THE RAFFLES BULLETIN OF ZOOLOGY 1999 **47**(1): 59-72

NOTES ON SOME SOUTHEAST ASIAN SPECIES OF SPIDER CRABS OF THE GENERA *DOCLEA* AND *HYASTENUS* (CRUSTACEA: DECAPODA: BRACHYURA: MAJIDAE)

L. W. Loh and **Peter K. L. Ng**
Department of Biological Sciences, National University of Singapore, Kent Ridge, Singapore 119260, Republic of Singapore.

ABSTRACT. - The spider crab *Doclea johnsoni* Ow-Yang, in Lovett, 1981, is shown to be a junior subjective synonym of *D. canaliformis* Ow-Yang, in Lovett, 1981. *Hyastenus trispinosus* Rathbun, 1916, is also synonymised under *H. subinermis* Zehntner, 1894. The geographical distribution of *Hyastenus cracentis* Griffin & Tranter, 1986, and *H. elatus* Griffin & Tranter, 1986, are also extended to Hong Kong and Singapore respectively.

KEY WORDS. - Majidae, *Doclea*, *Hyastenus*, taxonomic notes.

INTRODUCTION

In a recent study of some spider crabs (Majidae) in the Zoological Reference Collection of the Raffles Museum (ZRC), Department of Biological Sciences, National University of Singapore, the taxonomy of several species was reappraised. *Doclea johnsoni* Ow-Yang, in Lovett, 1981, recognised as a valid species by Wagner (1986) is shown to be a junior subjective synonym of *D. canaliformis* Ow-Yang, in Lovett, 1981. *Hyastenus trispinosus* Rathbun, 1916, which has been suspected to be a junior synonym of *H. subinermis* Zehntner, 1894, is confirmed as such after holotypes of both species were examined. Range extensions are also reported for two other recently described species, *Hyastenus cracentis* Griffin & Tranter, 1986, and *H. elatus* Griffin & Tranter, 1986.

The carapace length was measured as the post-rostral carapace length. This was determined as the distance from the line joining the preorbital angle of the supraorbital eave or region of both sides, to the centre of the posterior margin of the carapace. The length of ambulatory legs was considered to be that of only the merus, carpus, prododus and dactylus. This was determined by adding up the maximum lengths of each individual segment from proximal to distal margin. The material examined in the course of this study is held in the following depositories: Smithsonian Institution, Washington D.C. (USNM); Muséum d'Histoire

Received 15 Sep 1998 Accepted 13 Mar 1999

Naturelle, Geneva (MGe); and Zoological Reference Collection of the Raffles Museum, Singapore (ZRC). The abbreviations G1 and cl are used for the male first gonopod and post-rostral carapace length respectively.

TAXONOMY

FAMILY MAJIDAE

Genus *Doclea* Leach, 1815

Doclea canaliformis Ow-Yang in Lovett, 1981
(Figs. 1-3)

Doclea canalifera - De Man, 1895: 486, pl. 12 figs. 1, 1a-b; Buitendijk, 1950: 65 [not *D. canalifera* Stimpson, 1857].
Doclea canaliformis Ow-Yang, 1963: 173, pl. 34 figs. A-C (nomen nudum).
Doclea canaliformis - Ow-Yang in Lovett, 1981: 120, fig. 260, 121; Wagner, 1986: 917 fig. 21-23, pl. VI.
Doclea simeti Griffin & Tranter, 1986: 115, fig. 34c, pl. 10.
Doclea johnsoni Ow-Yang, 1963: 178, pl. 35 fig. A (nomen nudum).
Doclea johnsoni Ow-Yang in Lovett, 1981: 120, fig. 261, 121; Wagner, 1986: 915: fig. 20.

Material examined. - Lectotype - male (ZRC 1984.6429) (cl 25.7 mm), Siglap, Singapore; coll. Jun.1934.

Paralectotypes - 1 female (ZRC 1984.6430), Siglap, Singapore; coll. Jun.1934. — 1 juvenile male, 1 juvenile female (ZRC 1965.10.14.31-32) (originally designated as the holotype and allotype of *D. canaliformis* Ow-Yang, 1963), Port Swettenham, Selangor, west coast Malay Peninsula. — 4 females (ZRC 1965.10.14.28-31) (original paratypes of *D. canaliformis* Ow-Yang, 1963), Siglap, Singapore, coll. Jun.1934, Jul.1934, May.1935.

Others - 1 female (ZRC 1984.6437) (holotype of *D. johnsoni*) (cl 34.4 mm), Tanjong Stapa, mud, 11-13m, coll. Fisheries Research collection B. 77, Ser. No. AC, coll. 15/82/55. — 4 males, 4 females (ZRC 1981.9.2.26-33), off East Coast Lagoon, Singapore, coll. P. K. L. Ng, Mar.1987.

Description. - Carapace more or less rhomboid, with short, dense pile; rostrum grooved, bifid, base of rostrum with one pair of submedian tubercles, tips slightly diverging in adults. Orbital margin swollen, separated from the postorbital spine by V-shaped slit. Outer edge of postorbital spine convex. Medial line of carapace with eight tubercles or spines, last two most pronounced, four tubercles in mesogastric region, one each in the urogastric and cardiac regions and two in the intestinal region, eighth directed upwards and backwards. Protogastric region with a longitudinal row of four tubercles, diverging posteriorly, first tubercle of row lying at level of second medial tubercle, last tubercle of row largest, lying at level between third and fourth median tubercles. Single tubercle present on outer side of protogastric row of tubercles, at level anterior to second tubercle of the row. Metagastric region with a large tubercle at either end of anterior margin. Hepatic region with only two to three tubercles. Inner part of anterior branchial region with 10 tubercles in three rows of four, two and four respectively, inner row of four curves towards last anterolateral spine. Anterolateral border of carapace with four tubercles or spines, first three of about equal size and fourth somewhat larger. A tubercle approximately one third as long as first anterolateral spine sometimes present just before first anterolateral spine. Basal antennal article with two small spines , posterior spine smaller than anterior one. Outer buccal frame produced into a spine.

Pterygostomial canal present. Chelae of male swollen when fully mature, about half as long as carapace length. Ambulatory legs long, slender, dense pile extending to proximal part of dactylus, 2.0-2.5 times cl G1 well chitinized in fully mature males, smooth, basal half slightly bent, distal half much narrower, straight (modified after Wagner, 1986).

Remarks. - In an unpublished honours thesis, Ow-Yang (1963) described two new species of *Doclea* from Singapore, *D. canaliformis* and *D. johnsoni*. The thesis, however, was never published and both names are not nomenclaturally valid. Lovett (1981), in compiling a guide to Malaysian decapods, consulted Ow-Yang's thesis and used his key (in verbatim) and figures. Lovett (1981) specifically noted that these from Ow-Yang's dissertation and he apparently treated it as a valid publication (which it is not). In publishing Ow-Yang's names, Lovett (1981) effectively validated *D. canaliformis* and *D. johnsoni*. Wagner (1986), in revising *Doclea*, credited both species to Lovett (1981). The proper authorship for these two species should thus be Ow-Yang, in Lovett, 1981.

Wagner (1986) examined the type specimens of *D. canaliformis* and *D. johnsoni*, and recognised both species. Although Lovett (1981) had validated Ow-Yang's (1963) names, he did not record any specimens, and merely cited Ow-Yang's (1963) thesis. As Ow-Yang's thesis is not published, all the specimens examined by him of *D. canaliformis* must thus be regarded as syntypes. Ow-Yang (1963) actually had selected a holotype, but this designation is invalid as his thesis is unpublished. Wagner (1986) selected a lectotype for *D. canaliformis*, but it was not the specimen Ow-Yang (1963) had chosen as the holotype. As noted earlier, Ow-Yang's holotype choice is invalid and Wagner's (1986) lectotype designation is thus valid. All of Ow-Yang's other specimens (including his supposed "holotype") are thus paralectotypes. There is no problem for *D. johnsoni* as it was only described from one

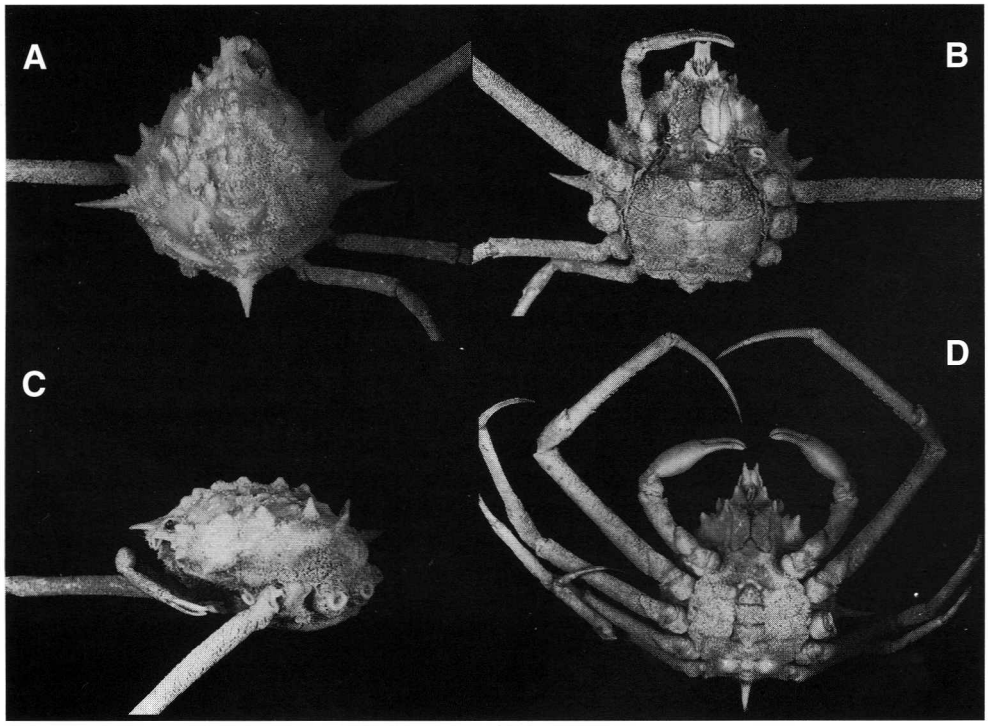

Fig. 1. *Doclea canaliformis* Ow-Yang in Lovett, 1981. A-C, paralectotype female; cl 25.2 mm; ZRC 1965.10.14.28. D, lectotype male; cl 25.7 mm; ZRC 1984.6429.

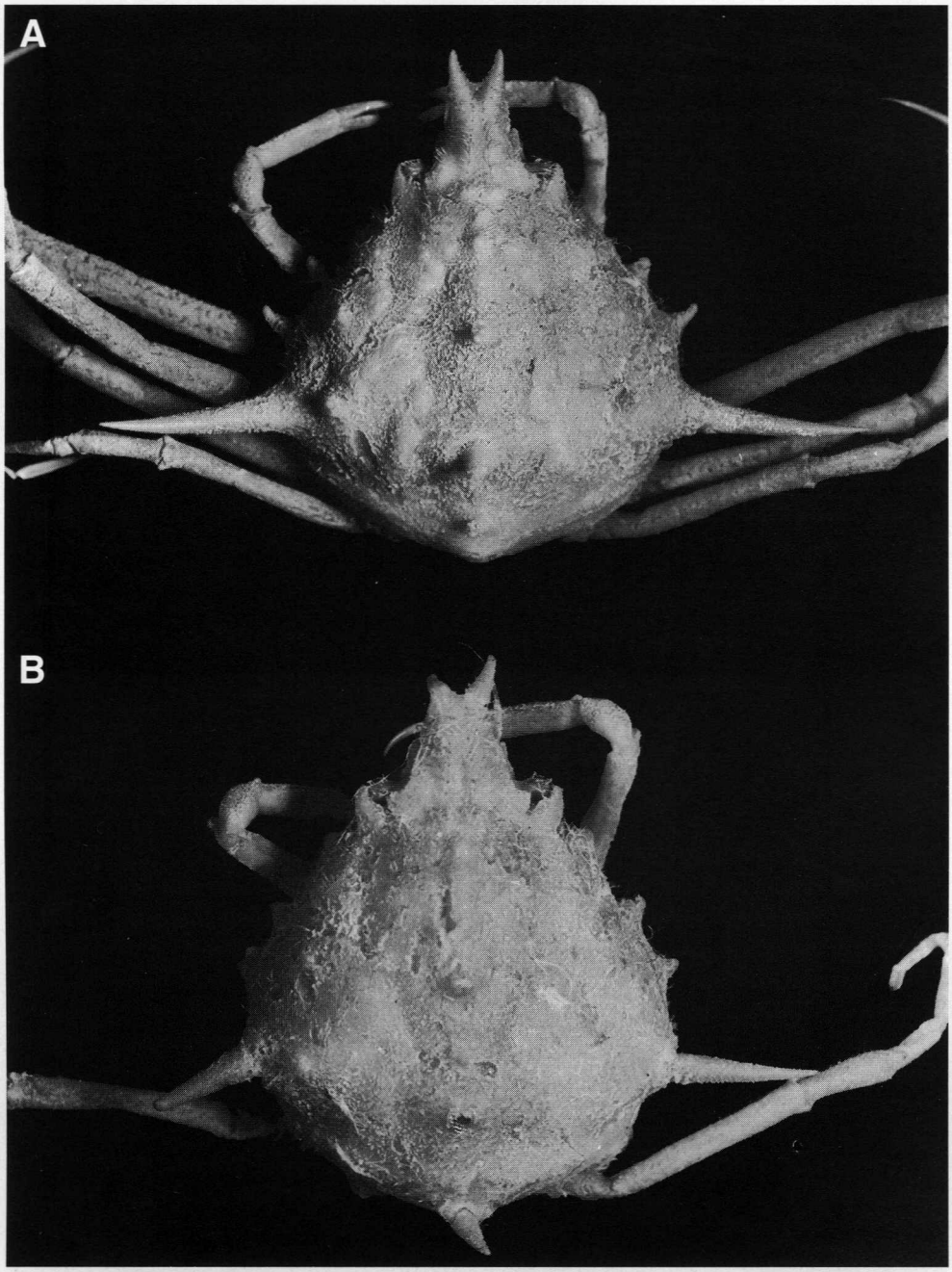

Fig. 2. *Doclea canaliformis* Ow-Yang in Lovett, 1981. A, paralectotype male, cl 14.4 mm; ZRC 1965.10.14.31 (intestinal spine broken). B, paralectotype female; cl 19.6 mm; ZRC 1965.10.14.32.

specimen. Specimens previously identified as *D. canalifera* Stimpson, 1857, by De Man (1895) and Buitendijk (1950) were also referred to *D. canaliformis* by Wagner (1986).

On the basis of a single large female, Ow-Yang (1963) described *Doclea johnsoni*, distinguishing it from *D. canaliformis* by its rounded (instead of rhomboid shape), and the presence of an additional medial tubercle and ten inner anterior branchial tubercles on the carapace (instead of seven in *D. canaliformis*). In addition to these differences, Wagner (1986) also noted that *D. canaliformis* has a large tubercle on either anterior end of the metagastric region while in *D. johnsoni*, the tubercle was small. No other specimens of *D. johnsoni* are known.

The study of the present series of specimens of *D. canaliformis*, including the types of *D. canaliformis* and *D. johnsoni*, shows that none of the differences recognised by Ow-Yang (1963) and Wagner (1986) are valid. The supposedly additional median tubercle on the posterior margin of the cardiac region in *D. johnsoni* is actually also present in *D. canaliformis*. However, in most of the specimens of *D. canaliformis* examined, this tubercle is usually small and obscured by thick pile. Although *D. canaliformis* was diagnosed as having seven tubercles on the inner branchial region of the carapace, there are in fact 10 tubercles present. Three of these tubercles are often low and are thus easily missed. The strength of the tubercles on either end of the metagastric region is also supposed to be stronger in *D. canaliformis*, but this character seems to be occasionally associated with size, being weaker in large

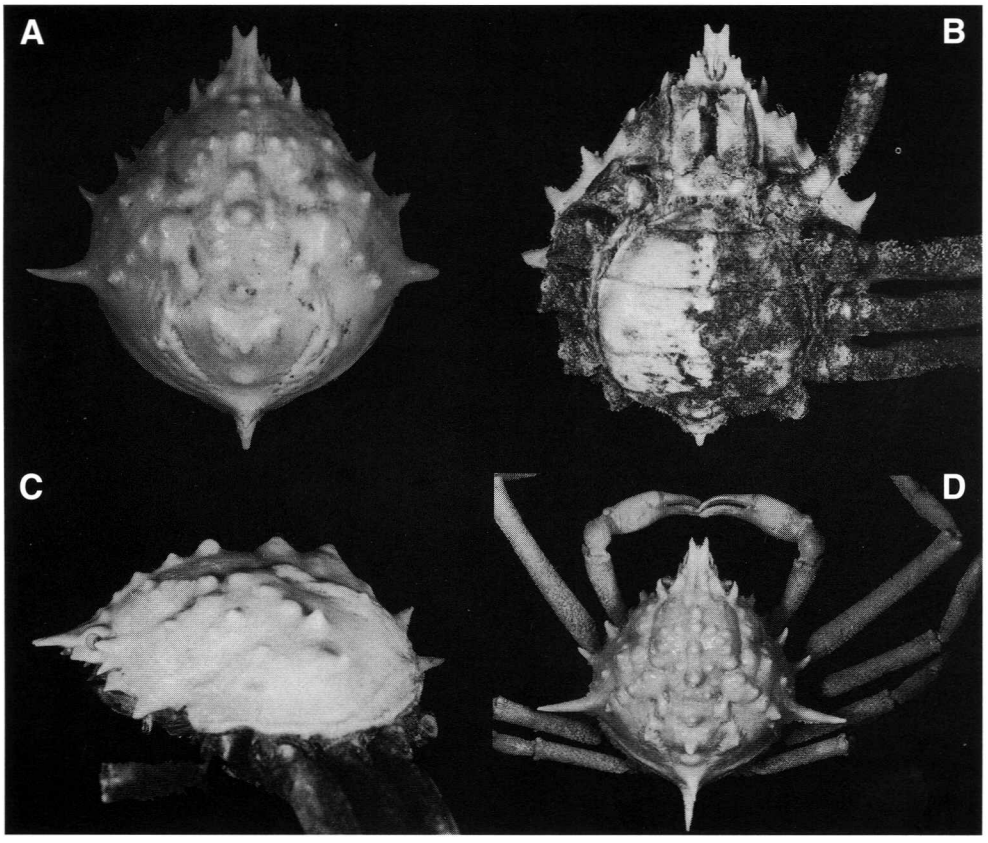

Fig. 3. *Doclea canaliformis* Ow-Yang in Lovett, 1981. A-C, female; cl 34.4 mm; ZRC 1984.6437 (holotype of *C. johnsoni* Ow-Yang in Lovett, 1981). D, lectotype male; cl 25.7 mm; ZRC 1984.6429.

specimens, as is the type of *D. johnsoni*. The lateral spines of the holotype of *D. johnsoni* are proportionately shorter than those in previously reported specimens of *D. canaliformis*. The present material shows that with increasing size (and age), the lateral spines become proportionately shorter. This trend had been noted in the genus by Wagner (1986), for example in *D. ovis* and *D. rissonii* where the sizes of the spines and tubercles change considerably with the maturity of the specimen, the rule being that the spines are longer in juveniles than in larger specimens. Similarly, the rounded appearance of the carapace of *D. johnsoni*, as compared to the rhomboid carapace of *D. canaliformis*, is easily explained by the fact that the holotype of *D. johnsoni* is an exceptionally large female. Therefore, all the supposed differences between *D. johnsoni* and *D. canaliformis* can be accounted for by infraspecific variation or size-associated changes. As such, *Doclea johnsoni* Ow-Yang in Lovett, 1981, should be regarded as a junior synonym of *D. canaliformis* Ow-Yang in Lovett, 1981.

While the types of *D. simeti*, described by Griffin & Tranter (1986) were not examined in this study, we nevertheless agree with Wagner (1986) that this species should be regarded as a junior synonym of *D. canaliformis*. There are no major differences between them. Likewise, the description and illustration by De Man (1895) of an animal identified as *D. canalifera* clearly indicates that it is *D. canaliformis* and not Stimpson's (1857) species. This is also the case for Buitendijk's (1950) specimens of "*D. canalifera*" from Singapore and Port Swettenham.

Although the identity of the collector was not indicated on the museum labels, we believe that the lectotype and paralectotype of *D. canaliformis* was part of the series of Singaporean specimens examined by Buitendijk (1950) (as *D. canalifera*). This is inferred from the locality data and date of collection (June 1934), although the female paralectotype has a label with presumably a date (6/33) tied to it. Buitendijk (1950), however, also describes a young female from the June 1934 lot matching the description of *D. japonica*. Also, while the two juveniles orginally designated as types by Ow-Yang appear very likely to be two of the four described by Buitendijk (1950) from Selangor, the whereabouts of the other two specimens (one male, one female) is uncertain.

Genus *Hyastenus* White, 1847

Hyastenus cracentis Griffin & Tranter, 1986
(Fig. 4)

Hyastenus diacanthus - Griffin & Tranter, 1974: 170 [not *Pisa* (*Naxia*) *diacantha* De Haan, 1839].
Hyastenus cracentis Griffin & Tranter, 1986: 138-139, figs. 44, 47c, d.

Material examined. - 1 male (cl 19.1 mm), 1 female (cl 24.0 mm) (ZRC 1968.2.14.2), Cr. 3/64, Station 35-T/160, Hong Kong, coll. Hong Kong Fisheries Research Station.

Diagnosis. - See Griffin & Tranter (1986).

Habitat. - Not known.

Distribution. - Red Sea, India, Java Sea and Hong Kong.

Remarks. - The present two specimens from Hong Kong agree well in all aspects with the detailed description and account of the species by Griffin & Tranter (1986). The female at

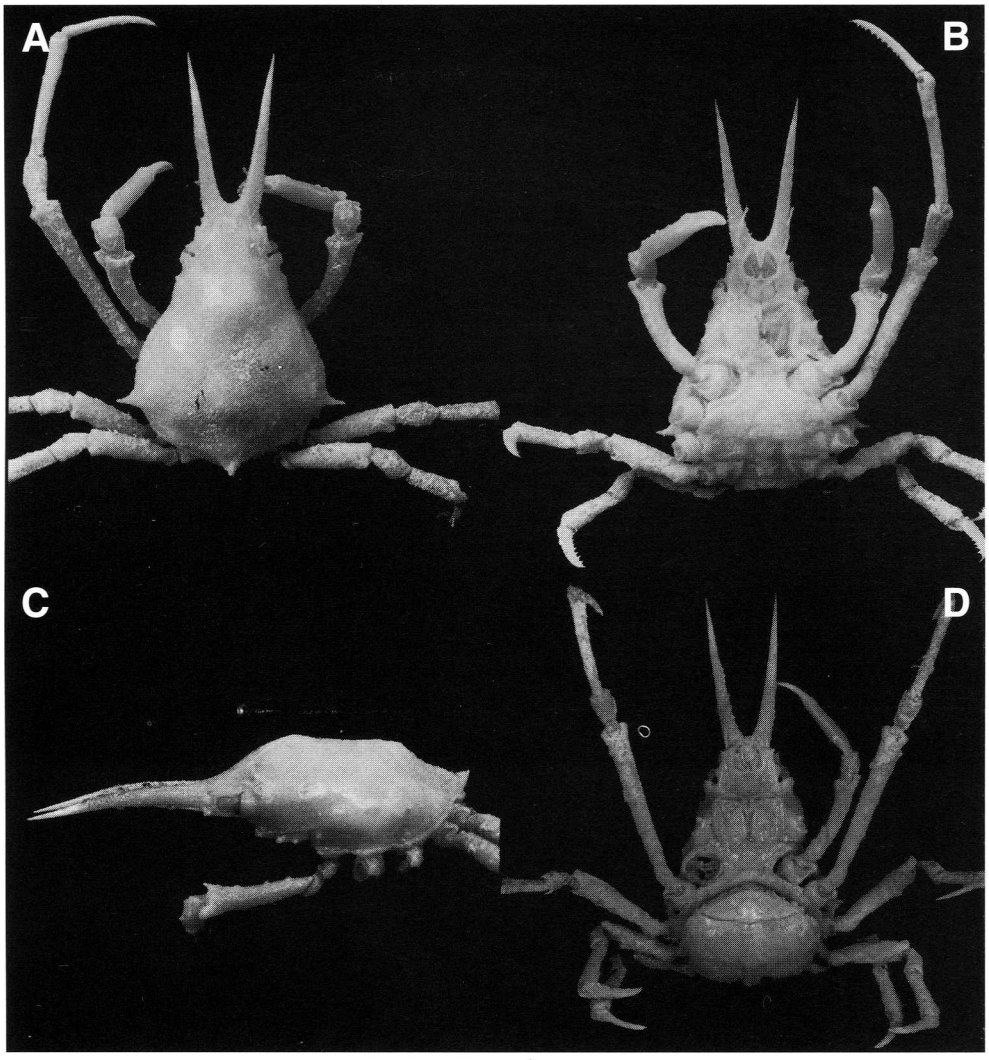

Fig. 4. *Hyastenus cracentis* Griffin & Tranter, 1986. A-C, male; cl 19.1 mm; ZRC 1968.2.14.2. D, female; cl 24 mm; ZRC 1968.2.14.2.

hand is the larger of the two specimens and is fully mature (gravid). The present record extends the known distribution of *H. cracentis* northwards through to the northern part of the South China Sea.

Hyastenus elatus Griffin & Tranter, 1986
(Fig. 5)

Hyastenus diacanthus - Campbell & Stephenson, 1970: 258, fig. 26; Serène & Lohavanijaya, 1973: figs. 114-118, pl. 10C.

Hyastenus elatus Griffin & Tranter, 1986: 141, figs.45, 46a, 47e-g [not *Pisa* (*Naxia*) *diacantha* De Haan, 1839].

Material examined. - 1 male (cl 24.4 mm) (ZRC 1973.3.9.2), off Singapore Island. — 1 female (ZRC 1965.10.14.56) (cl 32.6 mm), Port Bartis, Queensland, Australia.

Diagnosis. - Carapace pyriform, with moderately coarse pile, smooth when denuded. Rostrum subparallel, moderately long, slightly sinuous along length. Supraorbital eave laterally produced, antorbital angle a blunt right angle, more produced than preorbital. Mesogastric region exceptionally elevated appearing hump like from lateral view. Gastric region devoid of tubercles except for broad tubercle on apex of mesogastric region. Branchial region moderately inflated, entirely devoid of tubercles. Epibranchial spines short, directed backwards and curved slightly upwards at the tip. Cardiac region mildly inflated. Intestinal region with broad, low tubercle near posterior margin. Basal antennal article slender, anterolateral angle weakly produced, blunt, lateral margin nearly straight, proximal lobe broadly convex, suborbital hiatus a curved slit. Pterygostomial region with two tubercles, anterior one markedly larger. Female abdomen with segments 4-6 fused. G1 broad proximally, slender, tapering distally, apical tip pointed funnel-shaped.

Habitat. - Found on sandy to muddy substrates, intertidal to ca. 70 m. One specimen from inside a large sponge.

Distribution. - Singapore, Irian Jaya, Arafura Sea and northern Australia from north of Perth (Western Australia) to Botany Bay (New South Wales).

Remarks. - The male specimen examined in this study was collected from Singapore and has been previously figured and photographed by Serène & Lohavanijaya (1973). Although Griffin & Tranter (1986) included this specimen in the synonymy of *H. elatus*, they did not include Singapore in the distribution of the species.

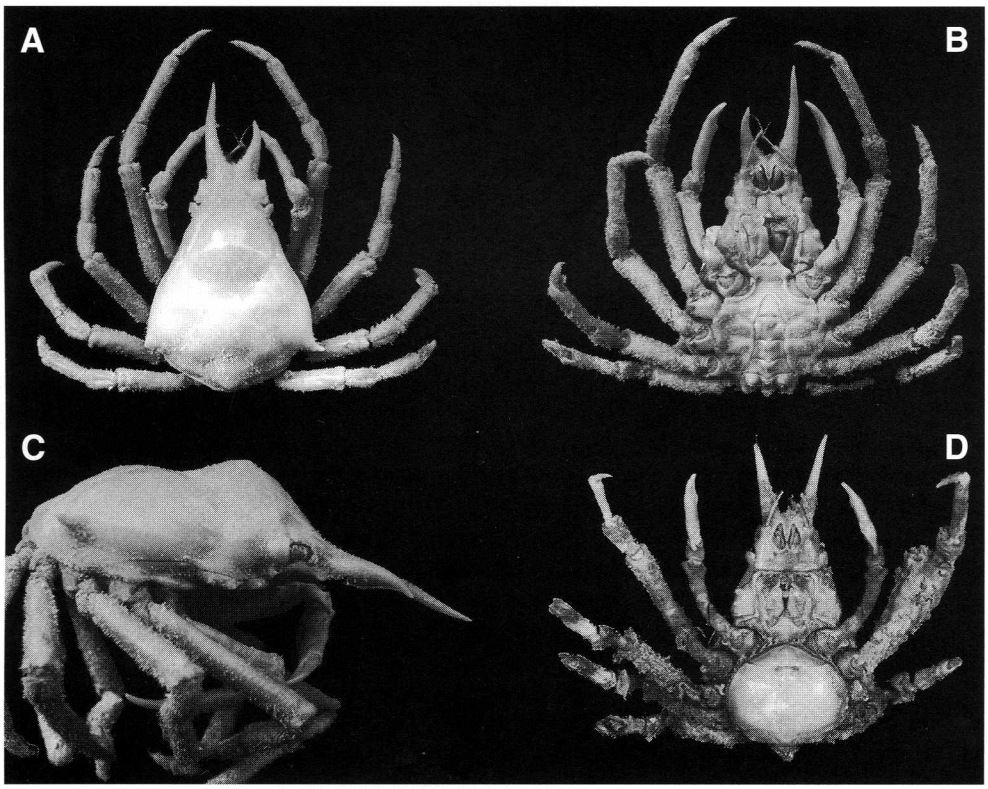

Fig. 5. *Hyastenus elatus* Griffin & Tranter, 1986. A-C, male; cl 24.4 mm; ZRC 1973.3.9.2. D, female; cl 32.6 mm; ZRC 1965.10.14.56.

Hyastenus diacanthus closely resembles *H. elatus* in its almost smooth protogastric, cardiac and intestinal regions which may have exceeding low tubercles. However, as described by Griffin & Tranter (1986), *H. elatus* is easily distinguished from the former by the extremely elevated gastric region, the shape of the basal antennal article and the morphology of the G1. The structures of the supraorbital eave and the suborbital hiatus of the two species are also distinct.

Hyastenus subinermis Zehntner, 1894
(Figs. 6-8)

Hyastenus subinermis Zehntner, 1894: 136, pl.7, figs. 2, 2a; Ow-Yang 1963: 167-170, pl. 33 fig A-D [part].
Hyastenus trispinosus Rathbun, 1916: 542-543; Griffin, 1976: 198 fig. 5(b); Griffin & Tranter, 1986: 156 fig. 40g, h, 41e, f.
Hyastenus hilgendorfi Buitendijk, 1939: 223; text figs. 9, 10 [part] [not *H. hilgendorfi* De Man, 1888].

Material examined. - Holotype - female (cl 5.8 mm) (MGe 39.f.), Ambon, Moluccas, coll. C. Pictet & M. Bedot, 1890.

Others - 1 male (USNM 48213) (holotype of *H. trispinosus* Rathbun, 1916), Tawi Tawi Group, Sulu Archipelago: Tinakta Island (N.), 1.4 miles; 5°11' 50"N 119°54'E, 18.3 m; co. S.; station 5159, coll. Albatross Philippine Expedition, United States Bureau of Fisheries, 21 Feb.1908. — 1 male (USNM 48265), Singapore, coll. Bryant & Palmer, 1909-10. — 2 females (ZRC 1993.266-267), Cyrene reef on, *Pavona*, Singapore, coll. B. Goh, 15 Aug.1986. — 1 female (ZRC 1965.10.19.19), Off Sultan Shoal, near Singapore, 33 m, bottom sand and coral, coll. Dec.1933. — 1 female (ZRC 1985.281), reef at Pulau Sudong, Singapore, 0.9 m, coll. Searle.

Diagnosis. - Carapace size small, sparsely pilose, regions distinct, faintly tuberculate or entirely devoid of tubercles. Rostral spines slender, divergent, horizontal and acuminate. Supraorbital eave developed, long, margin somewhat upturned, preorbital angle developed into a short forward directed spine, antorbital angle obtuse. Protogastric region with a very faint to distinct tubercle, if present. Mesogastric and cardiac region either smooth or with a low median tubercle each, both regions separated by a depressed urogastric region. Intestinal region with small curved spine, very close to posterior margin. Branchial region smooth or with two to three tubercles. Epibranchial teeth small, tuberculate to moderately long, curved apically. Basal antennal article with anterolateral angle produced into a finger-like projection, visible from dorsal view, lateral margin straight, proximal lobe broad, convex. Suborbital hiatus a very broad U shape. Pterygostomial region with three large teeth, posteriormost directly above cheliped. Male and female abdomen with seven free segments. Male G1 long and slender, broadened subdistally with subapical aperture, similar to that of *H. higendorfi* except for elongated, sinuous apical tip.

Habitat. - Collected from coral reefs, on seaweed to 33 m depth, sandy to coraline bottoms.

Distribution. - Sulu Archipelago, Ambon, Irian Jaya and Singapore.

Remarks. - In their synopsis of the genus *Hyastenus*, Griffin & Tranter (1986) opined that *H. subinermis* was a possible synonym for *H. trispinosus* Rathbun 1916. The types for both Rathbun's (1916) and Zehntner's (1894) species were examined in the current study. The holotype of *H. subinermis* is a juvenile female, contrary to Zehntner's (1894) description. While the holotype of *H. trispinosus* has a carapace with more prominent tubercles than those of *H. subinermis*, the two specimens nevertheless resemble each other in numerous

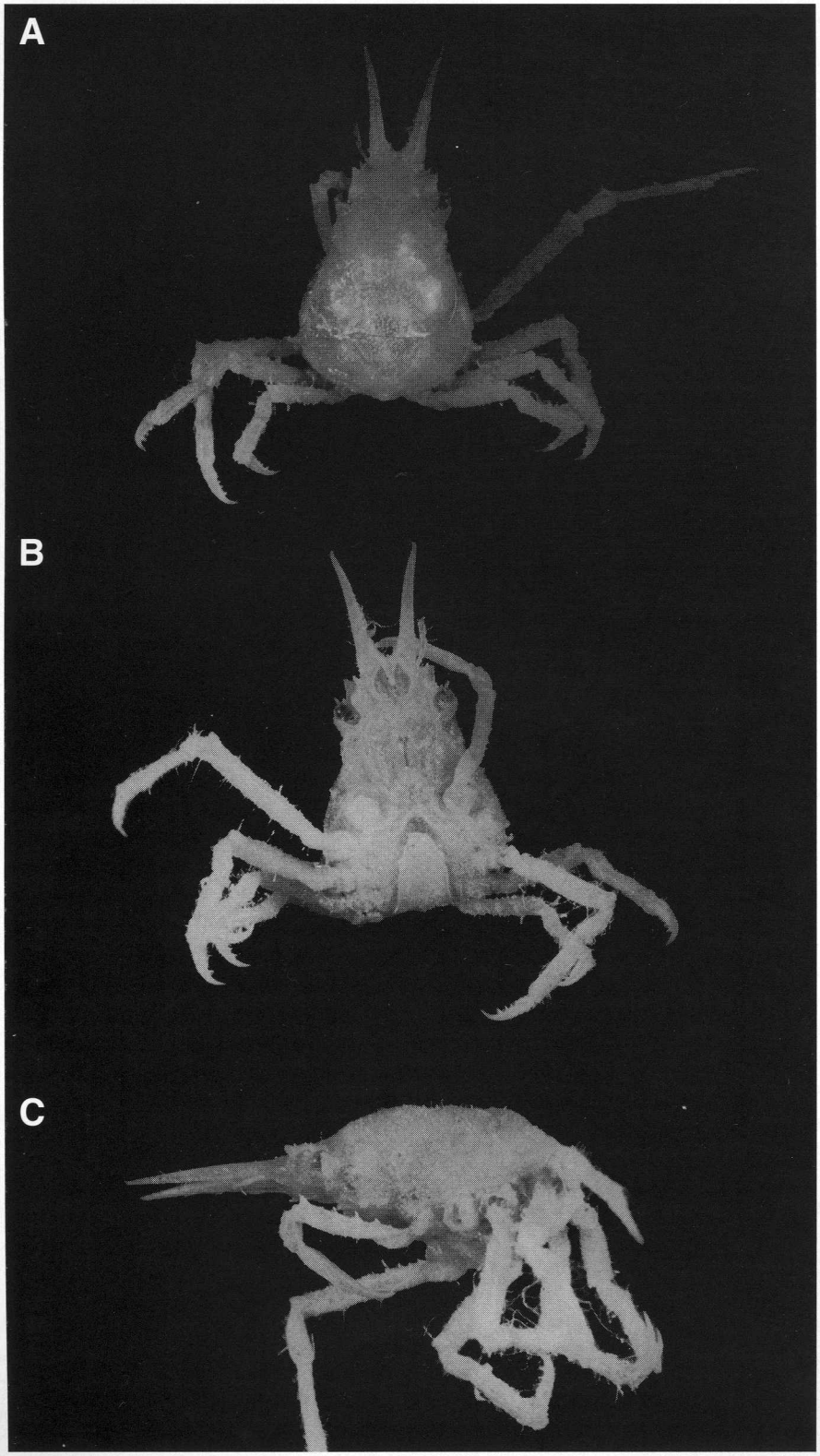

Fig. 6. *Hyastenus subinermis* Zehntner, 1894. Female; cl 5.8 mm; Mhn 39.f.;

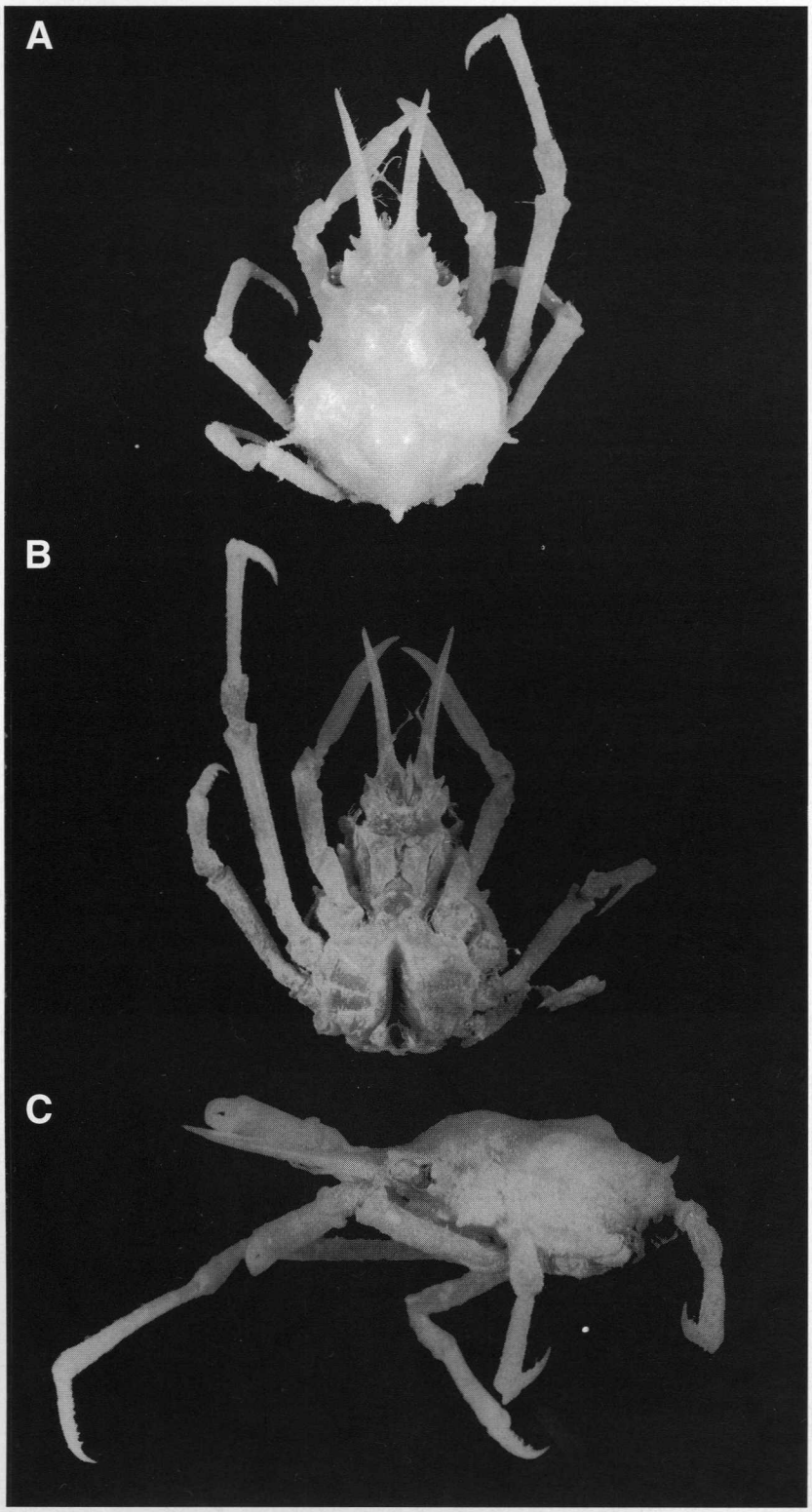

Fig. 7. *Hyastenus subinermis* Zehntner, 1894. Male; cl 8.6 mm; USNM 48213 (holotype of *H. trispinosus* Rathbun, 1916).

aspects. These include characters such as the form of the supraorbital eave, which in both specimens is distinctly well-developed (relative to other members of the genus), with the preorbital angle produced into a sharp forward-directed tip. The structure of the basal antennal article, another taxonomically important feature, also proved to be similar. In both specimens, the anterolateral angle bears a strong, sharp, slightly curved spinule, which is characteristically visible from the dorsal view of the crab. Laterally, the basal antennal article of both specimens is produced into a broad medial lobe. The pterygostomial region also bears two blunt teeth. A third tubercle follows closely behind, located directly above the insertion of the cheliped on either side of the body. Unlike *H. hilgendorfi*, which the two species also resemble, there are no more posterior tubercles along the branchial submargin of the carapace beyond this third tubercle. In more general terms, the size, shape and appearance of the the two species are also very similar. *Hyastenus trispinosus* is thus considered to be a junior synonym of *H. subinermis*.

While Zehntner's (1894) account of *H. subinermis* describes the carapace as being totally devoid of dorsal tubercles, some of the present specimens do possess tubercles, although they are often faint. Interestingly some degree of sexual dimorphism seems apparent in the species, in terms of the prominence of the carapace tuberculation, with the male specimens appearing to be more strongly tuberculated than the females.

On examination of the specimens identified as *H. subinermis* from the ZRC, many were found to be actually young *H. hilgendorfi*. *Hyastenus hilgendorfi* can be differentiated from the former by the presence of submarginal branchial tubercles beyond the one above the cheliped, as well as by the less developed supraorbital eave with a blunt preorbital angle. Correspondingly, the intestinal region possesses a blunt tubercle, located some distance from the posterior margin. In Zehntner's holotype of *H. subinermis*, the intestinal spine appears short and almost tuberculate. However, it is still more acute than the intestinal tubercle of *H. hilgedorfi*, and is positioned close to the posterior margin of the carapace. A blunt tubercle instead of a spinule is also found on the basal antennal segment of *H. hilgendorfi*. Although the specimens documented by Buitendijk (1939) have not been examined in this study, we believe that her entire series of specimens are *H. hilgendorfi*. They were all described as

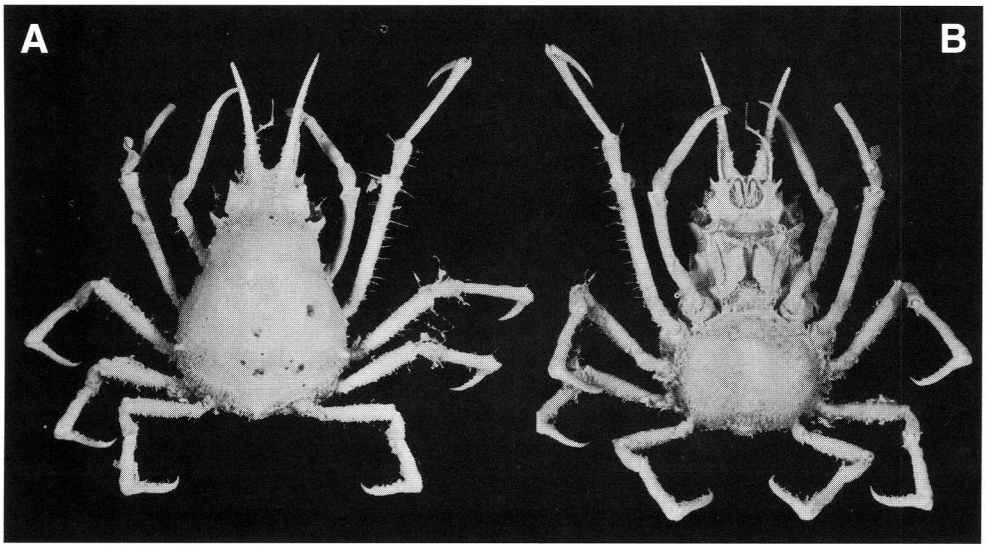

Fig. 8. *Hyastenus subinermis* Zehntner, 1894. Female; cl 6.5 mm; ZRC 1993.266.

having an intestinal tubercle each. Moreover, the G1 figured in the Buitendijk's (1939) account, as is a the case for Ow-Yang's (1963) report, is clearly that of *H. hilgendorfi* and not of *H. subinermis*.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to Bernd Hauser (MGe), Rafael Lemaitre (USNM), C. M. Yang, H. K. Lua, K. L. Yeo and Kelvin Lim (ZRC) for their assistance and the loan of specimens. The first author also thanks H. K. Yip, Y. Y. Goh and S. H. Tan for their help. This study has been partially support by a research grant to the second author from the National University of Singapore.

LITERATURE CITED

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

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

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

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

Griffin, D. J. G., 1976. Spider crabs of the family Majidae. (Crustacea: Brachyura) from the Philippine Islands. *J. nat. Hist.*, **10**: 179-222, figs. 1-11, tables 1-2.

Griffin, D. J. G. & H. A. Tranter, 1974. Spider crabs of the family Majidae (Crustacea: Decapoda: Brachyura) from the Red Sea. *Israel J. Zool.*, **23**: 162-198, figs. 1-4, pl. 1.

Griffin, D. J. G. & H. A. Tranter, 1986. The Decapoda Brachyura of the Siboga Expedition. Part VIII. Majidae. *Siboga-Exped.*, **39**C4: 1-335, 22 pls.

Leach, W. E., 1815. *The zoological miscellany; being descriptions of new or interesting animals* (Nodder & Son, London), **2**: 1-154 + 8 (unnumbered) pages. Atlas (1814): pls. 61-120.

Lovett, D. L., 1981. *A guide to the shrimps, prawns, lobsters, and crabs of Malaysia and Singapore.* Fac. Fish. Mar. Sci., Univ. Pertanian Malaysia, Sedang, Malaysia. Occ. Publn., **2**: i-iii, 1-156.

Man, J. G. De, 1888. Bericht uber die im Indischen Archipel von Dr. J. Brock gesammelten Decapoden und Stomatopoden. *Arch. Naturgesch.*, **5**: 215-600, pls. 7-22.

Man, J. G. De, 1895. Bericht uber die von Hern Schiffscapitän Storm zu Atjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java-See gesammelten Decapoden und Stomatopoden. *Zool. Jb. Syst.*, **8**: 485-609, pl. 12-14.

Ow-Yang, C. K., 1963. *Studies on the Systematics and Distribution of Marine Brachyura in Malaya with special references to the families Portunidae and Majidae.* Unpublished M.Sc. Thesis. Dept. Zool., Univ. Singapore, 268 pp., pls. 40.

Rathbun, M. J., 1910. The Danish Expedition to Siam 1899-1900, 5. Brachyura. *Kgl. Danske Vid. Selsk. Skr.*, (7) **5**: 303-367, map 1, pls. 1-2.

Rathbun, M. J., 1916. New species of crabs of the families Inachidae and Parthenopidae. (Scientific results of the Philippine cruise of the fisheries steamer Albatross, 1907-1910. No.34) *Proc. U.S. natn. Mus.*, **50**: 527-559.

Serène, R. & P. Lohavanijaya, 1973. The Brachyura (Crustacea: Decapoda) collected by the Naga Expedition, including a review of the Homolidae. *Naga Rep.*, **4** (4): 1-187, figs 1-186, pls. 1-21.

Stimpson, W., 1857. Prodomus descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. 3. Crustacea Maioidea. *Proc. Acad. nat. Sci. Philad.*, **1857**: 216-221.

Stimpson, W., 1907. Report on the Crustacea (Brachyura and Anomura) collected by the North Pacific Exploring Expedition 1853-1856. *Smithson. misc. Collns.*, **49** (1717): 1-240, pl. 1-26.

Wagner, H. P., 1986. A revision of the genus *Doclea* Leach, 1815 (Crustacea, Brachyura, Majidae). *Bull. Mus. natn. Hist. nat., Paris,* **8**: 1986, 893-953, figs. 1-36, pls. I-XI.

White, A., 1847. *List of the specimens of Crustacea in the collection of the British Museum.* Printed by order of trustees, London. Printed by Edward Newman, London: i-viii, 1-143.

Zehntner, L., 1894. Crustacés de l'archipel Malais (voyage de MM. M. Bedot et Ch. Pictet dans l'Archipel Malais). *Revue suisse Zool.*, **2**: 135-214, pls. 7-9.