fig. 29; Stephenson, 1972: 150; Stephenson, 1975: 199; Sakai, 1976: 372, pl. 133, fig. 3.

Material examined. - None

Size. - The male type specimen from the northwest coast of the Mitsio Isles, measures 7.3 by 10.0 mm (Crosnier, 1962).

Diagnosis. - Carapace glabrose; only protogastric and epibrianchial ridges present and granular; six frontal lobes, medians protruding, submedians broadest, laterals narrowest; inner orbital lobes acute; four anterolateral teeth, first stoutest, second to fourth subequal. Basal

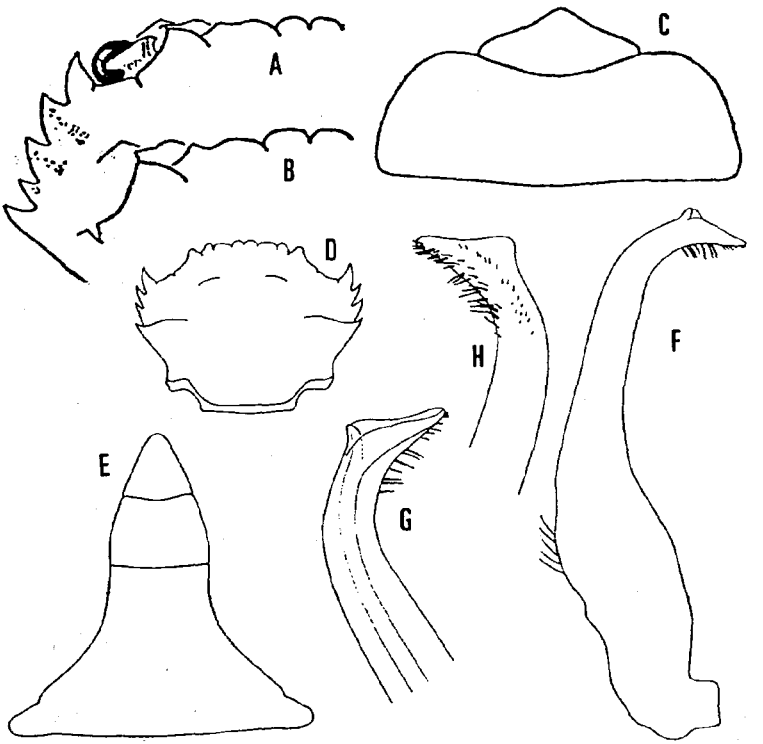


Fig. 45. A, C, *Thalamita malaccensis* Gordon, 1938 - Malaysia, holotype female, 15.5 by 22.3 mm; B - Malaysia, paratype female (juvenile) (after Gordon, 1938), D-H, *Thalamita mitsiensis* Crosnier, 1962 - Mitsio Isles, male, 7.3 by 10.0 mm (after Crosnier, 1962). A, frontal half of carapace dorsal surface; B, frontal half of carapace dorsal surface; C, ultimate and penultimate segment of female abdomen; D, carapace dorsal surface; E, male abdomen; F, left G1, abdominal surface; G, apex of left G1, abdominal surface, H, apex of left G1, sternal surface.

antennal segment narrower than major diameter of orbit, bearing five to six indistinct granules on a ridge. Merus of cheliped bears three spines on anterior border; carpus bears one large spine on internal angle, one spine and two granules on the external surface; manus with three spines on upper surface and two tubercles at distal extremity, outer surface granular and bearing a ridge on its lower border. Propodus of natatory leg with denticles on posterior border. Penultimate segment of abdomen with lateral borders convex, regularly convergent. G1 stout, curving at terminal end to flared tip, outer surface of tip with cluster of short bristles (adapted from Crosnier, 1962).

Colour. - Not known.

Habitat. - It habits on sandy bottoms at depths of 35-80 meters (Sakai, 1976).

Distribution. - Mitsio Isles, Madagascar, Malaysia, Philippines and Japan (fide Stephenson, 1972; Sakai, 1976). This species was recorded from Malaysia by Stephenson (1972).

Remarks. - Crosnier noted that *Thalamita mitsiensis* is close to *T.bandusia* Nobili, 1905. However, Crosnier (1962) stated that the latter differs in the G1 structure and in having the third anterolateral tooth smallest.

Thalamita pelsarti Montgomery, 1931
(Figs. 46A-C, 47A-C, 48A-D, 49A-J)

Thalamita prymna var. *pelsarti* Montgomery, 1931: 427, pl. 24, fig. 2, pl. 28, figs. 3,3a.
Thalamita prymna a - Calman, 1900: 22.
Thalamita prymna form a - Tweedie, 1950: 84, fig. 1a.
Thalamita prymna - Sakai, 1939: 416, pl. 51, fig. 1; Sakai, 1965: 125, pl. 64, fig. 2; Sakai, 1976: 372, pl. 133, fig. 1; Stephenson & Hudson, 1957: 346, figs. 2R, 3R, pl. 4, fig. 3, pls. 8L, 9E; Ow-Yang, 1963: 120 (part), pl. 25, figs. A-F, B1, B2; Stephenson & Rees, 1967a: 89 (part); Stephenson, 1972: 150 (part); Moosa, 1980: 71, fig. 6A; Lovett, 1981: 130 (part), figs. 292a-d; Dai et al., 1986: 228 (part), pl. 30(7), fig. 135(3); Dai & Yang, 1991: 249 (part), pl. 30(7), fig. 135(3).

Material examined. - SINGAPORE - 2 males (ZRC 1965.10.26.25-27), Siglap, Jul.1933 (det. as *T. prymna*). — 2 males (ZRC 1965.10.26.22-23), Sultan Shoal, coll. A.M., 8 Feb.1933 (det. as *T. prymna*). — 2 males (ZRC 1985.1015-1016), Sultan Shoal, coll. M.W.F. Tweedie, Dec.1933 (det. as *T. prymna*). — 1 male, 1 female (ZRC 1993.7234-7235), St John's Island, coll. D.Wee, 23 Jul.1993. — 2 males (ZRC 1985.1017-1019), Raffles Lighthouse, coll. D.S. Johnson, 24-29 Jul.1952 (det. as *T.prymna*). — 1 female (ZRC 1965.10.26.20-21), Pulau Ubin, Jun.1934 (det. as *T. prymna*). — 1 female (ZRC), Singapore, coll. D.S. Johnson. — 1 female (ZRC), Singapore, coll. D.S. Johnson.

PENINSULAR MALAYSIA - 1 male (ZRC 1965.10.26.19), Pulau Aor, Pahang, coll. M.W.F.Tweedie, Jun.1938 (det. as *T. prymna*). — 1 male (ZRC), Pulau Tioman, Pahang. — 1 male (ZRC), Pulau Tioman, Pahang (det. as *T. prymna*).

EAST MALAYSIA - 1 male, 1 female (ZRC 1987.25-26), Kota Kinabalu, Sabah, coll. Lee Nyanti, 5 Nov.1986.

Size. - The largest specimen is a male measuring 40.2 by 63.9 mm (ZRC 1993.7234).

Description. - Carapace broader than long, ratio of breadth to length approximately 1.6 times. Dorsal and ventral surface densely pilose except on the raised carapace ridges. All carapace ridges distinct and granular. Frontal ridges short and distinctly separated from each other. Protogastric ridges granular and arched, mesogastric ridge long and unbroken. Sparsely

spaced granules may extend on either side of the mesogastric ridge to the notch between the first and second anterolateral teeth. Epibranchial ridges separated by a distinct cervical groove. Cardiac and mesobranchial region slightly raised resulting in the absence of hairs.

Frontals straight, cut into six truncated lobes. Medians set on a slightly lower plane and separated by a narrow notch. Submedians broadest, with inner border sloping inwards anterolaterally and overlapping medians. Laterals narrowest with anterior borders rounded, separated from submedians by an open and deeper notch. In smaller specimens, all the frontal lobes are closely set with square cut anterior borders. Inner supraorbital lobe arched and slightly less than combined widths of the submedian and lateral lobes. Inner infraorbital lobe with finely serrated edge, leading anteriorly to an acute black tipped spine.

Five anterolateral teeth, first three large increasing in size from front to rear, fourth tooth rudimentary, fifth tooth smaller than third.

Basal antennal segment much wider than major diameter of orbit, bears four to five sharp spines on elevated crest and several minute granules at distal end of either side of the segment.

Chelipeds slightly unequal, granular and densely pilose. Anterior border of merus bearing three sharp spines and several spiniform tubercles in between; a spinule each on the distal proximity of the dorsal and ventral borders near articulation of wrist. Posterior border granular and finely pilose. Upper surface of carpus bears widely spaced rounded granules; similar granules line the anterior border and on the costa leading to enlarged spine at the inner angle. Outer surface bears three spines, the upper and lowest being terminations of two granular costae. Manus bears five to six spines on the upper surface, two on inner border of upper surface and an additional one to two spinules at the proximal end of the same border, two on outer border and a usual spine at the wrist articulation. Outer surface of manus bears two distinct granulated costae at the lower half, a third row of granules may be present and distinct, alternatively the upper half may show a confused row of granules. Inner surface with a distinct median costa, beset by a row of rounded granules. All other surfaces covered with granules and fine pubesence through out. Fingers slender and deeply grooved.

Merus of natatory leg with two grooves bearing fine felt of hairs on the dorsal surface. Usual spine at posterior border and another at the posterodistal angle. Posterior border of propodus serrated.

Penultimate segment of male abdomen slightly broader than long, lateral borders parallel for proximal half then converge gently to distal end, ultimate segment acutely triangular.

G1 elongate, slightly sinuous and tapering to an oblique tip. Sternal surface bear few scattered bristles near terminal end, all forwardly directing. Outer surface bears a row of slender bristles leading to a cluster behind the distal tip. Five to seven small conical spines occur amongst the cluster of bristles. Inner surface bears a row of fine bristles beginning just below lip and ending at the distal 4/5 of the G1. Basal lobe broad with a convex lateral border.

Colour. - Dorsal surface dark green with reddish tinge at the joints of the appendages.

Habitat. - The habitat of this species range from muddy to rocky shores within the intertidal zone. Also commonly found under coral heads of reef flats.

Distribution. - China, Japan, Malaysia, Singapore, Indonesia and Australia (fide Moosa, 1980; Dai et al.,1986; Dai & Yang, 1991). This species was first recorded from Malaysia and Singapore by Tweedie (1950).

Remarks. - *Thalamita pelsarti* was made a synonym of *T. prymna* by Stephenson & Hudson (1957). They stated that the pronounced hairiness and granulations on the chelipeds of the former was due to the relative absence of wear and tear. Moreover the differences in the number of spines on the manus and basal antennal segment, the frontal lobe arrangements and a small fourth anterolateral tooth were mentioned to be variable characters.

Aside from the size of the fourth anterolateral tooth, the other characters mentioned prove to be constant in the series of specimens that we have examined. These specimens resemble Montgomery's var. *pelsarti* in having a densely pilose and granulated cheliped; a deep notch separating the laterals from the submedian lobes; having more than five spines on the manus and three to five spines on the basal antennal segment. Unlike *T. prymna*, none of these specimens show a continuous and distinct ridge running from the mesogastric ridge to the notch between the first and second anterolateral teeth. On the other hand, only several sparsely spaced granules were found along this region of the carapace, very much like Montgomery's var. *pelsarti*. Therefore we have, together with other characters, chosen to recognise *T. pelsarti* as a distinct species.

Thalamita pelsarti is very close to *T. prymna* but differs in the following characters:

1. *T. pelsarti* is strongly granular and densely pilose on all surfaces of the manus of the chelipeds. The manus of *T. prymna* is smooth on the inner to lower surfaces and in between the lower costae on the outer surface. The granules are less numerous on the upper surface in the latter. Moreover the lower surface of the immovable finger in *T. prymna* is smooth and without a groove, unlike that of *T. pelsarti*, whereby the groove is deep.

2. The manus bears five to seven spines on the upper surface in *T. pelsarti*, due to the additional spinules arising from the strongly raised tubercles on the proximal end of the inner border. *Thalamita prymna* bears only five strong spines.

3. The frontal lobes of *T. pelsarti* are truncate and closely set in smaller specimens, the lobes become separated in larger specimens. The laterals become narrower and are separated from the submedians by a deep and open notch. On the other hand the lateral lobes of *T. prymna* remain closely set and squarely cut irrespective of size.

4. The inner supraorbital lobes are relatively less broad than *T. prymna*. The latter is wider than the combined width of its submedians and lateral lobes.

5. There are sparsely spaced granules from the mesogastric to the anterolateral teeth unlike *T. prymna* which has a distinct and continuous ridge.

6. The frontal ridges of *T. prymna* are closely set and truncate, the protogastric ridge ends just beneath the outer edge of the former. *Thalamita pelsarti* have widely set frontal ridges and the protogastric arch ends before the frontal ridges.

7. The merus on the ambulatory and natatory legs are grooved, bearing a fine felt of hairs on the dorsal surface. This surface is smooth and without hairs in *T. prymna*.

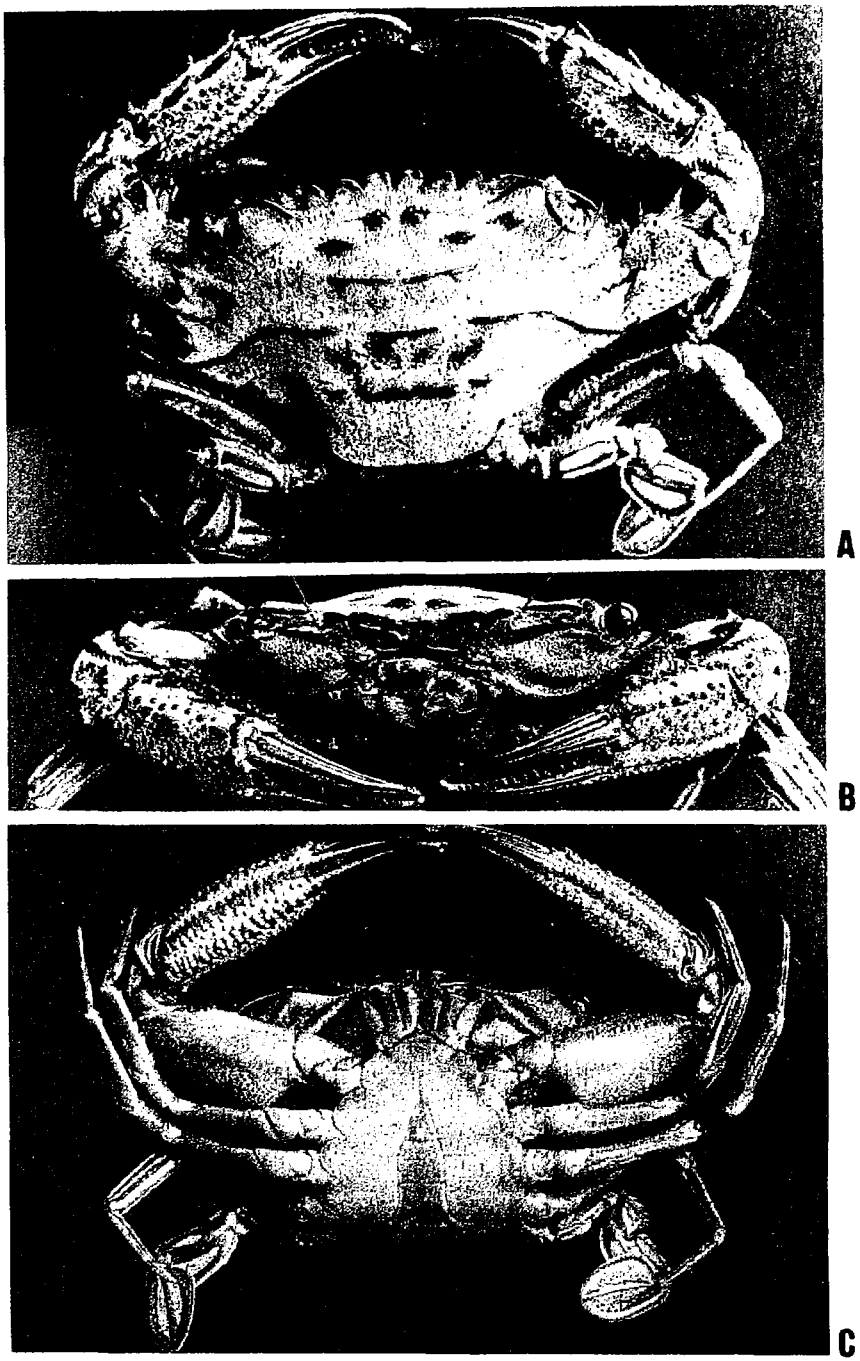


Fig. 46. *Thalamita pelsarti* Montgomery, 1931. ZRC 1993.7234, male, 40.2 by 63.9 mm. A, dorsal view; B, frontal view; C, ventral view.

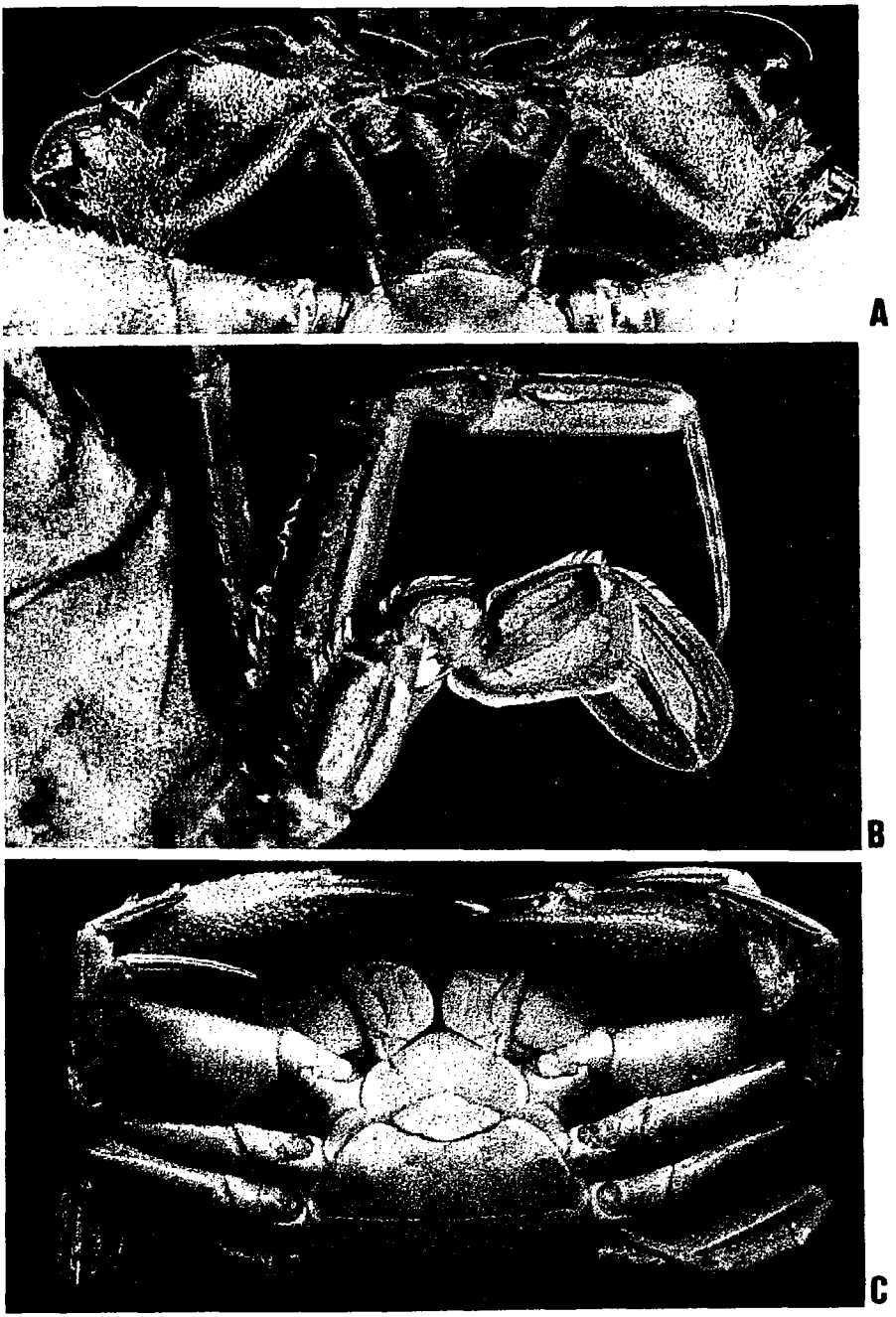


Fig. 47. *Thalamita pelsarti* Montgomery, 1931. A, ZRC 1993.7234, male, 40.2 by 63.9 mm, ventral view of front; B, ZRC 1993.7234, male, 40.2 by 63.9 mm, dorsal view of ambulatory and natatory legs; C, ZRC 1987.25, female, 34.9 by 53.5 mm, ventral view.

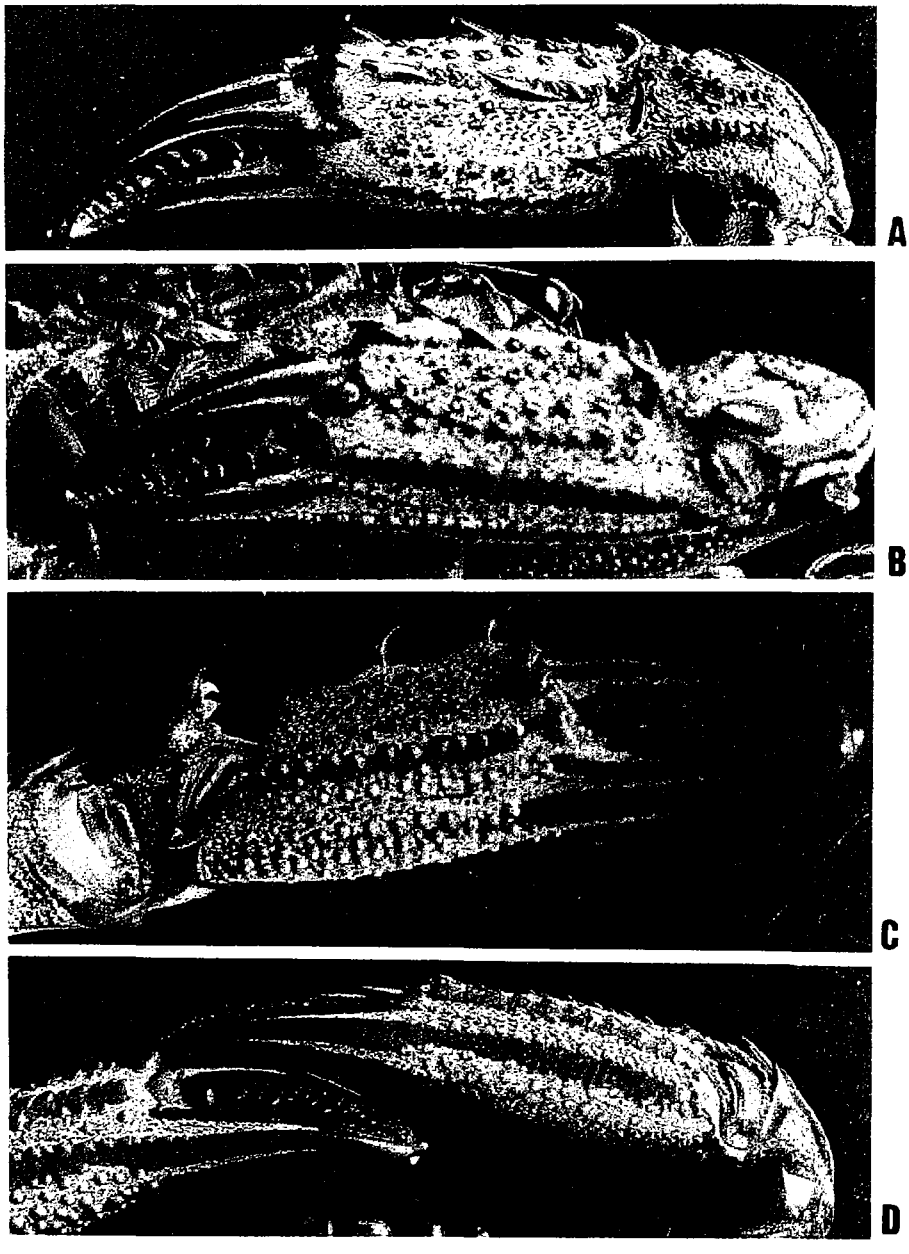


Fig. 48. *Thalamita pelsarti* Montgomery, 1931. ZRC 1993.7234, male, 40.2 by 63.9 mm. A, upper surface of cheliped manus; B, outer surface of cheliped manus; C, inner surface of cheliped manus; D, lower surface of cheliped manus.

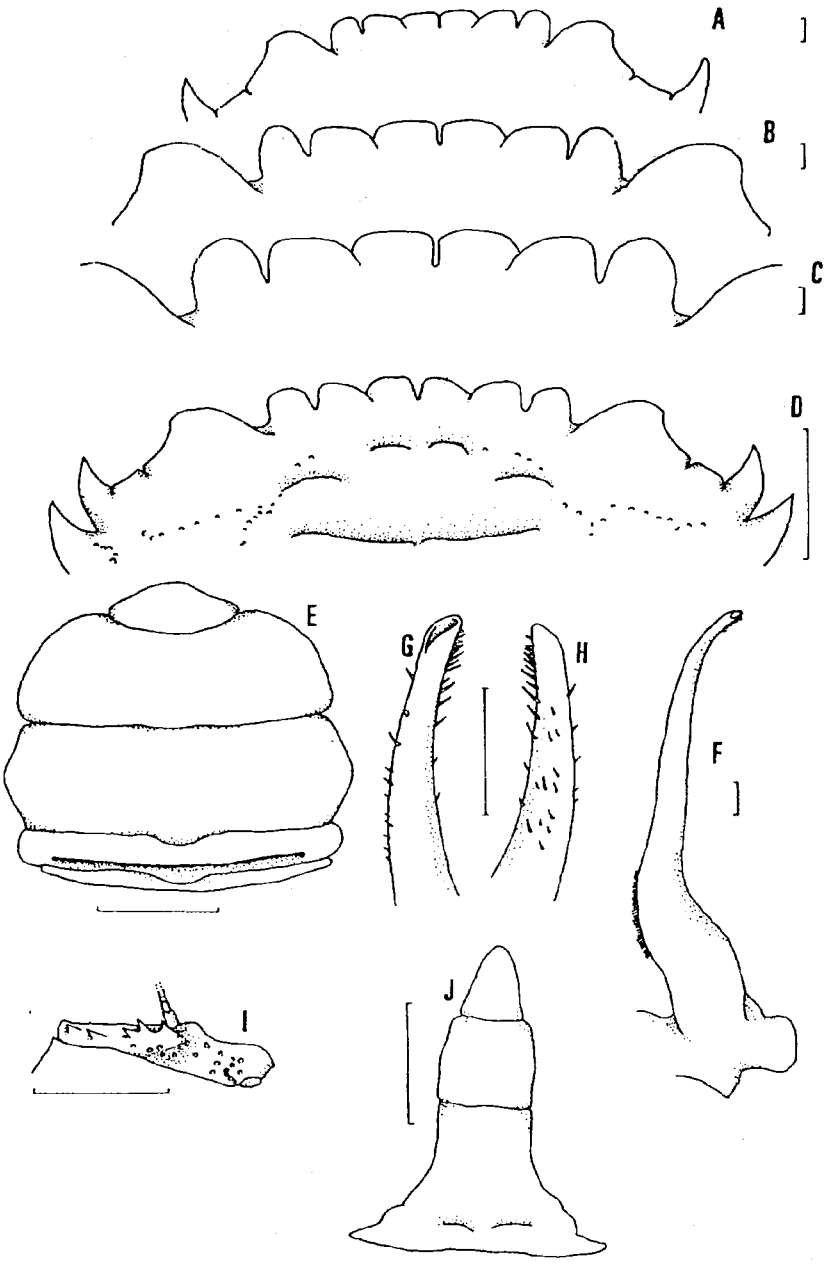


Fig. 49. *Thalamita pelsarti* Montgomery, 1931. A - ZRC 1965.10.26.25, male, 15.8 by 25.1 mm; B - ZRC 1965.10.26.19, male, 25.5 by 41.5 mm; C, E - ZRC 1987.25, female, 34.9 by 53.5 mm; D - ZRC 1987.26, male, 38.4 by 58.9 mm; F-J - ZRC 1993.7234, male, 40.2 by 63.9 mm. A, front dorsal surface; B, front dorsal surface; C, front dorsal surface; D, front dorsal surface; E, female abdomen; F, left G1 abdominal surface; G, apex of left G1 abdominal surface; H, apex of left G1 sternal surface; I, right basal antennal segment; J, male abdomen. Scales: A-C, F-H = 1.0 mm, D-E, I-J = 10.0 mm.

8. The basal antennal segment of *T. pelsarti* bears three to five sharp spines, the first to third may be fused at the base. *Thalamita prymna* shows only one to two fused spines with a broadly elevated base.

9. The G1 of *T. prymna* is sharply curved at the distal tip, almost at right angles to the axis. On the other hand the G1 of *T. pelsarti is* curved gradually to the tip. The terminal bristles on the outer surface are confined only to the distal tip in the former, *T. pelsarti* has the bristles extending down the length of the G1. The basal lobe bears a concave lateral border unlike the convex border in *T. pelsarti.*

Thalamita picta Stimpson, 1858
(Fig. 50A-F)

Thalamita picta Stimpson, 1858: 39; Stimpson, 1907: 85, pl. 10, fig. 5; A. Milne Edwards, 1873: 164, pl. 4, fig. 4; Miers, 1884: 540; Alcock, 1899: 79; Rathbun, 1906: 873; Balss, 1922: 111; Sakai, 1976: 373, pl. 131, fig. 2; Shen, 1937: 135; Ward, 1942: 81; Barnard, 1950: 175; Tweedie, 1950: 84; Edmondson, 1954: 263, figs. 35b, 36e-h; Stephenson & Hudson, 1957: 344, figs. 2A, 3A, pl. 4, figs. 2, pls. 8K, 10l; Forest & Guinot,1961: 33; Crosnier, 1962: 138, figs. 237-240, pl. 12, fig. 2; Ow-Yang, 1963: 116, pl. 24, figs. A-F, A1; Garth, 1965: 12, figs. 7, 11, 12; Stephenson & Rees, 1967a: 56; Stephenson, 1972: 150; Heath, 1973: 16, fig. 6e, 9d, 12d; Takeda & Shimazaki, 1974: 55; Yang et al., 1979: 83, fig. 8; Lovett, 1981: 130, figs. 290a-c; Dai et al., 1986: 229, pl. 30(8), fig. 136(1); Dai & Yang, 1991: 250, pl. 30(8), fig. 136(1).
Thalamita prymna var. *picta* - Borradaile, 1903: 201; Montgomery, 1931: 430.
Thalamita gardineri Borradaile, 1903: 205; Rathbun, 1911: 209.
Thalamita alcocki - Edmondson, 1954: 264, figs. 37a, b; Rathbun, 1906: 875 (non *Thalamita alcocki* De Man, 1902).
Charybdis picta - Ward, 1934: 9.
? *Thalamita investigatoris Alcock*, 1899: 85.

Material examined. - PENINSULAR MALAYSIA - 3 males, 1 female (ZRC 1965.10.26.1-4), Pulau Aor, Pahang, coll. M.W.F. Tweedie, Jun.1938.

Size. - The largest specimen is a male measuring 10.9 by 15.9 mm (ZRC 1965.10.26.1).

Diagnosis. - Carapace surface pilose; carapace ridges distinct, including cardiac and a pair of mesobranchial ridge; six frontal lobes, medians most projecting, rounded and distinctly separate, laterals narrowest and separated from broad submedians by deep notch; inner supraorbital lobe short and arched; five anterolateral teeth, fourth smallest, fifth sharpest and slightly protruding. Basal antennal segment with minutely granulated to smooth crest. Cheliped slighty unequal; merus bearing three to four spines on anterior border; carpus armed with strong spine at inner angle and three spinules at outer angle; manus with four spines on upper surface, outer surface granulated bearing three costae, inner surface smooth or with squamiform markings. Propodus of natatory leg with five to seven spines along posterior border. Penultimate segment of male abdomen with lateral borders parallel for two thirds of its length and then converge distally. G1 stout and straight, tip sharply curved and flared, outer surface of tip bearing fifteen to twenty short bristles and four to seven bristles on inner surface.

Colour. - Normally mottled greenish yellow in colour, but exhibiting colour variations. Sakai (1965: pl. 63, figs. 2, 3) recognised two differing colour morphs, the other being almost white with a red band extending the length of the carapace.

Habitat. - This is a small species, commonly found in intertidal zones of rocky shores to fringing coral reefs.

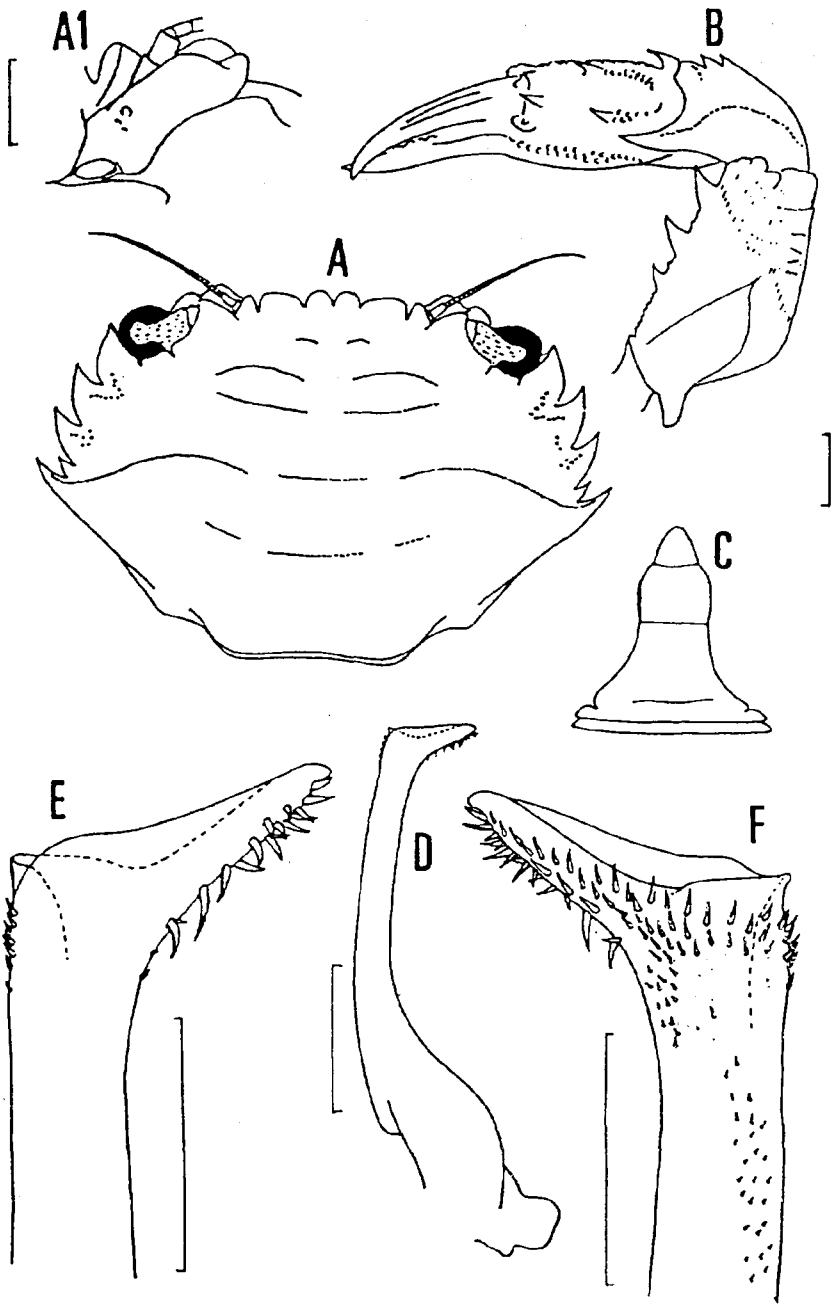


Fig. 50. *Thalamita picta* Stimpson, 1858. A-F - ZRC, Pulau Aor 6/1938, male, 10.0 by 16.0 mm (after Ow-Yang, 1963). A, carapace dorsal surface; A1, left basal antennal segment; B, right cheliped; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface. Scales: A, A1-D = 1.0 mm, E-F = 0.5 mm.

Distribution. - East Africa, Red Sea, India, China, Taiwan, Japan, Philippines, Malaysia, Australia, Marianas, Marshall, New Caledonia, Tuamotus, Samoa, Hawaii and Clipperton Island (adapted from Barnard, 1950; Garth, 1965; Stephenson & Rees, 1967; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded from Malaysia by Shen (1937).

Remarks. - Stephenson (1976) confirmed that the specimen of *Thalamita alcocki* De Man, 1902, recorded by Rathbun (1906) and repeated by Edmondson (1954), belongs to this species. They noted that Edmondson's illustration of the basal antennal segment to be granular, is a mistake, as the specimen possesses a smooth crest on the basal antennal segment (Stephenson, 1976). It also match *T. picta* in the other characters (see diagnosis above). *T. alcocki* by De Man (1902) however remains distinct from this species.

This species show variability in the degree of onamentations on the inner surface of the manus which varies from smooth to squamiform. Thus *T. gardineri* Borradaile, 1903, was made a synonym of *T. picta* because their abdomens and G1s are identical inspite of differences in the ornamentations on the manus inner surface (Stephenson & Hudson, 1957).

Although small specimens approach *T. investigatoris* (Alcock, 1899), Stephenson (1976), proposed that the latter be retained until the types can be reexamined because Alcock's description of the manus, with only two spines, sets it apart from *T. picta*. Thus it remains a tentative synonym of *T. picta*.

Thalamita prymna (Herbst, 1803)

(Figs. 51A-C, 52A-C, 53A-C, 54A-D, 55A, B, 56A-C, 57A-J)

Cancer prymna Herbst, 1803: 41, pl. 57, fig. 2.
Portunus (Thalamita) prymna - De Haan, 1835: 43, pl. 12, fig. 2, pl. A.
Thalamita prymna - De Man, 1888: 75, pl. 4, figs. 5, 6; Henderson, 1893: 372; Alcock, 1899: 78; Rathbun, 1910: 365; Shen, 1937: 133, fig. 18; Barnard,1950: 174; Chhapgar, 1957: 26, pl. 7, figs. o-q; Crosnier, 1962: 136, figs. 234-236; Ow-Yang, 1963: 120 (part), pl. 25, figs. A1, B3; Stephenson & Rees, 1967a: 89 (part); Stephenson, 1972: 150(part); Heath, 1973: 16, fig. 6d, 9e, 12e; Lovett, 1981: 130 (part), fig. 292a; Dai et al., 1986: 228 (part), pl. 30(7), fig. 135(3); Dai & Yang, 1991: 249 (part), pl. 30(7), fig. 135(3).
Thalamita prymna form b - Tweedie, 1950: 84, fig. 1b.
Thalamita crassimana Dana, 1852: 284, pl. 17, figs. 9a-d; Stimpson, 1858: 39; Stimpson, 1907: 86
?*Thalamita prymna* form C - Calman, 1900: 22.
?*Thalamita prymna* var. *annectans* - Laurie, 1906: 418.
?*Thalamita tenuipes* Borradaile, 1903: 204, fig. 35a-b.

Material examined. - Neotype - male, 34.8 by 54.9 mm, (BMNH 1890.10.20.51), Tuticorin, South East India, coll. E. Thurston.

Others. - SINGAPORE - 1 male (ZRC), Labrador Beach, coll. P.K.L. Ng, 8 Feb.1993. — 2 males, 1 gynandromorph (ZRC 1993.7236-7238), Labrador Beach, coll. D. Wee, 21 Jul.1993. — 6 males, 3 females (ZRC 1993.7239-7247), Labrador Beach, coll. D. Wee, 19 Aug.1993 (male 42.9 by 69.2 mm, ZRC 1993.7239, here designated as neotype of *Thalamita crassimana* Dana, 1852). — 1 female (ZRC 1965.10.26.20-21), Pulau Ubin, Jun.1934. — 1 male (ZRC 1965. 10. 26.28), Horsburgh Lighthouse, coll. M.W.F. Tweedie, Apr.1934.

PENINSULAR MALAYSIA - 1 female (ZRC 1965.10.26.29), Pulau Aor, Pahang, coll. M.W.F. Tweedie, Jun.1938. — 1 male, 1 female (ZRC 1965. 10.26.63-64), Pulau Aor, Pahang, coll. M.W.F. Tweedie, Jun.1938.

SRI LANKA - 1 male, 14.9 by 23.6 mm (BMNH 1882.19), Galle, Ceylon, coll. W. Ondaatje.

INDIA - 1 male (BMNH 1890.10.20.52), same data as neotype.

ARABIA - 2 males, 43.7 by 70.4 mm, 40.2 by 63.1 mm (RMNH D435), Jeddah, coll. Kruyt.

Size. - The largest specimen is a male measuring 46.3 by 71.7 mm (ZRC 1993.7239).

Description. - Carapace broader than long, ratio of breadth to length approximately 1.6 times. Dorsal surface smooth and shiny, pubescence retricted only to bases of anterolateral spines and in front of lateral parts of the carapace ridges. Frontal ridges closely set, prominent and truncate anteriorly. Protogastric ridges granular and arched, extending inwards to beneath outer edge of frontals. Mesogastric ridge unbroken, continued lateraly to the notch between the first and second anterolateral teeth. Epibranchial ridges separated by a faint cervical groove. No carapace ridges behind epibranchials except for H-shaped groove on the cardiac region.

Frontals straight, cut into six short and truncated lobes which are in close contact with one another. Medians set on a slightly lower plane and divided by a narrow incision. Submedians broadest often fused to medians. Laterals slightly narrower than medians, bluntly rounded and separated from submedians by a very shallow notch. Inner supraorbital lobe arched and broader than combined widths of the submedian and lateral lobes. Inner infraorbital lobe obtusely triangular with finely serrated edge.

Five anterolateral teeth, first three large increasing in size from front to rear, fourth tooth rudimentary, fifth tooth smaller than third.

Basal antennal segment much wider than major diameter of orbit, bears one to two broadly fused spines at base of antennal insertion and several spiniform tubercles.on each side of the ridge.

Chelipeds unequal, stout and somewhat tumid. Anterior border of merus bearing three sharp spines and a spinule each on the distal corner of anterior and ventral borders. Faint granules on upper surface of posterior border, lower surface of merus smooth. Upper surface of carpus bears widely spaced rounded granules; similar granules line the anterior border and on the costa leading to enlarged spine at the inner angle. Outer surface bears three spines, the upper and lowest being terminations of two granular costae. Manus bears five stout spines on the upper surface, two on inner border of upper surface, with spiniform tubercles at the proximal end, two on outer border and a usual spine at the wrist articulation. Outer surface of manus bears two distinct costae at the lower half, of which, the upper most in larger specimens is represented by a row of rounded granules. Upper half of manus with confused rows of granules. Inner surface smooth with an indistinct median costa, sometimes sparsely beset with a row of minute granules at proximal end. Entire surface of manus except those with granules remain smooth throughout and without hairs. Fingers stout in larger chela, long and sharper in smaller cheliped. Under surface of the immovable finger without groove.

Merus of ambulatory and natatory legs smooth and without hairs on the posterior surface. Merus of natatory leg with usual spine at posterior border and another at the distal end, propodus with posterior border serrated.

Penultimate segment of male abdomen longer than broad, lateral borders converge gently to distal end, ultimate segment acutely triangular. Third, fourth and fifth segment smoothly fused.

G1 elongate, stout and straight for most part, bent sharply at the terminal end. Outer surface bears a cluster of terminal bristles just behind tip, non to four small conical spines present amongst the bristles. Inner surface bear few widely spaced, short bristles beginning from distal end of the sharp bent, extending backwards along curvature and terminating at the mid region of the G1. Basal lobe truncate with a concave to straight lateral border.

Colour. - Ambulatory and natatory legs bluish green, including spines and fingers of chelipeds. Dorsal surface of carapace yellowish green with orange brown patches on the ridges. Ventral surface pale orange.

Habitat. - The habitat of this species is similar to that of *T. pelsarti*, being common on rocky shores at low tidal levels.

Distribution. - East Africa (Barnard, 1950), Madagascar (Crosnier, 1962), India (Henderson, 1893), Andaman Islands (Alcock, 1899), Japan (De Haan, 1835), Hong Kong (Stimpson, 1858), Malaysia (Tweedie, 1950), Singapore (Shen, 1937), and Australia (Stephenson & Rees, 1967).

Remarks. - The type specimen of *Thalamita prymna* is no longer present in the Berlin Museum and is probably lost. Owing to this we only have for comparison the description and figure in Herbst (1803), which is rather too schematic and small to be of much use. Moreover the type described was based upon a juvenile specimen, resulting in the absence of many adult features for identification. Despite these limitations, several characters have been chosen from the figure and a comparison with specimens reported by Henderson (1893), Alcock (1899) and Chhapgar (1957) from India (type locality of *T. prymna*), allows for the redefining of this species.

The specimens presently described, match Herbst's type in having a smooth inner surface on the manus of the cheliped; a closely set and truncated frontal lobes; a carapace ridge running to the notch between the first and second anterolateral teeth and a pair of strongly arched mesogastric ridges.

Alcock mentioned that the manus of the chelipeds are without hairs, less granulated and without a ridge separating the lower to inner surface as in *T. danae*. Both Henderson and Alcock record the frontal lobes to be closely set and remarkably square cut. The described specimen agrees entirely with the frontal lobes illustrated by De Man (1888: pl. 4 fig. 5) which Henderson referred to. Apart from Alcock and Henderson, Chhapgar also illustrated the continuous ridge running from the mesogastric to the notch between the first and second anterolateral teeth. Hence with these characters in mind we have chosen to define *T. prymna* on the basis of the present specimens, to prevent further confusion with *T. pelsarti* Montgomery, 1931 (new status).

Previous works have synonymized *T. pelsarti* under *T. prymna*, this has resulted in the latter species having extremely variable characters (refer to *T. pelsarti* for comparisons). Tweedie (1950) noted the differences in form and listed the two as *Thalamita prymna* form a and form b. He also mentioned that Shen's (1937) report on the Portunidae chose to make no distinctions between them. These specimens from Pulau Aor and Horsburgh lighthouse were re-examined and Shen's fig. 18a proved to be inaccurate. Specimens with the continuous ridge to the anterolateral teeth do not posses widely separated frontal lobes as shown in Shen's figure.

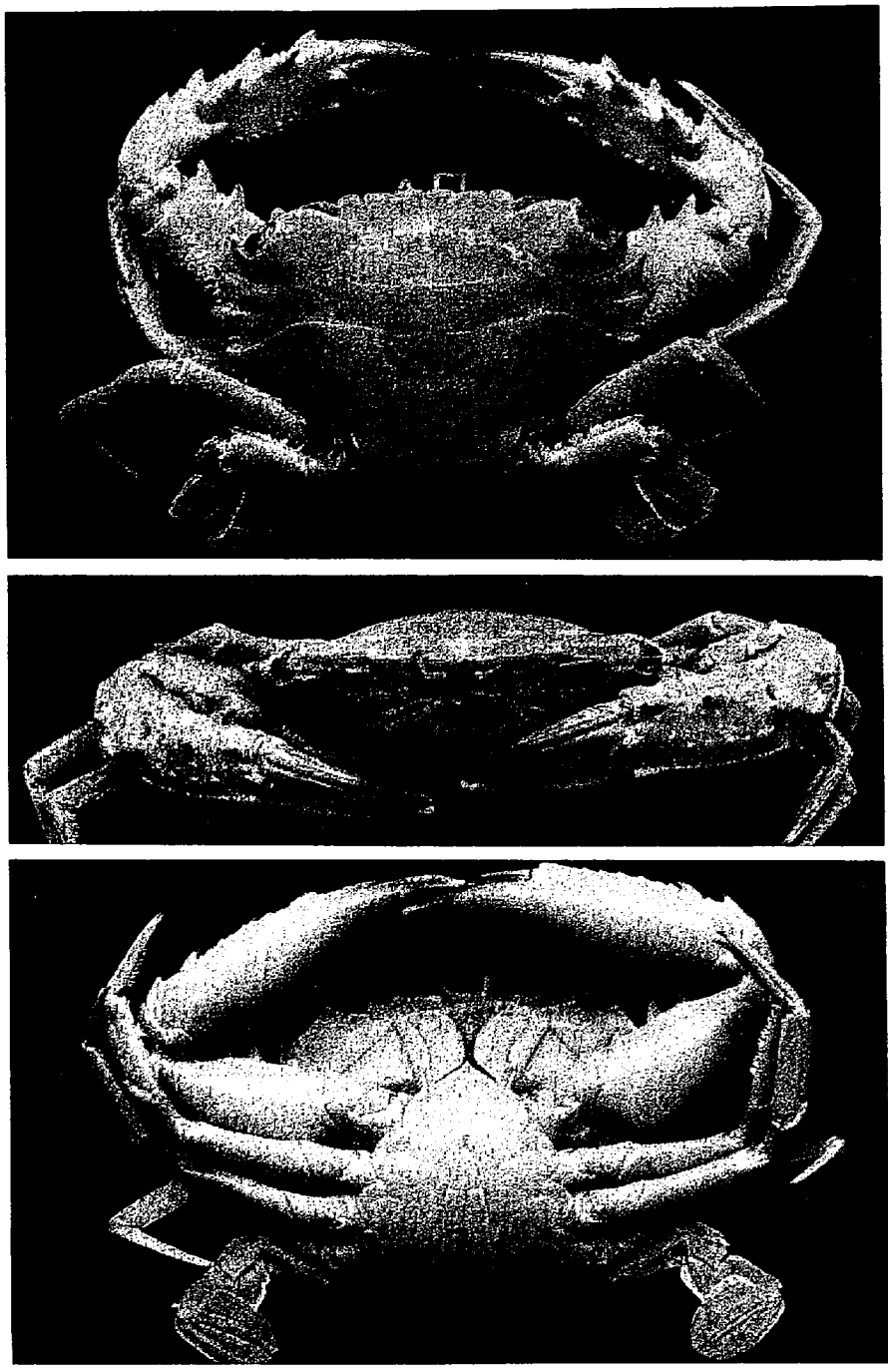


Fig. 51. *Thalamita prymna* (Herbst, 1803). BMNH 1890.10.20.51, neotype male, 34.8 by 54.9 mm. A, dorsal view; B, frontal view; C, ventral view.

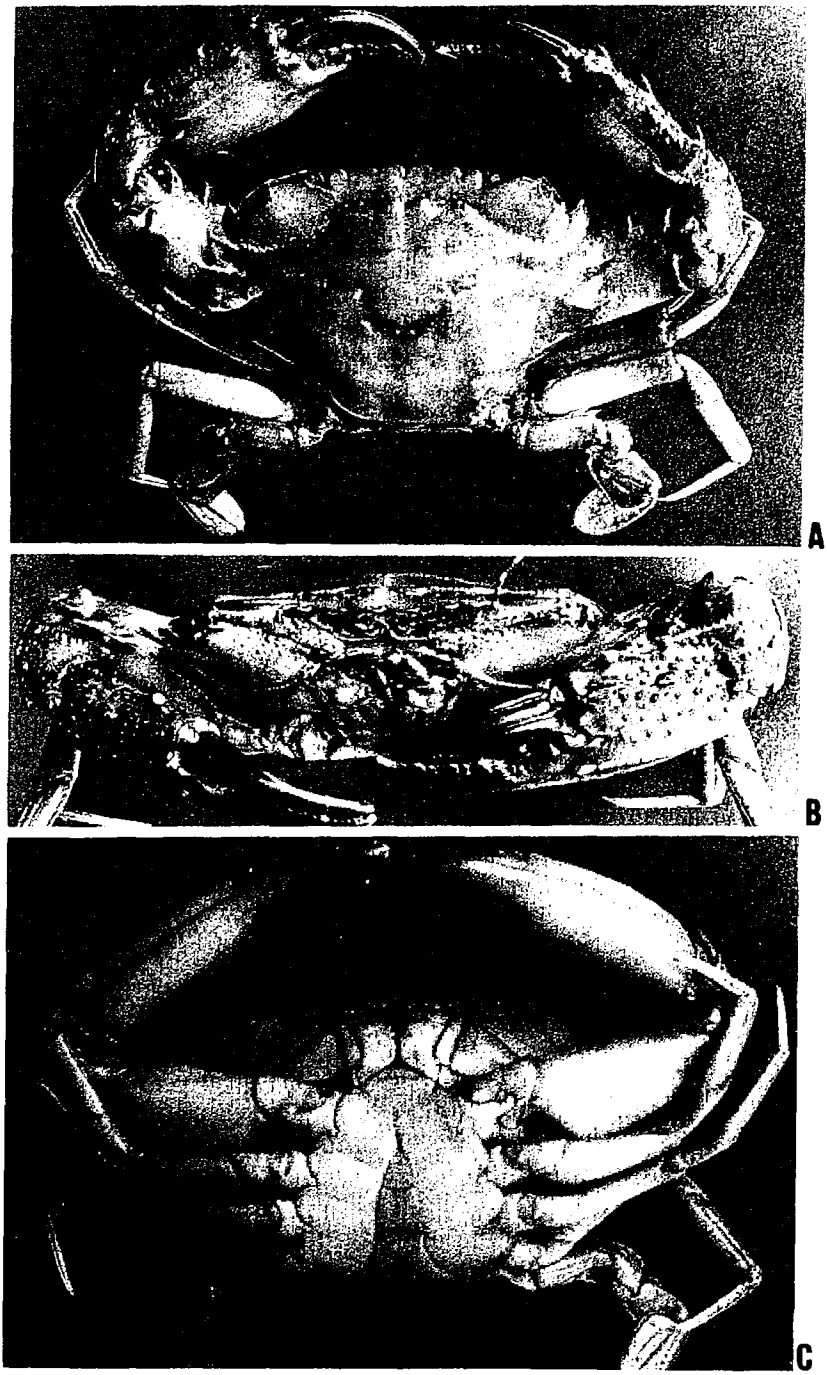


Fig. 52. *Thalamita prymna* (Herbst, 1803). ZRC 1993.7239, male, 42.9 by 69.2 mm. A, dorsal view; B, frontal view; C, ventral view.

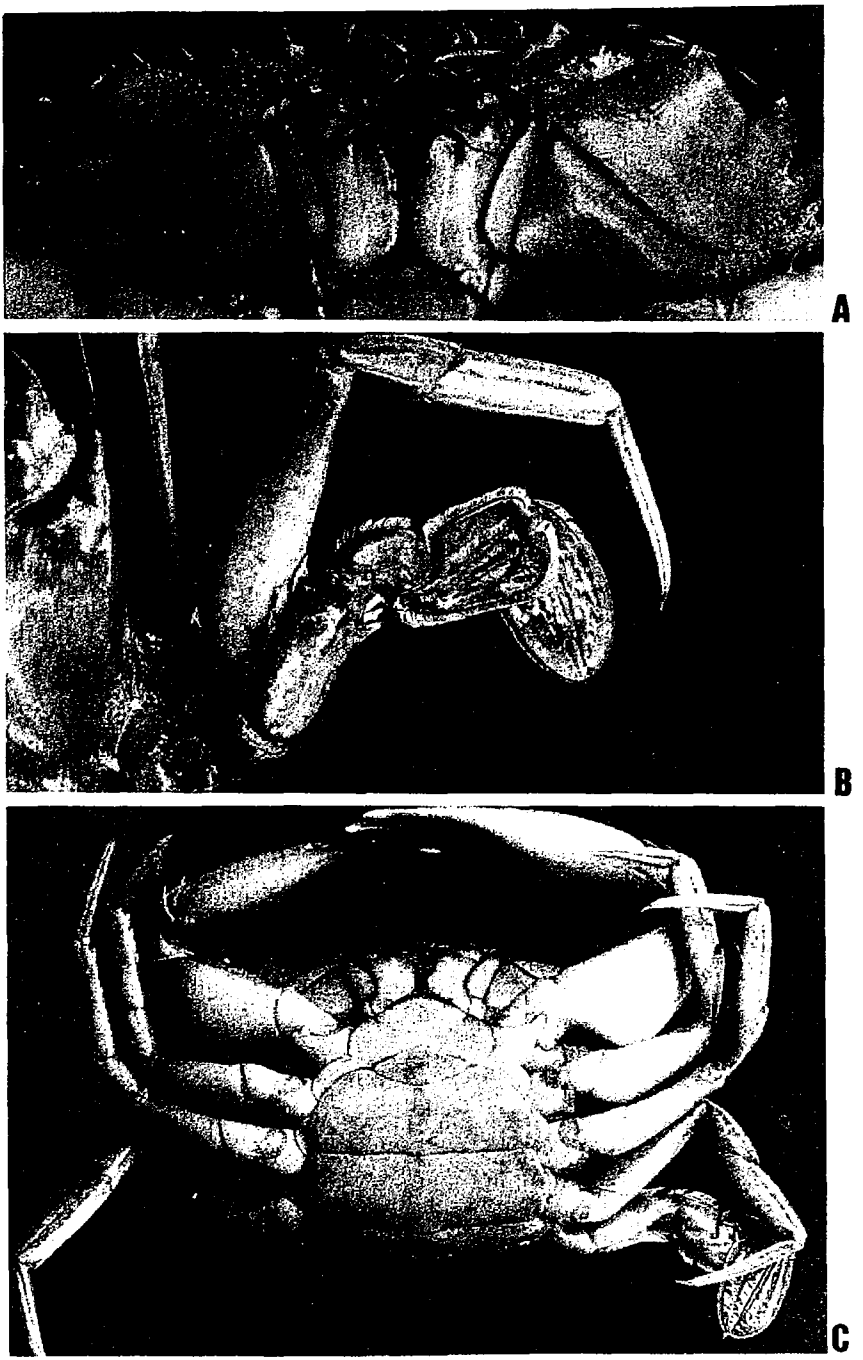


Fig. 53. *Thalamita prymna* (Herbst, 1803). A, ZRC 1993.7239, male, 42.9 by 69.2 mm, ventral view of front; B, ZRC 1993.7239, male, 42.9 by 69.2 mm, dorsal view of ambulatory and natatory legs; C, ZRC 1993.7240, female, 27.6 by 43.2 mm, ventral view.

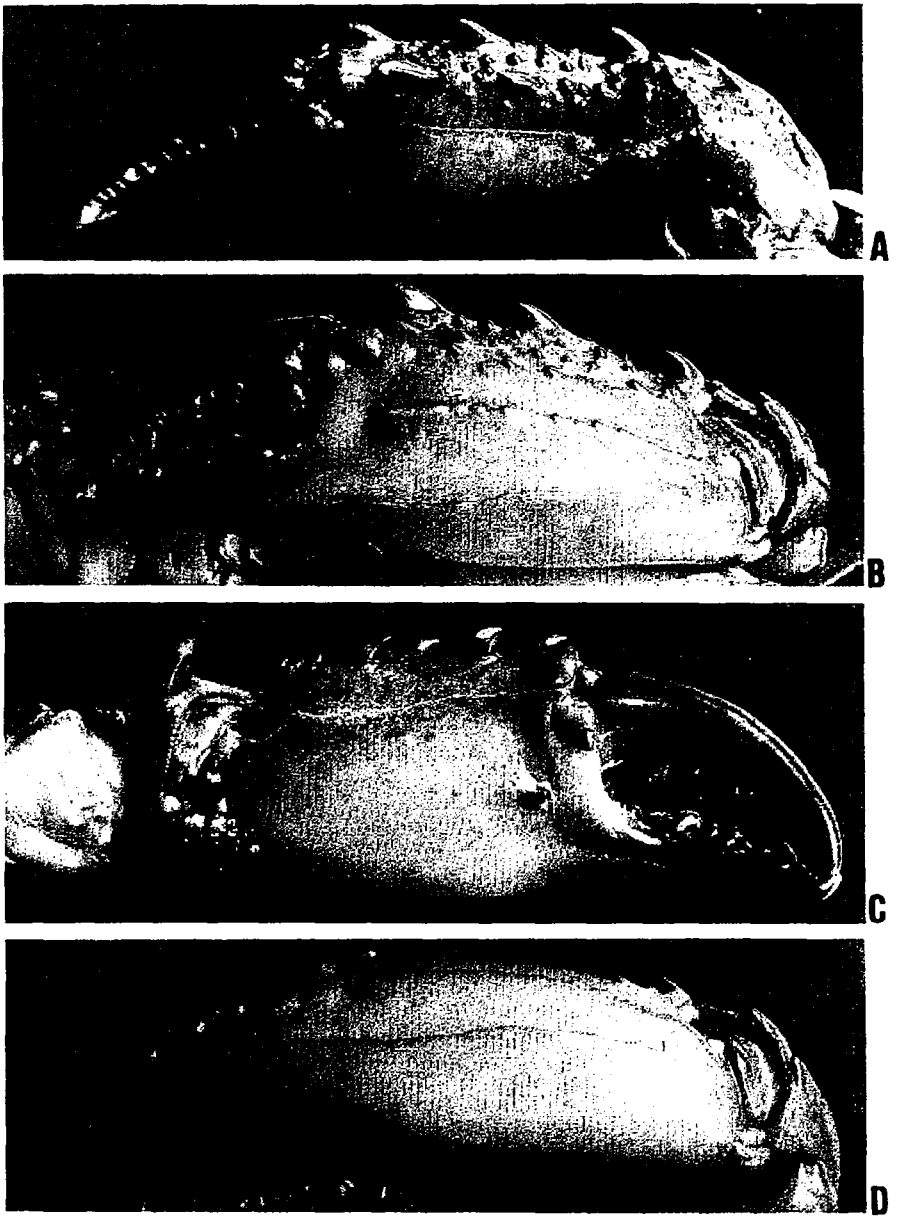


Fig. 54. *Thalamita prymna* (Herbst, 1803). ZRC 1993.7239, male, 42.9 by 69.2 mm, cheliped manus. A, upper surface; B, outer surface; C, inner surface; D, lower surfaces.

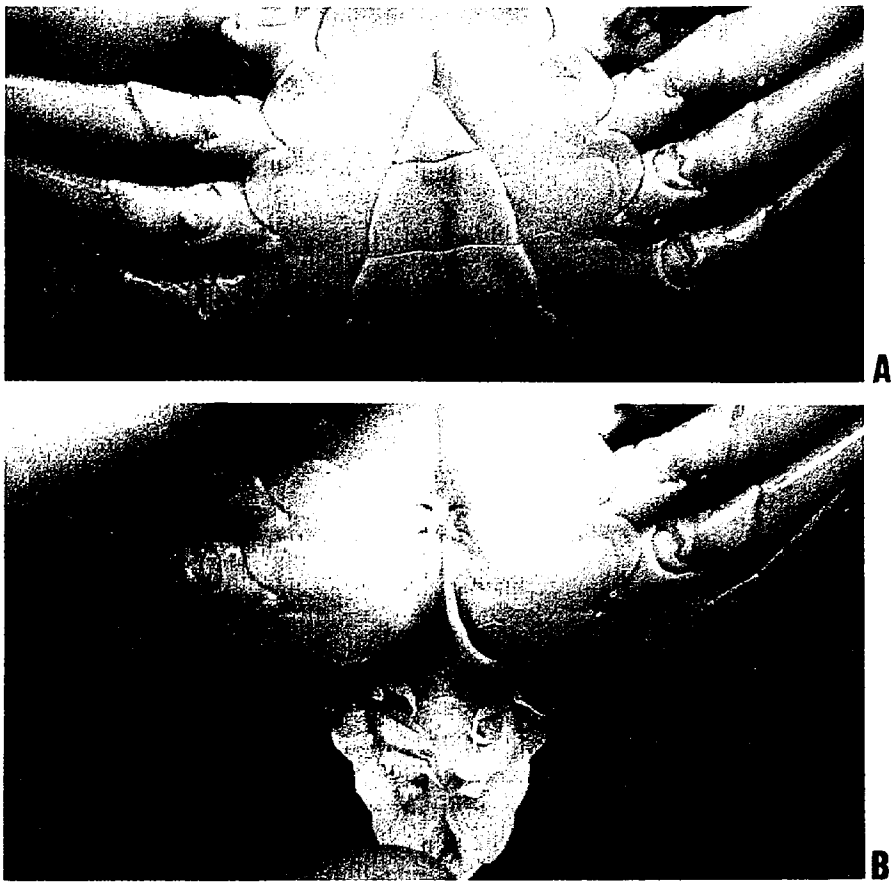


Fig. 55. *Thalamita prymna* (Herbst, 1803). ZRC 1993.7236, gynandromorph, 42.3 by 67.5 mm. A, ventral view; B, abdomen opened.

We suspect that Stephenson & Hudson (1957) had obtained both types but chose to keep them as *T. prymna*. Tweedie's form a and form b were synonymized under the same species, explained on their assumption that the differences were due to wear and tear, and this accounted for the smooth lower surface of the manus of the chelipeds and the reduced number of spines on the basal antennal segment in form b. Stephenson (1972) however, examined specimens with an elevated crest of fused tubercles, found it difficult to see how three to five spines will lead to an elevated crest simply through wear.

Dana (1852) noted that the specimen of his species *T. crassimana*, was similar to the *T. prymna* figured by De Haan (1833: pl. 12, fig. 2), characterised in having closely set, square cut frontal lobes and smooth inner to lower surfaces of the manus. Aside from the two features mentioned *T. crassimana* is similar to the present species in all other aspects. The type specimen of *T. crassimana* Dana, 1852, are lost and his diagrams have not been clearly illustrated. Although no type location was mentioned, it is known that he had collected

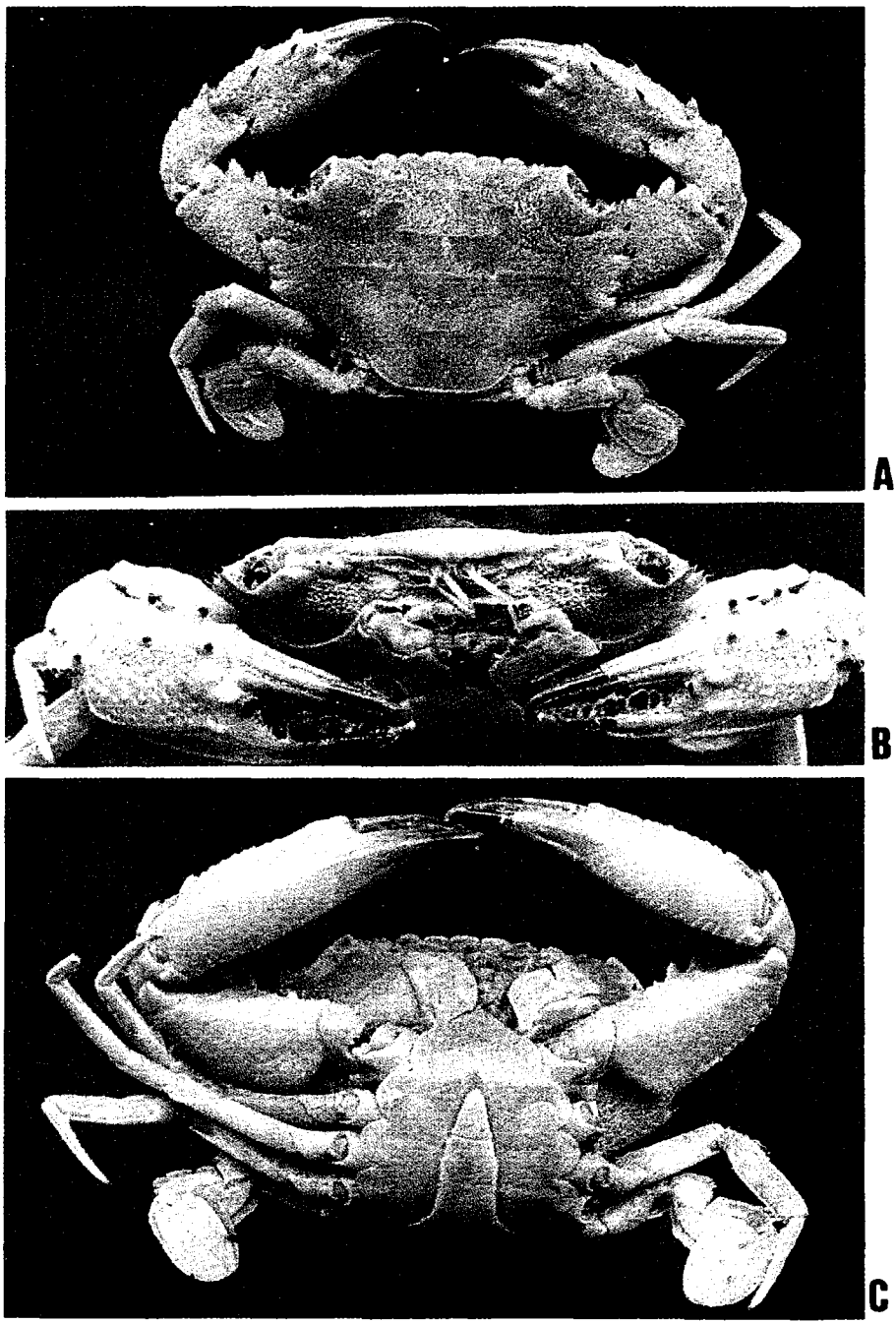


Fig. 56. *Thalamita* aff. *prymna* (Herbst, 1803). RMNH D435, male, 28.2 by 44.3 mm. A, dorsal view; B, frontal view; C, ventral view.

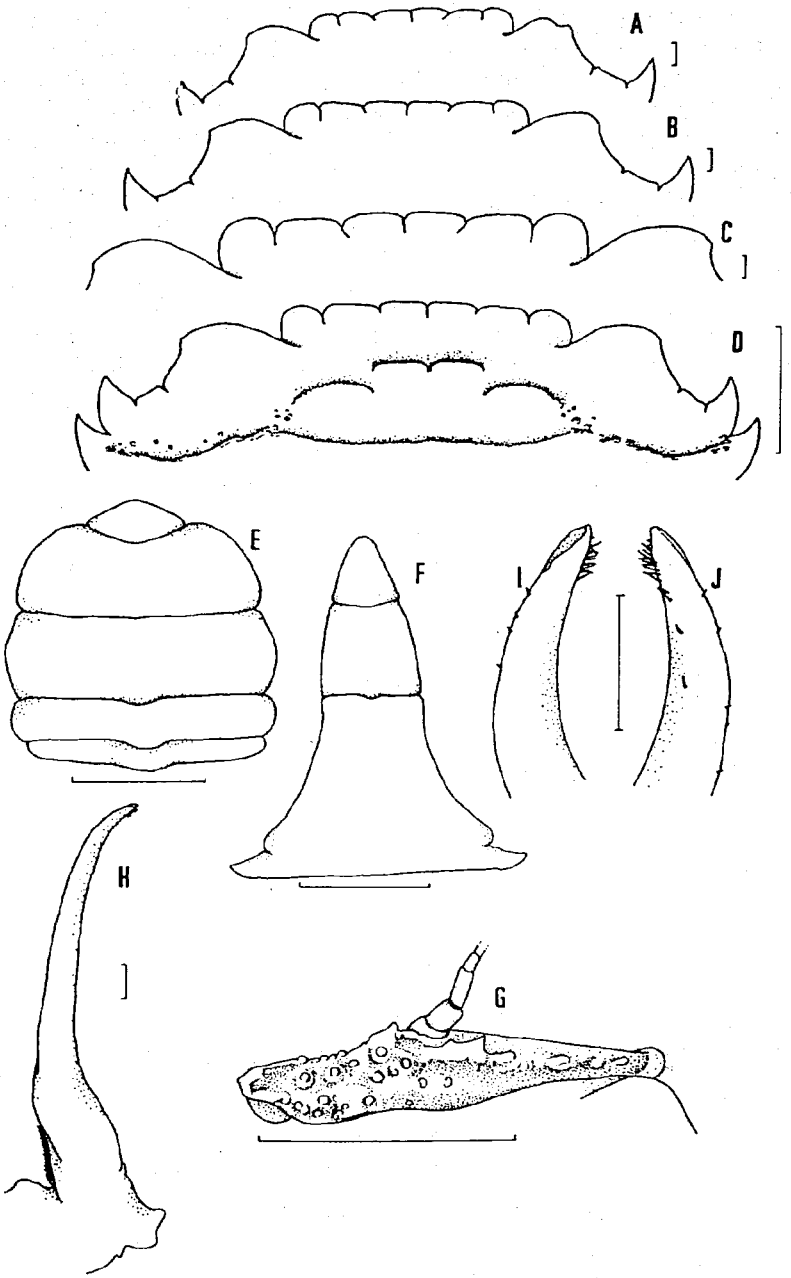


Fig. 57. *Thalamita prymna* (Herbst, 1803). A - ZRC 1965.10.26.63, male, 14.9 by 23.7 mm; B - ZRC 1965.10.26.64, female, 17.8 by 28.3 mm; C - ZRC 1993.7240, female, 27.6 by 43.2 mm; D - ZRC 1993.7241, male, 37.5 by 58.1 mm; E - ZRC 1993.7240, female, 27.6 by 43.2 mm; F-J - ZRC 1993.7239, male, 42.9 by 69.2 mm. A, front dorsal surface; B, front dorsal surface; C, front dorsal surface; D, front dorsal surface; E, female abdomen; F, male abdomen; G, left basal antennal segment; H, left G1 abdominal surface; I, apex of left G1 abdominal surface; J, apex of left G1 sternal surface. Scales: A-C, H-J = 1.0 mm, D-G = 10.0 mm.

specimens from Singapore. Hence the specimen measuring 42.9 by 69.2 mm (ZRC 1993.7239) from Labrador Beach, Singapore, is now designated as the neotype for *T. crassimana*. *Thalamita crassimana* thus becomes a junior synonym of *T. prymna*. A specimen (BMNH 1890.10.20.51-52) from Tuticorin, India, collected by E. Thurston and described by Henderson (1893) is hereby selected as the neotype for *T. prymna* to stabilise the taxonomy.

Thalamita tenuipes Borradaile, 1900, could well be a synonym of *T. prymna*, because the basal antennal segment bears two fused spines. However it needs to be re-examined as it is only a juvenile of 13mm in breadth.

We agree with Stephenson & Hudson in suggesting that Calman's form C be recognised as a new species because it differs from the general concept of *T. prymna*. On the other hand, the identity of *T. prymna* var. *annectans* Laurie, 1906, remains uncertain. Laurie established this variety based on several characters and not just one as mentioned by Stephenson & Hudson. On the inner border of the upper surface of the manus, it possesses an additional distal spine smaller than the other two on the same border. This feature is quite unlike that of *T. prymna* or *T. pelsarti*.

One specimen measuring 42.3 by 67.5 mm (ZRC 1993.7236) is a gynandromorph (Fig. 55A, B). In the dorsal view, the specimen shows nothing extraordinary, but in the ventral view the abdomen resembles that of a juvenile female. This specimen bears completely developed female gonopods and a left male G1.

Another series of specimens (Fig. 56A-C; females: 33.4 by 52.8 mm, 23.9 by 38.4 mm, 31.2 by 58.9 mm; males: 28.2 by 44.3 mm, 18.3 by 29.0 mm) identified as *T. prymna* from the Jeddah collection (RMNH D435) have been noted to resemble closely to *T. prymna* and *T. pelsarti*. However they cannot fit into any of the two species as defined above, there remains therefore the possibility of them being new. In view of the present geographical location covered by this monograph, the authors have chosen to describe these specimens at a later time.

Thalamita sexlobata Miers, 1886
(Fig. 58A-E)

Thalamita sexlobata Miers, 1886: 196, pl. 15,16, figs. 2a-c; Henderson, 1893: 373; Alcock, 1899: 87; Stephenson, 1945: 136, fig. 32c-d; Stephenson & Hudson, 1957: 350, figs. 2B, 3B, pl. 5, fig. 1, pls. 8N, 10K; Crosnier, 1962: 117, figs. 195-198; Ow-Yang, 1963: 126, pl. 26, fig. A-E; McNeill, 1968: 52; Stephenson, 1972: 151; Stephenson, 1975: 203; Lovett, 1981: 130, figs. 293a-c; Takeda, 1989: 156.
Thalamita sexlobata var. *plicatifrons* - De Man, 1902: 651.
Thalamita poissonii - Sakai, 1939: 17 (non *Thalamita poissonii* Audouin & Savigny, 1817).

Material examined. - PENINSULAR MALAYSIA - 1 juv. male (ZRC 1985.1026), east of Johor C1/11, coll. S.R.F.R.S.

Size. - The specimen examined measures 5.1 by 6.2 mm. It is badly damaged and cannot be used for a detailed description.

Diagnosis. - Carapace surface pilose; frontal ridges short and granular, epibranchial ridges widely interrupted at cervical groove, short and distinct pairs of cardiac and mesobranchial ridges; four frontal lobes, laterals broadly curved, wider than medians; inner orbital lobes

short and arched; five anterolateral teeth, first tooth distinctly large, fourth smallest. Basal antennal segment shorter than major diameter of orbit, bears a short granulated crest. Chelipeds with squamiform markings; merus bearing two to three spines on anterior boarder; carpus with the four usual spines; manus bearing four spines on upper surface of hand, outer distal one reduced to tubercle. Propodus of natatory leg without denticles on posterior border. Penultimate segment of male abdomen with lateral borders convex all the way. G1 stout with flared tip, outer border with row of bristles extending from the tip down to mid region, bristles on inner border minute (adapted from Stephenson & Hudson, 1957).

Colour. - Not known.

Habitat. - This species is found on sandy bottoms at 20-80m in depth (fide Stephenson, 1972).

Distribution. - Madagascar, Persian Gulf, Gulf of Mannar, Arakan Coast, Andaman Islands, Japan, Philippines, Malaysia, Java Sea, Australia, Tongatabu and Honolulu (fide Henderson, 1893; Alcock, 1899; Stephenson, 1972; Takeda, 1989). The only record known from Malaysia is the specimen collected from East of Mersing by Ow-Yang (1963) and Lovett (1981).

Remarks. - Sakai's description of *Thalamita poissonii* fits the present species well. Moreover the diagram of the G1 provided by Sakai is that of a *T. sexlobata* as noted by Stephenson & Hudson (1957). Takeda (1989) listed *T. sexlobata* as a new record for Japanese waters. Hence there exist a strong possibility that Sakai's *T. poissonii* is in fact the same as *T. sexlobata*, although it was not mentioned in his later works.

Stephenson & Hudson (1957) stated that the lateral lobes show variable degree of

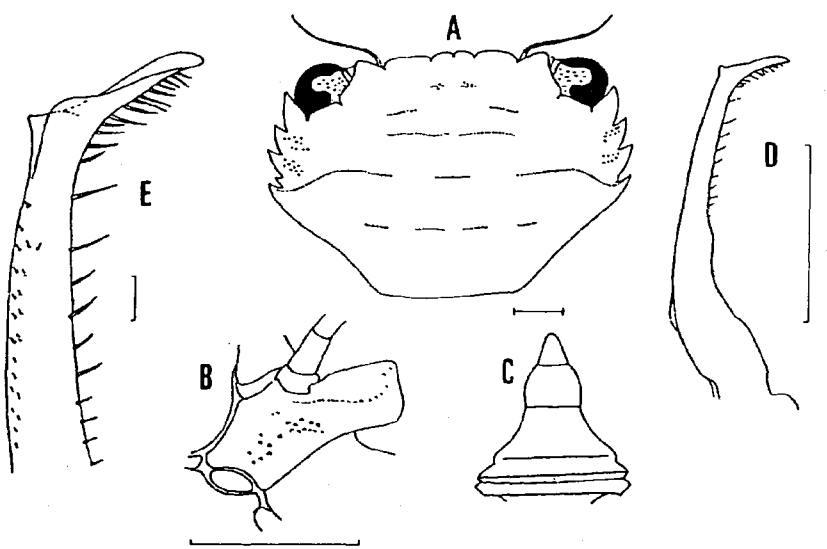


Fig. 58. *Thalamita sexlobata* Miers, 1886. A-E - ZRC 1985.1026, male, 5.2 by 7.6 mm (after Ow-Yang, 1963). A, carapace dorsal surface; B, left basal antennal segment; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface. Scales: A-D = 1.0 mm, E = 0.1 mm.

indentation, such that specimens almost approach a six lobed condition (as in *T. malaccensis*). This then allows for the synonymy of var. *plicatifrons* De Man, 1902, as the photograph of Stephenson & Hudson's specimen agrees with the figure of the frontal lobes of De Man's var. *plicatifrons*.

Thalamita sima H. Milne Edwards, 1834
(Fig. 59A-F)

Thalamita sima H. Milne Edwards, 1834: 460; Walker, 1887: 110; De Man, 1888: 75; De Man, 1895: 564; Alcock, 1899: 81; Stimpson, 1907: 83, pl. 9, fig. 2; Rathbun, 1910: 365; Balss, 1922: 11; Hale, 1927: 151; Montgomery, 1931: 430; Shen, 1934: 54, figs. 17,18; Sakai, 1934: 304; Sakai, 1939: 42, pl. 51, fig. 3; Sakai, 1976: 379, pl. 130, fig. 3; Stephensen, 1945: 120, fig. 27a-g; Barnard, 1950: 175, fig. 33b; Edmondson, 1954: 258, figs. 32e-h; Stephenson & Hudson, 1957: 352, figs. 2C, 3C, pl. 5, fig. 2, pl. 8D, 9G; Crosnier, 1962: 111, fig. 181; Ow-Yang, 1963: 128, pl. 27, figs. A-F, B1, E1; McNeill, 1968: 53; Stephenson, 1972: 151; Stephenson, 1975: 203; Lovett, 1981: 130, figs. 295a-d; Dai et al., 1986: 234, pl. 31(4), fig. 138(1); Dai & Yang, 1991: 254, pl. 31(4), fig. 138(1).
Portunus (Thalamita) arcuatus De Haan, 1835: 43, pl. 2, fig. 2, pl. 13, fig 1.

Material examined. - SINGAPORE - 6 males, 7 females (ZRC 1965.10.26.30-39), Siglap, coll. M.W.F. Tweedie, 1933. — 1 juv. (ZRC 1977.7.25.18), Siglap, Jun.1934. — 1 female (ZRC 1985.1030), off Siglap B49, coll.S.R.F.R.S.. — 1 female (ZRC 1985.1029), West of Bedok B48, coll. S.R.F.R.S., Jun.63. — 2 males (ZRC 1985.1031-1032), Damar Laut, coll. S.R.F.R.S., Jun.63. — 1 male (ZRC 1985.1028), south of Bedok B64, coll. S.R.F.R.S., Jun.63. — 2 males (ZRC 1985.1035-1036), kelong off Marine Parade. — 1 female (ZRC 1985.1034), off Tanjong Rhu B50, coll. S.R.F.R.S.. — 1 male (ZRC 1984.5619), Sentosa, coll. C.M. Yang, 10 Apr.1981. — 1 female (ZRC 1987.447), Sentosa reefs, coll. P.K.L. Ng, Jun.1986. — 1 male, 1 female (ZRC 1993.140), Sentosa, coll. D.G.B. Chia and T.L. Koh, Jan.1992. — 1 female (ZRC), Sentosa, coll. D.G.B. Chia and T.L. Koh, Jan.1992. — 1 female (ZRC 1993.447), Sentosa. — 1 male (ZRC), Pulau Semakau, coll. P. Ng, Oct.1992. — 13 males, 5 females (ZRC 1984.461-478), Horsburgh lighthouse, coll. H. Huat, 26 Nov.1982, 5 Dec.1982. — 1 male (ZRC 1985.1033), south of Singapore B73, coll. S.R.F.R.S., 19 Aug.55. 3 males, 1 female (ZRC 1984.479-482), Tuas, coll. W.M. Lee, 25 Sep.1982, 6 Nov.1982. — 2 males, 2 females (ZRC 1981.7.24.72-75), Tuas, coll. H.K. Voris, 28 Feb.1981. — 2 females (ZRC 1985.1037-1038), Singapore, coll. D.S. Johnson. — 8 males, 5 females (ZRC 1984.5548-5562), South China Sea, 150 miles off Singapore, coll. H. Huat, 19 Aug.1983. — 2 females (ZRC 1984.5565-5566), South China Sea; 150 miles off Singapore, coll. H. Huat, 28 Aug.1983.

PENINSULAR MALAYSIA - 1 female (ZRC), Pulau Tioman, Pahang, coll. P.K.L. Ng, Jun.1984. — 2 females (ZRC 1987.542-543), Pulau Tioman, Pahang, coll. P. Ng, 26 Jun.1985.

Size. - The largest specimen is a male measuring 36.2 by 57.8 mm (ZRC 1981.7.24.72). A gravid female was found measuring only 8.9 by 12.6 mm.

Diagnosis. - Carapace surface pilose; carapace ridges present in frontal, gastric and branchial regions, mesobranchial ridge less distinct, cardiac ridge interrupted in the middle; two frontal lobes, separated by shallow notch, anterior border slightly sinuous; inner supraorbital lobe outwardly directed and arcuate; last of the five anterolateral teeth distinctly longer than the rest. Basal antennal segment with smooth curved crest. Cheliped stout and unequal, covered with conspicuous squamiform tubercles; merus with three spines on anterior border; carpus armed with strong spine at inner angle and three spinules at outer angle; outer surface of manus bearing three costae, middle of inner surface with an indistinct ridge merging with squamiform markings, upper surface bearing five spines, lower surface covered with squamiform markings. Propodus of natatory leg with posterior border smooth. Penultimate segment of male abdomen with lateral borders parallel for three quarters of length, only converging distally; ultimate segment acutely triangular. G1 curve and narrowing smoothly to widely flared tip, armed with numerous elongated bristles on both inner and outer side of terminal end.

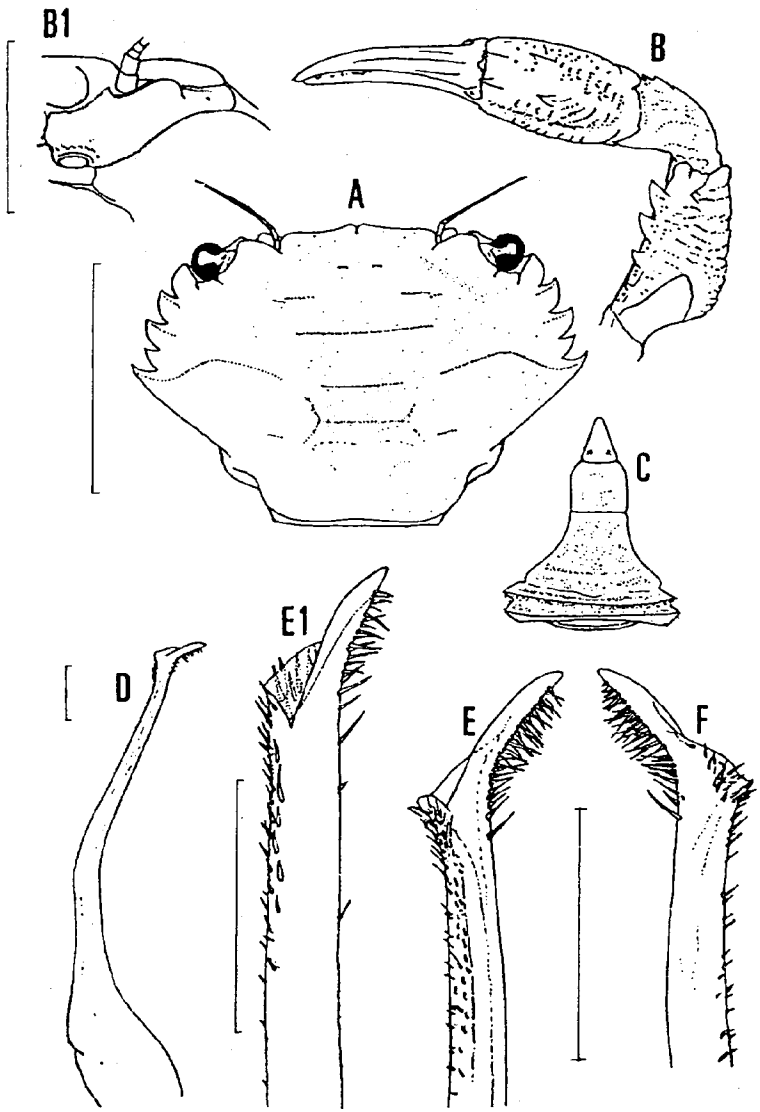


Fig. 59. *Thalamita sima* H. Milne Edwards, 1834. A-F, B1 - ZRC 1985.1034, male, 27.0 by 41.0 mm; E1 - ZRC B54, male (juvenile), 10.6 by 16.3 mm (after Ow-Yang, 1963). A, carapace dorsal surface; B, right cheliped; B1, left basal antennal segment; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; E1, apex of left G1 abdominal surface; F, apex of left G1 sternal surface. Scales: A-C = 20.0 mm, B1 = 10.0 mm, D = 1.0 mm, E, E1-F = 0.5 mm.

Colour. - Dorsal surface of carapace obscured by hairs, blackish and whitish mottled, ventral surface bluish. Mouth parts reddish, chelipeds black blotch at middle, fingers with bluish band on movable finger, tips white (fide Stimpson, 1907).

Habitat. - Most of the specimens were collected from deep waters, up to 30 meters in depth. Other habitats recorded by previous collectors, include the intertidal zones of mud flats and rocky shores.

Distribution. - East Africa, Red Sea, Sri Lanka, China, Taiwan, Japan, Thailand, Malaysia, Singapore, Indonesia, Australia, New Zealand, New Caledonia and Hawaii (fide Dai et al., 1986; Dai & Yang 1991). This species was first recorded from Malaysia by De Man (1895) and from Singapore by Walker (1887).

Remarks. - The flared tip character of the G1 of *T. sima* is also a common feature in *Thalamita picta* and *T. sexlobata*. The curved spinules and sparsely distributed bristles at the terminal end of *T. picta* and *T. sexlobata* respectively, separates them from the G1 of *T. sima*. This species come very close to *T. poissonii* (fide Stephenson & Hudson, 1957), but is easily distinguished from it by a recurved tip in the G1 of *T. poissonii*.

Thalamita spinicarpa, new species
(Figs. 60A-C, 61A-C, 62A, B, 63A-C, 64A-G)

Thalamita danae - Tweedie, 1950: 84 (part); Ow-Yang, 1963: 109 (part) (non *Thalamita danae* Stimpson, 1858).

Material examined. - Holotype - 1 male, 28.6 by 47.2 mm (ZRC 1993.7202), island next to Sentosa, Singapore, coll. P. Ng, 17 Jun.1984.

Paratypes. - 3 females (ZRC 1993.6987-6990), Pulau Semakau, Singapore, coll. R.E.S.T., 7 Sep.1993. — 1 male (ZRC), Sentosa, Singapore, coll. C. M. Yang & K.L. Yeo, 26 Feb.1991 (det. as *T. danae*). — 3 males (ZRC), Sentosa, Singapore, coll. P. Ng, 1981.

Others. - SINGAPORE - 1 male (ZRC 1985.1045), Pulau Sakudok, Changi, coll. M.W.F.Tweedie, Jun.1934. — 1 female (ZRC 1985.1022), Changi, coll. D.S. Johnson, 13 Sep.1953 (det. as T. prymna). — 1 male (ZRC 1985.1021), Labrador Beach, coll. D.S. Johnson, 7 Feb.1985 (det. as T. prymna). — 5 males, 1 female (ZRC 1993.7493-7498), Labrador Beach, coll. D. Wee, 21 Jul.1993. — 3 males, 2 females (ZRC 1993.7299-7303), Labrador Beach, coll. D.Wee, 19 Aug.1993. — 1 male (ZRC), Singapore, coll. D. Foo and N. Foong, 20 May.1991. — 1 male (ZRC), Singapore. — 3 males (ZRC 1965.10.22.68), Pulau Pisang, Jan.1934. — 1 male (ZRC 1985.1046), Pulau Pawai, coll. M.W.F.Tweedie, Nov.1933. — 1 male, 2 females (ZRC), Pulau Hantu, coll. P. Ng, Mar.1985. — 1 male, 1 female (ZRC 1993.141-142), Sentosa reefs, coll. P. Ng, Oct.1992. — 1 male (ZRC 1965.10.22.71), Sultan Shoal, Dec.1933. — 1 female (ZRC 1985.1023), Pulau Hantu, coll. D.S. Johnson, 21 Nov.1953 (det. as *T. prymna*). — 2 males, 1 female (ZRC 1985.1017-1019), Raffles Lighthouse, coll. D.S. Johnson, 24-29 Jul.1952 (det. as *T. prymna*).

Size. - The largest specimen is a male measuring 31.4 by 52.2 mm (ZRC 1993.7493).

Description. - Carapace surface densely pilose except on raised ridges. Ratio of carapace breadth to length approximately 1.65 times. Frontal ridges prominent and sarched. Protogastric and mesogastric ridges with markedly granular outlines. The latter may be interrupted in the mid line. Epibranchial ridges interrupted by unbroken metagastric ridge. Presence of a pair of short mesobranchial ridges and a broad median cardiac ridge.

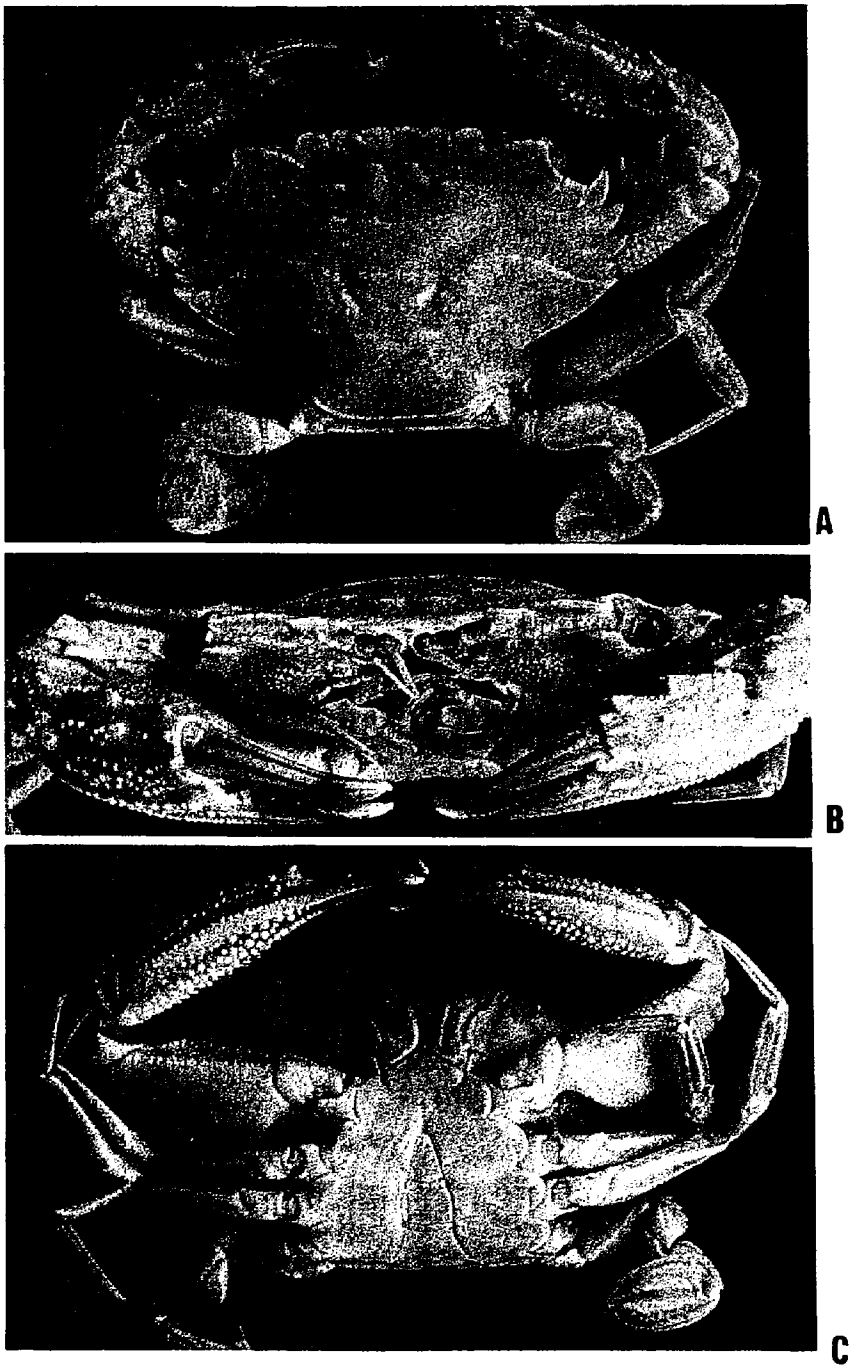


Fig. 60. *Thalamita spinicarpa*, new species. ZRC 1993.7202, holotype male, 28.8 by 47.2 mm. A, dorsal view; B, frontal view; C, ventral view.

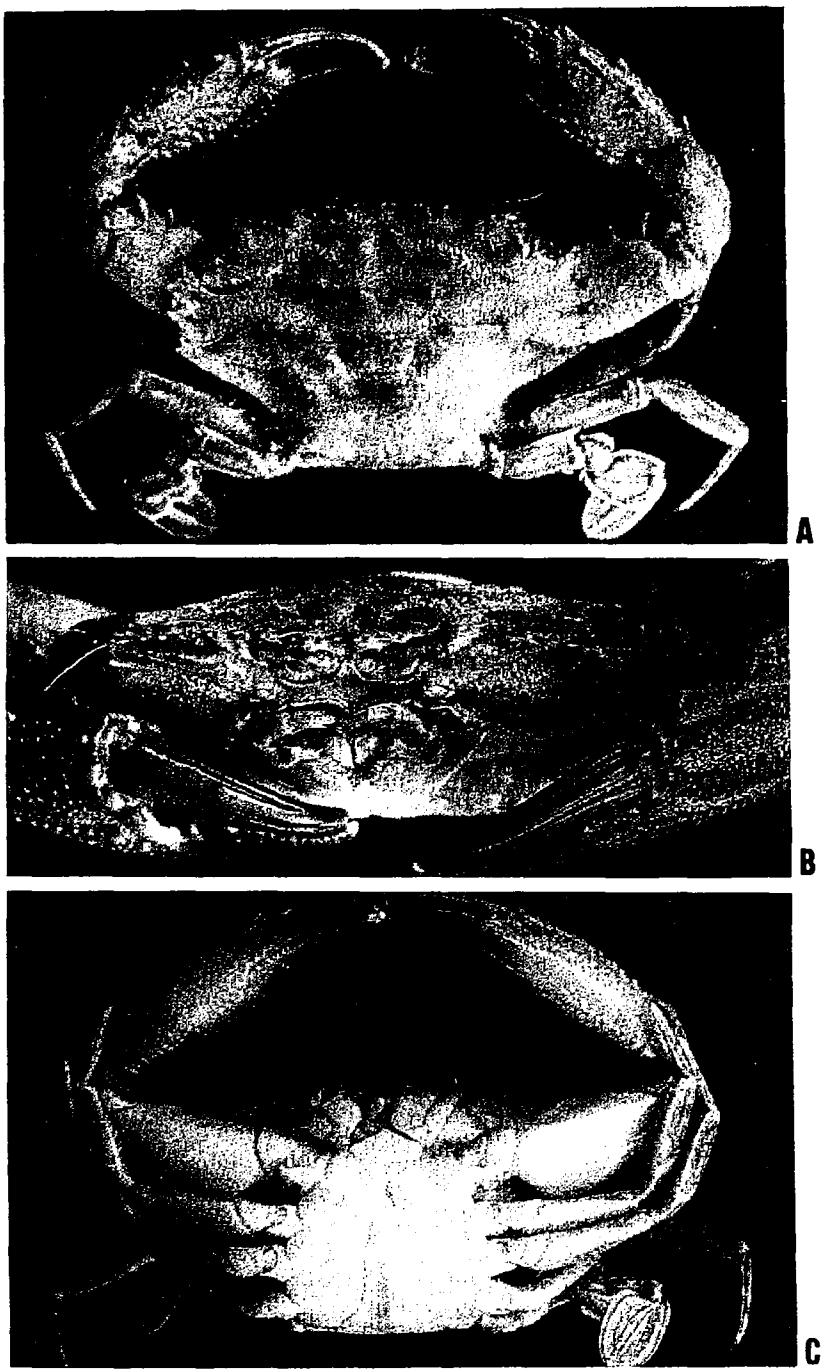


Fig. 61. *Thalamita spinicarpa*, new species. ZRC 1993.7299, male, 29.1 by 47.4 mm. A, dorsal view; B, frontal view; C, ventral view.

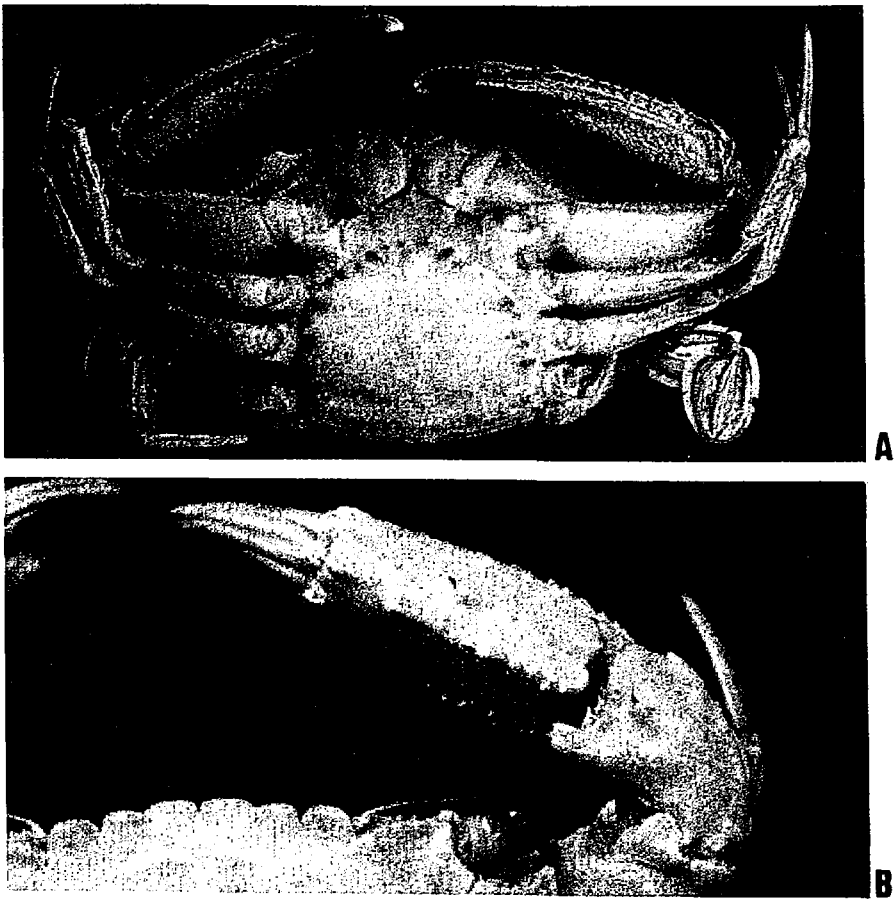


Fig. 62. *Thalamita spinicarpa*, new species. A, ZRC 1993.7300, female, 22.3 by 36.8 mm, ventral view; B, ZRC 1993.7299, male, 29.1 by 47.4, upper surface of cheliped manus.

Front cut into six truncated lobes. Medians lying on a lower plane separated by a narrow notch. Submedians slightly broader, with inner edges sloping gradually inwards, overlapping medians. Lateral lobes separated from submedians by an open notch, anterior border round in smaller specimens to truncate in larger ones. Inner supraorbital lobes broadly arched, slightly less than combined width of submedians and laterals. Five anterolateral teeth, first tooth stoutest, second and third of equal size both slightly smaller than first, fourth tooth rudimentary, fifth tooth slightly smaller than third.

Basal antennal segment much wider than major diameter of orbit, bears a crest composed of a row of seven to ten elevated rounded tubercles.

Chelipeds unequal, granular and finely pilose. Anterior border of merus bears three to four sharp spines and several small rounded tubercles, posterior border with dispersed granules.

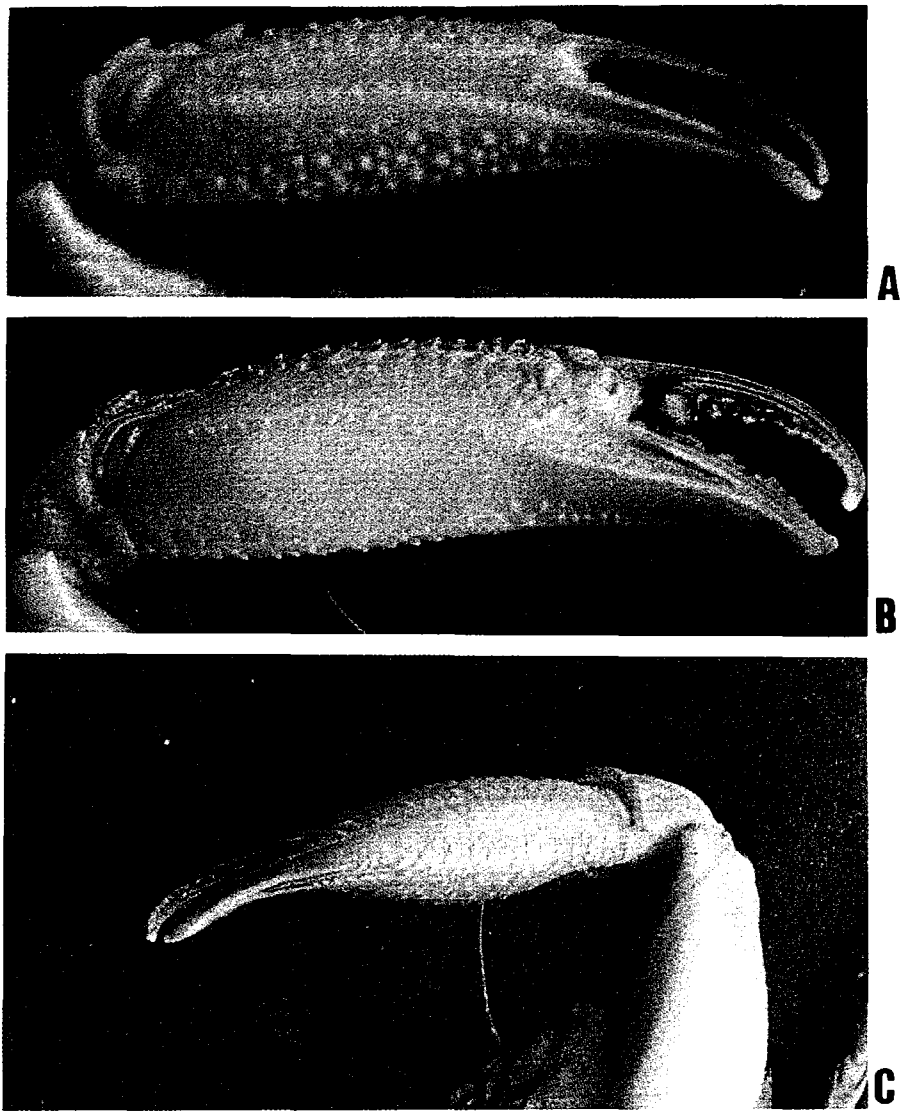


Fig. 63. *Thalamita spinicarpa*, new species. A, ZRC 1993.7202, holotype male, 28.8 by 47.2 mm, lower surface of cheliped manus; B, ZRC 1993.7299, male, 29.1 by 47.4 mm, lower surface of right cheliped manus; C, ZRC 1993.7299, male, 29.1 by 47.4 mm, lower surface of left cheliped manus.

Carpus bears a granulated costae ending in a strong stout spine at the inner angle, three spines on the outer surface of which the upper and lower most bears each a granular costa running backwards. Aside from the sparsely spaced tubercles and pubescence, the carpus bears an additional spine on the upper surface. Outer surface of the manus bears an indistinct upper and distinct two lower costae, all bordered by rounded tubercles. Upper surface bears four spines, two on the inner border, one on the mid region of the outer border and the usual

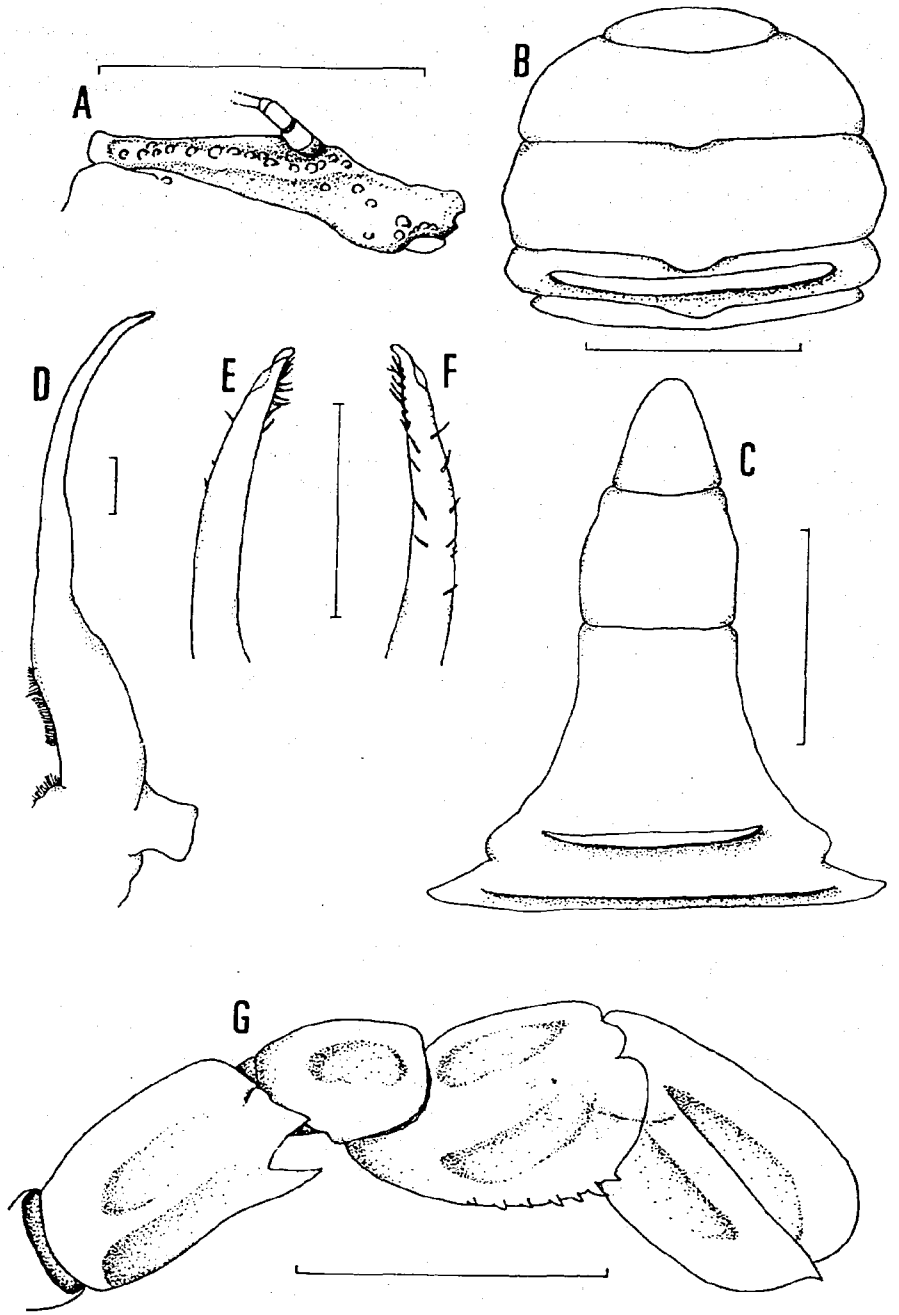


Fig. 64. *Thalamita spinicarpa*, new species. A, C-G - ZRC 1993.7202, holotype male, 28.6 by 47.2 mm; B - ZRC 1993.7300, female, 22.3 by 36.8 mm. A, right basal antennal segment; B, female abdomen; C, male abdomen; D, left G1 abdominal surface; E, apex of left G1 abdominal surface; F, apex of left G1 sternal surface; G, right natatory leg. Scales: A-C,G = 10.0 mm, D-F = 1.0 mm.

spine at the wrist articulation. In smaller specimens there may be an additional spinule at the distal end of the outer edge. Inner surface bears a granulated median costa. Lower to inner surface granulated and pubescent may be entirely smooth in larger specimens. Remainder of surfaces covered with bold rounded granules arising from amongst fine pile of hair. Movable finger of larger cheliped stout and blunt, and of the smaller cheliped more straight and slender.

Merus of ambulatory and natatory legs with grooves bearing fine hairs on the posterior surface. Posterior border of the natatory leg with the usual spine on the merus and with serrations on the propodus.

Penultimate segment of the male abdomen slightly broader than long, lateral borders parallel for proximal two thirds and then slanting gently inwards towards distal end. Ultimate segment acutely triangular, longer than broad. Second to fourth segment keeled. Dorsal surface finely tomentose in unworn specimens.

G1 gradually tapered, curving to a rounded and flat tip. Inner surface bearing sparcely spaced short bristles extending from basal region and ending just before distal tip, bristles increasing in size distally. Outer surface with cluster of terminal bristles closely packed behind tip, more than ten bristles can be seen. Basal lobe of the G1 truncate.

Colour. - Dorsal surface of carapace and chelipeds light green with mottled brown patches, brown bandings on the dactylus of ambulatory legs, anterior border of frontal lobes and lateral borders of the female abdomen. Lim et al. (1994: 153) provided a colour photograph of the species (as an unnamed new species of *Thalamita*) from Singapore.

Etymology. - The name denotes the additional spine on the carpus.

Habitat. - This species have been collected in abundance from the intertidal zone on sandy to rocky shores at tide levels of 0.1-0.5 meters.

Distribution. - Singapore.

Remarks. - This species is close to *Thalamita danae*. It is similar in having a small fourth anterolateral tooth; granular ridge in the basal antennal segment and rounded frontal lobes. Specimens of *T. spinicarpa* can be separated from *T. danae* by the additional spine on the upper surface of the carpus. This character also correlates directly with the absence of terminal conical spines and the presence of a truncated basal lobe in the G1. *Thalamita danae* possessses an ovate basal lobe in the G1. This species is a relatively smaller species as compared to *T. danae*. It also bears a more distinct set of mesobranchial and cardiac ridges. Like *T. danae*, this species also show variability in the degree of pubescence and granulations on the lower to inner surface of the manus. Larger specimens tend to be smoother and less pubescent on this surface.

Thalamita spinifera Borradaile, 1903
(Fig. 65A-D)

Thalamita exetastica var. *spinifera* Borradaile, 1903: 203.
Thalamita spinifera - Rathbun, 1906: 874; Edmondson, 1954: 269, figs. 41a-d,42a; Crosnier, 1962: 125, figs. 210-211, 214-215, pl. 11, fig. 1; Stephenson & Rees, 1967a: 93, fig. 34; Stephenson, 1972: 151; Stephenson, 1976: 24; Sakai, 1976: 377, pl. 133, fig. 2.

Material examined. - None

Size. - A male specimen from Madagascar measures 10.0 by 27.0 mm (fide Crosnier, 1962).

Diagnosis. - Carapace surface pilose; mesogastric and cervical groove interrupted in middle, cardiac and pair of mesobrianchial ridges present; six frontal lobes, medians prominent, set on lower plane, submedians broader than former, laterals acute and widely separated from submedian by deep notch; six anterolateral teeth, first largest and bearing a subsidiary basal tooth. Basal antennal segment bearing seven to eight granules. Cheliped granular on upper surface, lower to inner surface smooth; merus with three to four spines on anterior boarder; carpus with usual four spines; manus with four spines on upper surface and one reduced to a tubercle at distal end of outer border, outer surface bearing three costae. Propodus of natatory leg serrated at posterior border. Penultimate segment of abdomen of lateral borders parallel for 2/3 of its length, converge gradually at distal end. G1 short, stout, slightly curved with flared truncated tip, outer surface bearing single well spaced row of 20 to 30 bipinnate bristles, inner surface with few microscopic spinules (adapted from Crosnier, 1962).

Colour. - Not known.

Habitat. - Habitat of coral and sand beyond depths of 100 meters have been recorded (fide Stephenson, 1972).

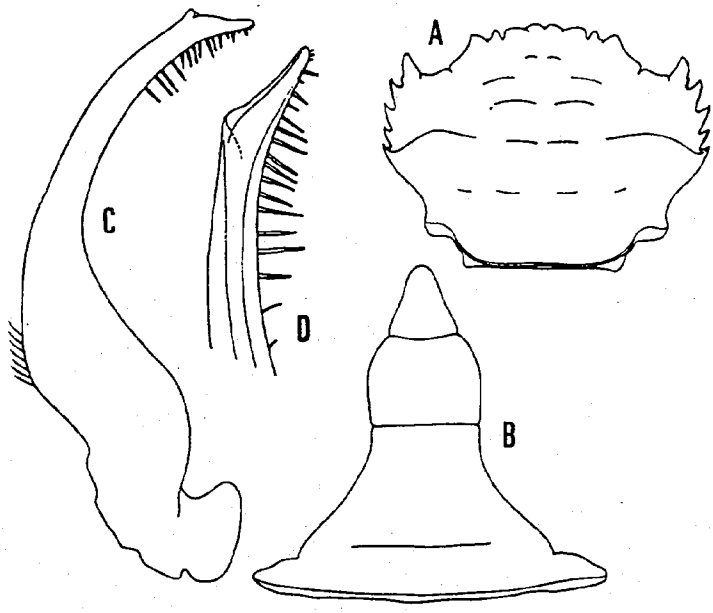


Fig. 65. *Thalamita spinifera* Borradaile, 1903 - Madagascar, male, 10.0 by 27.0 mm (after Crosnier, 1962).A, carapace dorsal surface; B, male abdomen; C, left G1 abdominal surface; D, apex of left G1, abdominal surface.

Distribution. - Madagascar, Laccadives, Maldives, Thailand, Malaysia, Indonesia, Philippines, Japan, Hawaii (fide Stephenson, 1972; Sakai, 1976). This species was first recorded from Malaysia by Stephenson (1972).

Remarks. - This species show variability in the size of the subsidiary tooth at the base of the first anterolateral tooth. The size varies from rudimentary to being fully developed. Large specimens of Thalamita spinifera have been noted to have a larger subsidiary tooth (Rathbun, 1906). This character seems to bridge the gap between the genera *Thalamita* and *Charybdis*. Hence, it has been suggested that *T. spinifera* be transferred to the genus *Charybdis* because in larger specimens the subsidiary tooth is large and the G1 matches that of a typical *Charybdis* form (Stephenson & Hudson, 1957). Stephenson (1972) mentioned that the only known species of *Charybdis rathbuni* Leene, 1938, described from a female holotype could well be a possible synonym of *T. spinifera*. The author has been unable to elucidate any other significant characters that might suggest this species be placed in the genus *Charybdis*. Hence this species is retained in *Thalamita* because smaller specimens are without the subsidiary tooth.

Thalamita spinimana Dana, 1852
(Figs. 66A-C, 67A-M)

Thalamita spinimana Dana, 1952: 283, pl. 17, fig. 18; A. Milne Edwards, 1873: 165, pl. 4, fig. 5; De Man, 1888: 76, pl. 4, fig. 7; Lanchester, 1900: 749; Sakai, 1936: 162, pl. 12, fig. 1; Shen, 1937: 131, fig. 17; Stephenson & Hudson, 1957: 354, fig. 20, 30, pl. 5, fig. 3, pls. 8P, 9H; Ow-Yang, 1963: 131, pl. 28, figs. A-F, B1, E1, F1; Stephenson & Rees, 1967: 95; McNeill, 1968: 53; Stephenson, 1972:152, fig. 5; 1975:24; Stephenson, 1976: 203; Moosa, 1980: 72, fig. 6B; Lovett, 1981: 130, figs. 289a-c; Dai et al., 1986: 227, pl. 30(6), fig. 135(2); Dai & Yang, 1991: 248, 30(6), fig. 135(2).

Material examined. - TAHITI - 2 males (RMNH D444), coll. 1887.

SINGAPORE - 1 male (ZRC 1993.7207), Labrador Beach, coll. D. Wee, 5 Aug.1993. — 3 males, 1 female (ZRC 1993.7208-7211), Labrador Beach, coll. D. Wee, 5 Aug.1993. — 2 males (ZRC 1993.7212-7213), Labrador Beach, coll. D. Wee, 5 Aug.1993. — 9 males, 7 females (ZRC 1993.7214-7229), Labrador Beach, coll. D. Wee, 5 Aug.1993. — 1 female (ZRC 1981.8.14.101), Tuas, coll. H.K. Voris, 10 Mar.1981. — 1 male (ZRC 1934.5789), Tuas, coll. W.M. Lee, 18 Sep.82. — 3 males, 1 female (ZRC 1981.8.14.40-43), Tuas, coll. H.K. Voris, 9 Mar.1981. — 2 male, 1 female (ZRC 1981.7.24.192-194), Tuas, coll. H.K. Voris, 4 Mar.1981. — 1 female (ZRC 1981.7.24.195), Tuas, coll. H.K. Voris, 4 Mar.1981. — 3 males, 2 females (ZRC 1984.5668-5672), Tuas, coll. W.M. Lee, 1 Oct.1982. — 2 males, 2 females (ZRC 1984.5790-5793), Tuas, coll. W.M. Lee, 25 Sep.1982. — 1 male (ZRC 1984.5929), Tuas, coll. W.M. Lee, 15 Feb.1984. — 1 male (ZRC), Tuas, May.1982. — 1 female (ZRC 1985.1043), Tanjong Gul, coll. D.S. Johnson, 25 Mar.63. — 1 male, 1 female (ZRC 1965.10.26.53-54), Blakang Mati (= Sentosa), coll. R. Hanitsch. — 1 male (ZRC), Sentosa, coll. S. Harminto, 24 Oct.87. — 1 male (ZRC), Sentosa, coll. C.M.Yang, 14 Nov.1985. — 2 males (ZRC), Sentosa (det. as *T. prymna*). — 1 male (ZRC), Sentosa, 22 Oct.1985. — 1 male, 1 female (ZRC 1991.544-545), Kusu Island, coll. C.M. Yang. — 1 female (ZRC 1965.10.26.50), Pulau Senang, Nov.1934. — 1 male (ZRC 1985.1039), B26, coll. S.R.F.R.S. — 1 male (ZRC 1985.1042), Pulau Hantu, coll. D.S. Johnson, 21 Oct.1956. — 2 males, 2 females (ZRC 1965.10.26.46-49), Pulau Pawai, coll. M.W.F. Tweedie, Nov.1933. — 4 males, 1 female (ZRC 1984.6270-6274), Pulau Hantu and Pulau Sudong, 16 Mar.1951, 8 Nov.1953 and 21 Nov.1953. — 2 males, 1 female (ZRC 1968.1.26.7), coll. R. Serène, Jan.1968. — 1 male (ZRC 1985.1040), Sultan Shoal B31, coll. S.R.F.R.S.. — 5 males, 3 females (ZRC 1965.10.26.55-62), Pulau Pisang lighthouse, 1934. — 1 male, 1 female (ZRC 1993.7205-7206), Pulau Hantu, coll. N. Sivasothi, 21 Aug.1993. — 2 females (ZRC 1993.7203-7204), Pulau Semakau, coll. D. Chia, 20 Jan.1992. — 1 male, 3 females (ZRC 1993.6982-6986), Pulau Semakau, coll. R.E.S.T., 7 Sep.1993.

PENINSULAR MALAYSIA - 1 female (ZRC 1985.1041), Pulau Hangka off Malacca, coll. R.U. Gooding, 8 Feb.1966.

Size. - The largest specimen is a male measuring 56.8 by 90.3 mm (ZRC 1934.5789).

Diagnosis. - Carapace pilose, broader than long; carapace ridges anterior to last anterolateral tooth granular and distinct, cardiac and mesobranchial ridges smooth; front cut into six lobes, medians and submedians truncate, the former slightly narrower and separated by a narrow incision, laterals narrowest, rounded at the apex and directed slightly obliquely; five anterolateral teeth decreasing in stoutness and increasing in sharpness from front to rear. Basal antennal segment armed with three to four spinules. Cheliped granular; merus with three to four spines on the anterior border and a smaller one at the distal end of the same border; carpus armed with strong spine at inner angle, three spinules at outer angle and two to three spinules on the upper surface; manus with seven to eight spines, outer surface bearing two distinct granulated costae; fingers sharp and deeply grooved. Propodus of natatory leg serrated on posterior border. Penultimate segment of male abdomen with lateral borders parallel and slightly convergent. G1 elongate, thin, gradually tapering to tip and curved laterally, outer side with two rows of elongated bristles becoming shorter and stouter towards tip.

Colour. - Two widely differing body colorations of the same species were collected from the same location at Labrador Beach and at Pulau Semakau. Below is a list of colour variations and their corresponding sizes.

Type 1: Carapace, cheliped and legs orange/red - 2 males (55.4 by 86.0 mm, 56.0 by 89.1 mm - ZRC 1993.7203-7204); 2 males (41.4 by 65.4 mm, 34.9 by 50.9 mm - ZRC 1993.7212-7213); 1 female (50.2 by 78.3 mm - ZRC 1993.6982-6986) (see Tan & Ng, 1988: 99; Lim et al., 1994: 79).

Type 2: Carapace and cheliped orange, legs bluish green - 3 males (33.7-52.6 by 53.8-83.8 mm - ZRC 1993.7208-7211); 1 female (31.7 by 50.8 mm - ZRC 1993.7208-7211).

Type 3: Carapace rusty purple, cheliped brownish, legs bluish green - 9 males (19.3-47.5 by 30.6-77.8 mm - ZRC 1993.7214-7229); 1 female (52.2 by 81.6 mm - ZRC 1993.6982-6986); 7 female (20.0-42.5 by 32.1-68.8 mm - ZRC 1993.7214-7229).

Type 4: Carapace orange, right cheliped orange, left cheliped brownish, legs bluish green - 1 male (30.1 by 48.2 mm - ZRC 1993.7207).

Specimens of colorations types 1 and 3 were reared in captivity and observed. Type 3 displayed an orange coloured moult, whilst retaining its purplish new exoskeleton. A specimen of type 2 moulted into the colouration seen in type 3. Many species of crabs show daily rhythms of colour change brought about by alternations in the degree of dispersion of pigment in their chromatophores. This pigment activity in turn have been found to be dependent upon light intensity and daily tidal rhythms (see Warner, 1977). However, these differing colour morphs in *T. spinimana* tend to remain permanent i.e. retaining either the distinct colorations of one or three, from juvenile to the adult stage. What triggers these colouration changes is not known.

Habitat. - This species is a common occurrence on rocky shores and coral reef flats at 0.0 to-0.1 m tide levels.

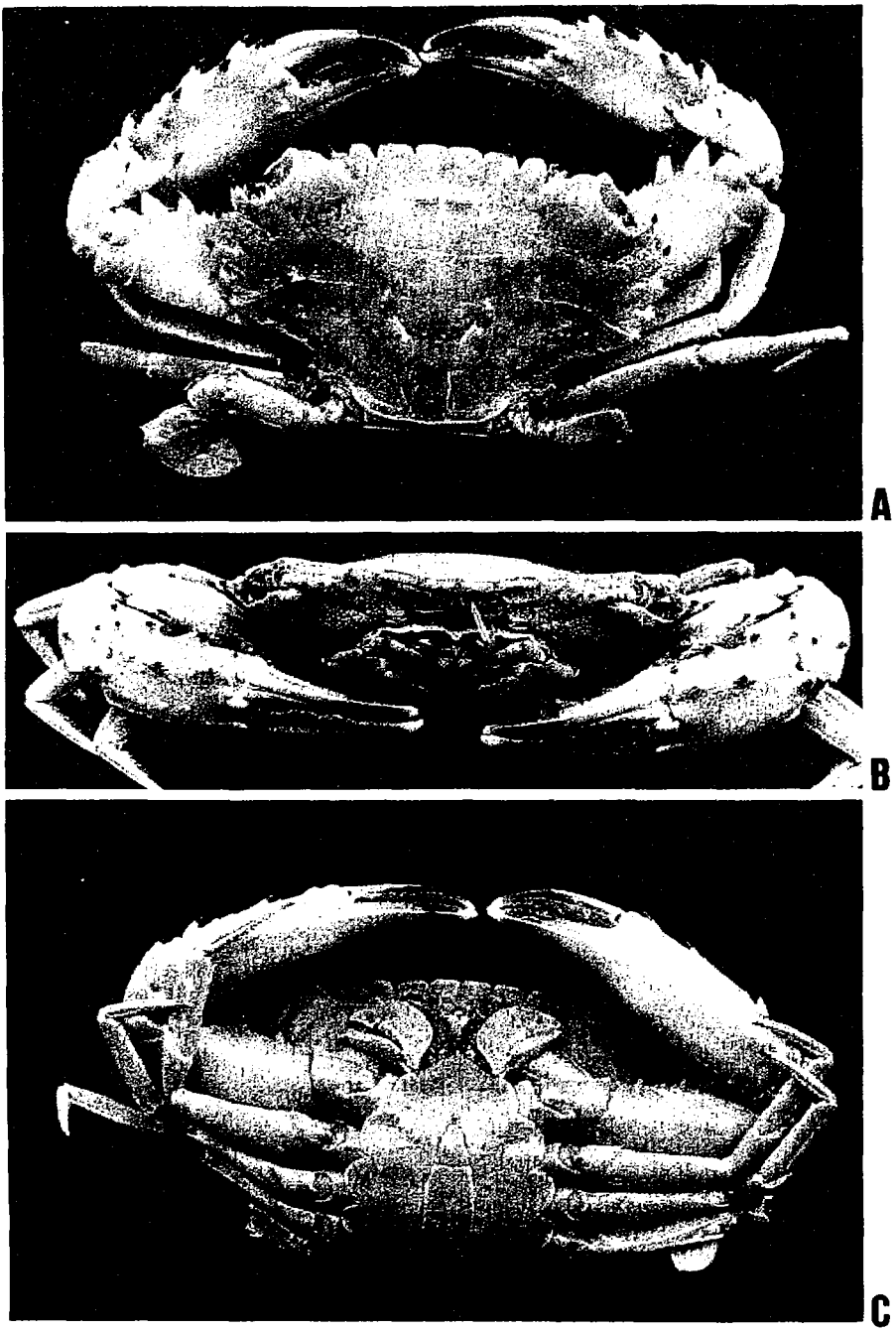


Fig. 66. *Thalamita spinimana* Dana, 1852. RMNH D444, male, 36.9 by 59.0 mm. A, dorsal view; B, frontal view; C, ventral view.

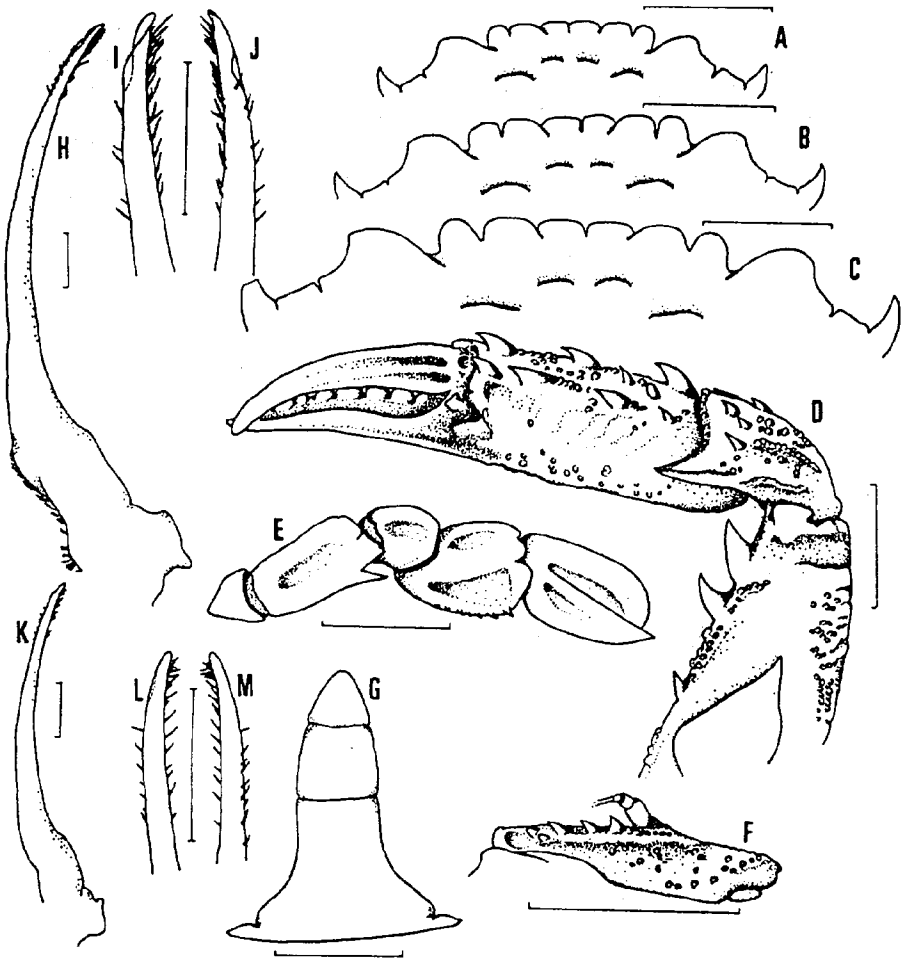


Fig. 67. *Thalamita spinimana* Dana, 1852. A - ZRC 1993.7214, female, 20.2 by 32.4 mm; B - ZRC 1993.7215, female, 26.0 by 41.5 mm; C-G - ZRC 1993.7216, male, 35.5 by 56.9 mm; H-J - ZRC 1993.7217, male, 28.9 by 46.3 mm; K-M - ZRC 1993.7218, male, 19.0 by 30.3 mm. A, front dorsal surface; B, front dorsal surface; C, front dorsal surface; D, right cheliped; E, right natatory leg; F, right basal antennal segment; G, male abdomen; H, left G1 abdominal surface; I, apex of left G1 abdominal surface; J, apex of left G1 sternal surface, K, left G1 abdominal surface; L, apex of left G1 abdominal surface; M, apex of left G1 sternal surface.

Distribution. - Hainan (China), Thailand, Malaysia, Singapore, Indonesia, Philippines, Pulao, Mariana, Australia, New Caledonia and Fiji (fide Stephenson, 1972; Stephenson & Rees, 1967; Moosa, 1980; Dai et al., 1986; Dai & Yang, 1991). This species was first recorded from Malaysia and Singapore by Lanchester (1900).

Remarks. - This species is close to *Thalamita prymna* and *T. coeruleipes*, but show distinct characters which easily separates it (Stephenson & Hudson, 1957: 355). Stephenson & Rees (1967) noted that the number of spines on the manus can range between six to eight,

irrespective of size. This have been found to be true, due to the development of the tubercles on the proximal end of the inner margin of the manus upper surface. Moreover it was noted that some of the larger specimens tend to have a much smoother carapace with the pilosity apparently worn away. The frontal lobes were also observed to vary from being closely fused in the smaller specimens to widely separate in the larger specimens as observed by De Man (1888) and Lanchester (1900). Variability in the shape of the terminal portion of the male G1 have also been illustrated by Ow-Yang (1963). However, upon closer examination, larger specimens were observed to have its terminal end elongated and flattened into a lip, unlike smaller specimens in which the tips are shorter and rounded at the apex. The minor differences in the G1 structures are not correlated by differences in their colour.

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