REVISION OF *SARMATIUM* DANA (CRUSTACEA:BRACHYURA: SESARMINAE) WITH DESCRIPTIONS OF THREE NEW SPECIES

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Sarmatium Dana, 1851, is revised and re-diagnosed. Crabs of this genus are primarily characterised by: carapace deeply vaulted; ocular peduncle swollen basally, cornea constricted and reduced; upper surface of palm of male cheliped bearing a series of transverse grooves separating transverse swollen ridges. *Sarmatium* is now considered to contain five species: *S. crassum* Dana, 1851; *S. germaini* (A. Milne Edwards, 1869); *S. striaticarpus* sp.nov.; *S. hegerli* sp.nov.; and *S. unidentatus* sp.nov. They are easily separated by the different patterns of ridges and grooves on the upper surfaces of the palm and carpus of the male cheliped. □*Crustacea, Brachyura, Grapsidae, Sesarminae, mangroves, Indo-West Pacific, new species.*

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Sarmatium Dana, 1851, has a very confused history. Established for a single species *S. crassum* Dana, 1851, it was enlarged considerably by Tesch (1917) who included six other Indo-West Pacific species and two Atlantic species. Serène & Soh (1970: 398) pointed out that the two Atlantic species, *S. curvatus* H. Milne Edwards, 1837, and *S. pectinatus* H. Milne Edwards, 1853, are rightfully placed into the genus *Metagrapsus* H. Milne Edwards, 1853. Tesch (1917) had previously considered *Metagrapsus* as a junior synonym of *Sarmatium*. Features to separate the two genera were given by Serène & Soh (1970). The six Indo-West Pacific species placed in *Sarmatium* by Tesch: *S. integrum* A. Milne Edwards, 1873; *S. inermis* de Man, 1887; *S. indicum* A. Milne Edwards, 1868; *S. punctatum* A. Milne Edwards, 1873; *S. biroi* Nobili, 1905; and *S. fryatti* Tesch, 1917 (=*rotundifrons* A. Milne Edwards, 1869), are now all included in *Neosarmatium* Serène & Soh, 1970. Tesch (1917), following de Man (1891), considered *Sarmatium germaini* (A. Milne Edwards, 1869) to be a junior synonym of *S. crassum* but *S. germaini* was later shown to be a valid species by Serène & Soh (1971).

Serène & Soh (1971) considered *Sarmatium* to consist of two species, *S. crassum* and *S. germaini*. It is apparent however, after examining the larger amount of material available for the present study, that what Serène & Soh (1971) thought to be *S. crassum* from Singapore is in fact a new species. In addition, field work carried out in northern Australia has revealed two hitherto unknown species. With the five species here recognised, the genus concept for *Sarmatium* can now be much better understood.

Abbreviations used in the text are: AM, Australian Museum, Sydney; MNHN, Muséum national d'Histoire naturelle, Paris; ZRC, Zoological Reference Collection, National Museum of Singapore; NNM, National Natural History Museum, Leiden; QM, Queensland Museum, Brisbane; SMF, Senckenberg Museum, Frankfurt; USNM, United States National Museum, Washington; ZMG, Zoological Museum of Goetingen (collection housed at SMF); ZMH, Zoological Museum of Hamburg; ZMK, Zoological Museum Copenhagen. The descriptions for this paper were prepared using the DELTA computer system for generating taxonomic descriptions (Dallwitz & Paine, 1986).

Measurements given in the text are of the carapace breadth (measured at the widest point including lateral spines) followed by length. Leg segments were measured in a straight line to give maximum dorsal length and so are not always the maximum possible length, and this should be borne in mind when using the ratios. The exact limits of the width of the hind margin are also sometimes difficult to determine and in this work they were defined by the point at which the lateral carapace suture meets the rear margin. Gonopod terminology follows that of Sakai & Yatsuzuka (1979).

Sarmatium Dana, 1851

Sarmatium Dana, 1851a: 288; 1851b: 251; 1852: 357-8;

Kingsley, 1880: 212; Serène & Soh, 1970: 397; 1971: 237; Sakai, 1976: 664.

Sarmatium (in part): De Man, 1887: 659; Alcock, 1900: 426; Tesch, 1917: 213, 258; 1918: 115; Crosnier, 1965: 74.

Sesarma (*Sarmatium*) (in part): De Man, 1929: 111; Tweedie, 1936: 67.

TYPE SPECIES

Sarmatium crassum Dana, 1851.

DIAGNOSIS

Carapace sub-quadrate, slightly wider than long; greatest width behind exorbital angles; deeply vaulted, depth c.0.8- 0.9 × carapace width in males; regions moderately defined; anterolateral margins regularly convex; with 1-3 teeth behind the exorbital angle; front deflexed, c.0.35- 0.4 × carapace width, 0.5 × fronto-orbital width, pre-orbital teeth obsolete. Ocular peduncle swollen basally, cornea constricted and reduced. Basal segment of antennal peduncle with a well developed outer rounded tongue; antennal flagellum small and entering orbit. Basal antennular segment swollen. Inter-antennular septum narrow, 0.2- 0.3 × width of front. Median post-frontal lobes distinct, very broad, lateral lobes not clearly differentiated. Third maxilliped merus 0.7- 0.8 × length of ischium; merus longer than wide; outer margin convex; antero-external angle not produced; exopod narrow, barely visible in frontal view. Chelipeds subequal; upper surface of palm with a series of transverse grooves separating swollen ridges; outer surface of palm without median longitudinal row; dorsal surface of dactyl in males with at least one large, broad, chitinous tubercle, and some small pointed chitinous tubercles. Legs: merus anterior margin with an acute sub-distal spine, unarmed terminally; carpus with accessory carinae on upper surface. G1 long, reaching just past suture between sternites 2/3; moderately stout; completely calcified; palp obvious but not separated from stem, rounded, calcified; apical process corneous, strongly produced, straight; gonopore terminal or slightly displaced towards the dorsal surface. G2 short, relatively narrow, tapering, twisted, tip blunt. Male abdomen relatively narrow, third segment slightly the wider or sub-equal to first; first segment does not cover entire width of sternum between 4th pereiopods. Base of penis slightly calcified, just visible beneath setae adjacent to margin of third segment.

REMARKS

Sarmatium is separated from the two closest genera *Neosarmatium* and *Metagrapsus* by two major characters: 1, ocular peduncle swollen basally, cornea constricted and reduced; 2, upper surface of palm of male cheliped with a series of transverse grooves separating swollen ridges.

KEY TO THE SPECIES OF *SARMATIUM*

1. Outer ventral border of cheliped palm with a marked longitudinal ridge extending onto fixed-finger (even on juveniles and females); male cheliped with superior outer surface of palm bearing 7-8 relatively evenly spaced transverse grooves; dactylus with three large, strong chitinous tubercles on proximal half, followed by 17-18 small acute chitinous tubercles; carpus with a finely granular area distally, without trace of oblique fine striations. Maximum size c.28mm..... ..... *germaini* A. Milne Edwards, 1869

   Outer ventral border of cheliped palm and fixed-finger without a longitudinal ridge; male cheliped with superior outer surface of palm bearing less than 7 strong transverse grooves; dactylus variously armed, but not as above; upper face of carpus sometimes with oblique fine striations. Maximum size 28mm 2

2. Palm of male cheliped with 4 major transverse grooves on upper outer surface. Dactylus with four strong chitinous tubercles on proximal half. Maximum size c.25mm.....3

   Palm of male cheliped with transverse grooves not as conspicuous, but with a large, smooth or granular swelling occupying most of upper outer surface. Dactylus with only one major chitinous tubercle on proximal half. Maximum size13-20mm.....4

3. Upper surface of carpus of cheliped with large patch of tiny, flattened, squamous granules behind articulation distally; these may be aligned into short fine rows near outer edge but never appear as transverse striations. Ridges and grooves on upper surface of palm all subparallel. First proximal tooth on dactyl of cheliped placed slightly distally from articulation.....*crassum* Dana, 1851

   Upper surface of carpus of cheliped with broad patch of c.25 long, fine, transverse striations

between articulation and spine of inner angle. Upper surface of palm with proximal most corrugated ridge separated from next broad groove by a triangular space. First proximal tooth on dactyl of cheliped placed almost on edge of proximal end ..... *striaticarpus* sp.nov.

4. Male cheliped has dorsal margin of dactyl, with 1 large forwardly directed, chitinous tubercle on outer edge, proximally. Superior outer face of palm with 2-3 narrow, smooth grooves distally, followed by a deep concavity, and a large swelling back to the posterior margin, the distal slope of which is long and covered in well separated, medium sized, low round granules. Upper surface of carpus with 9 prominent transverse ridges distolaterally. Maximum size c.20mm..... *hegerli* sp.nov.

Male cheliped has dorsal margin of dactyl bearing a single, large, elongate, slightly oblique, medial tooth, proximally. Superior outer face of palm with very broad, deep, smooth, oblique depression, a very large rounded medial transverse swelling, and a narrow proximal band of seven very fine, long transverse ridges. Upper surface of carpus without transverse ridges. Maximum size c.13mm ..... *unidentatus* sp.nov.

Sarmatium crassum Dana, 1851
(Figs 1A, 2, 3A-C)

Sarmatium crassum Dana, 1851b: 251; 1852: 358-9, pl. 23, fig. 1; H. Milne Edwards, 1853: 189; De Man, 1887: 651; Barnard, 1955: 28, fig. 9; Crosnier, 1965: 74-6, figs 121-124, pl. 5, fig. 1; McNeill, 1968: 78. - Serène & Soh, 1970: 397, 405 (name in list); Fishelson, 1971: 128, 130; Serène, 1973: 125-6; Hartnoll, 1975: 308, 318, 322-23; Holthuis, 1977: 174-5.

not *Sarmatium crassum*: Serène & Soh, 1970, pl. 4C, D; 1971: 237-40, fig. 2, pl. 2 [= *S. striaticarpus* sp. nov.]

?*Sarmatium crassum*: Nobili, 1899: 505; Alcock, 1900: 426-27; Tesch, 1917: 215.

Type Specimen
Lost.

Type Locality
Upolu, Samoa.

Material Examined
NNM 24830, 1♂ (18.8×16.5mm), Melita Bay, Entedebiz, Dahlak Arch., L. Rode Iee, Eritrea, 14.4.1962, J.S.R.S. Expedition. MP-B10475, 1♂ (13.2×12.0mm), Nosy Be, Madagascar, mangroves, A. Crosnier. MP-B10474, 1♂ (12.8×11.5mm), Route de Ducos, 4km de Noumea, P. Fourmanoir, 7.8.1971. QM W16819, 1♂ (8.0×7.1mm) 1 imm. ♀ (8.7×7.4mm), Harmer Ck, far N Queensland , 11°50'S, 142°57'E, mouth of river in mudbank at low water, P. Davie & J. Short, 31.10.1990. QM W16829, 1♀ (18.5×15.7mm), same data as QM W16819. QM W6791, 2♂♂ (14.8×13.2; 21.1×19.3mm), Curtis I. nr Tide I., MEQ, 23°46'S, 151°15'E, 17.Dec.1975, P. Saenger, mud in *Rhizophora*. QM W6804, 1♂ (20.8×18.0mm), 2m from mouth of Auckland Ck, nr Gladstone, MEQ, 23°51'S, 151°14'E, 17.12.1975, P. Saenger, mud in *Avicennia*. QM W15228, 8♂♂ (21.5×19.2; 21.0×19.7; 19.5×17.3; 17.0×14.7; 17.1×15.2; 17.2×15.2; 13.9×12.5; 11.8×10.4mm), 4♀♀ (24.2×20.5; 21.4×18.2; 18.0× 15.2; 11.9×10.0mm), Calliope R. and Auckland Ck, Gladstone, MEQ, 23°51'S, 151°16'E, Queensland Electricity Commision Survey, 1974-1983, P. Saenger. QM W5387, 1♀ (15.6×13.4mm), Mary and Susan River Heads, Hervey Bay, SEQ, P. Davie, 25.7.1975. QM W5357, 1♂ (12.6×10.6mm), Moon Ck, Fraser I., SEQ, 25°11'S, 153°04'E, 21.7.1975, P. Davie, R. Timmins. QM W5382, 1♂ (19.1×17.3mm), Eli Ck, Hervey Bay, SEQ, 25°17'S, 152°49'E, 26.7.1975, P. Davie. QM W5351, 1♀ (17.6×15.1mm), Pulgul Ck, S of Urangan, Hervey Bay, SEQ, 25°19'S, 152°54'E, 19.7.1975, P. Davie. QM W5287, 1♀ (24.3×20.3mm), small branch of Serpentine Ck, SEQ, 27°24'S, 153°07'E, Sept 1972, B. Campbell et al. NNM Unreg., 1♂ (13.9×12.1mm), Snellius Exped., 16.9.1930, Bongao, Tanitawi, Sulu Arch. ZMK K4410, 1♀ (23.6×19.4mm), Tahiti.

Description
Carapace: c.1.1×broader than long in males, 1.2 in females. Fronto-orbital width c.0.75-0.85×carapace length. Carapace deeply vaulted; convex in both directions but only slightly from side to side. Depth c.0.8×carapace width (c.0.7 in females). Regions moderately defined; mesogastric well defined; cardiac distinct; intestinal distinct. Lateral margins subparallel; slightly concave. Anterolateral margins regularly convex; with two blunt teeth behind the exorbital angle; exorbital angle blunt, only slightly projecting. First anterolateral tooth similar in size to exorbital angle but with longer margin; second anterolateral tooth blunt; minute, almost obsolete. Front c.0.36-0.39×carapace width; c.0.5× fronto-orbital width; moderately deflexed; with shallow median emargination and bilobed; lateral

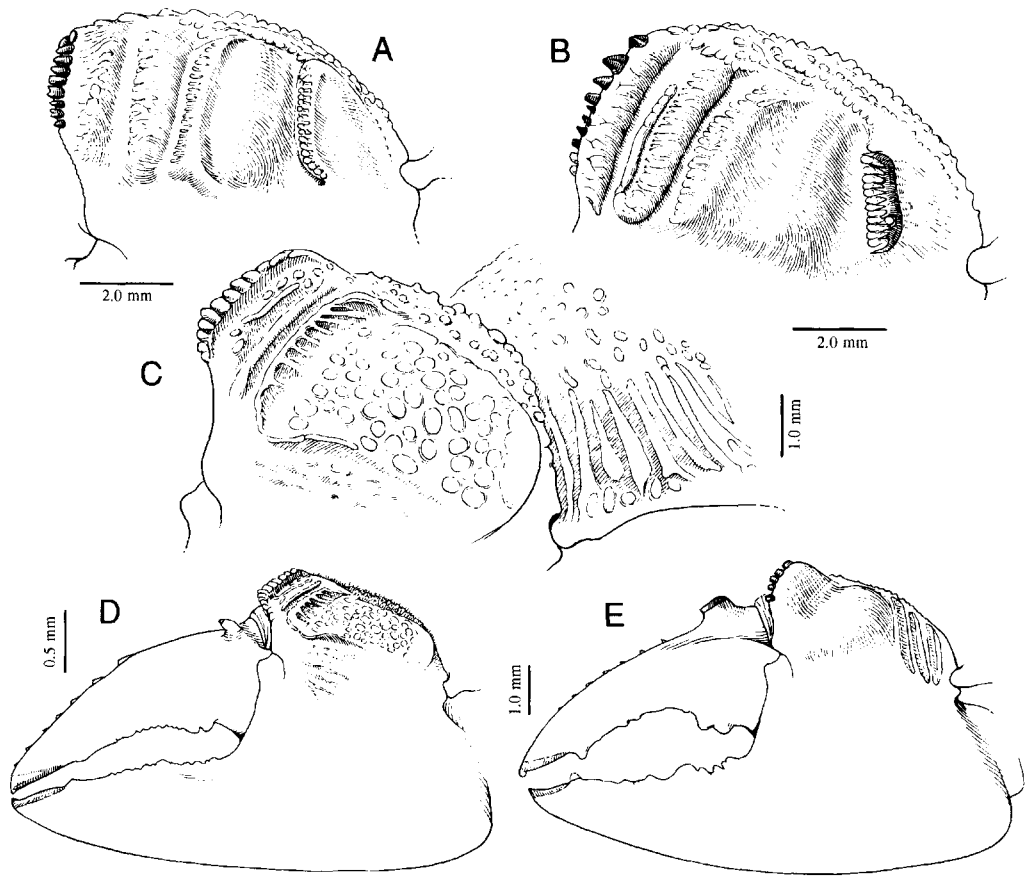

FIG. 1. A, *Sarmatium crassum* Dana, upper face of palm of♂ chela (QM W15228). B, *S. striaticarpus* sp.nov., upper face of palm of♂ chela (holotype, ZRC 1970.1.23.14). C,D, *S. hegerli* sp.nov., upper and outer faces of♂ chela (holotype, QM W9698). E, *S. unidentatus* sp.nov., outer face of male chela (holotype, AM P31822).

angles obtuse, blunt; pre-orbital teeth obsolete; lateral margins slightly diverging posteriorly. Post-frontal lobes distinct; median lobes distinctly broader than laterals; lateral lobes not clearly differentiated. Branchial ridges prominent forming a series of short broken granular striations; last continuous, parallel with posterolateral margin, and finishing over coxa of fourth walking leg. Posterior margin c.0.45-0.5 × carapace width. Carapace surface smooth, shining, punctate; setae arranged sparsely on branchial lines. Upper orbital border minutely granular; straight; inner angle rounded. Lower orbital border straight; evenly granular. Inner orbital tooth present; well developed; equilateral triangular, ocular peduncle swollen basally, cornea constricted and reduced. Basal segment of antennal peduncle with a well developed outer lobe in form of rounded tongue. Inter-antennular septum narrow; 0.22-0.24 × width of front.

Third maxilliped: Merus 0.7-0.8 × length of ischium. Suture between merus and ischium slightly sloping inward. Ischium inner margin microscopically granular. Palp articulates medially on distal margin of merus. Exopod narrow, barely visible in frontal view; flagellum normal.

Chelipeds: Subequal; large and robust. Merus posterior border with minutely granular striations; distinct subdistal spine; lower border granulate; anterior border convex, coarsely granulate; carpus with a small spine at inner angle; inner margin unarmed, striated, rounded, ventral-

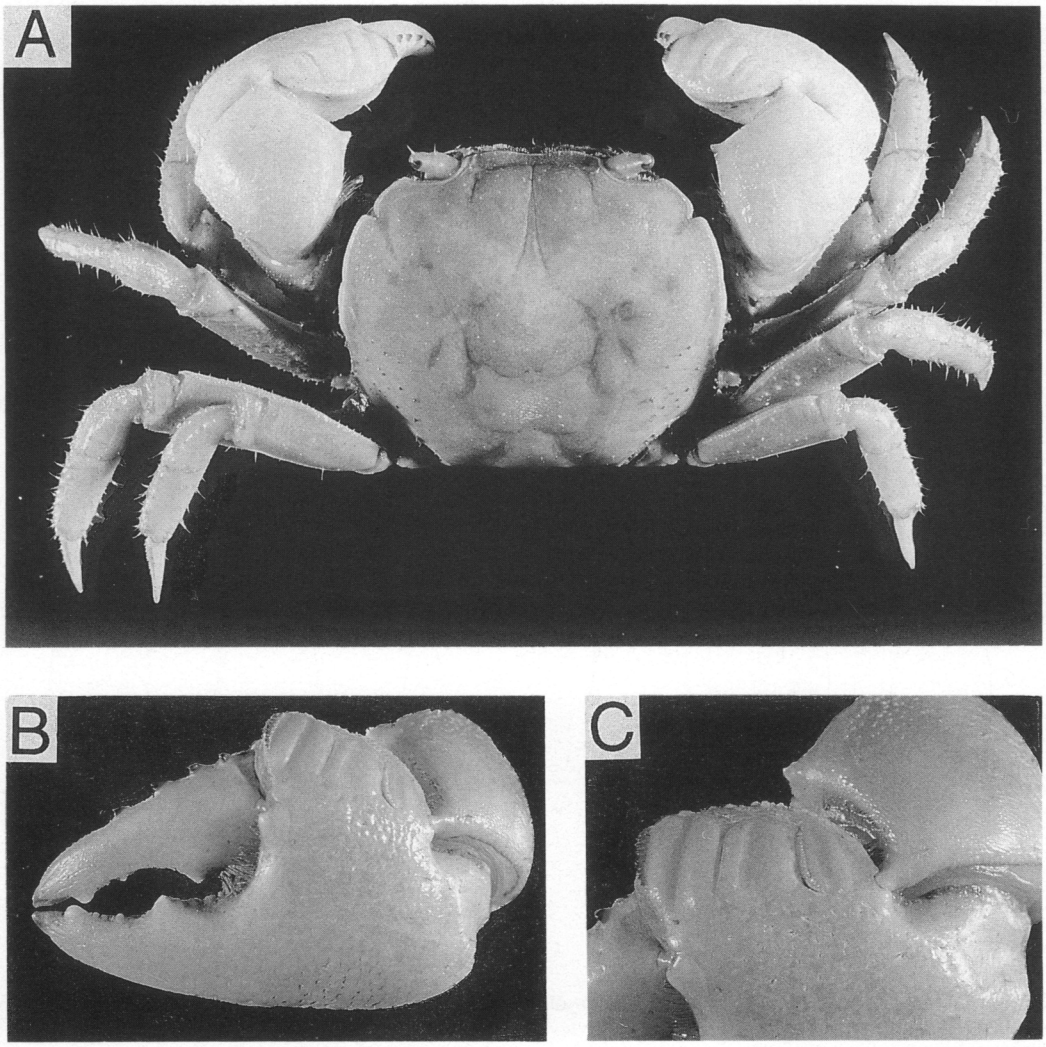

FIG. 2. *Sarmatium crassum*, ♂ (QM W15228). A, dorsal view. B, chela. C, upper surface of palm of chela. Scale line in mm.

ly with row of small granules and short proximal oblique crest bearing row of long setae; granules present on inner face of carpus just below inner angle; outer margin striated, with narrow patch of sparse, very short setae; upper surface microscopically striated proximally, smooth and wrinkled medially, behind articulation distally a large patch of tiny, flattened, squamous granules which become aligned into fine rows near outer edge. Palm upper surface with a series of transverse grooves separating swollen ridges, distal margin of upper surface of palm bearing row of 10-13 pectinated teeth along edge of articulation, proximal to this is a series of 6 broad, swollen, rounded ridges, relatively evenly separated, ridges 3/4 and 5/6 joined by low rim top and bottom; fourth ridge broader than others; fifth ridge low and with row of 15-20 granules along its lower distal edge; superior margin with a series of moderately large granules, but without conspicuous setation. Outer surface of palm smooth and punctate; without median longitudinal row; without a ventral ridge. Outer surface of palm naked, small patch of setae at base of fingers, fringe of setae at insertion of dactyl. Inner surface of palm with sparse large flat smooth granules,

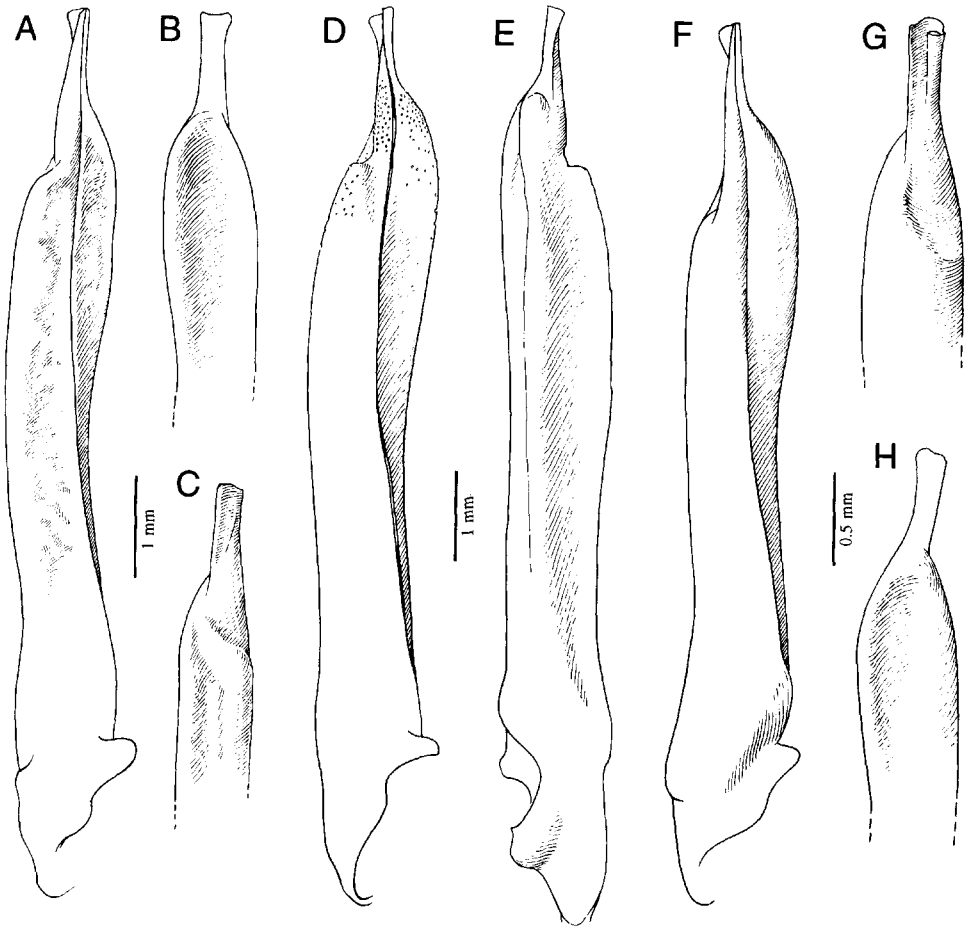

FIG. 3. Male first gonopods (setae removed). *Sarmatium crassum* Dana. A, abdominal view. B, C, lateral views of apex. *S. striaticarpus* sp.nov. D, abdominal view. E, sternal view. *S. hegerli* sp.nov. F, abdominal view. G, H, lateral views of apex.

largest and most conspicuous near gape, but not forming a strong vertical crest. Immovable finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.45×length propodus in males (0.5 in females). Ventral border of chela straight, or slightly convex. Dorsal surface of dactyl of males bearing 4 large, broad, chitinous tubercles in proximal three-fifths, first set away from joint about same distance as to following tooth, a small patch of setae in the space; second tooth larger than first; third and fourth teeth largest, similar sized; teeth 1-4 set increasingly obliquely, highest towards outer face; followed in distal quarter by a row of 12-14 small closely set chitinous tubercles of even size. Fingers pointed; curved slightly inwards; a moderate gape between cutting margins in males.

Walking legs: Medium length; compressed and flattened; second pair slightly the longest, c.1.5-1.7×maximum carapace width. Third leg: merus c.2.4-2.6×as long as wide; carpus c.2.6-2.8×as long as wide; propodus c.2.3- 2.6×as long as wide. Dactyli about equal to length of propodi; slender and almost straight; terminating in acute chitinous tips. Propodus with an accessory carina on inferior proximal portion of upper surface. Meri of legs 1-3 with scattering of small distally directed prickles; dorsal and ventral borders of meri granulate. Setae short, predominantly on upper distal face of carpi, and on upper half of propodi, and continuing onto dactyli in thin rows.

Male abdomen: Relatively narrow; third segment slightly the widest. Slightly calcified base of penis adjacent to margin of third segment. Segments three-five slightly tapering. Width segment three 4.1-4.7 × length (relatively narrower in smaller males). Segment six not elongated; 1.45-1.6 × wider than long. Telson nearly subequal in length to segment 6; 1.25-1.5 × longer than wide (relatively longer in large males); evenly rounded.

Gonopods: G1 moderately stout; slightly curved. Inner-dorsal margin distally curved inward. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, large, broad, rounded, calcified. Outer dorsal margin of stem convex. Distal part of the stem broad but narrowing. Apical process present; corneous; strongly produced; straight. Gonopore slightly displaced towards the dorsal surface. Setae long, simple, dense, obscuring structural detail. G2 short, relatively narrow, tapering, twisted, tip blunt.

COLOURATION

Fawn-brown, chelipeds and legs biscuit-coloured with orange tinge (Barnard, 1955); carapace purple in life with yellow patches, thoracic legs yellow with purple patches (Crosnier, 1965).

DISTRIBUTION

With certainty from only the following localities: Samoa (Dana, 1851b, 1852); Durban Bay, South Africa (Barnard, 1955); Madagascar (Crosnier, 1965); Dar es Salaam, Tanzania (Hartnoll, 1975); Eritrea, Red Sea (Fishelson, 1971; Holthuis, 1977); Sulu Archipelago, Indonesia (present record); eastern Queensland, from Brisbane north to 11 50'S on Cape York (McNeill, 1968; and present records); New Caledonia (Serène, 1973); Tahiti (present record).

Questionably from: Sumatra (Nobili, 1906 - no diagnostic characters were given, so may also be atributable to *S. striaticarpus* sp.nov.); Nicobars (Alcock, 1900, single ♀ specimen); 'Pacific' (Tesch, 1917, single ♀ specimen).

HABITAT

In the mangroves (Crosnier, 1965; McNeill, 1968). 'An uncommon species in creek mangrove, where specimens were collected from the *Ceriops* and mixed zones' (Hartnoll, 1975). Mangroves; mouth of river in mudbank at low water; mud in *Rhizophora*; mud in *Avicennia* (present records).

REMARKS

Serène & Soh (1970) presented data and figures separating what they believed to be *Sarmatium crassum* from *S. germaini*. Unfortunately their *S. crassum* specimens represent a new species very closely allied to *S. crassum*, but differing in a number of distinctive characters (see later). The accurate identity of *S. crassum* is slightly problematic as, being a Dana species, the type was destroyed in the Chicago fire of 1871. This means that it is difficult to be absolutely certain what is the true *S. crassum*. After considering Dana's description, I consider the Asian specimens previously attributed to *S. crassum* to be the new species, and it is here named *S. striaticarpus*. *Sarmatium crassum* differs from *S. striaticarpus* on the following grounds:

1. The shape and disposition of the ridges and grooves on the upper surface of the palm are different. In *S. crassum* the ridges are all subparallel and this is evident in Dana's Fig. 1d; whereas in *S. striaticarpus* the proximal most corrugated ridge is separated from the next broad groove by a triangular space. Also there is a slight groove separating the distal row of pectinatious teeth in Dana's figure which is also true of my *S. crassum* material but not present in *S. striaticarpus*.

2. The first proximal tooth on the dactyl of the cheliped is placed slightly distally from the articulation in *S. crassum* and this also seems true of Dana's figure although it is not clear; in *S. striaticarpus* it is placed almost on the very edge of the proximal end.

3. So far, *S. striaticarpus* is only known for certain from vicinities north of the equator. To remove all doubt over the identity of *S. crassum* the erection of a neotype would be necessary. I am reluctant to do this because I have not seen specimens from the type-locality (Samoa). Although the Asian specimens certainly represent a new species (*S. striaticarpus*), slight reservations must remain about the identity of the specimens here referred to *S. crassum*. The shape of the male abdomen in Dana's figure differs a little from that of the present material, and it is difficult to ascertain if this difference is due to growth changes (Dana's specimen was quite small), inaccuracies in the figure, or if it does in fact represent a real difference at the species level. In this last case a new name would be required for the material here identified as *S. crassum*.

Sarmatium striaticarpus sp.nov. can further be separated from *S. crassum* on the following grounds: the small chitinous tubercles on the dis-

tal half of the dactyl of the cheliped are greater in number and more closely spaced in *S. crassum*; *S. striaticarpus* has a broad patch of c.25 long, fine, transverse striations, mostly continuous but some subdivided, on the upper surface of the cheliped carpus between the articulation and the spine of the inner angle, in *S. crassum* the upper surface is microscopically striated proximally, smooth and wrinkled medially, and with a large patch of tiny, flattened, squamous granules behind the distal joint, which become aligned into fine rows near outer edge.

Sarmatium striaticarpus sp.nov.
(Figs 1B, 3D,E, 4)

Sesarma (*Sarmatium*) *crassum*: Tweedie, 1936: 67-8.
Sarmatium crassum: Serène & Soh, 1970, pl. 4C, D; 1971: 237-40, fig. 2, pl. 2; Sakai, 1976: 664-5.
? *Sarmatium* sp. (aff. *S. crassum* Dana): Sakai, 1936: 173, text-fig. 7.

MATERIAL EXAMINED
HOLOTYPE: ZRC 1970.1.23.14, 1♂ (24.3×23.0mm), Johore Straits, C.L. Soh, 21.1.1970.
PARATYPES: USNM 73213, 1♀ (16.2×14.0mm), Iloilo, Panay I., Philippines, H.C. Kellers, U.S. Navy, April 1929, Ilo Ilo Eclipse Exped.

DESCRIPTION
Carapace: c.1.1×broader than long. Fronto-orbital width c.0.75×carapace length. Carapace deeply vaulted; evenly convex longitudinally, flat from side to side. Depth c.0.8-0.9×carapace width. Regions well defined; mesogastric well defined; cardiac distinct; intestinal indistinct, defined laterally by branchio-intestinal grooves. Posterolateral margins divergent posteriorly; moderately concave. Anterolateral margins regularly convex; cristate; with three blunt, forwardly directed teeth behind the exorbital angle (third reduced to trace only). Front c.0.36×carapace width; 0.5×fronto-orbital width; moderately deflexed; with a broad median emargination; lateral angles obtuse; pre-orbital teeth obsolete; lateral margins slightly diverging posteriorly. Medial post-frontal lobes very broad, well defined, laterals almost obsolete; without clumps of setae. No short ridge on first epibranchial tooth. Branchial ridges not prominent; relatively short. Posterior margin c.0.5×carapace width. Carapace surface smooth, shining, punctate; setae arranged sparsely on branchial lines. Upper orbital border evenly granular; straight and slightly oblique; inner angle rounded. Lower orbital border straight; smooth. Inner orbital tooth present; well developed; equilateral triangular. Antennal flagellum very small, entering orbit. Orbital hiatus open. Basal segment of antennal peduncle with an elongate, rounded outer lobe. Basal antennular segment moderately swollen. Inter- antennular septum c.0.23×width of front.

Third maxilliped: Merus c.0.7×length of ischium. Suture between merus and ischium slightly sloping inward. Ischium sub-triangular; inner margin smooth. Palp articulates near outer distal margin of merus. Exopod narrow, barely visible in frontal view; c.0.3×width of ischium; flagellum normal.

Chelipeds: Subequal; large and robust. Merus of male without stridulatory ridge; posterior border minutely granulate; distinct subdistal spine; lower border granulate; anterior border coarsely granulate medially. Carpus with a spine at inner angle; inner margin with narrow granular bead; granules present on inner face of carpus just below inner angle; outer margin with a series of smooth granular striations; between articulation and spine of inner angle is a broad patch of c.25 long, fine, transverse striations, mostly continuous but some subdivided. Palm upper surface with a series of transverse grooves separating swollen ridges; a distally swollen margin bearing row of 10-12 pectinated teeth along edge of articulation, largest near superior margin, minute distally; behind this a wide groove; then a ridge, itself subdivided by a narrow groove into a very narrow distal ridge and a wide proximal ridge; behind this a series of two very wide swollen ridges separated by a broad concavity, but both ridges connected by a narrow margin top and bottom; behind this a triangular depression with its apex dorsally, and then a pair of short, closely-set comb-like ridges. Outer surface of palm smooth and punctate; with slight depression at base of fixed finger; without ventral ridge. Outer surface of palm naked; with small patch of setae at base of fingers just fringing articulation. Inner surface of palm with a low granular vertical crest of 5-6 granules largest ventrally; and an oblique crest of about 6 large granules running from below vertical crest to upper part of fixed finger. Immovable finger slightly flattened on outer surface; moderately long; length cutting edge c.0.45×length propodus. Ventral border of chela slightly convex. Dorsal surface of male dactyl with 15-17 chitinous tubercles; 4 large, widely spaced tubercles, set obliquely, on the proximal half, becoming longer but no higher distally; in

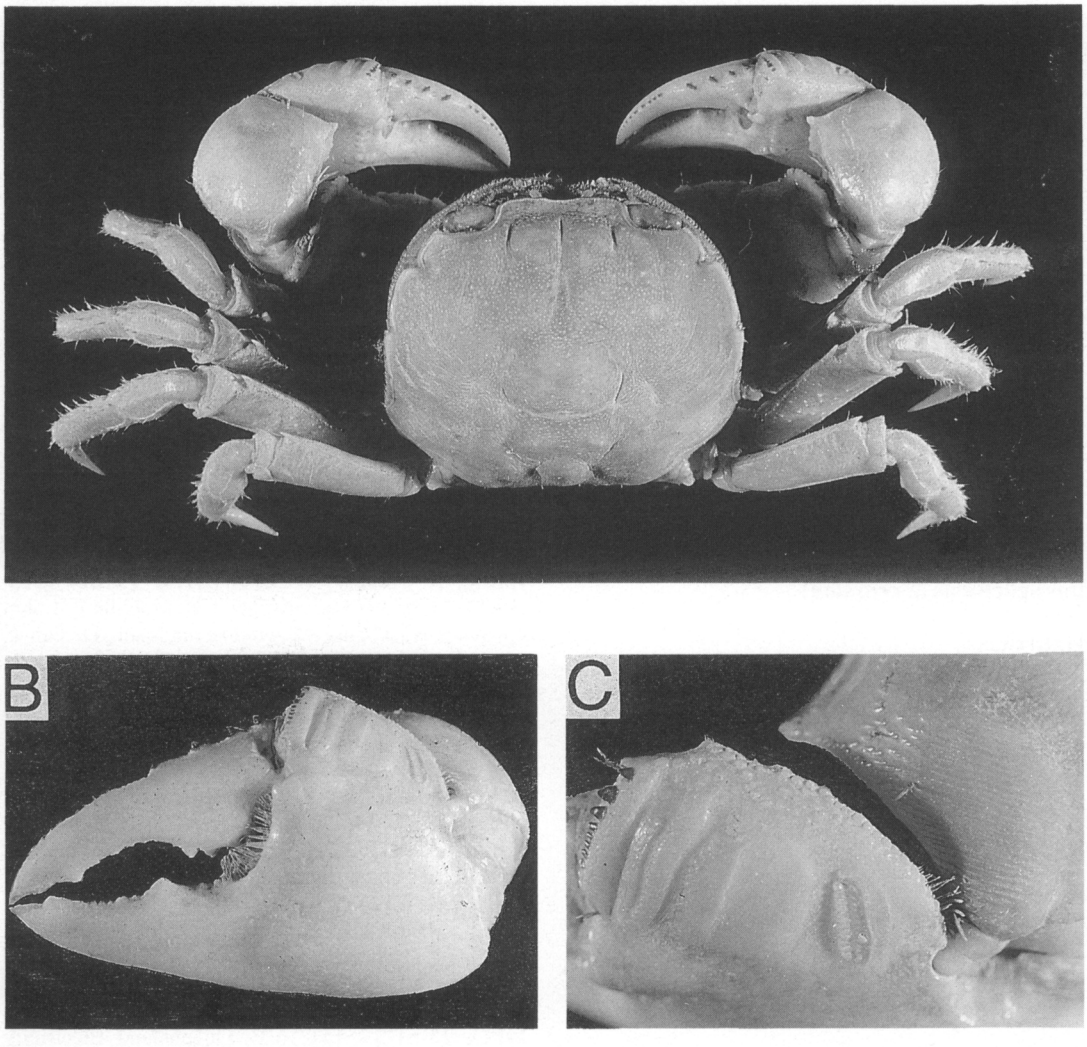

FIG. 4. *Sarmatium striaticarpus* sp.nov., ♂ (holotype, ZRC 1970.1.23.14). A, dorsal view. B, chela. C, upper surface of palm of chela. Scale line in mm.

distal half a row of 12 small closely set sharp tubercles, forwardly pointed, becoming minute distally; proximal portion of inner edge without distinct granules. Fingers pointed; curved inwards; a moderate gape between cutting margins.

Walking legs: Medium length; compressed; slender; first three pairs all of similar length but third pair slightly longest (c.1.7 × maximum carapace width). Third leg: merus c.2.8 × as long as wide; carpus c.2.6 × as long as wide; propodus c.2.6 × as long as wide; dactylus c.0.8 × length of propodus. Dactyli slender and slightly recurved; terminating in acute chitinous tips. Propodus with an accessory carina on inferior proximal portion of upper surface. Leg segments smooth, anterior margins minutely granular; fringed with short, soft, setae, also arranged in thin tufts in rows on anterior and posterior faces.

Male abdomen: Relatively narrow; third segment widest. First segment broad, only slightly narrower than third segment. Segments 3-5 slightly tapering. Width segment three c.4.3 × length. Telson longer than preceding segments, only slightly longer than sixth segment; c.1.4 × longer than wide; evenly rounded.

Gonopods: G1 moderately stout; slightly curved. Inner-dorsal margin evenly curved onto palp. Dorsal surface of stem flattened; completely

calcified. Palp well developed, separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex. Distal part of stem broad but narrowing. Apical process present; corneous; strongly produced; straight. Gonopore displaced towards the dorsal surface. Setae long, simple, lying around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, moderately twisted, apically pointed.

COLOURATION

Palm of the cheliped brownish red (Serène & Soh, 1971).

DISTRIBUTION

Singapore (Tweedie, 1936; Serène & Soh, 1971; present records); Southern Okinawa, Japan (Sakai, 1936, 1976); Philippines (present record). Relatively common in the mangroves of Singapore and Malaysia (Serène, 1973, referring to this species as *S. crassum*).

HABITAT

Mangrove swamp (Serène, 1973; Sakai, 1976; present records).

ETYMOLOGY

Named in reference to the characteristic striations on the upper surface of the carpus of the cheliped.

REMARKS

See 'Remarks' for *S. crassum*.

Sarmatium germaini (A. Milne Edwards, 1869) (Figs 5, 6A-C)

Sesarma germani A. Milne Edwards, 1869: 28; De Man, 1887: 651; 1891: 51.

Sarmatium germaini: Serène & Soh, 1970: 397, 405; 1971: 238, fig. 1, pl. 1 (1-4); Soh, 1978: 11, pl. 4a.

MATERIAL EXAMINED

LECTOTYPE. MP-B3668 (Dry), 1♀ (15.0×16.6mm), Poulo Condore, South China Sea, coll. M. Germain.

PARALECTOTYPES. MP-B10472 (Dry), 1♂ (13.3×12.4mm), Poulo Condore, South China Sea, coll. M. Germain. (On the posterior portion of the carapace is written '428' and below this 'GS' in faded black ink - specimen is dry, carapace intact but left cheliped, various legs and abdomen are detached.) MP-B10473, 1♂, same collection data as B10472, badly broken.

OTHER MATERIAL. ZRC 1970.2.20.3, 1♂ (27.8×25.6mm), Johore Straits, Singapore, C.L. Soh, Feb. 1970. MP-B10471, 1♂ (26.0×24.4mm), Port Swettenham, Malaysia, coll. Sasekumar, 22.10.1968. MP-B21576, 1♀ (19.9×17.4mm), Serangoon R., Singapore, mangroves, 28.8.1965. MP-B21574, 1♂ (14.2×13.1mm) 1♀ (16.9×15.3mm), Johore Baharu, 1°28'N, 103°44'E, mangroves, 10.7.1965. QM W14858, 1♂ (27.9×26.8mm), Mandai Swamps, Singapore, 1°25'N, 103°45'E, 1985, D.H. Murphy. ZMG 191a, 2♀♀ (16.7, 21.8) 2♂♂ (20.4, 21.9mm), Mariveles, Aibuleit, Bohol, Philippines, coll. Semper, 1876. NTM Cr.003558, 1 juv. ♂ (7.8×7.2mm), Creek 'H', East Arm, Darwin, N.T., mangrove lined creek, mean low water, R. Hanley, 28.8.1985. NTM Cr.003555, 1♂ (11.6×10.7mm), same data as Cr.003558. NTM Cr.003714, 1♂ (13.7×12.4mm), Creek 'H', East Arm, Darwin, N.T., mangrove creek, 4m, R. Hanley, 31.10.1984. NTM Cr.003718, 1♀ (17.5×16.1mm), same data as Cr.003714. NTM Cr.001693, 1♂ (16.5×14.7mm), 12°34.2'S 130°56.3'E, Darwin, N.T., in mangroves, low water spring, R. Hanley, 17.5.1984. AM P31821, 1♀ (13.1×11.8mm), Andranangoo Ck, Melville I., 1.5km upstream, west bank, *Rhizophora* mudbank, D. Grace, 21.6.1975. SMF Unreg., 3♀♀ (21.7-25.8), Smith Ck, Cairns, Mangroves, M. Skinner, 5.6.1980. SMF Unreg., 1♀ (27.1×24.4mm), nr Australian Institute of Marine Science, Cape Ferguson, NEQ, M. Türkay, 11.6.1980. QM W12334, 3♂♂ (21.6×20.0; 22.6×21.2; 22.2×20.6mm), 1♀ (21.8×19.4mm), Townsville, NEQ, 19°16'S, 146°49'E. QM W8212, 1♀ (17.4mm), Murray R., NEQ, 18°01'S, 145°53'E, 23.5.1978, P.Davie, at burrow entrance at night 10m inland from bank. QM W12333, 1♂ (15.6mm), Cardwell, NEQ, 18°16'S, 146°01'E, K.Broadbent. QM W1100, 1♂ (16.5mm), Orpheus I., 18°4'S, 146°30' E, in mangrove area. QM W17485, 5♂♂ (10.0-19.5mm), 3♀♀ (9.1-15.2mm), Calliope R. and Auckland Ck, Gladstone, MEQ, 23°51'S, 151°16'E, Queensland Electricity Commision Survey, 1974-1983, P. Saenger. QM W17486, 1♀ (12.2×11.0mm), small branch of Serpentine Ck, SEQ, 27°24'S, 153°07'E, Sept 1972, B. Campbell et al.

DESCRIPTION

Carapace: c.1.1×broader than long. Fronto-orbital width c.0.8×carapace length. Carapace deeply vaulted; evenly convex longitudinally, flat from side to side. Depth c.0.9×carapace width. Regions moderately defined; mesogastric well defined; cardiac distinct; intestinal indistinct, defined laterally by branchio-intestinal grooves. Lateral margins slightly divergent posteriorly; slightly concave. Anterolateral margins regularly convex; usually with two blunt, forwardly

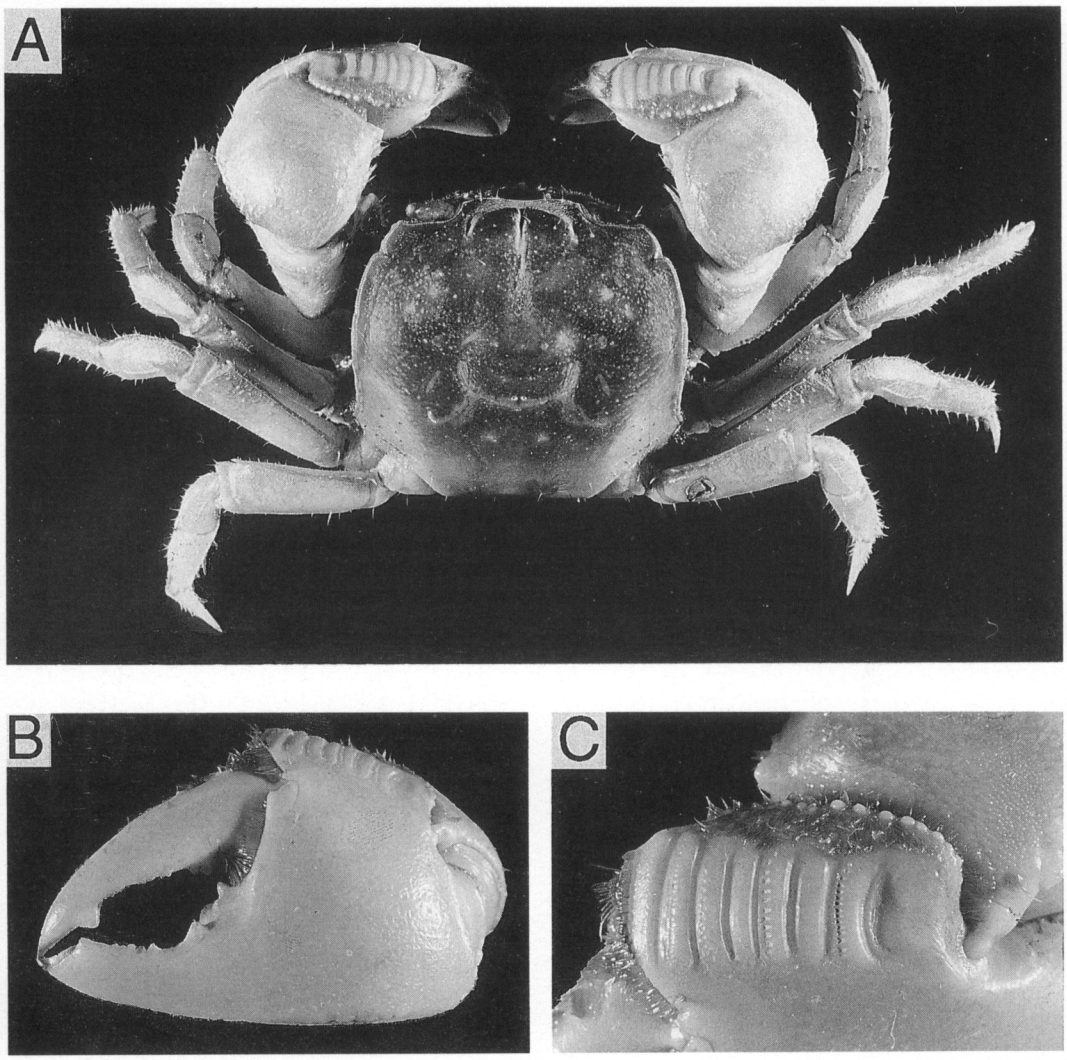

FIG. 5. *Sarmatium germaini* (A. Milne Edwards), ♂ (QM W14858). A, dorsal view. B, chela. C, upper surface of palm of chela. Scale line in mm.

directed teeth behind exorbital angle, a third tooth sometimes noticeable. Front c.0.4 × carapace width; 0.5 × fronto-orbital width; moderately deflexed; with broad median concavity; lateral angles obtuse; pre-orbital teeth obsolete; lateral margins slightly diverging posteriorly. Post- frontal lobes medially well defined, laterally indistinct; without clumps of setae. Branchial ridges moderately prominent; relatively short. Posterior margin c.0.5 × carapace width. Carapace surface smooth, shining; wrinkled and punctate posteriorly; setae arranged sparsely on branchial lines. Upper orbital border evenly granular; with slight median convexity; inner angle rounded. Lower orbital border straight; evenly granular. Inner orbital tooth present; well developed; equilateral triangular. Basal segment of antennal peduncle with broad and rounded outer lobe. Inter-antennular septum narrow; 0.25-0.3 × width of front.

Third maxilliped: Merus c.0.8 × length of ischium. Suture between merus and ischium horizontal. Ischium sub- triangular; inner margin smooth. Palp articulates near outer distal margin of merus. Exopod narrow; 0.4 × width of ischium; flagellum normal.

Chelipeds: Subequal; large and robust; merus

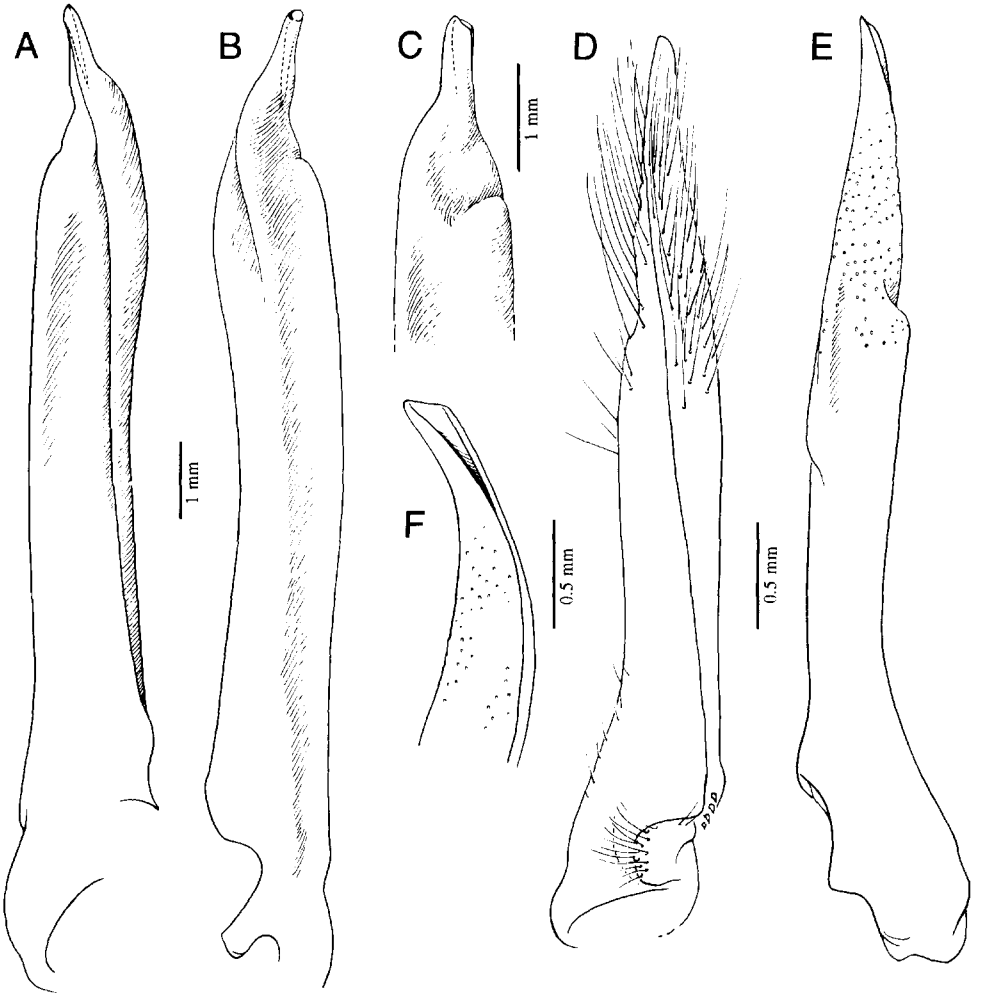

FIG. 6. Male first gonopods (setae removed, except for D). *Sarmatium germaini* (A. Milne Edwards) (QM W14858). A, abdominal view. B, sternal view. C, lateral view of apex. *S. unidentatus* sp.nov. (holotype, AM P31819). D, abdominal view. E, sternal view. F, lateral view of apex.

with posterior border minutely granulate; without distinct subdistal spine; lower border granulate; anterior border sparsely granulate, slightly coarser medially; carpus with a broad tooth at inner angle; tubercles present on inner face of carpus just below inner angle, 1 or 2 ventrally on vertical crest; outer margin smooth, wrinkled, upper medial surface behind articulation with a broad patch of small flattened vesicular tubercles. Palm upper surface with a series of transverse grooves separating swollen ridges: upper distal margin behind articulation with a row of 14-17 blunt chitinous tubercles, slightly larger towards inner end; behind this a series of 8 transverse swollen ridges, first 7 of similar shape evenly spaced, third to seventh subequal in width, slightly narrower than first and second; behind seventh, a much broader sulcus separating a much broader, proximal transverse swelling; ridges 3/4, 5/6, 7/8 narrowly connected top and bottom, more-or- less obviously; ridges 3,5, and 7 with a line of punctations on distal edge, deeper on 5, very deep on 7 so as to form a series of gutters with a prominent granule at the base of each gutter; behind transverse ridges superior border with large rounded granules. Outer surface of palm smooth

and punctate; without median longitudinal row. Ventral ridge extends to tip of fixed finger, less distinct distally, very prominent behind fixed finger, extends less than halfway towards proximal end. Outer surface of palm naked except for fringe of short setae around dactyl articulation; with a patch of 'fur' on superior margin behind transverse ridges. Inner surface of palm smooth; without a vertical crest. Immovable finger slightly flattened on outer surface; moderately long. Length cutting edge c.0.4-0.5×length propodus. Ventral border of chela convex, straight in small specimens. Dorsal surface of dactyl bearing 3 large chitinous tubercles in proximal half, set obliquely; followed immediately by 17-18 small acute chitinous tubercles. Fingers pointed; slightly curved inwards; a wide gape between cutting margins.

Walking legs: Medium length; cylindrical; slender; second pair slightly the longest, c.1.7×maximum carapace width. Third leg: merus c.2.3-2.5×as long as wide; carpus c.2.6-2.7×as long as wide; propodus c.2.2- 2.3×as long as wide; dactylus c.0.95×length of propodus. Dactyli slender and slightly recurved; terminating in acute chitinous tips. Propodus without short accessory carina on inferior proximal portion of upper surface. Meri of legs 1-3 with a scattering of small sharp prickles on outer surface; leg segments fringed with short setae, setae arranged in thin tufts in rows on anterior and posterior faces.

Male abdomen: Relatively narrow; third segment the widest. First segment broad, only slightly narrower than third segment. Segments three-five slightly tapering, each with slightly concave margins. Width segment three c.4.3×length. Telson length subequal to sixth segment; c.1.4×longer than wide; evenly rounded.

Gonopods: G1 moderately stout; curved. Innerdorsal margin evenly curved onto palp. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, large, narrow, rounded, calcified. Outer dorsal margin of stem convex. Distal part of the stem narrow. Apical process present; corneous; strongly produced; straight. Gonopore terminal. Setae long, simple, lying around corneous tip and apical part of stem obscuring structural detail. G2 short, evenly tapering, moderately twisted, apically pointed.

COLOURATION

Greenish brown with reddish tinge on legs (A. Milne Edwards, 1869); palm of the cheliped yellowish light brown (Serène & Soh, 1971).

DISTRIBUTION

Poulo Condore Island, Vietnam, South China Sea (type locality, A. Milne Edwards, 1869); Singapore and Malaysia (Serène & Soh, 1971, and present record); Hong Kong (Soh, 1978); Philippines (present record); northern Australia - from Brisbane to Darwin (present records).

HABITAT

In the mangroves and nearly always out of the water (A. Milne Edwards, 1869). Mangrove lined creek at mean low water; *Rhizophora* mudbank; at burrow entrance at night 10m inland from creek bank (present records).

REMARKS

A. Milne Edwards (1869) did not specifically designate a holotype but he gives the measurements for only a single specimen of 17×16mm, and does not mention its sex. From his description of the 'six ou sept très-petits bourrelets obliques et parallèles' on the chela, one might think that he examined a male, but these ridges are also present, albeit indistinctly, on the female. His note on habitat - that this species was collected almost always out of the water - does suggest that he was given more than one specimen to examine. De Man (1891) says, 'I was enabled to study a typical male specimen of *Ses. Germani* of the Paris Museum', but he does not give measurements. Serène & Soh (1971) state, 'The senior author ... was able to re-examine the holotype of *S. germaini* in the Paris Museum (April 1970); it is a dry female and not a male as indicated by De Man (1891).' The decision is taken here to designate the female as the lectotype - its measurements do not precisely conform to those given by A. Milne Edwards, but they are very near. There are also two dry male specimens at the Paris Museum, MP-B10472-3, and one of these was presumably the specimen examined by De Man. A relatively modern label identifies them as being collected by M. Germain from Poulo Condor, but no original labelling has been preserved. The specimens (one is little more than a series of fragments) are indeed *S. germaini* as defined here, and by Serène & Soh (1971), however they are both much smaller than the measurements given by A. Milne Edwards. They are considered, along with the female discussed above, to have been syntypes, and are thus designated here as paralectotypes.

The spelling of the species name was justifiably emended by Serène & Soh (1971) as the species was clearly intended to be named after its collector, R. Germain, and can thus be considered an 'incorrect original spelling' under Article 32(c) of the International Code of Zoological Nomenclature (1989, Third Edition).

Sarmatium hegerli sp.nov.
(Figs 1C,D, 3F-H, 7)

MATERIAL EXAMINED

HOLOTYPE: QM W9698, 1♂ (19.6×17.4mm), East Alligator R., Kakadu National Park, N.T., burrow in moist bank of drainage channel (K836), P. Davie, May 1980.

PARATYPES: QM W9699, 1♂ (9.9×8.7mm), East Alligator R., Kakadu N.P., N.T., edge of drainage channel in *Ceriops/Avicennia* stand with a thick *Aegilaitis* understory, (T6Q2) P. Davie, 19.6.1982. QM W9700, 1♂ (12.4× 10.8mm), East Alligator R., Kakadu N.P., N.T., open *Sonneratia* forest, very soft sloppy mud, (T6Q4) P. Davie 19.6.1982. QM W9701, 1 juv. (6.6×6.1mm), East Alligator R. Mouth, Kakadu N.P., N.T., low open *Avicennia/Aegilaitis* scrub, moist but firm substrate, some succulent saltmarsh plants, crab from shaded raised burrow entrance very near surface, (T5Q1), P. Davie, 16.6.1982. QM W9702, 1♂ (10.8 ×9.2mm), East Alligator R., Kakadu N.P., N.T., open *Sonneratia* forest, very soft sloppy mud (T6Q5), P. Davie, 19.6.1982. QM W9703, 4♀♀ (12.4×10.4; 12.1×9.6 (bopyrid infection); 10.9×9.0; 10.1× 8.5mm) 1♂ (13.6×11.9mm), East Alligator R., Kakadu N.P., N.T. (Site 27), P. Davie, May 1980. QM W9704, 1♂ (13.2 ×12.0mm), Middle Arm, Darwin, N.T., in burrow under rock rear boat ramp, firm mud, tidally inundated, salinity 32 ppt at low water, P. Davie, 29.6.1982. NTM Cr.001826, 1♂ (15.8×14.3mm), locality not supplied. NTM Cr.003068 1♂ (24.6×11.8mm), Creek 'H', East Arm, Darwin Harbour, 12°33.2'S, 130°56.3'E, mangroves, mean low water, R. Hanley, 1.7.1985.

DESCRIPTION

Carapace: c.1.1×broader than long in males, c.1.2 in females. Fronto-orbital width c.0.8×carapace length (0.9 in females). Carapace deeply vaulted; convex anteriorly, almost flat from side to side. Depth c.0.8×carapace width. Regions moderately defined; mesogastric well defined; cardiac distinct; intestinal indistinct, defined laterally by branchio-intestinal grooves. Lateral margins subparallel; slightly concave. Anterolateral margins regularly convex; with three blunt teeth behind the exorbital angle; second small but obvious, third minute almost obsolete. Exorbital angle blunt, rounded, not projecting. First anterolateral similar in size to exorbital angle but with longer margin. Front c.0.36- 0.39×carapace width; c.0.5×fronto-orbital width; moderately deflexed; with shallow median emargination; lateral angles rounded; pre-orbital teeth obsolete; lateral margins slightly diverging posteriorly. Median post-frontal lobes distinct, distinctly broader than laterals which are not clearly differentiated. Branchial ridges prominent as a series of short broken granular striations; last continuous, parallel with posterolateral margin, and finishing over coxa of fourth walking leg. Posterior margin c.0.5×carapace width. Carapace surface smooth, shining, punctate. Setae in short tufts over entire surface, less prominent on cardiac and intestinal regions. Upper orbital border minutely granular; straight; inner angle rounded. Lower orbital border straight; evenly granular. Inner orbital tooth present; well developed; acute equilateral triangular. Basal segment of antennal peduncle with well developed, elongate, rounded outer lobe. Inter-antennular septum narrow; 0.22-0.24×width of front.

Third maxilliped: Merus c.1.4×length of ischium. Ischium inner margin microscopically granular. Palp articulates medially on distal margin of merus. Exopod narrow, barely visible in frontal view; flagellum normal.

Chelipeds: Subequal; large and robust; merus with posterior border minutely granulate; with distinct subdistal spine; lower border minutely granulate; anterior border sparsely granulate, with a few large rounded granules medially on convexity; carpus with a spine at inner angle; inner margin minutely granular, rounded, ventrally with minutely granulate crest and a long proximal oblique ridge bearing row of long setae; granules present on inner face of carpus just below inner angle; outer margin striated, bearing thick band of short setae; upper surface smooth and sparsely granulate, with distinctive area of 9 prominent ridges and 8 grooves, running transversely along outer distal half behind joint. Palm upper surface with a series of transverse grooves separating swollen ridges: distal margin of upper surface of palm raised, with a series of 4-8 short, broad, truncated, chitinous teeth; proximal to this a series of 3 ridges separating 3 narrow smooth grooves, or sometimes the first ridge low and uneven and followed by area of small smooth granules, and then the other two arced ridges; on proximal slope of last ridge is a series of short ridges and grooves, longest towards upper mar-

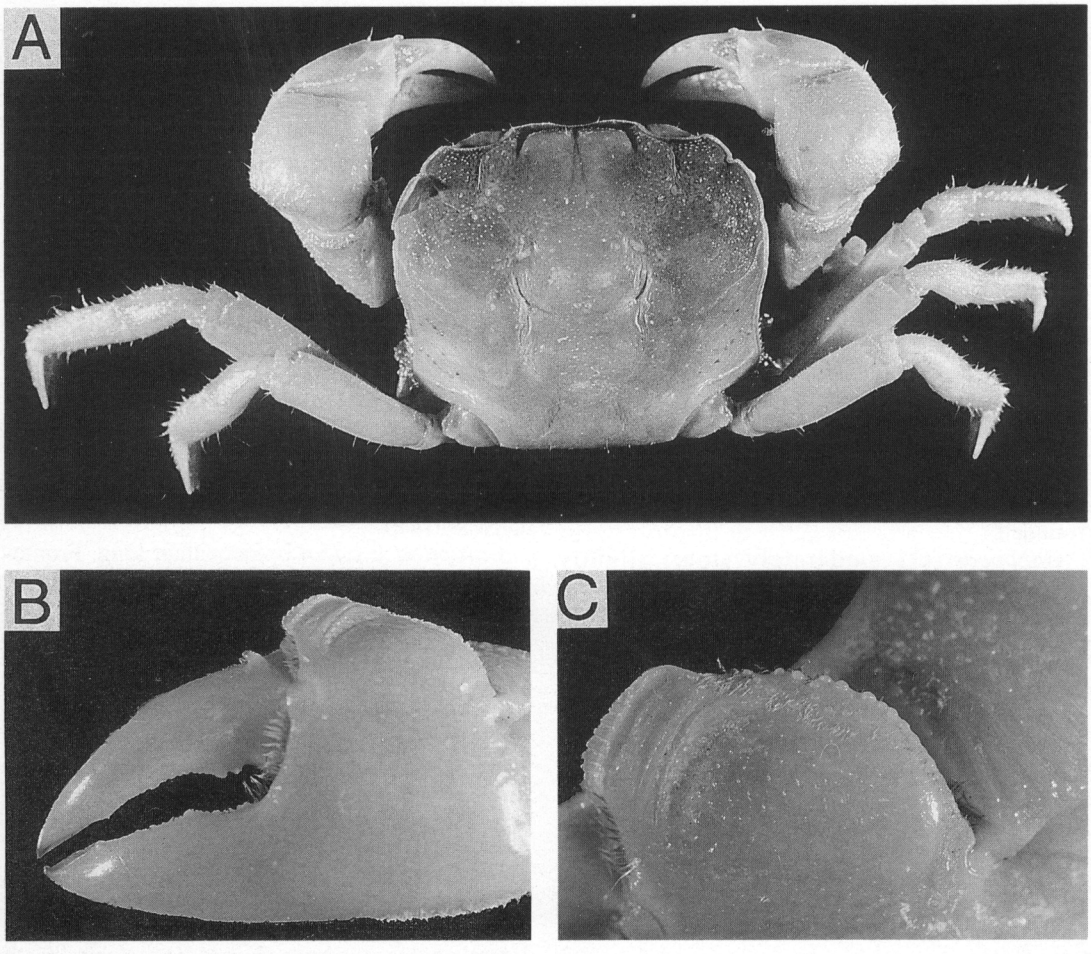

FIG. 7. *Sarmatium hegerli* sp.nov., ♂ (holotype, QM W9698). A, dorsal view. B, chela. C, upper surface of palm of chela. Scale line in mm.

gin; behind this a very broad deep concavity, and then a large swelling back to posterior margin, the distal slope of which is long and covered in well separated, medium sized, low round granules; superior margin with large rounded granules and short setae. Outer surface of palm smooth; without median longitudinal row; without a ventral ridge. Outer surface of palm naked except for fringe of setae at insertion of dactyl, and a small patch ventro-proximally behind joint and as a triangular patch proximally on ventral face. Inner surface of palm smooth; without vertical crest but with a few very low rounded tubercles, almost indistinguishable. Immovable finger rounded on outer surface; without ventral ridge; moderately long. Length cutting edge c.0.45-0.49 × length propodus. Ventral border of chela straight, or slightly convex. Dorsal surface of dactyl with 1 large forwardly directed, bluntly pointed, chitinous tubercle proximally near joint on outer edge of superior margin; 5-6 additional chitinous tubercles commencing c.two-fifths distance towards tip; first large, oblique, truncate; second smaller of same form; third also similar but very small, distal 2-3 minute and reducing distally, last tubercle situated well before tip; thick triangular patch of setae proximally on upper surface near joint. Fingers pointed; slightly curved inwards; a narrow gape between cutting margins in largest male, no gape in smaller males.

Walking legs: Medium length; compressed; second pair slightly the longest, c.1.3-1.5 × maximum carapace width. Third leg: merus c.2.4-2.7 × as long as wide; carpus c.2.5- 2.7 × as long

as wide; propodus c.2.3 × as long as wide. Dactyli about equal to length of propodi; slender and slightly recurved; terminating in acute chitinous tips. Propodus with an indistinct accessory carina on inferior proximal portion of upper surface. Meri of legs 1-3 with scattering of small distally directed prickles; dorsal and ventral borders of meri granulate. Setae short, covering anterior and posterior faces of carpi and propodi, and distal upper margins of meri; continue on to proximal half of dactyli in thin rows.

Male abdomen: Relatively narrow; third segment the widest, subequal with first. Segments three-five tapering. Width segment three c.4.25-4.9 × length, relatively narrower in smaller males. Segment six not elongated; 1.25-1.35 × wider than long. Telson longer than preceding segments, only slightly longer than segment 6; 1.4- 1.5 × longer than wide; evenly rounded.

Gonopods: G1 moderately stout; slightly curved. Inner-dorsal margin distally curved inward. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, large, broad, triangular, calcified. Outer dorsal margin of stem convex. Distal part of the stem broad but narrowing. G1 apical process corneous; strongly produced; straight. Gonopore slightly displaced towards the dorsal surface. Setae short, simple, obscuring structural detail. G2 short, relatively narrow, tapering, twisted, tip blunt.

Sternum: Thick covering of setae between insertion of telson and mouth frame.

HABITAT

Mangroves; burrows in riverbanks and banks of drainage channels; moist to very sloppy mud; not restricted to a particular mangrove zone. One burrow, apparently belonging to this species had a raised entrance, but this does not seem typical.

DISTRIBUTION

Only known from Northern Territory, Australia.

ETYMOLOGY

Named for Mr Ed Hegerl, director of the Australian Littoral Society, and one of Australia's leading marine conservationists. Someone I have followed into very many, very muddy places.

REMARKS

The key provided here separates *Sarmatium hegerli* sp.nov. from all other known species of *Sarmatium*. The pattern of grooves and ridges on the upper surface of the palm of the cheliped; the shape, number and position of the cheliped dactylar tubercles; and the male first gonopod are distinctive.

Sarmatium unidentatus sp.nov.
(Figs 1E, 6D-F, 8)

MATERIAL EXAMINED

HOLOTYPE: AM P31822, 1♂ (12.5 × 10.9mm), Nungbalgarri Ck, N.T., 2.5km upstream, west bank, D. Grace, 27.7.1976.

PARATYPE: AM P31819, 1♂ (11.7 × 10.4mm), Liverpool R., N.T., 14.3km upstream, amongst debris on mud floor in *Rhizophora* mangrove forest, D. Grace, 30.1.1975.

DESCRIPTION

Carapace: c.1.15 × broader than long. Fronto-orbital width c.0.85 × carapace length. Carapace deeply vaulted; convex in both directions, only slightly from side to side. Depth c.0.8 × carapace width. Regions moderately defined; mesogastric well defined; cardiac distinct; intestinal distinct. Lateral margins slightly divergent posteriorly; slightly concave. Anterolateral margins regularly convex; with two blunt teeth behind the exorbital angle. Exorbital angle blunt, rounded not projecting. First anterolateral tooth similar in size to exorbital angle but with longer margin. Second anterolateral tooth minute. Front c.0.4 × carapace width; c.0.5 × fronto-orbital width; moderately deflexed; with shallow median emargination; lateral angles quadrate, rounded; pre-orbital teeth obsolete; lateral margins sub-parallel. Median post-frontal lobes distinct, distinctly broader than laterals; lateral lobes not clearly differentiated. A series of short broken granular branchial striations; last continuous, parallel with posterolateral margin, and finishing over coxa of fourth walking leg. Posterior margin c.0.5 × carapace width. Carapace surface smooth, shining, punctate. Setae arranged sparsely on branchial lines. Upper orbital border minutely granular; straight; inner angle rounded. Lower orbital border straight; evenly granular. Inner orbital tooth present; well developed; bluntly triangular. Basal segment of antennal peduncle with a well developed elongate, rounded outer lobe. Basal antennular segment swollen. Inter- antennular septum narrow; 0.22-0.24 × width of front.

Third maxilliped: Merus c.1.35 × length of ischium. Ischium inner margin granular. Palp articulates medially on distal margin of merus.

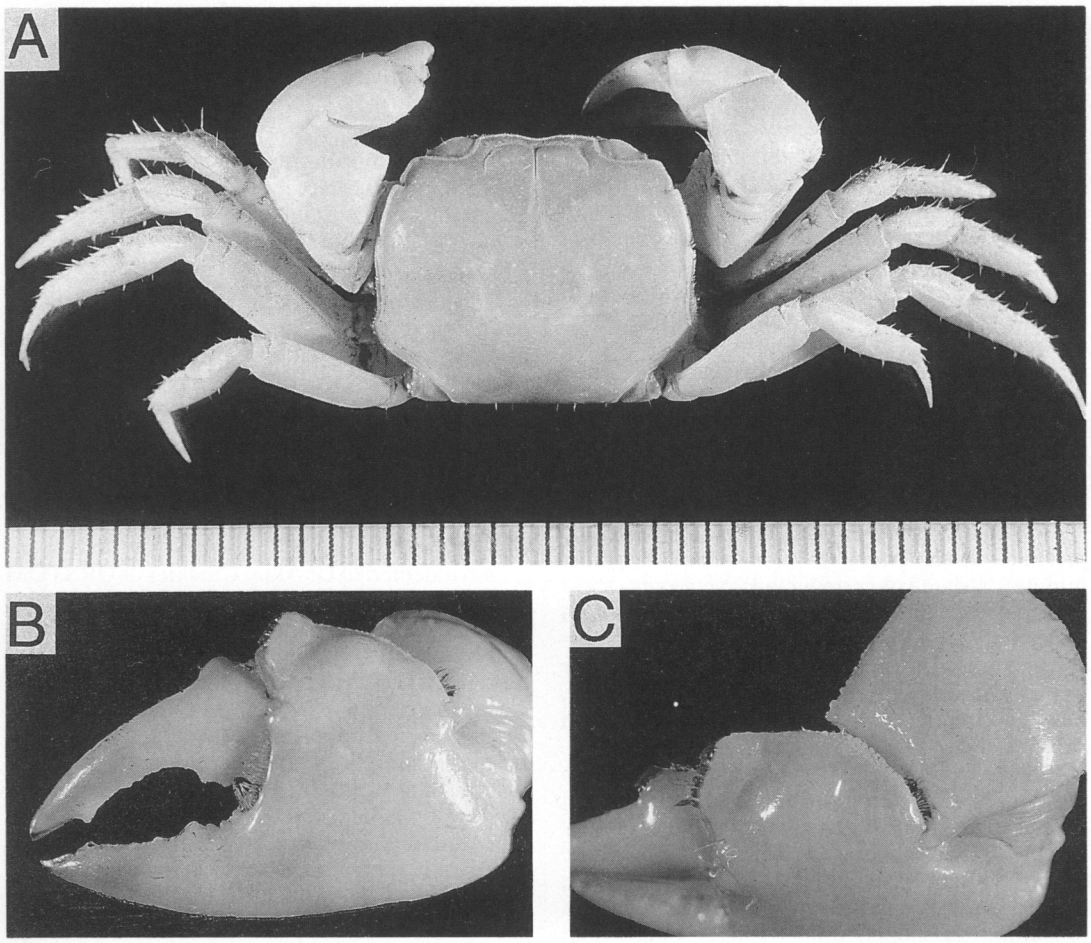

FIG. 8. *Sarmatium unidentatus* sp.nov., ♂ (holotype, AM P31819). A, dorsal view. B, chela. Scale line in mm.

Exopod narrow, visible proximally and distally in frontal view but mostly hidden; flagellum normal.

Chelipeds: Subequal; large and robust; merus with posterior border minutely striated; without distinct subdistal spine; lower border granulate; anterior border convex, coarsely granulate; carpus with inner angle granular; inner margin rounded, ventrally with row of minute granules and short proximal crest bearing row of long setae; granules present on inner face of carpus just below inner angle; outer margin striated, bearing rows of short dark setae; upper surface smooth and shiny distally, microscopically striated proximally. Palm upper surface with a series of transverse grooves separating swollen ridges: distal border of upper surface of palm with prominent crest bearing 5-6 short, broad, truncated, chitinous teeth; proximal to this a very broad, deep, smooth, oblique depression; then a very large medial transverse swelling; then a series of seven very fine, long transverse ridges ending near proximal margin of upper border; first six ridges joined top and bottom to form 3 pairs; superior margin distinctly granular, and lacking setation. Outer surface of palm smooth; without median longitudinal row; without a ventral ridge. Outer surface of palm naked except for fringe of setae at insertion of dactyl. Inner surface of palm sparsely granular, mostly smooth; with a low vertical crest of c.3 granules. Immovable finger rounded on outer surface, or slightly flattened on outer surface proximally; without ventral ridge; moderately long. Length cutting edge c.0.45 × length propodus. Ventral border of chela concave at base of fixed finger, bearing a shallow longitudinal depression. Dorsal surface

of dactyl tuberculate, bearing a pronounced slightly oblique, elongate proximal tooth, truncated and capped with chitin; a small patch of setae proximal to this tooth; distally followed by a broad gap and then a series of evenly spaced very small, acute, forwardly directed, chitinous tubercles, becoming minute distally and finishing at about three-quarters length of finger. Fingers pointed; curved inwards; a wide gape between cutting margins.

Walking legs: Medium length; compressed; second pair the longest, c.1.6-1.7 × maximum carapace width. Third leg: merus c.2.7 × as long as wide; carpus c.2.4- 2.5 × as long as wide; propodus c.2.5 × as long as wide. Dactyli about equal to length of propodi; slender and recurved; terminating in acute chitinous tips. Propodus without distinct accessory carina on inferior proximal portion of upper surface. Meri of legs 1-3 with scattering of small distally directed prickles; meri granular on superior margins; minutely striated over upper half. Setae very short and sparse on anterior halves of meri; thicker on upper halves of carpi, particularly along accessory ridges; also present on propodi on superior border and on both anterior and posterior faces, but disappearing distally; most obvious on anterior legs.

Male abdomen: First 3 sements subequal in width in holotype but third segment the widest in paratype. Segments three-five tapering, markedly from 3-4, then moderately. Width segment three c.4.6-4.8 × length. Segment six not elongated; c.1.8 × wider than long. Telson longer than preceding segments; c.1.3 × longer than wide; evenly rounded.

Gonopods: G1 moderately stout; slightly sigmoid. Inner-dorsal margin distally curved inward. Dorsal surface of stem flattened; completely calcified. Palp poorly developed, not separated from stem, small, narrow, rounded, calcified, situated c.two-thirds distance towards tip. Outer dorsal margin of stem convex. Distal part of the stem narrow. G1 apical process present; corneous; strongly produced; stout not markedly narrower than distal part of stem; straight. Gonopore terminal. Setae long, simple, lie around tip, mostly distal to palp. G2 short, relatively narrow, tapering, tip blunt.

Sternum: Thick covering of setae between insertion of telson and mouth frame.

HABITAT

Amongst debris on mud floor in *Rhizophora* mangrove forest.

DISTRIBUTION

Only known from Nungbalgarri Ck and Liverpool R., Northern Territory, Australia.

ETYMOLOGY

Named for the single pronounced slightly oblique, elongate, proximal tooth on the dactyl of the cheliped which is diagnostic.

REMARKS

The key provided here separates *Sarmatium unidentatus* sp.nov. from all other known species of *Sarmatium*. The pattern of grooves and ridges on the upper surface of the palm of the cheliped; the shape, number and position of the cheliped dactylar tubercles; and the male first gonopod are distinctive.

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