

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 $c.0.4 \times$ carapace width; $0.5 \times$ 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 $c.0.5 \times$ 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; $0.25-0.3 \times$ width of front.

Third maxilliped: Merus $c.0.8 \times$ 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; $0.4 \times$ width of ischium; flagellum normal.

Chelipeds: Subequal; large and robust; merus

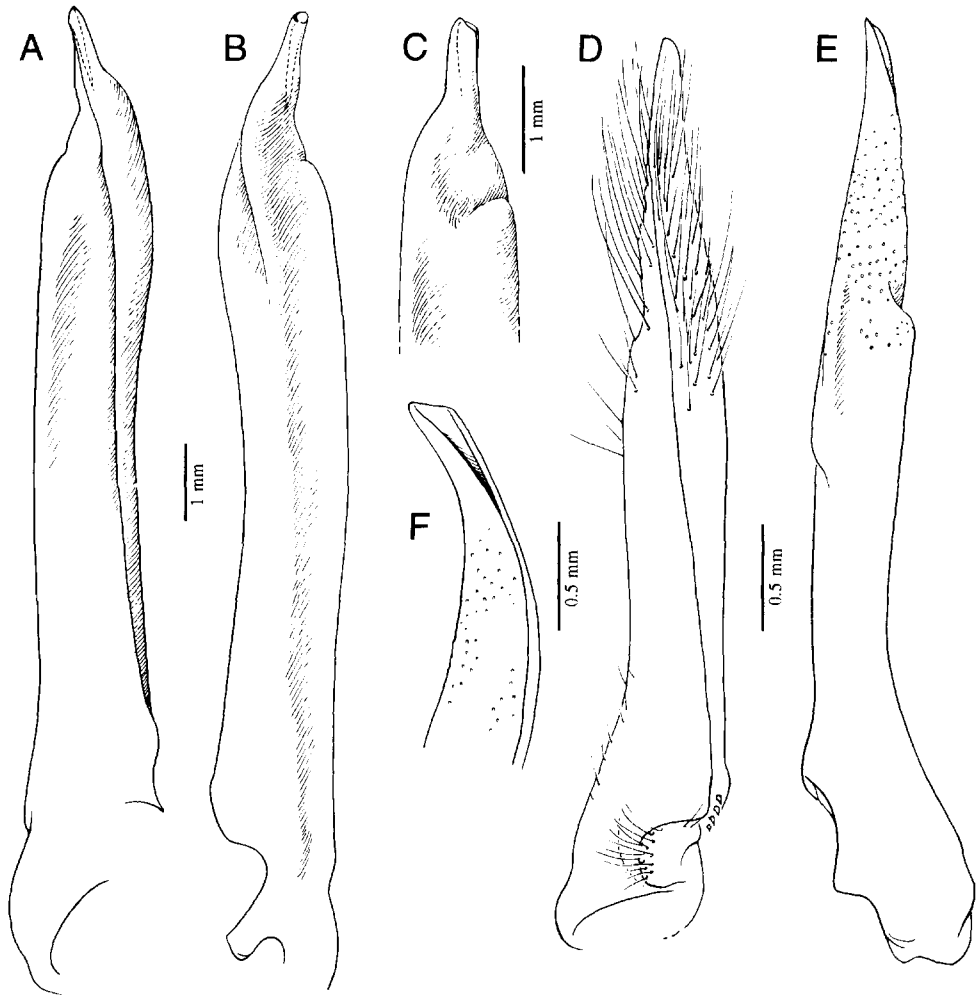


FIG. 6. Male first gonopods (setae removed, except for D). *Sarmatium germaini* (A. Milne Edwards) (QM W14858). A, abdominal view. B, sternal view. C, lateral view of apex. *S. unidentatus* sp.nov. (holotype, AM P31819). D, abdominal view. E, sternal view. F, lateral view of apex.

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. Inner-dorsal 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 arched ridges; on proximal slope of last ridge is a series of short ridges and grooves, longest towards upper mar-

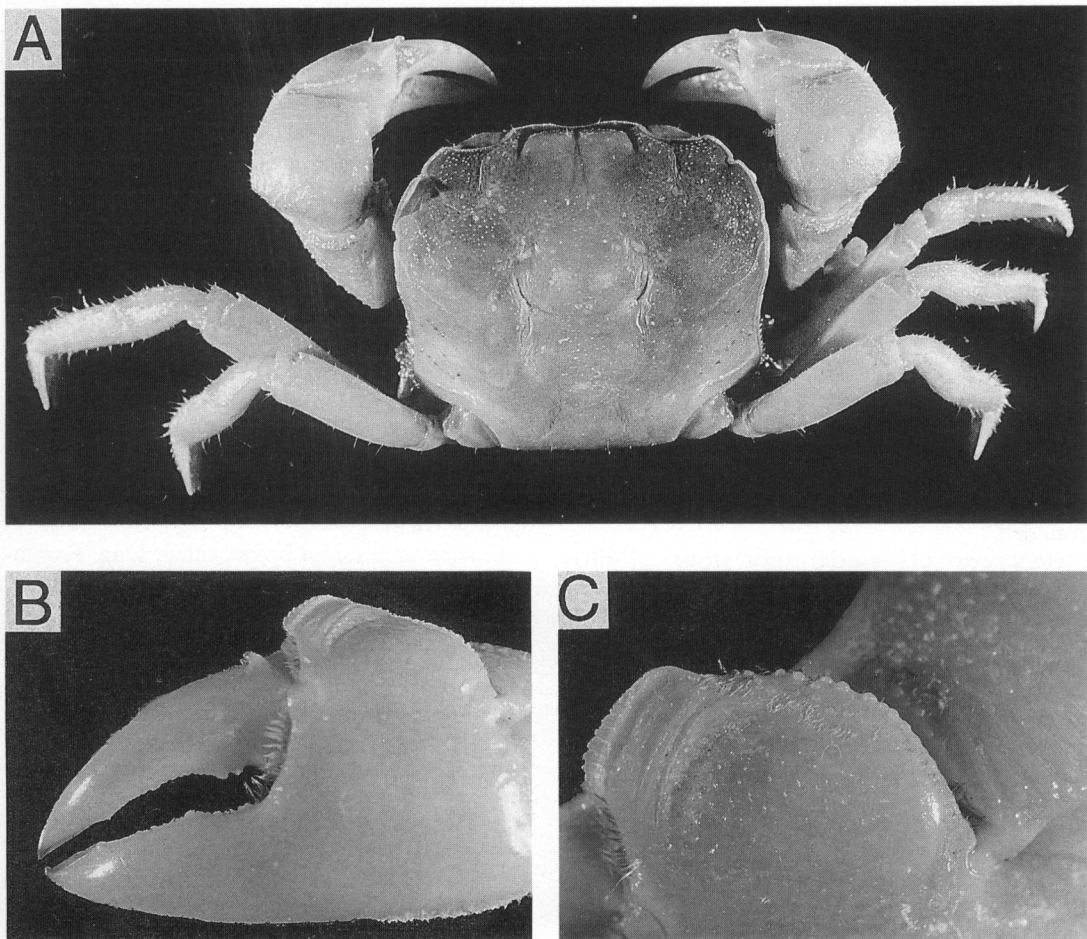


FIG. 7. *Sarmatium hegerli* sp.nov., ♂ (holotype, QM W9698). A, dorsal view. B, chela. C, upper surface of palm of chela. Scale line in mm.

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. Immobile 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.