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Volume 5 **Number 1** **December, 1988**

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Museum of Arts and Sciences

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Cover: *Hymenocera picta* first zoeal stage: **A**, lateral; **B**, dorsal. Scale line 0.5 mm.

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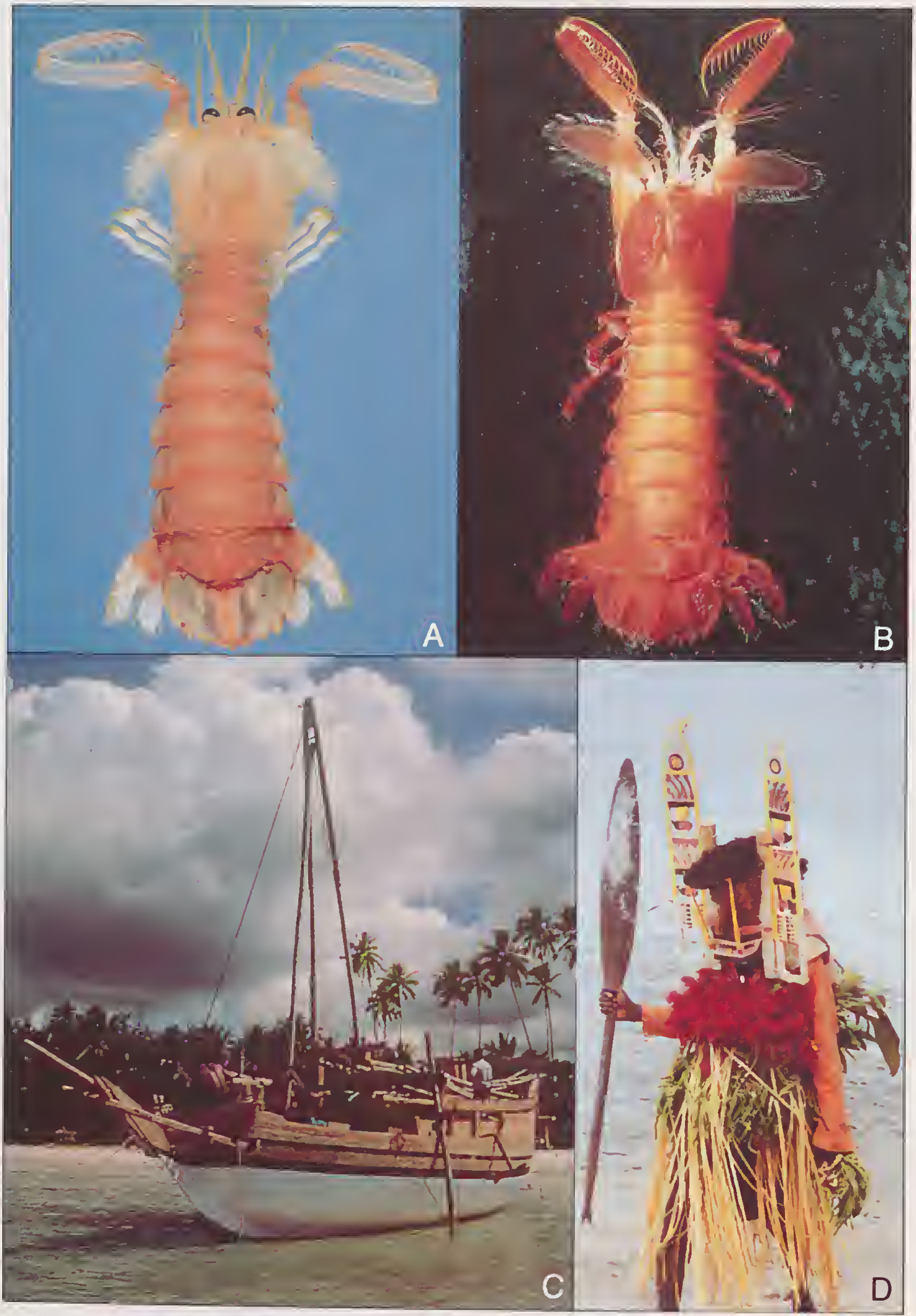

A, Mantis shrimp, *Bathysquilla crassispinosa* ♀; **B,** Mantis shrimp, *Bathysquilla microps* ♀; **C,** *Hati Marege* drying out on the beach at South Sulawesi. Photo: Dr Colin Jack-Hinton; **D,** Mask *Wanariu* walking along beach to village, prior to its use in removing taboos from the graveyard and malagan ceremonial area at the *cukuavatir*, commemorative ceremony. NGE 1983-4/31/13.

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GENERAL COMMUNICATION

BOOK REVIEWS

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A NEW SPECIES OF CUBOMEDUSAN (CUBOZOA: CNIDARIA) FROM NORTHERN AUSTRALIA

S.J. MOORE
Department of Zoology, British Museum (Natural History),
Cromwell Road, London, SW7 5BD, U.K.

ABSTRACT

A new species of cubozoan, *Tripedalia binata* is described from northern Australia. It is characterized by having undivided and paired pedalia.

KEYWORDS: *Cubozoa, Tripedalia,* new species, northern Australia.

INTRODUCTION

Some cubozoans are among the most venomous animals in the world. Although not all of these are considered lethal most can inflict severe stings and cause permanent cutaneous lesions. The discovery of another species, from a previously monotypic genus, is reported. The specific characters are distinctive and the medusa was found in sufficient numbers to discount the possibility that it merely represents a morphological variety of the previously known species *Tripedalia cystophora* Conant, 1897.

TOXICITY

The possibility that *Tripedalia* Conant might be venomous has not been discussed previously. Despite severe stings caused by other cubomedusans Miss S. Cunliffe (pers. comm.) observed no detectable sting when collecting *T. cystophora* from Grand Bahama in 1984 and Mr P. Alderslade (pers. comm.) noticed no effect when he applied tentacles of *T. binata* to the inner surface of his wrist. Conant (1897) mentioned however, that *T. cystophora* caught fish 'disproportionately large in comparison with its stomach'.

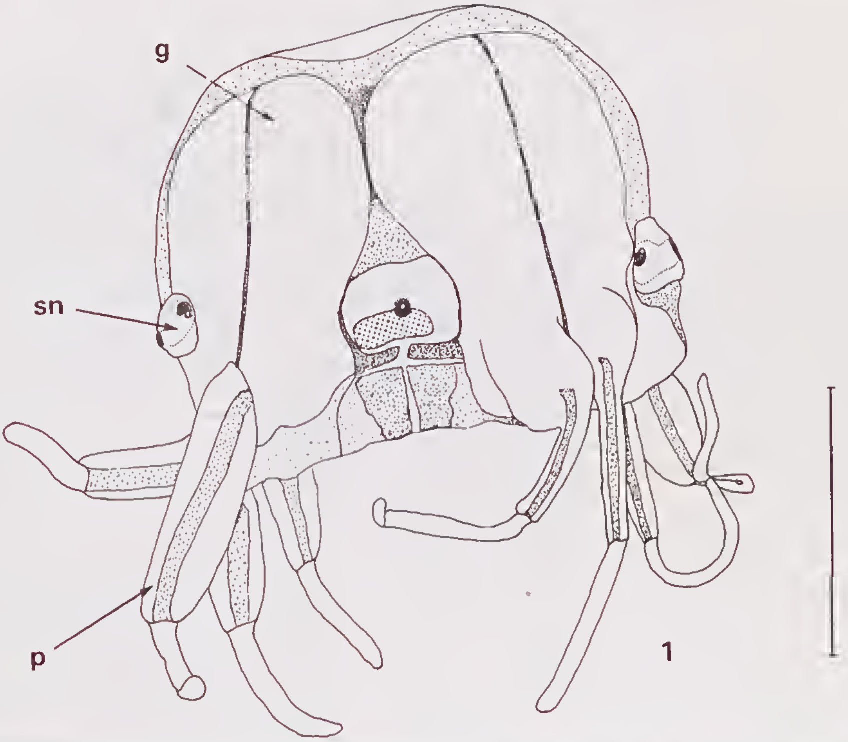

Fig. 1. *Tripedalia binata* holotype, lateral view showing gonads (g), pedalia (p) and sensory niches (sn). Scale line 7.0mm.

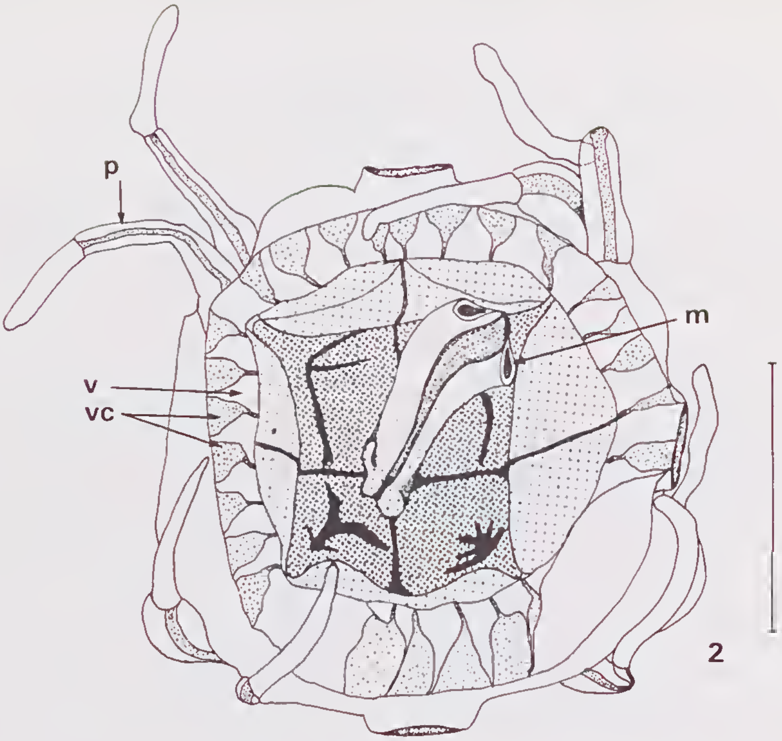

Fig. 2. *Tripedalia binata* holotype, subumbrellar view showing arrangement of mouth (m), pedalia (p), velum (v) and velar canals (vc). Scale line 7.0mm.

SYSTEMATICS

Tripedalia binata sp. nov.
(Figs 1-5)

Type material. HOLOTYPE — NTM (Northern Territory Museum, Darwin) C5858, Elizabeth River, Northern Territory, 12° 35.5′S 130° 56′E, among mangroves during high tide at surface, March 1985, R. Hanley, R. Williams and P. Alderslade. PARATYPES — NTM C2944 a-i, 11 specimens, data as holotype; BMNH (British Museum (Natural History), London) no. 1987-10.26.2-11, 10 specimens, data as holotype; BMNH no. 1987-10.26.1, 1 specimen, Francis Bay, Darwin, Northern Territory, 12° 29′S 130° 52′E, at surface, 5 April 1983, J. Bowen.

Additional material. INDIA: 2 specimens, Jambu River, Orissa, at surface, 12 June 1901, N. Annandale, in BMNH.

Description. Pedalia in four interradial pairs with one tentacle per pedalium (Fig. 1). Bell flattened apically, covered sparsely with small nematocyst warts (Fig. 3). Gonads on each radial canal, paired, extending from bell margin nearly to apex. Velum one fifth width of base of bell with 7-8 unpaired but short branching velar canals per quadrant (Fig. 4). Ocelli borne on short stalks in niches bordered by an orifice that extends slightly beyond bell margin (Figs 1 and 5). Stomach short, connected perradially to four small gastric saccules communicating with four perradial canals. Mouth cruciform, extending to base of bell (Fig. 2). Dimensions of holotype: 11.0mm from apex to velum, 14.5mm in diameter. Dimensions of paratypes: from 4mm bell height and 5mm bell diameter up to 11mm × 14.5mm.

Nematocysts: Ten-to-one ratio of stenoteles to atrichous isorhizas taken from tentacle squash samples. Atrichous isorhizas found in squash preparation of bell warts. Dimensions: stenoteles — 18-20 μm × 10-15 μm, most at upper end of size range: atrichous isorhizas — spherical diameter 12 μm. (Twenty of each measured).

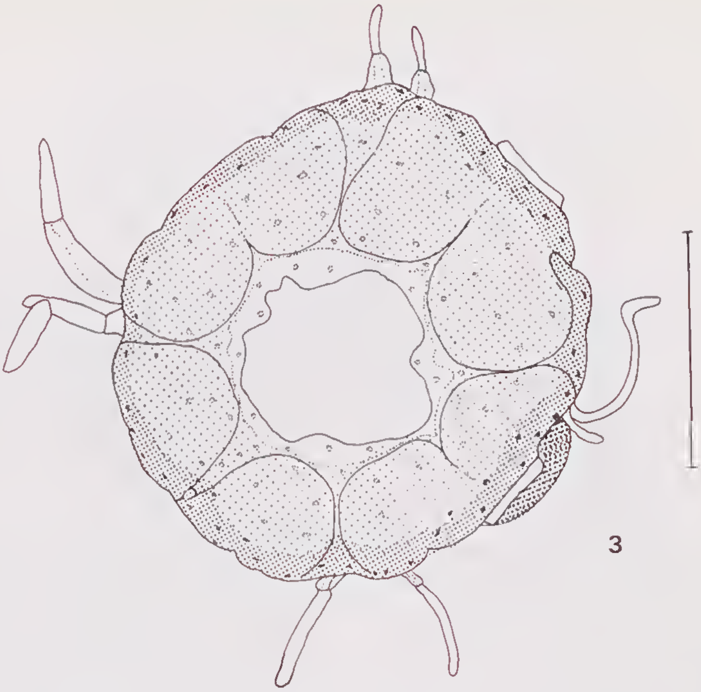

Fig. 3. *Tripedalia binata* holotype, apical view showing arrangement of nematocyst warts. Scale line 7.0mm.

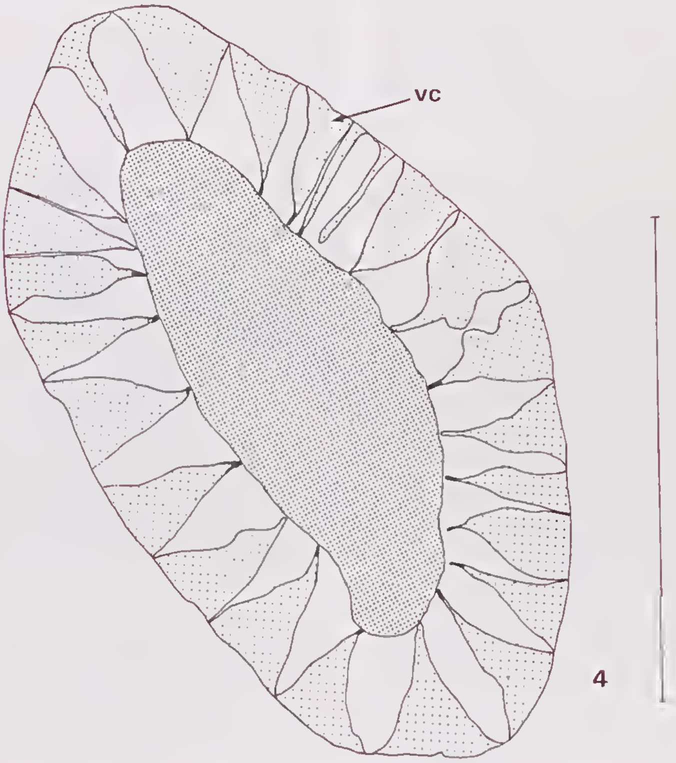

Fig. 4. *Tripedalia binata* paratype (from Francis Bay), subumbrellar view showing arrangement of velar canals (vc). Scale line 7.0mm.

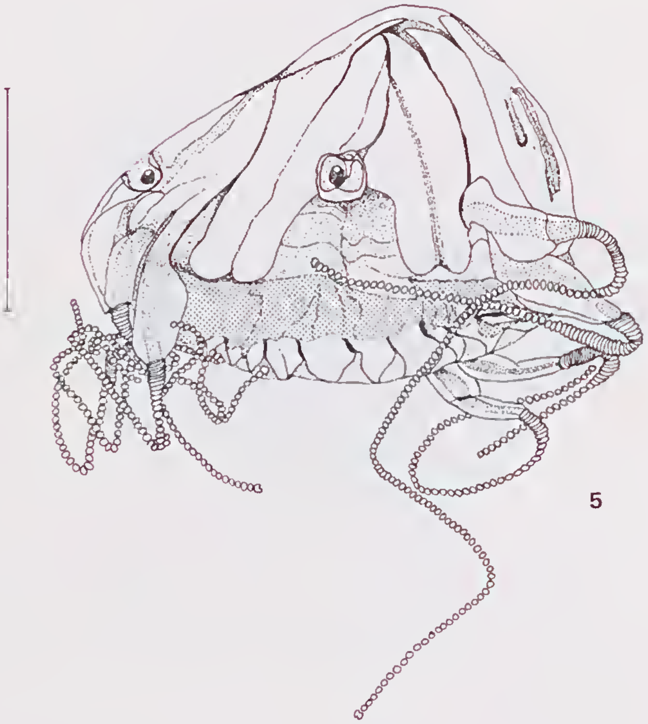

Fig. 5. *Tripedalia binata* paratype (from Francis Bay), lateral view showing tentacles partly extended. Scale line 7.0mm.

Remarks. The newly described species is referred to the family Carybdeidae due to the undivided condition of the pedalia (Kramp 1961). It is placed in the genus *Tripedalia* since it shares with *T. cystophora* Conant an interradial, grouped arrangement of separate and unbranched pedalia; and the size of the adult medusa, which is 3-4 times smaller than that of other cubozoans, is similar. The generic name *Tripedalia* is no longer appropriate since the newly described species, the second in the genus, differs from *T. cystophora* in the number of pedalia and tentacles which are paired and not in threes. In all samples examined these differences were constant in both species suggesting that *T. binata* in not a variation of *T. cystophora.*

Redefinition of Genus *Tripedalia* Conant, 1987. Carybdeidae with four interradial groups of 2 or 3 unbranched pedalia, each bearing a single tentacle (*vide* Kramp 1961:307).

ACKNOWLEDGEMENTS

Thanks are due to Mr P. Alderslade for supplying the specimens and to Professor Bouillon, Drs G.A. Boxshall and P.F.S. Cornelius for criticizing the manuscript.

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The Beagle, Records of the Northern Territory Museum of Arts and Sciences, 1988, 5(1): 5-15

A NEW GENUS AND SPECIES OF COMMENSAL SCALEWORM (POLYCHAETA:POLYNOIDAE)

J. RUSSELL HANLEY AND MELANIE BURKE
Northern Territory Museum of Arts and Sciences
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

A new genus and species *Disconatis contubernalis* gen. et sp. nov. from Northern Territory, Australia is described. The new species is commensal, living in the tubes of maldanid polychaete worms. *Lepidasthenia accolus* Estcourt is redescribed, and transferred to *Disconatis*.

KEYWORDS: Polychaeta, Polynoidae, new genus and species, commensals, Northern Territory, Australia.

INTRODUCTION

The dominant intertidal habitat on the coastline of the Australian Northern Territory is expansive mudflat, often backed by mangroves. Sampling for polychaete worms on these mudflats has shown maldanid worms are one of the more common components of the polychaete fauna. Maldanid worms inhabit tubes and, although not as common as some tube dwelling worms reported from mudflats in temperate latitudes, there are places on the Northern Territory coastline where many hundreds of tubes occupied by maldanid worms can be seen protuding from the mud.

While examining some maldanid worms and their tubes collected from Ludmilla Creek near Darwin, Northern Territory in 1983, the presence of a small scaleworm (Polychaeta:Polynoidae) in one of the tubes was noted. Closer inspection of the specimen revealed a number of unusual features and suggested it probably represented a species new to science.

Subsequently several collections of maldanid worms and their tubes have been obtained from a variety of locations in the hope of accumulating enough material of this interesting scaleworm to permit the description of a new species.

To date, only four more specimens have been found, suggesting that the species is rare. Examination of the specimens indicates the suite of characters which differentiate the animals as members of a new genus and species are common to all, thereby allowing us to proceed with a description.

Since the discovery of the first specimen, the existence of a commensal scaleworm inhabiting the tube of an arenicolid polychaete worm from New Zealand has come to our attention. The type of *Lepidasthenia accolus* Estcourt, 1967 bears a close similarity to the scaleworms we have collected from maldanid worm tubes and we consider both species to be members of the same genus.

The following abbreviations are used in the text: NTM, Northern Territory Museum, Darwin; NZOI, New Zealand Oceanographic Institute, Wellington.

SYSTEMATICS

Family Polynoidae

Disconatis gen. nov.

Type species *Disconatis contubernalis* sp. nov.

Diagnosis. Body elongate, almost quadrate in cross-section, uniform width, tapering rapidly anterior and posterior ends. Up to 152 segments. Elytra and small elytrophores numerous pairs, on segments 2, 4, 5, 7, 9, 11, continuing on alternate segments to end of body. Elytra small, vestigial and translucent, first pair much larger than subsequent pairs (Figs 2D, 3D, 5G). Prostomium bilobed, hexagonal, broader than long. Cephalic peaks absent. Two pairs of eyes. Two palps. Three antennae, lateral antennae inserted ventrally, median ceratophore curved upwards. Lateral antennae with ceratophores fused to underside of prostomium but not fused to each other in the midline (Fig. 1F). First or tentacular segment not distinct dor-

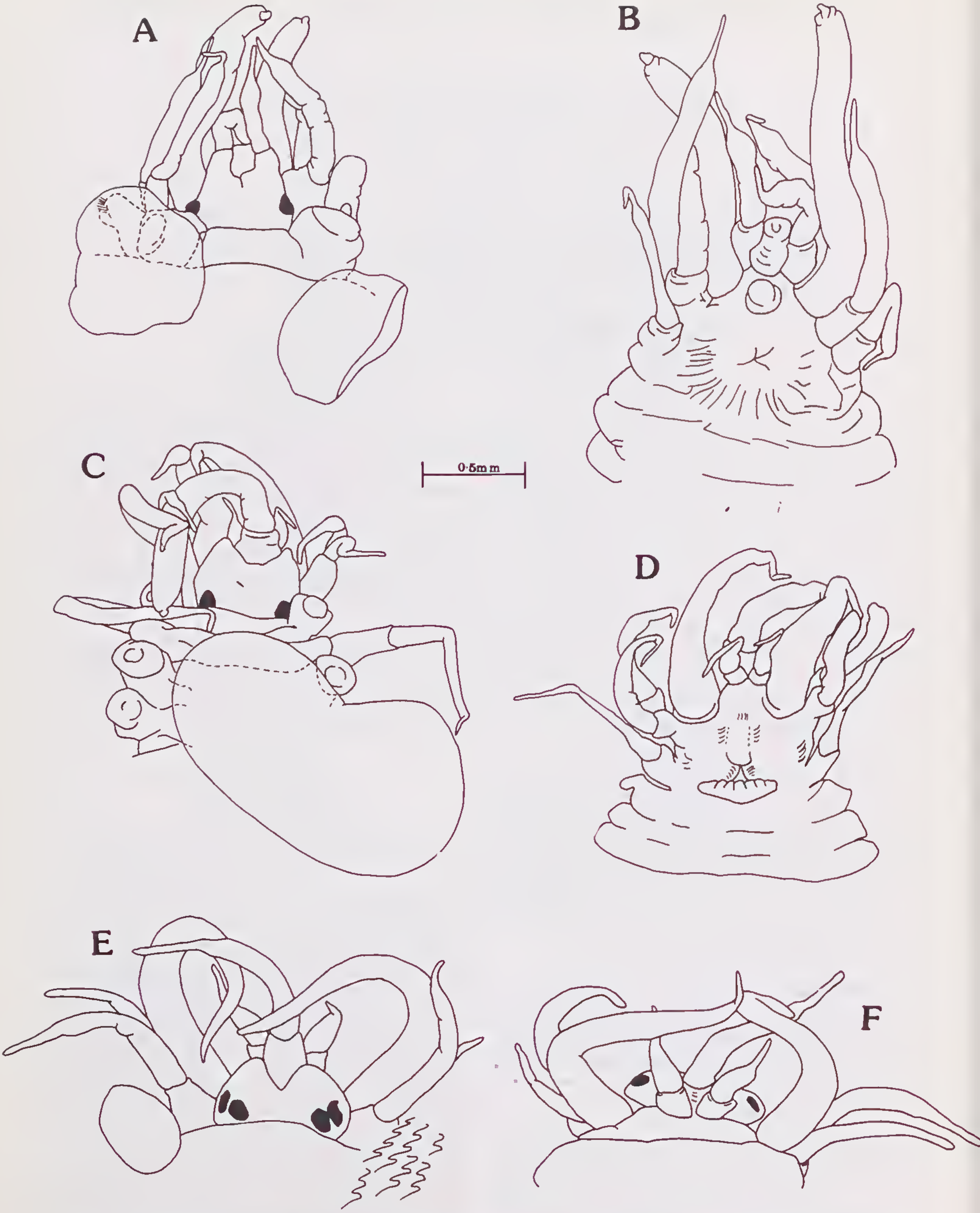

Fig. 1. Comparison of attachment of lateral ceratophores on prostomium: **A, B,** dorsal and ventral views of anterior end of *Lepidasthenia* sp. NTM W4200; **C, D,** same of *Harmothoe praeclara* NTM W1566; **E, F,** same of *Lepidasthenia accolus* holotype (note parapodia of right side missing).

sally; tentaculophores lateral to prostomium, achaetous, with two pairs of tentacular cirri. Segment 2 with elongate buccal cirri. Parapodia subbiramous; notopodia small, vestigial with notoaciculae without notosetae (Figs 2C, 3C, 4B, C, D, E, 5H). Neuropodia relatively long, thin with rounded presetal and postsetal lobes, deeply incised dorsally and ventrally. Neurosetae with row of serrations on outer convex edge of tips. Dorsal cirri present on non elytragerous segments with cylindrical cirrophores and distal styles, ventral cirri short. Pygidium moderately large, flattened disc with dorsal anus and pair of minute anal cirri (Figs 2E, 5A).

Etymology. The generic name alludes to the distinctive shape of the pygidium.

Remarks. The prostomial features of the new genus *Disconatis* do not allow it to be placed in the subfamily Lepidonotinae Willey, 1902. Reference to the criteria established for determining subfamily classification (Hanley 1987) demonstrates both species of *Disconatis* are not lepidonotoid. In members of the Lepidonotinae, the lateral antennae are attached directly to the prostomium often with no discernable suture between ceratophore and prostomium. Species of the genus *Lepidasthenia* Malmgren, 1867 are typically lepidonotoid (Fig. 1A, 1B) and

Table 1. Comparison of major characters between genera of Harmothoinae (Polynoidae). (Compiled from Pettibone 1969, Hartmann-Schroder 1960, Bidenkap 1907).

Genus	*Pairs of Elytra*	*Elytra attached to segment No.*	*Notosetae*	*Neurosetae*	*Other*
Disconatis gen. nov.	22-80	2,4,5,7,9,11 and alternate segments to end of body	absent	unidentate, serrations on convex edge of tips.	elytra vestigial, commensal with other Polychaetes Australasian
Grubeopolynoe Pettibone, 1969	Numerous Pairs up to 50 or more	2,4,5,7, alternate segments to 23,26,29,32 35,36,39,40, continuing to end of body with two pairs of elytra alternating with two pairs of dorsal cirri	2 types, short, stout, blunt tips, and longer, tapering to slender tips	mainly unidentate, sometimes with slight 2° tooth, setae of 2nd segment slender, different from the rest.	elytra large, commensal with other polychaetes North Pacific
Hololepidella Pettibone, 1969	up to 26 or more	2,4,5,7, alternate segments to 23,26,29,31, 34, alternate segments to end of body; sometimes irregular on posterior segments	stouter than neurosetae, nearly smooth, a few widely separated spines	with spinous regions, tips entire or bidentate.	elytra large, commensal with echinoderms Indo-West Pacific
Neohololepidella Pettibone, 1969	up to 50 or more	2,4,5,7, alternate segments to 23,26,29,32 34, alternate segments to end of body	numerous, thicker than neurosetae, nearly smooth tapering to blunt tips	numerous, with numerous spinous rows, slightly bifid and entire.	elytra size? associated with calcareous sponge Central Indian Ocean
Parahololepidella Pettibone, 1969	numerous	2,4,5,7, alternate segments to 23,26,29,32, 33,35, alternate segments to end of body; some irregularity posteriorly	thinner than neurosetae, short, stout, tapering to blunt tips.	stout, with faint spinous regions and slightly hooked, entire tips.	elytra small, found in tubes composed of sand grains tropical Atlantic
Polyeunoa Pettibone, 1969	at least 15	2,4,5,7, alternate segments to 23,26,29, 29, with or without some additional elytra, sporadically arranged, 1-14 extra pairs may be present, sometimes asymmetrical	me thickness or thicker n neurosetae, short to long, smooth or lightly serrated, tapering to blunt tips.	stout, with enlarged spinous regions and bare, nearly straight tips which are sometimes notched.	anterior elytra large, posterior elytra small when present, from alcyonarians and gorgonians and deep water Southern Ocean.
Pottsiscalisetosus Pettibone, 1969	numerous	2,4,5,7, alternate segments to 23,26,29,32, 33,35, continuing on alternate segments to end of body (may be some irregularity after segment 39).	thinner than neurosetae, tapered to blunt tips, very finely serrated	slightly to distinctly hooked, finely serrated, with semilunar pockets.	elytra large? has platelets commensal with asteroids Japan, Indian Ocean.
Uncopolynoe Hartmann-Schroder, 1960	unknown	unknown	absent	first 3 neuropodia have strongly curved hooks; other with uni or bidentate setae with serrated subdistal areas.	elytra large, associated with alcyonarians Red Sea.
Heteropolynoe Bidenkap, 1907	unknown	unknown	absent	unidentate, marginally serrated, slender in superior and coarse in inferior positions.	North Atlantic

have the lateral antennae attached directly to anterior extensions of the prostomium so the new species and *L. accolus* cannot be referred to *Lepidasthenia.*

On every specimen of *Disconatis* examined, the ceratophores of the lateral antennae are inserted termino-ventrally on the prostomium (Fig. 1E, F). This manner of insertion is typical of some genera which have previously been referred to the subfamily Harmothoinae. The subfamily status of some harmothoid genera is currently under review (Pettibone, pers. comm.) as, like *Disconatis,* they lack cephalic peaks and have certain parapodial features which distinguish them from the majority of harmothoid genera. Therefore we have avoided a subfamily determination for *Disconatis* here.

Some of the existing harmothoid genera show some similarities with *Disconatis* and could be confused with it. Within the Harmothoinae there are six genera which have elongate bodies and numerous pairs of elytra; comparison of the features of these genera with the new genus *Disconatis* is presented in Table 1. All six genera differ from *Disconatis* in two significant ways; they all have notosetae and the arrangement of elytra along the body is also different. *Disconatis* is unusual in that after segment 7, the elytra alternate with dorsal cirri to the end of the body. This arrangement distinguishes *Disconatis* from all six genera listed in Table 1. In the Polynoidae the most common arrangement, irrespective of body length or numbers of pairs of elytra, is to have the 12th to 15th pairs attached to segments 23, 26, 29 and 32. One other genus in Table 1 also differs from this common elytron attachment pattern; *Hololepidella* Pettibone, 1969 has the 12th-15th pairs attached on segments 23, 26, 29 and 31 but its elytron pattern is not the same as that seen in *Disconatis.* We have included in Table 1 two genera which bear some resemblance to *Disconatis,* although the numbers of pairs of elytra and their pattern of attachment are not known. *Uncopolynoe* Hartmann-Schroder, 1960 and *Heteropolynoe* Bidenkap, 1907 both lack notosetae, however neither has the unusual rows of serrations seen on the convex outer edge of the neurosetae tips in *Disconatis.* In addition, *Uncopolynoe* has strongly curved neurosetae in the first three setigers and the elytra are large.

All six specimens of the two *Disconatis* species were associated with tube-dwelling polychaete hosts, suggesting members of this new genus are obligatory commensals. Morphologically, specimens of *Disconatis* exhibit a diminution of the elytra and notopodia, a characteristic of several genera of commensal polynoid scaleworms. The reduction of the size, thickness and ornamentation of elytra, the loss of notosetae and the reduced notopodia are apparently the result of sharing a tube with a host. Perhaps, the protection afforded by the tube, and the clean water circulated through the tube by the host, diminish both the need for elytra to form a defensive covering and the requirement for large elytra and the presence of notosetae as aids in keeping the dorsal respiratory surface of the body clean. In specimens of *Disconatis,* the first pair of elytra are much larger than the subsequent pairs and may afford some protection to the head, particularly if the scaleworm's habits include sticking the anterior end out of the host's tube. A similar set of characteristics is known for some species of the genus *Perolepis* (Ehlers, 1908) in which all but the first pair of elytra are vestigial, the notopodia are small and notosetae are absent. *Perolepis* is a genus which is placed in the subfamily Lepidonotinae, and the presence of similar reductions of structures in genera from different subfamilies of the Polynoidae indicates a convergence due to parallel evolutionary trends.

Disconatis accolus (Estcourt) comb. nov.

(Figs 1E, 1F, 5)

Lepidasthenia accolus Estcourt, 1967: 68-69, Figs 1-4.

Type material. HOLOTYPE — NZOI SIR G31, Heathcote Estuary, Christchurch 43° 33′S 172° 44′E New Zealand, 29.v. 1961, coll. I.N. Estcourt.

Description. *Holotype:* Body flattened, elongate, tapering slightly anteriorly and more so posteriorly. Parapodia near posterior end projecting anteriorly. Length 56.5mm, width including parapodia 3.96mm. 152 segments 35 segments of which appear to be regenerating as they are much smaller. Mid-dorsum between parapodia darkly pigmented with flecks of dark pigment lightly scattered over prostomium, dorsum and elytra. Numerous, minute papillae on dorsal surface (Fig. 5B). Elytra small, vestigial, first pair much larger than following pairs. Elytrophores small.

Prostomium bilobed, much wider than long, roughly hexagonal, posterior half wider than anterior half without cephalic peaks (Fig. 1E). Two pairs of eyes, anterior pair smaller, crescentic, lying dorso-laterally at greatest width of prostomium. Posterior pair of eyes larger, oval, dorsal, lying close behind anterior pair, closer to midline. Two palps, moderately long with gentle taper. Three antennae, all smooth. Median antenna ceratophore in anterior notch, deflected upwards, style long, evenly tapering to tip. Lateral antennae ceratophores well defined, attached termino-ventrally, visible on underside of prostomium, not merging midventrally (Fig. 1F), styles short, basally stout, evenly tapering to tips. Tentacular or first segment achaetous, not visible dorsally, tentaculophores lateral to prostomium, two pairs of tentacular cirri similar length as median antenna, dorsal pair slightly larger than ventral pair. Second or buccal segment with first pair of elytra, subbiramous parapodia, ventral, buccal cirri much longer than following ventral cirri.

Parapodia subbiramous (Fig. 5H, 5I). Anterior parapodia almost cylindrical in cross section, much thinner in dorso-ventral plane than subovate posterior parapodia. Notopodium small, reduced, with notoaciculum, without notosetae. Neuropodium elongate, presetal lobe slightly longer, evenly tapering to rounded tip with indentation adjacent to distal tip of neuroaciculum. Postsetal lobe slightly shorter, lanceolate. Dorsal cirrophores large, stout; styles long, cirriform, smooth, extending well past tips of neurosetae. Ventral cirri short, cirriform, much shorter than neuropodium. Nephridial papillae not discernable. Neurosetae long, thin with subdistal swelling and rows of serrations below unidentate tip. Convex outer edge of neurosetae with unusual serrations (Fig. 5E). Upper neurosetae longer, thinner and with more rows of serrations than middle neurosetae. Inferior neurosetae, shorter, stouter with fewer rows of serrations than middle neurosetae (Fig. 5D-F). Elytra numerous pairs (up to 76) attached on segments 2,4,5,7,9,11 continuing on alternate segments to end of body. Elytra with smooth margins, without papillae or tubercles on surface (Fig. 5G). Some elytra with pigment patches.

Pygidium well developed, flattened and circular with pair of anal cirri, missing from holotype but attachment scars clearly visible (Fig. 5A). Anus dorsal. Holotype with many eggs in body cavity.

Habitat. Commensal with the polychaete, *Abarenicola affinis* Wells, 1963 (Arenicolidae).

Distribution. Known only from the type locality, Heathcote Estuary, Christchurch, New Zealand.

Disconatis contubernalis sp. nov.

(Figs 2, 3, 4,)

Type material. HOLOTYPE — NTM W3957, Barrow Bay, Port Essington, Northern Territory 11° 21′S 132° 13′E, from tube of maldanid polychaete, mudflat in front of mangroves, 18.ix. 1985 coll. R. Hanley, C. Watson Russell, M. Burke. PARATYPES — NORTHERN TERRITORY: NTM W3959, Barrow Bay, Port Essington, 11°21′S 132° 13′E, from tube of maldanid polychaete, mudflat in front of mangroves, 18.ix. 1985, coll. R. Hanley, C. Watson Russell, M. Burke; NTM W3963, Creek "H" East Arm, Darwin Harbour, 12° 32.6′S 132° 56.6′E, from tube of maldanid polychaete, mudflat, 28.xi. 1985, coll. R. Hanley; NTM W3961, East Arm Boat Ramp, Darwin Harbour, 12° 29.5′S 130° 54′E from tube of maldanid polychaete, 31.i. 1984, coll. R. Hanley; NTM W4841 Ludmilla Creek, Darwin, 12° 24.4′S 130° 50.6′E, from tube of maldanid, mudflat, 1983. coll. R. Hanley.

Description. *Holotype:* Body, elongate, almost quadrate, rapidly tapering at anterior and posterior ends. Parapodia, particularly those near posterior end, projecting anteriorly. Length 23mm, width including parapodia 2.30mm. 68 segments. Dorsal surface of body between parapodia darkly pigmented. Elytra small, vestigial, first pair much larger than subsequent pairs. Elytrophores small.

Prostomium bilobed, wider than long, hexagonal, anterior half wider than posterior half, without cephalic peaks (Figs 2A, 3A, B). Two pairs of circular eyes, anterior pair larger, lying dorso-laterally at greatest width of prostomium; posterior pair lying close

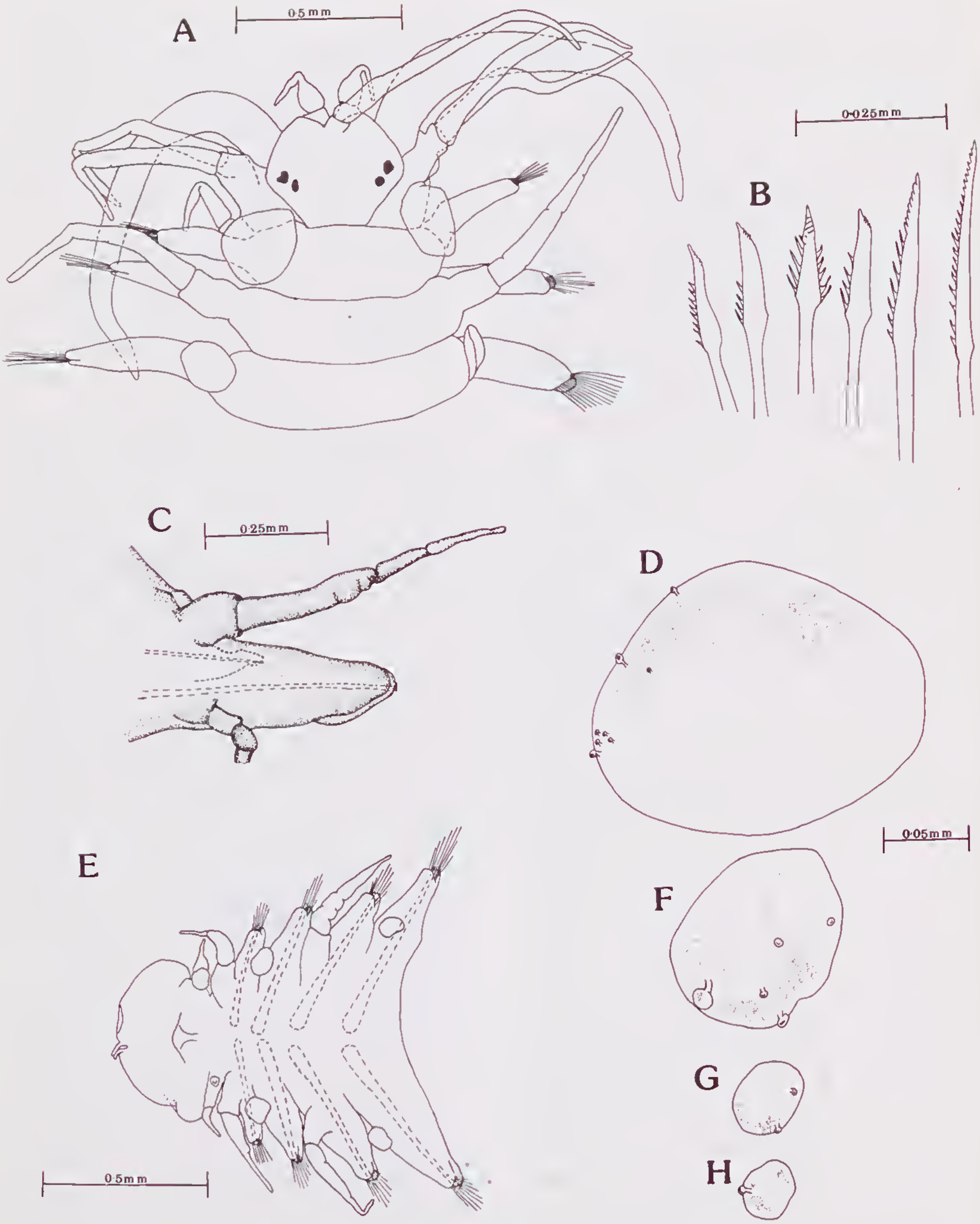

Fig. 2. *Disconatis contubernalis* holotype: **A**, anterior end; **B**, neurosetae from anterior segment; **C**, cirrigerous parapodium from anterior segment; **D**, elytron from second segment; **E**, posterior end showing distinctive flattened pygidium and small pair of anal cirri; **F**, elytron from 14th segment; **G**, elytron from 24th segment; **H**, elytron from 55th segment. D-H to same scale.

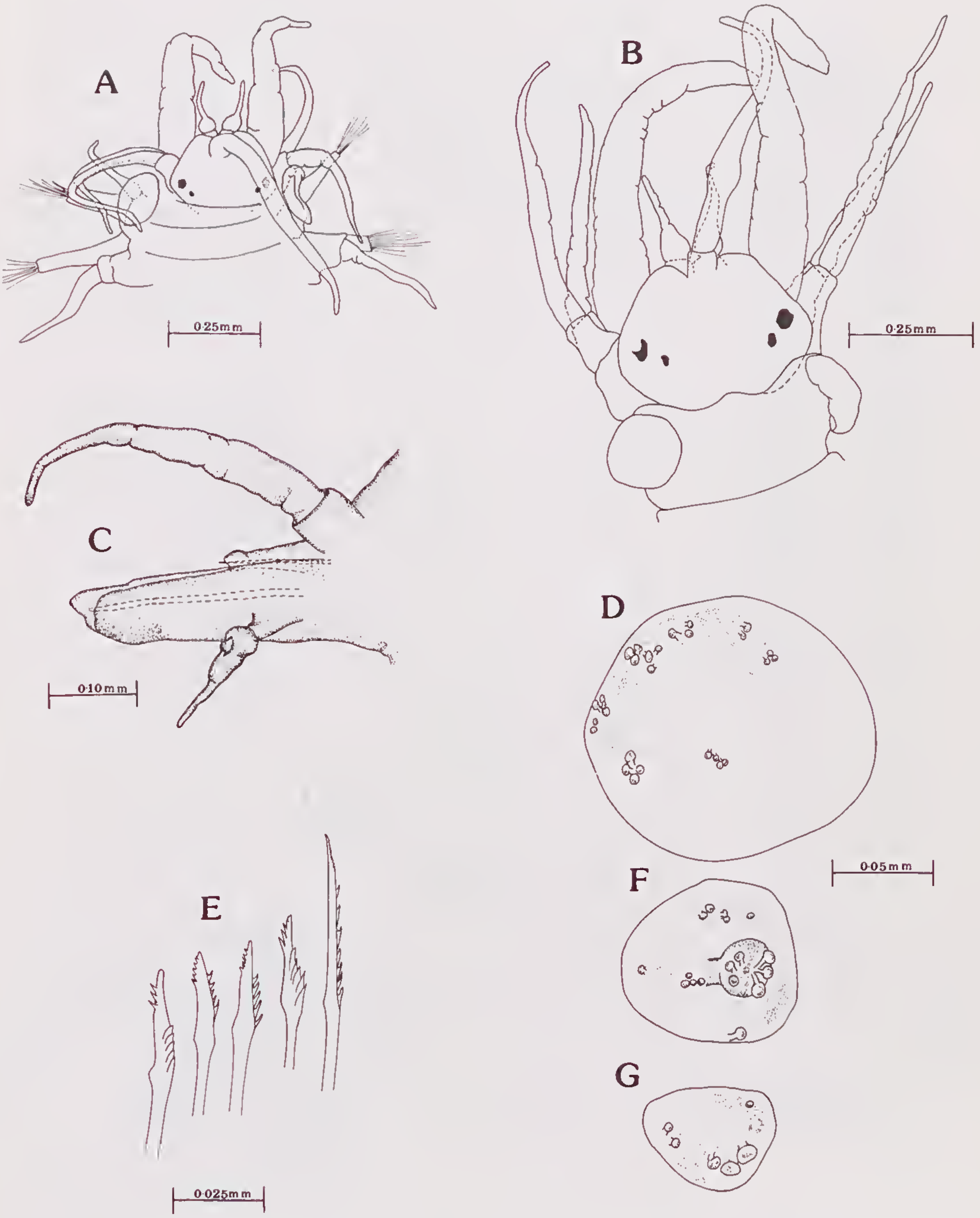

Fig. 3. *Disconatis contubernalis* paratypes: **A,** anterior end, NTM W3961; **B,** anterior end of NTM W3963, parapodia not figured; **C,** cirrigerous parapodium from anterior end of NTM W3963; **D,** elytron from second segment of NTM W3963; **E,** neurosetae from anterior segment of NTM W3963; **F,** elytron from 9th segment of NTM W3963; **G,** elytron from 35th segment of NTM W 3963. D-G to same scale.

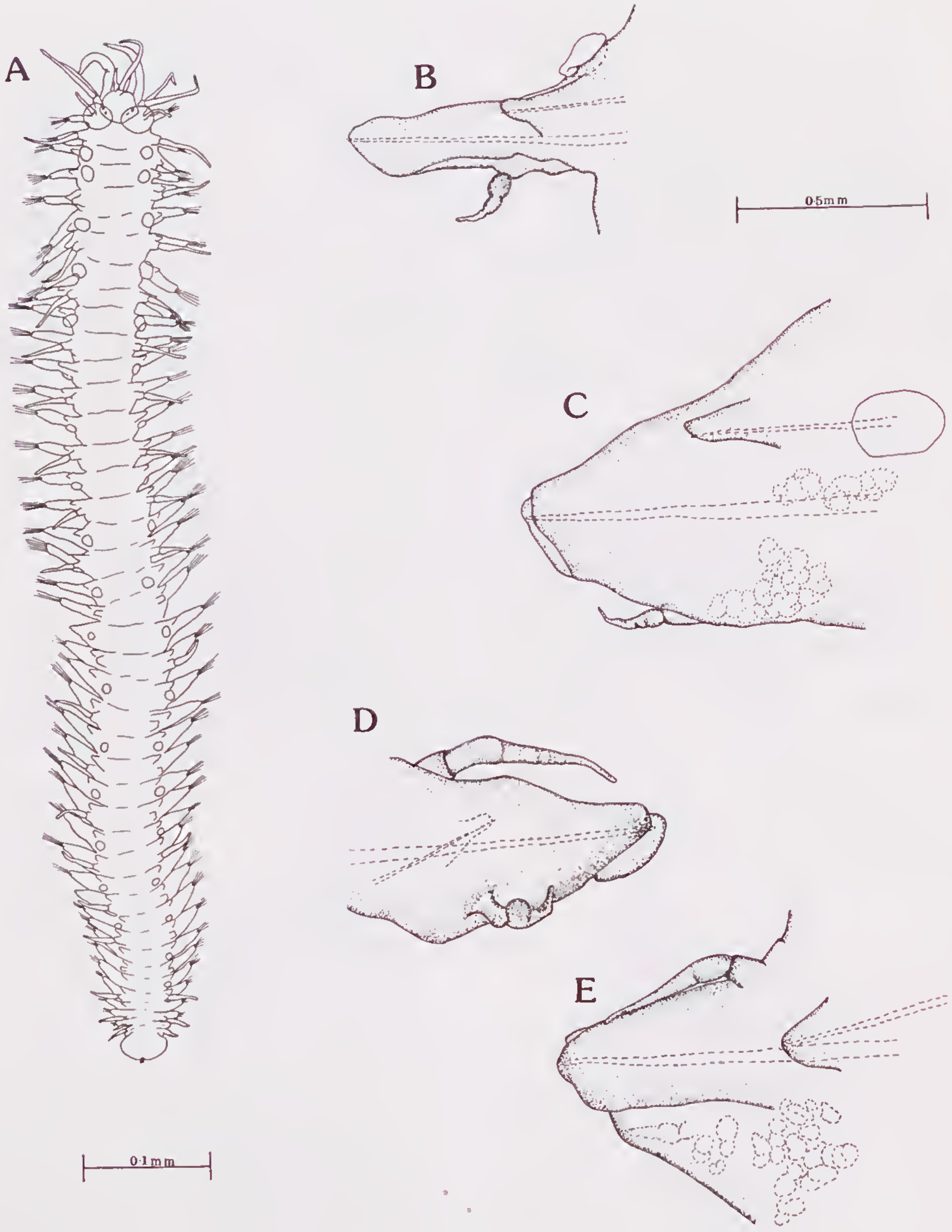

Fig. 4. *Disconatis contubernalis* paratypes: **A,** dorsal view of NTM W 4841; **B-E** NTM W3959 — , **B,** elytragerous parapodium from anterior segment; **C,** elytragerous parapodium from posterior segment; **D,** cirrigerous parapodium from anterior end of body; **E,** cirrigerous parapodium from posterior end of body. B-E to same scale.

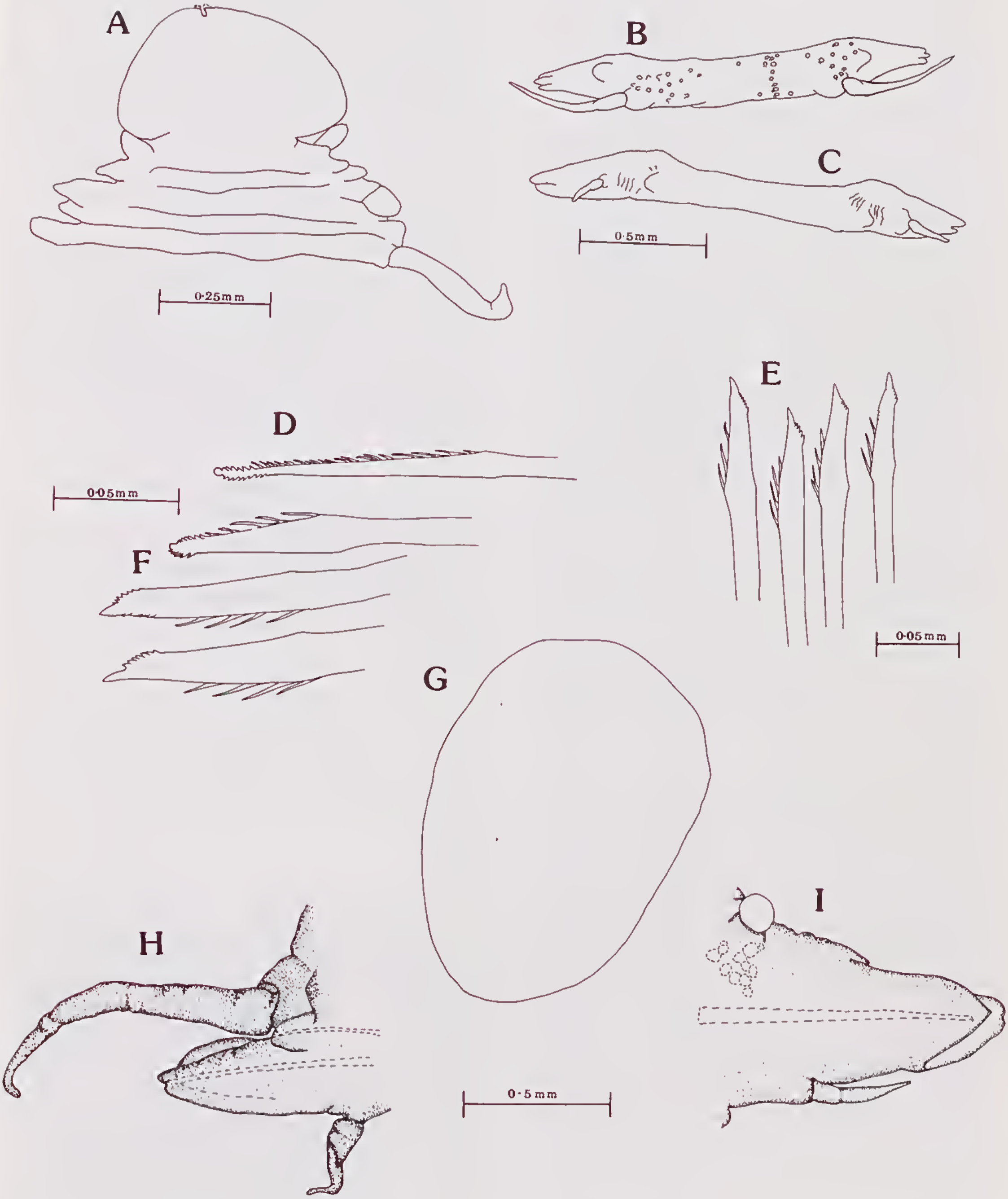

Fig. 5. *Disconatis accolus* holotype: **A,** posterior segments and distinctive, flattened pygidium; **B,** dorsal surface of anterior segment showing distribution of papillae; **C,** ventral view of anterior segment; **D,** superior neuroseta from anterior segment; **E, F,** middle and lower neurosetae showing unusual spinous ridges on convex edge near tip; **G,** elytron from second segment; **H,** cirrigerous parapodium from anterior end; **I,** elytragerous parapodium from middle of body. B,C to same scale, D,F to same scale, G-I, to same scale.

behind anterior pair, closer to midline. Two palps, relatively long, gradually tapering. Three antennae, smooth. Median antenna ceratophore in anterior notch deflected upwards, style long, gently tapering to filiform tip. Lateral antennae ceratophores inserted termino-ventrally, visible on underside of prostomium, not merging in the midline, styles short, stout bases, filiform tips. Tentacular (first) segment achaetous; not visible dorsally, tentaculophores lateral to prostomium, two pairs of tentacular cirri about the same length as median antenna, dorsal pair longer than ventral pair. No facial tubercle. Segment 2 with first pair of elytra, subbiramous parapodia, ventral buccal cirri considerably longer than following ventral cirri.

Parapodia subbiramous (Fig. 2C). Anterior parapodia almost cylindrical in cross-section, considerably thinner in dorsoventral plane than sub-ovate posterior parapodia. Notopodium small, reduced, notoaciculum present. Neuropodium elongate, presetal lobe slightly longer, wider, evenly tapering rounded tip, postsetal lobe slightly shorter, with rounded tip; neuroaciculum present, tip protudes from neuropodium. Dorsal cirrophores cylindrical, styles long, cirriform, smooth, extending well beyond neurosetae. Ventral cirri much shorter than neuropodium, cirriform, smooth. Nephridial papillae not visible.

Notosetae absent. Neurosetae long, thin with subdistal swelling and rows of serrations below unidentate tip. Unusual rows of serrations on the outer convex edge of tips of neurosetae (Fig. 2B). Upper and lower neurosetae longer, thinner and with more rows of serrations than middle neurosetae (Fig. 2B). Thirty four pairs of very small elytra attached on segments 2, 4, 5, 7, 9, 11, continuing on alternate segments to the end of the body. First pair of elytra much larger than following pairs (Fig. 2D-H). All elytra with smooth margins and no pigment. Surface of elytra with a few large papillae (Fig. 2D, 2F, 2G, 2H).

Pygidium moderately large, flattened, circular with pair of very small, stout cirri on posterior edge (Fig. 2E). Anus dorsal. Specimen with eggs in body cavity.

Paratypes: The four smaller paratypes resemble the holotype in most respects. There is no variation in the pattern of elytron attachment upon the body. The posterior half of the prostomium is wider than the anterior half, suggesting that the opposite condition in the holotype is unusual. Some variability in length and width of body and numbers of pairs of elytra was observed among the paratypes and is listed in Table 2.

Several of the elytra from the paratypes were found to have more of the large papillae on their dorsal surfaces than those noted on the holotype. A few of these large papillae also had some smaller papillae attached to their distal surfaces (Fig. 3F).

The shape of the presetal and postsetal lobes is also variable. While the presetal lobe is always slightly longer than the postsetal lobe, some parapodia had tapered rounded tips on both lobes, and sometimes the supraacicular portion of the presetal lobe is a little longer than the subacicular portion (Fig. 3C).

Habitat. Commensal with maldanid polychaete worms, intertidal.

Distribution. Darwin Harbour and Port Essington, Northern Territory.

Etymology. The species name *contubernalis,* refers to the commensal lifestyle of this species.

Table 2. Variable features of paratypes of *Disconatis contubernalis*

Paratype	Length (mm)	Width (mm)	No. segments	Pairs of elytra
NTM W3963	9.8	1.1	61	31
NTM W3961	7.8	1.2	45	23
NTM W4841	7.8	1.3	44	22

Remarks. *D. accolus* and *D. contubernalis* can be distinguished from each other by the following major characteristics. The elytra of *D. accolus* are smooth, while those of *D. contubernalis* have a few large papillae scattered over the dorsal surface. The many minute papillae found on the dorsum of *D. accolus* are absent from specimens of *D. contubernalis.* The postsetal lobes of parapodia on *D. accolus* are lanceolate, but those on specimens of *D. contubernalis* are rounded and resemble the presetal lobes.

Although both species of *Disconatis* are commensal with tube-dwelling polychaete worms, they are associated with two different families Arenicolidae and Maldanidae. *D. accolus* is known only from New Zealand, and *D. contubernalis* only from the Northern

Territory. The polychaete faunas of the two places are distinctively different, that of the Northern Territory is similar to that of the Indo-Malay archipelago, with a strong element of pan tropical Indo-West Pacific species, while the New Zealand fauna is characteristic of the southwestern Pacific with similarities to the fauna of the Southern Ocean and Antarctica.

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NEW SPECIES OF THE WATER MITE FAMILY HYDRYPHANTIDAE (ACARINA) FROM THE NORTHERN TERRITORY, AUSTRALIA

MARK S. HARVEY
Department of Environmental Records, Museum of Victoria,
71 Victoria Crescent, Abbotsford, Victoria 3067, Australia.

ABSTRACT

Four new species of Hydryphantidae, *Mamersa corndorl, Pseudohydryphantes wangai, P. aroona* and *P. mataranka,* are described from the Northern Territory, Australia. Keys to the known species of *Mamersa* Koenike and the Australasian species of *Pseudohydryphantes* K. Viets are presented.

KEYWORDS: Acarina, Hydryphantidae, *Mamersa, Pseudohydryphantes,* new species, northern Australia.

INTRODUCTION

Information concerning the water mite family Hydryphantidae in Australia has increased dramatically over the past few years with the publication of three papers that have increased the number of known species from 5 to 17 (Cook 1986, Harvey 1987, Harvey 1988). Most records of hydryphantids are from the relatively well collected areas of southern Australia, but recent field work in northern Australia has resulted in the discovery of several previously undescribed species that highlight the need for more extensive collecting of water mites in the tropics. One of these species, *Cyclohydrypantes mutarnee* Harvey from north Queensland, has already been described (Harvey 1987). Four others, one belonging to a genus previously unrecorded from Australia (*Mamersa* Koenike), are described.

Methods follow Harvey (1987). Specimens are lodged in the Northern Territory Museum, Darwin (NTM) and the Museum of Victoria, Melbourne (NMV). Those mounted in glycerol gel on microscope slides are designated 'SL', while those remaining in Koenike's fluid or alcohol are designated 'FL'. Terminology of the glandularia follows Harvey (1987).

SYSTEMATICS

Genus *Mamersa* Koenike

Mamersa Koenike, 1898: 372; Lundblad 1949: 17; K. Viets 1956: 146; Cook 1974: 90 (type species *Mamersa testudinata* Koenike, 1898, by monotypy).

Armothyas Nayar, 1969: 48 (type species *Armothyas indicus* Nayar, 1969, by original designation). Synonymized by Bader (1980).

Diagnosis. Dorsal and ventral shields present, each divided into a number of platelets. Many pairs of acetabula situated on genital flaps.

Remarks. The genus *Mamersa,* the sole member of the subfamily Mamersinae (Cook 1974), currently contains six species: *M. testudinata* Koenike (southern Africa, Madagascar), with a subspecies *M. testudinata expansa* Cook from Uganda, *M. dividua* Bader (East Africa), *M. petrophila* Cook (India), *M. gennada* Cook (India), *M. indica* (Nayar) (India) and *M. rouxi* Walter (Aru Islands, Sumatra). The new species described here is the first to be recorded from Australia.

Although Bader (1980) raised the Mamersinae to the level of family, I believe that this taxon is best retained in the Hydryphantidae, and that the family be defined by the presence of a stout distal seta on the pedipalpal tibia. This seta is occasionally lost or reduced in some protziines and wandesiines. A similar structure is found elsewhere amongst water mites only in certain genera of the family Pionidae, which are currently placed in separate superfamily to that of the Hydryphantidae (Cook 1974) and are clearly unrelated.

Key to species of *Mamersa* (modified from Bader 1980)

1. Ventrolateralia divided 2
Ventrolateralia undivided 3
2(1). Suture line between coxae III and IV

lateral .... *rouxi* Walter
Suture line between coxae III and IV antero-lateral .... *dividua* Bader

3(2). Swimming setae present; dorsolateralia 4 rhomboid 4
Swimming setae absent; dorsolateralia 4 nearly square .... *petrophila* Cook

4(3). Postero-lateral margin of dorsolateralia 4 straight or only slightly convex 5
Postero-lateral margin of dorsolateralia 4 markedly convex .... *gennada* Cook

5(4). Body length greater than 500 μm . 6
Body length approximately 380 μm (♂), 400 μm (♀) . *indica* (Nayar)

6(4). Lateral margin of dorsolateralia 4 approximately same length as lateral margin of platelet bearing lg5 .... *corndorl* sp. nov.
Lateral margin of dorsolateralia 4 much shorter than lateral margin of platelet bearing lg5 .... *testudinata* Walter

Mamersa corndorl sp. nov.

(Figs 1-11)

Type material. HOLOTYPE — ♂, Corndorl Billabong, near Jabiru, Northern Territory, 3.v.1983, M. Malipatil, J. Fyson and A. Sharley, NTM A15 (SL). PARATYPES — NORTHERN TERRITORY: 5 ♂, 8 ♀, same data, NTM A16-28 (SL); 2 ♂, 2 ♀, same data, NMV K840-843 (SL); 1 ♀, same data except 5.i.1983, NTM A29 (SL); 1 deutonymph, same data except 5.ii.1983, NMV K844 (SL); 1 ♀, 2 deutonymphs, same data except 1.iii.1983, NTM A30-32 (SL); 6 adults, same data except 4.v.1983, NMV K845-850 (FL); 1 ♂, 1 ♀, same data except 1.vi.1983, NTM A33-34 (SL); 8 adults, same data except 1.vi.1983, NTM A35-42 (FL).

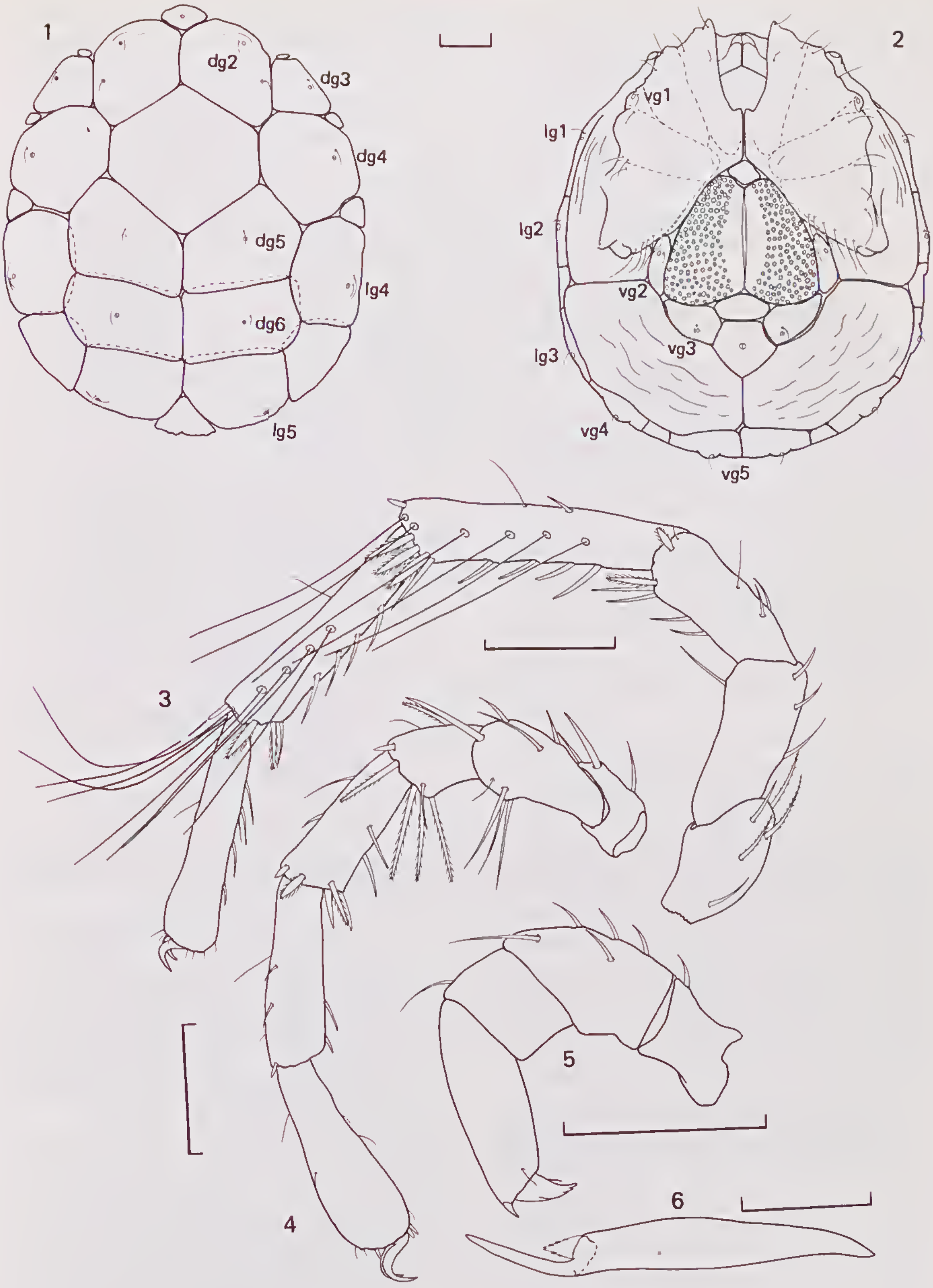
Additional material. NORTHERN TERRITORY: 67 adults and 5 deutonymphs, Corndorl Billabong, near Jabiru, 5.ii.-1.vi.1983, M. Malipatil, J. Fyson and A. Sharley, NTM (FL).

Diagnosis. Ventrolateralia undivided. Lateral margin of dorsolateralia 4 approximately same length as lateral margin of platelet bearing lg5.

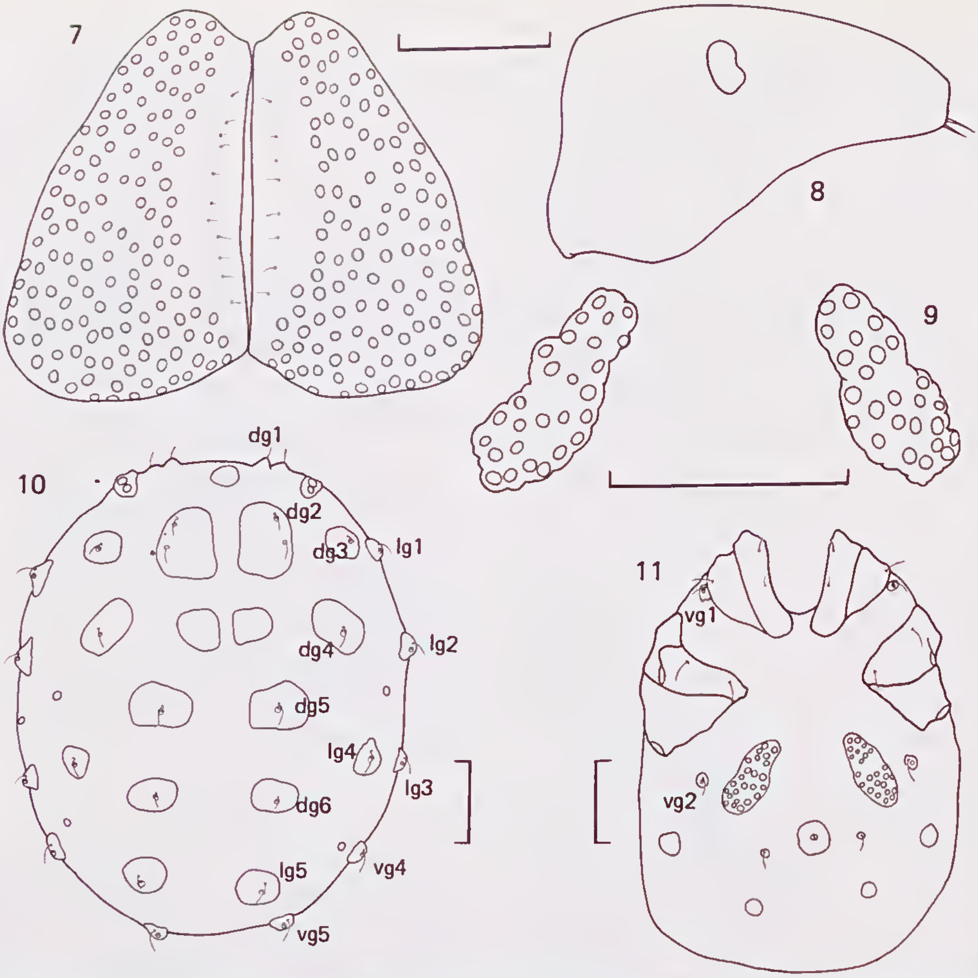
Description. *Adults:* Dorsal and ventral shields present. Lateral eyes on small ocular tubercles set in lateral margin of ventral shield, eyes of similar size; median eye apparently absent, but a small unsclerotized area in the centre of dorsocentralia 1 (Fig. 1) may represent a vestigial median eye. Six pairs of dorsoglandularia, five pairs of lateroglandularia and five pairs of ventroglandularia present (Figs 1, 2); dg1 and preocularia situated on anterior margin of ventral shield (not visible in Figs 1 or 2); dg3 on same level as postocularia; lateral margin of dorsolateralia 4 approximately same length as lateral margin of platelet bearing lg5; lg1, lg2, lg3, vg4 and vg5 situated on small platelets on lateral margin of body; vg2 situated on small sclerite lateral to genital field; vg3 on same level as anus or slightly anterior to anus; vg2 and vg3 sclerites adjacent, not separated by genital field; ventrolateralia undivided. Genital region (Fig. 7): mesal edge of genital flaps with a row of small setae; many pairs of acetabula situated on flaps. Ejaculatory complex not studied. Chelicera (Fig. 6) slender, cheliceral claw slightly curved, with several short teeth; cheliceral lamella about one-third as long as claw, serrate. Capitulum (Fig. 8) with down-turned anterior extension. Pedipalp (Fig. 5): tibia without a thickened sub-distal seta on medial surface, but with stout distal seta. Coxae I-III without stout setae on distal ends (Fig. 2). Legs III and IV with swimming setae arranged as follows: leg III: ♂, genu 5-6, tibia 5-8; ♀, genu 6-7, tibia 6-8; leg IV: ♂, telofemur 1, genu 6-8, tibia 5-6; ♀, telofemur 1, genu 7-8, tibia 5-8. Pedal claws with small serrations, but without a dorsal tooth (Figs 3, 4).

Dimensions (μm), ♂ (♀): dorsal shield 811-922/685-779 (844-1018/753-871); ventral shield 830-894/704-779 (849-1018/760-859); capitulum length 221 (243-293); chelicera length 340 (333-364); genital field 255-278/314-349 (246-306/289-339); pedipalp: trochanter 48-50 (48-51), femur 82-87 (89-95), genu 40-45 (48-51), tibia 108-116 (119-122), tarsus 35-40 (35-39); leg I: trochanter 76-88 (82-90), basifemur 117-124 (123-135), telofemur 84-96 (92-109), genu 134-143 (134-155), tibia 153-161 (154-165), tarsus 159-166/54-59 (154-166/51-57); leg IV: trochanter 138-154 (146-167), basifemur 111-118 (125-147), telofemur 134-141 (134-160), genu 218-226 (218-250), tibia 210-224 (221-233), tarsus 180-204/40-43 (197-211/40-45).

Deutonymphs: Dorsal and ventral shields absent; dorsum and venter with platelets



Figs 1-6. *Mamersa corndorl:* **1-5,** holotype ♂ — **1,** dorsal shield; **2,** ventral shield; **3,** left leg IV; **4,** left leg I; **5,** right pedipalp. **6,** paratype ♀ , left chelicera. Figs 1,2, to same scale. Scale lines 100 μm.



Figs 7-11. *Mamersa corndorl:* **7, 8,** holotype ♂ — **7,** genital field; **8,** capitulum, lateral aspect; **9-11,** paratype deutonymph, NTM A32 — **9,** provisional genital field; **10,** dorsal aspect; **11,** ventral aspect. Figs 7,8, to same scale. Scale lines 100 μm.

arranged as in Figs 10, 11. Glandularia as in adults except that vg3 lacks a glandularium and is reduced to a single seta. Provisional genital field (Fig. 9) with many acetabula situated in two discrete fields. Pedipalp and legs much as in adults.

Dimensions (μm): body 596-811/486-626.

Etymology. The specific epithet is a noun in apposition taken from the type locality.

Remarks. *Mamersa corndorl* is very similar to the African species *M. testudinata,* but they differ in the relative sizes of dorsolateralia 4 and the platelet bearing lg5, and in the shape of the capitulum (compare Fig. 8 with Bader 1964, Fig. 3). Despite the unusual nature of the dorsal and ventral shields of *Mamersa* spp., the homologies of the glandularia with those of other hydryphantids (e.g. see Harvey 1987) are easily established.

Genus *Pseudohydryphantes* K. Viets

Pseudohydryphantes K. Viets, 1907: 142; K. Viets 1936: 144; K. Viets 1956: 157; Cook 1974: 88; Harvey 1987: 108 (type species *Pseudohydryphantes parvulus* K. Viets, 1907, by monotypy).

Diagnosis. See Cook (1974) and Harvey (1987).

Remarks. As noted by Harvey (1987), seven species of *Pseudohydryphantes* have been described from Australia, with further species known from Europe, North America and New Zealand. The three new species described here are of zoogeographical interest in that they extend the range of the genus into the tropics. The key to the Australasian species of *Pseudohydryphantes* presented by Harvey (1987) is amended here to accommodate the three new species from the Northern Territory.

Key to Australasian species of *Pseudohydryphantes*

1. Glandularia completely surrounded by sclerotized rings 2
Glandularia only partially surrounded by sclerotized rings thus forming crescents 3
2(1). Tarsal claws with ventral serrations; chelicerae not elongate; capitulum without extension ..... *bebelus* Cook
Tarsal claws without ventral serrations; chelicerae elongate; capitulum with long, down-turned anterior extension to accommodate chelicerae .... *occabus* Harvey
3(1). Tarsal claws with large, ventral serrations .... *vepres* Harvey
Tarsal claws ventrally smooth or with one small ventral tooth 4
4(3). Tarsal claws with one small ventral tooth .... *doegi* Harvey
Tarsal claws without ventral teeth 5
5(4). Chelicerae elongate; capitulum with long down-turned anterior extension to accommodate chelicerae .... *stylatus* Cook
Chelicerae not elongate; capitulum without extension 6
6(5). Setae on genital flaps very short .... *amatus* Cook
Setae on genital flaps long 7
7(6). Sclerites associated with glandularia stellate .... *mataranka* sp. nov.
Sclerites associated with glandularia not stellate 8
8(7). Sclerites associated with glandularia small, not crescent shaped .... *crassipes* Cook
Sclerites associated with glandularia crescent shaped 9
9(8). Sclerites associated with median eye, preocularia and postocularia thick ... . *aroona* sp. nov.
Sclerites associated with median eye, preocularia and postocularia thin 10
10(9). Mesal seta of pedipalpal tibia sub-distal; ♂ genital flaps with single, mesal row of setae .... *cooki* Harvey
Mesal seta of pedipalpal tibia sub-basal to medial; ♂ genital flaps with setae covering most of flaps, not confined to mesal edge .... *wangai* sp. nov.

Pseudohydryphantes wangai sp. nov.

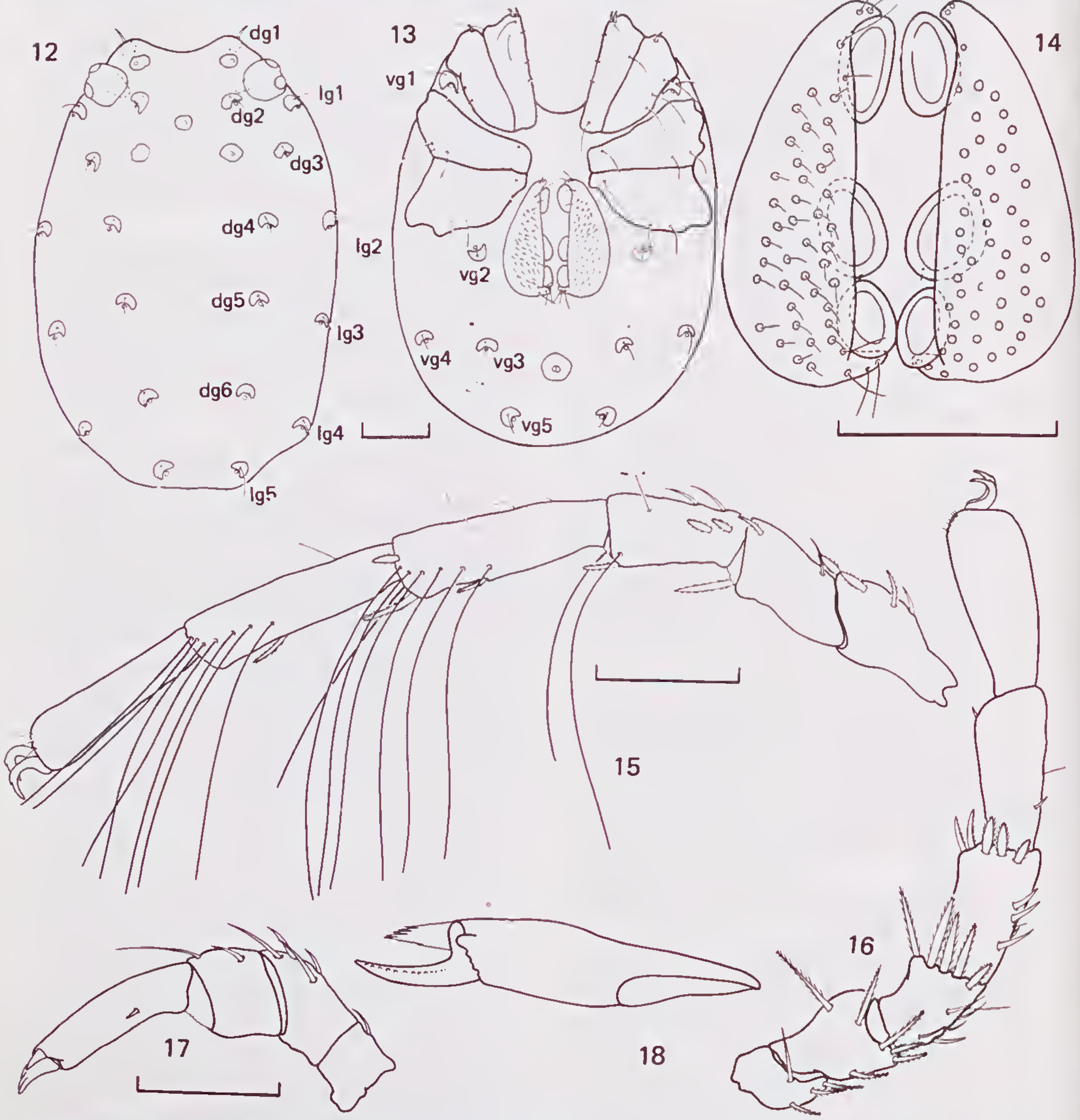
(Figs 12-18)

Type material. HOLOTYPE — ♂, pool at base of Wangai Falls, Litchfield Park, Northern Territory, 27.vi.1987, M.S. Harvey and M.E. McKaige, NTM A43 (SL). PARATYPES — NORTHERN TERRITORY: 1 ♂, 1 ♀, same data as holotype, NTM A44-45 (SL); 6 ♂, 2 ♀, same data as holotype, NMV K828-835 (SL, FL); 1 ♀, Dunlop's Swamp, Katherine Gorge National Park, 7.vii.1987, M.S. Harvey and A.L. Yen, NMV K836 (SL).

Diagnosis. Glandularia only partially surrounded by sclerotized rings thus forming crescents. Tarsal claws without ventral teeth. Pedipalpal tibia with a sub-basal to medial seta on mesal surface. Male genital flaps with setae covering most of flaps, not confined to mesal edge.

Description. *Adults:* Integument papillate. Lateral eyes on ocular tubercles; anterior-lateral eye slightly larger than posterior-lateral eye; postocularia posterior to median eye, but on same level as dg3 (Fig. 12). Six pairs of dorsoglandularia, five pairs of lateroglandularia and five pairs of ventroglandularia present (Figs 12, 13); sclerites associated with glandularia crescent shaped (Figs 12, 13); vg3 and vg4 slightly anterior to anus, not near genital flaps (Fig. 13). Genital region of male (Fig. 14) wider than that of female (those of all available females not in suitable position to illustrate); genital flaps of male with setae covering most of flaps, not confined to mesal edge; genital flaps of female with a row of several setae confined to mesal edge; three pairs of elliptical to ovoid acetabula (Fig. 14). Ejaculatory complex with proximal arm slightly longer than proximal chamber. Chelicera (Fig. 18) of normal proportions, cheliceral claw curved, with 18-20 short teeth; cheliceral lamella about half as long as claw, serrate. Capitulum without long, down-turned anterior extension. Pedipalp (Fig. 17): tibia with a thickened sub-basal to medial seta on mesal surface, and with stout distal seta. Coxae I-III with 1-2 stout setae on distal ends (Fig. 13). Legs III and IV with swimming setae arranged as follows: leg III: ♂, telofemur 1, genu 6, tibia 7-8; ♀, telofemur 1 genu 6, tibia 8; leg IV: ♂, telofemur 2, genu 8-9, tibia 7-8; ♀, telofemur 2, genu 7-8, tibia 6-7. Pedal claws without serrations, but with a dorsal tooth (Figs 15, 16). Anus surrounded by sclerotized ring (Fig. 13).

Dimensions (μm), ♂ (♀): body 685-763/448-531 (731-803/477-572); capitulum length 192-206 (193-221); chelicera length 269-282 (275-307); genital field 161-177/147-160 (165-180/161-165); pedipalp: trochanter 39-45 (41-44), femur 79-83 (84-86), genu 45-51 (51-53), tibia 126-138 (134-141), tarsus 34-37 (33-38); leg I: trochanter 51-53 (54-61), basifemur 54-64 (58-64), telofemur 70-83 (75-77), genu 92-108 (97-105), tibia 109-122 (116-120), tarsus 122-139/51-55 (127-133/52-54); leg IV: trochanter 95-109 (109-117), basifemur 73-83 (79-81), telofemur 96-108 (108-110), genu 141-165 (156-161), tibia 142-173 (164-172),



Figs 12-18. *Pseudohydryphantes wangai:* holotype ♂, except Fig. 15: **12,** dorsal aspect; **13,** ventral aspect; **14,** genital field, setae on left side not shown; **15,** left leg IV, paratype ♀, NTM A45; **16,** right leg I; **17,** right pedipalp; **18,** chelicera. Figs 12, 13, to same scale; 15, 16, to same scale; 17, 18, to same scale. Scale lines 100 μm.

tarsus 140-166/43-44 (147-154/44-45).

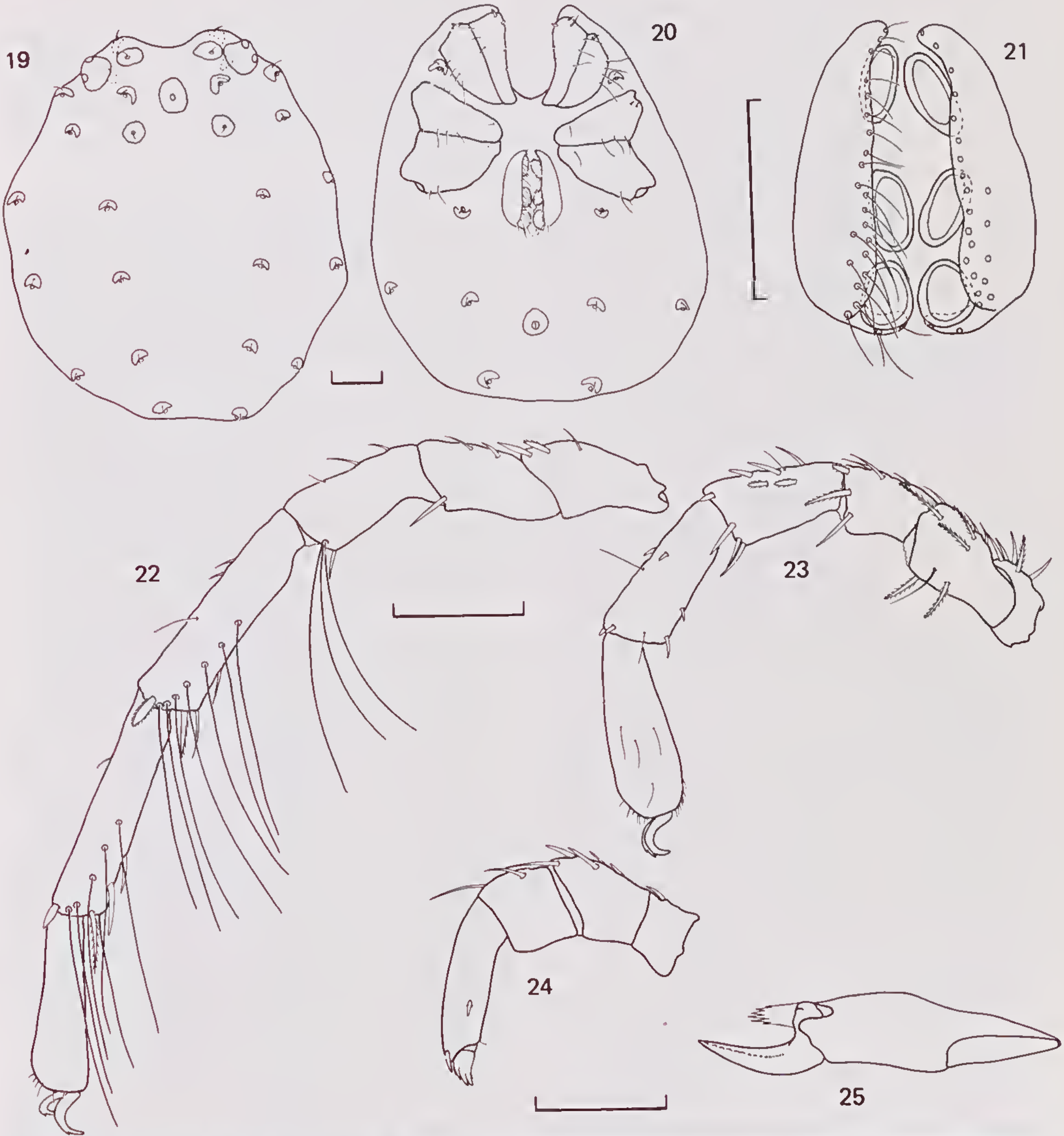
Etymology. The specific epithet is a noun in apposition taken from the type locality.

Remarks. *Pseudohydryphantes wangai* is very similar to *P. cooki* from Victoria, but differs in the position of the mesal seta on the pedipalpal tibia, and by its small size. Males further differ from all known males of the genus in the presence of many setae covering much of the genital flaps; other species possess setae confined largely to the mesal edge of the flaps.

Pseudohydryphantes aroona sp. nov.

(Figs 19-25)

Type material. HOLOTYPE — ♂, tributary of Aroona Creek, 41 km NE. of Victoria River on Victoria Highway, Northern Territory, 8.vii.1987, M.S. Harvey and A.L. Yen, NTM A46 (SL).



Figs 19-25. *Pseudohydryphantes aroona:* holotype ♂— **19,** dorsal aspect; **20,** ventral aspect; **21,** genital field, setae on left side not shown; **22,** left leg IV: **23,** left leg I; **24,** right pedipalp; **25,** chelicera. Figs 19, 20, to same scale; 22, 23, to same scale; 24, 25, to same scale. Scale lines 100 μm.

Diagnosis. Glandularia only partially surrounded by sclerotized rings thus forming crescents. Tarsal claws without ventral teeth. Male genital flaps with setae confined to mesal edge.

Description. *Adult male:* Integument papillate. Lateral eyes on ocular tubercles; anterior-lateral eye slightly larger than posterior-lateral eye; postocularia posterior to median eye but on same level as dg3 (Fig. 19); sclerites associated with median eye, preocularia and postocularia thick. Six pairs of dorsoglandularia, five pairs of lateroglandularia and five pairs of ventroglandularia present (Figs 19, 20); sclerites associated with glandularia crescent shaped (Figs 19, 20); vg3 slightly anterior to anus, and on same level as vg4, not near genital flaps (Fig. 20). Genital region (Fig. 21): mesal edge of flaps with a row of approximately 20 setae; three pairs of acetabula, first two pairs elliptical, third pair ovoid. Ejaculatory complex with proximal arm slightly longer than proximal chamber. Chelicera (Fig. 25) of normal proportions, cheliceral claw curved, with 15 short teeth; cheliceral lamella about half as long as claw, serrate. Capitulum without long, down-turned anterior extension. Pedipalp (Fig. 24): tibia with a thickened sub-distal seta on medial surface, and with stout distal seta. Coxae I-III with 1-2 (usually 1) stout setae on distal ends (Fig. 20). Legs III and IV with swimming setae arranged as follows: leg III: telofemur 2, genu 5, tibia 6; leg IV: telofemur 3, genu 7, tibia 6. Pedal claws without serrations, but with a dorsal tooth (Figs 22, 23). Anus surrounded by sclerotized ring (Fig. 20).

Dimensions (μm): body 795/565; capitulum length 192; chelicera length 285; genital field 160/122; pedipalp: trochanter 45, femur 88, genu 56, tibia 136, tarsus 33; leg I: trochanter 52, basifemur 65, telofemur 78, genu 114, tibia 130, tarsus 148/52; leg IV: trochanter 119, basifemur 86, telofemur 114, genu 179, tibia 191, tarsus 153/45.

Etymology. The specific epithet is a noun in apposition taken from the type locality.

Remarks. This species is most similar to *P. cooki* and *P. wangai* but differs from these species by the enlarged sclerotized rings surrounding the median eye, preocularia and postocularia.

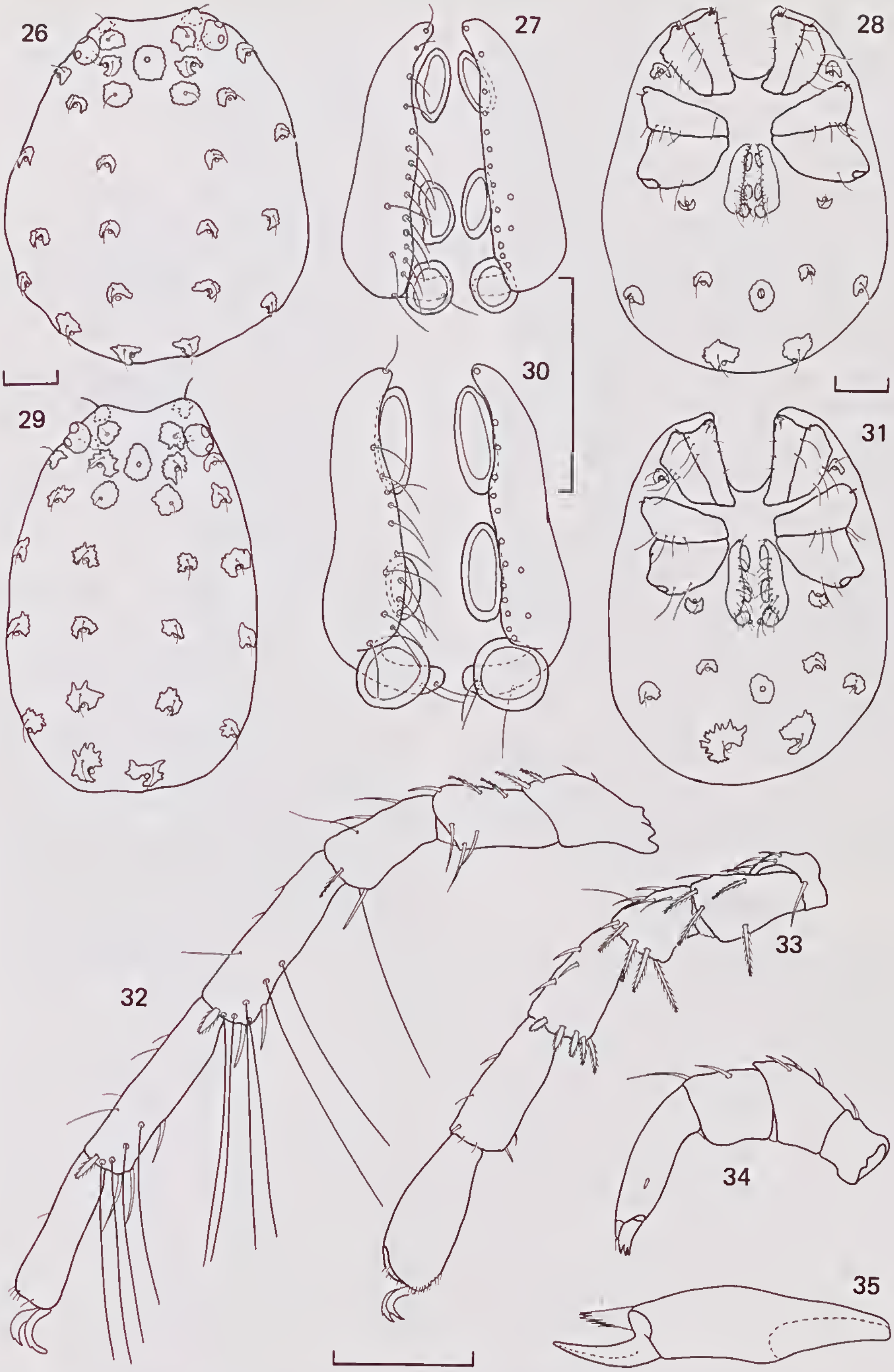
Pseudohydryphantes mataranka sp. nov.

(Figs 26-35)

Type material. HOLOTYPE — ♂, Roper River, 1.5 km S. of Mataranka Springs, Northern Territory, 5.vii.1987, M.S. Harvey and A.L. Yen, NTM A47 (SL). PARATYPE — NORTHERN TERRITORY: 1 ♀, pool at base of Wangai Falls, Litchfield Park, 27.vi.1987, M.S. Harvey and M.E. McKaige, NMV K788 (SL).

Diagnosis. Sclerites associated with glandularia, median eye, preocularia, postocularia and anus stellate or crenulate; those associated with glandularia not forming a ring. Tarsal claws without ventral teeth. Male genital flaps with setae confined to mesal edge.

Description. *Adults:* Integument papillate. Lateral eyes on ocular tubercles; anterior-lateral eye larger than posterior-lateral eye; postocularia posterior to median eye and on same level as dg3 (Figs 26, 29). Six pairs of dorsoglandularia, five pairs of lateroglandularia and five pairs of ventroglandularia present (Figs 26, 28, 29, 31); sclerites associated with glandularia stellate, especially in ♀, not surrounding glandularia (Figs 26, 28, 29, 31); vg3 slightly anterior to level of anus and vg4, and not near genital flaps (Figs 28, 31). Genital region (Figs 27, 30) of male wider than those of female, mesal edge of flaps with a row of approximately 16 (♂), 14 (♀) setae; three pairs of acetabula, first two pairs elliptical, third pair ovoid. Ejaculatory complex with proximal arm slightly longer than proximal chamber. Chelicera (Fig. 35) of normal proportions, cheliceral claw curved, with 14-15 short teeth; cheliceral lamella about half as long as claw, serrate. Capitulum without long, down-turned anterior extension. Pedipalp (Fig. 34): tibia with a thickened sub-distal seta on medial surface, and with stout distal seta. Coxae I-III with 1-3 (usually 1) stout setae on distal ends (Figs 28, 31). Legs III and IV with swimming setae arranged as follows: leg III: ♂, ♀, telofemur 1, genu 5, tibia 6; leg IV: ♂, telofemur 2, genu 6, tibia 5; ♀, telofemur 2, genu 4, tibia 6. Pedal claws without serrations, but with a small dorsal tooth (Figs 32, 33). Anus surrounded by stellate sclerotized ring (Figs 28, 31).



Figs 26-35. *Pseudohydryphantes mataranka:* holotype ♂, except Figs 29-31: **26,** dorsal aspect; **27,** genital field, setae on left side not shown; **28,** ventral aspect; **29,** dorsal aspect, paratype ♀; **30,** genital field, setae on left side not shown, paratype ♀; **31,** ventral aspect, paratype ♀; **32,** left leg IV; **33,** right leg I; **34,** right pedipalp; **35,** chelicera. Figs 26, 29, to same scale; 27, 30, to same scale; 28, 31, to same scale; 32-35, to same scale. Scale lines 100 μm.

Dimensions (μm), ♂ (♀): body 717/512 (666/448); capitulum length 160 (180); chelicera length 249 (255); genital field 140/107 (161/117); pedipalp: trochanter 41 (40), femur 78 (78), genu 49 (45), tibia 120 (123), tarsus 30 (33); leg I: trochanter 49 (51), basifemur 46 (51), telofemur 64 (64), genu 91 (95), tibia 105 (102), tarsus 117/48 (121/51); leg IV: trochanter 103 (96), basifemur 70 (69), telofemur 88 (87), genu 134 (137), tibia 148 (147), tarsus 121/35 (137/43).

Etymology. The specific epithet is a noun in apposition taken from the type locality.

Remarks. This remarkable species is unlike any other species of the genus in the possession of stellate sclerites associated with the glandularia, median eye, preocularia, postocularia and anus, especially in the female.

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HETEROMYSIDS (CRUSTACEA; MYSIDACEA) FROM NORTHERN AUSTRALIA WITH DESCRIPTION OF SIX NEW SPECIES

MASAAKI MURANO
Department of Aquatic Biosciences, Tokyo University of Fisheries,
4-5-7 Konan, Minato-ku, Tokyo 108, Japan.

ABSTRACT

Twelve species of heteromysids collected from northern Australia were studied. Six of these species are described as new: *Heteromysis (Olivaemysis) essingtonensis, H. (O.) quadrispinosa, H. (O.) sexspinosa, H. (O.) tenuispina, H. gracilis* and *Heteromysoides macrops. Heteromysis (Heteromysis) gymnura* W. Tattersall and *H. (Olivaemysis) zeylanica* W. Tattersall are new records for Australian waters.

KEYWORDS: Mysidacea, Heteromysini, taxonomy, northern Australia, new species.

INTRODUCTION

Heteromysids from Australian waters were first reported by W. Tattersall (1927) with descriptions of two species. Since 1979, a series of taxonomic studies has been carried out on specimens from the Great Barrier Reef, Heron Island and northern Australia by Băcescu (1979, 1983, 1986) and Băcescu and Bruce (1980).

The present paper deals with 12 species of heteromysids collected from Darwin Harbour, Northern Territory of Australia and in neighbouring waters. Six of these species, *Heteromysis (Olivaemysis) essingtonensis, H. (O.) quadrispinosa, H. (O.) sexspinosa, H. (O.) tenuispina, Heteromysis gracilis* and *Heteromysoides macrops,* are described herein as new species.

With the addition of the present species, the known heteromysid fauna in Australia now consists of 20 species as follows.

From southern Australia: *Heteromysis tasmanica* W. Tattersall, 1927; *H. waitei* W. Tattersall, 1927.

From northeastern Australia: *Heteromysis (Gnathomysis) harpaxoides* Băcescu and Bruce, 1980; *H. (G.) stellata* Băcescu and Bruce, 1980; *H. (Heteromysis) australica* Băcescu and Bruce, 1980; *H. (H.) heronensis* Băcescu, 1979; *H. (H.) tethysiana* Băcescu, 1983; *H. (Olivaemysis) abrucei* Băcescu, 1979; *H. (O.) macrophthalma* Băcescu, 1983; *Heteromysoides longiseta* Băcescu, 1983.

From northern Australia: *Heteromysis (Gnathomysis) harpaxoides* Băcescu and Bruce, 1980; *H. (Heteromysis) australica* Băcescu and Bruce, 1980; *H. (H.) communis* Băcescu, 1986; *H. (H.) gymnura* W. Tattersall, 1922; *H. (H.) spinosa* Băcescu, 1986; *H. (Olivaemysis) essingtonensis* sp. nov.; *H. (O.) quadrispinosa* sp. nov.; *H. (O.) sexspinosa* sp. nov.; *H. (O.)tenuispina* sp. nov.; *H. (O.) zeylanica* W. Tattersall, 1922; *H. gracilis* sp. nov.; *Heteromysoides macrops* sp. nov.

All the type specimens are stored in the Northern Territory Museum, Darwin, Australia (NTM).

SYSTEMATICS

Heteromysis (Heteromysis) gymnura W. Tattersall

(Fig. 1)

Heteromysis gymnura W. Tattersall, 1922: 500-502; O. Tattersall, 1962: 243-245.

Material. NORTHERN TERRITORY: 2 adult ♂ and 1 immature ♂, NTM Cr.004088, 4.0, 4.3 and 3.7mm, Table Head, Port Essington, 8m, from gorgonian host, 7.viii. 1986.

Remarks. Specimens collected are identified as *H. gymnura* W. Tattersall by: (1) large eye lacking a denticle at distal end of medial margin of eyestalk (Fig. 1A); (2) segment 3 of antennal peduncle longer than either of the other 2 segments (Fig. 1B); (3) shape of thoracic endopod 3 (Fig. 1D); (4) lack of spines on inner margin of endopod of uropod; and (5) shape and armature of telson (Fig. 1L). Minor differences are present in thoracic endopods 3-8. In W. Tattersall's specimens thoracic endopod 3 is armed with

Fig. 1. *Heteromysis (Heteromysis) gymnura* adult ♂: **A,** anterior end; **B,** antenna; **C,** second thoracic endopod; **D,** third thoracic endopod; **E,** extremity of third thoracic endopod; **F,** one of fourth to eighth thoracic endopods; **G,** one of fourth to eighth thoracic endopods; **H,** one of fourth to eighth thoracic endopods; **I,** third pleopod; **J,** fourth pleopod; **K,** fifth pleopod; **L,** uropod and telson.

3 stout spines on inner margin of carpopropodus, while those from Table Head have 4 spines of which the distal 2 overlap each other at almost the same position, giving the appearance of only one spine (Fig. 1E). I think that W. Tattersall (1922) possibly overlooked one of these paired spines. W. Tattersall (1922) described carpopropodus of thoracic endopods 4-8 as being composed of 3 segments. In the Table Head specimens they are also 3-segmented (Fig. 1G, H). However, I found a 2-segmented carpopropodus (Fig. 1F), but I cannot determine its true position.

O. Tattersall (1962) recorded this species from Zanzibar, on the east coast of tropical Africa, illustrated it and later (1967) gave an illustration of the male pleopod 4. Her drawings, however, gave me the impression as if these are of a species distinct from my specimens because of dissimilarities in the male pleopods, antennular peduncle, rostrum, and thoracic endopod 3. Subsequently I examined O. Tattersall's material on loan from the collection of the British Museum (Natural History). The material is composed of 2 specimens, one is a female in fairly good condition and the other is a fragmentary male, divided into 2 parts.

O. Tattersall (1967, Table 1, Fig. 36) indicated the male pleopod 4 to be modified, but I was unable to observe any modification on the fragmentary male. O. Tattersall (1962, Figs 26, 27) described and illustrated the sexual dimorphism of thoracic endopod 3. The present male specimens are allied to that of her female but not to that of the male. However, the discrepancy cannot be clarified because the thoracic endopod 3 is missing in both sexes of her specimens. O. Tattersall (1962) illustrated the female antennular peduncle to be slender, but I did not observe it to be so slender as in her figure (1962, Fig. 25).

In the material from Zanzibar the rostrum is different between sexes, in the female it is longer and covers the basal part of the antennular peduncles, as shown by O. Tattersall (1962, Fig. 25) and in the male it is shorter as shown in Fig. 1A.

Distribution. This species has previously been recorded from the Gulf of Manaar, India (W. Tattersall 1922) and from Zanzibar (O. Tattersall 1962). It seems to be widely distributed in coastal regions of the tropical Indian Ocean.

Heteromysis spinosa Băcescu
(Fig. 2)

Heteromysis spinosa Băcescu, 1986: 19-22.

Material. NORTHERN TERRITORY: 1 adult ♀, NTM Cr.005491, 3.0mm, Table Head, Port Essington, 11°14.8′S 132°11.2′E, 6m, coral rubble washings, 12. v. 1983, N.L. Bruce; 3 adult ♀, NTM Cr.005029, 2.7, 3.0 and 3.1mm, Fort Hill Wharf, Darwin Harbour, 5m; 23 vii 1986, P. Alderslade. WESTERN AUSTRALIA: 1 adult ♂, NTM Cr. 005476, 2.9mm, Ashmore Reef.

Remarks. The present specimens are easily identified as *H. spinosa* Băcescu, because of the shape of the eye (Fig. 2A). Differences between the type specimen and the present specimens are 6-7 lateral spines on telson of type specimens, while 6-9 spines in present specimens, spines are considerably shorter (Fig. 2D, E) as compared with those of type specimen; number of spines on margin of telson cleft, 3-6 in present specimens (Fig. 2D, E) and 4 in type specimen; inner margin of endopod of uropod armed with 9-11 spines in present specimens (Fig. 2C) as against 6 in type material. Spines may be increase in number and decrease in length during growth; type specimen was subadult (2.5mm), present specimens are adults (2.7 to 3.1mm).

The specimens from Fort Hill Wharf were commensal with sponges.

Distribution. Previously only known from Darwin Harbour, Northern Territory of Australia.

Heteromysis (Heteromysis) communis Băcescu
(Fig. 3)

Heteromysis communis Băcescu, 1986: 22-24.

Material. NORTHERN TERRITORY: 1 immature ♀, NTM Cr.005222, 2.5mm, Dudley Point Reef, Darwin Harbour, 10m, sponge washings, 31.viii.1982, R. Williams; 1 immature ♀, NTM Cr.005223, 2.9mm, same data as above; 1 immature ♀, 3.2mm and 1 immature ♂, 3.0mm, NTM Cr.005224, same data as above; 1 immature ♂ (damaged) and 1 juvenile, NTM Cr.005225, same data as above; 3 adult ♂, NTM Cr.005504, 3.4, 3.3

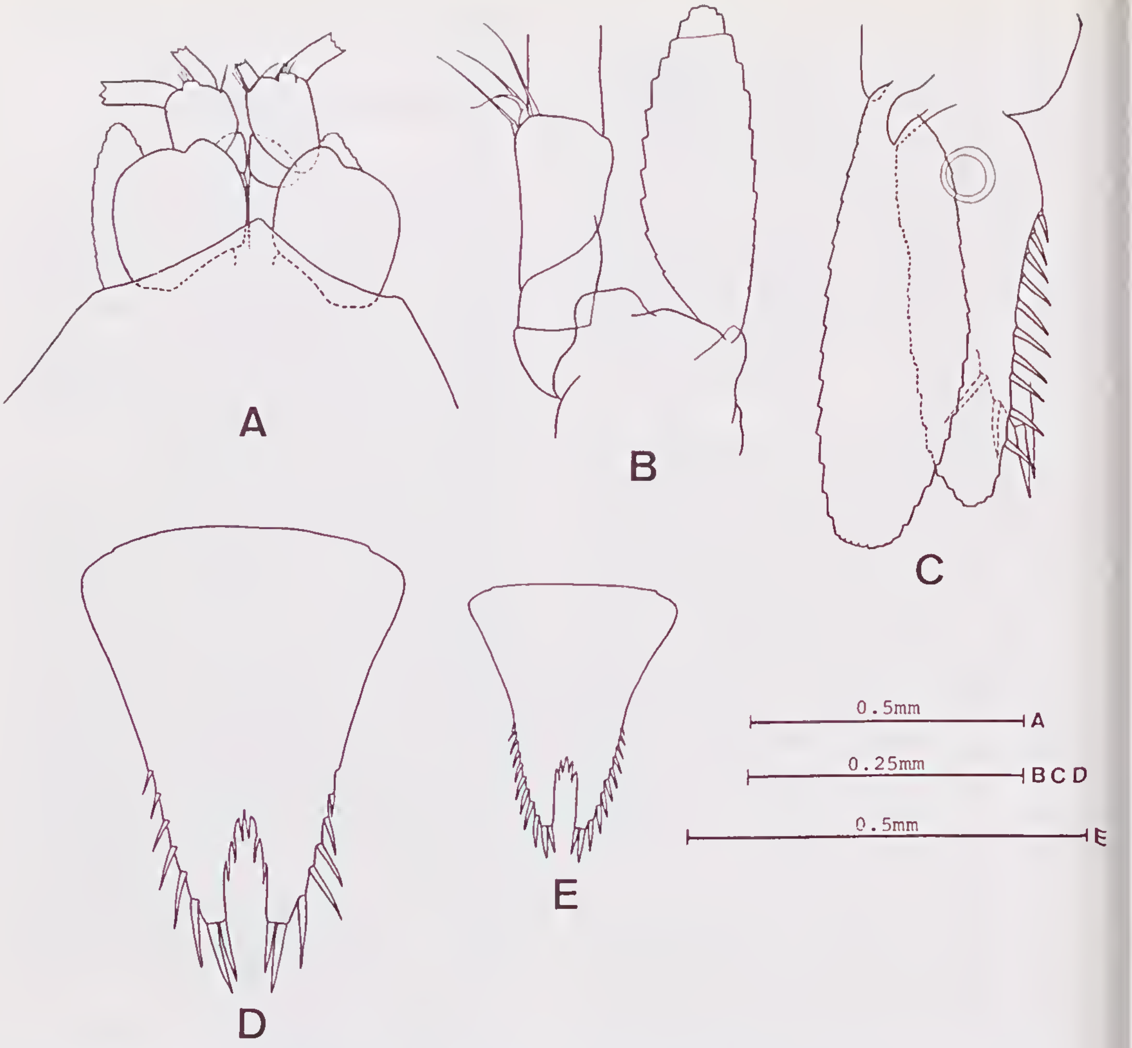

Fig. 2. *Heteromysis (Heteromysis) spinosa* adult ♀ : **A**, anterior end; **B**, antenna; **C**, uropod; **D**, telson; **E**, telson.

and ca 3.3mm, Fort Hill Wharf, Darwin Harbour, ?5m, 23.vii.1986, P. Alderslade.

Remarks. The present specimens differ from those described by Băcescu (1986) in the following ways: (1) distal end of medial margin of eyestalk pointed in dorsal view in type specimens, but not so in present specimens (Fig. 3A); (2) carpopropodus of male thoracic endopod 3 is 3 times as long as broad in present specimens (Fig. 3C) as against 4 times in type specimens, and (3) penis of type specimen armed with only a single seta in anterior distal angle, while that of present specimens armed with 2 setae in anterior distal angle and a seta on middle of posterior margin (Fig. 3G).

This species has the following specific characteristics in addition to those given in the original description. Male rostrum triangular with narrowly rounded apex extending to midlength of segment 1 of antennular peduncle and covering basal part of eyestalks (Fig. 3A). Merus of thoracic endopod 3 subequal to carpopropodus in length, inner margin with 4 small flagellate spines and triangular process distally (Fig. 3C, E). Thoracic endopod 4 with 4-segmented carpopropodus more slender and less hirsute than posterior pairs, and with straight claw distally (Fig. 3F).

The present specimens were collected with sponges.

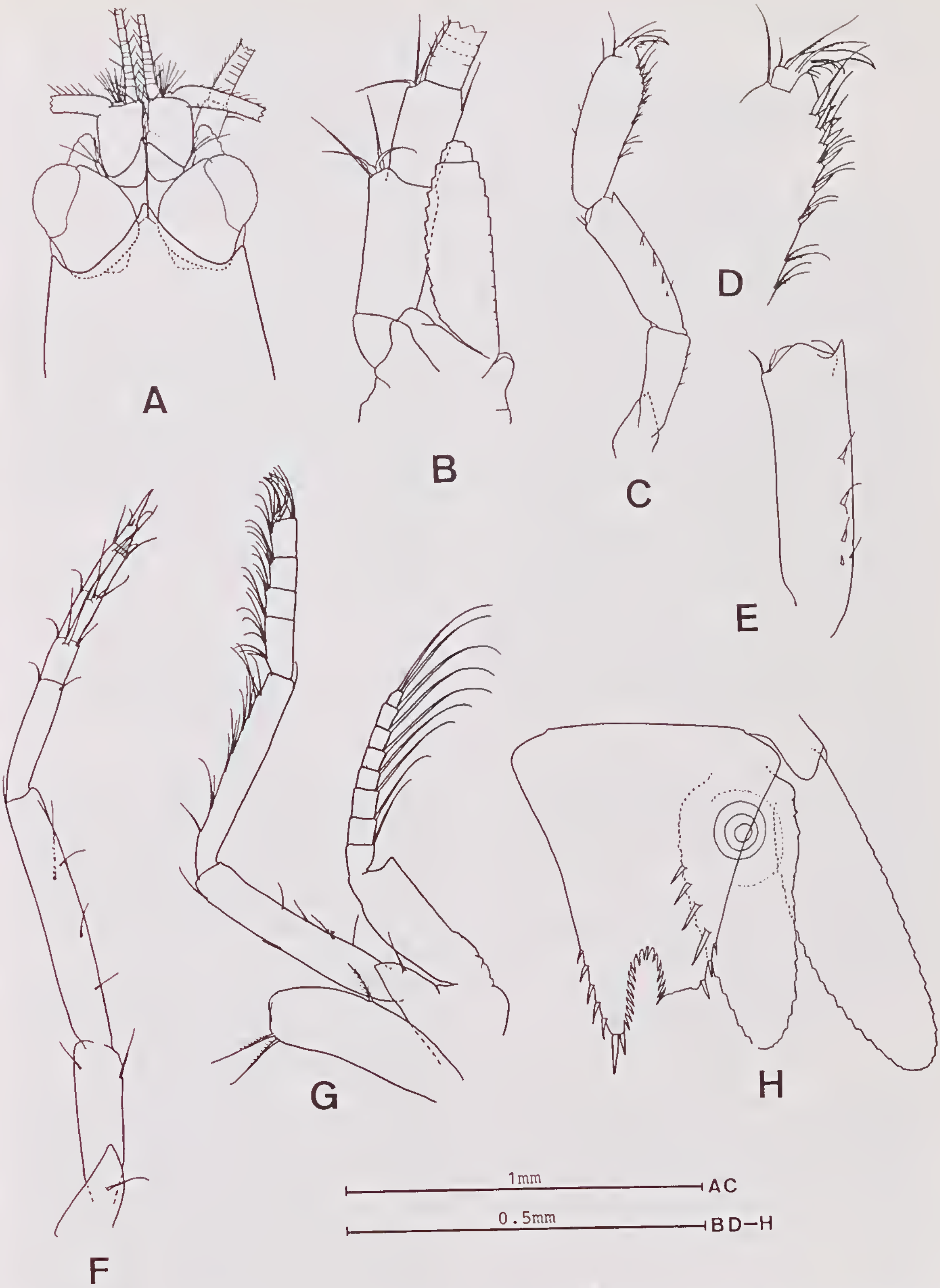

Fig. 3. *Heteromysis (Heteromysis) communis* adult ♂: **A**, anterior end; **B**, antenna; **C**, third thoracic endopod; **D**, extremity of third thoracic endopod; **E**, merus of third thoracic endopod; **F**, fourth thoracic endopod; **G**, eighth thoracic limb and penis; **H**, uropod and telson.

Distribution. Previously only known from Darwin Harbour, Northern Territory of Australia.

Heteromysis (Heteromysis) australica Băcescu and Bruce

(Fig. 4)

Heteromysis (Heteromysis) australica Băcescu and Bruce, 1980: 63-65.

Material. NORTHERN TERRITORY: 1 adult ♂, 5.3mm and 1 adult ♀ with embryos, 5.5mm, NTM Cr.005219, Dudley Point Reef, Darwin Harbour, 12°25'S 130°49.1'E reef flat, 6.ix.1982, A.J. Bruce.

Remarks. The present specimens differ from the original description of *H. (H.) australica* in the following respects: (1) rostrum short and rounded in present specimens (Fig. 4A), but long and pointed in type specimens; (2) carpopropodus of thoracic endopod 3 of present specimens with small hook at posterior angle of outer margin (Fig. 4D), but not illustrated on type material; (3) penis of present specimens more robust and without seta (Fig. 4G), while that of type material with one seta on anterior margin; and (4) telson sinus deeper, ⅓ of telson length (Fig. 4I) while that of type specimens is ¼ of telson length.

Present specimens may be distinct from *H. australica,* because of differences in rostrum and penis, which seem to be specific. However, more specimens from both localities need to be examined to support this contention.

Distribution. Known from Heron Island, Queensland (Băcescu and Bruce 1980) and Darwin Harbour (present data).

Heteromysis (Olivaemysis) zeylanica W. Tattersall

(Fig. 5)

Heteromysis zeylanica W. Tattersall, 1922: 499-500.

Material. NORTHERN TERRITORY: 2 adult ♂, NTM Cr.005499, 3.8 and 4.0mm, Dudley Point Reef, Darwin Harbour, 12° 25'S 130° 49.1'E, reef flat, 6 ix 1982, A.J. Bruce.

Remarks. The present specimens differ from the original description of *H. zeylanica* in the following points: (1) antennal scale longer than antennal peduncle (Fig. 5B), but shorter in type specimens; (2) antennal peduncle with segment 2 longer than 3 (Fig. 5B), while both segments equal in length in type specimens; (3) carpopropodus of thoracic endopod 3 with 6 spines (Fig. 5C), as against type specimens with 4 or 5 spines; and (4) carpopropodus of thoracic endopod 4 divided into 3 subsegments (Fig. 5D) and into 6 subsegments in endopods 5-8 (Fig. 5E), while in type specimens these endopods have 4 subsegments.

W. Tattersall (1922) did not describe the male pleopods. Males of the present specimens have modified pleopods 2-4; pleopod 2 armed with 7 strong flagellate spines on distal half of inner margin (Fig. 5F), pleopod 3 with obliquely rounded distal margin armed with 9 flagellate spinules (Fig. 5G), and pleopod 4 similar to pleopod 3 but slightly larger and armed on obliquely rounded distal margin with 16 flagellate spinules which are smaller than those of pleopod 3 (Fig. 5H).

Distribution. Known from the Gulf of Manaar, India (W. Tattersall 1922) and Darwin (present data).

Heteromysis *(Olivaemysis) essingtonensis* sp. nov.

(Figs 6, 7)

Type material. HOLOTYPE — ♂, NTM Cr.005492, 6.1mm, Table Head, Port Essington, Northern Territory, 4m, rubble washings, 12.v.1983, N.L. Bruce, ALLOTYPE — ♀ with embryos, NTM Cr.005492, 6.2mm, same data as holotype. PARATYPE — ♂, NTM Cr.005493, 6.3mm, same data as holotype except 6m.

Additional material. NORTHERN TERRITORY: 1 immature ♀, NTM Cr.005500, 5.2mm, Table Head, Port Essington, 8m, from gorgonian host, 7.viii.1986.

Description. Anterior margin of carapace produced into triangular rostrum with narrowly rounded apex and concave lateral margins, reaching base of antennular peduncle (Fig. 6A, C), anterolateral corners rounded, posterior margin of carapace emarginate, exposing last thoracic somite dorsally.

Eye with cornea occupying ⅓ of whole eye and slightly narrower than stalk; stalk gradually becoming broader posteriorly as proximolateral angle swells out laterally, without spine at distal end of medial margin, medial margin sparsely hispid (Fig. 6A, C).

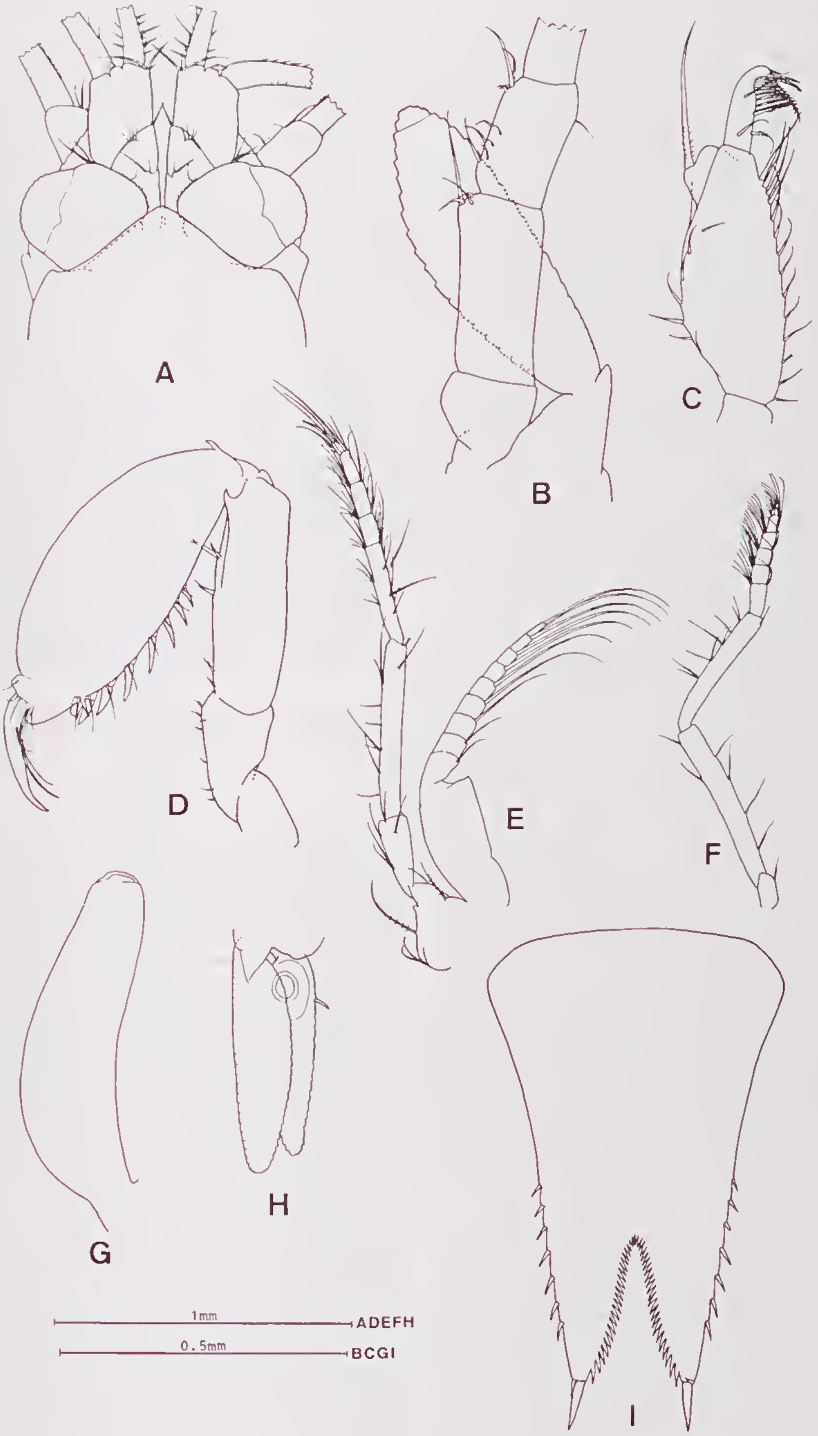

Fig. 4. *Heteromysis (Heteromysis) australica* adult ♂ except **E,** adult ♀ : **A,** anterior end; **B,** antenna; **C,** mandibular palp; **D,** right third thoracic endopod; **E,** fourth thoracic limb; **F,** one of fifth to eighth thoracic endopods; **G,** penis; **H,** uropod; **I,** telson.

Antennular peduncle not showing large differences between sexes except small processus masculinus in male, segment 1 with prolonged outer distal corner tipped with several setae, segment 2 triangular in dorsal view with oblique connection with segment 3, segment 3 with inner margin shorter than outer margin and armed with one seta at middle and with 3 setae at distal corner, 2 of which grow forwardly and one outwardly; flagellate spine (Fig. 6B) present at each inner distal angle of 3 peduncular segments (Fig. 6A, C).

Antennal scale elliptical, less than 3 times as long as broad, extending to midlength of segment 3 of antennular peduncle, setose all round, distal suture present; antennal peduncle longer than scale, shorter than antennular peduncle, with segment 2 longest (Fig. 6D).

Labrum with triangular anterior margin with obtusely pointed apex.

Other mouthparts and thoracic endopods 1 and 2 as shown in Fig. 6E-I.

Thoracic endopod 3 robust, not showing marked sexual dimorphism, merus less than 3 times longer than broad, sparsely armed with setae, carpopropodus about 2 times as long as broad, inner margin smooth in proximal half and armed with 6 strong flagellate spines on distal half, terminal claw very strong (Fig. 7A,B). Carpopropodus of remaining thoracic endopods divided into 3 subsegments in endopod 4, 5 in endopods 5 and 7, and 6 in endopod 6 (Fig. 7C), condition in endopod 8 unknown due to damage.

Uropod setose all round; exopod extending beyond telson by 1/3 of its length, 3.5 times longer than broad; endopod somewhat shorter than exopod, inner margin slightly concave, with 13-15 spines increasing in length distally along entire length exclusive of short distance near apex (Fig. 7D).

Telson longer than last abdominal somite, 1.2 times longer than broad, lateral margin slightly concave, with 18-21 spines increasing in length distally along entire length; apical lobes terminating in 2 spines, inner spine shorter than outer and equal in size to distalmost spine on lateral margin; sinus 2/7 of telson length, widest in middle part, with 12-14 small spines in about proximal half (Fig. 7E).

All pleopods of both sexes uniramous and unsegmented; female pleopods subequal, increasing in length posteriorly; male pleopods 1, 2 and 5 similar to those of female, pleopod 3 modified, with 14 flagellate spinules on distal end obliquely rounded, pleopod 4 similar to pleopod 3, with 16 flagellate spinules (Fig. 7F).

Remarks. This species is closely related to *H. abrucei* collected from Heron Island, northeastern Australia, in its general form, and by having telson with spines along entire length of lateral margins and with spines in proximal half of sinus. Between these species, however, the following differences may be noted: (1) apex of rostrum narrowly rounded in new species, while obtusely pointed in *H. abrucei;* (2) eyes bear a denticle at distal end of medial margin of eyestalk in *H. abrucei,* whereas this denticle is absent in new species; and (3) endopod of uropod furnished with 13-15 spines on almost the entire length of inner margin in new species, while *H. abrucei* is armed with only 3 spines on inner margin near statocyst.

Etymology. The species is named after the locality in which it was collected.

Heteromysis (Olivaemysis) quadrispinosa sp. nov.

(Fig. 8)

Type material. HOLOTYPE — ♀ with embryos, NTM Cr.005494/A, 4.6mm, Table Head, Port Essington, Northern Territory, 11° 14.8′S 132° 11.2′E, 4m, rubble washings, 12 v 1983. ALLOTYPE — ♂, NTM Cr.005494/B, same data as holotype.

Additional material. NORTHERN TERRITORY: 1 immature ♀ and 1 immature ♂, NTM Cr.005494, 3.8 and 3.4mm, same data as holotype; 1 adult ♀ with embryos, NTM Cr.005495, 4.5mm, same data as holotype except 6m and coral washings.

Description. Carapace produced anteriorly into triangular rostrum with very narrowly rounded or pointed apex extending to midlength of antennular peduncle segment 1, lateral margins of rostrum slightly concave (Fig. 8A, B), anterolateral corners of carapace rounded, posterior margin emarginate, leaving last thoracic somite exposed dorsally.

Eye extending laterally, with hemispherical cornea narrower than stalk and occupying less than half of whole organ; stalk with well developed denticle at distal end of medial margin (Fig. 8A, B).

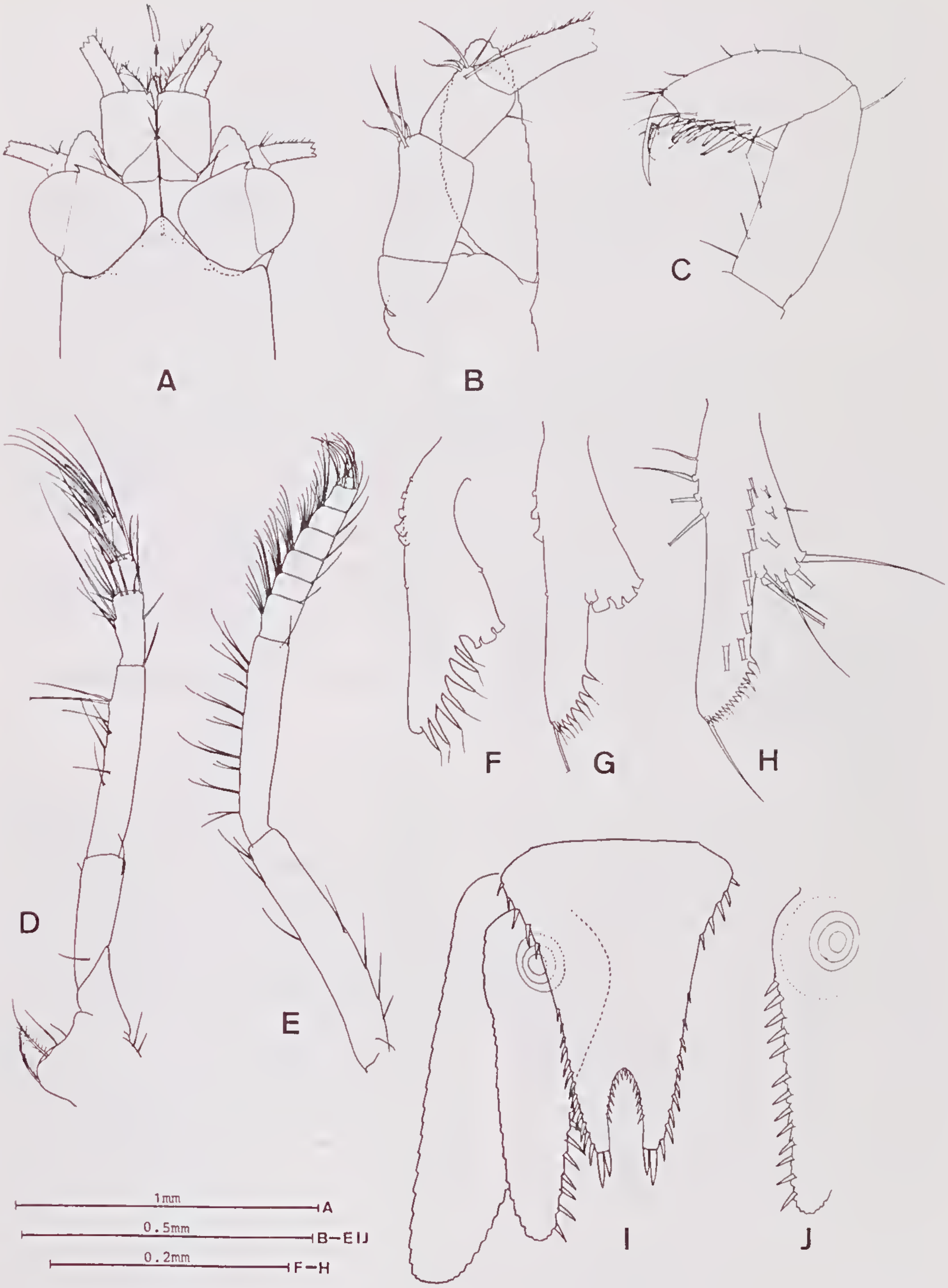

Fig. 5. *Heteromysis (Olivaemysis) zeylanica* adult ♂: **A**, anterior end; **B**, antenna; **C**, extremity of third thoracic endopod; **D**, fourth thoracic endopod; **E**, one of fifth to eighth thoracic endopods; **F**, second pleopod; **G**, third pleopod; **H**, fourth pleopod; **I**, uropod and telson; **J**, inner margin of endopod of uropod.

Antennular peduncle robust, segment 1 with outer distal corner greatly extending anteriorly and tipped with several setae, segment 2 obliquely articulated with segment 3, with 2 setae at inner distal corner, segment 3 with one flagellate spine and 3 setae at inner distal corner, one of these thick, long, and extending laterally (Fig. 8A, B).

Antennal scale elongate elliptical, nearly 3 times longer than broad, reaching midlength of segment 3 of antennular peduncle, setose all round, distal suture present. Antennal peduncle extending to apex of scale (Fig. 8C).

Thoracic endopod 3 robust, merus more than 3 times longer than broad, with 4 spinous setae on outer side, carpopropodus about 2 times as long as broad, furnished on distal 2/3 of inner margin with 4 flagellate spines, 2 distal spines arranged in a pair, terminal claw very strong (Fig. 8D, E).

Thoracic endopod 4 slender, with 3-subsegmented carpopropodus, subsegment 1 equal to combined length of subsegments 2 and 3 (Fig. 8F). Thoracic endopods 5-8 with 6-subsegmented carpopropodus, dactylus very small, ending in slender claw (Fig. 8G).

Male thoracic somites 2-7 with simple triangular sternal process.

Marsupium composed of 2 pairs of brood laminae.

Uropod with both rami broad, setose all round; endopod extending for 1/4 of its length beyond apex of telson, with 4 spines in statocyst region on inner margin; exopod extending for 1/7 of its length beyond apex of endopod, inner margin slightly more convex than outer (Fig. 8H, I).

Telson longer than last abdominal somite, triangular with apical sinus, slightly longer than broad, lateral margin nearly straight, furnished with 10-12 spines along entire length, densely on distal half and proximal 1/4, and sparsely on middle part, apex of lobes furnished with 2 spines, inner spine subequal to distalmost spine on lateral margin and less than half as long as outer spine; apical sinus about 1/3 of telson length, with 31 slender spines in holotype and 23 spines in allotype along entire length of margin (Fig. 8I, J).

In male, pleopod 1 not modified, small; pleopod 2 slightly modified, with one flagellate spine on apex and one on inner margin (Fig. 8K); pleopod 3 modified, with 6 flagellate spinules on obliquely rounded apex and 3 flagellate spinules on inner margin (Fig. 8L); pleopod 4 similar to pleopod 3 in structure but much broader, with more than 30 flagellate spinules on obliquely rounded apex (Fig. 8M); pleopod 5 not modified, smaller than pleopod 4 (Fig. 8N).

Remarks. The new species is related to *H. brucei* O. Tattersall and *H. abrucei* in: (1) rostrum with pointed or very narrowly rounded apex; (2) eyestalk with a denticle at distal end of medial margin; (3) endopod of uropod with spines on inner margin near statocyst; and (4) telson with spines along entire length of lateral margin. However, the new species differs from the two latter species in the armature of telson sinus, the armature on carpopropodus of thoracic endopod 3 and the number of lateral spines on telson, and moreover, it is distinguishable from *H. abrucei* by the number of subsegments of thoracic endopods 5-8 and the structure of male pleopods 3,4.

Etymology. The species is named after the 4 spines on the carpopropodus of thoracic endopod 3.

Heteromysis (Olivaemysis) sexspinosa sp. nov.

(Figs 9, 10)

Material. HOLOTYPE — ♀ with embryos, NTM Cr.005501, 5.9mm, Table Head, Port Essington, Northern Territory, 8m, from gorgonian host, 7 viii 1986.

Additional material. NORTHERN TERRITORY: 1 adult ♀, 5.7mm, 2 immature ♀, 4.0 and 4.1mm, and 1 immature ♂, 3.4mm, NTM Cr.005501, same data as holotype.

Description. Carapace produced into triangular rostrum with rounded apex and slightly concave lateral margins, extending anteriorly to midlength of antennular peduncle segment 1 (Fig. 9A), anterolateral corner of carapace rounded, posterior margin emarginate, leaving last thoracic somite exposed dorsally.

Eye with hemispherical cornea narrower than stalk, eyestalk with well developed denticle at distal end of medial margin (Fig. 9A).

Antennular peduncle robust, segment 1 with distolateral corner strongly produced anteriorly and tipped with several setae, segment 3 connected with segment 2 obliquely, furnished at distomedial end with one flagel-

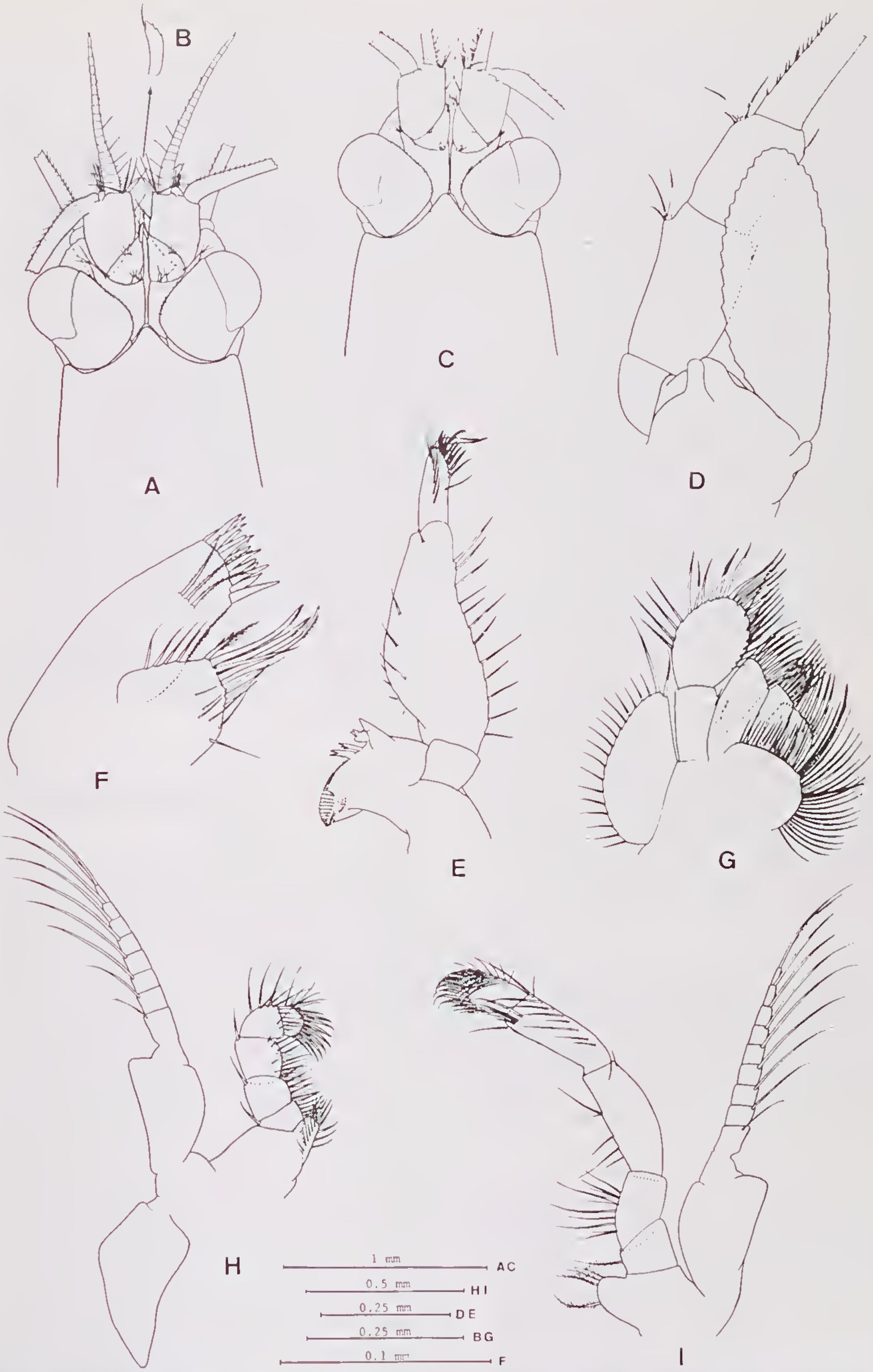

Fig. 6. *Heteromysis (Olivaemysis) essingtonensis* holotype except **C**, allotype: **A**, anterior end; **B**, flagellate spine on third segment of right antennular peduncle; **C**, anterior end; **D**, antenna; **E**, mandible; **F**, maxillule; **G**, maxilla; **H**, first thoracic limb; **I**, second thoracic limb.

late obtuse spine and 3 setae, one of these thick, long and extending laterally (Fig. 9A).

Antennal scale elongate elliptical, 2.5 times longer than broad, extending to mid-length of antennular peduncle segment 3, inner margin more convex than outer margin, setose all round, distal suture invisible. Antennal peduncle not reaching apex of scale, combined length of segments 2 and 3 subequal to scale length (Fig. 9B).

Mouthparts and thoracic endopods 1 and 2 as shown in Fig. 9C-E and Fig. 10A, B; in holotype some setae and spines may be abnormal in their shape and colour.

Thoracic endopod 3 robust, merus slightly less than 3 times longer than broad, carpopropodus less than 2 times as long as broad, furnished on distal half of inner margin with 6 flagellate spines, proximal 2 spines more slender than distal 4 arranged in 2 pairs, terminal claw very strong (Fig. 10C, D).

Thoracic endopod 4 slender, with 3-subsegmented carpopropodus shorter than merus, subsegment 1 equal to combined length of subsegments 2 and 3 (Fig. 10E).

Thoracic endopods 5-8 with 7- or 8-subsegmented carpopropodus (in holotype, 8-subsegmented in endopods 5 and 7, and 7-subsegmented in endopods 6 and 8), dactylus very small, terminating in slender claw (Fig. 10F). Exopods of thoracic limbs composed of 8 segments in limb 1, and 9 in limbs 2-8 in addition to basal plate (Fig. 10B, C, F).

Marsupium composed of 2 pairs of brood laminae.

Uropod with both rami broad, setose all round; endopod extending for 1/4 of its length beyond apex of telson, with 2 spines in statocyst region on inner margin; exopod less than 4 times as long as broad, extending for 1/5 of its length beyond apex of endopod, inner margin slightly more convex than outer (Fig. 10G).

Telson longer than abdominal somite 6, triangular with apical sinus, 1.2 times longer than broad, lateral margin slightly concave in proximal half and slightly convex in distal half, with 18-19 spines along entire length, spines densely arranged on distal 1/2 and proximal 1/4 and sparsely arranged in middle, apex of telson lobes with 2 spines, inner spine subequal to distalmost spine on lateral margin and outer spine more than 2 times as long as inner; apical sinus more than 1/4 of telson length, with 25 slender spines along entire margin (Fig. 10H).

Remarks. *Heteromysis macrophthalma* Băcescu is closely allied to *H. sexspinosa* in many points. However, *H. sexspinosa* differs from the former species by having: (1) carpopropodus of thoracic endopods 5-8 consisting of 7 or 8 subsegments, while *H. macrophthalma* has 6 subsegments; (2) lateral margin of telson with 18-19 spines along entire length (an adult female, 5.7mm, with embryos in marsupium, collected at the same station with the holotype, possessed an unarmed part as in *H. macrophthalma,* Fig. 10I), while *H. macrophthalma* has 15 spines along the entire margin but separated by a median gap; (3) carpopropodus of thoracic endopod 3 with 6 flagellate spines, proximal 2 separated from each other, while *H. macrophthalma* has 2 to 3 smaller spines in addition to 6 larger spines with proximal 2 close together; and (4) body length is larger (5.7-5.9mm) than in *H. macrophthalma* (4-5mm).

Adult male is unknown.

Etymology. The species is named after the 6 spines on the carpopropodus of thoracic endopod 3.

Heteromysis (Olivaemysis) tenuispina sp. nov.

(Fig. 11)

Type material. HOLOTYPE — ♂, NTM Cr. 005496, 4.2mm, Table Head, Port Essington, 11° 14.8′S 132° 11.2′E, 6m, rubble washings, 12.v.1983.

Additional material. NORTHERN TERRITORY: 1 adult ♂, NTM Cr.005497, 4.2mm, Coral Bay, Port Essington, 11° 11.0′S 132° 03.4′E, 6m, coral reef edge, 16.v.1983, N.L. Bruce. WESTERN AUSTRALIA: 1 adult ♂, 4.2mm, 1 immature ♀, 3.6mm and 1 juvenile, 2.4mm, NTM Cr.005226, North West Shelf, 16° 34′S 121° 27′E; 40m, coralline rock washings; 17.viii. 1985, B.C. Russell. QUEENSLAND: 1 near-adult ♂, NTM Cr.005477, 3.6mm, Torres Strait, 10° 03.2′S 142° 39.6′E, P. Blyth.

Description. Carapace with frontal margin produced anteriorly into short triangular rostrum with concave lateral margins and narrowly rounded apex extending slightly beyond base of antennular peduncle (Fig. 11A), anterolateral corners rounded, post-

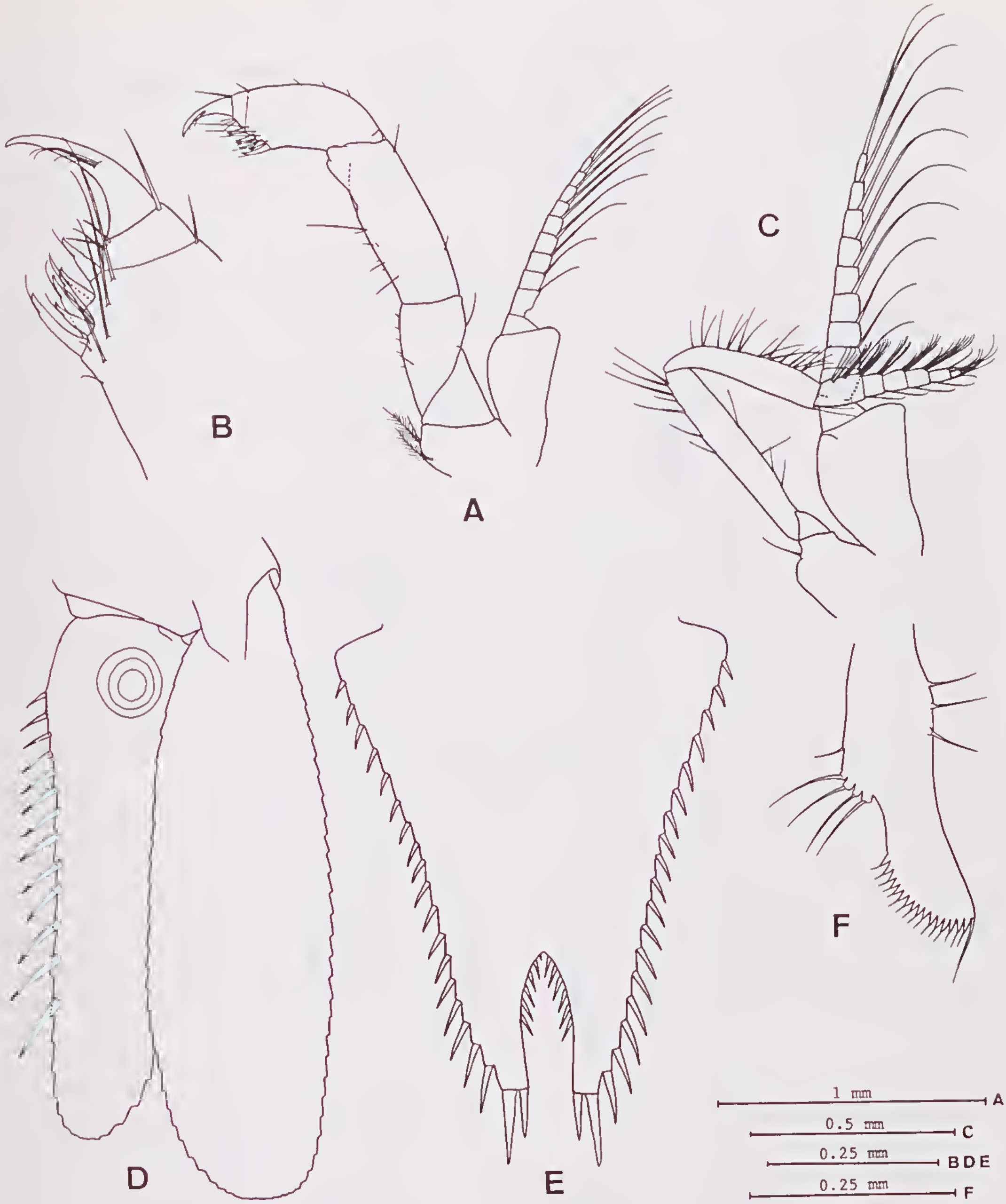

Fig. 7. *Heteromysis (Olivaemysis) essingtonensis* holotype: **A,** third thoracic limb; **B,** extremity of third thoracic limb; **C,** eighth thoracic limb; **D,** uropod; **E,** telson; **F,** fourth pleopod.

erior margin emarginate, leaving last thoracic somite exposed dorsally.

Eye with cornea narrower than stalk; eyestalk with prominent denticle at distal end of medial margin (Fig. 11A).

Antennular peduncle robust, segment 1 with prolonged distolateral angle tipped with several setae, segment 2 with long inner margin and very short outer margin for oblique connection with segment 3, with 2 setae at distomedial corner, segment 3 broader than preceding segment, armed on middle of medial margin with one seta and at distomedial corner with one flagellate spine and 3 setae, one seta stout and extending outwardly (Fig. 11A).

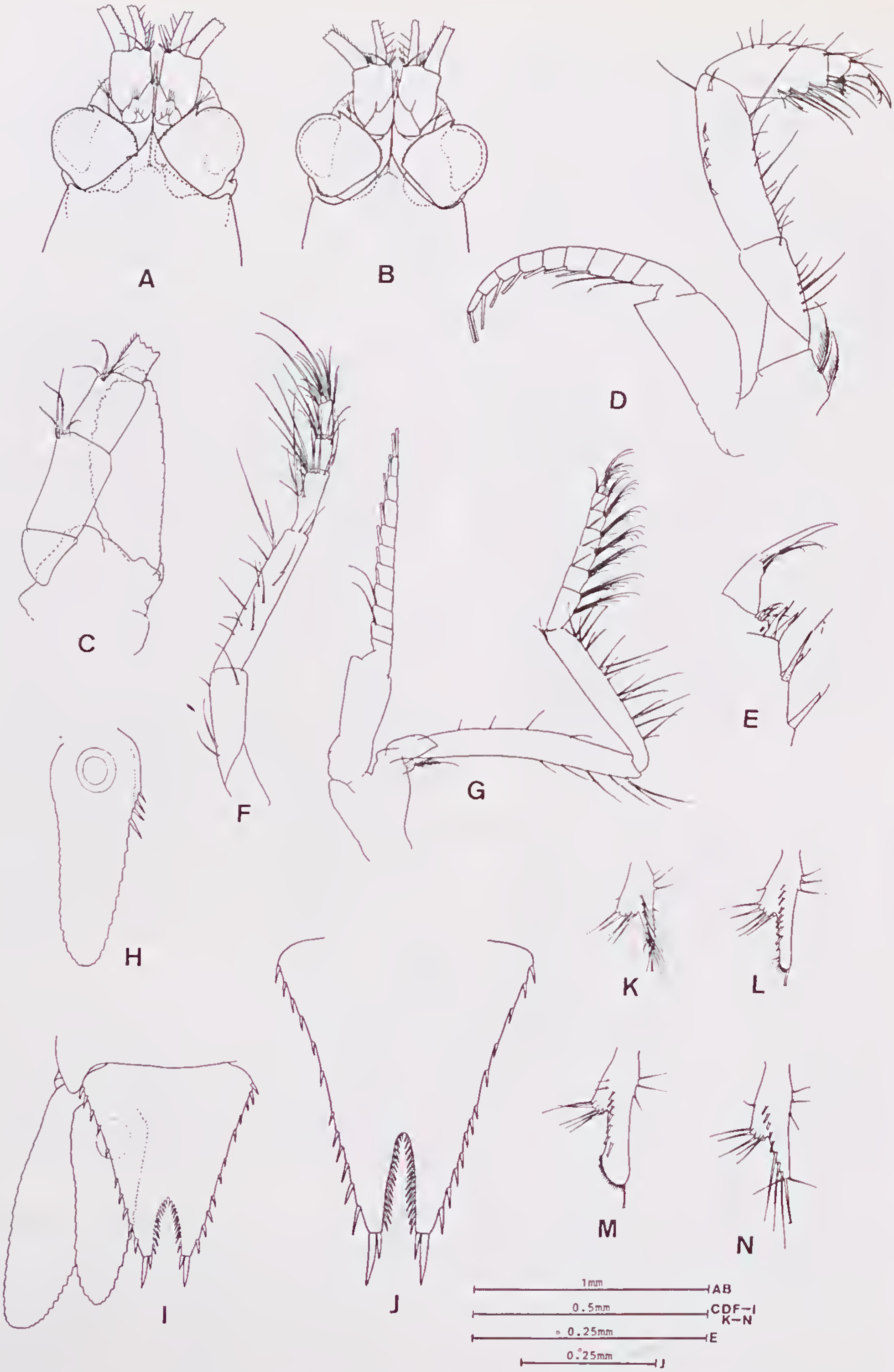

Fig. 8. *Heteromysis (Olivaemysis) quadrispinosa* **A, C-H, J,** holotype, **B, I, K-N,** allotype: **A,** anterior end; **B,** anterior end; **C,** antenna; **D,** third thoracic limb; **E,** extremity of third thoracic endopod; **F,** fourth thoracic endopod; **G,** eighth thoracic limb; **H,** endopod of uropod; **I,** uropod and telson; **J,** telson; **K,** second pleopod; **L,** third pleopod; **M,** fourth pleopod; **N,** fifth pleopod.

Antennal peduncle extending to mid-length of antennular peduncle segment 3. Antennal scale extending to distal end of antennal peduncle, more than 2.5 times longer than broad, lanceolate, inner margin more convex than outer margin, setose all round, distal suture present (Fig. 11B).

Thoracic endopods 1 and 2 as shown in Fig. 11C, D.

Thoracic endopod 3 with merus slightly more than 2 times as long as broad and armed with long seta at middle of inner margin, carpopropodus less than 2 times as long as broad, inner margin with 2 pairs of strong spines on distal part and pair of slender spines at end of proximal naked part (Fig. 11E, F).

Thoracic endopod 4 slender, with 3-subsegmented carpopropodus (Fig. 11H); thoracic endopods 5-8 slender, carpopropodus divided into 6-7 subsegments (Fig. 11I) (in holotype, subdivided into 6 in endopod 5 and into 7 in endopods 6-8); thoracic exopods distal to basal plate 9-segmented in exopod 1 and 10-segmented in exopods 2-8 (Fig. 11D, H).

Male pleopods 1 short, equal to side lobe in length; pleopod 2 modified , tapering, inner margin armed with 3 spines becoming longer and stouter distally (Fig. 11J); pleopod 3 modified, with rounded apical margin armed with 20 flagellate spinules (Fig. 11K); pleopod 4 similar to pleopod 3 in shape but larger, furnished on rounded apical margin with 29 flagellate spinules, each spinule smaller than those of pleopod 3 (Fig. 11L); pleopod 5 not modified, equal to pleopod 3 in length.

Uropod setose all round; endopod extending slightly beyond tip of apical spines of telson, tapering, with 9 spines along inner margin from statocyst region to distal 3/5; exopod more than 3 times longer than broad, extending for 1/6 of its length beyond apex of endopod (Fig. 11M).

Telson described based on right half because spines on left lateral margin abnormally arranged: telson triangular with apical sinus, 1.3 times longer than broad, 1.3 times longer than last abdominal somite, lateral margin naked and concave for proximal 3/5, convex and furnished with 13 spines in distal 2/5, lateral spines increasing in length distally, followed by apical ones without gap, apical lobes of telson narrower distally, armed on narrow distal end with 2 spines, outer spine slightly longer than inner, longest among all marginal spines; sinus deep, 1/3 of telson length, narrower in mouth than in middle part, with 16 spines on proximal half of sinus margin (Fig. 11O).

Remarks. The present new species resembles *H. minuta* O. Tattersall from Singapore (O. Tattersall 1967) and *H. coralina* Modlin from Florida (Modlin 1987) by having: (1) eye with a denticle at end of medial margin of stalk; (2) telson with spines on only distal 2/5 of lateral margin; and (3) telson sinus with spines on only proximal half of margin. However, it is easily distinguishable from *H. minuta* by the throacic endopod 3, which is 2 times as long as broad in the new species, as against 7.5 times in *H. minuta*, and from *H. coralina* by the endopod of uropod, the new species bears 9 spines from statocyst region to distal 3/5 of the inner margin while *H. coralina* has 5 spines in statocyst region.

A specimen from Coral Bay differs from the holotype by having (1) thoracic endopod 3 with a pair of more slender proximal spines on carpopropodus (Fig. 11F), (2) male pleopod 4 with 35 flagellate spinules, (3) telson wider (Fig. 11N); and (4) telson sinus shallower, broader at apex and with 9 spines on proximal 1/3 of margin. These differences, especially appearance of telson, gives the impression of another species, but I judged this specimen to belong to *H. tenuispina* from many other similarities such as rostrum, eye, thoracic limbs, endopod of uropod, etc.

Etymology. The species is named after the 2 slender spines on the carpopropodus of thoracic endopod 3.

Heteromysis (Gnathomysis) harpaxoides Băcescu and Bruce

Heteromysis (Gnathomysis) harpaxoides Băcescu and Bruce, 1980: 68-70

Material. WESTERN AUSTRALIA: 1 adult ♂, NTM Cr.005475, 4.9mm, Ashmore Reef; from *Dardanus* sp.

Distribution. This species has been previously recorded from Wistari Reef, Great Barrier Reef.

Heteromysis gracilis sp. nov.

(Fig. 12)

Type material. HOLOTYPE — ♀ with embryos, NTM Cr.005502, 5.1mm, Dudley

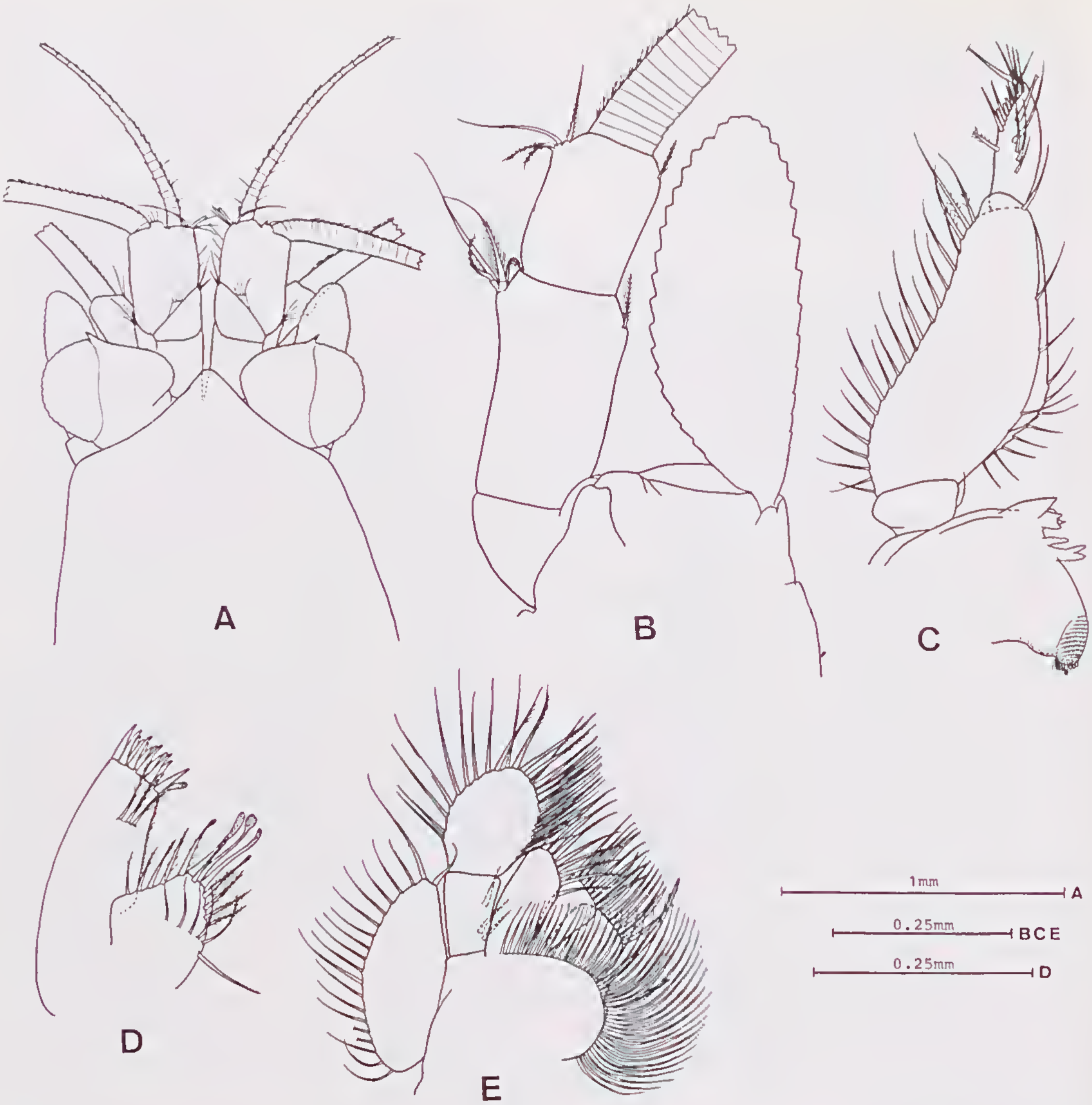

Fig. 9. *Heteromysis (Olivaemysis) sexspinosa* holotype: **A,** anterior end; **B,** antenna; **C,** mandible; **D,** maxillule; **E,** maxilla.

Point Reef, Darwin, 12° 25′S 130° 49.1′E, reef flat, 6.ix.1982, A.J. Bruce.

Description. Body relatively slender for this genus (Fig. 12A).

Carapace produced in triangular rostrum with pointed apex, extending to midlength of antennular peduncle segment 1 (Fig. 12B), anterolateral corner rounded, posterior margin emarginate, leaving last thoracic somite exposed dorsally (Fig. 12A).

Eye large, without denticle at distal end of medial margin of stalk, cornea hemispherical, slightly wider than stalk, occupying more than half of whole eye (Fig. 12B).

Antennular peduncle rather slender, segment 1 with prolonged distolateral corner tipped with several setae, segment 2 triangular in dorsal view, with 2 setae at distomedial corner, segment 3 articulating with segment 2 obliquely, with one seta on middle of inner margin and 3 setae at distomedial corner, but lacking flagellate spine with obtuse tip (Fig. 12B).

Antennal scale shorter than antennular peduncle, lanceolate, about 4 times longer than broad, outer margin straight, inner margin evenly convex, setose all round, distal suture invisible (Fig. 12C). Antennal pedun-

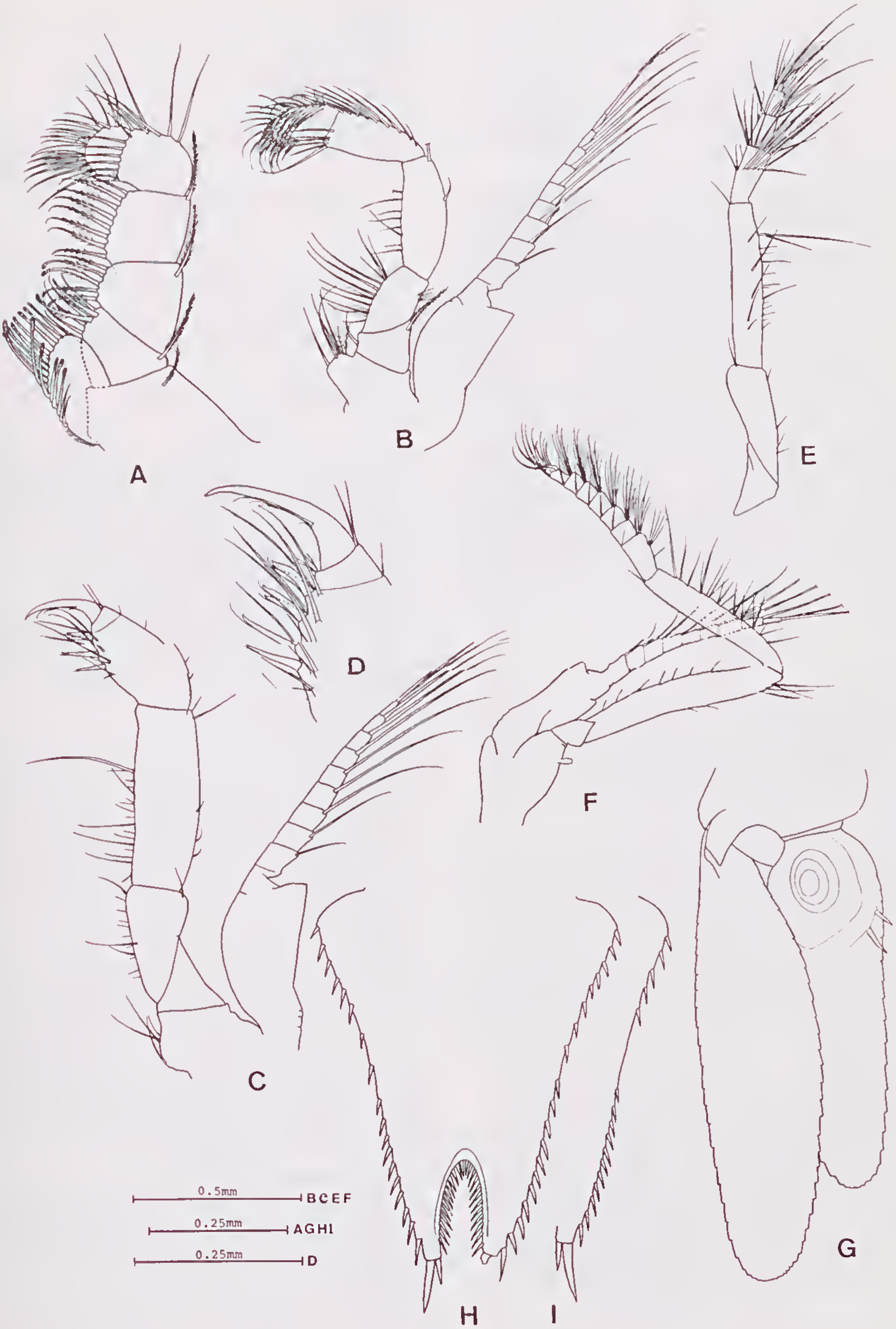

Fig. 10. *Heteromysis (Olivaemysis) sexspinosa* holotype except **I**, adult ♀ : **A,** first thoracic endopod; **B,** second thoracic limb; **C,** third thoracic limb; **D,** extremity of third thoracic endopod; **E,** fourth thoracic endopod; **F,** eighth thoracic limb; **G,** uropod; **H,** telson; **I,** right lateral margin of telson.

cle not extending to apex of scale, segment 2 occupying nearly half of peduncle length (Fig. 12C).

Labrum with triangular anterior margin with obtusely pointed apex.

Thoracic endopod 2 with dactylus fringed with setae, terminal claw short and slender (Fig. 12D).

Thoracic endopod 3 slender, merus 6 times longer than broad, inner margin slightly convex, terminating in denticle, with 3 long and one short flagellate spines, outer margin slightly concave, carpopropodus longer than merus, 6 times longer than broad, inner margin with 8 spines along almost entire length, terminal claw small, 1/5 as long as carpopropodus (Fig. 12E). Thoracic endopod 4 slender, carpopropodus divided into 5 subsegments, subsegment 1 long, 1/3 of carpopropodus length, dactylus small, terminating in slender claw 3.5 times longer than dactylus (Fig. 12F). Remaining thoracic endopods missing; exopods of thoracic limbs 9-segmented in addition to basal plate (Fig. 12E, F).

Endopod of uropod extending for 1/5 of length beyond apex of telson, with 17 spines on inner margin from statocyst region to near apex, spines more slender on distal half than on proximal half; exopod of uropod exceeding apex of endopod by 1/6 of length (Fig. 12G).

Telson triangular with apical sinus, 1.3 times longer than broad, lateral margin with 11-12 spines increasing in length posteriorly along almost entire length except on unarmed proximal 1/5 to 1/6, apex armed with 2 spines, outer spine 1.5 times longer than inner, apical sinus about 1/5 of telson length, with 14 spinules on proximal 3/4 of margin (Fig. 12H).

Remarks. This new species bears the following characteristics: (1) eye without denticle at distal end of medial margin of stalk; (2) thoracic endopod 3 with slender carpopropodus 6 times longer than broad; (3) endopod of uropod with spines throughout the inner margin; and (4) telson with spines along almost the entire length of lateral margin.

In these points the new species is similar to *H. armoricana* from the Atlantic coast of France (Nouvel 1940) and *H. eideri* from the Mediterranean coast of France (Băcescu 1941). However, it is distinguishable from the two latter species by the number and arrangement of spines on the carpopropodus of thoracic endopod 3 and on the lateral margin of the telson.

Male is unknown.

Etymology. The species is named after the shape of body and thoracic appendages.

Heteromysoides macrops sp. nov.

(Fig. 13)

Type material. HOLOTYPE — ♀, NTM Cr.005498, 2.8 mm, Coral Bay, Port Essington, 11° 12.0'S 132° 03.0'E, 3-4m N.L. Bruce.

Description. Body depressed dorso-ventrally.

Carapace with frontal margin produced into short triangular rostrum with straight lateral margins, covering basal part of eyes (Fig. 13A), anterolateral corners rounded, posterior margin emarginate, leaving last thoracic somite uncovered dorsally.

Eye large, rectangular, flattened, completely covering antennular peduncle segment 1 in dorsal view, with small cornea located distolaterally in dorsal view (Fig 13A).

Antennular peduncle robust, segment 1 with prolonged distolateral angle tipped with several setae, segment 2 short, connected obliquely with segment 3, segment 3 about as long as segment 1, broader than segment 2, with 4 long setae at distomedial angle (Fig. 13A, B).

Antennal peduncle slightly shorter than anntennular peduncle, segment 2 more than 2 times as long as broad, about half of peduncle length. Antennal scale lanceolate, extending slightly beyond distal margin of segment 2 of own peduncle, less than 3 times longer than broad, inner margin more convex than outer margin, setose all round, distal suture present (Fig. 13C).

Labrum wider than long, with triangular anterior margin with obtusely pointed apex.

Thoracic endopod 2 rather robust, carpopropodus shorter than merus and 2 times as long as dactylus (Fig. 13D).

Thoracic endopod 3 missing. Thoracic endopod 4 slender, merus about 1.3 times longer than ischium, carpopropodus slightly longer than merus, 4-subsegmented, subsegment 1 longer than following 2 subsegments together but shorter than following 3 subseg-

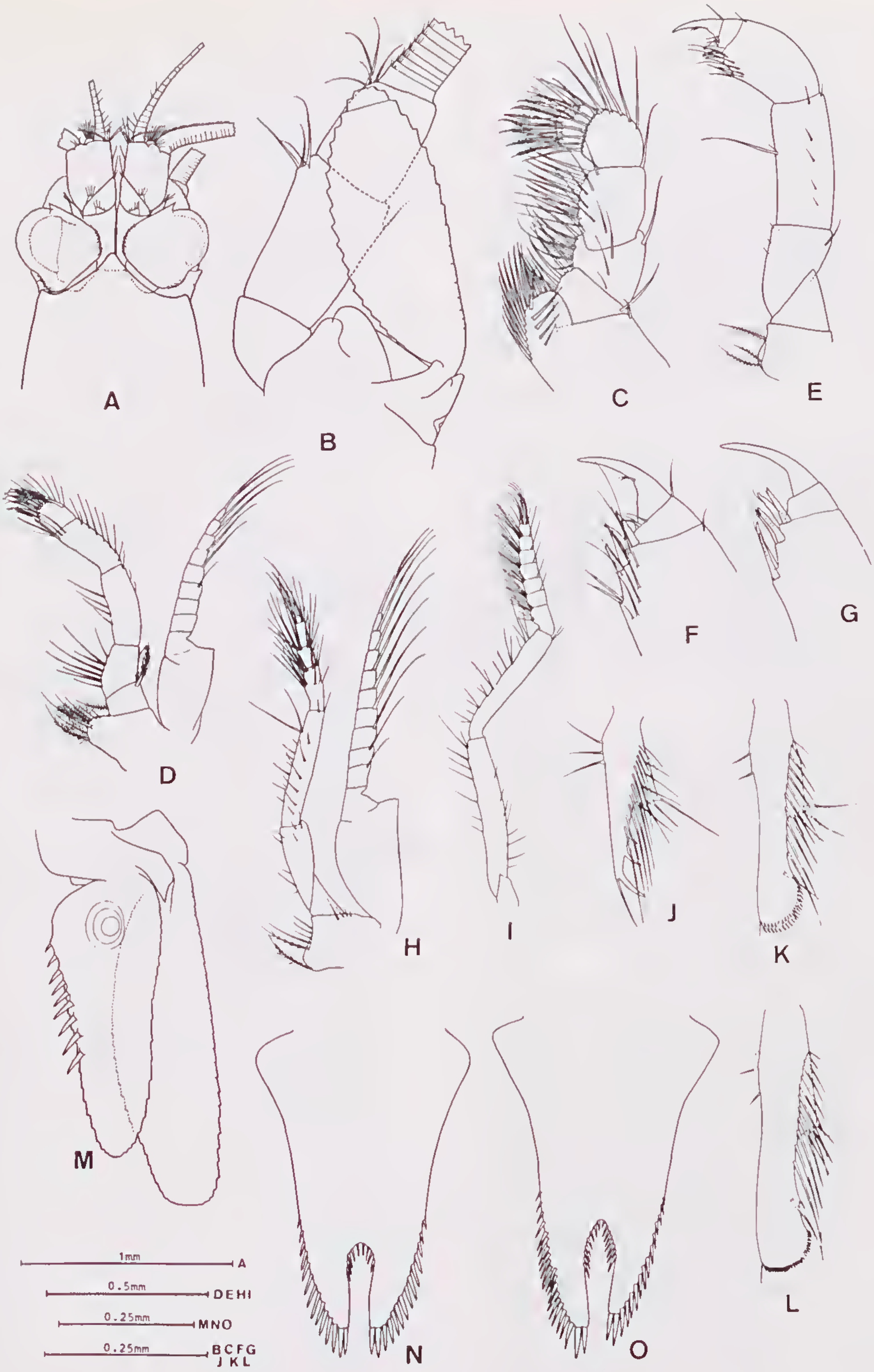

Fig. 11. *Heteromysis (Olivaemysis) tenuispina* holotype except **G, N,** adult ♂: **A,** anterior end; **B,** antenna; **C,** first thoracic endopod; **D,** second thoracic limb; **E,** third thoracic endopod; **F,** extremity of third thoracic endopod; **G,** extremity of third thoracic endopod; **H,** fourth thoracic limb; **I,** eighth thoracic endopod; **J,** second pleopod; **K,** third pleopod; **L,** fourth pleopod; **M,** uropod; **N,** telson; **O,** telson.

ments together (Fig. 13E). Thoracic endopod 5 missing. Thoracic endopods 6-8 equal in structure, merus subequal to ischium, slightly longer than carpopropodus, carpopropodus 4-subsegmented, subsegment 1 slightly longer than following 2 subsegments combined, with 3 groups of setae on inner margin, subsegments 2 and 3 with one group of setae at distal end of inner margin (Fig. 13F). Thoracic exopods with small basal plate with rounded distolateral corner, natatory part 7- or 8-segmented (Fig. 13E,F).

First 5 abdominal somites subequal, somite 6 about 1.3 times longer than somite 5.

Female pleopods uniramous, unsegmented, increasing in length posteriorly, pleopod 5 twice as long as pleopod 1.

Uropod setose all round; endopod extending beyond telson for ⅓ length of endopod, inner margin straight, armed with 8-9 small spines from statocyst to near apex, these spines arranged irregularly and increasing in length distally; exopod slightly longer than endopod, with inner and outer margins convex (Fig. 13G).

Telson triangular with apical sinus, slightly longer than wide, lateral margin slightly concave, naked in proximal half and armed on distal half with 8 spines increasing in length distally, each apex furnished with 2 spines, outer spine twice longer than inner one, apical sinus U-shaped, shallow, ⅑ of telson length, with 3 spines at base and one spine on each lateral margin (Fig. 13H).

Remarks. Five species of *Heteromysoides* have been recorded as follows: *H. cotti* Calman from Canary Islands (Calman 1932), *H. spongicola* Băcescu from Cuba (Băcescu 1968), *H. longiseta* Băcescu from Heron Island (Băcescu 1983), *H. dennisi* Bowman from the Bahamas (Bowman 1985) and *H. berberae* Băcescu and Müller from Somalia (Băcescu and Müller 1985). The shape of eye and the marginal spines of telson relate the new species to *H. cotti* and *H. longiseta*. However, it is easily distinguishable from *H. cotti* by the length of eye, the number of subsegments on carpopropodus of thoracic endopods 5-8 and the arrangement of spines on endopod of uropod, and from *H. longiseta* by lacking long setae on pleopods.

Etymology. The species is named after the large eye.

Key to the heteromysid fauna in Australia

1. Eye cylindrical, cornea more or less globular, occupying distal portion of stalk; male pleopods modified or not modified .... genus *Heteromysis* 2
Eye quadrangular, flattened, cornea located at distolateral corner of stalk; male pleopods not modified .... genus *Heteromysoides* 20
2(1). Eye with a distinct denticle at distal end of medial margin of eyestalk 3
Eye without such a denticle 10
3(2). Lateral margin of telson with spines on distal half only .... *H. (Olivaemysis) tenuispina* sp. nov.
Lateral margin of telson with spines throughout entire margin (sometimes with unarmed gap) 4
4(3). Endopod of uropod with more than 10 spines along entire inner margin .... *H. zeylanica* W. Tattersall
Endopod of uropod with 2-4 spines in statocyst region of inner margin 5
5(4). Lateral margin of telson with unarmed gap 6
Lateral margin of telson with spines throughout 7
6(5). Carpopropodus of thoracic endopod 3 with small spines in addition to strong spines; thoracic endopods 5-8 with 6-subsegmented carpopropodus; body length 4-5mm .... *H. (Olivaemysis) macrophthalma* Băcescu
Carpopropodus of thoracic endopod 3 without small spines; thoracic endopods 5-8 with 7- or 8-subsegmented carpopropodus; body length 5.7-5.9mm .... *H. (Olivaemysis) sexspinosa* sp. nov.
7(6). Telson sinus with spines on proximal 2/3 .... *H. (Olivaemysis) abrucei* Băcescu
Telson sinus with spines along entire margin 8
8(7). Lateral margin of telson with longer interval between last marginal spine and apical spine than other intervals between lateral spines; body length 8-11mm .... *H. waitei* W. Tattersall
Interval between last marginal spine

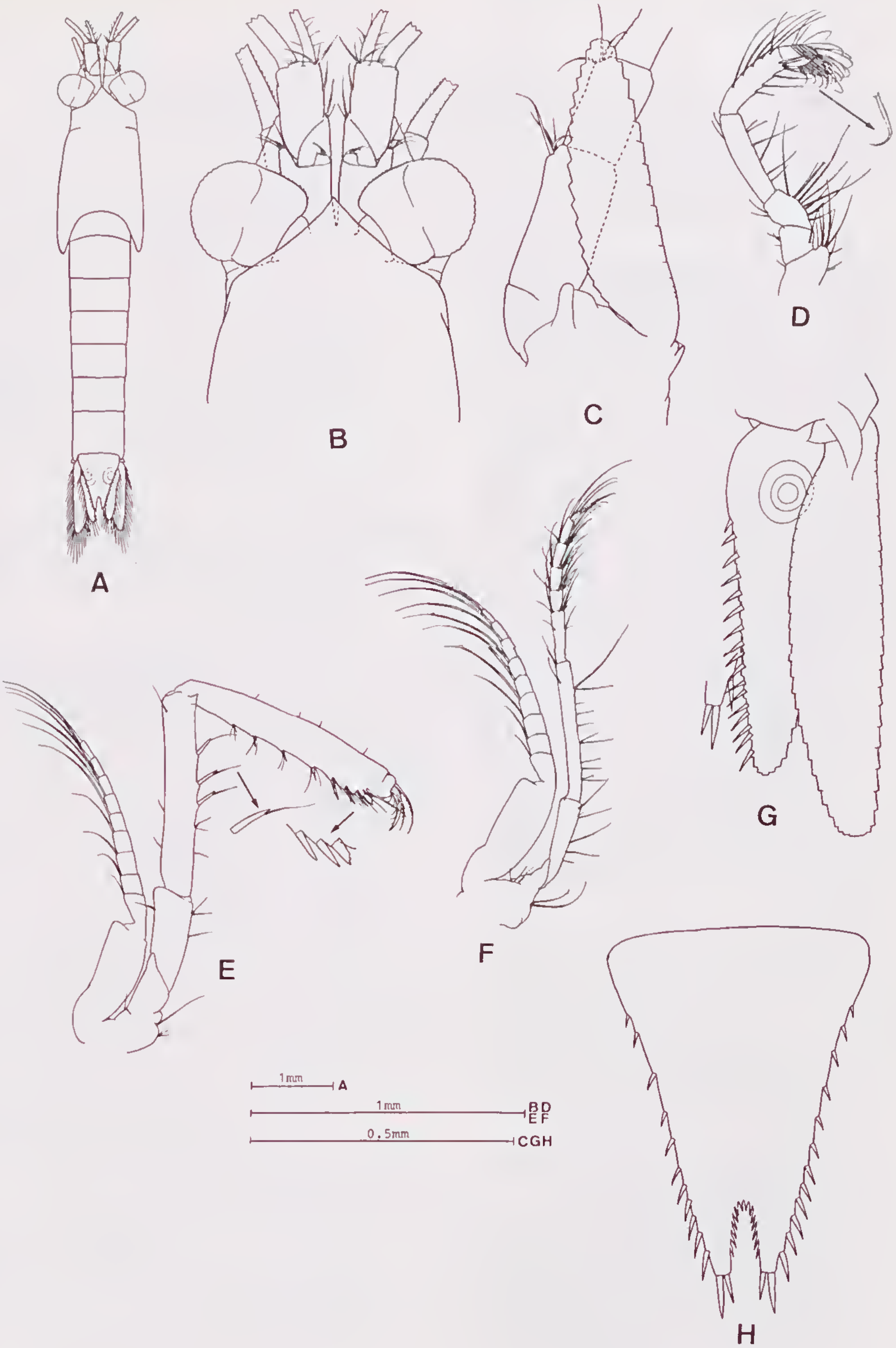

Fig. 12. *Heteromysis gracilis* holotype: **A,** dorsal view of body; **B,** anterior end; **C,** antenna; **D,** second thoracic endopod **E,** third thoracic limb; **F,** fourth thoracic limb; **G,** uropod; **H,** telson.

and apical spines of telson similar to intervals between other marginal spines 9

9(8). Rostrum obtusely pointed; thoracic endopods 5-8 with 6-subsegmented carpopropodus; telson with about 11 spines on lateral margin; telson sinus about 1/3 as long as telson .... *H. (Olivaemysis) quadrispinosa* sp. nov.

Rostrum rounded; thoracic endopods 5-8 with 7- or 8-subsegmented carpopropodus; telson with about 18 spines on lateral margin; telson sinus about 1/4 as long as telson .... *H. (Olivaemysis) sexspinosa* sp. nov.

10(2). Merus of thoracic endopod 3 with serrate inner margin, carpopropodus huge 11

Merus of thoracic endopod 3 without serrate inner margin 12

11(10). Carapace with about 4 rows of minute tubercles on anterior 1/4 .... *H. (Gnathomysis) stellata* Băcescu and Bruce

Carapace without such tubercles on carapace .... *H. (Gnathomysis) harpaxoides* Băcescu and Bruce

12(10). Eye with cornea located at distolateral corner, as in *Heteromysoides* spp. ..... *H. (Heteromysis) spinosa* Băcescu

Eye with cornea more or less hemispherical and located at distal end of stalk 13

13(12). Three antennular peduncle segments each with flagellate spine at distomedial corner .... *H. (Olivaemysis) essingtonensis* sp. nov.

Antennular peduncle without flagellate spine on any segment 14

14(13). Entire lateral margin of telson with spines except short distance on proximal part; thoracic endopod 3 with carpopropodus 6 times longer than broad; telson sinus more than 1/3 as long as telson .. *H. gracilis* sp. nov.

Lateral margin of telson without spines on proximal 1/2-1/3; carpopropodus of thoracic endopod 3 less than 3 times longer than broad (except nearly 5 times in *H. communis*) 15

15(14). Endopod of uropod without spines 16

Endopod of uropod with spines 17

16(15). Telson sinus more than 1/3 as long as telson, with more than 40 spines on margin; lateral margin of telson with about 16 spines; merus of thoracic endopod 3 without flagellate spines .... *H. (Heteromysis) gymnura* W. Tattersall

Telson sinus about 1/4 as long as telson, with about 10 spines on margin; lateral margin of telson with 5 spines; merus of thoracic endopod 3 with flagellate spines .... *H. (Heteromysis) tethysiana* Băcescu

17(16). Endopod of uropod with 16 spines along entire inner margin; telson with 13-15 spines on distal 2/3 of lateral margin .... *H. tasmanica* W. Tattersall

Endopod of uropod with less than 5 spines on proximal half of inner margin; telson with less than 7 spines on distal half of lateral margin 18

18(17). Apex of telson with 2 spines with inner spine longer; endopod of uropod with one spine .... *H. (Heteromysis) australica* Băcescu and Bruce

Apex of telson with 2 spines with outer spine longer; endopod of uropod with more than 2 spines 19

19(18). Endopod of uropod with 2 spines . ... *H. (Heteromysis) heronensis* Băcescu

Endopod of uropod with 4-5 spines .... *H. (Heteromysis) communis* Băcescu

20(1). Eye as long as broad; pleopods 2-5 with enormous terminal seta .... *H. longiseta* Băcescu

Eye longer than broad; pleopods 2-5 without such seta .... *H. macrops* sp. nov.

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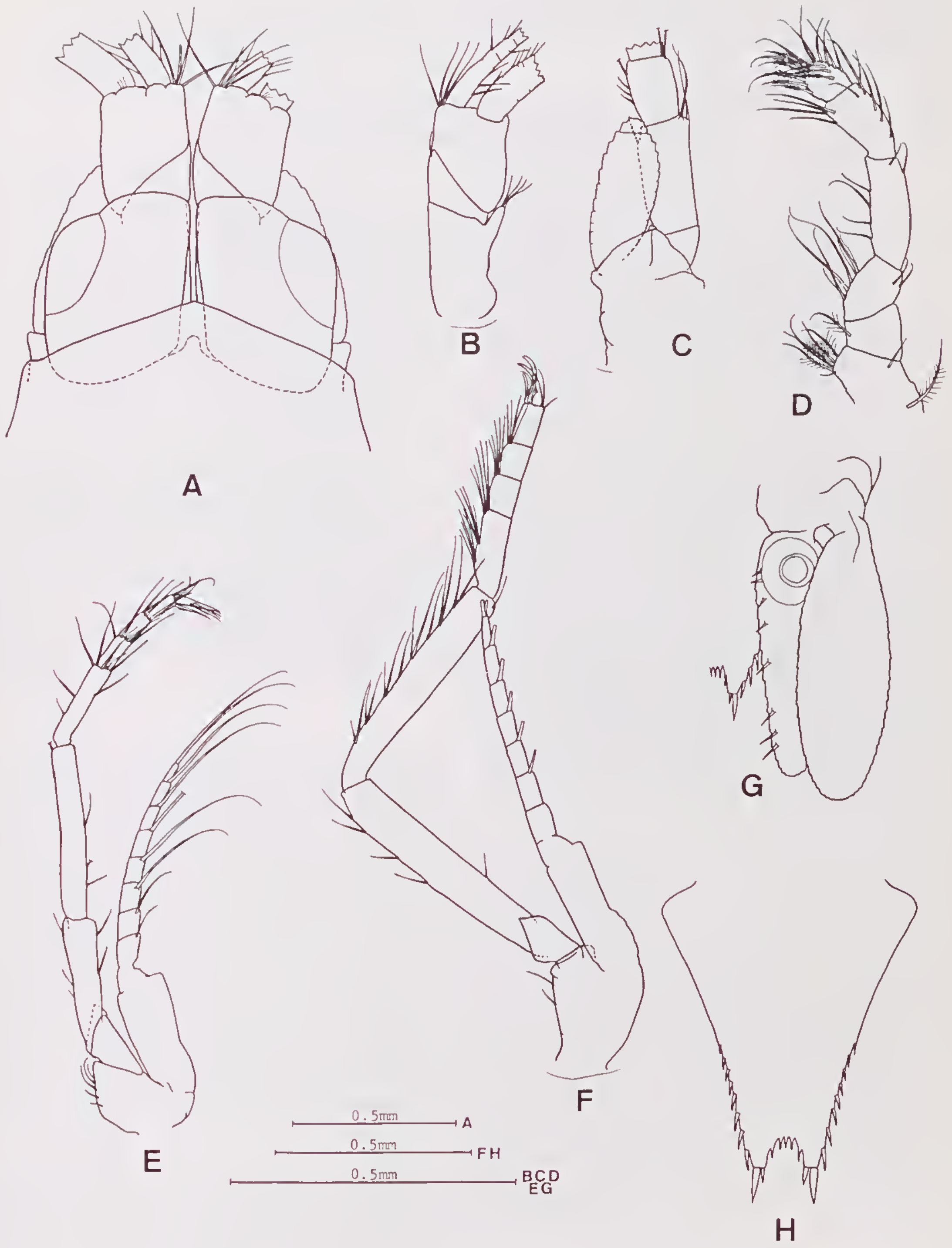

Fig. 13. *Heteromysoides macrops* holotype: **A,** anterior end; **B,** antennule; **C,** antenna; **D,** second thoracic endopod; **E,** fourth thoracic limb; **F,** eighth thoracic limb; **G,** uropod; **H,** telson.

examining the present material. Thanks are also due to Ms J. Ellis, British Museum (Natural History), London, for the loan of specimens of *Heteromysis gymnura*.

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A NEW GENUS AND FIVE NEW SPECIES OF CALLIANASSIDAE (CRUSTACEA: DECAPODA: THALASSINIDEA) FROM NORTHERN AUSTRALIA

K. SAKAI
Laboratory of Crustacea, Shikoku Women's University,
711-11 Tokushima, Ohjincho-Furukawa, Japan.

ABSTRACT

A new genus, *Neocallichirus* and five new species, *N. darwinensis* and *N. horneri* (type species) from around Darwin, Northern Territory, Australia, and *Callianassa acutirostella, C. parvula* and *Neocallichirus caechabitator* from Australian North West Shelf, of Callianassidae (Crustacea: Decapoda: Thalassinidea) are described. *Callianassa praedatrix* de Man, originally reported from Indonesia, is recorded for the first time from Australia. A key to Australian callianassid species is provided.

KEYWORDS: Crustacea, Decapoda, Thalassinidea, Callianassidae, *Callianassa,* new taxa, North West Shelf, Northern Australia.

INTRODUCTION

Some specimens of the family Callianassidae Dana in the collection of the Northern Territory Museum in Darwin have been studied. The material includes specimens collected in 1983 by the R. V. "Soela" (CSIRO) survey in North West Shelf, Western Australia and collections made around Darwin.

All of the Australian callianassids are revised, and a new genus, *Neocallichirus,* is proposed. From north Western Australia two new species, *Callianassa acutirostella* and *C. parvula,* are recorded by the R.V. "Soela". *C. praedatrix* de Man, which was originally reported from Indonesia, is also recorded from North West Shelf as the first Australian record. *C. amboinensis* de Man, which was recorded from Dampier Archipelago by Poore and Griffin (1979:248), is collected also from North West Shelf and added to its callianassid fauna. From the Northern Territory three new species, *Neocallichirus darwinensis, N. horneri* and *N. caechabitator* are now reported.

Fifteen species of Australian callianassid species were described by Poore and Griffin (1979) and one new species by Sakai (1984), so the number of Australian callianassids is increased from 16 to 22 species by adding the five new species described in the present paper and the Indonesian species *C. praedatrix* de Man.

The 22 Australian species are: *Callianassa acutirostella* sp. nov.; *C. amboinensis* de Man, 1888; *C. arenosa* Poore, 1975; *C. australiensis* (Dana, 1852); *C. ceramica* Fulton and Grant, 1906; *C. joculatrix* de Man, 1905; *C. parvula* sp. nov.; *C. praedatrix* de Man, 1905; *Glypturus collaroy* (Poore and Griffin, 1979); *G. karumba* (Poore and Griffin, 1979); *G. martensi* (Miers, 1884); *G. mucronata* (Strahl, 1861); *Calliax aiquimana* (Baker, 1907); *C. bulimba* (Poore and Griffin, 1979); *C. tooradin* (Poore and Griffin, 1979); *Neocallichirus caechabitator* sp. nov.; *N. horneri* sp. nov.; *N. limosa* (Poore, 1975); *N. darwinensis* sp. nov.; *Gourretia coolibah* Poore and Griffin, 1979; *G. manihaniae* Sakai, 1984; *Ctenaocheles collini* Ward, 1945.

Owing to the habit of burrowing in sand and mud, specimens of callianassid species are rarely obtained and, even if captured, they are often much damaged in many cases. Of the five new species described in the present paper two lack both first pereiopods and one lacks its larger cheliped. The key to Australian callianassid species (except the species of *Gourretia* de Saint Laurent and *Ctenocheles* Kishinouye is newly provided for application to damaged specimens without pereiopods.

SYSTEMATICS

Family Callianassidae Dana

Callianassidae Dana, 1852:12. — de Saint Laurent 1974:513.

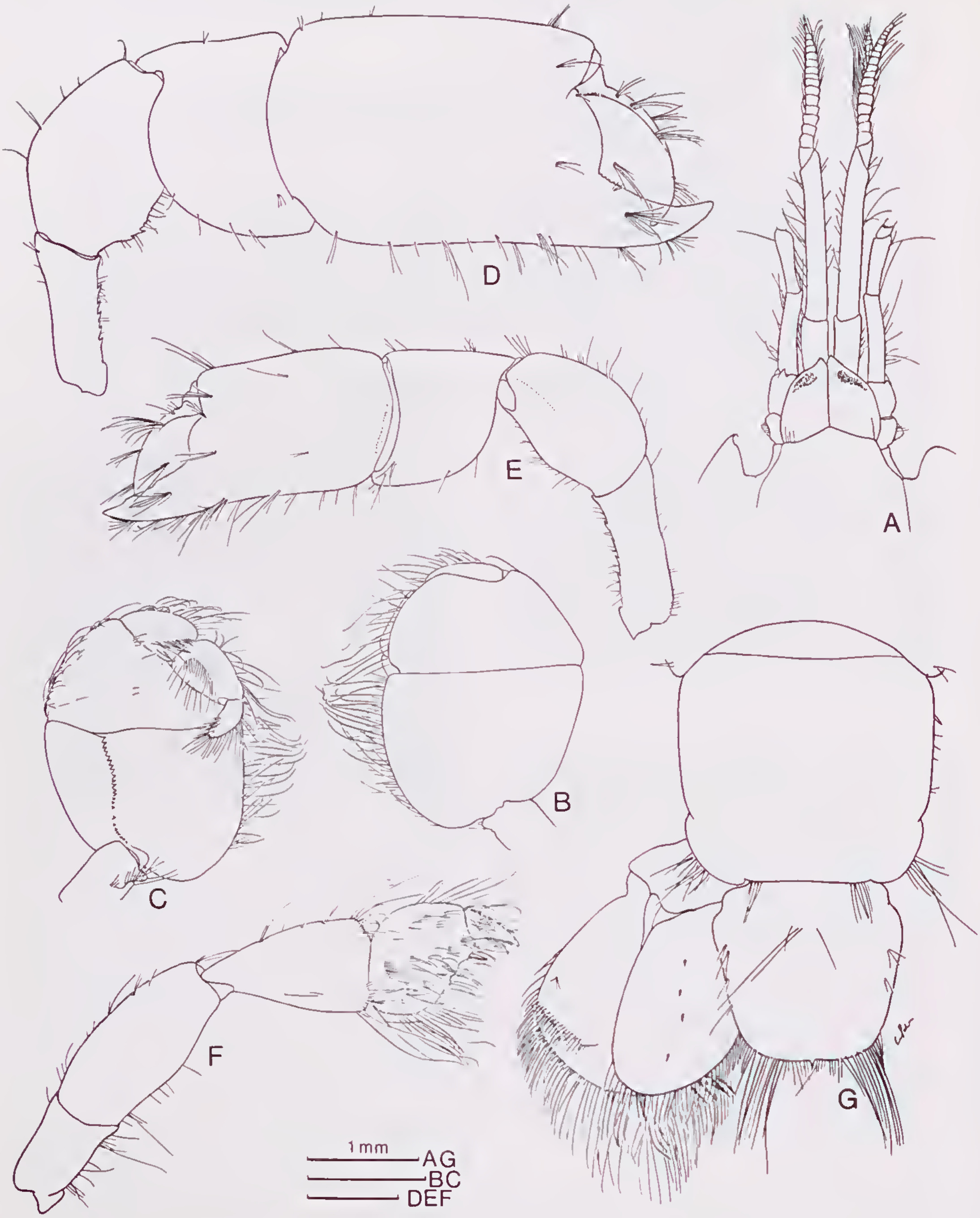

Fig. 1. *Callianassa amboinensis* NTM Cr.005176♀ : **A**, anterior carapace and antennae, dorsal aspect; **B**, third maxilliped, outer aspect; **C**, same, inner aspect; **D**, larger cheliped, outer aspect; **E**, smaller cheliped, outer aspect; **F**, third pereiopod, outer aspect; **G**, sixth abdominal segment and tail-fan, dorsal aspect.

Diagnosis. Linea thallassinica present. No epipods on pereiopods. Posterior lobe of scaphocerite (maxilla 2) without long distal seta. Pleopod 2 different from following pleopods (except in *Callianopsis* de Saint Laurent, 1974; *Ctenocheles* Kishinouye, 1926). Uropod exopod often bilobed. Cheliped large with carpus markedly expanded compared to merus (except *Calliapagurops* de Saint Laurent, 1974).

Australian genera included. *Callianassa* Leach, 1814; *Glypturus* Stimpson, 1866; *Calliax* de Saint Laurent, 1974; *Neocallichirus* gen. nov.; *Gourretia* de Saint Laurent, 1974; *Ctenocheles* Kishonouye, 1926.

Remarks. de Saint Laurent (1974:513) assigned eight genera to Callianassinae on the form of the maxillipeds 1 and 3, uropod exopod, rostral carina, oval of the carapace, cardiac protuberance and others, and later in 1979 she established another new genus, *Paracalliax* from Mauritania, West Africa. However, not all of the genera recognized by de Saint Laurent were accepted by other workers (Manning and Felder 1986:437). In 1986 Manning and Felder redefined *Glypturus* as a distinct genus and later in 1987 Manning established a new genus, *Corallianassa* Manning. He distinguished *Glypturus* from all the other callianassid genera by the combination of characters such as chelipeds, rostrum, lateral rostral spines and the cornea, however, the chelipeds of *Callianassa* sensu lato are known to be sexually dimorphic (Poore 1975:205), so it seems that the characters of rostrum, lateral rostral spines and cornea are not homogeneous in the respective genera.

In this paper de Saint Laurent's scheme of *Callianassa* sensu lato is revised and *Neocallichirus* gen. nov is proposed.

Key to Australian Callianassidae

1. Antennular peduncle exceeding antennal peduncle 2

Antennular peduncle shorter than antennal peduncle 7

2(1). Rostrum distinct, broad or narrow acute spine .... *Callianassa* (part) 3

Rostrum short, broadly-based, obtuse or sharp 5

3(2). Rostrum exceeding eyestalks; (telson slightly wider than long, without median spine) .... *C. parvula* sp. nov.

Rostrum shorter than eyestalks 4

4(3). Telson 1.2 times as wide as long, bearing triangular median spine on posterior margin; maxilliped 3 operculiform, merus width 0.6 length of ischium and merus combined .... *C. acutirostella* sp. nov.

Telson 1.5 times as wide as long, without median spine on posterior margin; maxilliped 3 subpediform, ischium and merus narrow .... *C. joculatrix* de Man

5(2). Antennular peduncle slightly longer than antennal; (telson subquadrate; maxilliped 3 merus width 0.6 length of merus and ischium combined) .... *C. arenosa* Poore

Antennular peduncle distinctly longer than antennal peduncle 6

6(5). Maxilliped 3 combined merus and ischium oval; precorneal region elongate, exceeding antennule segment ... . *C. amboinensis* de Man

Maxilliped 3 merus produced on its inner distal part; precorneal region rounded, not exceeding antennule segment .... *C. australiensis* (Dana)

7(1). Maxilliped 3 propodus and dactylus both tapering .... *Callianassa* (part) 8

Maxilliped 3 propodus subquadrate or subovate and dactylus broadened .... *Calliax* 9

Maxilliped 3 propodus subquadrate and dactylus slender 11

8(7). Maxilliped 3 merus with distal median spine .... *C. praedatrix* de Man

Maxilliped 3 merus without distal median spine; (anterior part of carapace strongly downturned) .... *C. ceramica* Fulton and Grant

9(7). Maxilliped 3 with long exopod; pigmented area of cornea small .... *C. tooradin* (Poore and Griffin)

Maxilliped 3 without exopod; pigmented area of cornea large 10

10(9). Telson concave posteriorly, widest at midpoint ...... *C. aequimana* Baker

Telson straight posteriorly, widest proximally .... *C. bulimba* (Poore and Griffin)

11(7). Uropod exopod tapering posteriorly .... *Glypturus* 12

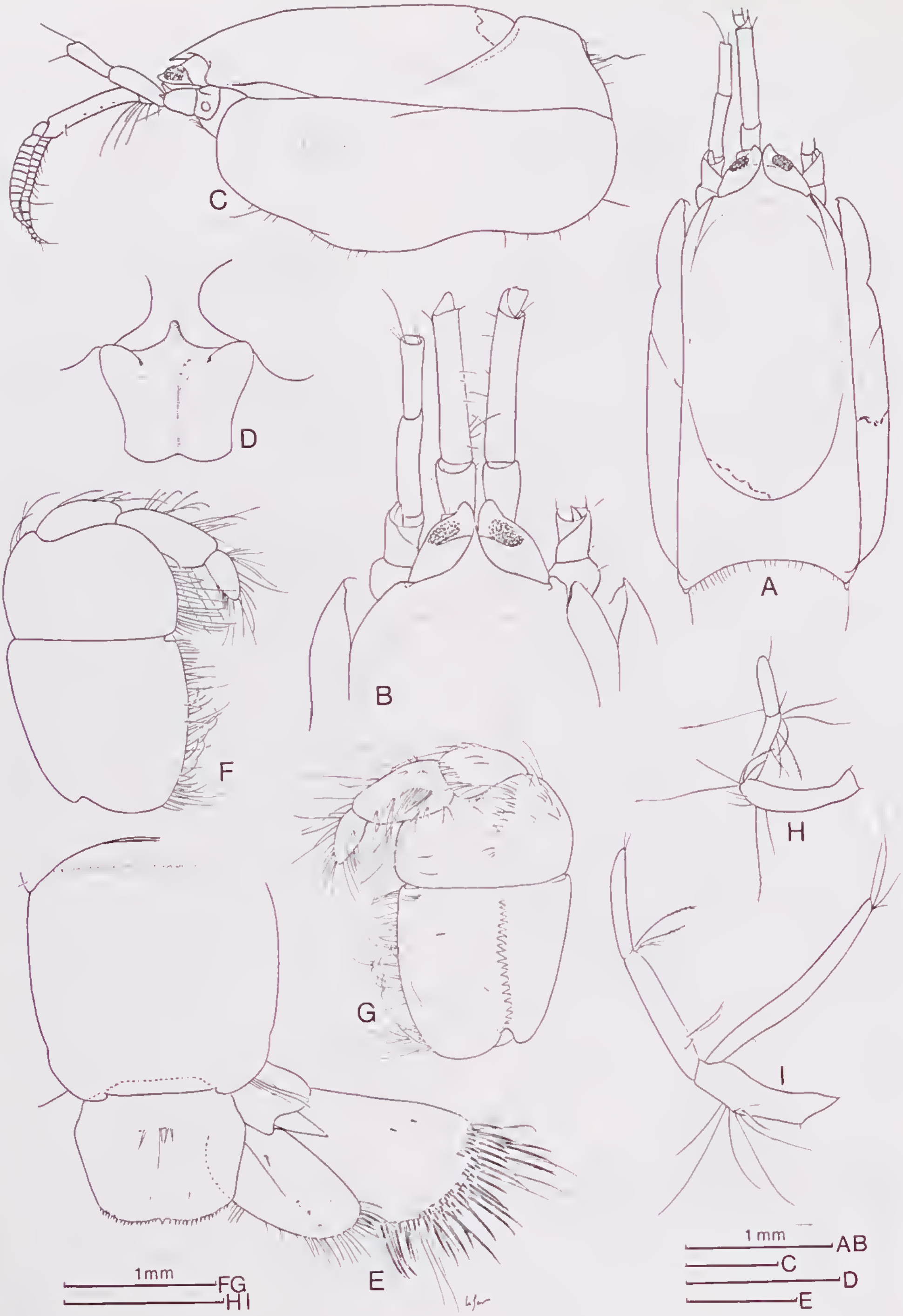

Fig. 2. *Callianassa acutirostella* holotype ♀: **A**, carapace and antennae, dorsal aspect; **B**, anterior carapace and antennae, dorsal aspect; **C**, carapace and antennae, lateral aspect; **D**, third sternite, ventral aspect; **E**, sixth abdominal segment and tail-fan, dorsal aspect; **F**, third maxilliped, outer aspect; **G**, same, inner aspect; **H**, first pleopod in female; **I**, second pleopod in female.

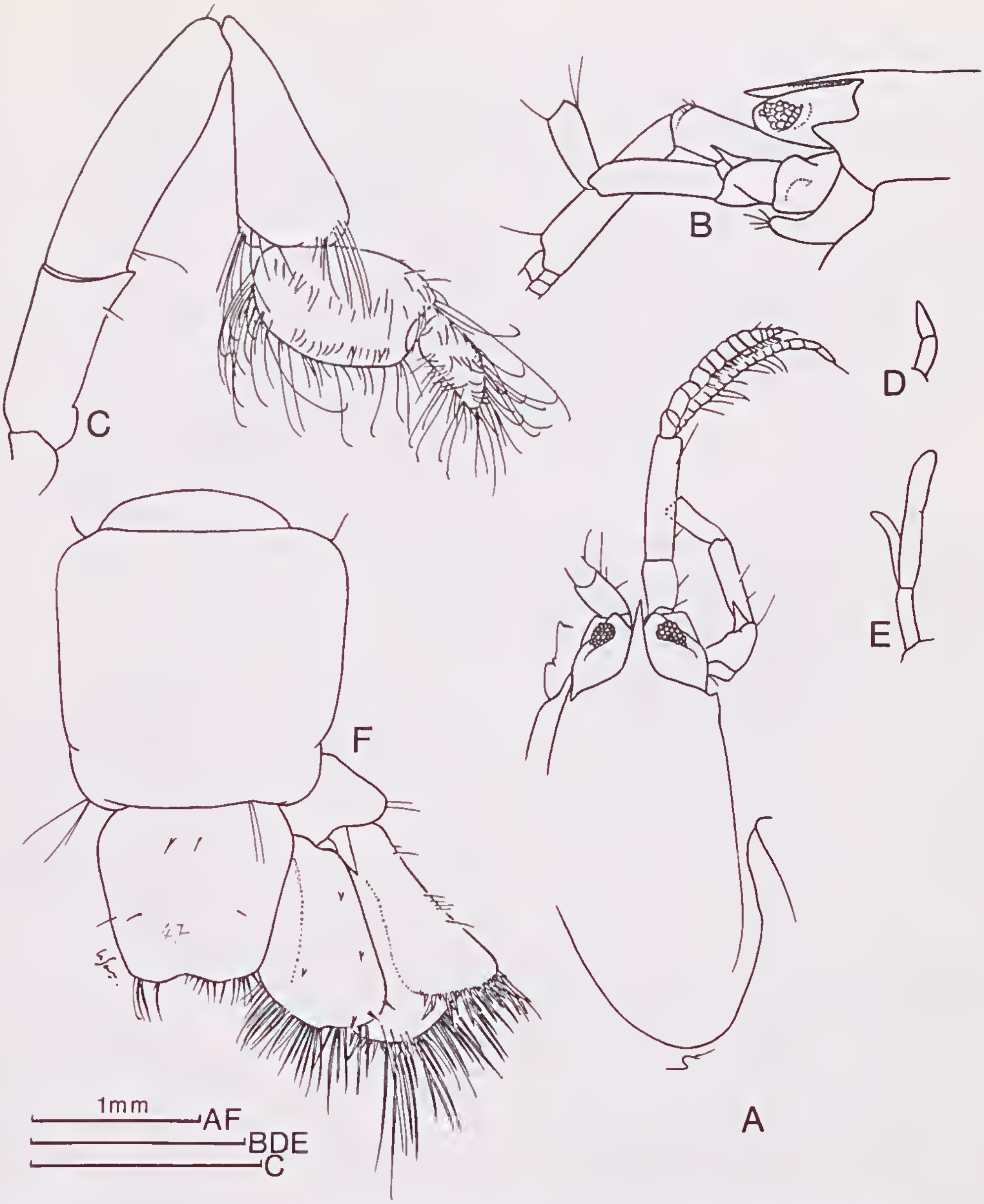

Fig. 3. *Callianassa parvula* holotype ♀ : **A,** anterior carapace and antennae, dorsal aspect; **B,** same, lateral aspect; **C,** third pereiopod, outer aspect; **D,** first pleopod in female; **E,** second pleopod in female; **F,** sixth abdominal segment and tail-fan, dorsal view.

Uropod exopod broadened posteriorly .. *Neocallichirus* 15

12(11). Rostrum distinct, broad or narrow acute spine; lateral projections spinose 13

Rostrum short, broadly-based, obtuse or sharp; lateral projections short, obtuse or obsolete 14

13(12). Telson subovate, widest at midpoint; rostrum directed anteriorly .... *G. collaroy* (Poore and Griffin)

Telson tapering, widest proximally; rostrum directed upwards .... *G. martensi* (Miers)

14(12). Pereiopod 3 propodus not produced on posterior margin; larger cheliped merus convex on dorsal margin; maxilliped 3 without exopod .... *G. mucronata* (Strahl)

Pereiopod 3 propodus distinctly pro-

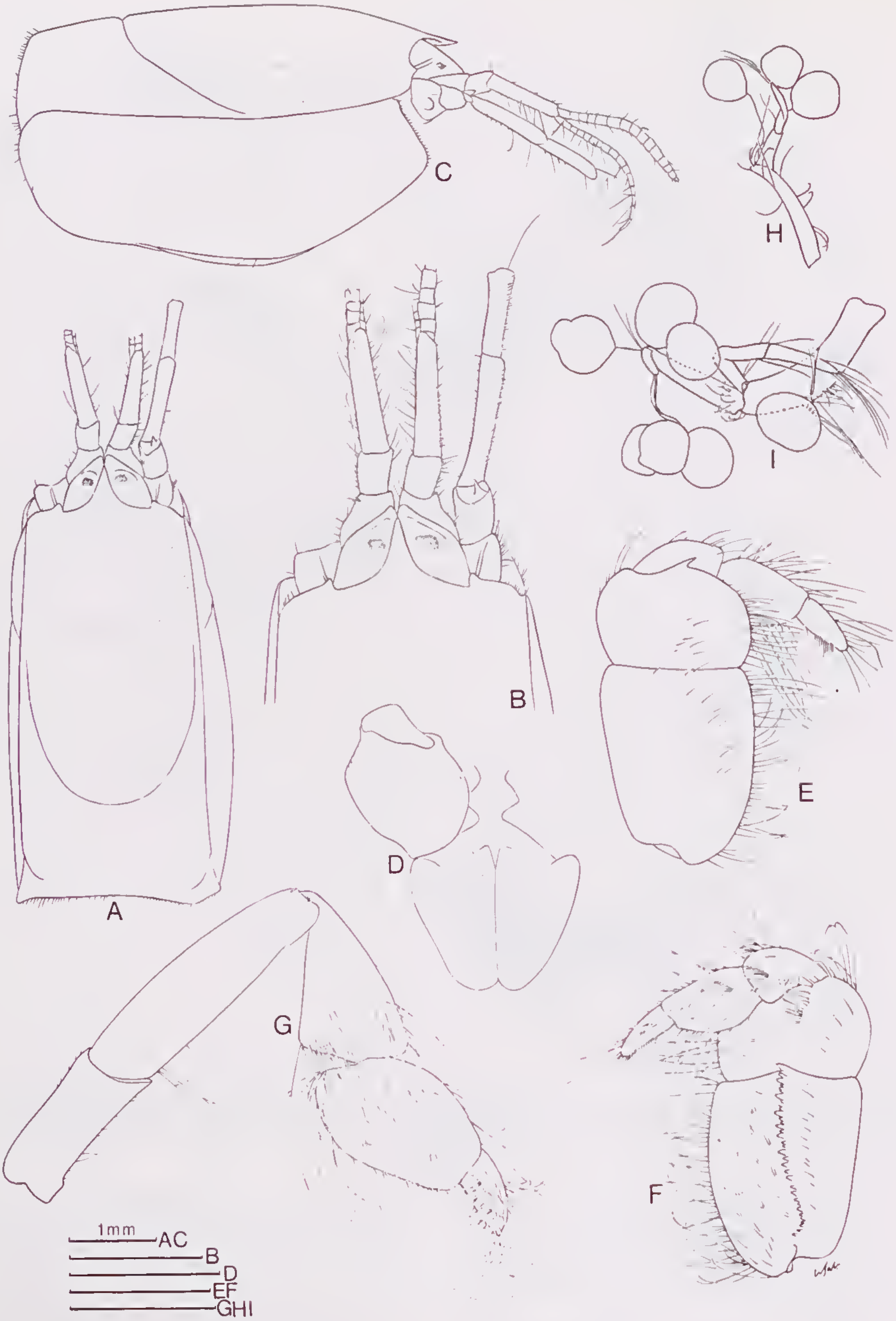

Fig. 4. *Callianassa praedatrix* NTM Cr.005175 ovig. ♀ : **A,** carapace and antennae, dorsal aspect; **B,** anterior carapace, dorsal aspect; **C,** carapace and antennae, lateral aspect; **D,** third sternite, ventral aspect; **E,** third maxilliped, outer aspect; **F,** same, inner aspect; **G,** third pereiopod, outer aspect; **H,** first pleopod with eggs; **I,** second pleopod with eggs.

duced on posterior margin; larger cheliped merus straight on dorsal margin, irregularly spinose ventrally; maxilliped 3 with small exopod .... *G. karumba* (Poore and Griffin)

15(11). Pereiopod 3 propodus distinctly produced on posterior margin .... *N. horneri* sp. nov.

Pereiopod 3 propodus not produced on posterior margin 16

16(15). Eye peduncle truncate distally. Pigmented area of cornea compact and subdistally situated .... *N. darwinensis* sp. nov.

Eye peduncle rounded distally .. 17

17(16). Larger cheliped merus with strong proximal hook on ventral margin; eye central .... *N. limosa* (Poore)

Larger cheliped merus proximally serrated on ventral margin; eye subdistal .... *N. caechabitator* sp. nov.

Genus Callianassa Leach

Callianassa Leach, 1814:386, 400; de Saint-Laurent 1974:514 (type species *Cancer (Astacus) subterraneus* Montagu, 1808).

Trypaea Dana, 1852:513, synonymized by de Saint Laurent 1973:514.

Diagnosis. Carapace with well defined oval, without rostral carina or posterior protuberance. Maxilliped 3 without exopod, endopod pediform or operculiform, propodus less than 3 times broader than dactylus, dactylus narrow.

Species included. *C. parvula* sp. nov.; *C. acutirostella* sp. nov.; *C. joculatrix* de Man (1905:610); *C. arenosa* Poore, (1975:197); *C. amboinensis* de Man, (1888:480); *C. australiensis* (Dana, 1852:573); *C. praedatrix* de Man, (1905:607); *C. ceramica* Fulton and Grant, (1906:121).

Callianassa amboinensis De Man

(Fig. 1)

Callianassa amboinensis de Man, 1888:480-482, Pl. 20, Fig. 4. — Poore and Griffin 1979:248-250, Fig. 14. — Sakai 1984:96-99, Figs 1-2.

Material. 1 ♀, NTM Cr. 005176, TL 21mm, CL 4mm, Stn C1/44, Table Head, Port Essington, Northern Territory, 11° 14.8′S 132° 10.8′E, 11.v.1983, scuba, N.L. Bruce.

Remarks. The present small female specimen, probably immature, is to be assigned as de Man's species *C. amboinensis* on account of the shapes of pigmented area, antennular peduncles, 3rd maxillipeds, 1st pereiopods, tail-fan and the propodus of 3rd pereiopods (Fig. 1A-G).

Distribution. This species is widely distributed on reefs at: Heron Island, Queensland; Port Essington, Northern Territory; Dampier Archipelago, north Western Australia; Ambon, Indonesia (type locality). This is the first record from Northern Territory.

Callianassa acutirostella sp. nov.

(Fig. 2)

Type material. HOLOTYPE — ♀, NTM Cr.000786, TL 20mm, CL 4.5mm, RV "Soela", Stn. B4, epibenthic sledge, North West Shelf, Western Australia, 19° 05.1′S 118° 53.7′E, 82m, 27.iv.1983, T. Ward.

Description. Female. Rostrum (Fig. 2A-C) broadly-based downturned acute spine, more than half length of eyestalks; both lateral projections obsolete. Cervical groove situated on posterior fifth of carapace, including rostrum. Pereiopod 3 sternite convex with shallow median suture on surface (Fig. 2D).

Eyestalks converging anteriorly with obtuse innerdistal tip, reaching slightly beyond antennular peduncular segment 1; pigmented area large, subterminal. Antennular peduncular segment 1 slightly longer than segment 2, distal segment long, more than three times as long as segment 2; flagella subequal to terminal peduncular segment. Antennal peduncle shorter than antennular reaching before distal part of antennular peduncular segment 3; terminal segment shorter than penultimate; scaphocerite small, rod-like.

Maxilliped 3 (Fig. 2F, G) merus width about 0.6 length of ischium and merus combined, merus 0.6-0.7 length of ischium; ischium with curved row of 18 spinules on inner surface. Carpus slightly broadened distally; propodus tapering, simple, more than half as wide as long; dactylus tapering, length about same width of propodus.

Pereiopods 1 and 3 missing.

Pleopod 1 in female (Fig. 2H) uniramous, slender, three-segmented. Pleopod 2 (Fig.

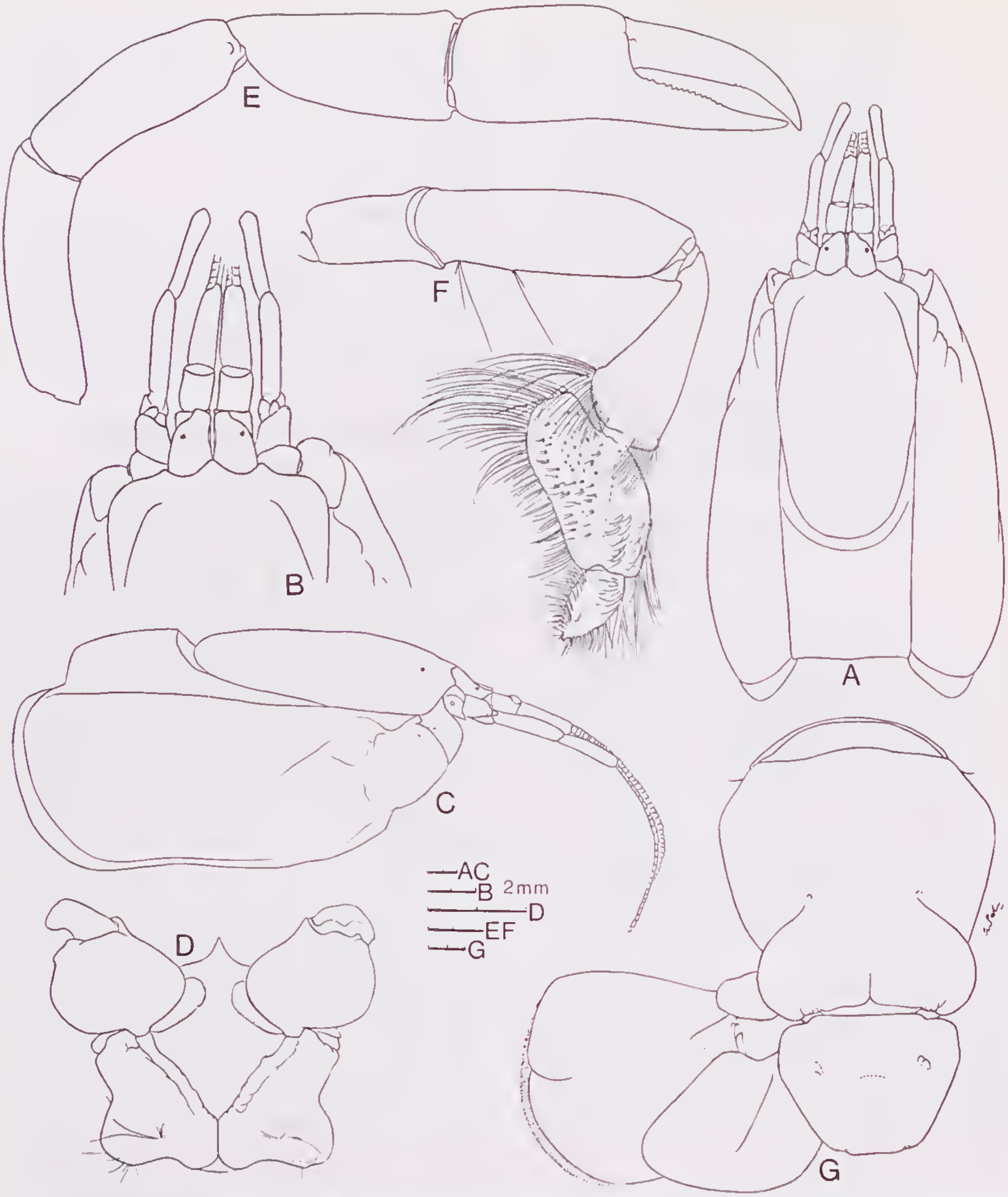

Fig. 5. *Neocallichirus darwinensis* holotype ♀: **A,** carapace and antennae, dorsal aspect; **B,** anterior carapace, dorsal aspect; **C,** carapace and antennae, lateral aspect; **D,** third sternite, ventral view; **E,** smaller cheliped, outer aspect; **F,** third pereiopod, outer aspect; **G,** sixth abdominal segment and tail-fan, dorsal aspect.

2I) biramous, slender; exopod subequal to two-segmented endopod.

Telson (Fig. 2E) 1.2 times as wide as long, converging posteriorly on distal two-thirds, posterior margin armed with triangular median spine; endopod 1.6 times as long as wide, overreaching telson and with median carina on proximal two-thirds; exopod longer and wider than endopod, straight on lateral margin and largely convex on posterior margin, continuous to medial margin.

Etymology. This species is named from the latin words, *acutus* meaning sharp and *rostellum,* diminitive form of rostum as shown in the morphology.

Remarks. The present specimen is small in size, only measuring 20mm in total length, but can be safely considered mature as the first and second pleopods are well developed with plumose setae.

C. acutirostella is similar to *C. parvula* and *C. joculatrix* in having a spinose rostrum and the antennular peduncle exceeding the antennal peduncle, but distinguished from the latter two species in the shapes of the 3rd maxillipeds and the tail-fan. In *C. parvula* the 3rd maxillipeds are lost, so it is impossible to compare it with the other two species, however the telson is slightly wider than long and without a posterior median spine, while in *C. acutirostella* it is 1.2 times as wide as long and with a posterior median spine and in *C. joculatrix* 1.5 times as wide as long and without a posterior median spine. In *C. joculatrix* the shape of the 3rd maxillipeds is characteristic as it is narrow. The relationship between *C. acutirostella* and *C. parvula* are further described in the remarks on *C. parvula.*

Distribution. North West Shelf, Western Australia, shallow water.

Callianassa parvula sp. nov.
(Fig. 3)

Type material. HOLOTYPE — ♂, NTM Cr.000783, TL 15mm, CL 4mm, R.V. "Soela", epibenthic sledge, North West Shelf, Western Australia, 19° 04.4'S 118° 47.35'E, 83m, 27.iv.1983, T. Ward.

Description. Male. Carapace thinly calcified and much damaged. Rostrum (Fig. 3A,B) narrow forwardly-directed acute spine, overreaching eyestalks; lateral projections obtuse, half length of eyestalks. Cervical groove on posterior fourth of carapace, excluding rostrum.

Eyestalks converging anteriorly from about mid-length to obtuse apex; pigmented area large, subdistal on outer-lateral margin. Antennular peduncular segment 1 nearly reaching distal margin of eyestalk; terminal segment elongate, more than twice length of segment 2; antennular flagella short, thick, slightly longer than segments 2 and 3 combined. Antennal peduncular segment 4 distinctly overreaching antennular penultimate segment; segment 5 shorter than segment 4, failing to reach distal margin of antennular peduncle; scaphocerite slender and acute at tip.

Maxillipeds 3 and pereiopods 1 missing.

Pereiopods 3 (Fig. 3C) propodus 1.5 times as long as broad, posterior margin rounded; dactylus about 0.33 length of propodus.

Pleopod 1 in male (Fig. 3D) simple, small and two-segmented. Pleopod 2 (Fig. 3E) biramous; endopod and exopod narrow, leaf-like.

Telson (Fig. 3F) slightly wider than long, converging distally from near its proximal to distal angle; distal margin slightly concave and without median spine. Uropodal endopod longer than telson; exopod slightly longer than endopod, lateral margin largely concave.

Etymology. The species is named from the latin words, *parvus* meaning small and *ule,* the latin diminutive suffix.

Remarks. The holotype is much damaged, however its characteristics are discernible from other species.

As mentioned in the remarks of *C. acutirostella, C. parvula* is closely related to *C. acutirostella* in the acute rostrum and the elongated terminal segment of antennular peduncle and also the large pigmented area of the eyestalks, however it differs in that, in *C. parvula,* the rostrum is a narrow acute spine, much longer than the eyestalks and the scaphocerite is distinct, slender and with an acute tip, while in *C. acutirostella,* the rostrum fails to reach the distal margin of the eyestalks and the scaphocerite is small.

Distribution. North West Shelf, Western Australia, shallow waters.

Callianassa praedatrix de Man
(Fig. 4)

Callianassa praedatrix de Man, 1905:607.
Callianassa (Cheramus) praedatrix — de Man 1928:146, Pl. 15, Figs 22-22d.

Material. 1 ovig. ♀, NTM Cr.005175, TL wanting abdominal somite 6 and telson 15mm, CL including rostrum 5mm., RV "Soela", trawl, North West Shelf, Western Australia, 19° 58.4'S 117° 49.1'E, 42m, 26.vi.1983.

Description. Damaged female specimen. Rostrum (Fig. 4A-C) anteriorly-directed acute triangle, more than half length of eyestalks; lateral projections obtusely triangular, 0.2 length of eyestalks. Dorsal transverse part of cervical groove situated on posterior fourth of carapace, excluding rostrum. Pereiopod 3 sternite (Fig. 4D) heart-shaped

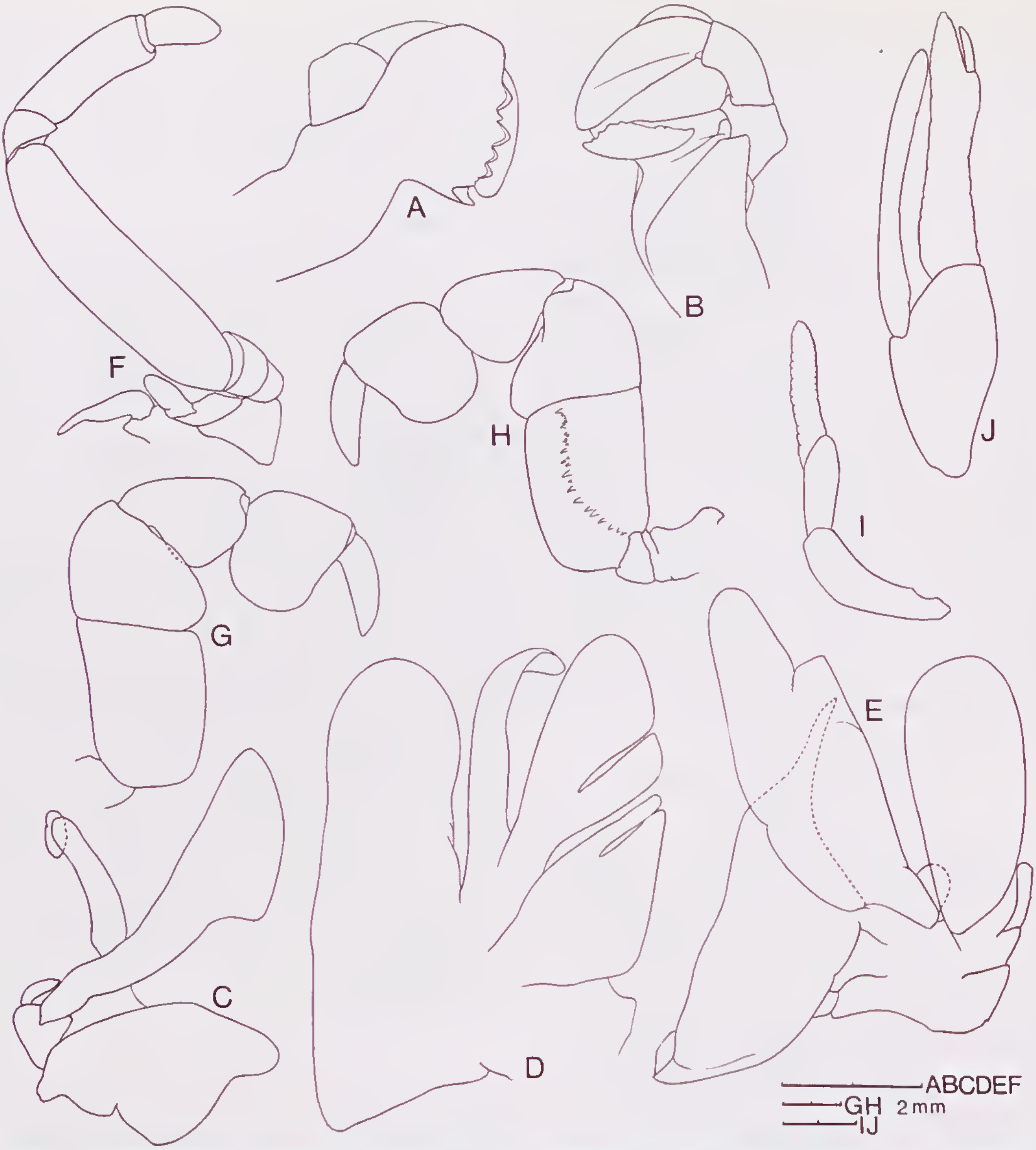

Fig. 6. *Neocallichirus darwinensis* holotype ♀ : **A,** mandible, outer aspect; **B,** same, inner aspect; **C,** maxillule, outer aspect; **D,** maxilla, outer aspect; **E,** first maxilliped, outer aspect; **F,** second maxilliped, outer aspect; **G,** third maxilliped, outer aspect; **H,** same, inner aspect; **I,** first pleopod in female; J, second pleopod in female.

with narrow median groove, laterally thickened with rounded anterolateral angle.

Eyestalks medially contiguous, converging anteriorly from about mid-length, apex obliquely truncate, reaching before distal margin of antennular peduncular segment 1; dorsal surface transversely concave anterior to pigmented area; eye large, central. Antennular peduncular segment 1 thick, about twice length of segment 2, latter about one third length of distal segment; flagella slightly shorter than peduncle. Antennal peduncle exceeding antennular by proximal part of distal segment, penultimate segment about 1.5 times as long as distal; scaphocerite short and pointed, flagellum wanting.

Eyestalks medially contiguous, converging anteriorly from about mid-length, apex obliquely truncate, reaching before distal margin of antennular pedunclar segment 1; dorsal surface transversely concave anterior to pigmented area; eye large, central. Antennular peduncular segment 1 thick, about twice length of segment 2, latter about one third length of distal segment; flagella slightly shorter than peduncle. Antennal peduncle exceeding antennular by proximal part of distal segment, penultimate segment about 1.5 times as long as distal; scaphocerite short and pointed, flagellum wanting.

Maxilliped 3 (Fig. 4E, F) merus width about half length of ischium and merus combined; ischium 1.2 times as long as wide, with row of about 37 obtuse, irregularly-sized teeth on inner surface; merus slightly more than 0.5 length of ischium, rounded on medial margin and provided with sharp, inwardly directed median spine on distal margin; carpus, propodus and dactylus slender.

Pereiopods 1 wanting.

Pereiopods 3 (Fig. 4G) propodus oval, 1.5 times as long as broad, outer surface setose; dactylus about 0.5 length of propodus.

Pleopods 1 in female (Fig. 4H) uniramous, slender and three-segmented. Pleopods 2 (Fig. 4I) biramous and slender, exopod and endopod two-segmented.

Tail-fan lost.

Remarks. The single female specimen is small in size, measuring only 15mm in total length excluding the 6th abdominal somite and the telson.

Though the specimen described is without the 1st pereiopods and the tail-fan, it shows sufficient characteristics for it to be identified as *C. praedatrix* in the shape of the 3rd maxillipeds and the 3rd pereiopods, the relative length of the terminal segment of the antennular peduncle, which is three (de Man 1928) or four times (de Man 1905) as long as the penultimate, and the spiniform rostrum, reaching to the middle of 1st segment of the antennular peduncle.

C. praedatrix is closely related to *C. propinqua* de Man, 1905, *C. modesta* de Man, 1905 from Indonesia and *C. longicauda* Sakai, 1967 from Japan, in bearing a large distal spine on the merus of the 3rd maxilliped.

Distribution. North West Shelf, Western Australia, 42m deep; 4° 20′S 122° 58′E, between Wowoni and Butung, Indonesia, 75-94m (Type locality). New to the Australian fauna.

Genus *Glypturus* Stimpson

Glypturus Stimpson, 1866:46. — Manning and Felder 1986:437 (type species *Glypturus acanthochirus* Stimpson, 1866).

Diagnosis. Carapace with well defined oval, without rostral carina or cardiac protuberance. Maxilliped 3 with or without exopod, endopod subpediform or operculiform, propodus expanded, over 3 times broader than dactylus. Uropod endopod tapering distally. Telson much broader than long, and much shorter than uropod.

Australian species included. *G. collaroy* (Poore and Griffin 1979:260); *G. martensi* (Miers, 1884:13) (= *Callianassa haswelli*, Poore and Griffin, 1979, synonymized by Sakai 1984:99); *G. mucronata* (Strahl, 1861:1056); *G. karumba* (Poore and Griffin, 1979:266).

Genus *Calliax* de Saint Laurent

Calliax de Saint Laurent, 1974:514 (type species *Callianassa lobata* de Gaillande and Lagardere, 1966).

Diagnosis. Carapace without defined oval, without rostral carina or cardiac protuberance. Maxilliped 3 with or without exopod; endopod subpediform or operculiform, propodus expanded, with dactylus nearly as long as broad and with rounded tip.

Australian species included. *C. tooradin* (Poore and Griffin, 1979:275); *C. aequimana* (Baker, 1907:182); *C. bulimba* (Poore and Griffin, 1979:257).

Genus *Neocallichirus* gen. nov.

Type Species. *Neocallichirus horneri* sp. nov.

Diagnosis. Carapace with well defined oval, without rostral carina or cardiac protuberance. Maxilliped 3 without exopod, endopod subpediform, propodus expanded, over 3 times broader than dactylus. Uropod endopod broadened posteriorly. Telson about as long as broad, about as long as uropod.

Australian species included. *N. horneri* sp. nov., *N. darwinensis* sp. nov., *N. limnosa* (Poore), *N. caechabitator* sp nov.

Non-Australian species included. *N. grandimana* (Gibbes, 1850:194); *N. pachydactyla* (A.Milne Edwards, 1870:86); *N. indica* (de Man, 1905:605); *N. moluccensis* (de Man, 1905:606); *N. rathbunae (Schmitt, 1935:4);*

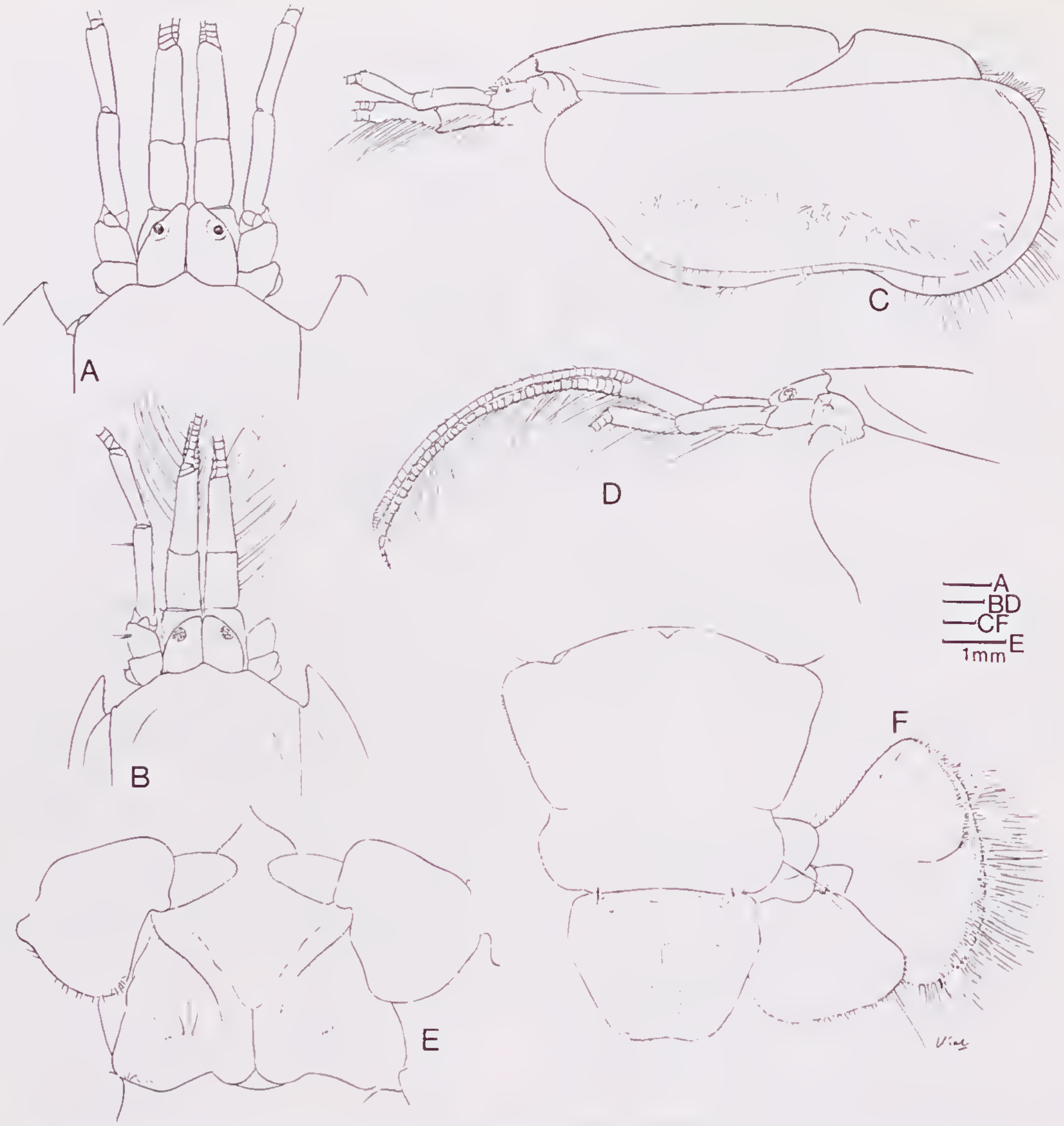

Fig. 7. *Neocallichirus horneri:* **A,** anterior carapace and antennae, dorsal aspect, holotype ♀ ; **B-F,** paratype ♂ - **B,** anterior carapace and antennae, dorsal aspect; **C,** carapace and antennae, lateral aspect; **D,** anterior carapace, lateral aspect; **E,** third sternite, ventral aspect; **F,** sixth abdominal segment and tail-fan, dorsal aspect.

N. natalensis (Barnard, 1946:379); *N. sassandrensis* (Le Leoff and Intes, 1974:43).

Remarks. This genus is closely related to *Callichirus, Glypturus* and *Calliax* in that the propodus of the maxilliped 3 endopod is expanded, however, it is distinguished from them by a combination of characters as the telson is nearly as long as broad and about as long as the uropod, and the uropod endopod is broadened posteriorly.

Neocallichirus darwinensis sp. nov. (Figs 5, 6)

Type Material. HOLOTYPE — ♀, NTM Cr.000090, TL 110mm, CL 24mm, Mindil Beach, Darwin, Northern Territory, ELWS, 13.xi.1981, J.R. Hanley.

Description. Female. Large species. Rostrum (Fig. 5A-C) broadly-based downturned, obtusely triangular, 0.1-0.2 length of eyestalk; lateral projections broad and obtuse, about as long as or half as long as rostrum. Cervical groove deeply incised on posterior third of carapace. Pereiopod 3 sternite (Fig. 5D) showing characteristic diamond-shaped thickening (Holthuis and Gottlieb 1958:60); median Y-shaped thickening of this diamond-shaped structure broadened with two tufts of setae, both lateral platforms smooth on surface, contiguous medially on their posterior halves.

Eyestalks medially contiguous, converging anteriorly from about mid-length to obliquely truncate precorneal region, reaching slightly beyond antennular peduncular segment 1; pigmented area compact, subdistal.

Antennular peduncular segment 1 about 1.5 times length of segment 2, latter about 0.5 of length of distal segment; flagella subequal, about 1.8 times as long as peduncle. Antennal peduncle exceeds antennular by proximal part of peduncular segment 5, penultimate segment about 1.2 times long as terminal, scaphocerite rounded protuberance; flagellum 40mm in length.

Mandibular palp (Fig. 6A, B) three-segmented, incisor process bearing eight irregular teeth, including proximal triangular tooth separated from others by deep concavity, molar process with row of obtuse denticles. Maxillular exopod (Fig. 6C) two-segmented, distal segment short, flattened, distally flexed on proximal segment. Maxillar scaphognathite (Fig. 6D) broad. Maxilliped 1 (Fig. 6E) palp a small rounded lobe. Maxilliped 2 (Fig. 6F) merus broadly bent inward, 1.2 times as long as three distal segments combined; dactylus short, about 0.5 length of propodus. Maxilliped 3 (Fig. 6G, H) ischium and merus combined as broad plate, former with sinous row of about 30 irregularly arranged spines on inner surface; carpus broadened distally; propodus broadly expanded to form subquadrate plate; dactylus slender, about as long as propodus.

Pereiopod 1 larger cheliped missing. Smaller cheliped (Fig. 5E) slender; ischium, merus and carpus elongated, subequal in length. Chela about 1.5 times as long as carpus; fixed finger slightly shorter than dactylus, cutting edge with row of 14 denticles on proximal two-thirds, dactylus narrow, cutting edge entire.

Pereiopod 3 (Fig. 5F) merus more than twice length of ischium; carpus about 0.75 length of merus, broadened distally in narrow triangular shape; propodus and dactylus setose, former about 2 times as long as wide, smooth on ventral margin and with rounded posterior lobe almost parallel to ventral margin of carpus, dactylus small and triangular.

Pleopod 1 in female (Fig. 6I) uniramous, three-segmented; pleopod 2 (Fig. 6J) biramous, narrow, leaf-like, endopod broader and longer than exopod, appendix interna rod-like, situated on distal part of medial margin. Pleopods 3-5 biramous, broad, leaf-like, endopod broadened, appendix interna reduced hook in middle part of medial margin.

Telson (Fig. 5G) about half length of abdominal somite 6, about 1.2 times as wide as long, widest proximally, converging posteriorly on distal two-thirds; distal margin narrowly truncate, dorsal surface with transverse row of setae in midline and posteriorly longitudinally concave with longitudinal rows of setae on both sides. Uropodal exopod about as long as broad, 1.5 times length of endopod; endopod subsquare, distinctly exceeding telson.

Etymology. The present species is named after the locality where the specimen was collected.

Remarks. The single female specimen lacks a larger cheliped, however, it shows features enough to be distinguished from other Australian species. This species is closely related to *N. moluccensis* from the reef of Ambon, Indonesia, in the form of an obliquely truncate precorneal region. The type material of *N. moluccensis*, a male measuring 60mm in length, large enough to show specific characters, was not accessible to me, however it was described by de Man (1905:606; 1928:159), who compared it with *N. indica*.

In *N. moluccensis* the antennal peduncle projects by nearly two thirds of the terminal segment beyond the antennular peduncle, the terminal and penultimate antennal segments are of nearly equal length; the eyestalks do not reach to the distal end of the basal antennular peduncle, and are provided with short setulae on each inner dorsal surface; the distinctly faceted and black pigmented corneae are large, and located on the proximal half. On the other hand, *N. darwinensis* shows that the eyestalks overreach the proximal antennular segment, and without short setulae on the inner dorsal surface;

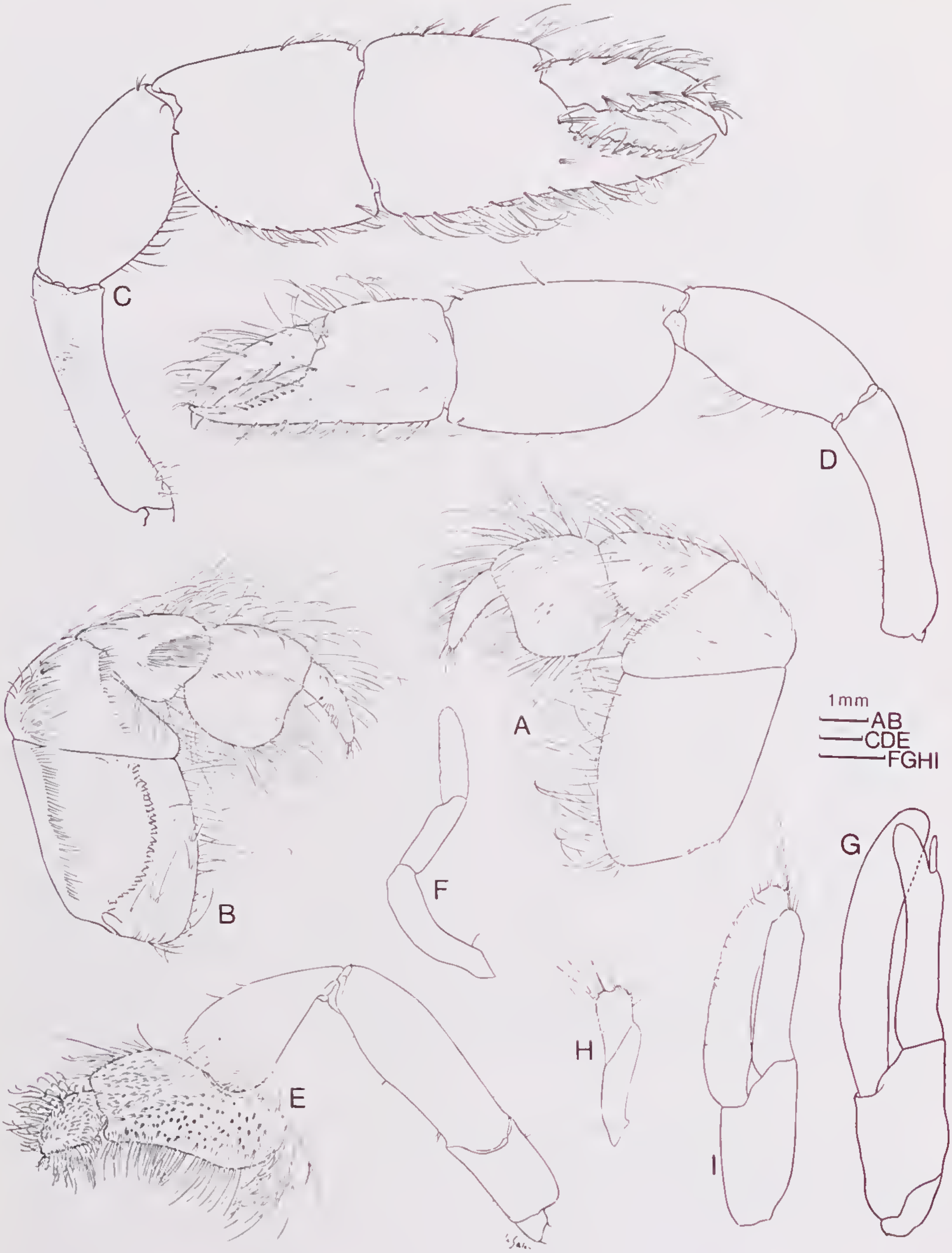

Fig. 8. *Neocallichirus horneri:* **A-B, E, H-I,** paratype ♂ - **A,** third maxilliped, outer aspect; **B,** same, inner aspect; **E,** third pereiopod, outer aspect; **H,** first pleopod in male; **I,** second pleopod in female; **C-D, F-G,** holotype ♀ - **C,** larger cheliped, outer aspect; **D,** smaller cheliped, outer aspect; **F,** first pleopod in female; **G,** second pleopod in female.

and the corneae are reduced, and situated in the distal half.

Neocallichirus horneri sp. nov.

(Figs 7,8)

Type material. HOLOTYPE — ♀, NTM Cr.000846, TL 58mm, CL 13mm, Nightcliff, Darwin, Northern Territory, 15.v.1976, P. Horner. PARATYPE — 1 ♂, NTM Cr.002048, TL 54mm, CL 14mm, 1st pereiopods wanting, West Shoal Bay, Darwin, Northern Territory, intertidal, Northern Territory Fisheries Department.

Description. Female. Rostrum (Fig. 7A-D) broadly-based, downturned, obtusely triangular, 0.1-0.2 length of eyestalk; lateral projections broad and obtuse, about as long as or half as long as rostrum. Cervical groove remarkable, situated on posterior third of carapace. Pereiopod 3 sternite (Fig. 7E) with Y-shaped thickening narrow, medially contiguous on posterior half; each lateral platform with transverse row of setae.

Eyestalks medially contiguous, converging anteriorly to truncate tip, reaching slightly longer (holotype) or shorter (paratype) than antennular basal segment. Pigmented area large, subterminal. Antennular basal segment 1.2 times as long as segment 2, latter thick, about 0.6 of length of distal segment; flagella about 1.5 times length of peduncle. Antennal peduncle exceeding antennular by distal part of distal segment, scaphocerite small rounded protuberance; flagellum 23mm in length, about 2.8 times as long as antennular flagella.

Maxilliped 3 (Fig. 8A, B) basis proximally with row of 4 spines on inner surface. Ischium and merus forming broad plate, latter with sinous row of 26 (paratype, ♂)-29 (holotype, ♀) spines on inner surface. Carpus triangularly expanded on distal margin; propodus subsquare with convex ventral margin; dactylus slender, about as long as propodus.

Pereiopod 1 in female similar, slightly unequal. Larger cheliped (Fig. 8C) in right side. Ischium slender, unarmed, and about 3 times as long as broad. Merus twice as long as broad in midline, shorter than ischium; dorsal margin smooth, evenly convex and ventral more convex than dorsal, finely denticulate. Carpus and chela broad, compressed; carpus about as long as broad in midline, subequal to merus on dorsal margin, chela about twice length of carpus. Fixed finger slender and incurved distally, finely denticulate on cutting edge, increasing in size proximally. Dactylus exceeding fixed finger at tip, equal in length to dorsal margin of palm; cutting edge proximally concave, finely serrated with central notch and broadly incurved distally. Smaller cheliped (Fig. 8D) on left side. Ischium and merus unarmed, each about equal in length. Carpus and chela compressed, former longer than merus and about 1.5 times as long as broad, latter longer than carpus. Fixed finger shorter than palm, finely serrated on cutting edge. Dactylus about 1.5 times length of palm in dorsal line, cutting edge smooth, broadly concave distally.

Pereiopod 3 (Fig. 8E) carpus triangularly broadened on ventral margin, propodus with rounded posterior lobe distinctly exceeding ventral margin of carpus.

Pleopod 1 (Fig. 8H) in male uniramous, two-segmented, distal segment broad and concave on distal margin; pleopod 2 (Fig. 8I) biramous, leaf-like, larger than in female. Pleopod 1 (Fig. 8F) in female uniramous, three-segmented; pleopod 2 (Fig. 8G) biramous, narrow leaf-like, appendix interna short rod-like, situated on distal part of medial margin.

Telson (Fig. 7F) about two-thirds length of abdominal somite 6, about 1.2 times as wide as long, widest on proximal two-fifths, converging posteriorly in posterior three-fifths; distal margin narrow and 0.5 as long as greatest width at base; dorsal surface slightly concave mesially with mesial slit posterior to middle transverse row of setae and with longitudinal rows of setae along both sides. Uropodal exopod broadly developed, broader than long, exceeding endopod. Endopod subsquare, about as long as broad, slightly longer than telson.

Etymology. The species is dedicated to the collector of the holotype, P. Horner.

Remarks. The present species is very similiar to *N. indica* and *N. darwinensis* in the shape of the 3rd maxillipeds, tail-fan and eyestalks. In *N. indica*, however, the apex of the eyestalk is provided with some blunt tubercles, the posterior margin of the propodus of the 3rd pereiopods is not protuberant but parallel to the ventral margin of the carpus, while in *N. horneri* the apex of the eyestalks is also smooth and truncate, and the

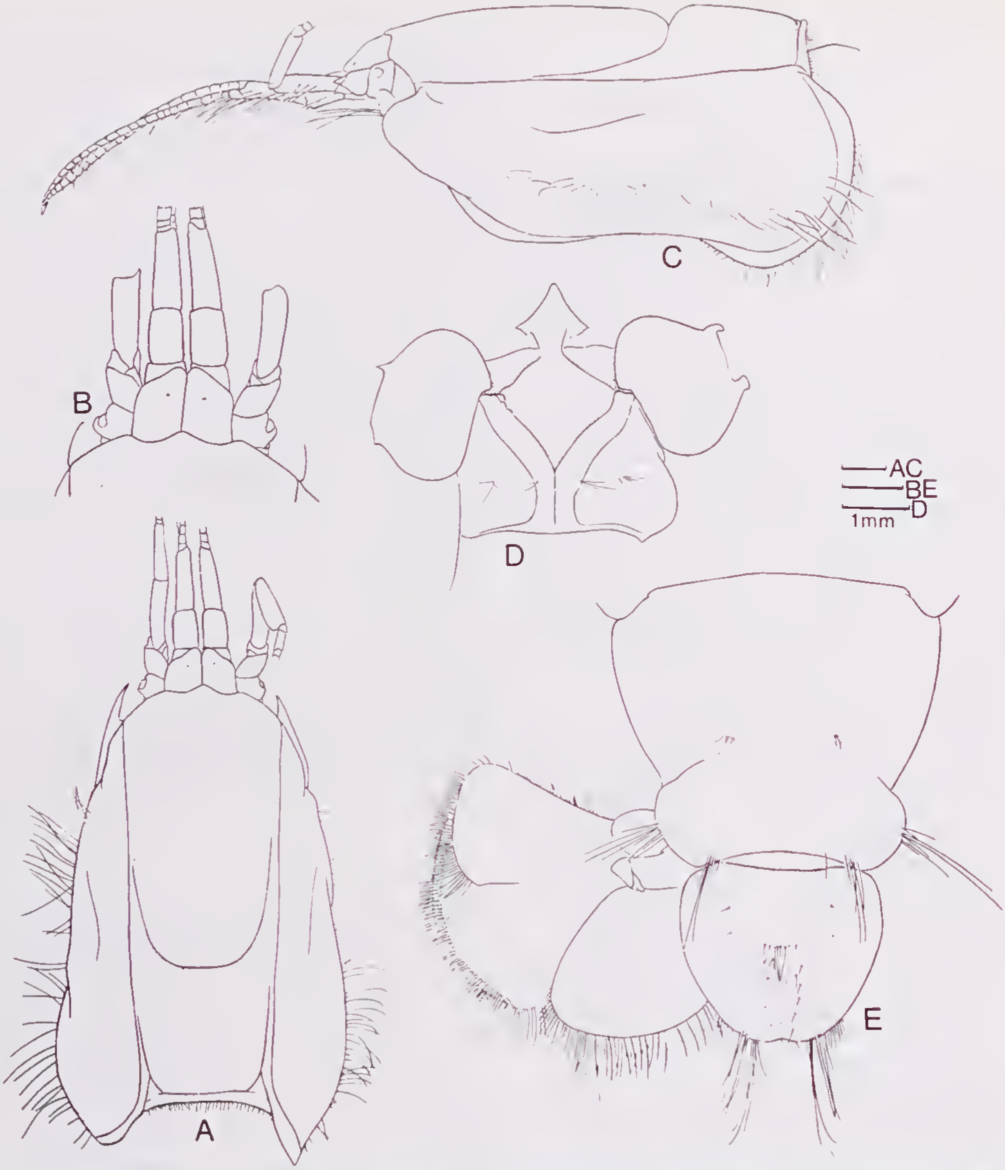

Fig. 9. *Neocallichirus caechabitator* holotype ♀ : **A,** carapace and antennae, dorsal aspect; **B,** anterior carapace, dorsal aspect; **C,** carapace and antennae, lateral aspect; **D,** third sternite, ventral aspect; **E,** sixth abdominal segment and tail-fan, dorsal aspect.

posterior margin of the propodus of the 3rd pereiopod is more protuberant posteriorly than the ventral margin of the carpus.

Both *N. horneri* and *N. darwinensis,* both collected from Darwin, may be compared with each other as follows.

N. darwinensis	*N. horneri*
Y-shaped thickening of pereiopod 3 sternite broadened with 2 tufts of setae.	Y-shaped thickening narrowly swelling without setose tufts; lateral platform with transverse row of setae.
Pigmented area of cornea compact	Pigmented area of cornea large.
Antennular segment 2 short, 0.5 length of terminal.	Antennular segment 2 slightly elongate 0.6 length of terminal.
Antennal peduncle exceeding antennular by proximal part of terminal segment.	Antennal peduncle exceeding antennular by distal part of terminal segment.
Telson about half of abdominal somite 6.	Telson about two-thirds length of abdominal somite 6.

Distribution. Darwin (type locality) and West Shoal Bay, Northern Territory, intertidal zone.

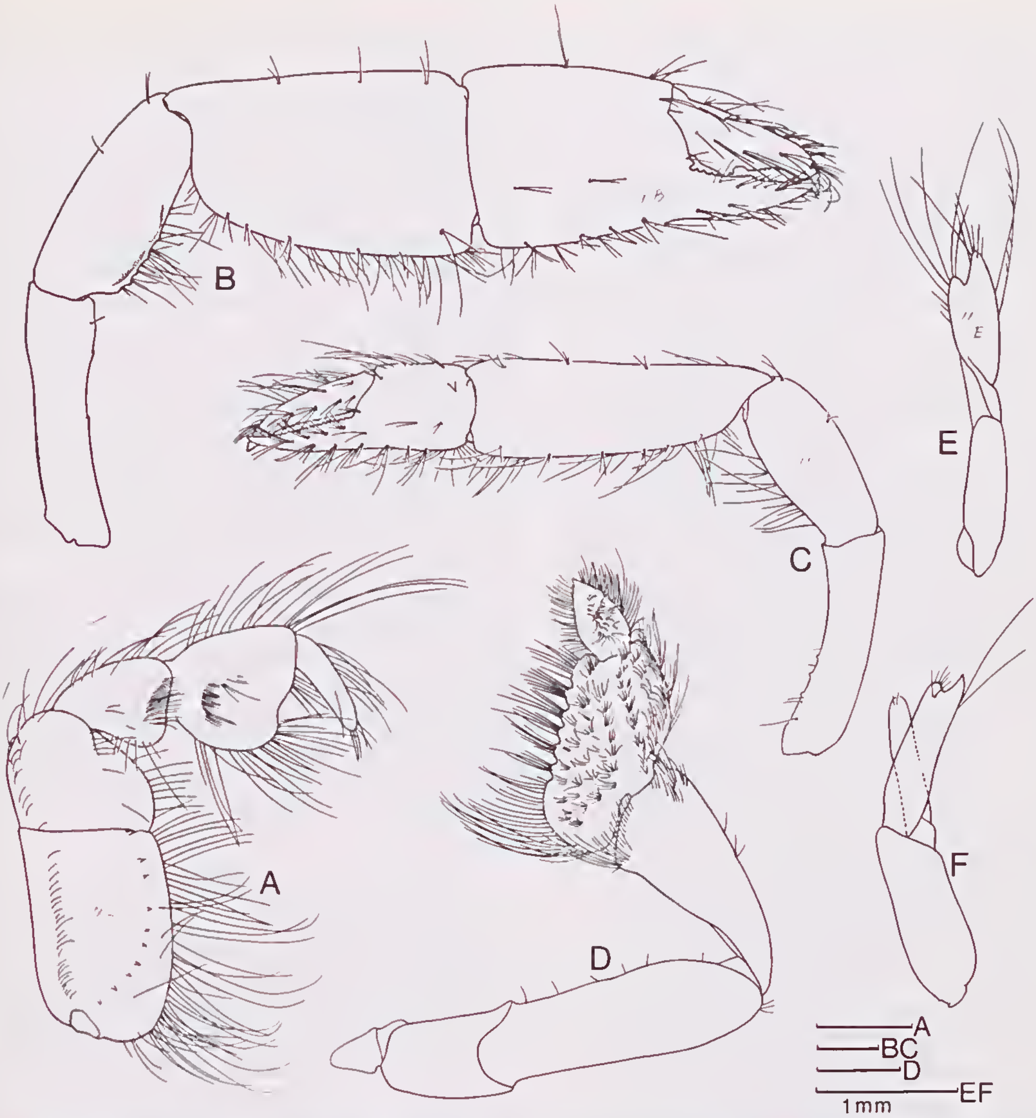

Fig. 10. *Neocallichirus caechabitator* holotype ♀ : **A,** third maxilliped, outer aspect; **B,** larger cheliped, outer aspect; **C,** smaller cheliped, outer aspect; **D,** third pereiopod, outer aspect; **E,** first pleopod in female; **F,** second pleopod in female.

Neocallichirus caechabitator sp. nov.

(Figs 9-10)

Type material. HOLOTYPE — ♀ , NTM Cr.00803, TL 35mm, CL 9mm, False Creek Point, Shoal Bay, Darwin, Northern Territory, 1.0m, 24.i.1977, Northern Territory Fisheries Department.

Description. Female. Probably immature. Rostrum (Fig. 9A-C) broadly-based downturned, triangular, about 0.2 times as long as eyestalks; lateral projections obscure. Cervical groove situated on posterior third of carapace. Pereiopod 3 sternite (Fig. 9D) narrowly edged on posterior margin, Y-shaped thickening broad, each medially contiguous on posterior half and with tuft of setae; lateral platform with tuft of setae.

Eyestalks touching medially, obliquely truncate distally, not exceeding distal margin of antennular basal segment; pigmented area small, subdistal. Antennular basal segment longer than segment 2, latter about two-thirds length of terminal segment; flagella subequal, about 1.5 times as long as peduncle. Antennal peduncle exceeds antennular peduncle by half length of terminal segment, penultimate segment longer than terminal; scaphocerite rudimentary; flagellum 16mm in length.

Maxilliped 3 (Fig. 10A) ischium and merus combined forming broad plate, latter with spinous row of 10 spinules on inner surface. Carpus triangularly expanded on distal margin; propodus subsquare, broadened on ventral half and slightly concave on anterodistal margin; dactylus slender, about as long as propodus.

Pereiopod 1 unequal. Larger cheliped (Fig. 10B) on right side. Ischium slender, about 3.5 times as long as broad, with two denticles on ventral margin. Merus about twice as long as broad, slightly shorter than ischium; ventral margin evenly increasing proximally in breadth, armed with row of six denticles and tufts of setae, dorsal margin entire. Carpus and chela expanded in breadth, former 1.6 times as long as broad and about 1.3 times as long as merus. Chela about 1.2 times as long as carpus; propodus about as long as merus on dorsal margin; cutting edge of fixed finger shortly notched proximally, medially convex in low triangular form, armed with more than ten denticles, distally incurved. Dactylus about two-fifths length of propodus; cutting edge convex on proximal third, distally incurved. Smaller cheliped (Fig. 10C) on left side. Ischium slender, about four times as long as broad. Merus more than twice as long as broad and about two-thirds length of ischium. Carpus elongate, about three times as long as broad and 1.7 times as long as merus. Chela 2.7 times as long as broad and three-fourths length of carpus; fixed finger about as long as propodus, cutting edge with seven denticles on proximal half. Dactylus 1.8 times as long as propodus, cutting edge unarmed.

Pereiopod 3 (Fig. 10D) merus more than 2 times length of ischium. Carpus shorter than merus, increasing distally in breadth on ventral margin. Propodus 1.8 times as long as broad, ventral margin denticulate, bearing five isolated tufts of setae, flanked by broad bands of setae; posterior lobe rounded, not extending beyond ventral margin of carpus. Dactylus less than half length of propodus, covered with setae, apically tipped.

Pleopod 1 in female (Fig. 10E), probably in immature form, uniramous, three-segmented, distal segment distally bilobed. Pleopod 2 (Fig. 10F) biramous; exopod distally bilobed and endopod without appendix interna. Pleopods 3-5 biramous, broadened, appendix interna undeveloped.

Telson (Fig. 9E) two-thirds length of adbominal somite 6, slightly broader than long, widest proximally, tapering posteriorly on distal two-thirds to convex postero-distal angle; distal margin narrow, slightly concave at middle; dorsal surface with transverse row of setae, and posteriorly medially concave to distal margin. Uropodal endopod subsquare, distally rounded, longer than broad, slightly exceeding telson; exopod broadly rounded on distal margin, median ridge conspicuous on distal half.

Etymology. This species is named from the latin words *caec* meaning blind and *habitator* meaning inhabitant, that is, it has eyes so small as to be effectively blind.

Remarks. The present species is closely related to *N. indica* and *N. moluccensis* in the shape of the 3rd maxillipeds, the tail-fan, and in the relative length between the antennal and the antennular peduncles. However in *N. caechabitator* the pigmented area of eyestalks is small, while in these two Indonesian species it is well developed in shape.

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TWO NEW MANGROVE-DWELLING PORCELLANID CRABS, OF GENUS *PETROLISTHES* STIMPSON, FROM TROPICAL AUSTRALIA (CRUSTACEA: DECAPODA: ANOMURA)*

JANET HAIG

Allan Hancock Foundation, University of Southern California,
Los Angeles, California 90089, U.S.A.

ABSTRACT

Two anomuran crabs of the family Porcellanidae are described from tropical Australian waters: *Petrolisthes limicola* sp. nov. from the Northern Territory, and *P. haplodactylus* sp. nov. from the Northern Territory and Queensland. Both species inhabit muddy substrates around mangroves. They and four related Australian species are compared in a key.

KEYWORDS:Crustacea, Anomura, Porcellanidae, *Petrolisthes,* Australia, Queensland, Northern Territory, mangroves, new species.

INTRODUCTION

Among porcellanid crabs from the Northern Territory, Australia, sent for identification by Dr A.J. Bruce, were several lots of material that had been collected near or among mangroves and which proved to belong to two closely related but distinct species, both undescribed. Two lots of one of these species, without habitat data but presumably from mangrove areas as well, had been found earlier among unidentified material in the collections of the Australian Museum. On the basis of this material the new species are described below.

Only one measurement, the carapace length (cl), is given for each specimen, with the exception of holotypes for which the carapace breadth (cb) is also cited. Material from the Northern Territory, including the holotypes, is deposited in the Northern Territory Museum of Arts and Sciences (NTM), Darwin. Material from Queensland is deposited in the Australian Museum (AM), Sydney.

SYSTEMATICS

Petrolisthes limicola sp. nov.
(Figs 1, 2)

Type material. HOLOTYPE — NTM Cr. 001699/A, ♀ cl 9.8mm, cb 9.4mm, Stn CH/1, Creek "H", Darwin Harbour (East Arm), Northern Territory, 12° 34.2′S 130° 56.3′E, 17.v.1984, low water at springs level, in mangroves, coll. J.R. Hanley. PARATYPES — NORTHERN TERRITORY: NTM Cr. 001699/B, 3♂ cl 5.5 to 7.8mm, 2♀ both cl 6.7mm, same data as holotype; NTM Cr. 003590, ♂ cl 3.7mm, Stn CH/6, same locality, 28.viii.1985, medium low water, mangrove lined creek, coll. R. Hanley; NTM Cr. 005022, ♀ ov. cl 8.2mm, Stn CP/V5C, West Bay, Port Essington, Cobourg Peninsula, 14.ix. 1985, medium low water, mudflats in front of mangroves, coll. R. Hanley, C.W. Russell, and M. Burke.

Additional material. NTM Cr. 003716, 1 ♂ cl *ca* 5.8mm, Stn CH/2, Creek "H", Darwin Harbour (East Arm), 12° 34.2′S 130° 56.3′E, 31.x.1984, 4 metres, mangrove creek, coll. R. Hanley; NTM Cr. 003077, 1♀ cl 4.8mm, Stn CH/4, same locality, 4.ii.1985, low water at springs, mangrove *R. stylosa* zone, coll. R. Hanley.

Description. Carapace (Fig. 1) slightly longer than broad. Frontal region slightly deflexed; front rather broad, sinuously triangular; median lobe well developed, rounded at tip, usually with faint median groove; lateral lobes scarcely projecting, oblique. Orbits rather shallowly concave, oblique; outer orbital angle weakly produced, unarmed. Dorsal surface with faint transverse rugae posterolaterally, otherwise nearly smooth; grooves defining various regions usually inconspicuous. Lateral margins

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*This paper is Contribution 433 of the Allan Hancock Foundation.

Fig. 1. *Petrolisthes limicola* paratype ♀, NTM Cr. 001699/B. Drawn by Rafael Lemaitre.

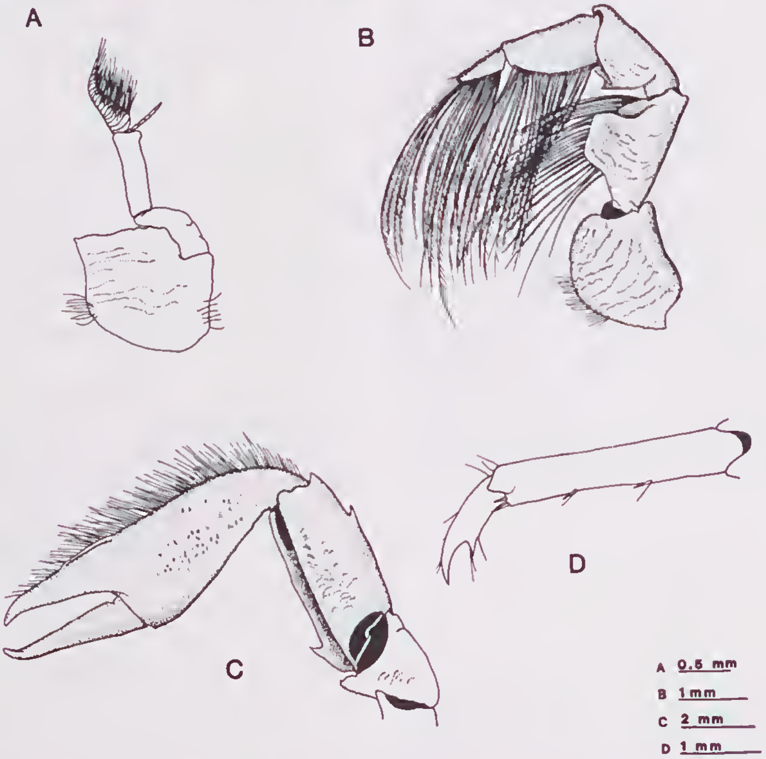

Fig. 2. *Petrolisthes limicola:* **A,** antennule, left outer view; **B,** outer maxilliped, **C,** left cheliped, inner view; **D,** dactyl and propodus of right walking leg, ventral view. Drawn by Rafael Lemaitre.

subparallel or slightly convex, strongly cristate. Carapace devoid of setae.

Basal segment of antennular peduncles (Fig. 2A) without prominent lobes or spines anteriorly. First movable segment of antennal peduncles with anterior margin produced into prominent spine-tipped tooth; second with sharp subproximal or submedian spine on anterior margin; third unarmed; flagellum very long, non-setose or with minute bristles at distal end of each article. Outer maxillipeds (Fig. 2B) with ischium and merus rugose; mesial meral lobe subquadrate.

Merus of chelipeds transversely rugose on dorsal surface; inner margin with prominent rounded lobe. Carpus over twice as long as broad; dorsal surface nearly smooth, with faint, obliquely transverse striations; inner margin minutely crenulate, with sharp, well developed tooth near proximal end, rest of margin unarmed and nearly straight; outer margin slightly convex, with strong spine at distal end and another on distal third of margin. Dorsal surface of palm slightly convex, without median longitudinal ridge; outer margin and that of fixed finger thin, minutely crenulate; dorsal surface near outer margin with fringe of long, fine setae. Dorsal surface and margin of dactyl minutely granulate. Fingers hooked near tip, dactyl passing under pollex; inner side of fingers (Fig. 2C) non-setose.

Walking legs slender, nearly smooth. Merus with transverse rugae on outer surface; with few scattered setae; legs 1 and 2 with strong posterodistal spine, leg 3 unarmed. Carpus with few scattered setae; leg 1 with strong anterodistal spine, legs 2 and 3 unarmed. Propodus (Fig. 2D) with scattered setae; posterior margin with two movable spines plus pair at distal end. Dactyl long and slender, with scattered setae; posterior margin produced medially as strong tooth tipped with sharp corneous spinule, thence abruptly narrowing distally to form long, curved claw.

Abdomen smooth. Telson with seven plates.

Variations. In one female paratype (NTM Cr. 001699/B) the inner margin of the carpus of the right cheliped bears a second tooth on its proximal half. The outer margin of the same carpus has two closely set spines, instead of a single spine, on its distal third. The spinulation of the left cheliped is normal.

Etymology. From Latin "limicola", a mud-dweller: a noun in apposition.

Remarks. The specimens from Stns CH/2 and CH/4 are not included in the type series because of their poor condition: the first has a crushed carapace and the second lacks both chelipeds. A female paratype from Stn. CH/1 is parasitized by a rhizocephalan.

In the structure of the dactyl of the walking legs *P. limicola* resembles an eastern Pacific species, *P. zacae* Haig, which inhabits mangrove areas in Costa Rica and Panama. Aside from that character it shows no close relationship to *P. zacae,* in which the carapace has an epibranchial spine on either side, the carpus of the chelipeds is armed with three or four teeth on the inner margin and a row of spines on the outer margin, and the merus of the walking legs bears spines anteriorly (Haig 1968: 63, Fig. 2).

Petrolisthes haplodactylus sp. nov.

(Figs 3, 4)

Type material. HOLOTYPE — NTM Cr. 001355/A, ♂ cl 4.9mm, cb 4.5mm, Mickett Creek, Darwin, Northern Territory, 12° 23.0′S 130° 56.7′E, 30.vi.1982, muddy mangrove creek, coll. P. Davie. PARATYPES — NORTHERN TERRITORY: NTM Cr. 001355/B, ♀ cl 4.4mm, same data as holotype; NTM Cr. 004599, ♀ ov. cl 5.3mm, Stn CP/V5, West Bay, Port Essington, Cobourg Peninsula, 14.ix.1985, medium low water, mudflats in front of mangroves, coll. R. Hanley and M. Burke. QUEENSLAND: AM P.3830, 2♀ cl 5.1 and 5.3mm, Finches Bay, Cooktown, coll. A.R. McCulloch; AM P.837, 1♂ cl 6.2mm, 2♀ cl 5.4 and 7.3mm, Fraser Island, registered vii.1908, "Collection Kirton".

Description. Carapace (Fig. 3) as long as, or slightly longer than broad. Frontal region slightly deflexed; front rather broad, sinuously triangular; median lobe well developed, rounded at tip, without median groove; lateral lobes scarcely projecting, nearly transverse. Orbits shallowly to rather deeply concave, oblique; outer orbital angle weakly produced, unarmed. Dorsal surface with transverse rugae posterolaterally, otherwise nearly smooth; surface slightly uneven, areas well defined. Lateral margins subparallel or convex, strongly cristate. Carapace without setae except for occasional

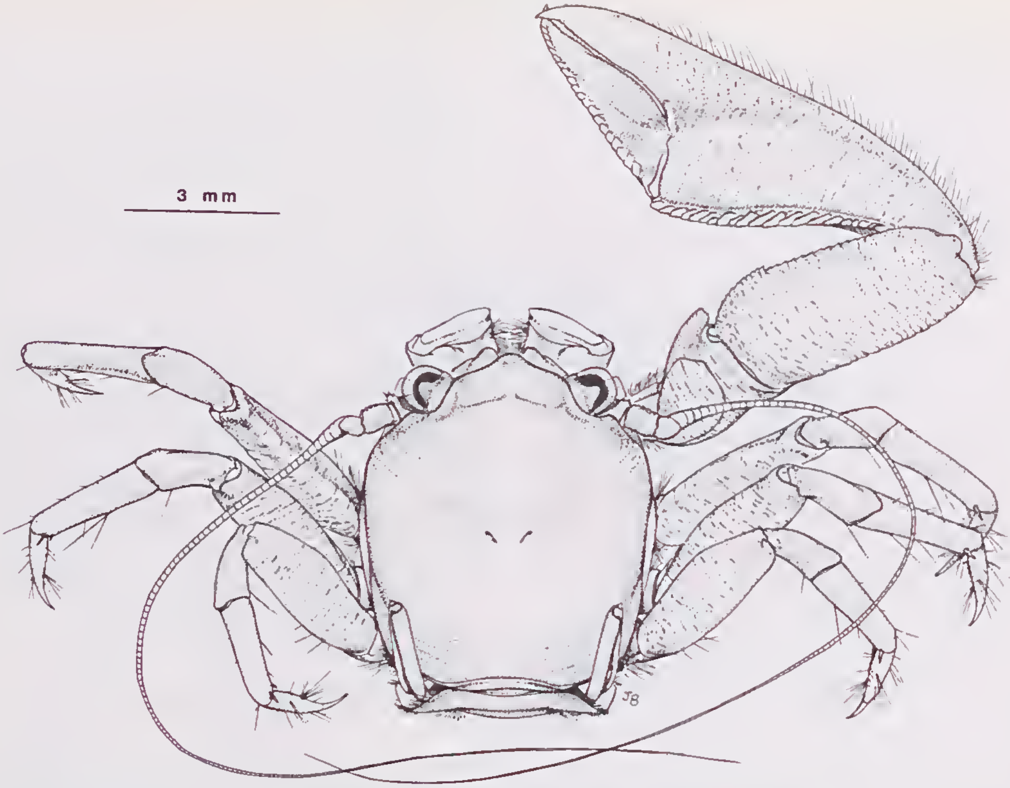

Fig. 3. *Petrolisthes haplodactylus* paratype ♂, AM P.837. Drawn by Jerry Battagliotti.

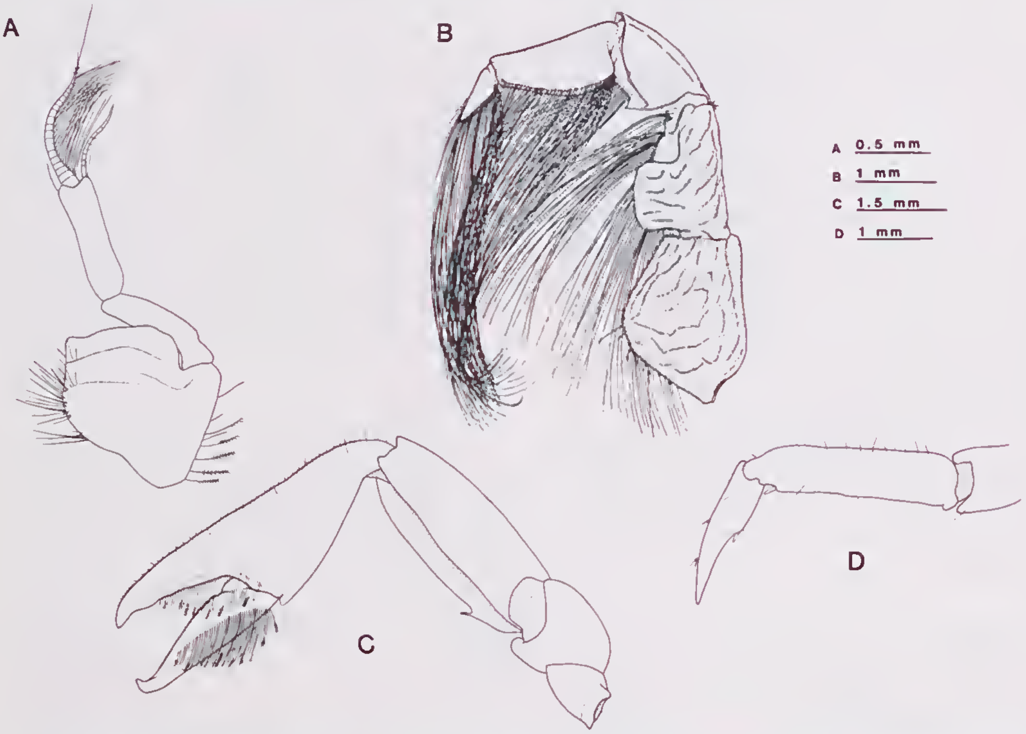

Fig. 4. *Petrolisthes haplodactylus:* **A,** antennule, left outer view; **B,** outer maxilliped; **C,** left cheliped, inner view; **D,** dactyl and propodus of right walking leg, ventral view. **A, C,** and **D** drawn by Frances Runyan; **B** drawn by Jerry Battagliotti.

occurrence of small, inconspicuous tuft on frontal margin.

Basal segment of antennular peduncles (Fig. 4A) without prominent lobes or spines anteriorly. First movable segment of antennal peduncles with anterior margin produced into small, pointed or rounded lobe; second and third segments unarmed; flagellum very long, non-setose or with few minute bristles at distal end of each article. Outer maxillipeds (Fig. 4B) with ischium and merus rugose; mesial meral lobe subquadrate.

Merus of chelipeds with faint transverse rugae dorsally; inner margin with prominent rounded lobe. Carpus over twice as long as broad; dorsal surface nearly smooth, with faint, obliquely transverse striations; inner margin minutely crenulate, with single small tooth proximally, rest of margin unarmed and nearly straight; outer margin slightly convex, with small spine at distal end, otherwise unarmed. Dorsal surface of palm with distinct median longitudinal ridge; outer margin and that of fixed finger thin, minutely crenulate and with fringe of long and short setae. Dorsal surface and margin of dactyl obliquely rugose. Fingers hooked near tip, dactyl passing under pollex; inner side of fingers (Fig. 4C) with long tuft of fine, closely set setae.

Walking legs slender, nearly smooth. Merus with transverse rugae on outer surface; with few scattered setae; posterodistal angle unarmed on all legs. Carpus with few scattered setae; no anterodistal spine on any legs. Propodus (Fig. 4D) with few scattered setae; posterior margin unarmed except for pair of long, slender movable spines at distal end. Dactyl long and slender, with scattered setae; distal half of posterior margin abruptly tapering to form long, curved claw; point where narrowing begins marked by minute spinule, this concealed by sparse tuft of long, flexible bristles.

Abdomen smooth. Telson with seven plates.

Etymology. From Greek "haploos", single or simple, and "dactylos", a finger or toe, referring to the form of the dactyl of the walking legs.

Remarks. The two species described in this paper are the only Indo-west Pacific members of the genus *Petrolisthes* that lack a row of three or more spines on the posterior margin of the dactyl of the walking legs. They are closely related and occupy similar ecological niches, but differ consistently in several details. *P. haplodactylus* may be distinguished from *P. limicola* by the following characters:

Antennal peduncle: The anterior margin of the first movable segment is produced into a small lobe, and the anterior margin of the second movable segment is unarmed. In *P. limicola* the first movable segment is produced anteriorly into a strong tooth and the second bears a spine.

Carpus of chelipeds: The outer margin is unarmed except for a small spine at the distal end. *P. limicola* has two strong spines on the outer margin.

Chela: The dorsal surface of the palm bears a median longitudinal ridge, and there is a long, thick tuft of setae on the inner side of the fingers. Both ridge and tuft are absent in *P. limicola*.

Walking legs: The merus and carpus of all three pairs of legs are unarmed, the posterior margin of the propodus is unarmed except for a pair of spines at the distal end, and the posterior margin of the dactyl has a minute median spinule. In *P. limicola,* legs 1 and 2 bear a posterodistal meral spine and leg 1 an anterodistal carpal spine; there are four spines (including the distal pair) on the posterior margin of the propodus; and the posterior margin of the dactyl bears a strong median tooth.

DISCUSSION

The two species described in this paper belong to a well defined group of Indo-west Pacific *Petrolisthes* in which the carapace is relatively smooth and without spines, and the carpus of the chelipeds bears a single tooth or lobe proximally on the inner margin (one or two additional small teeth or spines are occasionally present in juveniles). The following key will separate the members of this group that are known to occur in Australian waters.

1. Dactyl of walking legs with 3 or more spines on posterior margin 2
   Dactyl of walking legs with a single tooth or spinule on posterior margin 5

2(1). Front narrow triangular 3
   Front rather broad, sinuously triangular 4

3(2). Carpus of chelipeds with outer margin unarmed except for tooth at distal end .... *unilobatus* Henderson

Carpus of chelipeds with 2 or 3 teeth on outer margin in addition to one at distal end ... *elongatus* (H. Milne-Edwards)

4(2). Merus of first walking legs with prominent posterodistal spine .... *kranjiensis* Johnson

Merus of first walking legs with posterodistal spine very small or absent .. .. *teres* Melin

5(1). Carpus of chelipeds with 2 prominent spines on outer margin; dactyl of walking legs with strong submedian tooth on posterior margin .... *limicola* sp. nov.

Carpus of chelipeds with 1 small spine at distal end of outer margin; dactyl of walking legs with minute spinule on posterior margin .... *haplodactylus* sp. nov.

ACKNOWLEDGEMENTS

I am indebted to several persons for their assistance at various stages of this research. A.J. Bruce sent material for examination and provided station data, While he was Curator of Crustacea at the Australian Museum, J.C. Yaldwyn permitted me to borrow specimens from that institution. Jerry Battagliotti, Frances Runyan, and Rafael Lemaitre shared in preparation of the illustrations. J.S. Garth reviewed the manuscript.

REFERENCE

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THE GENUS *LOPHOPILUMNUS* (CRUSTACEA:BRACHYURA:PILUMNIDAE): THE REDISCOVERY OF *L. CRISTIPES* (CALMAN, 1900) AND THE DESCRIPTION OF A NEW SPECIES

P.J.F. DAVIE
Queensland Museum, PO Box 300, South Brisbane, Qld 4101, Australia.

ABSTRACT

The genus *Lophopilumnus* Miers is considered to contain three species. *L. dilatipes* (Adams and White) is known from the Philippines, and *L. cristipes* (Calman), and a new species *L. globosus* are both from northern Australia. *L. globosus* is separated from the other species by its deep, swollen carapace, the form of the anterolateral teeth, the spinous chelae, and the shape of the walking legs. A lectotype and paralectotype have been nominated for *L. dilatipes*. The known distribution of *L. cristipes* has been extended from Torres Strait to Cape Bossut in northwestern Australia.

KEYWORDS: Crustacea, Brachyura, Pilumnidae, *Lophopilumnus*, new species, Australia.

INTRODUCTION

In late 1986 the author was fortunate to be funded by the Australian Biological Resources Study to visit Australian museums to assess their holdings of Australian xanthoid crabs as part of a commencing study on that group. In the Western Australian Museum and the Northern Territory Museum were two species of large pilumnids which were remarkable for the crested merus on their ambulatory legs. One of these species was later identified as *Lophopilumnus cristipes* (Calman, 1900), and the other, a new species belonging to *Lophopilumnus* Miers. Only females of the new species were available until a large intact male was discovered amongst a collection of crabs from the North West Shelf, northern Australia, donated to the Queensland Museum by the Commonwealth Scientific and Industrial Research Organisation.

The genus *Lophopilumnus* was proposed in a footnote by Miers (1886:148) to accomodate *Pilumnus dilatipes* Adams and White because 'Not only are the palatal ridges nearly obsolete, but the ambulatory legs are strongly cristated'. Calman (1900) in his description of *Pilumnus cristipes* pointed out the close relationship with *Lophopilumnus* and Balss (1933) and Takeda and Miyake (1968) have both assigned it questionably to *Lophopilumnus*. Their main reservation concerned the fact that the cristate merus of *L. dilatipes* is not notched to form a subdistal lobe as it is in *P. cristipes*. This will be further discussed later. The only specimens so far reported in the literature for either species are the original types. During a visit to the British Museum (Natural History) the male and female type specimens of *L. dilatipes* were examined and additional specimens of *L. cristipes* were found.

Measurements given in this paper are of carapace breadth, and were made to the nearest 0.1mm using dial calipers. Illustrations were done using a 'camera lucida'. The institutions in which the study material is housed are abbreviated in the text as follows: Northern Territory Museum (NTM); Western Australian Museum (WAM); Queensland Museum (QM); British Museum (Natural History) (BMNH).

SYSTEMATICS

Genus *Lophopilumnus* Miers

Lophopilumnus Miers, 1886: 148; Calman 1900: 18; Balss 1933: 12; Takeda and Miyake 1968: 3-4. (type species *Pilumnus dilatipes* Adams and White, 1848: 44, by original designation).

Diagnosis. Carapace strongly convex; regions quite well defined and moderately granular, separated by smooth shallow furrows. The ridges that define the efferent branchial channel are feebly developed and mainly confined to the lower part of the

Fig. 1. *Lophopilumnus dilatipes* lectotype ♂. Scale line in mm.

endostome not reaching the upper border of the buccal frame. Antero-lateral margins behind the outer-orbital angle cut into four lobes or sharp teeth. Postero-lateral border slightly longer and relatively straight, not markedly concave. Front bilobed and prominently protruding; lateral lobules present. Chelipeds unequal but of same general form; covered with low granules or short spines. Ambulatory legs with strong crest on merus which may or may not have a subdistal notch and lobe; a similar subdistal lobe also developed to a greater or lesser extent on the merus of the cheliped.

Lophopilumnus dilatipes (Adams and White)

(Fig. 1)

Pilumnus dilatipes Adams and White, 1848: 44, Pl. 9, Fig. 4.

Lophopilumnus dilatipes — Miers 1886: 148; Calman 1900: 18; Balss 1933: 12; Takeda and Miyake 1968: 3-4.

Type material. LECTOTYPE — BMNH 1843.6, ♂ (34mm), Philippine Isles, "Samarang", Cumming Colln. PARALECTOTYPE — BMNH 1843.6. ♀ (28mm), data as above.

Remarks. As a holotype was not designated by Adams and White one of the two syntypes can be chosen to become a lectotype. Following recommendation 74B of the International Code, the illustrated male is chosen as lectotype and the female thus becomes a paralectotype.

The type description was short but the figures were good and there seems little need to fully redescribe the species. Unfortunately the tips of the first male pleopods are broken off and therefore this character is not available to help define the taxon — what remains is of a typical pilumnid shape and close to *L. cristipes.* The form of the legs is the remarkable feature of this species. The crest on the merus is not notched subdistally as in other species. The carpus has twin dorsal crests — a very high mid-dorsal one, and a lower one posterior to it. Anterior to the major crest is a shelf and a very swollen and convex anterior face with a fringe of long hairs.

Distribution. Philippines (the original description listed the type locality as 'Eastern Seas', however the label associated with the specimens is more specific).

Lophopilumnus cristipes (Calman)

(Figs 2a-j, 3a,b)

Pilumnus cristipes Calman, 1900: 17-19, Pl. 1, Figs 1-3; Balss 1933: 11, 31; Takeda and Miyake 1968: 3-4.

?Lophopilumnus cristipes — Balss 1933: 12.

Type material. HOLOTYPE — BMNH 1900.11.26.1, imm. ♀ (28mm), fringing reef, Mabuiag, Torres Strait;

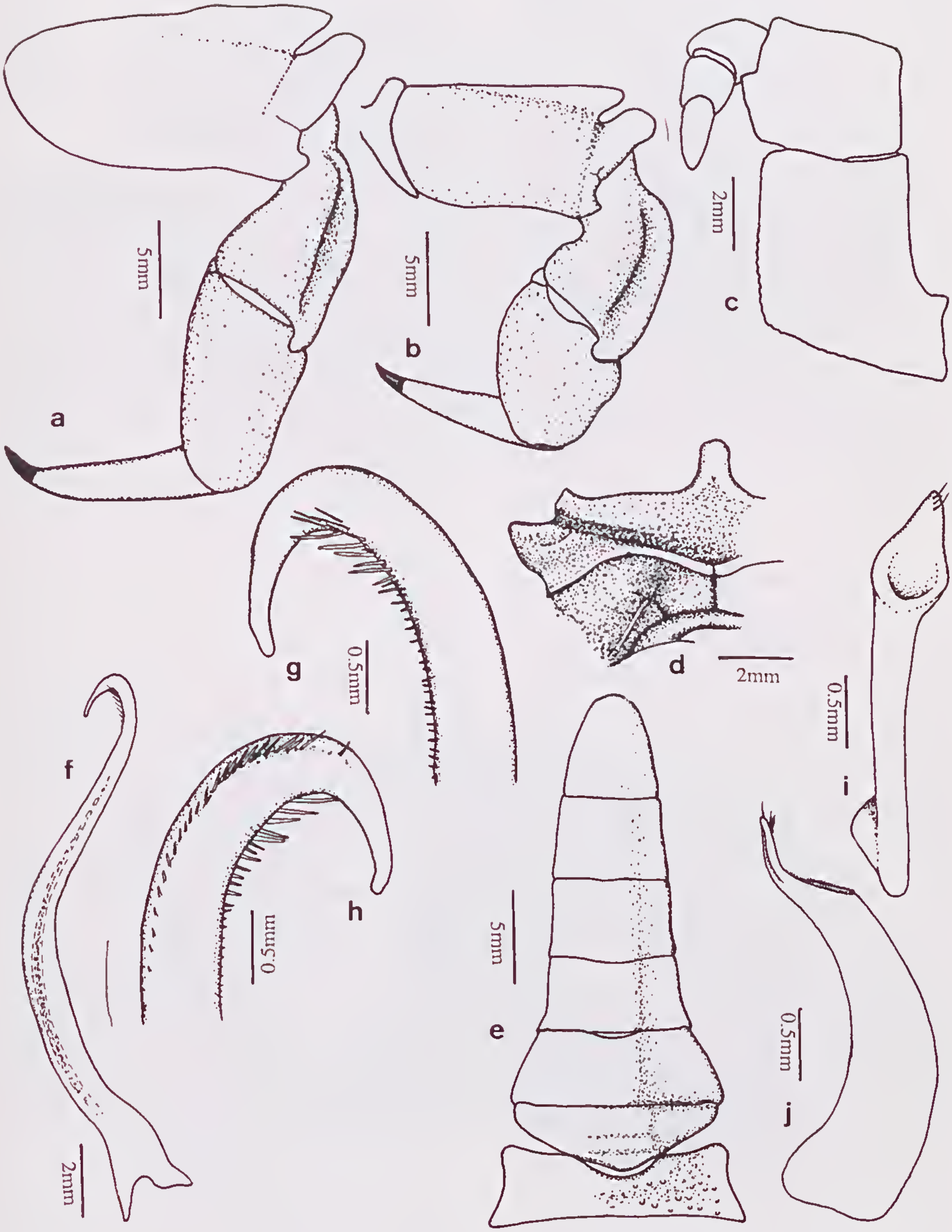

Fig. 2. *Lophopilumnus cristipes:* **a,** second walking leg (denuded); **b,** fourth walking leg (denuded); **c,** third maxilliped (denuded); **d,** epistome; **e,** ♂ abdomen; **f,** first ♂ pleopod; **g, h,** abdominal and sternal views of same; **i, j,** second ♂ pleopod.

Additional material. AUSTRALIA: BMNH 1929.8.1.6, 1 imm. ♀, Thursday Isl., Torres Strait; BMNH 1932.7.7.28, 1 ♀, Arafura Sea; WAM 2273-86, 1♂(42.8mm), Cape Bossut, N.W. Australia, reef and sand flat, 13.x.1962, R.W. George on Dorothea; NTM Cr.2411, 1 ovig. ♀ (33.2mm), East Point, Darwin, N.T., shore reef, 8.ix.1975, A.J. Dartnall.

Remarks. Calman's (1900) excellent description needs little amendment. One feature he fails to mention however is the very strong, high granular crests on the hepatic, protogastric, and anterior branchial regions. The male pleopods are typical pilumnid with curved tips, and are illustrated here for the first time.

Habitat. Appears to be a shallow water, intertidal reef flat species.

Distribution. From Cape Bossut, northwest Australia to Torres Strait, north Queensland.

***Lophopilumnus globosus* sp. nov.**

(Figs 4a-e, 5a-f, 6a,b)

Type material. HOLOTYPE — QM W14878, ♂(45.5mm), North West Shelf, W. Australia, 19° 29.6′S, 118° 52.2′E, trawled 37-38m, 25. x. 1983, T. Ward (CSIRO). PARATYPES — AUSTRALIA: NTM Cr.2970, 1 ovig. ♀ (45.8mm), N. of Wessel Islands, Arafura Sea, Northern Territory, trawled 40m, 17.iv.1985, W. Houston; NTM Cr.3247, 1 ovig. ♀ (44.6mm), N.W. Australia, 16° 34.0′S, 121° 27.0′E, trawled 40-46m, 17.iv.1985, B.C. Russell; NTM Cr.2420, 1♀ (48.6mm), Tasman Point, Gulf of Carpentaria, vii.1976, J. Elder; NTM Cr.2422, 1 ♀ (57.1mm), 16km off Port Essington, ix.1976, R. Geslick.

Description. Carapace globose *ca* 1.3 times broader than long (1.29-1.38); evenly convex fore and aft and from side to side although anterolateral margin upturned; anterolateral margins subequal in length to posterolateral margins. Surface of carapace, chelipeds and posterior face of legs covered with short stiff golden bristles, almost furlike; beneath this the carapace is moderately granulate laterally becoming smoother medially and posteriorly. Regions are evident beneath the hair and moderately strongly defined by smooth furrows, especially the gastric and the combined cardiac and intestinal regions which are strongly indicated. Posterior margin with a broad costate rim.

Front divided by broad notch into two strongly protruding lobes, each obliquely truncate and granular; a broad U-shaped sinus separates a strong spinous preorbital tooth on each side; fronto-orbital width *ca* 0.55 times carapace width.

Antero-lateral margins divided into four strong teeth behind the spinous external orbital angle; these teeth increase in size from first to fourth; the first three are forwardly directed while the last is directed laterally; each tooth is sharply pointed and armed with small accessory granules.

Supraorbital border with pointed granules on inner angle, relatively smooth on inner half, and again becoming granular laterally; cut by two small fissures, the edges of which are in contact for most of their length, one adjacent the external orbital angle, the other nearly medial in position. Inferior border with a deep, narrow, lateral fissure below the external orbital angle; concave and granular and with a prominent spine at inner end adjacent the basal antennal segment. Basal antennal segment protrudes into orbit such that flagellum has free access; flagellum relatively fine and short, reaching laterally to about outer edge of orbit. Basal antennular segment with strong, smooth, oblique ridge, bearing a row of short hairs; and another similar crest near the outer edge of the socket.

Epistome sharply sunken medially such that the buccal margin forms a small protruding shelf. The palatal ridges defining the efferent branchial channel are obsolete, and do not extend to the buccal frame.

Subhepatic regions evenly covered with rounded granules. Pterygostome smooth to microscopically granular.

Third maxilliped with merus *ca* 0.55 times length of ischium; merus with internal margin formed into sharply acute and granulate angle beneath palp.

Chelipeds unequal, stout, spinous and covered with short golden bristles. Merus with granular borders, otherwise relatively smooth; posterior meral border of larger cheliped with a large, broad, truncate spine subdistally and a similar slightly smaller one distally, these being simply pointed and smaller on the lesser cheliped; mostly naked

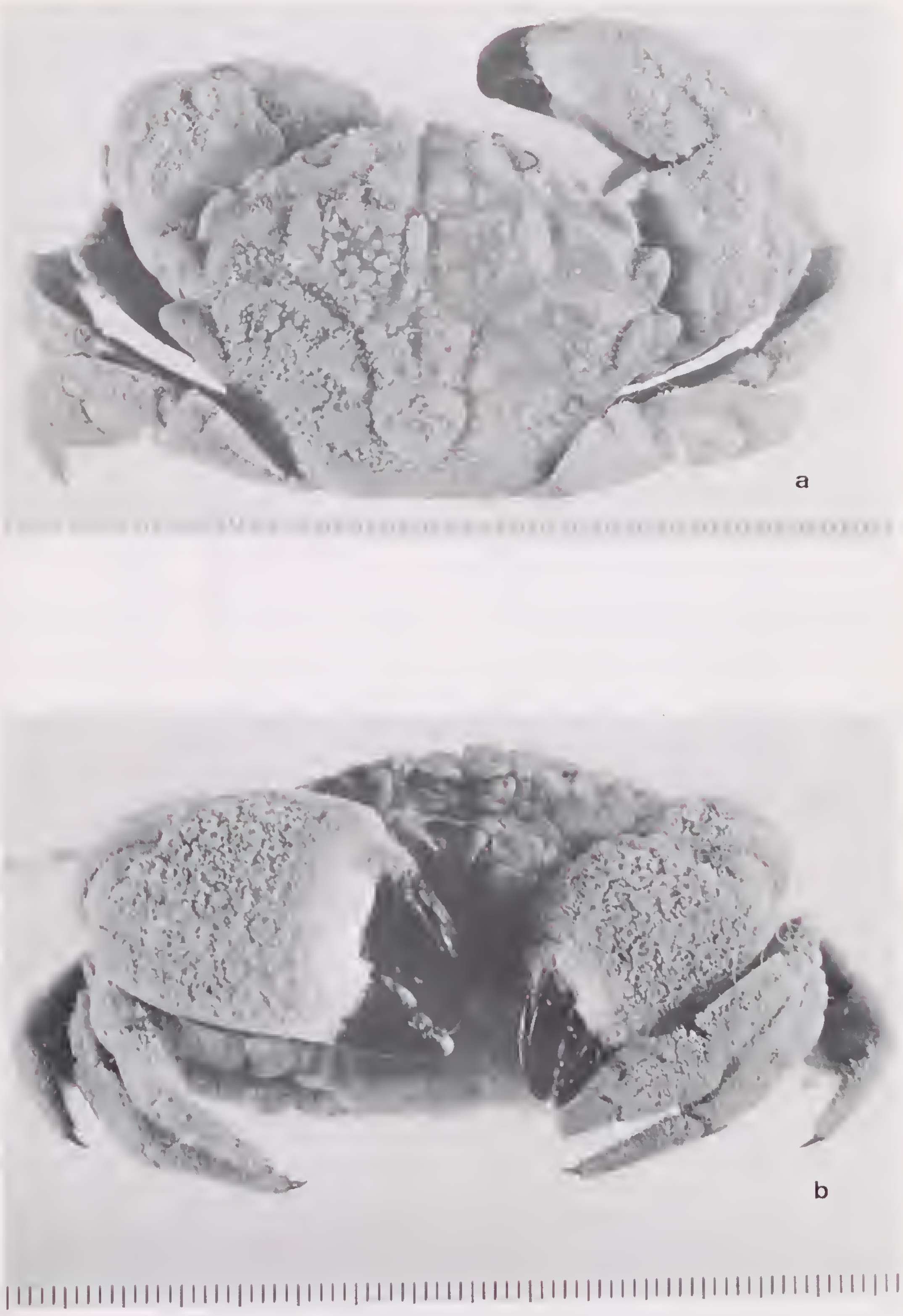

Fig. 3. *Lophopilumnus cristipes* ♂: **a**, dorsal view, **b**, frontal view. Scale lines in mm.

except at distal spines and around articulation. Carpus with coarse sharp tubercles dorsally and laterally, and with a larger sharp spine at the antero-internal angle. Palm also with coarse sharp tubercles in longitudinal rows, largest on dorsal margin; spines on dorsal margin may be darkly pigmented. Palm relatively high, height approximately three-quarters length on larger chela of male holotype. Fingers of chelae with blunt tubercles basally, otherwise smooth; darkly pigmented but not extending onto palm from fixed finger; cutting edges with broad blunt teeth, pointed terminally.

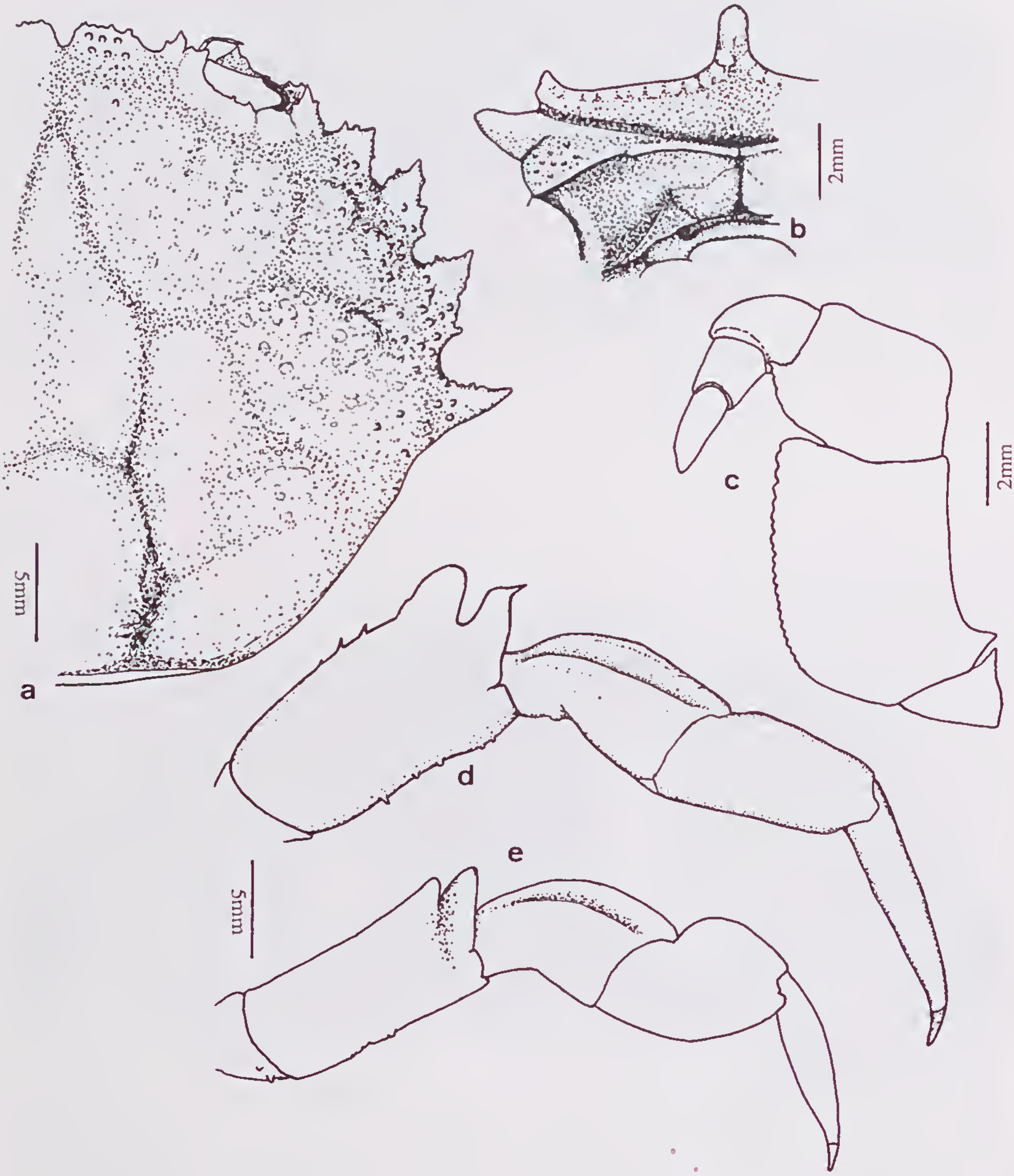

Fig. 4. *Lophopilumnus globosus:* **a,** carapace (denuded); **b,** epistome; **c,** third maxilliped (denuded); **d,** second walking leg (denuded); **e,** fourth walking leg (denuded).

Ambulatory legs short and stout; first and second pairs subequal and longest, being a little longer than the carapace width. Merus of second pair about twice as long as broad (length measured along mid-line of posterior face), but narrower on the fourth pair (*ca* 2.4 times). Meri with large, flattened, and apically rounded pre-distal lobe, separated from a sharp distal tooth by a broad sinus; much less marked on fourth pair than on others. Behind this lobe on upper border of merus are a few small spinules, and on lower borders are some small sharp granules. Carpus and merus subequal in length, dactyl a little longer. Carpus with a broad shallow furrow running longitudinally on the postero-dorsal surface, which is continued to a minor degree on the propodus; anterior face of carpus flat.

Abdomen of male relatively narrow, first segment the broadest, second segment constricted basally; tapering evenly from segment four. Telson about as long as wide at base, bluntly rounded, longer than other segments. Sternite eight is visible in gap between first and second abdominal segments. Sternum covered with small granules and both sternum and abdomen with a covering of low golden setae.

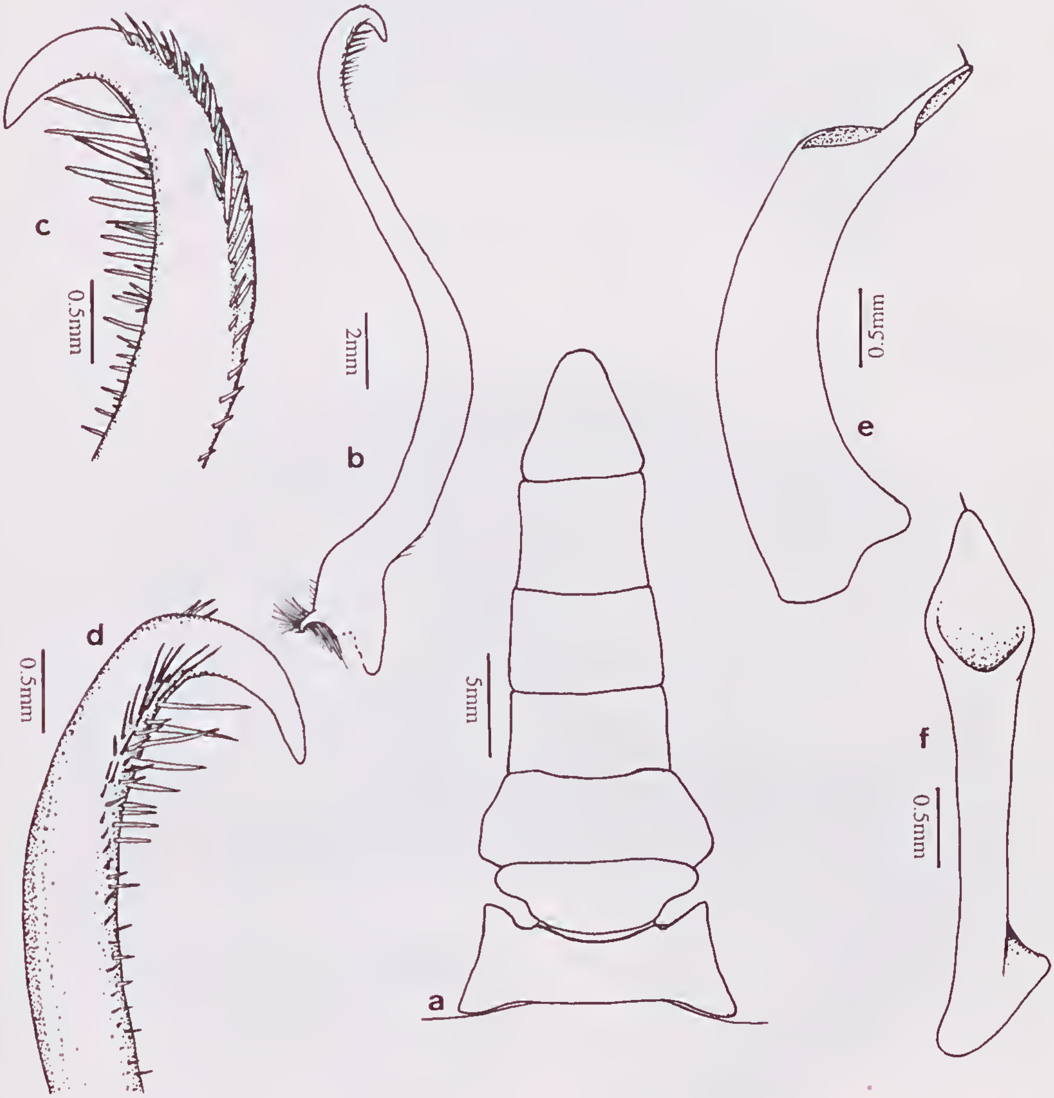

Fig. 5. *Lophopilumnus globosus:* **a**, ♂ abdomen; **b**, first ♂ pleopod; **c, d**, abdominal and sternal views of same; **e, f**, second ♂ pleopod.

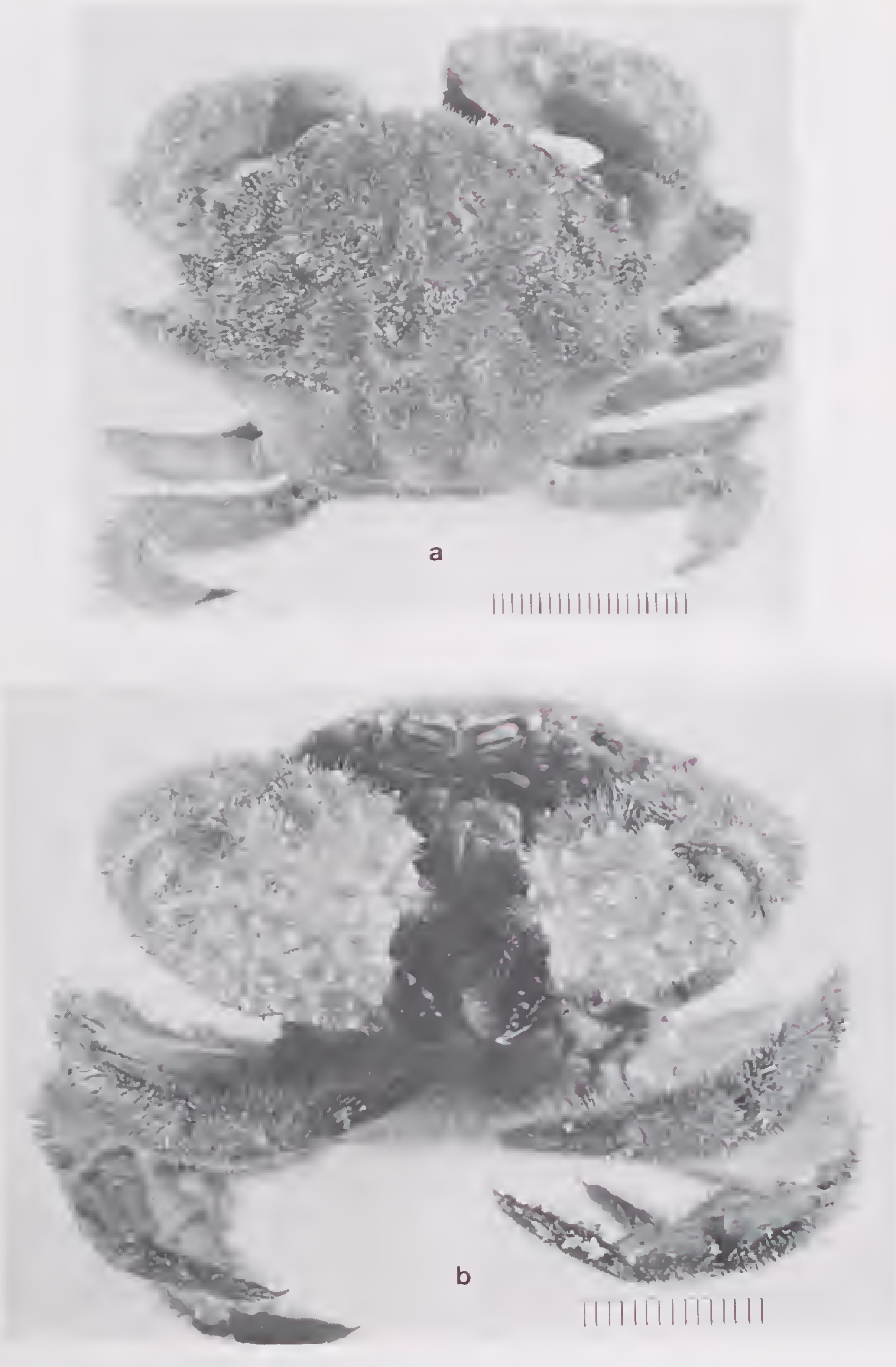

Fig. 6. *Lophopilumnus globosus:* holotype ♂: **a,** dorsal view; **b,** frontal view. Scale lines in mm.

First pelopod of male sinuous and evenly tapering; tip recurved; a row of stiff setae on the abdominal and sternal faces distally (as figured). Second pleopod of typical pilumnid form, rather narrow and tip quite long, with a single seta distally.

Remarks. *L. globosus* is readily separable from the other two described species by its deeper more globular body, the form of the anterolateral teeth, the spiny chelipeds and the shape of the crests and sub-distal lobes on the meri of the walking legs.

Habitat. No specific information is available except that all specimens have been trawled from shallow water (30-50m).

Distribution. Northern Australia from the North West Shelf off Western Australia to the Gulf of Carpentaria. Not yet recorded from off eastern Australia.

DISCUSSION

Each of the species here included in the genus *Lophopilumnus* differs quite markedly from the others in overall appearance, and this in itself causes hesitancy in suggesting they are derived from the same stock. In particular the shape of the leg segments of *L. dilatipes* is remarkably different from the other two species. The presence or absence of a subdistal notch in the meral crest is probably of minor importance, but the broad convex face of the carpal segments in *L. dilatipes* compared with the flat smooth face of the other two species seems of more significance. If *Lophopilumnus* were to be accepted as monotypic it could then easily be argued that each of the other two species are also sufficiently distinct to warrant placement in new genera. This would not be desirable given our present poor state of knowledge of pilumnid systematics. Apart from the divergence of the leg segments *L. dilatipes* does approach an intermediate state between the deep rounded carapace and spinous anterolateral borders of *L. globosus* and the more flattened carapace and bluntly lobed anterolateral borders of *L. cristipes.*

The three species have many features in common including: the form of the endostome; abdomen shape; the presence of crests on the meri of the walking legs; the overall shape of the chelipeds and the relative sizes of each cheliped; the similar definition of regions on the carapace; the strongly bilobed and protruding front with lateral lobules; and probably similar male gonopods (the tip of the first gonopod of L. dilatipes is not known.).

The status of the genus should certainly be reviewed if more related species are found, or when the family as a whole is given full revisionary treatment.

ACKNOWLEDGEMENTS

I wish to thank the Bureau of Flora and Fauna for the ABRS grant to visit other Australian Museums and their support of my study of Australian xanthid crabs. Drs Gary Morgan (Western Australian Museum) and A.J. Bruce (Northern Territory Museum) kindly assisted me during my stay in their institutions and lent me specimens. Dr Ray Ingle and Mr Paul Clark kindly gave me assistance and access to type specimens during my visit to the British Museum of Natural History. Dr Trevor Ward of the CSIRO is thanked for the donation of the North West Shelf specimen of *Lophopilumnus globosus.* Carlos Picasso took the photographs of *L. cristipes* and *L. globosus.* Mr Philip Lawless assisted in making up the plates and composing the illustrations. Mrs Peta Woodgate is thanked for her typing skills.

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TWO MANTIS SHRIMPS NEW TO THE AUSTRALIAN FAUNA (CRUSTACEA:STOMATOPODA:BATHYSQUILLIDAE)

A.J. BRUCE
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

Two deep-sea mantis shrimps, *Bathysquilla crassispinosa* (Fukuda) and *B. microps* (Manning), are reported for the first time from Australian Seas, from about 350m and 1000m depths respectively in the Coral Sea. The morphology of the specimens is described and illustrated and the relationships and zoogeography of the family Bathysquillidae are discussed.

KEYWORDS: Crustacea, Stomatopoda, Bathysquillidae, zoogeography, Australia.

INTRODUCTION

The little known deep-water stomatopod family Bathysquillidae contains only four species in three genera. Of these, only one has been previously recorded from Australian waters. *Altosquilla soelae* Bruce, has been found to occur in some numbers on the northwest shelf region of Western Australia (Bruce 1985). Recent surveys carried out by the research vessels of the Commonwealth Scientific and Industrial Research Organisation, the F.R.V. 'Soela' and the R.V. "Franklin," off the coast of Queensland, have recently collected three specimens of two species of the genus *Bathysquilla* Manning.

SYSTEMATICS

Superfamily Bathysquilloidea Manning, 1967

Family Bathysquillidae Manning, 1967

Genus *Bathysquilla* Manning, 1963

Bathysquilla crassispinosa (Fukuda)

(Figs 1 A-C, 2, 3 A-H, 4A, 5, Frontispiece A)

Lysiosquilla crassispinosa Fukuda, 1909:61, Pl. 5 Fig. H; 1910: 146-149, Pl. 4, Figs 4, 4a; Gordon 1929: 462, Figs 1-2; Barnard 1950:859-860, Fig. 3b.

Bathysquilla crassispinosa — Manning 1969: 95, 98; Ingle and Merrett 1971: 197; Manning and Struhsaker 1976: 440-443, Figs 1 a-c, 2; Bruce 1985: 474-475, Fig. 4b; Moosa 1985 (1986): 371, Pl. 1 A-B.

Material. 1 ♂, 1 ♀, NTM CR. 006298, F.V. *'Soela'*, Cruise 0685, stn. 11, 20° 59.15'S 152° 58.55'E, 343-350m, trawl '18 xi 1985, coll. T. Ward and A.J. Bruce.

Description. The following are additions to the previously published data.

In profile, rostrum sigmoid with tip ventrally convex, slightly upturned.

Mandible (♂, left) with stout corpus, palp 3 segmented, segments slender, sparsely setose, lengths in ratio 15:18.5:12, incisor process robust, with teeth feebly divided into distal group of 3 larger teeth and proximal group of 5 smaller teeth, molar process narrow, tapering, with upper row of 8 blunt marginal teeth, lower with row of 9. Maxillula with short, blunt, recurved, sparsely setose palp; distal endite short, tapering, with stout terminal spine, with 2 smaller spines dorsally and 4 spiniform setae; proximal endite distally broad, truncate, with 3 transverse rows of short, simple spines. Maxilla 5 segmented, proximal segment with oval endite, antepenultimate segment with bilobed endite, distal endite larger than proximal, penultimate segment with broad simple endite and terminal segment elongate, with simple oval endite, medial margins of endites all densely setose, lateral margins of proximal segments more sparsely setose.

First maxilliped slender, chela with palm compressed, subrectangular, 2.0 times longer than deep, with dactyl about 0.3 of palm length, stout, moderately curved, ventrally concave, with small tuft of simple setae at about 0.3 of dorsal length, distoventral angle of palm rounded, with low raised carina bearing row of about 16 short spines, with one larger spine proximally, densely setose medially and laterally, setae simple, distoventral angle of palm with 3 stout spines, distal half of spine spatulate, with strong acute marginal dentations (Fig. 3B), ventral margin of palm densely setose, setae shorter proximally, longer distally, strongly flattened, anterior margin with palisade of small truncated denticulations, except at tip, posteromedial and posterolateral surfaces densely covered with microspinules, tip feebly bilobed, with small pore, dorsal margin of propod with numerous long slender simple setae distally, distomedially and distolaterally; chela articulated with propod in line of longitudinal axes.

Second maxilliped with dactyls bearing 11-10 teeth in both sexes, the proximal teeth on the left side in each specimen very small, all larger teeth except terminal finely obliquely milled distally, non-serrate; propodus with acute distoventral angle, occlusal surface with four long mobile spines proximally, lateral cutting edge with row of numerous small acute fixed teeth, not forming palisade, medial cutting edge with 9 and 10 long slender fixed perpendicular spines in male and female respectively, medial and lateral margins separated by narrow groove with depressions at intervals to oppose tips of dactylar teeth; carpus with two strong dorsal teeth, small fixed ventral tooth in male, short mobile spine in female.

Third maxilliped with large subchela, palm about 1.6 times longer than width, with 3 strong mobile spines proximoventrally, cutting edge with about 17 short fixed spines laterally, 3 isolated fixed spines medially, dactyl stout, curved, extending to proximal ventral propodal spine, dorsal surface with dense longitudinal row of setae; carpus with 5 strong mobile ventral spines; propod and carpus with long and short rows of long setae ventrally and along dorsal margin propod.

Fourth maxilliped similar to third, subchela slightly smaller and less robust, ventral propod with 3 large mobile spines proximally, ventral carpus with 3, propod cutting edge with about 19 short fixed spines laterally, 3 isolated mobile spines medially.

Fifth maxilliped similar to fourth, distinctly smaller, ventral propod with 3 mobile spines proximally, ventral carpus with 3; propod cutting edge with about 7 short, fixed spines laterally, 3 isolated spines medially.

Sixth thoracopod with short, curved, 2-segmented protopodite, coxopodite about 3.0 times longer than central width; basipodite short, about 0.3 of coxopodite length; longer ramus with proximal segment 3 times longer than distal width, subcylindircal, moderately expanded distally, with distolateral tuft of spiniform setae, long plumose setae along distal medial margin; distal segment compressed, about 0.7 of proximal segment length, expanded centrally, tapering distally to rounded tip, about 3.5 times longer than greatest width, medial margin glabrous, distolateral border with thick brush of long setae, finely and densely setulose, numerous, long flexible spiniform setae proximally; shorter ramus with proximal segment about 0.2 of coxopodite length, sparsely setose, subcylindrical, distal segment compressed, about 2.1 times proximal segment length, slightly broadened distally and rounded lateral border with few minute setae, inner margin with fringe of longer, feebly plumose setae. Seventh and eight thoracopods similar.

Endopodite of ♂ first pleopod 2 segmented; proximal segment medially robust, laterally membranous; distal segment with short robust appendix interna proximally, elongated, semitubular appendix masculina with medial flange, and recurved anterior uncinate process.

Receptaculum seminis on ♀ sixth thoracic sternite with well developed thick triangular median plate, apex swollen, smooth, about 2.0 times longer than wide, small median transverse plate posteriorly with pair of feebly sigmoid subcylindrical submedian processes, about 7.0 times longer than central width, strongly divergent, ventral surface strongly calcified, posteromedial surface membranous.

Genital papillae of ♂ elongate, subcylindrical, rigid, about 0.75 of eighth thoracic coxal segment length.

Measurements. See Table 1.

Colouration. General body colour pale orange-red, palest on carapace, becoming more intense posteriorly to sixth abdominal segment; telson with median carina and margins orange-red, central portions greyish, carpus and distal merus of second maxilliped orange-red, distal dactyl feebly orange-red,

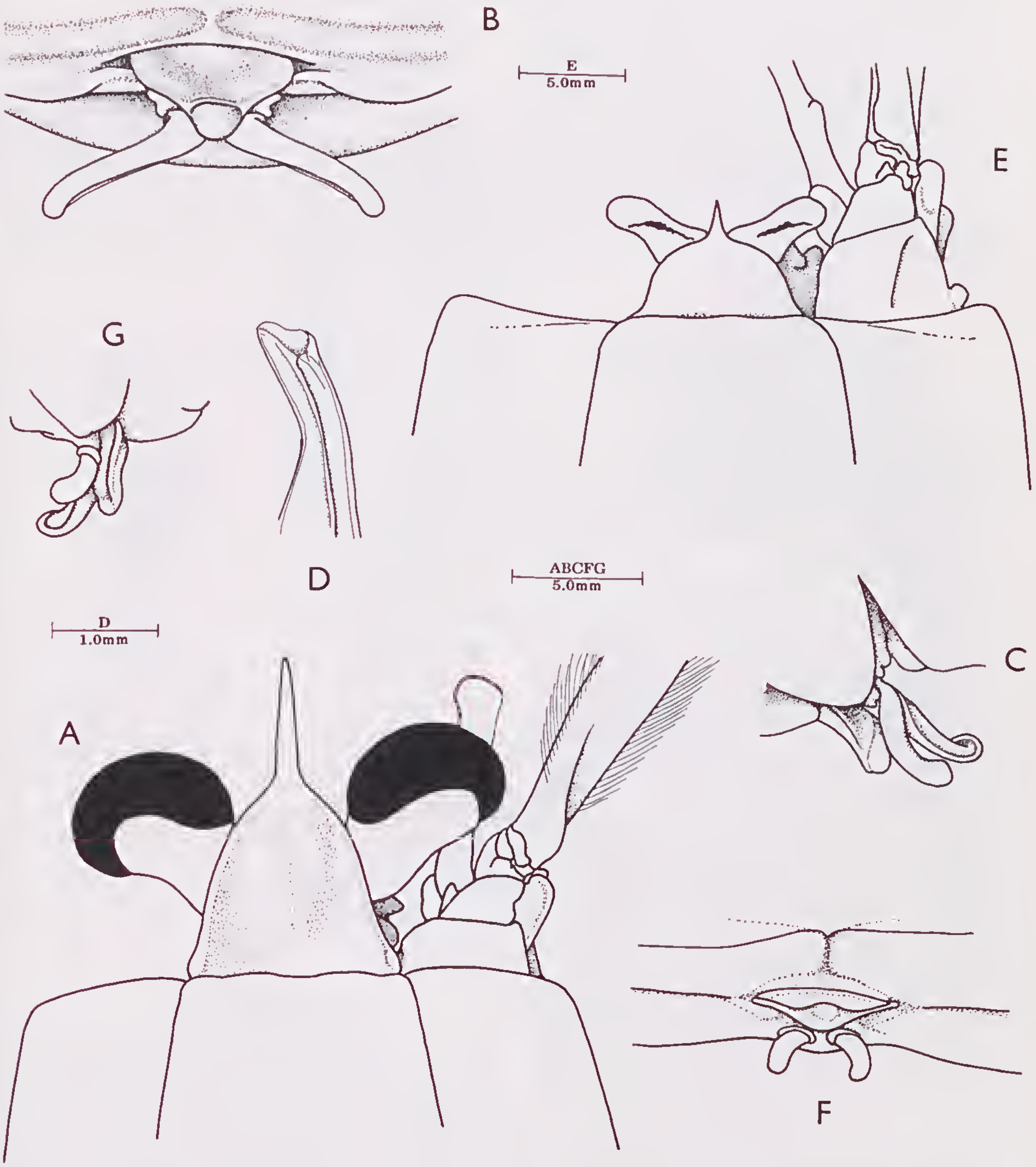

Fig. 1. *Bathysquilla* spp. ♀ : **A-D**, *B. crassipinosa* — **A,** anterior carapace, rostrum, eyes, antennal peduncle; **B,** sixth thoracic sternite; **C,** same, lateral view; **D,** tip of appendix masculina, medial aspect. **E-G,** *B. microps* — ♀ . **E,** anterior carapace, rostrum, eyes, antennal peduncle; **F,** sixth thoracic sternite; **G,** same, lateral.

spines white, propod mainly white, scaphocerite, 6-8th thoracic limbs, exopod and endopod of uropod white. Cornea well pigmented, black. Antennal peduncles and flagella pinkish.

Distribution. Japan: Sagami Bay (Fukuda 1909, 1910; Komai 1938), off Owase (Komai 1927); Tosa Bay, (Ingle and Merrett 1971). Madagascar: 18° 54′S. 43° 55′E (Manning and Struhsaker 1976). Mocambique: 25° 12′S 34° 04′E (Ingle and Merrett 1971). South Africa: north of Durban, Natal (Calman 1923; Gordon 1929), Durban, 29°42′S 31° 29′E (von Bonde 1932, Barnard, 1950). Philippines: off Luzon, 13° 49.4′N 120° 04.2′E; 14° 00.0′N 120° 12.9′E (Moosa 1985).

Bathysquilla microps (Manning)

(Figs 1 D-F, 5, Frontispiece B)

Lysiosquilla microps Manning, 1961: 693-696, Fig. 5, Pls 10-11.

Bathysquilla microps — Manning 1969: 95-99, Figs 26-28; Manning and Struksaker 1976; 443-408, Figs 1 d-f, 2; Moosa 1985 (1986): 371-373, Fig. 1.

Material. — 1♂, QM W15314, Stn. 14/1, 17° 49.45′S 148° 39.51′E, 990-1006m, F.V. 'Franklin', 5°C, beam trawl, 8 v 1986.

Description. The following are additions to the previously published descriptions.

In profile, tip of rostrum down-curved, ventrally concave. Protopodite of antenna with ventral and lateral papillae. Dactyl of second maxilliped with 13 spines on each side, proximal spine being quite small; propod with 14 and 13 large medial spines on right and left sides, with 32 and 35 minor spines along lateral margins, with 12 and 10 proximal spines being small, forming continuous row, larger spines grouped opposite spaces between larger medial spines. Protopod of uropod without ventrolateral tooth; proximal segment of exopod with 7 (right) and 6 (left) graduated mobile spines laterally.

Receptaculum seminis on sixth thoracic sternite with thick well developed anterior triangular median plate, about 2 times longer than deep, well calcified anteriorly and ventrolaterally, soft ventromedially, swollen, with small ventral apical papilla; posteriorly with transverse median prominence bearing short, paired processes, strongly bowed, well calcified anteriorly, feebly calcified posteromedially. Telson with very distinct lateral carinae.

Colouration. Dense crimson red, including most spines and setae; antennular peduncles pale, pinkish; raptorial claw propodal spines distally pale; cornea white.

Measurements. See Table 1.

Distribution. (Fig. 5) Reported from several localities on the Caribbean region, Surinam and French Guiana (Manning and Struhsaker 1976). In the Indo-West Pacific region, first reported from Hawaii (Manning & Struksaker, 1976) and subsequently from the Philippines (Moosa 1985), off Luzon, 13° 49.1′N 119° 59.8′E. and 13° 53.7′N 119° 58.5′E.

Table 1. Measurements (mm) of *Bathysquilla* spp. from the Coral Sea.

Parameter	*B. crassispinosa*		*B. microps*
	♂	♀	♂
Total body length	142	213	187
Carapace length	26	34	36
Carapace width	26	39	38.5
Rostral length	13	16	6
Rostral width	9	11.5	8.5
First abdominal segment length	11.5	16	15.5
First abdominal segment width	34	47.5	46.5
Telson length	25	29.5	33.5
Telson width	35	47	49
Antennular peduncle length	17.5	25	32.2
Antennal scale length	24.5	33.5	38.5
Corneal width	6.8	7.8	5.6
Corneal depth	2.9	4.0	1.9
Corneal index	382	435	642
Second maxilliped, dactyl length	34	44	45
Second maxilliped, dactyl width (central)	4.5	4.5	5.0
Uropod, proximal exopod segment length	11.5	15	15.5
Uropod, distal exopod segment length	10.5	13	15

DISCUSSION

The mouthparts of most stomatopods, with the exception of the raptorial second maxilliped, have not been described. The mouthparts of six stomatopod genera, *Alima* Leach, *Oratosquilla* Manning, *Harpiosquilla* Holthuis, *Anchistisquilla* Manning, *Odontodactylus* Bigelow and *Gonodactylus* Berthold, now placed in four different stomatopod families, have been described in detail by Kunze (1981) and can be readily compared with those of *Bathysquilla crassipinosa*. Prior to this report, figures of most of the mouth-

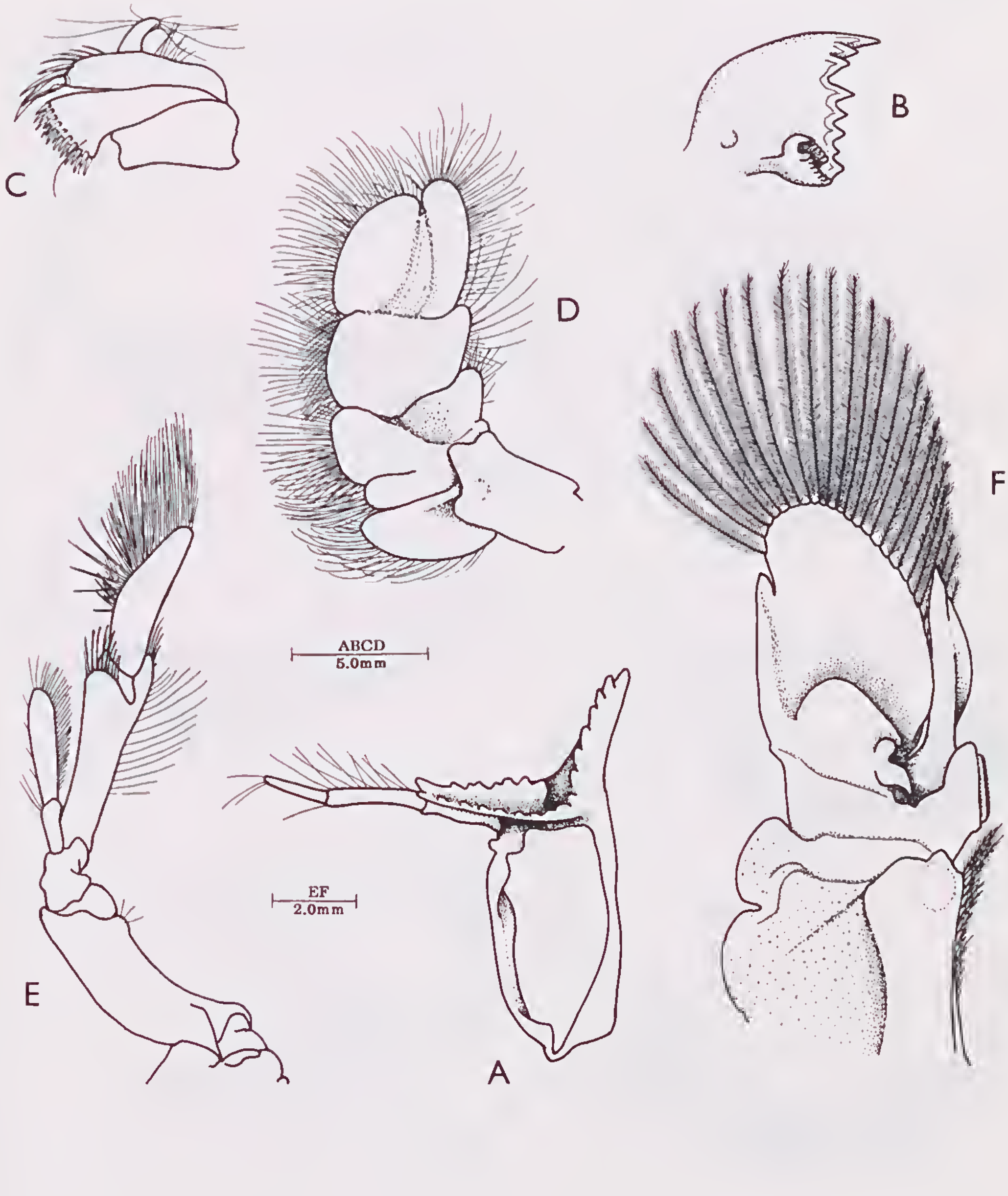

Fig. 2. *Bathysquilla crassispinosa* ♀ (except F): **A,** mandible; **B,** same, incisor process; **C,** maxillula; **D,** maxilla; **E,** sixth thoracopod; **F,** ♂, first pleopod, endopod.

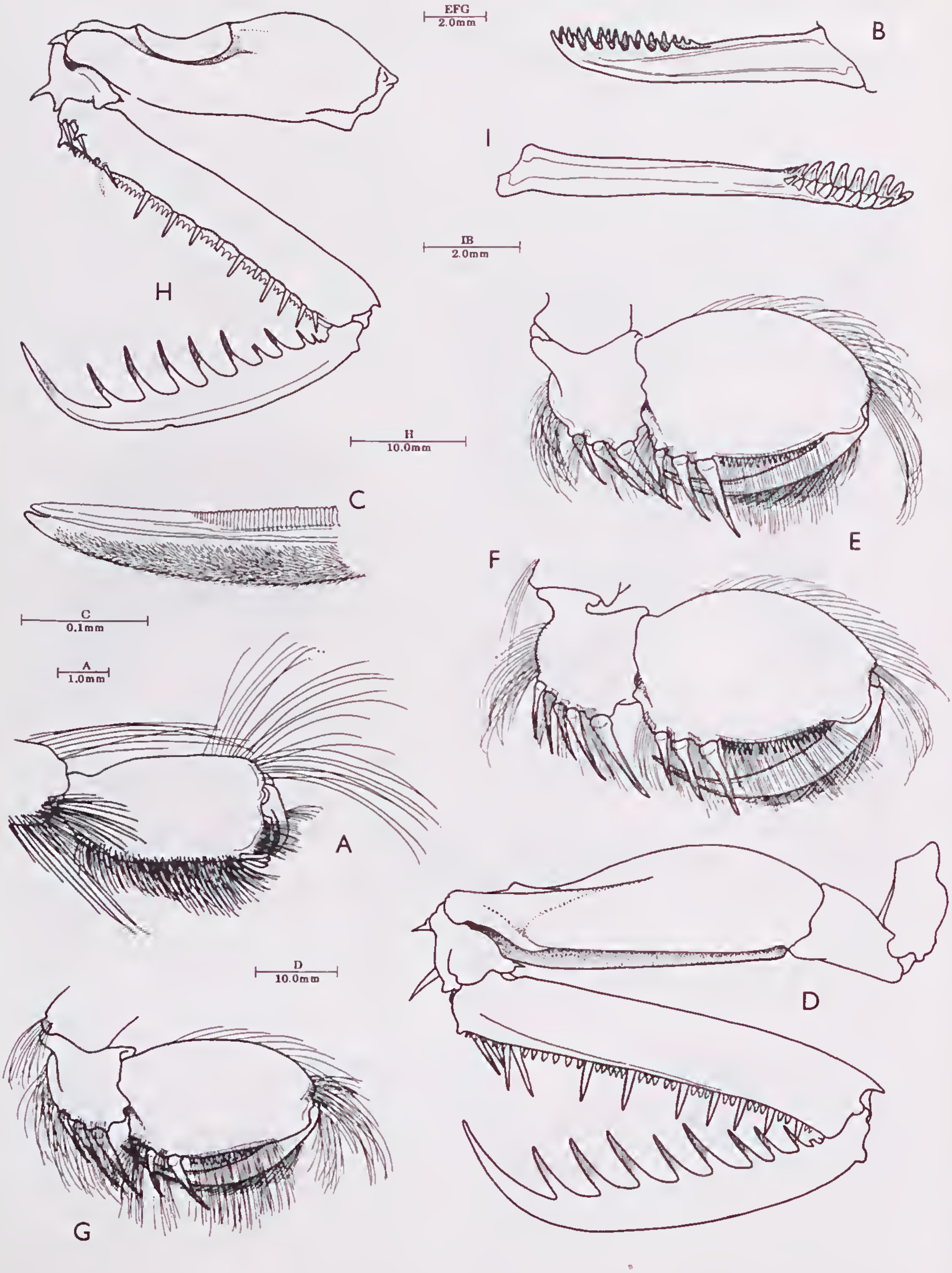

Fig. 3. A-H, *Bathysquilla crassispinosa* ♂ (except **H**): **A,** first maxilliped, chela; **B,** same, distoventral propodal spine; **C,** same, ventral palmar seta, tip only; **D,** second maxilliped, lateral; **E,** third maxilliped, carpus and chela; **F,** fourth maxilliped; **G,** fifth maxilliped, same; **H,** second maxilliped, ♀ , medial; **I,** *Harpiosquilla stephensoni* ♂, first maxilliped, ventral propodal spine.

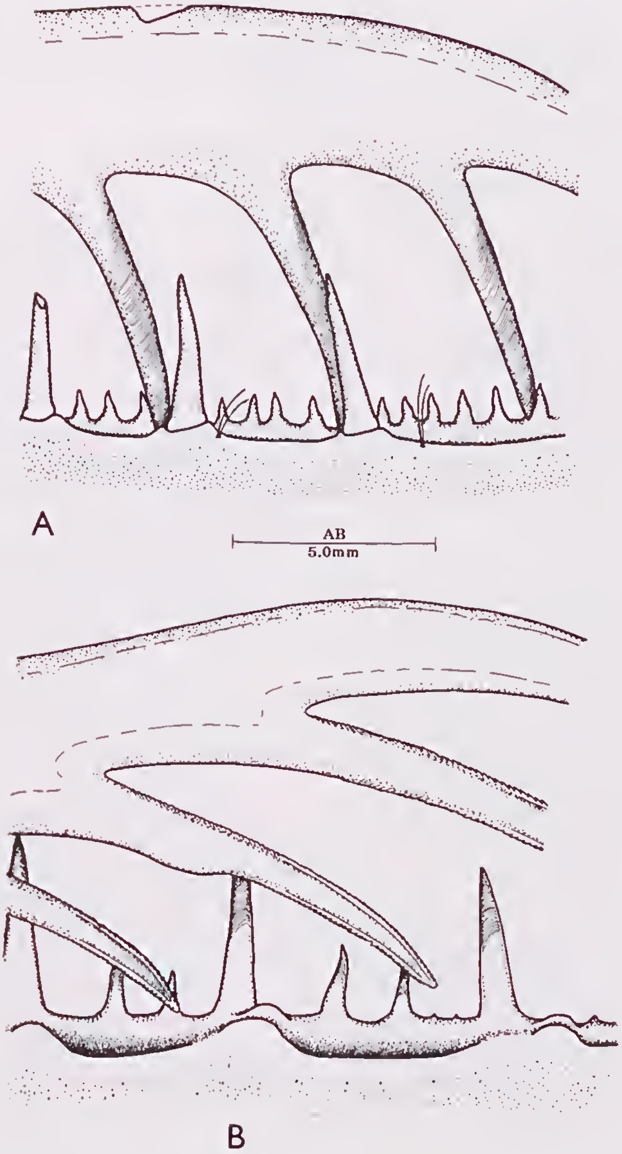

Fig. 4. A, *Bathysquilla crassispinosa* ♀, second maxilliped, dactylar and prododal spines; **B.** *Harpiosquilla stephensoni* ♀, second maxilliped, dactylar and propodal spines.

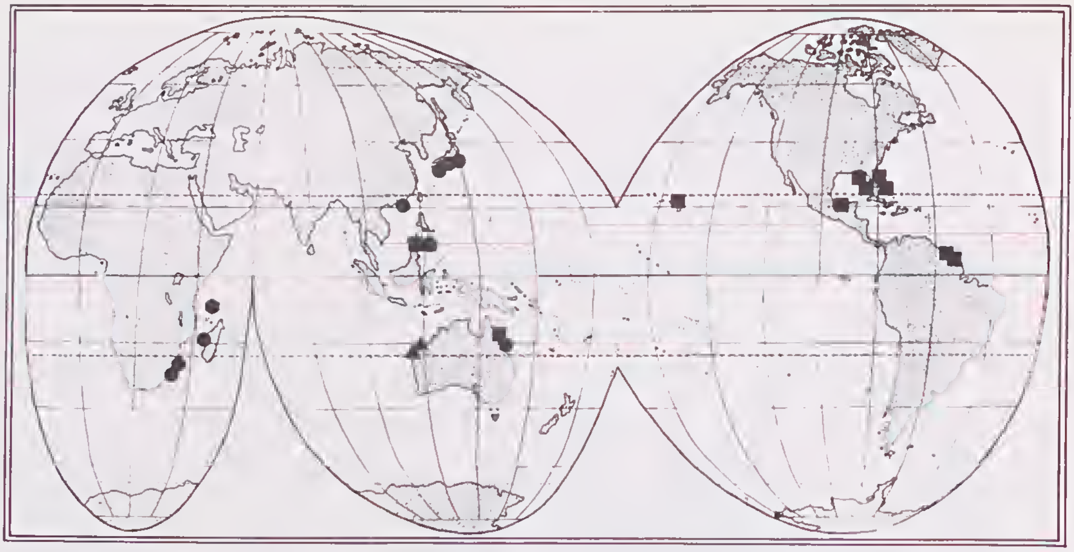

Fig. 5. Distribution of four species of Bathysquillidae:▲, *Altosquilla soelae* ● , *Indosquilla manihinei* ●, *Bathysquilla crassipinosa;* ■, *B. microps.*

parts of *Pseudosquilla* Dana (Pseudosquillidae) and *Lysiosquilla* Dana (Lysiosquillidae) were also provided by Townsley (1953). The mouthparts of the bathysquillid species, *Indosquilla manihinei* Ingle and Merrett, 1971, have not been described and only the mandible, first and second maxillae have been described and illustrated for *Altosquilla soelae* Bruce, 1985. Comparison with these descriptions indicates that *Bathysquilla* shows the closest resemblance, in its mouthparts, to those of *Harpiosquilla,* in the family Harpiosquillidae.

The mandibles are essentially similar in *Bathysquilla* and *Harpiosquilla,* and may, for convenience, be compared with those of *H. stephensoni* Manning 1969. The mandibular palp in *Bathysquilla* is slightly less setose than in *Harpiosquilla* and the incisor and molar process less robust. The maxillula has a more stoutly developed palp, with longer simple setae, the distal endite has three stout, articulated spines distally instead of two, with four spiniform setae proximally, and the expanded distal margin of the proximal endite has three rows of short spines, whereas in *Harpiosquilla* the palp is short, with two short setae only, the upper lacinia has a stout ankylosed distal spine, distodorsal spiniform seta, and three proximal simple setae; the lower lacinia more expanded, with more numerous, more slender spines. The maxilla in *Bathysquilla* is generally broader than in *Harpiosquilla* but with basically similar segmentation and setation. The first maxilliped of *Bathysquilla* has the subchela only slightly modified, without an expanded ventral portion and a flexed normal position as occurs in *Harpiosquilla,* the dactyl has only a short dorsal seta tuft and is ventrally concave, opposing onto an obsolete cutting edge with a row of short spines, with dense short simple seta laterally and three distally dentate spines only, the ventral palm densely covered with numerous specialized setae. In *Harpiosquilla,* the subchela is little longer than broad, strongly curved and with the posteroventral palm expanded, the dorsal surface of the dactylus densely setose and the ventral aspect is not concave, opposing into a long raised carina, with rows of setae medially and laterally, and the posteroventral region of the palm is densely provided with a mass of distally dentate setae. The second maxilliped in *Harpiosquilla* has the teeth more strongly compressed, with the edges finely serrated, the medial and lateral aspects being finely milled; the propod has only one row of fixed spines, situated medially, the long and short erect spines being in the same row, with a row of deep pits laterally into which the spines of the propod rest. In *Bathysquilla* the edges of the propodal spines are not serrated and the propodal spines are in two distinct rows, separated by shallow pits which will house the tips of the propodal spines, with the long spines in the medial row and the short spines laterally. The proximal propod is also armed with three long mobile spines in *Harpiosquilla* and four in *Bathysquilla*. In the third to fifth maxillipeds (M), the propodal and carpal spinulation is as follows:

	Bathysquilla			*Harpiosquilla*		
	Mxp. 3	Mxp. 4	Mxp. 5	Mxp. 3	Mxp. 4	Mxp. 5
proximal palmar	3	3	3	3	3	3
medial palmar	3	3	3	0	1	1
ventral carpal	5	3	3	2	2	2
medial carpal	0	0	0	2	1	0

The chela of the fifth maxilliped in *Harpiosquilla* is more subrectangular than oval, as in *Bathysquilla,* with a dense tuft of short setae along the distal margin, where only a few long setae are present in *Bathysquilla.*

The present records of *Bathysquilla* species provide a considerable extension to the known distribution ranges for bathysquillid stomatopods. Although, as yet, records of these species are widely separated, it begins to look as though their disjunct distribution may be more apparent than real and that further collections from appropriate depths and on suitable substrates, on which little information is available, may indicate a much less irregular distribution pattern.

The genus *Bathysquilla* is of considerable antiquity and *B. wetherelli* (Woodward, 1879) is known from Lower Eocene strata in southern England (Quayle 1987).

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A NOTE ON *GNATHOPHYLLOIDES MINERI* SCHMITT (CRUSTACEA: DECAPODA: PALAEMONIDAE), INCLUDING ITS FIRST OCCURRENCE IN AUSTRALIAN WATERS.

A.J. BRUCE
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

Gnathophylloides mineri Schmitt (Crustacea: Decapoda: Palaemonidae) has been reported as new record from Australian waters.

KEYWORDS: Crustacea, Decapoda, Palaemonidae, *Gnathophylloides mineri,* new record, Australia.

INTRODUCTION

Recently a photograph of some small commensal shrimps on an echinoid host was made available for examination. These shrimps clearly showed the characteristic colour pattern of *Gnathophylloides mineri* Schmitt. The specimens had been photographed underwater by scuba-divers and had not been collected. A request for some specimens was subsequently successful and the specimens form the basis of the present note. A further specimen was also collected during the trans-Pacific cruise of the F.V. 'Raleigh', as part of the Operation Raleigh project in 1986, when collections of shrimps were made from numerous island localities. It is a pleasure to thank the collectors, Steve Smith and Mark Richmond, for kindly supplying the specimens.

SYSTEMATICS

Gnathophylloides mineri Schmitt
(Figs 1-2)

Gnathophylloides mineri Schmitt, 1933: 7, Fig. 3.

Material. (i) 1♂, 1 ovig. ♀, North Solitary Island, 29° 25'S 153° 24.0'E, New South Wales, 12m, 24.iiv.1988, coll. S.D.A. Smith, NTM. Cr.006495. (ii) 1 ovig. ♀, Tongatapu, Tonga, Stn. SP.61a, Operation 'Raleigh', 5-20m, 15.viii.1986, coll. M. Richmond, NTM. Cr.004336.

Description. The three specimens agree well with the original description provided by Schmitt (1933). In the Solitary Islands specimens, the rostrum bears four acute dorsal teeth, with the tip markedly upturned in the case of the female. The Tongan specimen has only three dorsal rostral teeth. All specimens also have a very small distal ventral rostral tooth. In the Solitary Islands female the rostrum distinctly exceeds the distal corneal margin, but in the male falls well short. The second pereiopods are subequal and similar, but markedly larger in the male than in the female, about 2.0 and 0.95 times the postorbital carapace length respectively, the male chela being 1.5 times the length of the female chela, in the Solitary Islands material.

Measurements. Postorbital carapace length, (i) ♂ 1.8mm, ♀ 2.5mm, (ii) 2.2mm. Length of ovum, advanced, 0.7mm.

Host. *Tripneustes gratilla* (Linn.) (Echinodermata: Echinoidea)

Colouration. (i) Broad dorsal band of narrow white and pale brown striae, broad dorsolateral band of white, broad lateral band of chocolate brown, expanded over first three pleura, extending whole length of body, with lower band of white laterally along ventral branchiostegite and pleura; antennal peduncles, corneae and chela and carpus of second pereiopods white; pereiopods pale yellowish, caudal fan pinkish (from colour photographs).

(ii) Creamy white, with reddish pink band along body laterally (from collector's notes).

The colour pattern of the Zanzibar specimen previously reported by Bruce (1974) showed a broad white lateral band extending from the postorbital region to the upper pleuron of third abdominal segment, with a broad band of dark chocolate brown over lower branchiostegite and pleura, with dorsal carapace and abdomen finely striate with

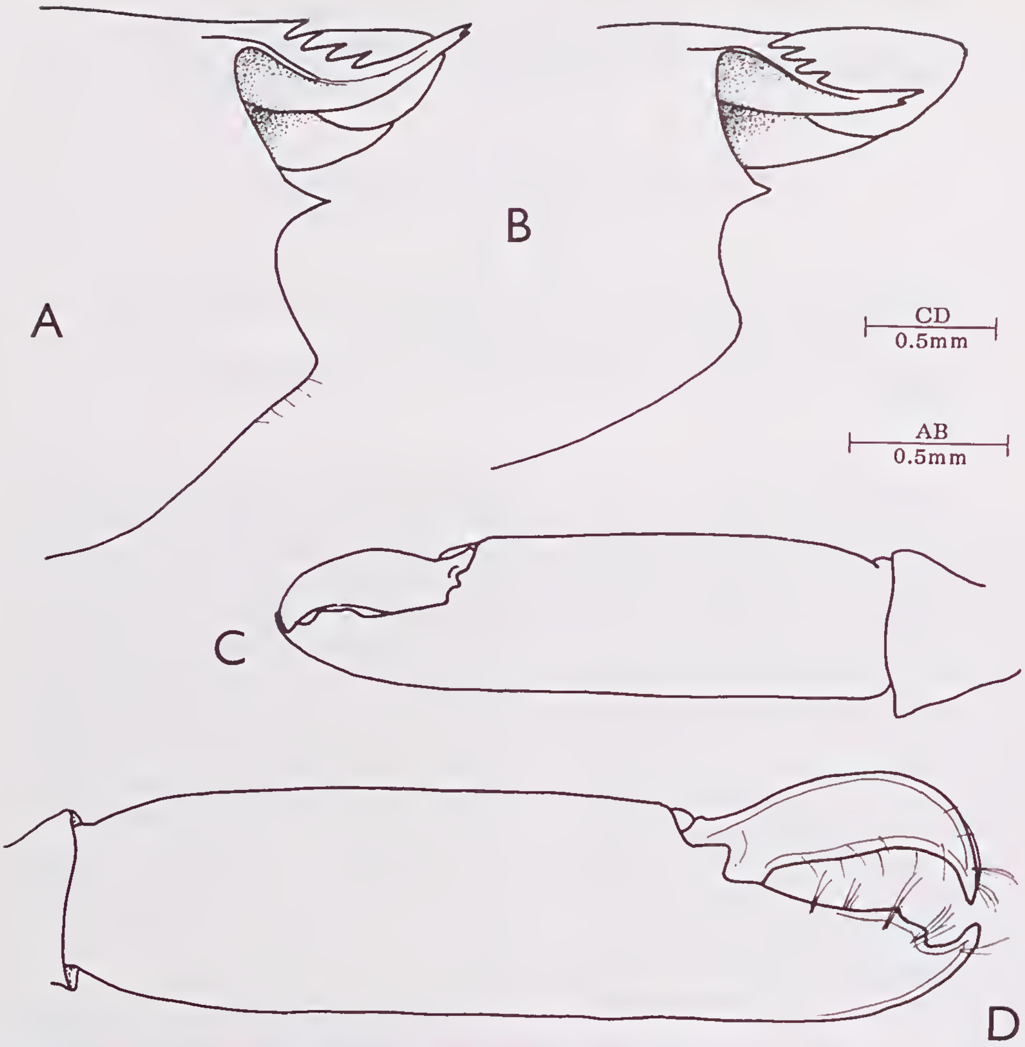

Fig. 1. *Gnathophylloides mineri*: **A,B,** Northe Solitary island ovigerous ♀ — **A,** anterior carapace and rostrum, lateral; **B,** chelo of second pereiopod. ♂ — **C,** anterior carapace and rostrum; **D,** chela of second pereiopod.

narrow longitudinal bands of white and pinky-blue, breaking up into white dots on a pinky-blue ground over fourth, fifth and sixth tergites; medial eyestalks and telson similar. Antennal peduncles and proximal flagella, lateral eyestalks, cornea and second pereiopods white. Ambulatory pereiopods pale purple, uropods transparent (from colour photograph).

Remarks. *G. mineri* was first reported from Ballena Point, Ensenada, Costa Rica, and has been subsequently reported from the Caribbean Sea, Colombia, Mexico and Florida. It is one of the relatively few circumtropical shrimps and was first reported from the Indo-West Pacific region by Castro (1971), who recorded specimens in association with *Tripneustes gratilla* and *Pseudoboletiana indiana* in Hawaiian waters. Subsequently the species was reported from Zanzibar and the Seychelle Islands (Bruce 1974), in both cases also in association with *T. gratilla.* The species has also been recorded in the Eastern Pacific region, from Malpelo Island, Colombia (Abele 1975), probably in association with *T. depressus.* The present Australian record represents a considerable extension in the recorded distribution of this species, linking the western Indian Ocean and the central Pacific Ocean records, as well as representing a considerable southerly range extension into relatively cold waters for an apparently trop-

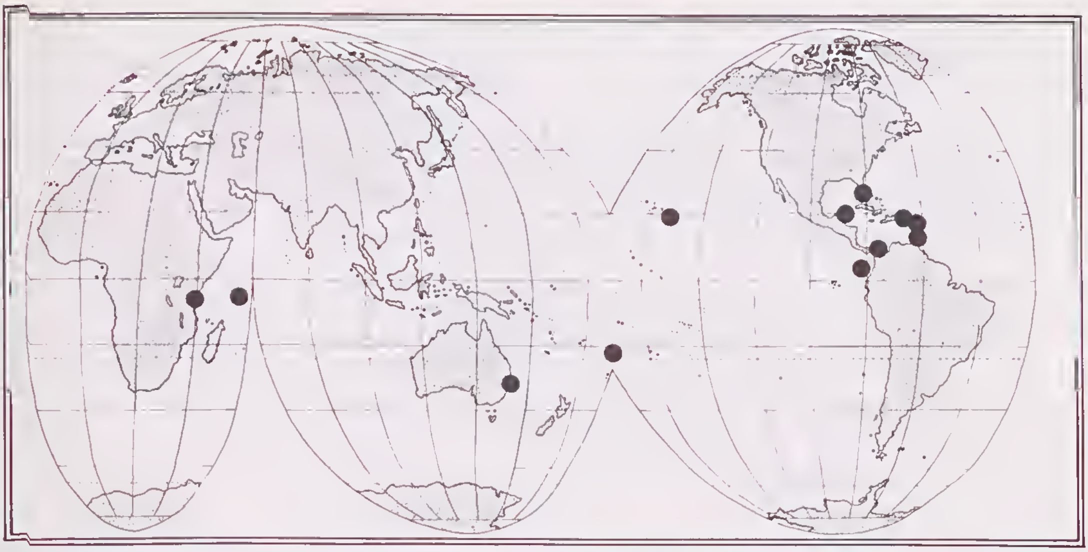

Fig. 2. Distribution of *Gnathophylloides mineri.*

ical species. It seems probable that the distribution of the shrimp is controlled primarily by that of its host animal, typically an urchin of the genus *Tripneustes*, unless a suitable alternative host is available. The shrimps can probably be found whereever the host urchins occur in numbers. The collector notes that the shrimps were uncommon and that over 50 host urchins were examined but only the single pair of shrimps was observed. The shrimps have been noted, but not collected, on the same host on previous occasions, at the North Solitary Island at 10m on 15 February 1988 and at South Solitary Island at 15m on 22 January 1988. The collector has also photographed *G. mineri* on *Pseudoboletia maculata* at the Solitary Islands, a new host record. Both *Tripneustes* and *Pseudoboletia* are members of the Toxopneustidae, but so far, no specimens of *Gnathophylloides*, or other shrimps, have been reported from *Toxopneutes*.

The biology of *G. mineri* at St. Croix, Virgin Islands, has recently been described by Patton *et. al.* (1985), who described the colour pattern in detail. The pattern in the Virgin Islands specimens shows the closest correspondance to the Indo-West Pacific specimens, although the tint of some colour zones may show some differences, i.e., the dorsal zone is of white striae on a pink-blue ground in the Zanzibar specimen but on a brownish ground in the St. Croix material. These specimens therefore provide an interesting confirmation of the consistency of colour pattern that can occur in some very widely distributed shrimp species, as has been previously reported for some others, such as *Thor amboinensis* De Man (Chace 1972). It may be noted that the fine striae on the median dorsal band bear a close similarity to the appearance of the longitudinally ridged spines of the host, along which the shrimps appear to be normally orientated.

The host of the Tongan specimen was not ascertained as the specimen was found adherant to the surface of a live specimen of *Tridacna maxima* purchased in the local market at Nuku'alofa, supplied by local divers.

The genus *Gnathophylloides* is also represented in Australian waters by *G. robustus* known only from the type material collected near Geraldton, Western Australia (Bruce 1973), in association with *Centrostephanus tenuispinus*. In contrast to the widely distributed *G. mineri*, *G. robustus* may prove to be indigenous to Australia only.

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FURTHER RECORDS OF THE HYMENOCERINE SHRIMP *PHYLLOGNATHIA SIMPLEX* FUJINO (CRUSTACEA:DECAPODA)

A. J. BRUCE
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

The small hymenocerine shrimp *Phyllognathia simplex* Fujino, known only from Sagami Bay, Japan, has recently been collected from Lizard Island (Queensland, Australia) and Wongat Island (Madang, Papua-New Guinea). An amended description of the species is given.

KEYWORDS: Crustacea, Decapoda, Palaemonidae Hymenocerinae, *Phyllognathia simplex,* distribution, Australia, Papua New Guinea.

INTRODUCTION

The only previously known specimens of the small hymenocerine shrimp *Phyllognathia simplex* Fujino were collected from 20-50m in Sagami Bay, Hokkaido, Japan, in 1963 and the lack of further records suggested that the species might be restricted to Japanese waters. The holotype, an ovigerous female, lacks the posterior telson, and the paratype, another ovigerous female, is extensively mutilated. The collection of two further specimens confirms the accuracy of Fujino's account and enables some further details to be added, as well as providing considerable increase of the known distribution of the species. CL refers to postorbital carapace length; TL total body length.

SYSTEMATICS

Phyllognathia simplex Fujino

(Figs 1-2)

Phyllognathia simplex Fujino, 1973: 90-99.

Material. 1 ♀ juv. NTM Cr. 005983. Wongat Island, Madang, Papua-New Guinea, 6 m, 19 ix 1987, coll. J. Mizen; 1 ovig. ♀ , NTM Cr. 006035 Stn. NQ 131, Lizard Island, Queensland, 14° 40′S. 145° 17′E, 15m, 13 xii 1987, coll. G.C.B. Poore and D. Petch.

Description. The two specimens agree closely, in general, with the original species description.

Larger ovigerous ♀ with rostral tip missing, dentition 7/3, possibly 8/4, all teeth anterior to posterior orbital margin, postrostral carina extending to about 0.3 of postorbital carapace length, ventral rostral margin with well developed median row of plumose setae, dorsal interdental spaces feebly setose, posterior half of dorsal carina with submedian pairs of long simple setae; inferior orbital angle feebly produced, with small reflected ventral flange; antennal spine distinctly postmarginal, tip not exceeding anterolateral carapace margin, branchiostegite with anterolateral angle strongly produced, medially reflected beneath basicerite, margins setose. Smaller specimen with rostrum intact, dentition 8/3, postrostral carina less well developed, with more numerous long simple submedian dorsal setae.

Telson about 1.9 times length of sixth abdominal segment, 2.5 times longer than wide, lateral margins straight, convergent, dorsal spines well developed, marginal, at 0.25 and 0.66 of telson length; posterior margin angular, about 0.3 of anterior width, with small acute median point, lateral posterior spines slightly larger than dorsal, intermediate spines robust, about 0.25 of telson length, submedian spines slender, about 0.6 of intermediate spine length, setulose.

Mouthparts of ovigerous ♀ similar to holotype. Mandible (right) with molar process elongate, slender, with two blunt distal teeth separated by group of 4 simple setae. Maxillula with feebly bilobed palp, lower lobe with single relatively long, slender simple seta; upper lacinia narrow, distally truncate with 5 short, stout, feebly biserrate distal spines; lower lacinia elongate, narrow, with few long feebly setulose setae. Maxilla with broad tapering palp with 7-8 long plumose setae laterally, medial border glabrous, basal endite greatly reduced, small rounded lobe with 2 long sparsely setulose setae, coxal region feebly convex, scaphognathite with densely setose margins. First maxilliped with palp elongate, tapering, non-setose, basal endite well developed, rounded, distomedial margin sparsely setose, setae simple, coxal region non-setose. exopod with slender flagellum with 4 plumose distal setae, caridean lobe narrow, margin strongly setose, epipod large, elongate, feebly bilobed, anterior lobe 4.0 times longer than posterior. Second maxilliped with dactylar segment short and broad, armed with short, stout strongly biserrate spines distally intergrading to long slender setulose setae proximally, proximal segments of endopod normal,

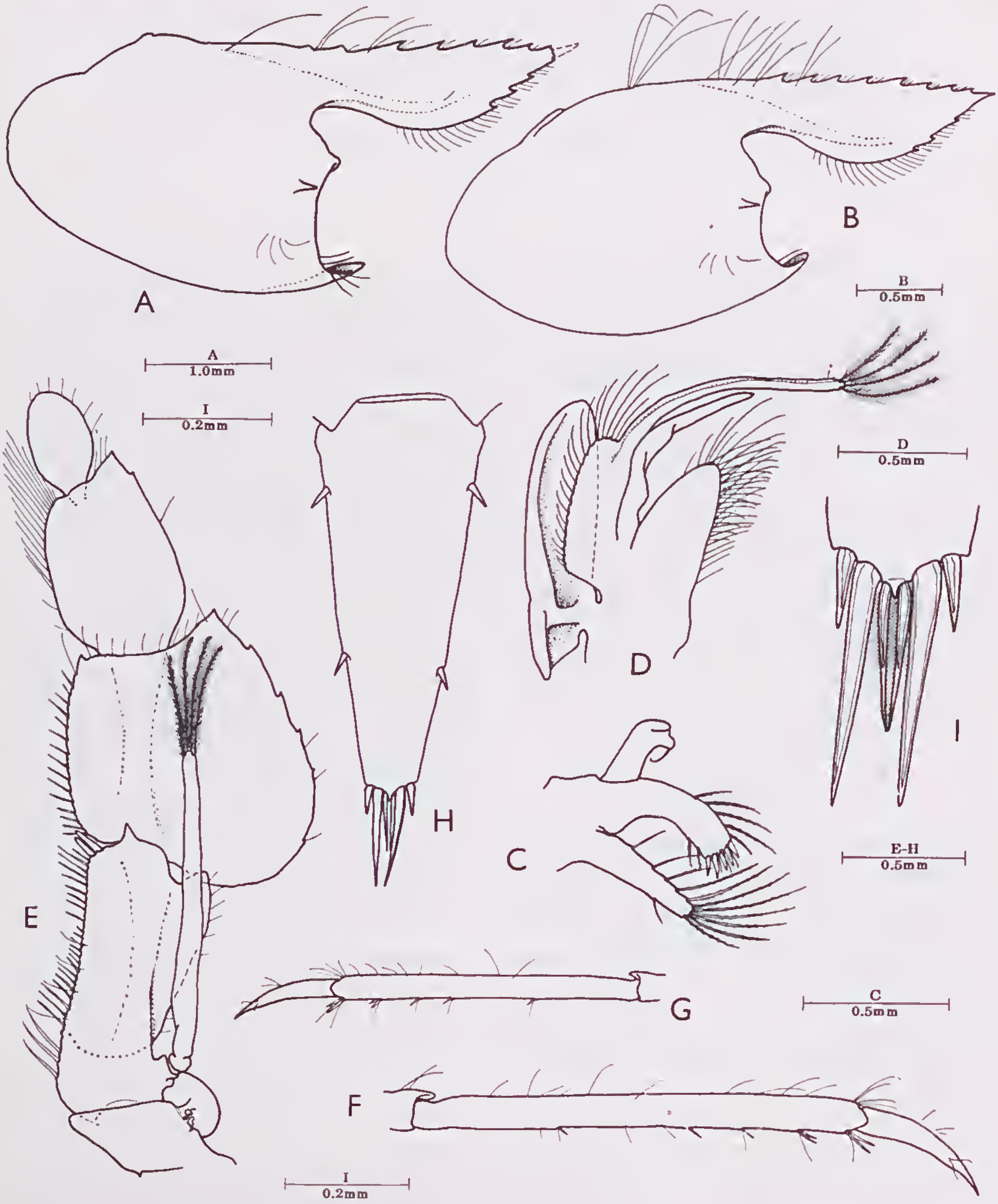

Fig. 1. *Phyllognathia simplex* (**A, C-F,** ovig ♀ , **B, G, H,** juv. ♀); **H, A, B,** carapace and rostrum; **C,** maxillula; **D,** first maxilliped; **E,** third maxilliped; **F, G,** third pereiopod, propod and dactyl; **H,** telson; **I,** posterior telson spines

exopod flagellum with four plumose distal setae only, coxa with small medial process, with large subcircular epipod laterally, without podobranch. Third maxilliped with ischium enclosed by anterolateral branchiostegite, meral segment beneath basicerite, endopod with four distinct segments: terminal dactylar segment oval, laminar, about 1.8 times longer than broad, sparse simple setae round distal and lateral margins; propod laminar, about 1.4 times longer than broad, about 1.7 times dactyl length, with distolateral angle acutely produced with single small lateral accessary tooth, lateral margin almost devoid of setae, medial margin with dense fringe of long simple setae distally; carpus subequal to axial length of propod, maximum length about 1.2 times maximum width, lateral margin very broadly expanded, laminar, posteriorly rounded, with acute distolateral lobe, lateral margin dentate, medial margin expanded, laminar, with small acute distomedial tooth, medial margin with numerous short, spiniform setae; ischium comparatively robust, axial length about 1.2 times carpal length, with acute distodorsal tooth, about 1.6 times longer than greatest width, lateral margin expanded with anterolateral lobe, margin sparsely setose, medial margin with 2 stout peglike distal spines, rest with numerous feebly serrulate spiniform setae; basis short, stout, about 0.25 of ischiomeral axis length, not medially produced, with 3 simple medial spines, exopod with flagellum slender, reaching to mid carpus, with 4 plumose setae distally; coxa compressed, projecting medially, non-setose, with small oval lateral plate, without discernable arthobranch.

First and second pereiopods as previously

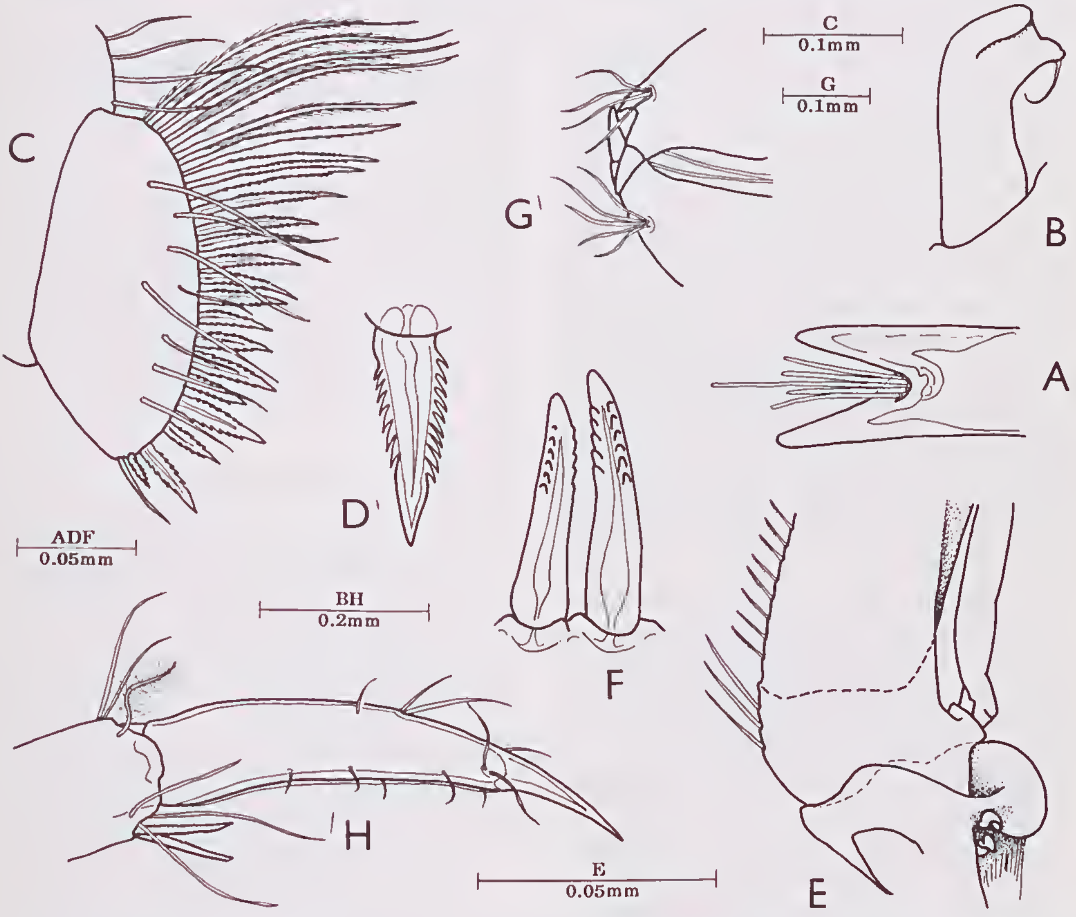

Fig. 2. *Phyllognathia simplex* ovigerous ♀: **A,** molar process of right mandible; **B,** palp of maxillula; **C,** dactylar segment of second pereiopod; **D,** same, marginal spine; **E,** third maxilliped, coxo basal region, dorsal; **F,** same, distomedial spines of meral segment; **G,** third pereiopod, dactyl.

described. First pereiopods with coxae with small ventro-median process, fourth thoracic sternite with low thick, posteriorly carinate, triangular, transverse median process. Second pereiopods with coxae unarmed. Fifth thoracic sternite with broad, thin, transverse plate with small median notch and rounded median tubercle posteriorly, posterior to coxae. Chela of second pereiopods with small subterminal accessory tooth on fixed finger forming notch into which closed dactyl fits. Third ambulatory pereiopod with dactyl about 5.5 times longer than proximal depth, with sharp ventral margin, unguis feebly demarkated, about 0.3 of corpus length; corpus compressed, feebly curved, tapering distally, without distoventral accessory tooth, with dorsal and distolateral setae; propod about 2.4 times dactyl length in ovigerous female, 2.7 in juvenile, with distoventral pair of finely serrulate spines, ventral margin with one distal pair and 3 single ventral spines: fourth and fifth pereiopods similar, propods less strongly spinose. Pleopods and uropods without special features.

Measurements (mm). Ovig. ♀ — TL, 10.0; CL, 3.5; CL, 1.6; ovum length, 0:5. Juv.♀ — TL, 7.2; CL, 2.7; CL, 1.0.

Colouration. Juv. ♀ : Carapace silvery-grey dorsally, greyish-white laterally, with longitudinal dorsolateral line of five round blue spots surrounded by bright yellow. Eyestalk with longitudinal row of three small red spots. Ovig. ♀ : Generally mottled brown-cream, "sand like", with transparent caudal fan. Carapace with dorsolateral lines of yellow patches with deep blue centres; abdomen with similar smaller patches. Lamellar mouths parts with yellow spots. Chelae and pereiopods banded, reddish and white. Ova orange.

Remarks. The present records represent a considerable extension of the known distribution of *P. simplex* and clearly indicate that it is not restricted to Japanese waters. However, records are as yet too few to suggest that the species has an anti-tropical distribution, as noted for some other taxa (Briggs 1987).

The third maxillipeds in the genus *Phyllognathia* Borradaile are unusual amongst palaemonoid shrimps, with the endopod having four segments instead of the usual three. The only shrimp genus having a similar configuration is the genus *Hymenocera* Latreille. The genera *Phyllognathia* and *Hymenocera* are unique in having maxillipeds in which the ischium and merus are distinctly articulated, as noted by Borradaile (1917) in his key to the then known genera of Gnathophyllidae. This clearly suggests a close relationship between these two genera, in contradistinction to other genera, which is confirmed by many other details of their general morphology. The functional importance of this articulation is not clear, but it may be noted than in aquarium observations of *Hymenocera* feeding on the asteroid *Linckia,* fine precision feeding movements are carried out, they could almost be termed dissections, with the chelae of the first pereiopod, behind a guard formed by the depressed endopods of the third maxillipeds. The relationship between ischium and basis is also unusual in the third maxilliped of *Phyllognathia simplex,* as there is no trace of a division between these segments dorsally but it is quite distinct ventrally. In *Hymenocera* also, the articulation between ischium and basis is very feebly marked.

Both collectors remarked on the striking colour pattern of the two shrimps, not previously recorded. The pattern appears similar to, but quite distinct from, that of *Phyllognathia ceratophthalma* (Balss), which consists of large orange patches outlined with black spots, in longitudinal rows on a yellow-brown ground colour (Bruce 1980).

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A NEW PALAEMONID SHRIMP FROM THE *ZOSTERA*-BEDS OF MORETON BAY, QUEENSLAND, AUSTRALIA (DECAPODA: PALAEMONIDAE)

A. J. BRUCE
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

A new species of palaemonid shrimp, *Periclimenes anacanthus,* is described and illustrated. As a species of the "*Periclimenes grandis* species group", it is most closely related to *P. calmani* Tattersall or *P. ensifrons* (Dana) and *P. grandis* (Stimpson). The species is apparently free-living and associated with *Zostera*-beds in southern Queensland.

KEYWORDS: Crustacea, Decapoda, Palaemonidae, *Periclimenes,* new species, Queensland, Australia.

INTRODUCTION

Through the kindness of Dr J.G Greenwood, some samples of shrimps collected by epibenthic sledge from sea-grass beds in southern Moreton Bay, Queensland, were made available for study. Amongst these were found a number of specimens of a *Periclimenes,* of the "*P. grandis* group" which could not be identified with any of the so-far described species of this group. This species is now described in detail

SYSTEMATICS

Periclimenes anacanthus sp. nov.

(Figs 1-5)

Type material. HOLOTYPE — ♀ (ovig.), Polka Point, Dunwich North Stradbroke Island, Moreton Bay, Queensland, 27° 29′S 153° 24′E, 0.5-1.0m below LWS, epibenthic sledge, November 1987, coll. J. and J.G. Greenwood, NTM. Cr.006317. ALLOTYPE — ♂, same data as holotype. NTM CR.006317. PARATYPES — 3♂ , 6♀ (5 ovig.), NTM Cr.006317. 1 ♀ , Rijksmuseum van Natuurlijke Historie, Leiden, RMNH, Crust. 37303.

The largest ovigerous female, with the right (?) minor second pereiopod attached has been selected as the holotype, and a male, also with the right (?) minor second pereiopod still attached, as the allotype.

Description. A typical medium-sized, (to ca. 24mm), member of the *P. grandis* species group. Carapace smooth, glabrous, with well developed rostrum, about 1.15 of postorbital carapace length in females, 1.50 in males, distinctly more slender in latter, compressed, slightly upcurved distally, extending well beyond antennular peduncle, to level of distal end of scaphocerite, lateral carinae obsolete, with 8-9 dorsal teeth in females, 7-8 in males, first tooth situated just in front of posterior orbital margin, evenly spaced, 2-3 ventral teeth in both sexes, all on distal half, dorsal interdental spaces with short plumose setae, tip of rostrum with simple dorsolateral setae, ventral margin with median plumose setae proximal to first tooth, double row distally; epigastric tooth present, with spiniform setae anteriorly, supraorbital spine acute, hepatic spine larger than supraorbital, orbit feebly developed, inferior orbital angle small, slightly produced with small medial flange, subacute, antennal spine large, marginal, anterolateral margin of branchiostegite feebly concave, anterolateral angle not produced, blunt.

Abdominal segments smooth, glabrous, with third slightly posterodorsally produced; fifth segment about 0.75 of sixth segment length, sixth compressed, about 1.3 times longer than deep, with posterolateral angle acute, posteroventral angle subacute; pleura of first three segments broadly rounded, enlarged in females, fourth bluntly produced, fifth produced with acute posterior angle. Telson about 1.5 of sixth segment length, 2.5 times longer than anterior width, lateral margins straight, convergent to posterior margin, latter about 0.4 of anterior

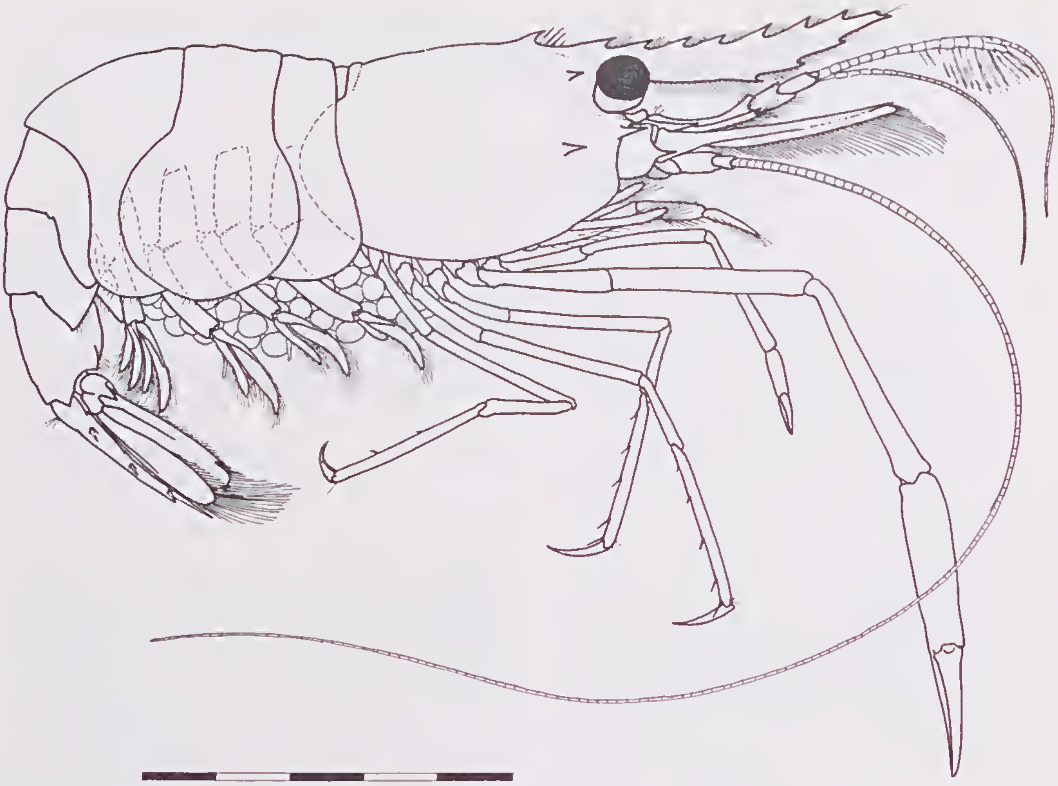

Fig. 1. *Periclimenes anacanthus* holotype ♀, Moreton Bay, Queensland. Scale bar in mm.

width, angular, with small acute median process; dorsal surface with transverse row of short simple setae anteriorly, two pairs of moderately large dorsal spines present at about 0.33 and 0.66 of dorsal length, each about 0.08 of mid-dorsal telson length, submarginal; three pairs of posterior spines, lateral spines short and stout, shorter than dorsal spines, intermediate spines long, robust, about 0.33 of telson length, submedian spines slender, about 0.35 of intermediate spine length, setulose, some simple setae present dorsally.

Eye with large globular well-pigmented cornea, oblique, without transverse banding, dorsal accessory pigment spot distinct, stalk feebly compressed, about as wide as posterolateral marginal length.

Antennular peduncle reaching to about 0.75 of rostral length; proximal segment about 2.5 times longer than central width, sides sub-parallel, stylocerite slender, acute, slightly exceeding half segment length, statocyst well developed with discoid statolith; anterolateral angle feebly produced, with strong lateral tooth; ventromedian margin setose, with acute tooth at half length; intermediate and distal segments short, together equal to about half proximal segment length, distal segment longer and more slender than intermediate; upper antennular flagellum slender, biramous, with 11 proximal segments fused; shorter free ramus with 2 segments, about 7-8 groups of aesthetascs; lower flagellum filiform, about 1.25 times carapace length.

Antennal basicerite with strong acute lateral tooth; carpocerite short, about 2.6 times longer than distal width, not exceeding proximal fourth of scaphocerite; flagellum well developed, about 6.0 times carapace length, scaphocerite reaching to about tip of rostrum, about 4.4 times longer than greatest width, at about 0.3 of length, tapering gradually distally to broad rounded tip, width equal to about half proximal width, lateral margin feebly concave with strong acute distolateral tooth far exceeding distal margin of lamella.

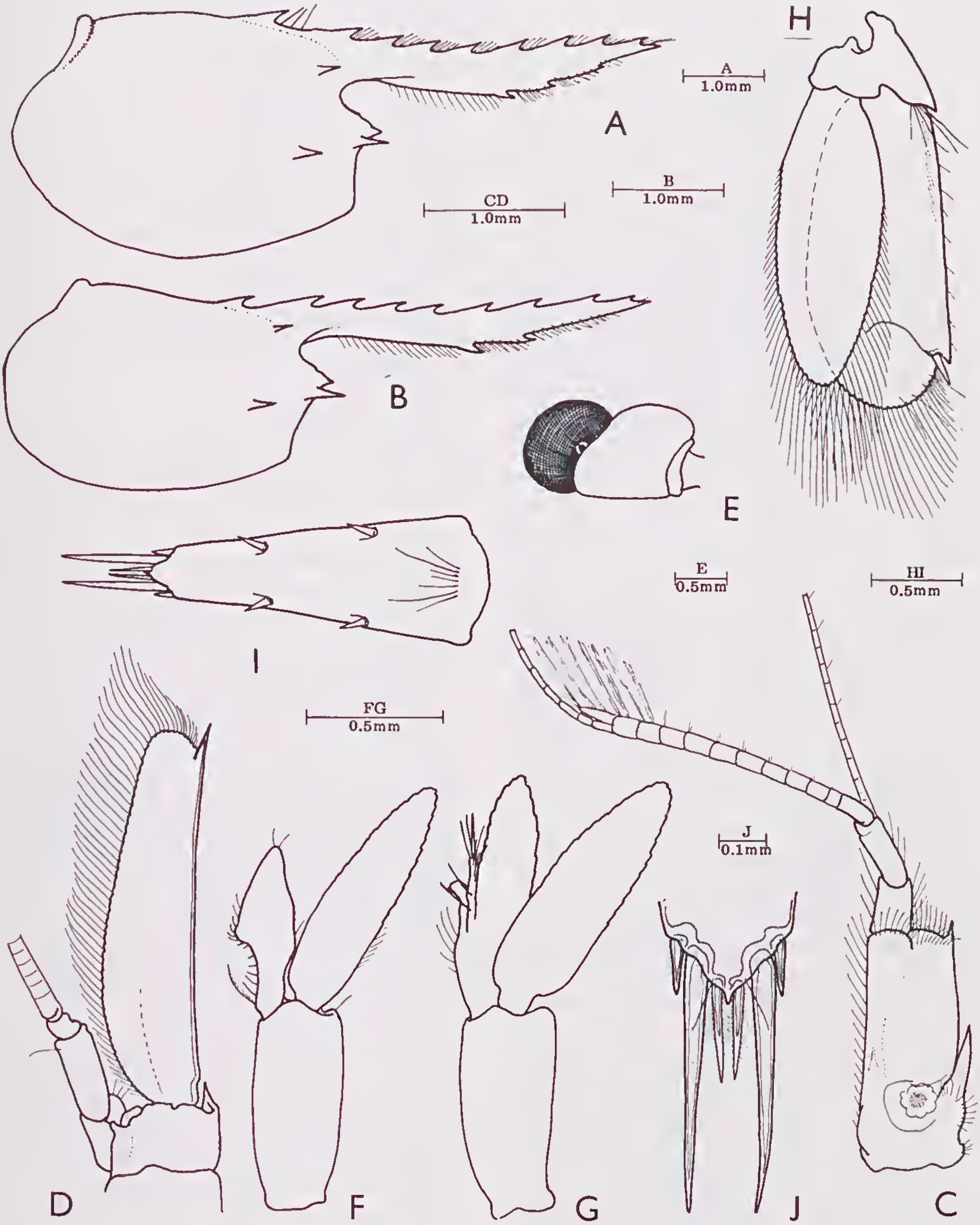

Fig. 2. *Periclimenes anacanthus:* **A**, holotype ♀, **B**, allotype ♂, **C-E**, **H-J**, paratype ♂, **F**, **G** — paratype ♂: **A**, **B**, carapace and rostrum; **C**, antennule; **D**, antenna; **E**, eye, dorsal; **F**, first pleopod; **G**, second pleopod; **H**, uropod; **I**, telson; **J**, same, posterior spines.

Epistome unarmed. Ophthalmic segment with small, acute "bec ocellaire". Thoracic sternites moderately narrow, fourth with slender, finger-like median process.

Mouthparts generally similar to *P. grandis* (see Bruce 1976). Mandible (right) moderately robust, corpus without palp, molar process stout, slightly expanded distally, with 5 large blunt distal teeth, small group of short setae present between posterior teeth; incisor process stout, tapering, with three robust distal teeth, central tooth smaller than outer teeth, medial border sharp with row of (?) small tubercles along dorsal margin. Maxillula with bilobed palp, upper lobe smaller than lower, with two short, simple setae, lower lobe stout with distal process bearing short simple spine; upper lacinia curved, not expanded, with about 8-9 stout spines distally; lower lacinia stout, tapering, blunt, with numerous setulose distal setae, plumose setae ventrally. Maxilla with palp simple, proximal half broadened, distal half slender, lateral margin setose; basal endite slender, bilobed, distal lobe slightly broader than proximal, with 14 and 12 simple distal setae respectively; coxal endite obsolete, medial margin feebly convex; scaphognathite about 3.0 times longer than broad, posterior lobe large, rounded, anterior lobe small, tapered anteriorly, medial margin concave. First maxilliped with slender, tapering palp with setulose medial preterminal seta; basal endite broad and rounded, moderately setose along medial margin with feebly setulose setae distally and feebly serrulate setate proximally, with group of four long submarginal setae proximally, exopod well developed, caridean lobe small, flagellum flattened, with numerous plumose setae distally; coxal endite simple, medial margin sparsely setose, epipod large, obscurely bilobed. Second maxilliped of normal form, dactylar segment moderately broad, densely armed with strongly serrulate spines medially, propod with distomedial angle broadly rounded, with about 10 long serrulate spines, carpus with acute ventromedial angle, ischiomerus and basis normal, exopod well developed, with numerous plumose setae distally, coxa medially convex, with 6 long simple setae, epipod subrectangular, without podobranch. Third maxilliped slender, with endopod exceeding carpocerite by about 0.6 of distal segment length; ischiomerus distinct from basis, about 9.0 times longer than central width, sparsely setose, with simple setae ventrally, with 5-6 small distolateral spines; penultimate segment about 6.5 times longer than distal width, 0.6 of ischiomeral segment length, sparsely setose dorsally, with long serrulate setae ventrally; terminal segment tapering distally with stout simple terminal spine, about 0.4 of penultimate segment length, 5.0 times longer than proximal width, with numerous feebly serrulate spines ventromedially; basis obliquely articulated with ischiomerus, medial border feebly convex and setose, exopod with broad flagellum with numerous plumose setae distally; coxa slightly produced medially, feebly setose, with oval lateral plate, with small tri-lamellar arthrobranch.

First pereiopods slender, reaching to about distal end of scaphocerite. Chela with palm subcylindrical, moderately compressed, about 2.2 times longer than deep, with 3-4 transverse rows of short serrulate cleaning setae proximally; fingers slender, slightly compressed, tapering with small hooked tips and entire, sharp cutting edges, dactylus about 1.2 times palm length, 5.6 times longer than proximal width, sparsely setose, fixed finger similar; carpus about 1.8 times chela length, slender, about 9.5 times longer than distal width, distal width about 2.0 times proximal width, with row of long serrulate cleaning setae distally; merus about 0.8 of carpus length, uniform, unarmed, about 10.0 times longer than central width, ischium about 0.5 of carpus length, about 5.5 times longer than distal width, obliquely articulated with basis; basis about 0.33 of carpus length, ventrally carinate, with spiniform setae; coxa robust, with small distoventral process with spiniform setae.

Second pereiopods almost all detached, apparently asymmetrical and unequal, extending well beyond scaphocerite by chela and about 0.5 of carpus length. Larger pereiopod with palm of chela subcylindrical, smooth, slightly swollen centrally, about 3.5 times longer than deep, fingers slender moderately compressed, with small hooked tips, dactylus about 0.7 of palm length, sparsely setose, about 0.16 times longer than proximal depth, cutting edge with two small low teeth on proximal third, distal two thirds sharp, entire, unarmed, fixed finger similar, proximal third with three small low teeth,

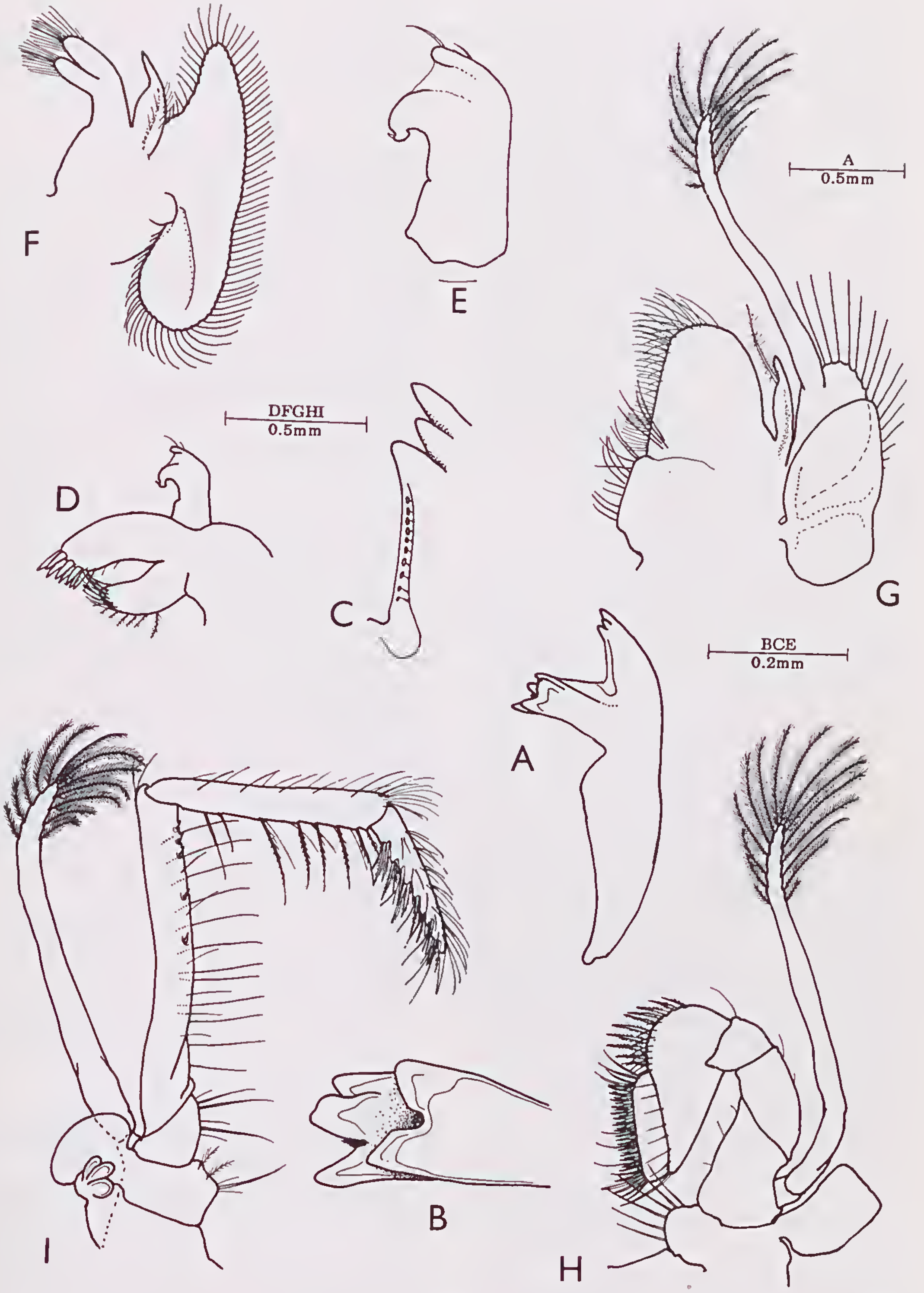

Fig. 3. *Periclimenes anacanthus* paratype ♀ : **A,** right, mandible; **B,** same, molar process; **C,** same, incisor process; **D,** maxillula; **E,** same, palp; **F,** maxilla; **G,** first maxilliped; **H,** second maxillipod; **I,** third maxilliped.

distal tooth larger and separated by wider gap than proximal two; carpus about 1.18 of palm length, moderately swollen distally, about 8.0 times longer than distal width, distal margins feebly excavate, unarmed; merus subequal to palm length, about 8.5 times longer than central width, without distoventral tooth; ischium about 0.85 of palm length, tapered proximally, unarmed, about 8.0 times longer than distal width; basis and coxa without special features. Smaller pereiopod similar, shorter and more slender; palm about 3.4 times longer than central depth, fingers about 0.9 of palm length, dactylus about 8.0 times longer than proximal width, fingers with distal half of cutting edges entire, proximal half with series of 7-8 small low acute teeth, most marked on fixed finger, with distal tooth largest; carpus about 0.85 of chela length, slender, unarmed, about 9.5 times longer than distal width; merus distoventrally unarmed, about 0.85 of carpus length, 1.65 of ischium length.

Ambulatory pereiopods moderately slender. Third pereiopod exceeds scaphocerite by about length of dactyl; dactyl equal to about 0.4 of propod length, slender, curved, about 6.5 times longer than proximal depth, compressed, ventral margin sharp, unguis feebly distinct, about 0.33 of carpus length, corpus with small group of setae at 0.6 of dorsal margin length, sparse short, ventral setae and single distolateral and medial setae; propod about 14.5 times longer than distal width, with pair of strong spines distoventrally and preterminally, with 5 single spines along ventral margin, dorsal border with scattered spiniform setae; carpus about 0.5 of propod length, 7.0 times longer than wide, unarmed; merus subequal to propod length, about 11.0 times longer than wide, unarmed; ischium about 0.5 of merus length, 6.5 times longer than distal width, unarmed; basis and coxa normal. Fourth and fifth pereiopods similar, longer, less strongly spinose ventrally on propods.

Pleopods with basipodite robust, compressed. Male first pleopod with basipodite about 2.3 times longer than broad; exopod about 1.2 times basipodite length, 4.0 times longer than wide; endopod 0.7 of exopod length, 2.8 times longer than wide, proximal half narrow, bilaterally concave, medial margin with long setulose seta proximally, 11 distally serrulate spines distally, lateral margin without spines or setae, distal half tapering to rounded tip, with sparse, short, feebly plumose setae and numerous simple setae. Male second pleopod about 2.3 times longer than broad; exopod 1.3 times longer than basipodite, 3.4 times longer than broad, endopod 0.9 of exopod length, about 4.3 times longer that wide, with appendices arising at about 0.37 of medial margin; appendix masculina with corpus short, reaching to about 0.6 of endopod length about 5.0 times longer than wide, with four long simple setae distally, subequal to length of carpus, two shorter preterminal ventral setae, four single setae spaced along ventral aspect, proximal 2 setae with central portions serrulate, others simple; appendix interna much shorter than appendix masculina, with few distal concinnuli only.

Uropod with protopodite posterolaterally acute, with long setae dorsally; exopod broad, about 2.5 times longer than wide, extending well beyond posterior telson margin, lateral margin straight, sparsely setose, with numerous submarginal setae ventrally, with stout distolateral tooth, with strong mobile spine medially, diaeresis moderately distinct; endopod about 0.9 of exopod length, 3.0 times longer than wide.

Measurements (mm). Holotype ♀ : total body length 23.6; carapace and rostrum 7.3; postorbital carapace 3.15; chela of second pereiopod 4.0. Allotype ♂: total body length 12.0; carapace and rostrum 5.0; postorbital carapace 3.0; chela of second pereiopod 2.0. Postorbital carapace lengths: ovigerous ♀ paratypes, 2.5-3.2; non-ovigerous ♀ paratype 3.0; ♂ paratypes 2.0-2.2. Largest detached major second pereipod, dactyl 1.8; propod, 4.4; carpus, 3.0; merus, 2.6; ischium, 2.0: largest detached minor second pereiopod, dactyl, 1.5; propod 2.2; carpus, 2.7; merus, 2.3; ischium, 2.8. Length of ovum, 0.5m.

Colouration. No data.

Habitat. The specimens were all collected from a single night haul of an epibenthic sledge through *Zostera.*

Associated fauna. *Periclimenes indicus* (Kemp), abundant; *Hippolyte caradina* Holthuis, abundant; *Latreutes pygmaeus* Nobili and *L. mucronatus* (Stimpson), numerous; *Nikoides danae* Paulson, two; *Processa australiensis* Baker, two; *Alpheus papillosus* Banner and Banner, one.

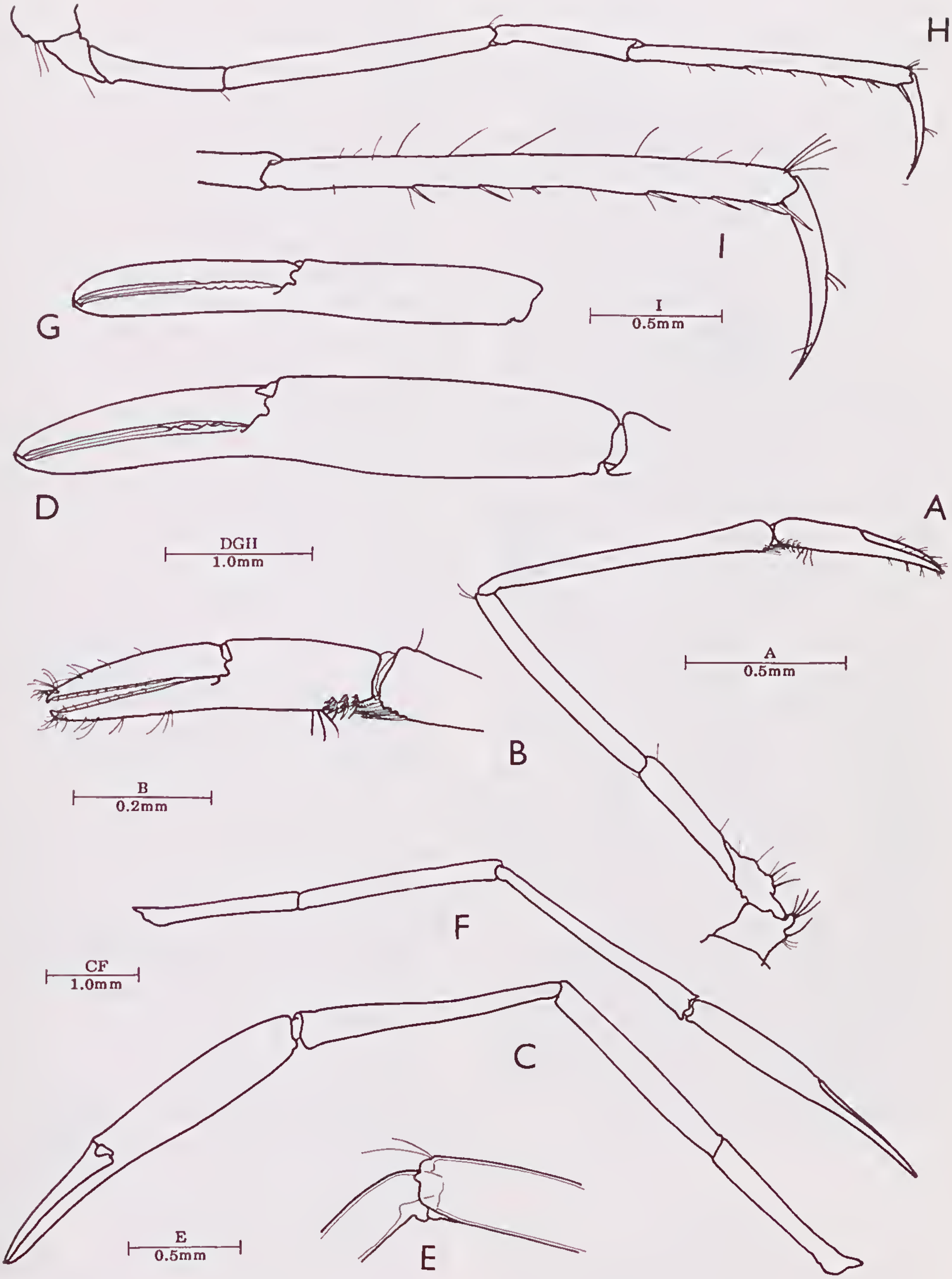

Fig. 4. *Periclimenes anacanthus* paratypes: **A,** first pereiopod; **B,** same, chela; **C,** major second pereiopod; **D,** same, chela; **E,** same, mero-carpal joint; **F,** minor second pereiopod; **G,** same, chela; **H,** third pereiopod; **I,** same, propod and dactyl.

Systematic Position. *P. anacanthus* appears most closely related to either *P. calmani* Tattersall or *P. grandis* (Stimpson) and *P. ensifrons* (Dana). *P. anacanthus* resembles *P. calmani* in the absence of a distoventral tooth on the merus of the second pereiopods and the general proportions of the rostrum and pereiopods, but differs distinctly in the presence of supraorbital spine. The only Indo-West Pacific *Periclimenes* species known to have a fourth thoracic sternal process, supraorbital spines and without meral spines on the second pereiopods, is *P. nilandensis* Borradaile, a commensal species of more squat proportions, with distinctly shorter, more robust second pereiopods, with the carpus much shorter than the palm (Holthuis 1952; Bruce 1978). *P. anacanthus* is generally similar in its morphology to *P. grandis,* the species used by Kemp (1922) to typify his "*P. grandis* species group", but it differs in lacking a distoventral meral spine on the second pereiopods, and spines on the distal carpus. The carpal spines are also lacking in *P. ensifrons,* but this little known species has rarely featured in recent literature and is known with certainty only from the original brief original descriptions and illustrations (Dana 1852, 1852a, 1855) and the type material from north Borneo is no longer extant. The only other record (Nobili 1907) is from the Tuamotu Islands and should be re-examined, as the specimen of *P. ensifrons* reported by Nobili (1899) from Beagle Bay, Papua, has been subsequently re-identified as a specimen of *Leander tenuicornis* (Say) by Holthuis (1952). *P. ensifrons* has a distinctly deeper, more strongly up-curved rostrum. The scaphocerite has a particularly slender lamina, far exceeded by the distolateral tooth, closely similar to that of *P. elegans* (Paulson) as illustrated by Kemp (1922, fig. 61a) whereas that of *P. anacanthus* is more similar to that of *P. demani* Kemp (Kemp 1922, fig. 64).

DISCUSSION

Periclimenes grandis (Stimpson) and *P. elegans* (Paulson), together with other members of the "*P. grandis* species group", as originally designated by Kemp (1922) are amongst the commonest and most widely distributed of intertidal and shallow subtidal Indo-West Pacific coral reef shrimps. Amongst specimens of these shrimps a small number are not infrequently found that lack the meral and carpal spines of the second pereiopods that are present in the other specimens. Some of these would therefore appear to represent specimens of *P. ensifrons* or *P. anacanthus* or other species, depending upon the combination of deficiencies. These variations are probably due to changes in pereiopod morphology as the result of regeneration following autotomy. Where the other species, such as *P. grandis, P. elegans,* etc., have been collected in some numbers, these aberrant specimens can probably be safely assigned to one of the dominant species. The identifications of isolated specimens can often present problems. No doubt exists over *P. anacanthus* as all of the dozen specimens were collected simultaneously and are consistent in the lack of meral and carpal spines on the second pereiopods. Also, no specimens resembling *P. grandis* or *P. elegans* were collected. However, as almost all of these appendages are detached, it is not fully certain that they are similar and asymmetrical in males and females. It is possible that the males have similar large chela, with few strong teeth, and the females, similar small chelae, with more numerous small teeth.

The endopod of the male first pleopod is particularly unusual for a species of *Periclimenes*. Many species have a small distomedial lobule, (but this is generally absent in the *P. grandis* group), with short spines and stout plumose setae proximally and with slender plumose setae around the distal and lateral margins. No other species have been reported in which numerous slender simple setae are distributed over the distal and lateral margins of the endopod.

A key to the species of an expanded "*Periclimenes grandis* species group" has been recently provided (Bruce 1987). *P. anacanthus* can be readily inserted into that key by the addition of the following couplet:

16. Supraorbital spines present 16a
 Supraorbital spines absent 17
16a. Second pereiopods with carpus much shorter than palm; R. 1 + 7-9/3-5 .... *P. nilandensis* Borradaile
 Second pereiopods with carpus much longer than palm; R. 1 + 6-9/2-3. .... *P. anacanthus* sp. nov.

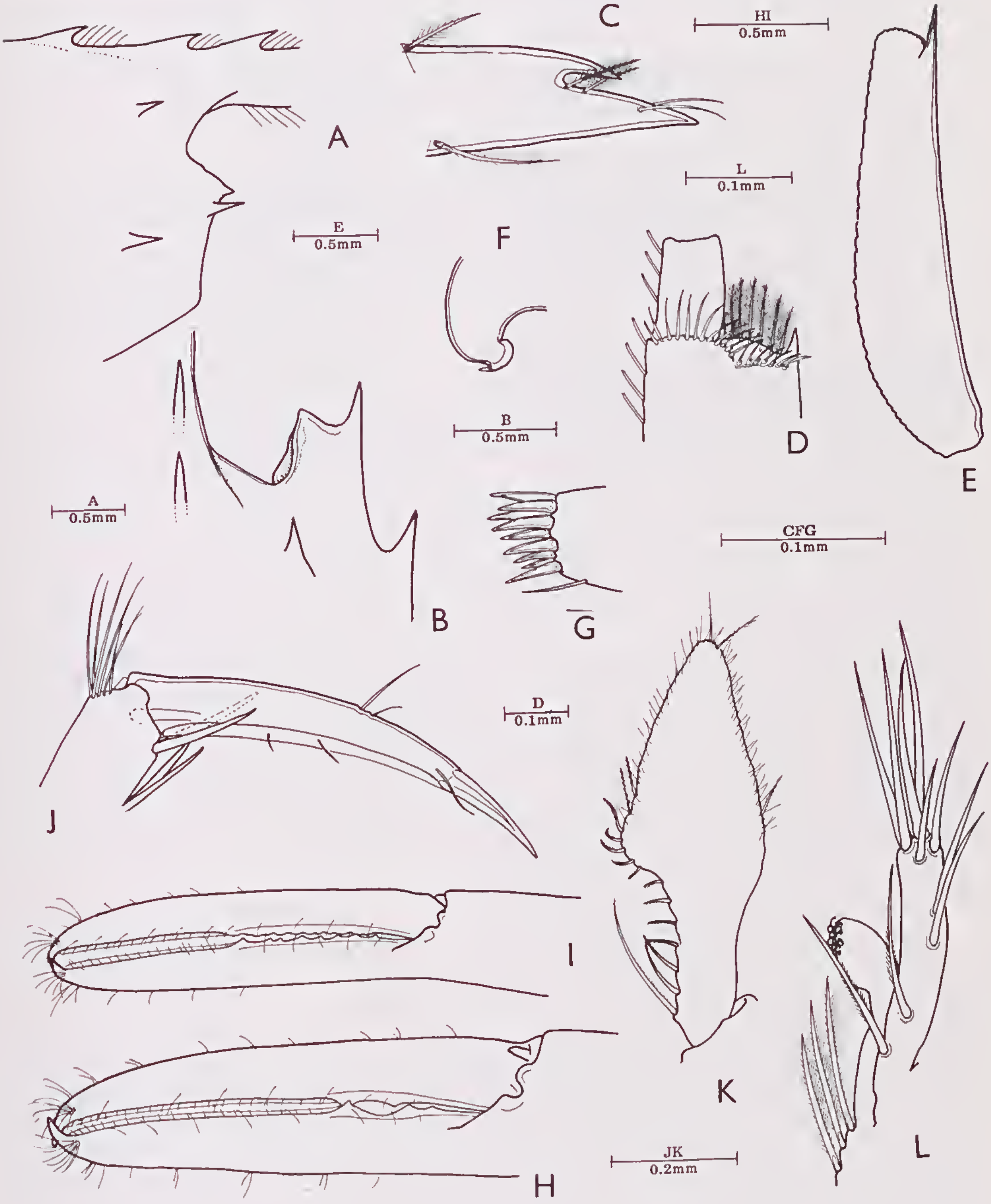

Fig. 5. *Periclimenes anacanthus* paratypes: **A,** orbital region, lateral; **B,** same, dorsal; **C,** tip of rostrum; **D,** antennular peduncle, distal end of proximal segment; **E,** scaphocerite; **F,** maxillula, ventral lobe of palp; **G,** same, upper lacinia, distal end; **H,** major second pereiopod, fingers of chela; **I,** minor second pereiopod, same; **J,** third pereiopod, dactyl; **K,** male first pleopod, endopod; **L,** male second pleopod, endopod, appendix interna and appendix masculina.

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THE OCCURRENCE OF *PALAEMONETES ATRINUBES* BRAY (CRUSTACEA:DECAPODA:PALAEMONIDAE) ON THE AUSTRALIAN EAST COAST

A.J. BRUCE
Northern Territory Museum of Arts and Sciences
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

The palaemonid shrimp, *Palaemonetes atrinubes* Bray, previously known from Western Australia is reported from Frazer Island, Queensland.

KEYWORDS: Crustacea, Decapoda, Palaemonidae *Palaemonetes atrinubes,* Queensland, Australia.

INTRODUCTION

Through the kindness of Peter Davie, some specimens of *Palaemonetes* in the collection of the Queensland Museum were made available for study. The genus *Palaemonetes* is very poorly represented in the Indo-West Pacific region or adjacent fresh or brackish waters. Two species are known from China and the only other two occur on Australia coasts. *P. australis* Dakin has been reported from numerous localities in southern Western Australia by Dakin (1915), Serventy (1938), and Bray (1976). The second species, *P. atrinubes* Bray, has a generally more northerly distribution in Western Australia, reaching as far north as Cookatoo Island (16° 06′S). Neither species has been previously recorded outside Western Australia.

SYSTEMATICS

Palemonetes atrinubes Bray

(Fig. 1)

Palemonetes atrinubes Bray, 1976: 76-82.

Material. 2 ♂, 1 ovig. ♀, 4 juv., QM W.11984 Moon Creek, W.side of Frazer Island, Qld., 25° 13′S 153° 00′E, 0.6m, rotenone, 3 October 1984, coll. J. Johnson.

Description. The specimens agree essentially with the description provided by Bray (1976), and, in particular, the branchiostegal spine is always clearly on the anterior carapace margin in all specimens. The rostrum shows some variation. The dentition varies from 7-8 dorsal teeth and 3-4 ventral teeth. The most posterior tooth is situated on the carapace, well behind the posterior orbital margin and the anterior tooth is always subterminal. In the type material the rostral dentition is 6/4, with the distal third of the dorsal margin of the rostrum unarmed, except for the preterminal tooth. This feature is present in some of the Frazer Island specimens but is less marked in others. None of the dorsal rostral teeth appear to be articulated. The dorsal denticular interspaces are feebly setose; the ventral rostral margin bears a median row of plumose setae proximally.

The antennule has the biramous upper flagellum with the fused portions only slightly longer than the shorter ramus, whereas in the type material it is reported to be twice the length. The distal segments of the short ramus also appear to be ventrally concave and laterally imbricate, with two groups of aesthetases arising from the concavity of each segment.

The fourth thoracic sternite is armed with a small acute median process.

The second pereiopods have the chela about 0.6 of the carpus length and fingers about 0.6 of the palm length, as in the type material, with the fingers with sharp unarmed cutting edges. The third pereiopod has a robust, feebly armed propod, with a distoventral and a single ventral spine only; the dactyl is about 0.5 of the propod length, instead of 0.3 as reported in the original descriptions. The fifth pereiopods have the propod about 1.85 times the length of the third, with seven transverse groups of serrulate setae distolaterally.

The appendix masculina of the male second pleopod closely resembles the original description, extending well beyond the appendix interna, with four long apical

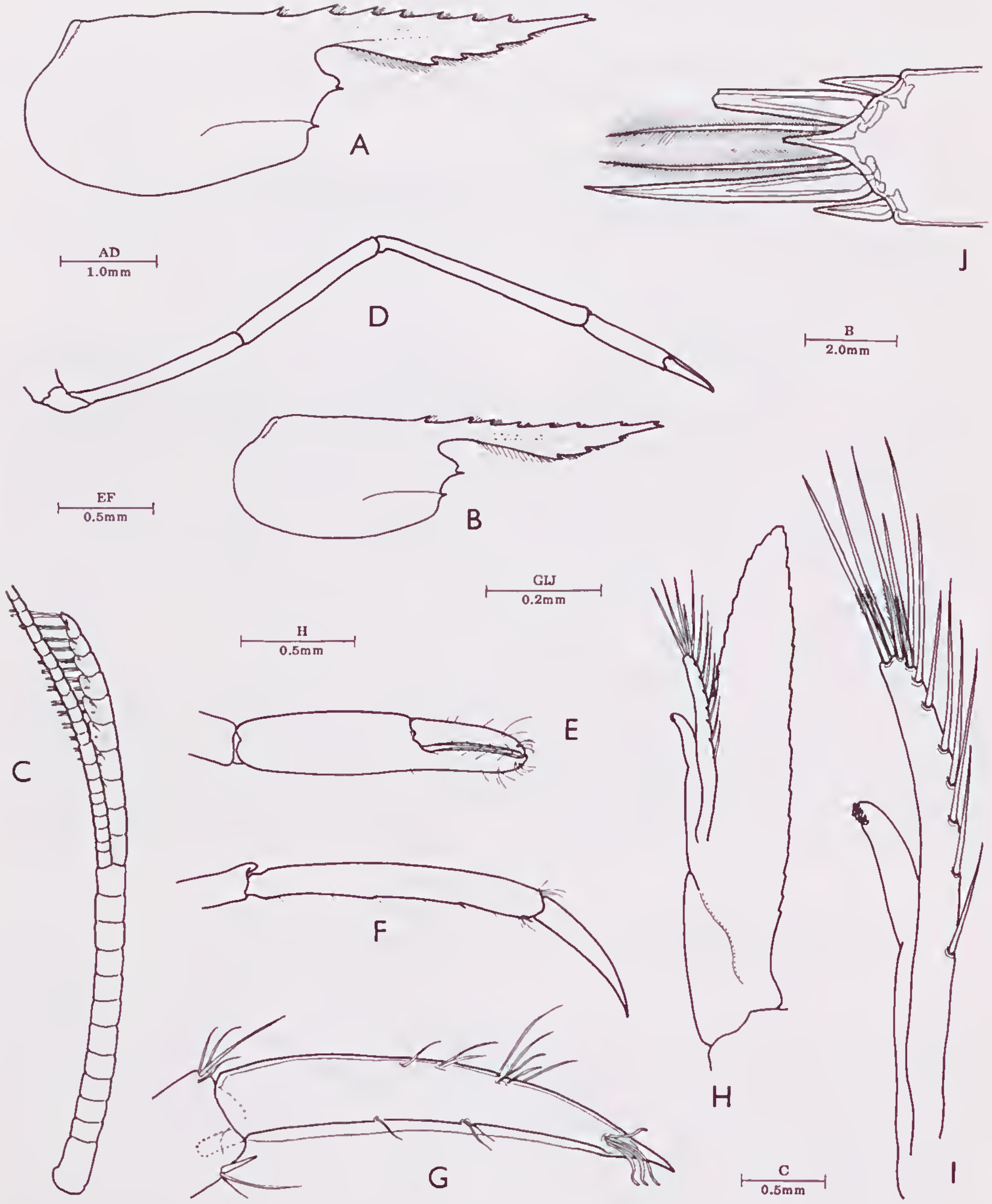

Fig. 1. *Palaemonetes atrinubes:* **A,** carapace and rostrum, ovigerous ♀; **B,** same, juvenile; **C,** antennule; D, second pereiopod; **E,** same, chela; **F,** third pereiopod; **G,** same, dactyl; **H,** first pleopod, ♂ endopod; **I,** same, appendix interna and appendix masculina; **J,** telson, posterior spines.

spines and 10 similar spines along the disto-lateral border; the apical spines are finely spinulose on the central portion.

The posterior margin of the telson has two pairs of spines, with a pair of slender plumose submedian setae. The lateral spine is about 0.25 of the medial spine length, as opposed to 0.5 in the type material.

Measurements. Post-orbital carapace lengths (mm): ovig. ♀ 5.2; ♂ 5.5-5.6; juvs. 3.0-3.6. Length of ovum, 0.8.

Habitat. Sandy floored mangrove pools.

Remarks. The discovery of specimens of *P. atrinubes* on the east coast of Australia, at a latitude of 25°S, suggests that this species may occur all around Australia's northern coastline, where suitable habitats occur. This is of interest, as no species of this genus have been previously recorded from the east coast, probably due mainly to inadequate sampling.

The genus is poorly represented outside the New World, European, Mediterranean and Middle Eastern waters, with one species occuring in Nigeria, *P. africanus* Balss, and two in south-east asian fresh waters, in China, *P. sinensis* (Sollaud), and Vietnam, *P. tonkinensis* (Sollaud), (Strength 1976), and otherwise only known from the two coastal species found in Australia, *P. australis* Dakin and *P. atrinubes* Bray.

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A NOTE ON THE FIRST ZOEAL STAGE LARVA OF *HYMENOCERA PICTA* DANA (CRUSTACEA:DECAPODA:PALAEMONIDAE)

A.J. BRUCE,
Northern Territory Museum of Arts and Sciences
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

The first zoeal larva stage of the palaemonid shrimp, *Hymenocera picta* Dana, is described and illustrated. The morphology of the larva is typical of the family Palaemonidae and confirms the placement of the subfamily Hymenocerinae in that family.

KEYWORDS: Crustacea, Decapoda, Palaemonidae, *Hymenocera picta,* first zoeal larva, morphology.

INTRODUCTION

In a recent paper, describing the first zoeal larval stage of *Gnathophyllum americanum* Guerin, it was noted that the first zoeal larva of *Hymenocera picta* Dana had also been hatched (Bruce 1986). At that time, neither the larvae or the prepared figures were available, but the latter have recently been found and are used as the basis of the present report. The larvae were hatched from an ovigerous female collected from the seaward intertidal reef of Mombasa Island, Kenya, in 1973. The larvae were dissected under a Wild M8 stereo-microscope and the drawing prepared with a Wild M11 with an optical drawing tube, from appendages mounted in ethylene glycol. The larvae described are only the second species of the genera placed in the family Gnathophyllidae Dana by Holthuis (1955), but replaced in the Palaemonidae by Bruce (1986). The description of the larvae of *Hymenocera* further illustrates the uniformity of the larvae in the Palaemonidae, with the exception of those of *Anchistioides.*

SYSTEMATICS

First Zoeal Stage of *Hymenocera picta* Dana

(Figs 1-5)

Description. Carapace with short slender unarmed rostral process reaching to about middle of proximal segment of antennular peduncle, small epigastric tubercle present, carapace otherwise devoid of spines.

Abdomen six-segmented, strongly flexed between third and fourth segments, without dorsal or lateral spines, pleura of first three segments rounded, pleopods absent. Telson broadly triangular, slightly concave posteriorly, with 7 + 7 setae, plumose except for outer pair, subequal, except for submedian pair, about 0.2 of length of fourth pair, and outer pair, about 0.5, posterior margin between fourth spines sparsely armed with minute spinules.

Antennule with subcylindrical unsegmented peduncle with 2 distal flagella; inner flagellum consisting of long plumose seta, equal to about 0.75 of the peduncle length; outer flagellum short, about 0.33 of peduncle length, with 2 aesthetascs only and one preterminal plumose seta distally.

Antenna biramous; protopod robust, about 1.5 times as long as distal width, with small distomedial spine; exopod with 3 distal segmentations and 10 distomedial plumose setae, first and second lateral setae short, rest long, medial margin with proximal tubercle; endopod subcylindrical, slightly tapering, distally acute, with long plumose preterminal lateral seta.

Eyes sessile.

Mandible moderately robust, without palp; molar process distinct, with 2 spines and preterminal seta; incisor process tridentate, lacinia mobilis robust, denticulate along outer margin.

Maxillula with short stout palp, with single simple preterminal spine; upper lacinia with 3 stout setulose spines and 2 simple setae; lower lacinia smaller, with 3 simple distal setae and 1 proximal ventral seta.

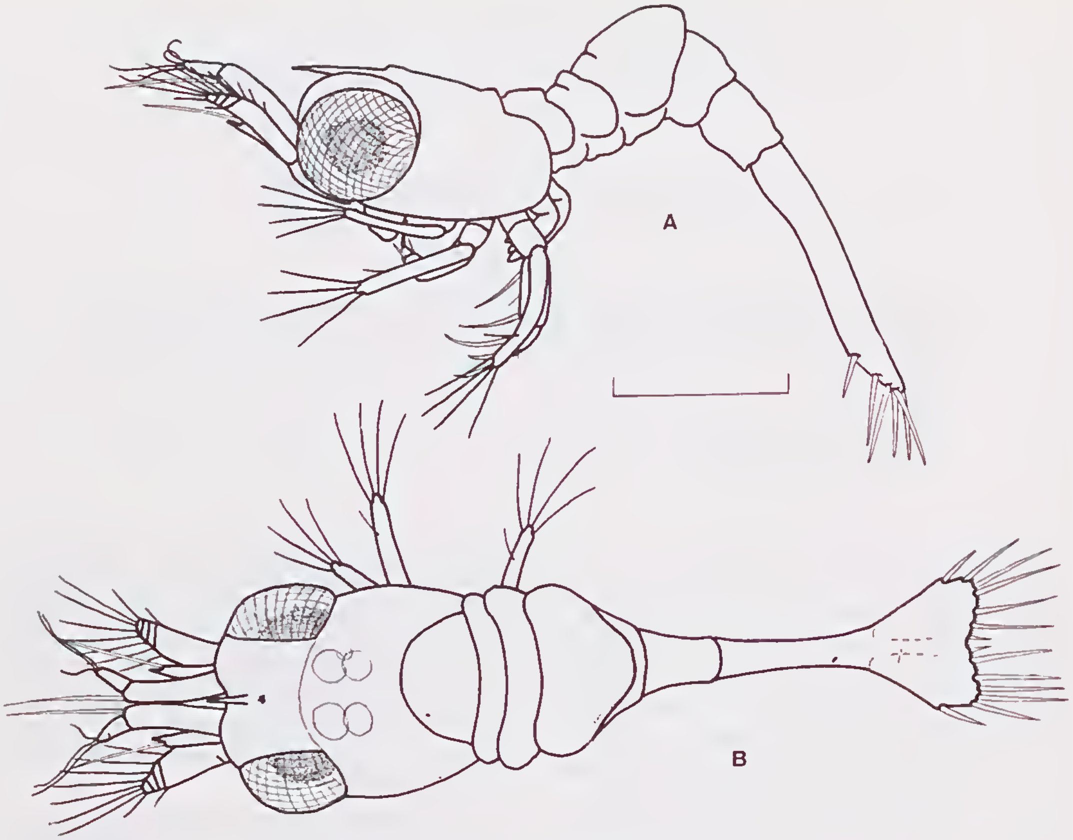

Fig. 1. *Hymenocera picta* first zoeal stage: **A,** lateral; **B,** dorsal. Scale line 0.5 mm.

Maxilla with unsegmented, tapering, proximally expanded palp, margins finely setose, with long simple terminal seta; protopod obscurely subdivided into basal and coxal segments, basal segment distinctly bilobed, each lobe with single simple seta, coxal segment simple, with 2 slender setae distally and stout plumose spiniform seta proximally; exopod with 5 plumose setae.

First maxilliped biramous; endopod subcylindrical, tapering, three segmented, with 2 short, 1 long slender distal setae; exopod well developed, with 4 plumose setae distally; protopod feebly produced medially with 2 large, 1 small spiniform setae.

Second maxilliped biramous; endopod 3-segmented, proximal segment largest, unarmed, intermediate segment with distolateral spine and distomedial setae; distal segment shortest, about 0.33 of proximal segment length, with very robust, strongly laterally dentate terminal spine, about 2.0 times distal segment length, with 2 short simple preterminal setae; exopod well developed, as in first maxilliped; protopod with two distomedial spiniform setae and small proximomedial tubercle.

Third maxilliped biramous; endopod subcylindrical, tapering distally, proximal segment robust, 2.0 times as long as distal width, with 2 long simple spiniform setae medially; intermediate segment about 0.8 of proximal segment length, with 2 long, simple, robust, distoventral spines; distal segment short, about 0.3 of proximal segment length, with 1 long simple terminal spine and 3 short simple pre-terminal setae; exopod well developed, as in first maxilliped, with short simple pre-terminal seta; protopodite with two medial spiniform setae only.

First and second pereiopods represented by biramous limb buds only; third to fifth pereiopods lacking.

Remarks. The morphology of the first zoea of *Hymenocera picta* shows a very close resemblance to other known palaemonid larvae and suggests that the genera of the Hymenocerinae, *Hymenocera* Latreille, with

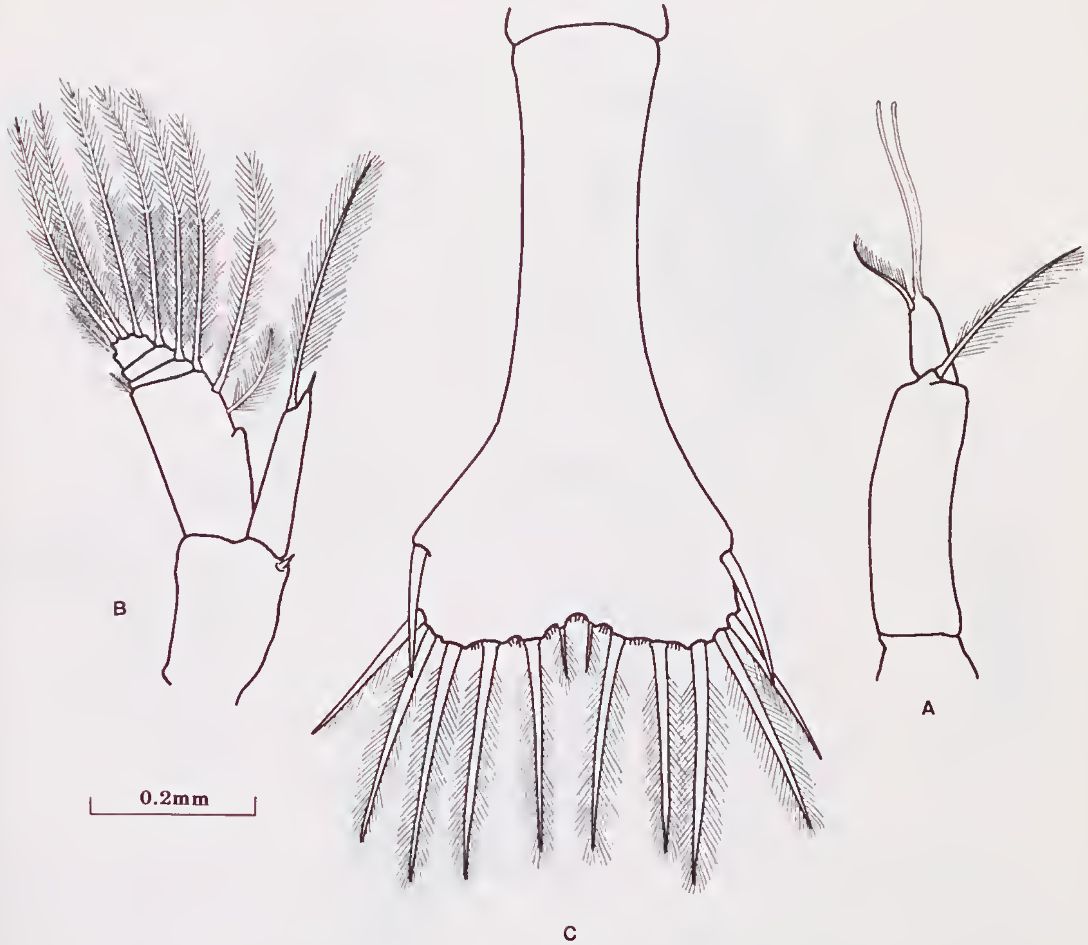

Fig. 2. *Hymenocera picta* first zoeal stage: **A**, antennule; **B**, antenna; **C**, telson.

only one, or possibly two species, and *Phyllognathia* Borradaile, with only two species, *P. ceratophthalma* (Balss) and *P. simplex* Fujino, should be included in the family Palaemonidae. The larvae of *Anchistioides* are so different from the majority of palaemonid larvae that it is difficult to believe that they are as closely related to other palaemonids as their adult morphology suggests. Borradaile (1915, 1917) established the family Anchistioididae for the inclusion of *Anchistioides* but this was abandoned on the basis of the study of Gordon (1935), who placed it in the subfamily Pontoniinae. The apparent morphological resemblance may be largely due to the commensal life-style of the species of *Anchistioides*, living in association with sponges. Even for commensal shrimps, they are unusual in having a lunar planktonic phase, presumably in association with reproduction, but ovigerous females may be readily found inside sponges, so the planktonic shrimps must have some way of returning to suitable hosts. In most commensal shrimps, as far as is presently known, the whole of the post-larval life is spent in permanent association with their host animal, without any planktonic phase. Such a phase would appear to present great hazards due to many individuals failing to relocate an appropriate host, with subsequent high mortality due to predation or other factors. Lunar periodicity has only been recorded for *A. antiguensis* in the vicinity of Bermuda (Wheeler and Brown 1936; Wheeler 1937) and has not been reported in the Indo-West Pacific species of the genus.

The Palaemonoida contains only two families, the Campylonotidae Sollaud 1913, and the Palaemonidae Samouelle 1819, if the

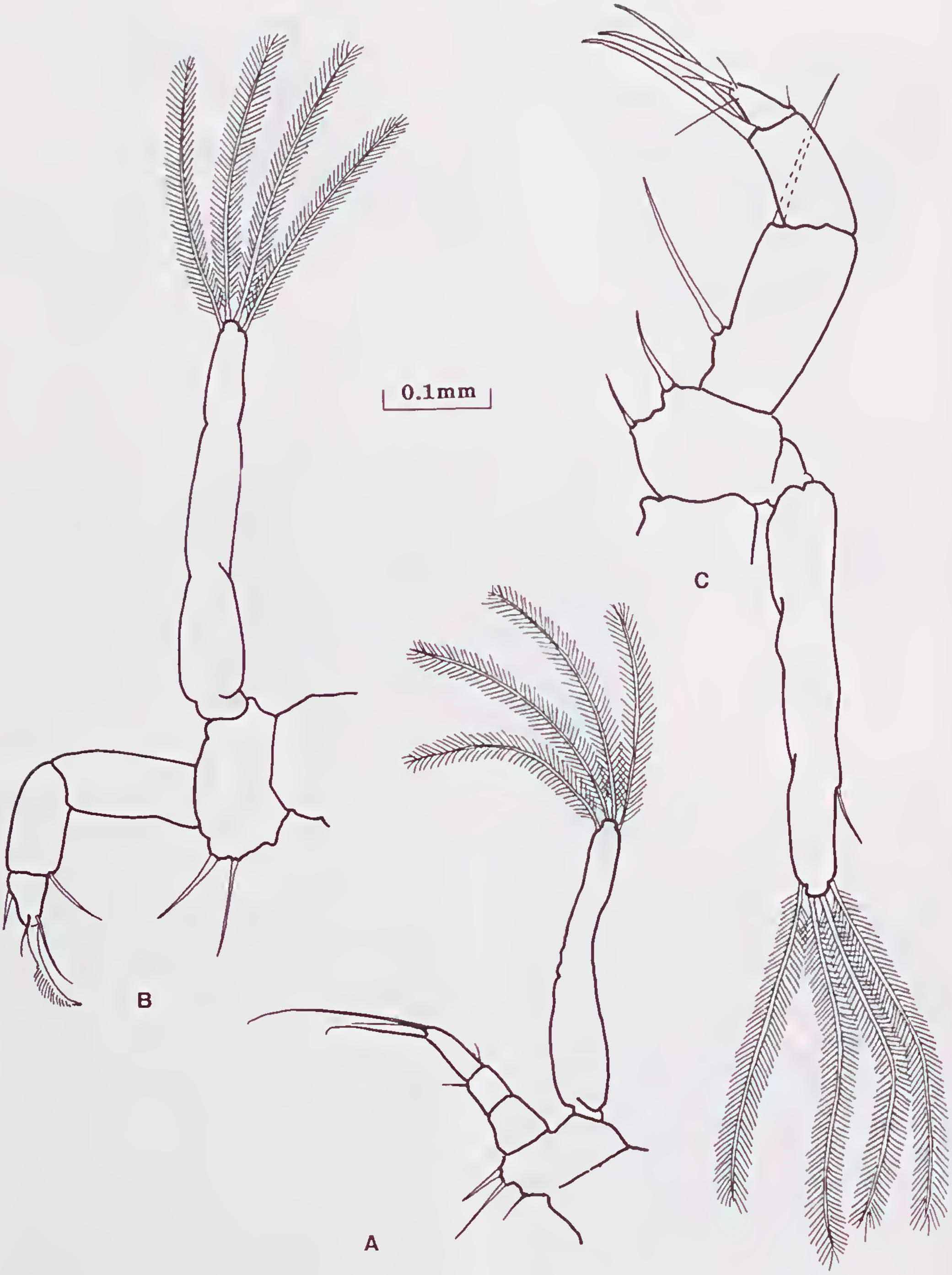

Fig. 3. *Hymenocera picta* first zoeal stage: **A**, mandible; **B**, maxillula; **C**, maxilla.

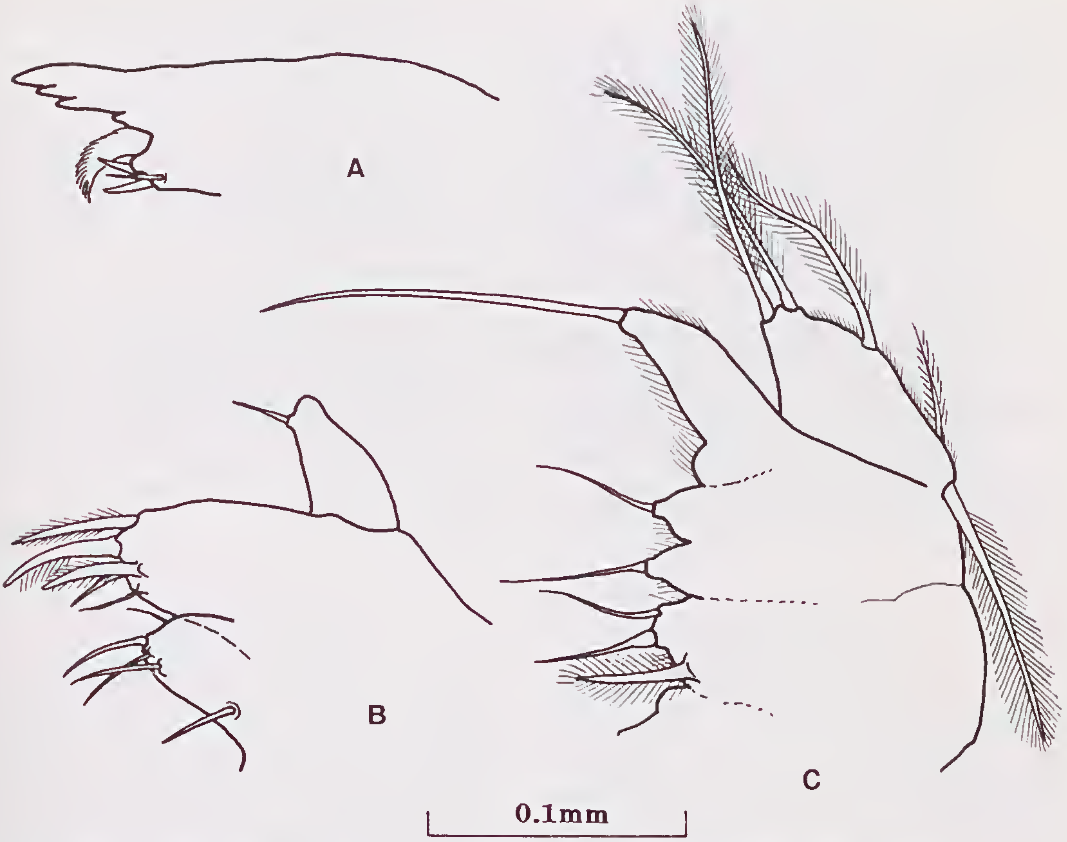

Fig. 4. *Hymenocera picta* first zoeal stage: **A,** first maxilliped; **B,** second maxilliped; **C,** third maxilliped.

family Gnathophyllidae is included in the *Palaemonidae* as proposed by Bruce (1986). The first zoeal larval stage is known for a number of palaemonid genera, including *Macrobrachium* Bate, *Leander* Desmarest, *Palaemon* Weber, *Palaemonetes* Heller, *Brachycarpus* Bate, *Periclimenes* Costa, *Periclimenaeus* Borradaile, *Philarius* Holthuis, *Harpiliopsis* Borradaile, *Coralliocaris* Stimpson, *Anchistus* Borradaile, *Pontonia* Latreille and *Typton* Costa. They are all very similar in their general morphology. The first zoeal stage of *Campylonotus* Bate has been described by Pike and Williamson (1966), who have suggested that, on the basis of the larval characters, this genus is more closely related to the Pandalidae than to the Palaemonidae. The larvae of *Bathypalaemonella* Balss, the only other genus placed in the Campylonotidae, have not been described, but it seems quite likely that *Bathypalaemonella* is not closely related to *Campylonotus* and, on the basis of the adult mouthparts, may also not be closely related to the Palaemonidae. This suggests that the Palaemonoida consists of only two families the Palaemonidae and the Anchistioididae.

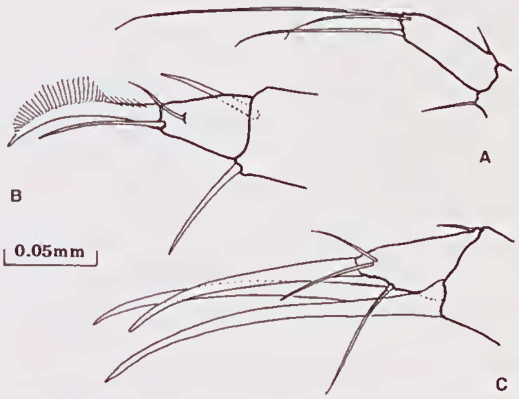

Fig. 5. *Hymenocera picta* first zoeal stage, distal segments of maxillipedal endopods; **A,** first maxilliped; **B,** second maxilliped; **C,** third maxilliped.

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FIVE NEW EPIGEAN SPECIES OF THE AUSTRALIAN PLANTHOPPER GENUS *SOLONAIMA* KIRKALDY (HOMOPTERA: FULGOROIDEA: CIXIIDAE)

HANNELORE HOCH
Fachbereich Biologie-Zoologie, Philipps-Universität,
Lahnberge, PO Box 1929, D-3550 Marburg,
Federal Republic of Germany.

ABSTRACT

Five new epigean species of the cixiid genus *Solonaima* Kirkaldy, which is endemic in Australia, are described from Queensland: *S. bifurca* sp. nov., *S. riocampa* sp. nov., *S. cedrivula* sp. nov., *S. minuta* sp. nov., and *S. ornata* sp. nov.. A key to the epigean *Solonaima* species is given.

KEYWORDS: Homoptera, Fulgoroidea, Cixiidae, *Solonaima,* new species, Australia.

INTRODUCTION

Prior to this study the endemic Australian cixiid genus *Solonaima* Kirkaldy was represented by only two species in the epigean fauna of Queensland, *S. solonaima* Kirkaldy (type species) and *S. pallescens* (Distant). As a result of recent investigations in limestone caves and lava tubes in North Queensland (Chillagoe, Mt. Mulgrave, Undara) Hoch and Howarth (in prep.) described six cavernicolous species which undoubtedly belong to *Solonaima.* These species display varying degrees of cave adaptation (three facultative, three obligate cave species). Moreover, Hoch and Howarth *(op. cit.)* redescribed *S. solonaima* and *S. pallescens,* re-defined the genus and gave reasons for its monophyly. Subsequent examination of cixiid material preserved at the Queensland Museum, Brisbane, and the Queensland Department of Primary Industries, Brisbane, revealed the existence of another five new *Solonaima* species. Unfortunately the collecting data do not hold any ecological information, but since none of these species displays any troglomorphic characters (e.g. eye-, wing-, pigment-reduction) I proceed on the assumption that they are epigean.

The following abbreviations are used for the names of institutions where the specimens are held: QM Queensland Museum, Brisbane; QDPI Queensland Department of Primary Industries, Brisbane.

SYSTEMATICS

Genus *Solonaima* Kirkaldy

Solonaima Kirkaldy, 1906: 396 (type species *Solonaima solonaima* Kirkaldy, by monotypy).

Talaloa Distant, 1907: 294, synonymized by Muir 1925: 104.

Diagnosis. (modified after Hoch and Howarth, in prep.).

Moderately large cixiids with wings shallowly tectiform. Vertex concave, with lateral margins strongly ridged, divided into anterior and posterior portions by a transverse carina; posterior portion nearly vertical, with lateral margins diverging posteriorly. Frons and clypeus narrow, centrally and laterally ridged; lateral margins convex and directed anterolaterad. Frons slightly broadened beneath eyes. Rostrum elongate, almost attaining anterior margin of genital segment. Median ocellus in epigean species distinctly present, in cavernicolous species reduced or absent. Antennal segments elongate, cylindrical, second segment two to three times as long as first. Pro- and mesonotum tricarinate. Tegmina translucent to hyaline; Sc + R branch distad of basal third, and Cu forking distad of Sc + R branch. Hind tibiae laterally unarmed, with six apical teeth. Hind legs with basal tarsal segment elongate, about 1.3 times as long as segments II and III together. Male genital segment higher than wide caudally; caudal margin symmetrical with medioventral process simple, subtriangular. Parameres spoon-shaped, apically dilated; dorsal margin of dilated part produced in a more or less conspicuously pointed tip. Aedeagus with dorsal portion of basal part in all epigean species with bulbous or spinose processes which form a groove conducting the spine (which arises subapically on the right side) to left. Movable distal part of aedeagus well developed, bent dorsally to the left. Female genitalia with ovipositor complete; distal portion of pregenital sternite slightly bent dorsad; 9th tergite obliquely truncate, with wax-secreting area medially divided by a membranous area.

Key to the epigean species of *Solonaima*

1\. Clavus dark; median carina of frons obsolete .... *ornata* sp. nov.
Clavus translucent; median carina of frons sharply ridged 2

2(1). Anterior portion of vertex rectangular 3
Anterior portion of vertex pentagonal 4

3(2). Dark markings along distal crossveins of tegmen; first antennal segment dark brown; basal part of aedeagus laterally with two rigid spinose processes (one on each side) which are directed caudad .... *solonaima* Kirkaldy
Distal crossveins of tegmen without dark markings; first antennal segment whitish; basal part of aedeagus with only one spinose process arising right laterally .... *minuta* sp. nov.

4(2). Anterior portion of vertex wider at base than long in midline 5
Anterior portion of vertex as long as or longer in midline than wide at base 6

5(4). Anterior portion of vertex twice as wide at base as long in midline; tegmen without markings; each laterodorsal angle of male genital segment produced into a pointed tip; basal part of aedeagus ventrally with a short, slender spine .... *riocampa* sp. nov.
Anterior portion of vertex about 1.6 times as wide at base as long in midline; tegmen with brownish markings along crossveins; male genital segment with caudal margin smooth; basal part of aedeagus ventrally with a bifurcate spinose process .... *bifurca* sp. nov.

6(4). Basal part of aedeagus left laterally without any spinose processes near its base, right laterally with two slender spines: the superior one directed caudad, the inferior one directed basad .... *cedrivula* sp. nov.
Basal part of aedeagus left laterally with compact, basally flattened spine which is bent laterodorsad, and right laterally with a trifurcate spinose process which is directed straight caudad .... *pallescens* (Distant)

Solonaima bifurca sp. nov.

(Figs 1-5)

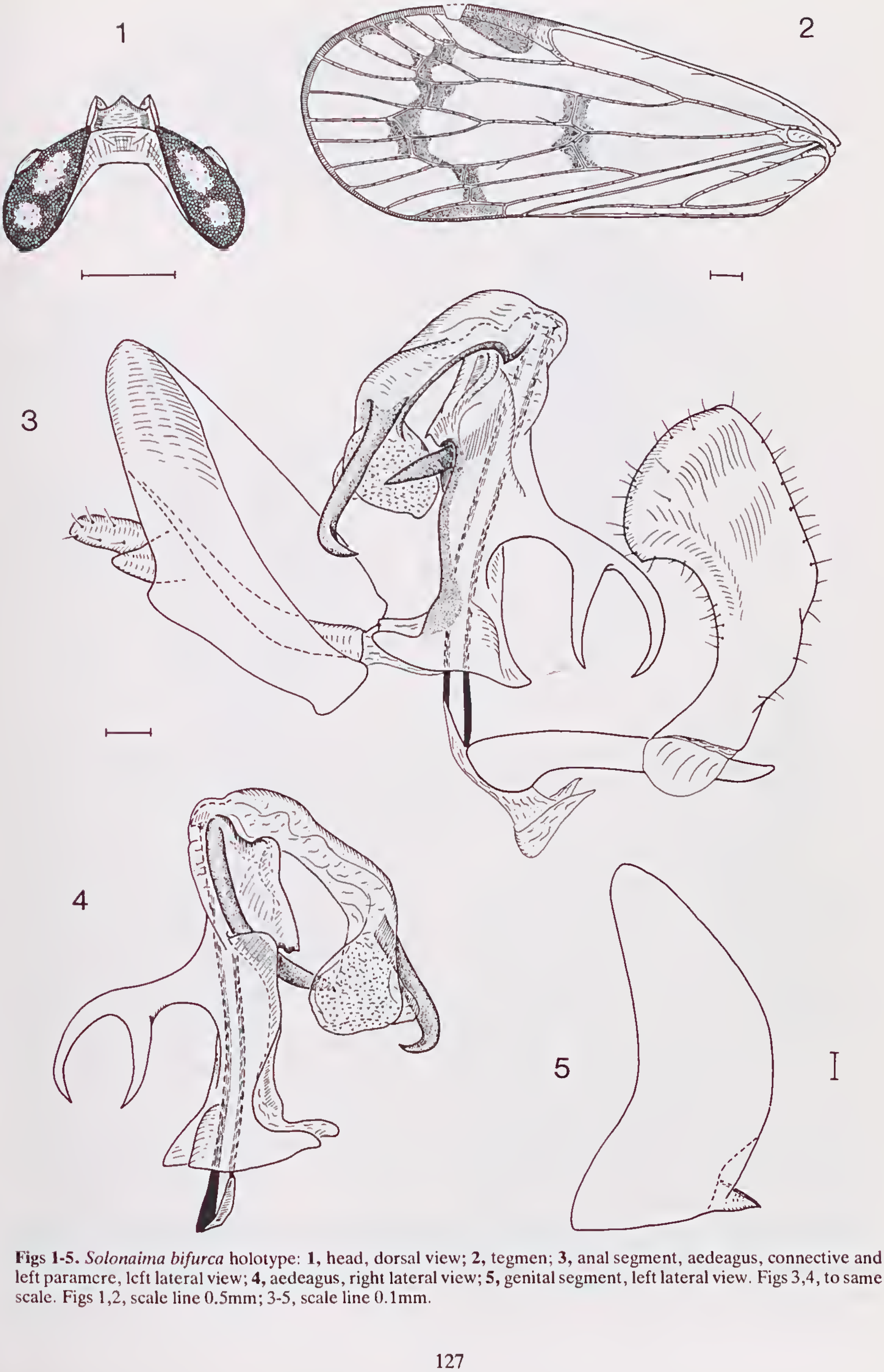
Type material. HOLOTYPE — ♂, National Park (= Lamington National Park), Queensland, xii.1921, H. Hacker, in QM. PARATYPES — ♂, 1 ♀, same data as holotype, in QM. 1 ♀, same locality as holotype, xii.1919, in QM.

Description. Generally dark brown; pronotum yellowish; first antennal segment dark brown. Tegmen translucent, with dark brown markings along distal and proximal crossveins and in inner apical cell; pterostigma distinct, brownish. Total length ♀ 8.8-9.0mm, ♂ 9.8 mm.

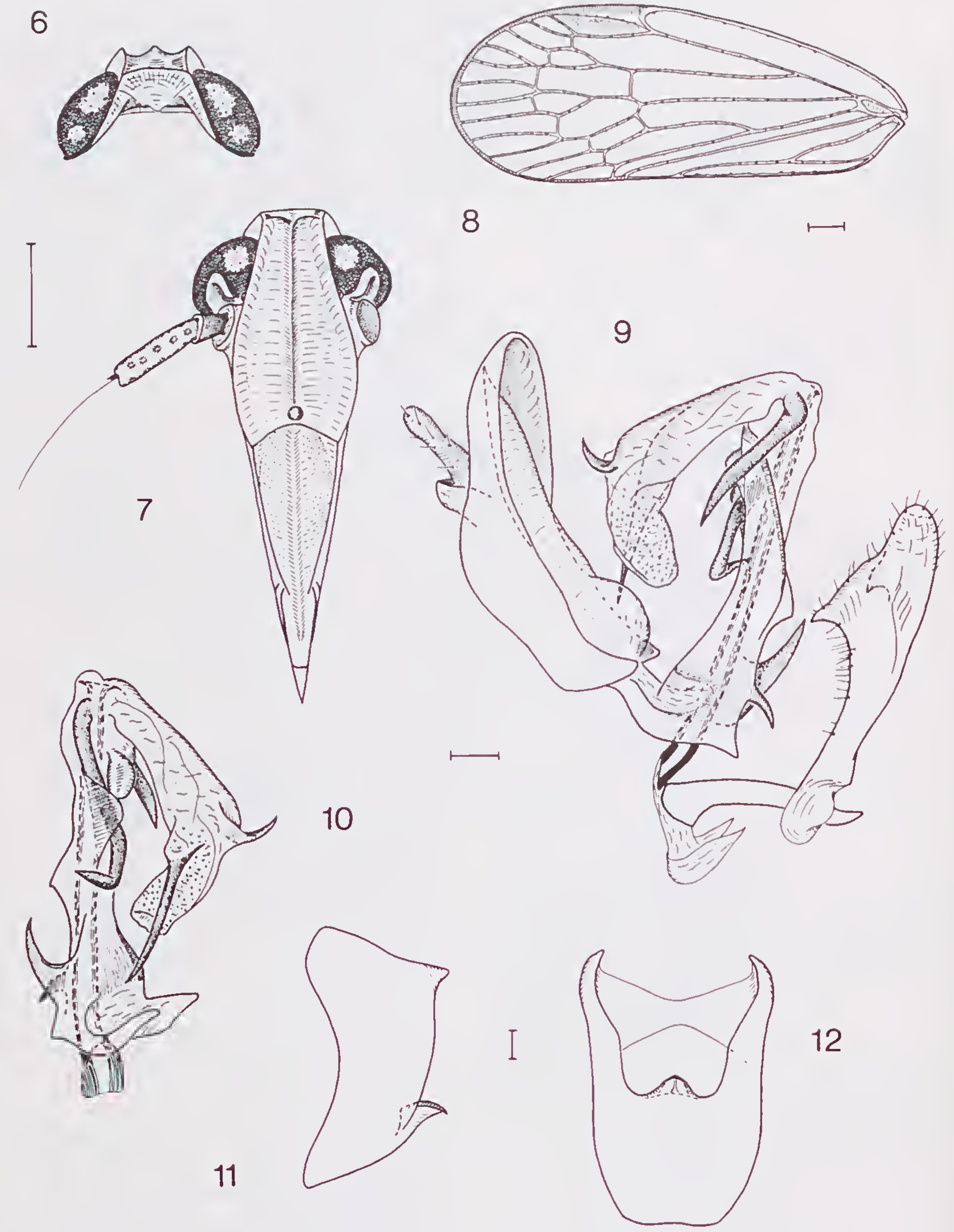
Head: Anterior portion of vertex broad pentagonal, 1.6 times as wide at base as long in midline. Frons twice as long as its greatest width, with median carina sharply ridged; area of frons concave. Post- and anteclypeus together as long as frons. Second antennal segment 2.25 times as long as first.

Thorax: Pronotum about as long as anterior portion of vertex, and 1.4 times as wide as greatest width of head. Mesonotum in midline about 9.4 times the length of pronotum. Basal tarsal segment of hind leg with 7, second tarsal segment with 6 to 7 apical teeth. Tegmen 2.5 times as long as wide. Longitudinal veins densely, but inconspicuously papillate.

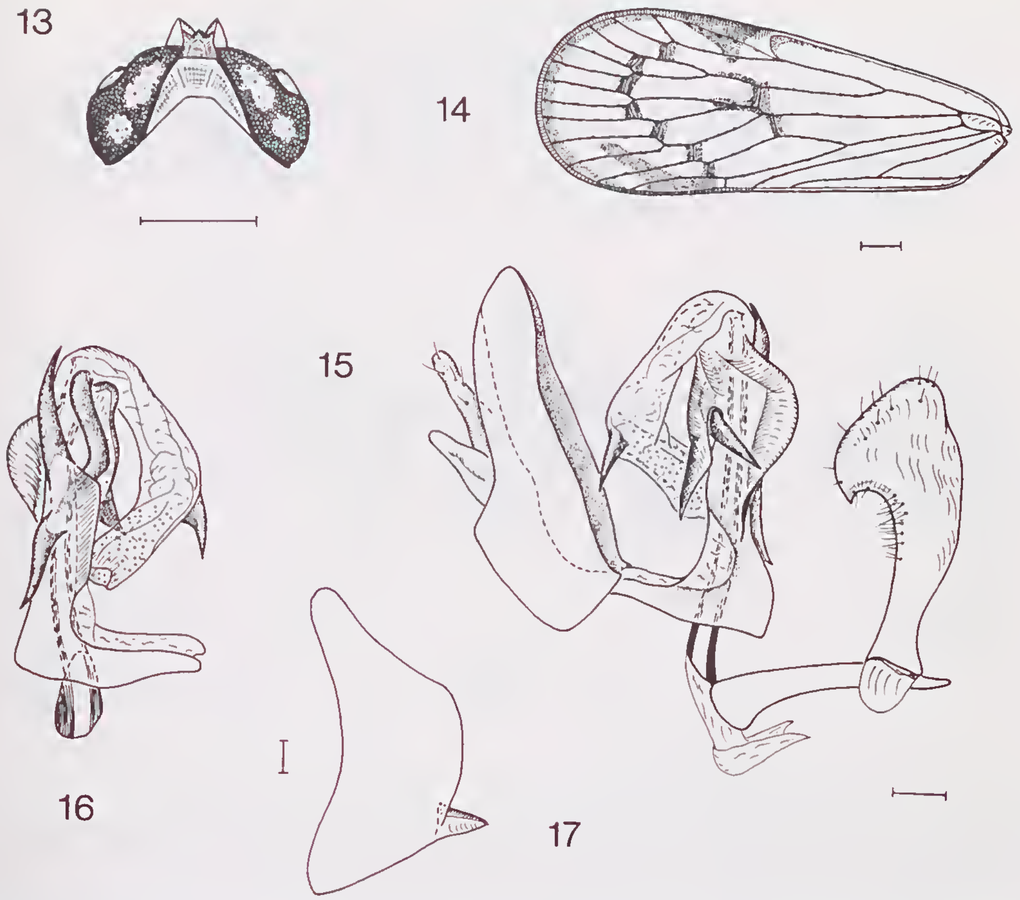
Male genitalia (Figs 3-5): Genital segment caudally 1.5 times as high as wide, in lateral aspect ventrally 4.7 times as long as dorsally; caudal margin smooth. Anal segment nearly ovate, slightly asymmetrical, hood-shaped.



Figs 1-5. *Solonaima bifurca* holotype: **1,** head, dorsal view; **2,** tegmen; **3,** anal segment, aedeagus, connective and left paramere, left lateral view; **4,** aedeagus, right lateral view; **5,** genital segment, left lateral view. Figs 3,4, to same scale. Figs 1,2, scale line 0.5mm; 3-5, scale line 0.1mm.



Figs 6-12. *Solonaima riocampa* holotype: **6,** head, dorsal view; **7,** head, ventral view; **8,** tegmen; **9,** anal segment, aedeagus, connective and left paramere, left lateral view; **10,** aedeagus, right lateral view; **11,** genital segment, right lateral view; **12,** same, ventral view. Figs 6,7, to same scale; 9, 10, to same scale. Figs 6-8, scale line 0.6mm; 9-12, scale line 0.1mm.



Figs 13-17. *Solonaima cedrivula* holotype: **13**, head, dorsal view; **14**, tegmen; **15**, anal segment, aedeagus, connective and left paramere, left lateral view; **16**, aedeagus, right lateral view; **17**, genital segment, left lateral view. Figs 15, 16, to same scale. Figs 13,14, scale line 0.5mm; 15-17, scale line 0.1mm.

Parameres with dorsal tip of dilated distal part blunt, otherwise as described for the genus. Basal part of aedeagus ventrally with a strong bifurcate spine directed basad; dorsal portion with 2 lamellar processes forming a groove for a long, terete spine which inserts subapically on the right side. Distal part of aedeagus apically granulate; with a strong spine inserting left laterally, directed basad and apically curved ventrad. Connective straight.

Female genitalia: Distal portion of pregenital sternite slightly bent dorsad, otherwise as described for the genus.

Remarks. *S. bifurca* can easily be distinguished from all other *Solonaima* species by its large body size and the bifurcate spinose process on the ventral side of the aedeagus' basal part.

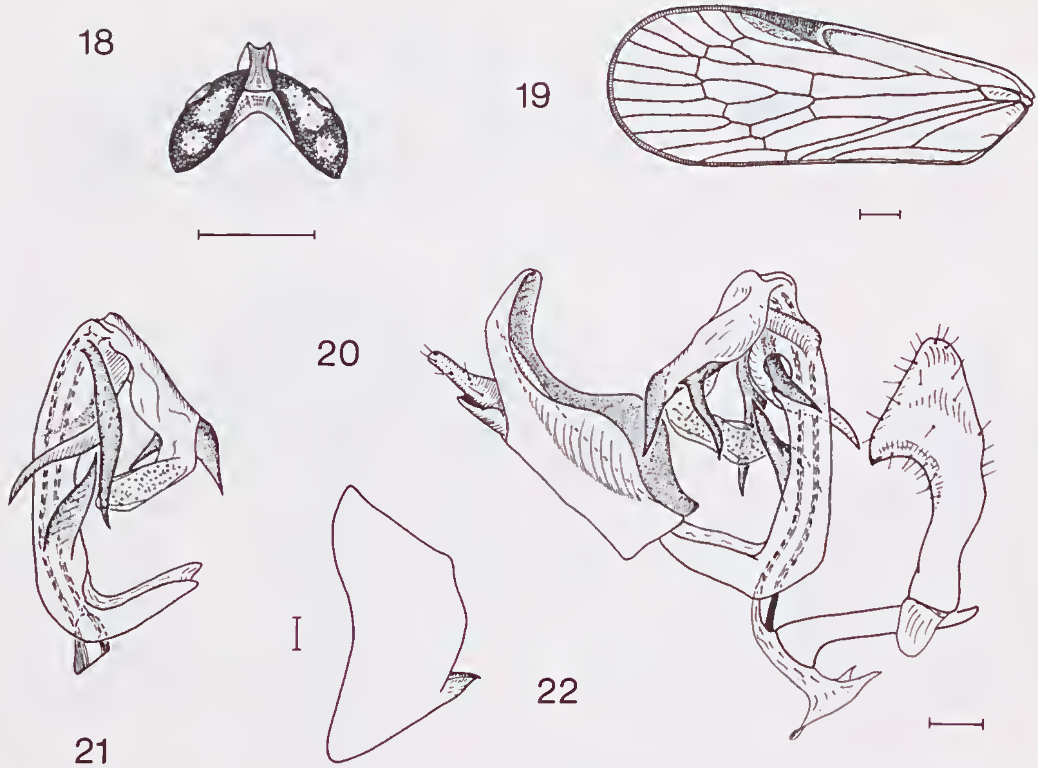
Solonaima riocampa sp. nov.

(Figs 6-12)

Type material. HOLOTYPE — ♂, Brookfield, Queensland, 10.x.(19)26, H. Hacker, in QM.

Description. *Male* — Generally brownish; pronotum yellowish; antennal segments dark brown. Tegmen translucent, venation brownish, without markings; pterostigma distinct, brownish. Total length ♂ 7.1 mm.

Head: Anterior portion of vertex broad pentagonal, about twice as wide at base as long in midline. Frons 1.6 times as long as its greatest width, with median carina sharply ridged; area of frons shallowly concave, almost planate. Post- and anteclypeus together 1.3 times as long as frons. Second antennal segment nearly 3 times as long as first.



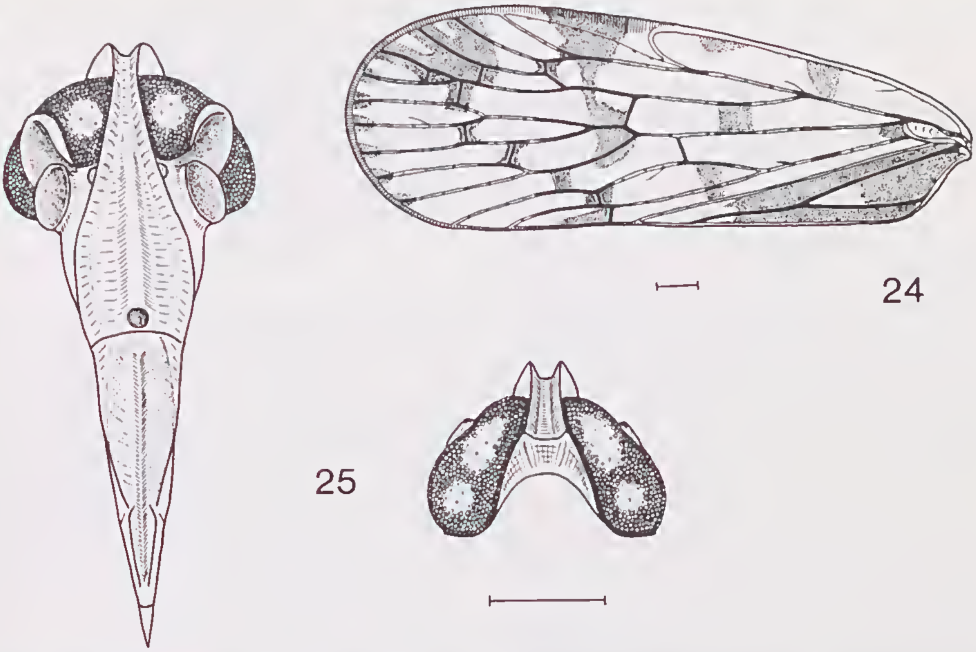
Figs 18-22. *Solonaima minuta* holotype: **18,** head, dorsal view; **19,** tegmen; **20,** anal segment, aedeagus, connective and left paramere, left lateral view; **21,** aedeagus, right lateral view; **22,** genital segment, left lateral view. Figs 20,21, to same scale. Figs 18,19, scale line 0.5mm; 20-22, scale line 0.1mm.

Thorax: Pronotum as long as anterior portion of vertex, 1.5 times as wide as greatest width of head. Mesonotum in midline about 7.5 times the length of pronotum. Basal tarsal joint of hind leg with 7, second tarsal joint with 8 apical teeth. Tegmen 2.7 times as long as wide. Longitudinal veins densely but inconspicuously papillate.

Male genitalia (Figs 9-12): Genital segment caudally 1.2 times as high as wide, in lateral aspect ventrally 5.8 times as long as dorsally, with each laterodorsal angle produced in a short, stout process which is directed mediad. Medioventral process of genital segment medially ridged. Anal segment broad at base, apically rounded and slightly bent ventrad. Dilated part of parameres with dorsal tip acute and directed cephalad, and medially at base with a short pointed process. Basal part of aedeagus on its right side with a strong spine directed caudad and ventrally with a short, slender spine bent basad. Dorsal portion of basal part with a bulbous distal and a lamellar proximal protuberance; these forming a groove through which a long, slender, movable spine (inserting subapically on the right side) is led to the aedeagus' left side and recurrently bent to the right side in its distal third. Basal part of aedeagus apically on the left side with a long, slender, movable spine which is curved laterad. Distal part of aedeagus on its right side with a long, slender spine which in repose is directed straight basad, and a short, slender spine on its left side which is curved laterocaudad. Distal part of aedeagus apically granulate. Connective slightly bent caudad.

Female — Female unknown.

Remarks. This species may be distinguished from other epigean *Solonaima* species by the broad anterior portion of the vertex (twice as wide at base as long in midline), the shape of the male genital segment (laterodorsal angles) produced in short pointed processes) and the armament of the aedeagus.



Figs 23-25. *Solonaima ornata* holotype: **23,** head, ventral view; **24,** tegmen; **25,** head, dorsal view. Figs 23,25, to same scale. Scale lines 0.5mm.

Solonaima cedrivula sp. nov.

(Figs 13-17)

Type material. HOLOTYPE — ♂, Little Cedar Creek, Mt. Spec, 1086 ft (*ca* 330 m), to light, N.E. Queensland, 1.ii.1965, E.C. Dahms, in QM.

Description. *Male* — Generally brownish; pronotum yellowish; first antennal segment dark brown. Tegmen translucent, with venation brownish and brown markings along distal and proximal crossveins and across the 3 inner apical cells; pterostigma distinct, brownish. Total length ♂ 6.7 mm.

Head: Anterior portion of vertex pentagonal, narrow, about as long as its basal width. Frons like in *S. bifurca* sp. nov. about twice as long as its greatest width, with median carina sharply ridged; area of frons concave. Post- and anteclypeus together 1.1 times as long as frons. Second antennal segment 2.4 times as long as first.

Thorax: Pronotum about as long as anterior portion of vertex, and 1.3 times as wide as greatest width of head. Mesonotum in midline 8.4 times the length of pronotum. Basal and second tarsal segments of hind leg apically with 7 teeth. Tegmen 2.7 times as long as wide. Longitudinal veins densely but inconspicuously papillate.

Male genitalia (Figs 15-17): Genital segment caudally 1.5 times as high as wide, in lateral aspect ventrally 7.5 times as long as dorsally; caudal margin smooth. Anal segment broad at base, apically rounded, hood-shaped. Parameres with dorsal tip of dilated part produced into a stout, apically acute process. Basal part of aedeagus with 2 slender spines inserting medially on its right side: the inferior one directed basad, the superior one directed distad. Dorsal portion of basal part with a rigid, s-shaped, spinose process which is curved basad to the left, with its base forming a groove through which a long, slender, terete spine (inserting subapically on the right side of basal part of aedeagus) is led to the left. Basal part of aedeagus on its left side with an ear-like protrusion which is bent ventrad. Distal part of aedeagus apically granulate, left laterally with a slender spine which in repose is directed basad. Connective straight.

Female — Female unknown.

Remarks. *S. cedrivula* externally resembles *S. pallescens,* but can be distinguished from this and the other *Solonaima* species by the spine-configuration of the aedeagus.

Solonaima minuta sp. nov.
(Figs 18-22)

Type material. HOLOTYPE — ♂, Iron Range, Cape York Peninsula, N. Queensland, 27.iv. - 4.v.1973, G.B. Monteith, In QM. PARATYPES — 2 ♀, same data as holotype. 1 ♂, Lockerbie Scrub, Cape York Peninsula, N. Queensland, 7 - 14.iv.1977, R.I. Storey, in QDPI.

Description. Generally brownish; vertex and pronotum yellowish; first antennal segment whitish, apically brownish, second antennal segment yellowish brown. Tegmen translucent, without any markings, venation brownish; pterostigma distinct, dark brown. Total length ♂ 5.6-5.9 mm, ♀ 6.0-6.3 mm.

Head: Anterior portion of vertex longitudinal rectangular, slightly broadened at base, anterior transverse carina vanishing. Anterior portion of vertex 1.5 times as long as its basal width. Frons 2.7 times as long as its greatest width, with median carina only slightly ridged; area of frons concave. Post- and anteclypeus together 1.2 times as long as frons. Second antennal segment about twice as long as first.

Thorax: Pronotum half as long as anterior portion of vertex, and 1.4 times as wide as greatest width of head. Mesonotum in midline 9.2 times the length of pronotum. Basal and second tarsal segments of hind leg apically with 7 spines. Tegmen 2.5 times as long as wide. Longitudinal veins densely but inconspicuously papillate.

Male genitalia (Figs 20-22): Genital segment caudally 1.25 times as high as wide, in lateral aspect ventrally 5.7 times as long as dorsally; caudal margin smooth. Anal segment broad at base, apically rounded and bent ventrad, laterally with two shallow lobes directed ventrad. Parameres like in *S. cedrivula*. Basal part of aedeagus with a rigid basal and two movable subapical spines on its right side: basal spine irregularly tapering, directed dorsocaudad; subapical spines long, slender, one directed basad, the other (which is nearly invisible in right lateral view) curved to the left side, passing through a groove formed by a rigid spine-like, s-shaped process of the dorsal portion of the aedeagus basis. Distal part of aedeagus apically granulate, with two spines on its left side. Connective straight.

Female genitalia: As in *S. bifurca*.

Distribution. Known only from Iron Range and Lockerbie Scrub in Cape York Peninsula (Queensland).

Remarks. This species can be distinguished from other *Solonaima* species by its whitish first antennal segment and the configuration of aedeagal spinulation.

Solonaima ornata sp. nov.
(Figs 23-25)

Type material. HOLOTYPE — ♀, Mt. Tozer Area, Iron Range, N. Queensland, 29.iv. - 1.v.1973, G.B. Monteith, in QM.

Description. *Female* — Head and mesonotum brownish, antennal segments yellowish brown; pronotum, legs and abdomen yellowish. Tegmen translucent, with clavus dark and characteristic dark brown markings (Fig. 24); venation brownish, in areas of markings dark brown; pterostigma distinct, dark brown. Total length ♀ 8.9 mm.

Head: Vertex anteriorly rounding into frons, not separated from frons by a transverse carina. Frons 2.2 times as long as its greatest width, median carina obsolete; area of frons nearly planate. Post- and anteclypeus together about as long as frons.

Thorax: Pronotum 1.4 times as wide as greatest width of head. Mesonotum in midline about 7 times the length of pronotum. Basal and second tarsal segments of hind leg with 7 apical teeth. Tegmen 2.8 times as long as wide. Longitudinal veins densely papillate.

Female genitalia: As in *S. bifurca*.

Male — Male unknown.

Remarks. Although *S. ornata* is so far known only from a single female, this species differs significantly from all other known *Solonaima* species not only in its characteristic pattern of the tegmina, but also in the median carina of the frons which in all other epigean *Solonaima* species is sharply ridged while it is rather obsolete in *S. ornata*.

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REVISION OF AUSTRALIAN DICROTELINI WITH THE DESCRIPTION OF THREE NEW GENERA (HEMIPTERA:REDUVIIDAE)

M.B. MALIPATIL

Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin NT 0801, Australia.

ABSTRACT

Three new genera, *Barlircduvius* gen. nov. (type species *B. westraliensis* sp. nov.) from Western Australia, *Arrilpecoris* gen. nov. (type species *Arrilpecoris aridellus* sp. nov.) from Northern Territory and *Karlacoris* gen. nov. (type species *K. roundatus* sp. nov.) from Western Australia are described. The following synonymies are made: *Orgetorixa* China, 1925 and *Neonyllius* Miller, 1954a with *Nyllius* Stål, 1859; *Neonyllius echinus* Miller, 1954a with *Nyllius asperatus Stål, 1859; Dicranurocoris* Miller, 1954b with *Dicrotelus* Erichson, 1842; *Dicranurocoris victoriae* Miller, 1954b, *Dicranurocoris canberrae* Miller, 1954b and *Dicranurocoris tasmaniae* Miller, 1954b with *Dicrotelus prolixus* Erichson, 1842; *Orgetorixa evansi* Miller, 1954a and *O. saeva* Miller, 1954a with *O. australica* China, 1925; *Paranyllius pudicus* Miller, 1954a with *P. turneri* Miller, 1954a. *O. australica* transferred to genus *Nyllius*. Notes on diagnosis of Australian members of tribe Dicrotelini, and a key to genera are provided.

KEYWORDS: Hemiptera, Reduviidae, Dicrotelini, new genera and species, Australia.

INTRODUCTION

Stål (1874) included the Australian genera *Dicrotelus* Erichson and *Nyllius* Stål in his subfamily Reduviina without including them in his key to the genera of the subfamily. Lethierry and Severin (1896) catalogued these genera under the subfamily Harpactoridae.

Stål (1859) placed *Dicrotelus* and *Nyllius* in Dicrotelida Stål, but Miller (1954a) for the first time employed the term Dicrotelini to include the genera *Henricohahnia* Breddin (included previously under Division Polididusaria by Distant (1904)), *Tapirocoris* Miller, *Karenocoris* Miller and *Malaiseana* Miller from the Oriental Region, and *Nyllius, Dicrotelus, Orgetorixa* China, *Paranyllius* Miller and *Neonyllius* Miller from the Australian Region.

Dicrotelines form a distinct group, and although placed in the subfamily Harpactorinae, they share the following characters with such genera as *Oncocephalus* Klug, *Pygolampis* Germar and *Sastrapada* Amyot and Serville of the subfamily Stenopodinae: elongate, linear body shape, slightly incrassate fore femur, antennal segment 1 slightly thicker than other segments, sickle shaped paramere, endosoma without minute spines, but with sclerotized lobes.

The present contribution describes three new genera from the Northern Territory and Western Australia to bring the known Australian dicroteline fauna to 6 genera and 7 species.

In the following descriptions all measurements are in millimetres.

Abbreviations for institutions and collections: ANIC Australian National Insect Collection, CSIRO, Canberra; BM British Museum (Natural History), London; MV Museum of Victoria, Melbourne; QM Queensland Museum, Brisbane; SAM South Australian Museum, Adelaide; TDA Tasmanian Department of Agriculture, Hobart; TM Tasmanian Museum, Hobart; UQIC University of Queensland Insect Collection, Brisbane; WAM Western Australian Museum, Perth.

SYSTEMATICS

The tribe Dicrotelini may be recognized by the combination of the following characters:

Body usually elongate, linear. First segment of antenna thicker than other segments, head dorsally with a median conically

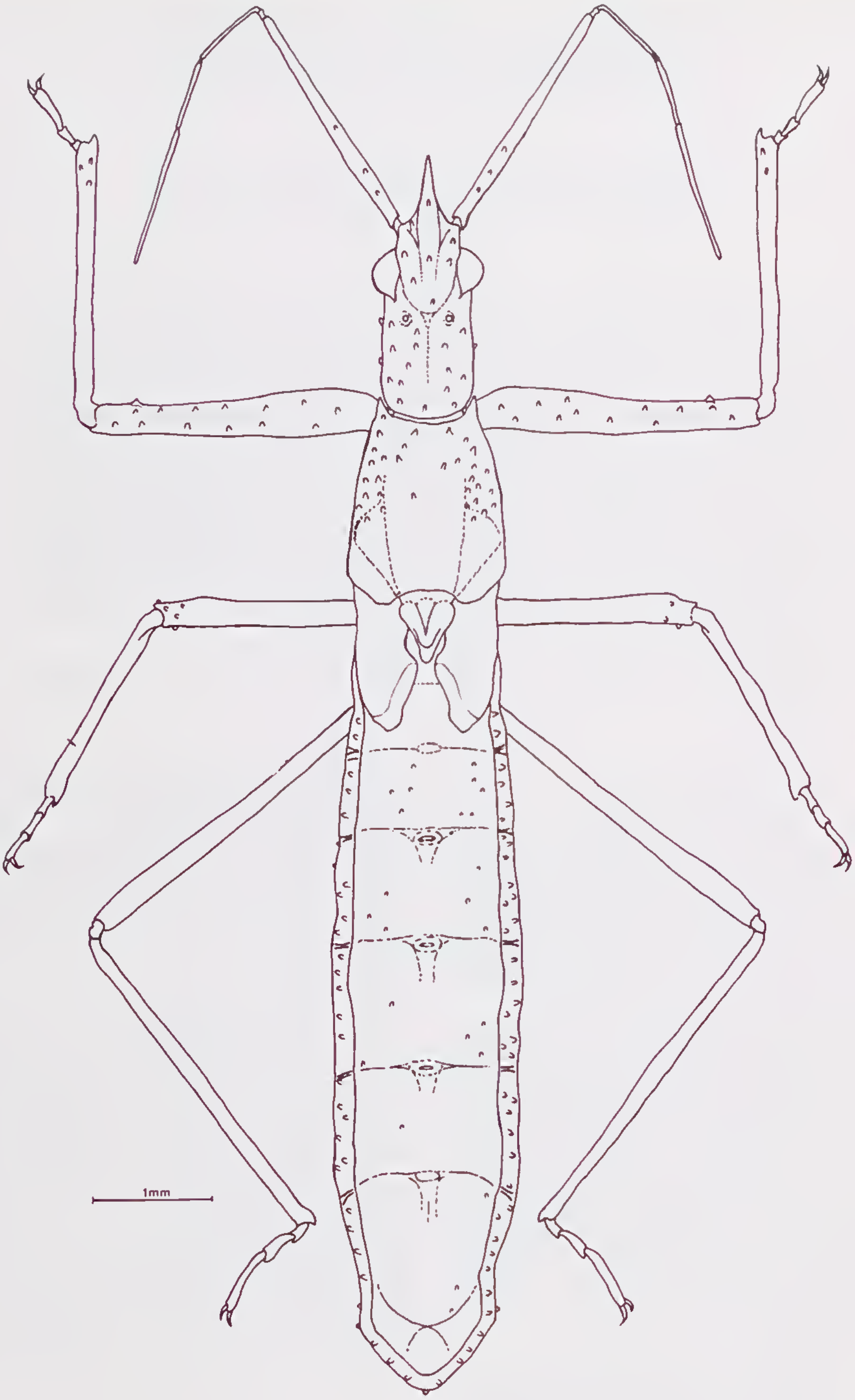
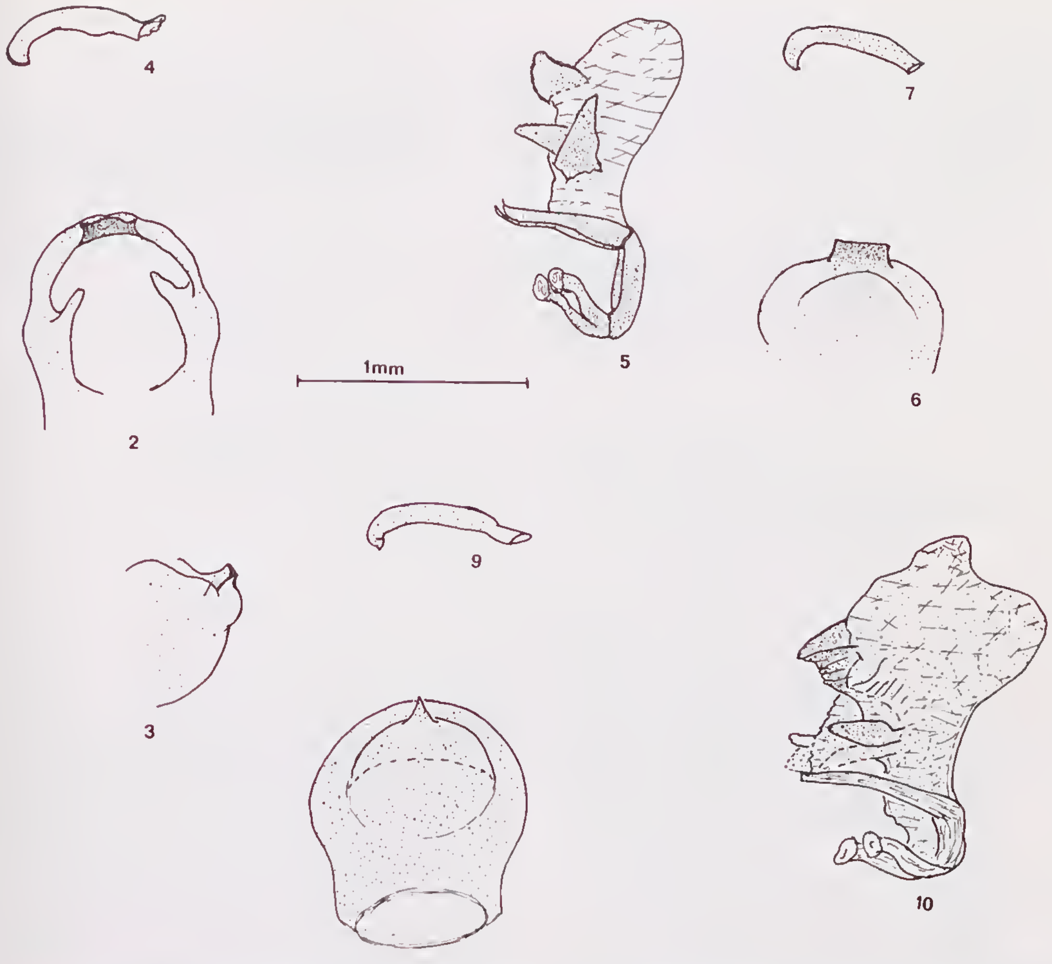


Fig. 1. *Dicrotelus prolixus*, dorsal view.



Figs 2-10. 2-5, *Dicrotelus prolixus* — **2,** pygophore, dorsal view; **3,** same, lateral view of apical part; **4,** left paramere, dorsal view; **5,** aedeagus, lateral view. **6,7,** *Nyllius asperatus* — **6,** apical part of pygophore, dorsal view; **7,** left paramere, dorsal view. **8-10,** *N. australicus* — **8,** pygophore, dorsal view; **9,** left paramere, dorsal view; **10,** aedeagus, lateral view. Figs 6 and 8 not to scale.

produced projection between antenna (e.g. Fig. 11), projection laterally flattened, apically pointed and about as long as anteocular part of head. Fore femur more incrassate than other femora, armed below with one or more spines or tubercles.

Last visible abdominal segment bilobed, more distinctly in ♀ than in ♂.

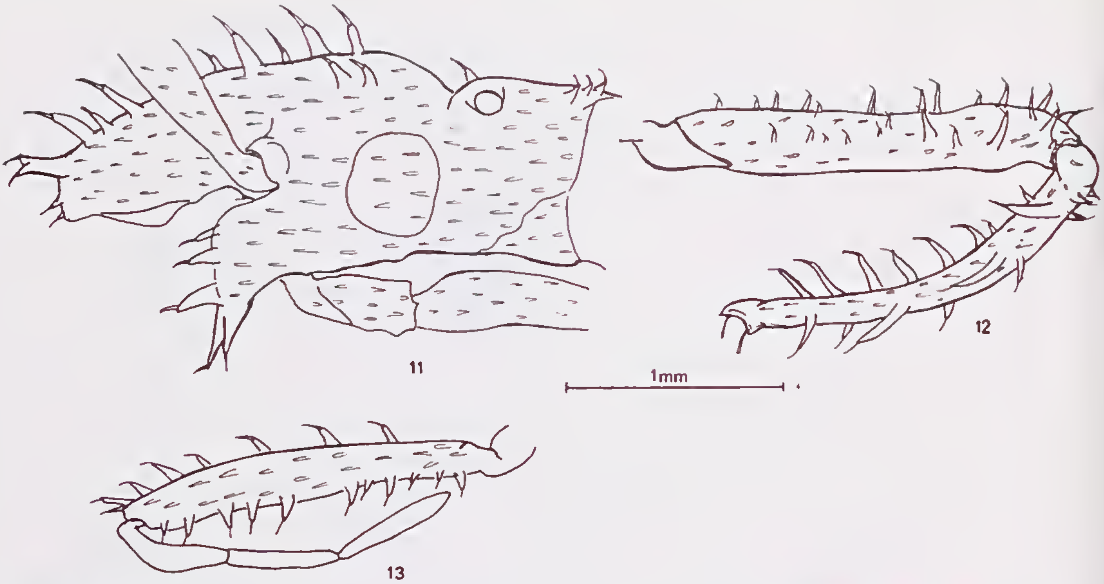
Male genitalia: Paramere simple; aedeagus with well developed dorsal phallothecal sclerite, endosoma with sclerotized lobes.

Key to the Australian Genera of Dicrotelini

1. Fore femur armed ventrally with 3 or more spines 2
Fore femur armed ventrally with 1 preapical spine 4

2(1). Fore tibia curved and strongly spined ventrally (e.g. Fig. 12) .... *Barlireduvius* gen. nov.
Fore tibia almost straight and unarmed 3

3(2). Posterior lobe of pronotum with acute lateral angles; antennal segment 1 conspicuously thicker than other segments; eyes with distinct scalelike setae .... *Arrilpecoris* gen. nov.
Posterior lobe of pronotum rounded, without acute lateral angles; antennal segment 1 only slightly thicker than other segments; eyes without distinct scalelike setae .... *Karlacoris* gen. nov.



Figs 11-13. *Barlireduvius westraliensis:* **11,** head, lateral view; **12,** left fore femur and tibia, lateral view; **13,** left antenna, lateral view.

4(1). Posterior lobe area of pronotum not produced laterally; commonly micropterous .... *Dicrotelus* Erichson

Posterior lobe area of pronotum conspicuously produced laterally; macropterous 5

5(4). Sixth visible abdominal segment produced posterolaterally; disc of anterior lobe of pronotum without well developed tubercles or spines .... *Paranyllius* Miller

Sixth visible abdominal segment not produced posterolaterally; disc of anterior lobe of pronotum with well developed tubercles or spines .... *Nyllius* Stål

Genus *Dicrotelus* Erichson

Dicrotelus Erichson, 1842:284 (type species *Dicrotelus prolixus* Erichson, 1842, by monotypy).

Dicranurocoris Miller, 1954b:238 Syn. nov.

Description. In addition to that of Miller (1954b) for *Dicranurocoris.*

Male genitalia: Pygophore posterior end with a plate like projection on inner margin (e.g. Figs 2, 3); paramere tip pointed (e.g. Fig. 4); endosoma with 3 large lobes (e.g. Fig. 5).

Notes. When comparing his new genus *Dicranurocoris* with *Dicrotelus,* Miller (1954b) commented that the former has strongly tuberculate legs and head, spinose anterior lobe and postero-lateral angles of posterior lobe of pronotum, and tuberculate scutellum and connexivum. In the present study I have examined the types of all the species presently included in these genera and a long series of non-type specimens and found a considerable variation in all the above characters, even within a single series. I found no major characters, either external or internal, to distinguish these genera, hence the synonymy.

Dicrotelus prolixus Erichson

(Figs 1-5)

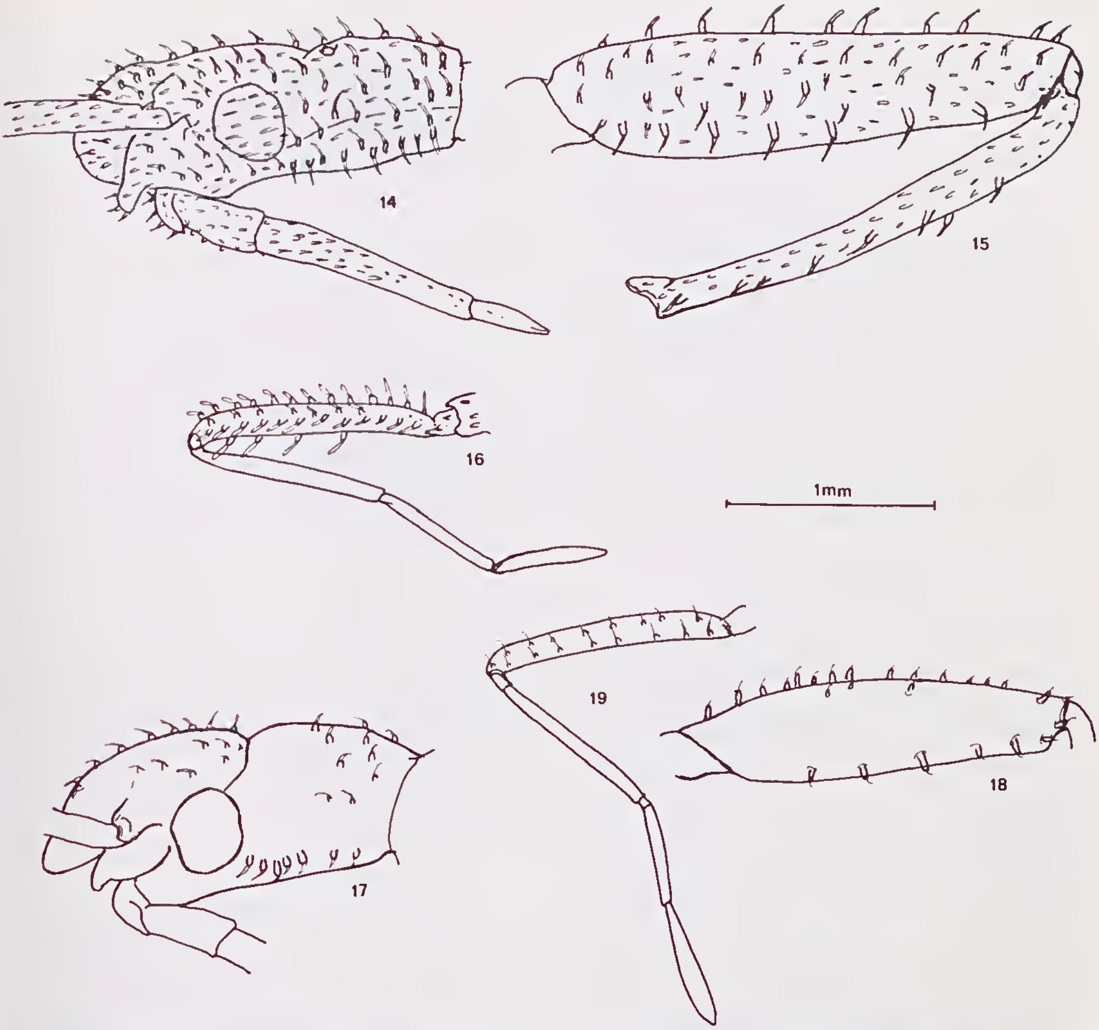
Dicrotelus prolixus Erichson, 1842:284-85; Stål 1874:42.

Dicranurocoris victoriae Miller, 1954b:238-40. Syn. nov.

Dicranurocoris canberrae Miller, 1954b:239-40. Syn. nov.

Dicranurocoris tasmaniae Miller, 1954b:239-40. Syn. nov.

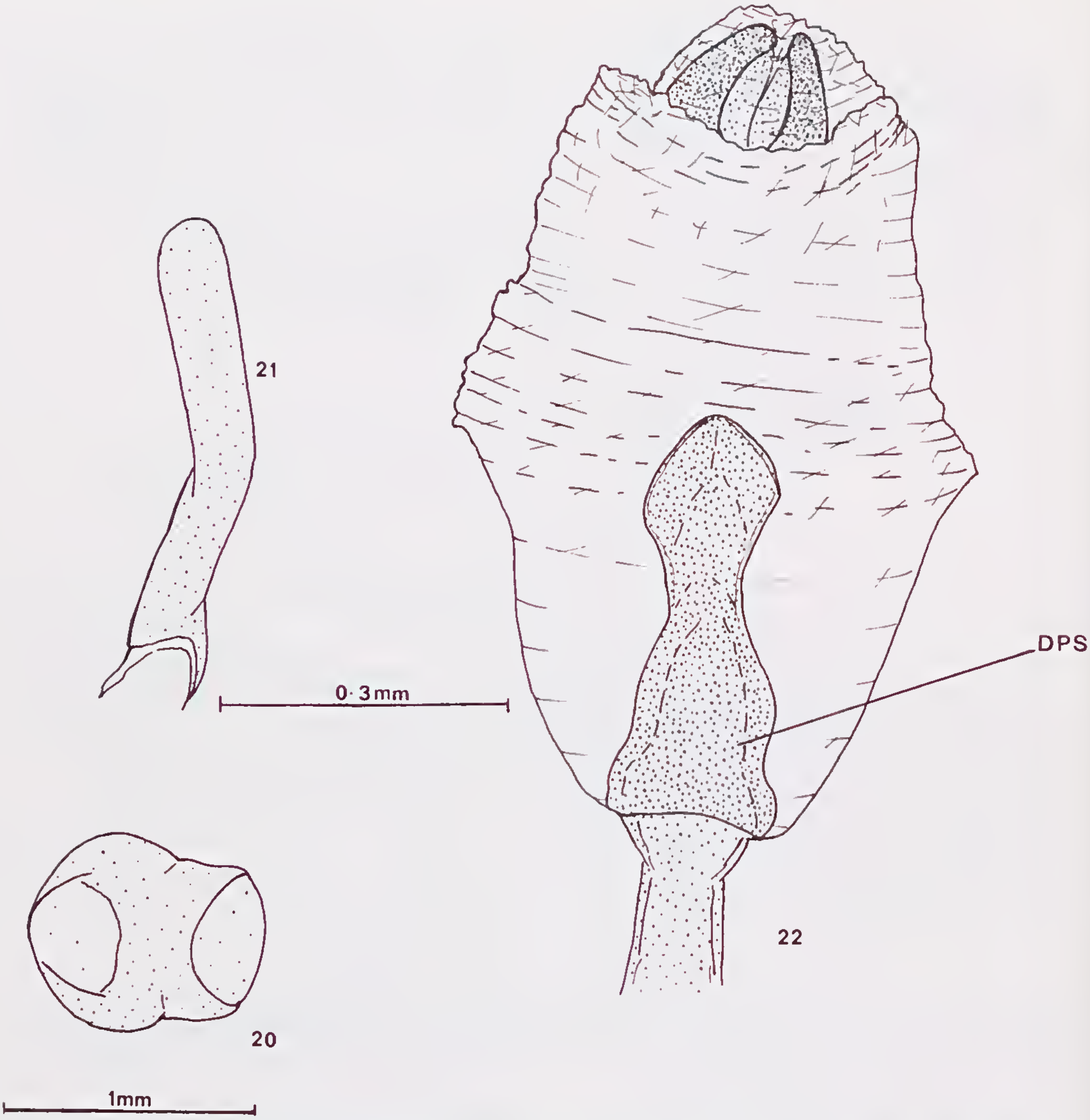
Type material. All micropterous. LECTOTYPE here designated — ♀, "Van Diemens Land Schayer", "2909", "Typus", "*Dicrotelus* Er. *prolixus* Er.", in Zoologisches Museum, Berlin. Following missing: distal segment of right antenna, tarsi of right fore and left midleg. HOLOTYPE —



Figs 14-19. 14-16, *Arrilpecoris aridellus* — **14,** head, lateral view; **15,** left fore femur and tibia, lateral view; **16,** left antenna, lateral view. **17-19,** *Karlacoris rotundatus* — **17,** head, lateral view; **18,** left fore femur, lateral view; **19,** left antenna, lateral view.

♀, PARATYPE — 1 ♀, *Dicranurocoris victoriae* Miller, Toora, Victoria, 16.xii.1937, R.V. Fyfe, in ANIC. HOLOTYPE — ♀, *Dicranurocoris canberrae* Miller, Canberra, Australian Capital Territory, xii.1929, H.J. Willings, in ANIC. HOLOTYPE — ♂, PARATYPE — 1 ♀, *Dicranurocoris tasmaniae* Miller, New Norfolk, Tasmania, in tussocks, Lea, in SAM.

Additional material. *Micropterous:* NEW SOUTH WALES: 1 ♀, Wee Jaspar, 7.i.1955, T.E. Woodward, in UQIC: 1 ♀, Llangothlin, 16.xii.1975, B. Cantrell, in UQIC. VICTORIA: 1 ♂, 1 ♀, Warburton, Pres. by J.E. Dixon, in MV; 1 ♂, 3 ♀, Healesville, 15.xii.1958, A. Neboiss, in MV; 4 ♂, 2 ♀, Woodend Reserve, 23.v.1919, J.E. Dixon, in MV; 1 (?), Hopkins, Falls, 28.x.1955, A. Neboiss, in MV; 2 ♂, Wallan, 25.xii.1956, F. Hallgarten, in MV; 1 ♂, 2 ♀, Gippsland, 20.viii.1919, J.E. Dixon, in MV; 1 ♂, 3 ♀, Sylvia Ck, Toolangi district, 15.xii.1958, F.E. Wilson, in MV; 2 ♂, 3 ♀, Launching Place, xii.1923, J.E. Dixon, in MV. TASMANIA: 1 ♀, Ouse, light trap, 17.xi.1958, in TDA; 1 ♀, Blackmans Lagoon, 11.xi.1972, A. Neboiss, in MV; 2 ♂, 5 ml W of Oatlands, 5.xii.1974, A. Neboiss, in MV; 1 ♀, North Esk River, Blessington, 1.iii.1967, A. Neboiss, in MV. *Submacropterous:* VICTORIA: 1 ♀, Lower Tarwin, xi.1925, G.F. Hill, in MV.



Figs 20-22 *Karlacoris rotundatus:* **20,** pygophore, dorsal view; **21,** left paramere, dorsal view; **22,** aedeagus, dorsal view. Figs 21 and 22 to same scale. DPS, dorsal phallothecal sclerite.

Description. *Micropterous* — Following are additions to original description of this species and synonymized species listed above:

Measurements are of lectotype, followed by ranges of non-type specimens in parentheses.

Body length 12.92 (9.30-13.20), maximum width 2.11 (1.53-2.28).

Head: Length 2.90 (2.20-2.78), width across eyes 1.00 (0.88-0.98), interocular space 0.60 (0.48-0.52), eye length 0.44 (0.39-0.41); length antennal segments: I, 2.70 (2.20-2.50); II, 0.76 (0.72-0.80); III, 0.68 (0.64-0.65); IV, 1.00 (1.03-1.05).

Thorax: Pronotum length 1.70 (1.28-1.60), maximum width 1.60 (1.08-1.45); scutellum length 0.54 (0.40-0.54), width 0.63 (0.42-0.65); hemelytra extending to posterior margin of or less commonly to middle of 2nd visible abdominal segment, length 1.40 (0.97-1.30).

Abdomen: Male genitalia: Pygophore (Figs 2,3); paramere (Fig. 4); aedeagus (Fig. 5).

Submacropterous — As for micropterous except:

Body length 13.70, maximum width 2.28.

Head length 2.74, width across eyes 1.00, interocular space 0.50, eye length 0.41; length antennal segments: I, 2.48; remaining segments missing.

Length pronotum 2.04; width posterior margin 1.96; length scutellum 0.80, width 0.72; hemelytra extending to about middle of 3rd last visible abdominal segment, length 6.85, length corium 4.88.

Notes. There are some structural variations between the micropterous and submacropterous forms. In micropterous form the posterior lobe of pronotum is shortened, laterally narrowed and dorsally explanate, and in lateral view slightly lower than the anterior lobe, and the scutellum is also slightly shortened and narrowed.

All Miller's (1954b) species, viz. *canberrae, tasmaniae* and *victoriae* were distinguished from each other by characters, which I found in the present study after examination of a long series of specimens, to be only minor variations even within specimens from a single locality. Therefore I have synonymized all these species with *prolixus*.

Genus *Nyllius* Stål

Nyllius Stål, 1859:365 (type species *Nyllius asperatus* Stål, 1859, by monotypy).

Orgetorixa China, 1925:486-87. Syn. nov.
Neonyllius Miller, 1954a: 480. Syn. nov.

Description. Body elongate. Head cylindrical, between antennal base spinosely produced; antenna geniculate, 1st segment slightly shorter than head, incrassate; labial 1st segment short, 2nd segment 2 times as long as 1st. Pronotum medially constricted, anterior lobe with many spinules, posterior margin sinuate anterior to scutellum, anterolateral angles spinosely produced; scutellum acutely produced at apex; hemelytra almost fully covering abdomen; anterior femur incrassate, armed below with a minute spine anterior to middle, middle and hind femora subequal.

Abdominal margins armed with spinules.

Male genitalia: Pygophore with a projection on inner margin at posterior end (e.g. Fig. 6); paramere with tip pointed (e.g. Fig. 7); aedeagus with sclerotized lobes on endosoma (e.g. Fig. 10).

Notes. This genus differs from *Dicrotelus* in having almost fully developed hemelytra and the posterior lobe area of pronotum conspicuously produced laterally. Miller (1954a) listed several differences between the genus *Nyllius* and *Orgetorixa*. After examination of a large series of specimens including the types of all the species of these two genera, I find in *Orgetorixa* none of the specimens has the basal segment of antennae longer but is equal or slightly shorter than the head, and the remaining characters listed by Miller are only minor and exhibit considerable variation even within one geographic series. Therefore I synonymise *Orgetorixa* with *Nyllius*. Also I can not find any major characters in *Neonyllius* that would distinguish it from *Nyllius*, hence its synonymy with the latter.

Nyllius asperatus Stål

(Figs 6,7)

Nyllius asperatus Stål, 1859:366.
Neonyllius echinus Miller, 1954a: 480-81. Syn. nov.

Type material. LECTOTYPE here designated — ♀, "Typus", "2910", "N.H. Orr. Preiss", "*Nyllius asperatus* Stål", in Zoologisches Museum, Berlin. Right mid leg missing. PARALECTOTYPE — 1 ♀, same data as lectotype, in Zoologisches Museum, Berlin. HOLOTYPE — ♂, *Neonyllius echinus* Miller, Queensland, Australia, ex coll. Fruhstorfer, in Vienna Museum. Following missing: right mid and both hind tarsi, distal 2 segments of left and 4th segment of right antennae.

Additional material. WESTERN AUSTRALIA: 1 ♀, 1922-23, in BM; 1♀, in BM; 1 ♂, Glen Forrest, feeding at flowers of *Hakea bipinnatifida*, 15.viii.1976, S.M. Postmus, in WAM, 1 ♂, same locality but 18.vii.1976, in WAM; 2♂, Frenchman Bay, Albany, on terminal leaves of *Anthoceris viscosa*, 22.i.1972, G.W. Kendrick, in WAM; 2 ♂, Mandurah, 27.xi.1962, A. Douglas leg, in WAM; 1♀, Mundaring nr Perth, 15.ix.1923, G.A.K. Marshall, in BM; 1♀, Pinjarrah, Lea, in BM. SOUTH AUSTRALIA: 3♂, 1 ♀, Kangaroo Island, in SAM, 1 ♀, same locality, 1-6.iii.1886, in SAM. TASMANIA: 1 (?), King Island, in TDA; 1♀, Launceston, in TDA; 1 ♂, 1 (?), Margate, J.W. Evans, in TDA; 1♂, Mt Wellington, Lea, in TDA.

Description. Generally testaceous or fuscotestaceous; covered with silky hairs except on membrane. Measurements are of lectotype, followed by ranges of non-type specimens in parentheses.

Body length 12.24 (10.00-11.60), maximum width 2.74 (2.40-3.00).

Head: Length 2.74 (2.53-2.61), width across eyes 1.05 (1.05-1.17), interocular space 0.64 (0.52-0.64), interocellar space 0.40 (0.36-0.42), eye-ocellar space 0.31 (0.27-0.30), eye length 0.40 (0.42-0.46). Length antennal segments: I, 2.12 (1.98-2.14); II, 1.13 (1.13-1.26); III, 0.93 (0.99-1.12); IV, 1.05 (0.98).

Thorax: Pronotum length 2.04 (2.02-2.16), maximum width excluding spines 2.40 (2.28-2.63); scutellum length 1.14 (0.93-1.08), width 0.88 (0.79-1.08). Hemelytral length 6.94 (6.50-7.34), corium length 4.80 (4.50-4.86); membrane width 2.04 (1.80-2.12).

Abdomen: Pygophore posterior margin as in Fig. 6; paramere (Fig. 7).

Notes. Internal cell of membrane *sensu* Miller (1954a) is variable even within one geographic series, for instance, Mandurah, W.A. 1♂ has a distinct cell whereas the other ♂ lacks it. But all other W.A. specimens examined have this cell; South Australian and Tasmanian specimens usually do not have a distinct cell. Therefore it is not a good taxonomic character.

Nyllius australicus (China) comb. nov.

(Figs 8-10)

Orgetorixa australica China, 1925:487-88.

Orgetorixa evansi Miller, 1954a:482-83, 485, Syn. nov.

Orgetorixa saeva Miller, 1954a:484-85. Syn. nov.

Type material. HOLOTYPE — ♂, Sydney, New South Wales, J.J. Walker, in BM. PARATYPE — ♀, same data as holotype, in BM. HOLOTYPE — ♂, *Orgetorixa evansi* Miller, New Norfolk, Tasmania, 31.x.1935, in BM. HOLOTYPE — ♂, *Orgetorixa saeva* Miller, Dorrigo, New South Wales, W. Heron, B.M. 1934-232, in BM.

Additional material. QUEENSLAND: 1 ♀, Queen Mary Falls Park nr Killarney, 28.iii.1959, T.E. Woodward, in UQIC; 3 ♀, Lamington National Park, 17-21.ii. 1964, G. Monteith and H.A. Rose, in UQIC, 1 ♂, same locality, 18.v.1965, F.D. Page, in UQIC. NEW SOUTH WALES: 1 ♂, Merimbula, 25.ii.1950, F.E. Wilson, in SAM; 1♂, Numeralla, 4.iv.1968, E. McC. Callan, in ANIC. VICTORIA: 1 ♂, in MV; 1 ♀, Mulgrave, 6.i.1924, J.E. Dixon Collection, in MV; 1♂, 4 ♀, Warburton district, J.E. Dixon Collection, in MV; 1 ♀, Belgrave, 15.x.1954, F.E. Wilson, in SAM; 1♂, 1 ♀, Fern Tree Gully, J.E. Dixon Collection, in MV; 1♂, Lorne, 4.ii.1958, N. Dobrotworsky, in MV; 1♂, Gembrook, in MV; 1 ♂, Walhalla, iv.1930, F.E. Wilson, in MV; 1 ♂, 3 ♀, Cann River, xi.1928, J. Clark, in MV; 1 ♂, 2km SW Mt Ronald, 2.xii.1976, A.A. Calder, in MV. TASMANIA: 1 ♀, leg Verreaux, in Museum National d'Histoire Naturelle, Paris, 1♀, in TM, 1♀, A. Simon, in SAM; 1 ♀, Hobart, 8.xi.1913, in TM, 1 ♀, 27.ix.1914, in TM, 1♀, Lea, in TM; 1 ♀, Collinsvale Road, 16.x.1970, in TDA; 1♂, St Marys, in QM; 1 ♀, Launceston, TDA.

Description. Following are additions to original description.

Measurements are of holotype, followed by ranges of non-type specimens in parentheses.

Body length 12.50 (11.50-15.50), maximum width 2.38 (2.35-3.06).

Head: Length 3.06 (2.82-3.50), width across eyes 1.35 (1.22-1.35), interocular space 0.72 (0.64-0.81), interocellar space 0.31 (0.36-0.40), eye-ocellar space 0.27 (0-27-0.31); eye length 0.54 (0.50-0.54); length of antennal segments: I, antennae missing in holotype (2.48-2.79); II, (1.48-1.53); III, (1.17-1.37); IV, (1.13).

Thorax: Pronotum length 2.52 (2.41-2.52), maximum width 2.70 (2.52-2.70); scutellum length 1.08 (1.08-1.42), width 0.90 (0.96-1.06); hemelytral length 8.16 (7.30-9.75), corium length 5.61 (5.07-6.82), membrane width 2.04 (1.87-2.40).

Abdomen: Male genitalia: Pygophore in dorsal view as in Fig. 8; paramere (Fig. 9); aedeagus (Fig. 10).

Notes. This species differs from *N. asperatus* in having the pygophore with projection on inner margin at posterior end pointed, the posterior lobe of pronotum in lateral view almost smooth without pronounced tubercles, the tip of scutellum slightly more distinctly upcurved, and the basal segment of antennae equal to or only slightly shorter than head.

Genus *Paranyllius* Miller

Paranyllius Miller, 1954a:475 (type species *Paranyllius turneri* Miller, 1954a, by original designation).

Description. In addition to Miller (1954a):

Male genitalia: Pygophore, paramere and aedeagus as in *Nyllius.*

Notes. This genus differs from *Nyllius* in lacking well developed tubercles or spines on the disc of anterior lobe of pronotum, and in having a posterolaterally produced 6th visible abdominal segment. The following modifications to the original description are necessary: internal cell of membrane indistinct; external apical angle of segments 7 and 9 lobately produced in ♀, but not in ♂.

Paranyllius turneri Miller

Paranyllius turneri Miller, 1954a:475, 477-78.

Paranyllius pudicus Miller, 1954a:478-79. Syn. nov.

Type material. HOLOTYPE — ♀, Yanchep, 32m. N of Perth, Western Australia, 29.i-8.ii.1936, R.E. Turner, B.M. 1936-28, in BM. HOLOTYPE — ♂, *Paranyllius pudicus* Miller, Yalingup, South Western Australia, 1-12.xii.?, in BM.

Additional material. WESTERN AUSTRALIA: 1 ♂, 1 ♀, Perth, 25.ii-12.iii.1936, R.E. Turner, B.M. 1936-28, in BM.

Description. Following are additions to original description:

Measurements are of holotype, followed by those of a ♂ non-type specimen in parentheses.

Body length 11.39 (10.43), maximum width 2.43 (1.37).

Head: Length 2.88 (2.40), width across eyes 1.08 (0.97), interocular space 0.63 (0.46), interocellar space 0.24 (0.19), eye-ocellar space 0.24 (0.18), eye length 0.40 (0.39); length antennal segments: I, 1.80 (1.86); II, 1.00 (1.07); III, 0.86 (0.93); IV, 0.72 (0.70).

Thorax. Pronotum length 1.89 (1.51), maximum width excluding spines 2.07 (1.67); scutellum length 1.08 (0.93), width 0.90 (0.78); hemelytral length 6.46 (6.42), corium length 4.42 (4.16); membrane width 1.26 (1.20).

Barlireduvius gen. nov.

Type species *Barlireduvius westraliensis* sp. nov.

Description. Elongate, linear insects. Body above excluding hemelytra and below excluding abdomen and appendages with small, irregular stout spines, fore femur and tibia in addition with long stout spines.

Head about 2 times as long as wide across eyes, with distinct transverse impression near posterior margin of eyes (e.g. Fig. 11) with distinct V shaped smooth line extending from near transverse furrow to base of antenna; antennal segment 1 robust, about 3 times as long as segment 2, armed with stout spines in 2 series (e.g. Fig. 13); labial segment 2 longest.

Pronotum subequal in length to maximum width, with lobes distinct, anterior lobe narrower than posterior lobe, anterior margin concave, posterior margin invaginated, in front of scutellum straight, disc of posterior lobe with a ridge on either side of midline diverging posteriorly towards base of pronotum; scutellum triangular, slightly longer than wide, disc raised, apex produced; legs spined, fore legs longer and stouter than other legs, mid legs shorter than hind legs, fore femur and tibia slightly curved and armed with long stout spines (e.g. Fig. 12); hemelytra exposing narrow lateral area of abdomen.

Abdomen with connexival area particularly towards posterior margin of each segment and posterior margins of last 2 visible segments irregularly spined; last visible segment bilobed.

Notes. The genus differs from all other genera of the tribe Dicrotelini by having fore tibiae curved and ventrally strongly spined, and the 1st antennal segment which has 2 series of distinct spines.

Etymology. "Barli" — bent or curved in "Yindjibarndi", the major Australian Aboriginal language in the type locality, alludes to the bug's curved fore tibia.

Barlireduvius westraliensis sp. nov.

(Figs 11-13)

Type material. HOLOTYPE — ♀, Tambrey, 21.38S 117.36E, Western Australia, 21.viii.1958, R.P. McMillan, in WAM. Fore, hind and left mid tarsi, and 4th segment of left antenna missing.

Description. Generally stramineous, broad areas on posterior part of head, pronotum, scutellum, clavus, membrane and mid legs fuscous or dark.

Body length 14.50, maximum width 2.90.

Head: Length 2.48, width across eyes 0.96, interocular space 0.72, interocellar space 0.48, eye-ocellar space 0.16; length antennal segments: I, 1.53; II, 0.50; III, 0.46; IV, 0.58; length labial segments: I, 0.46; II, 0.62; III, 0.32.

Thorax: Pronotum length 2.88, width anterior margin 0.99, maximum width excluding spines 2.80; scutellum length 1.28, width 0.93; hemelytra abbreviated exposing terminal 2 1/2 segments, length, 7.34, length corium 4.72.

Arrilpecoris gen. nov.

Type species *Arrilpecoris aridellus* sp. nov.

Description. Elongate, ovate insects. Body and appendages excluding hemelytra sparsely covered with tubercles each distinctly armed with a scalelike setae (e.g. Fig. 14); body and appendages in addition thickly covered with simple scalelike setae, membrane bare.

Head cylindrical behind eyes, about 2 times as long as wide across eyes, with distinct transverse impression near posterior margin of eyes, eyes covered with conspicuous scalelike setae; antennal segment 1 *ca* 1.5 times as long as segment 2 (e.g. Fig. 16); labial segment 2 longest, segment 1 and 3 subequal.

Pronotum equal in elngth to maximum width, lateral angles acutely produced, lobes distinct, anterior margin concave, posterior margin in front of scutellum gradually concave; scutellum triangular, apex produced upwards; corial outer margins parallel exposing broad area of abdomen.

Etymology. "Arrilpe" — acute or pointed in "Aranda", the major Australian Aboriginal language in the type locality, alludes to the bug's acute lateral angles on posterior lobe of pronotum.

Arrilpecoris aridellus sp. nov.

(Figs 14-16)

Type material. HOLOTYPE — ♀, 32 km S by E of Alice Springs, 23.59S 133.56E, Northern Territory, 23.ix.1976, J.C. Cardale, in ANIC. PARATYPE — ♀, Native Gap, 19 km SSE of Aileron, 22.48S 133.10E, Northern Territory, 9.ix.1979, I.D. Naumann, in ANIC.

Description. Generally dark reddish brown, abdominal venter dirty yellow, abdominal connexiva with alternate dark and pale bands, legs with irregular dark and pale bands.

Body length 8.30; maximum width 2.64.

Head length 1.76, width across eyes 0.89, interocular space 0.54, interocellar space 0.41, eye-ocellar space 0.23; length antennal segments: I, 1.20; II, 0.83; III, 0.61; IV, 0.51; length labial segments: I, 0.42; II, 1.04; III, 0.31.

Pronotum length 1.96, width anterior margin 0.74, maximum width 2.21; scutellum length 0.81, width 0.62; hemelytra extending to almost tip of abdomen, length 4.88, length corium 3.31.

Karlacoris gen. nov.

Type species *Karlacoris rotundatus* sp. nov.

Description. Elongate, ovate insects. Body above (excluding membrane), below and appendages covered with minute tubercles each distally armed with a bristle (e.g. Fig. 17), fore femur ventrally armed in addition with several spines in 2 irregular series (e.g. Fig. 18), pronotum and femur with some tubercles of varying sizes.

Head about 2 times as long as wide across eyes, with distinct transverse impression near posterior margin of eyes (e.g. Fig. 17), eyes without conspicuous setae; antennal segment 1 less than 1½ times as long as segment 2 (e.g. Fig. 19); labial segment 2 longest, segments 1 and 3 subequal.

Pronotum subequal in length to maximum width, lobes distinct, posterior lobe *ca* 1½ times as long as anterior lobe, latter with regular smooth depressed areas on either side of midline, anterior and posterior margin in front of scutellum concave; scutellum triangular, apex produced upwards; corial outer margin narrowly exposing abdomen.

Male genitalia: Pygophore gradually rounded posteriorly (e.g. Fig. 20), paramere simple (e.g. Fig. 21), endosoma with sclerotized lobes near distal end (e.g. Fig. 22).

Notes. This genus may be easily recognized from *Arrilpecoris* by the characters given in the key.

Etymology. "Karla" — west in "Walmatjari", the major Australian Aboriginal language in the type locality, alludes to the bug's western distribution in Australia.

Karlacoris rotundatus sp. nov.

(Figs 17-22)

Type material. HOLOTYPE — ♂, Old Fossil Down, 30 m. E. of Fitzroy Crossing, 18.11S 125.53E, Western Australia, W. Martin, in ANIC. Following missing: left midtarsi, right fore tarsi, left fore tibia and tarsi.

Description. Generally stramineous, apical segment of labium, small irregular areas on femora, and tibia, tarsal claws and pulvilli, membrane and disc of scutellum fuscous.

Body length 9.60; maximum width 2.28.

Head length 1.76, width across eyes 0.96, interocular space 0.52, interocellar space 0.39, eye-ocellar space 0.17; length antennal segments: I, 1.16; II, 0.88; III, 0.49; IV, 0.59; length labial segments: I, 0.40; II, 1.05; III, 0.37.

Pronotum length 1.96, width anterior margin 0.72, maximum width 2.20; scutellum length 0.88, width 0.86; hemelytra almost fully covering abdomen, length, 4.88, length corium 3.06.

Male genitalia: Pygophore as in (Fig. 20), paramere (Fig. 21), aedeagus with distinct dorsal phallothecal sclerite and sclerotized lobes near distal end of endosoma (Fig. 22).

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A NEW SPECIES OF *CTENOTUS* (REPTILIA: SCINCIDAE) FROM CENTRAL AUSTRALIA, AND A KEY TO THE *CTENOTUS LEONHARDII* SPECIES GROUP

MAX KING[1], PAUL HORNER[1] AND GREG FYFE[2]
[1]*Northern Territory Museum of Arts and Sciences.*
GPO Box 4646, Darwin, NT 0801, Australia.
[2]*Conservation Commission of the Northern Territory.*
PO Box 1046, Alice Springs, NT 0871, Australia.

ABSTRACT

A new species of *Ctenotus* Storr (Reptilia:Scincidae), *C. septenarius* sp. nov., from the arid south of the Northern Territory of Australia is described. This species is a member of the *Ctenotus leonhardii* species group (*sensu* Storr *et al.* 1981), and is distinguished from other members of that complex by both scalation and back pattern.

KEYWORDS: Reptilia, Scincidae, *Ctenotus,* new species, Northern Territory, Australia.

INTRODUCTION

The genus *Ctenotus* Storr, 1964 is the largest and most rapidly expanding taxon of scincid lizards found in Australia. It includes 72 species which are distributed throughout the continent and only one of these occurs in New Guinea. *Ctenotus* species are found in a diversity of habitats ranging from sandy deserts to tropical savannah forest. Moreover, numerous examples of microhabitat specialization are known, where sympatrically distributed species exist in subtly differentiated niches (Pianka 1969).

Storr, Smith and Johnstone (1981) recognised 10 separate species groups in *Ctenotus* and these are the *C. labillardieri* group, *C. essingtonii* group, *C. pantherinus* group, *C. grandis* group, *C. rubicundus* group, *C. lesueurii* group, *C. atlas* group, *C. schomburgkii* group, *C. colletti* group and *C. leonhardii* group. Of these, the *C. leonhardii* group was originally composed of 11 species, most of which are found in arid Australia, with a bias in their distribution towards the west of Australia. That is, 9 of these species occur in Western Australia. Since 1981, this species group has been expanded and now includes the following species: *C. alleni* Storr, 1974; *C. gagudju* Sadlier, Wombey and Braithwaite, 1985; *C. greeri* Storr, 1979; *C. hebetior* Storr, 1978; *C. hilli* Storr, 1970; *C. kurnbudj* Sadlier, Wombey and Braithwaite, 1985; *C. leonhardii* (Sternfeld, 1919); *C. militaris* Storr, 1975; *C. mimetes* Storr, 1969; *C. pulchellus* Storr, 1978; *C. regius* Storr, 1971; *C. rutilans* Storr, 1980; *C. serventyi* Storr, 1975; *C. tanamiensis* Storr, 1970; *C. uber* Storr, 1969. A table summarizing the diagnostic characteristics of the *C. leonhardii* species group is presented as Table 1.

These small to moderately large *Ctenotus* are distinguished from the other species groups by a predominance of reddish rather than olive pigmentation and the replacement of black by dark brown. The pattern is complex and includes longitudinal rows of spots as well as stripes. The dark vertebral and white midlateral stripes may be either distinct, weakly developed or absent. The dark upper lateral zone encloses 1-3 series of pale dots rather than larger spots. In terms of scalation and morphology, the second supraocular scale is not much wider than the first; the lamellae under the toes have an obtuse keel, or narrow to moderately wide callus, and the toes are compressed (from Storr *et al.* 1981).

This paper describes a sixteenth species from the *C. leonhardii* species group which was recently found in the arid southern sector of the Northern Territory. In addition, a key is provided to distinguish the members of the *C. leonhardii* species group.

MATERIALS AND METHODS

A total of 12 specimens of a previously undescribed species of *Ctenotus* were examined and compared to specimens of the *C. leonhardii* species group. The specimens

Table 1. A tabular summary of morphological characteristics which distinguish members of the *Ctenotus leonhardii* species group. Single boxed characters are used to demarcate species, whereas elongate boxes include a cluster of species characterised by a particular feature. Such subdivisions are necessary before diagnostic characters can be used to distinguish members of a cluster. + and – refer to presence or absence of a character.

Character	*C tanamiensis*	*C. gagudju*	*C. kurnbudj*	*C. uber*	*C. pulchellus*	*C. mimetes*	*C. alleni*	*C. hilli*	*C. regius*	*C. greeri*	*C. rutilans*	*C. leonhardii*	*C. septenarius*	*C. serventyi*	*C. hebetior*	*C. militaris*
No dark stripes on body, pattern mostly longitudinal series of whitish dots and dashes	⊞	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Frontoparietals fused to form a single shield	–	⊞	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Series of dark upper lateral blotches on tail	–	–	⊞	–	–	–	–	–	–	–	–	–	–	–	–	–
Pale mid-lateral stripe well developed, at least posteriorly	–	+	+	–	–	+	+	+	+	+	+	+	+	+	+	+
Nasals usually separated	–	–	+	⊞	⊟	+	+	–	+	–	+/–	–	⊞	⊟	+	–
Dark latero-dorsal stripe much wider than vertebral stripe	–	–	+	⊞	⊟	–	+/–	–	+/–	–	+	+/–	–	–	⊞	⊟
Legs spotted with dark brown, rather than streaked	–	–	–	–	–	⊞	–	–	–	–	–	–	–	–	–	–
Pale upper lateral dots tending to clump into large squarish spots	–	–	–	–	–	⊞	–	–	–	–	–	–	–	–	–	–
5 or more dark stripes on back	–	–	–	–	+	–	–	–	–	–	–	–	+	+	+	+
Dark vertebral stripe (if present) not pale edged	–	+	+	+/–	–	+	⊞	⊞	–	–	–	–	–	–	–	–
Less than 30 midbody scale rows	+/–	+/–	+/–	+/–	–	+/–	⊞	⊟	+	+	–	+/–	+/–	+	–	–
Pale mid-lateral stripe extending forward to lores	–	–	–	–	–	+	–	–	⊞	–	–	–	⊞	⊞	–	–
26 or less midbody scale rows	–	–	+/–	–	–	+/–	+/–	–	+/–	⊞	–	–	–	+/–	–	–
34 or more midbody scale rows	–	–	–	+/–	+/–	–	–	+/–	–	–⊞	⊟	–	–	–	+/–	
26 or more subdigital lamellae under 4th toe	+/–	+/–	+/–	+/–	+/–	+/–	+	+/–	+/–	+/–	+	+/–	⊞	⊟	+/–	–

failed to key out to any of the currently recognised *Ctenotus* species and are here described as a new species. The scalation nomenclature used follows that defined by Storr *et al.* (1981:193-8). A series of 25 counts and measurements were made on each specimen using micrometer adjusted calipers and a steel rule.

SYSTEMATICS

Ctenotus septenarius sp. nov.

(Figs 1-3)

Type material. HOLOTYPE — gravid ♀, NTM R13704, Bacon Range, near Henbury meteorite craters, 24° 35S 133° 08E, Northern Territory, coll. G. Fyfe, 17.ix.1986, beneath small rock slab. PARATYPES — NORTHERN TERRITORY: 1♀, NTM R13705, same data as holotype; 1♂, NTM R13706, same data except 24° 34S 133° 08E, 11.ix.1986; 2♂, NTM R13707-8, same data except 17.ix.1986; 3♂, 1♀, NTM R13709-12, same data except 18.ix.1986; 1♀, NTM R13713, 25° 18'S 130° 44'E, Valley of Winds on N.W. side of Mount Olga, coll. G. Fyfe and T. Barnett, 20.viii.1986; 1♂, juv., NTM R15089-90, 25° 17'S 130° 43'E, on S.E. side of Mount Olga, coll. J.A. Kerle, 5.iii.1988.

Diagnosis. Distinguished from all other members of the *Ctenotus leonhardii* species group by the possession of seven dark dorsal stripes. It may be further distinguished from most similar members of the *C. leonhardii* species group, that is those with five dark stripes in their back pattern, by the following characters. In *C. septenarius* the midlateral stripe is prominent and extends to the face as either a solid line, or as dots and dashes, when anterior to the forelimbs. In contrast, a midlateral line is either completely absent, or only present on the posterior portion of the body, in *C. pulchellus, C. hebetior and C. militaris. C. serventyi* has a similar lateral pattern to *C. septenarius,* but is distinguished from this species by the lower number of subdigital lamellae beneath the fourth toe (18-24 compared to 26-32), and usually contacting nasal scales.

C. septenarius is also distinguished from other *Ctenotus* species groups which have a multilined back pattern, by the characteristic red-brown dorsal background colouration.

Fig. 1. *Ctenotus septenarius* holotype, when alive.

Fig. 2. *Ctenotus septenarius* juvenile, from Mt. Olga. Scale line 10mm.

Fig. 3. Diagrammatic representation of the lower dorsal back pattern of *Ctenotus septenarius*. The numbers correspond to each of the dorsal stripes and are as follows — 1, Vertebral (dark violet-brown); 2, Paravertebral (cream); 3, Dorsal 'a' (dark violet-brown); 4, Red-brown background; 5, Dorsal 'b' (dark violet-brown); 6, Latero-dorsal (cream); 7, Latero-dorsal (dark violet-brown); 8, Dorso-lateral (white); 9, Upper lateral zone (dark violet-brown); 10, Mid-lateral (white).

Description. The holotype has the following characteristics:

Head: Width 6.9mm, depth 6.7mm, 12.3mm long from tip of rostral scale to anterior margin of ear (19% of SVL). Snout 5mm long from tip of rostral scale to anterior margin of orbit. Snout pointed. Nasal scales separated by rostral and frontonasal scales, internasal scales absent, prefrontal scales separated by frontal scale. Two loreal scales (L and R), posterior loreal scales 1.4 times as wide as high, twice size of anterior loreal scales. Frontoparietal scales paired. Interparietal scale distinct. Parietal scales large and in contact behind interparietal. Five nuchal scales (L), six (R). Single primary temporal scale and two secondary temporals (L and R). Four supraocular scales (L and R) first three contacting frontal, second subequal to first and third. Nine supraciliary scales present (L and R). First largest, 4th to 6th markedly smaller than others. Eleven upper palpebral scales (L), twelve (R). Lower eyelid moveable, opaque. Two presubocular scales (L and R). Eight supralabial scales (L and R), sixth under orbit. Seven infralabial scales (L and R), two contacting postmental. Four obtusely pointed ear lobules on anterior margin of oval auricular opening, lowest smallest. Tympanum sunken. Opening 2.4mm high, 1.1mm wide.

Body: Elongate, slender and as wide as deep. Snout vent length 65.0mm. Axilla to groin length 38mm (58% of SVL). Tail length 127mm (posterior 20% not original). Tail slender, round in section and tapers to point. Dorsal scales smooth with four parallel rows of larger paravertebral scales extending from nuchals to tail. 75 paravertebral scales to vent where they form two rows of larger scales. Scales on sides small and smooth, those on abdomen twice as large as lateral scales. Subcaudal scales single and very large. Twenty eight body scale rows around the midline. The specimen was gravid and contained two eggs 19mm (L), 18mm (R) in length.

Limbs: Pentadactylic with extremely long, pointed and compressed toes. Length of forelimb 19mm (29% of SVL), length of hindlimb 34mm (52% of SVL). Length of fourth toe 11.2mm (33% of hindlimb length). 31 subdigital lamellae under fourth toe, excluding claw. These are undivided and each with narrow light brown callus.

Table 2. Morphometric and meristic characteristics of *Ctenotus septenarius*.

	N = 10	
Characters	$\bar{x}$	*R*
Snout-Vent length in mm	60.4	(55-65)
Axilla-Groin length in mm	30.9	(26-38)
Forelimb length in mm	18.2	(16-19)
Hindlimb length in mm	32.7	(30-34)
Fourth toe length in mm	11.7	(11-12)
Head width in mm	7.7	(6.9-9.3)
Head depth in mm	6.5	(5.8-7.5)
Nostril-Snout Length in mm	1.1	(1.0-1.3)
Orbit-Snout length in mm	5.3	(4.8-5.5)
Ear-Snout length in mm	12.7	(11.9-13.7)
Forelimb-Snout length in mm	21.8	(19.0-23.5)
Nasals in contact (+ or −)	11-; 1+	
Prefrontals in contact (+ or −)	5-; 6+	
Number of supraciliarics	9.1	(8-11)
Number of upper palpebrals	10.7	(10-12)
Number of presuboculars	2.0	(2)
Number of loreals	2.0	(2)
Number of supralabials	8.0	(8)
Number of infralabials	6.9	(6-8)
Number of nuchals	4.3	(3-6)
Number of temporals	3.0	(3)
Number of ear lobules	3.6	(3-5)
Number of subdigital lamellae	28.9	(26-32)
Number of midbody scale rows	28.6	(28-30)
Number of paravertebral scale rows	70.1	(64-75)
Axilla-Groin length to Snout-Vent length ratio	1:1.9	(1:1.7-1:2.1)
Forelimb length to Snout-Vent length ratio	1:3.3	(1:3.0-1:3.7)
Hindlimb length to Snout-Vent length ratio	1:1.8	(1:1.7-1:2.1)

Colouration. (in alcohol) *Head:* Dorsal surface mid-brown. Darker mottling on frontal, frontoparietal, interparietal and parietal scales. Dark violet-brown latero-dorsal and cream dorso-lateral stripes begin at first supraocular scale and first supraciliary scales respectively, then extend along dorsal surface of body. Temporal region also dark violet-brown with three cream spots between ear and orbit. White stripe extends from second loreal scale (posterior margin), beneath orbit to auricular opening. It then extends along side of specimen as prominent white midlateral stripe. Supralabials pale brown mottled with grey. Infralabials mottled grey and off-white. Ventral surface off-white changing to cream on chin.

Body: Dorsal surface red-brown with complex pattern of stripes. In neck to shoulder region pattern consists of 5 dark violet-brown stripes, four light stripes and two broad zones of red-brown background colour. Posterior to this, dorsal pattern expands into seven dark stripes, 6 light stripes and two broad zones of background colour (Fig. 3). In detail; dark violet-brown vertebral stripe (1 of Fig. 3) half as wide as paravertebral scales, extends from posterior margin of parietal scales to base of tail. Vertebral stripe margined by cream paravertebral stripes (2 of Fig. 3) which are half as wide as vertebral stripe. Paravertebral stripe bordered by narrow (quarter width of vertebral), dark violet-brown stripe (3 of Fig. 3) which extends from shoulders to hindlimbs. This separates cream paravertebral stripe from wide zone of red-brown background colour (4 of Fig. 3). A second narrow dark violet-brown stripe (5 of Fig. 3), also extending from shoulders to hindlimbs, separates red-brown zone from equally narrow cream latero-dorsal stripe (6 of Fig. 3). Dorsal stripes (3 and 5 of Fig. 3) coalesce in the region of the forelimbs to produce single stripes on neck. The cream latero-dorsal stripe (6 of Fig. 3) extends along length of back and borders dark violet-brown latero-dorsal stripe (7 of Fig. 3), which is as wide as vertebral stripe, and extends from above orbit to posterior of hindlimbs. In posterior region, latero-dorsal stripe flecked with light brown. Distinct white dorso-lateral stripe (8 of Fig. 3) borders black latero-dorsal stripe and extends from first supraciliary scale to base of tail. From distance back pattern appears as three dark stripes edged in white (Figs 1 and 3).

Upper lateral zone of body dark violet-brown (9 of Fig. 3) three scales wide, and extends from behind orbit to base of tail. Longitudinally biased series of 40 white spots in this zone. Prominent white mid-lateral stripe (10 of Fig. 3) one scale wide, borders upper lateral zone and extends from second loreal scale to groin. In area between forelimb and orbit mid-lateral stripe interrupted by two intrusions of dark-violet brown lateral zone and also auricular opening. Lower lateral zone, two scales wide, mottled dark brown and white spots (approximately 25), this coalesces into immaculate silver grey ventral surface.

Limbs: Light brown background colouration on dorsal surface of forelimbs separating three black stripes. Cream on ventral surface. Hindlimbs similar but with four black stripes.

Tail: Light brown on dorsal surface. Basal portion has remnants of dark vertebral and light dorsolateral stripes. Dark upper lateral zone of body extends along sides of tail as a dark edged midbrown stripe. Cream on ventral surface.

Distribution and habitat. Specimens of *C. septenarius* were collected on the lower slopes of rocky hills associated with the Henbury meteorite craters and Mount Olga. At the former locality, the substrate consisted of gibber like plains with numerous small fist sized rocks and occasional larger slabs. At the latter, shallow soils separated fist to head sized rocks imbedded in the surface.

The Henbury sites were sparsely vegetated with blue bush (*Maireana* sp.), scattered *Cassia* shrubs and *Aristida* grass tussocks. The north western Mount Olga locality was predominantly *Acacia* shrubland (*A. aneura* and *A. pruinocarpa*) with scattered *Aristida* grass clumps and *Cassia* shrubs. In contrast, the south eastern Mount Olga locality centred on a stony creek bed with silt deposits. Here a relatively dense thicket of *Melaleuca* was the dominant vegetation. Observations at all localities suggest that *C septenarius* is a burrowing species, and burrows either under rocks or vegetation.

The restricted distribution of this species suggests that *C. septenarius* lives in a relatively specialized habitat type. However, one of us (G.F.) has also observed specimens putatively identified as *C septenarius* near Ayers rock (Uluru), which suggests a wider distribution. It is noteworthy that the ubiquitous *C. leonhardii,* a widely distributed habitat generalist, was sympatric with *C. septenarius* at both Henbury meteorite craters and Mount Olga.

Variation amongst the paratypes. The specimens analysed are generally uniform in most characteristics of scalation and morphology. This variation is summarised in Table 2.

Specimens from the type locality do not vary markedly from the holotype in their colouration. The series of specimens from Mount Olga differ slightly in that the pale midlateral stripe is less regular in form on the anterior portion of the body directly behind the forelimbs (Fig. 2).

In most specimens, the seven dark violet-brown dorsal stripes may become indistinct, anteriorly coalescing to form 5 stripes. They are however quite distinct in the posterior half of the body.

Etymology. The species name *septenarius* is derived from the latin term *septenarius* which means 'containing seven'. This refers to the seven characteristic black stripes found in the back pattern of this species.

A key to species of the *Ctenotus leonhardii* species group

Because of the increase in size of this species group and the great similarity in species morphology, a key separating the species is included and has been derived from the following sources: Cogger (1986); Sadlier *et al.* (1985); Storr (1969, 1974, 1978) and Storr *et al.* (1981).

1. No dark stripes on body, pattern mostly longitudinal series of whitish dots and dashes ..*tanamiensis* Storr
Pattern more complex, contains dark stripes or zones 2

2(1). Frontoparietals fused to form a single shield .... *gagudju* Sadlier, Wombey and Braithwaite
Frontoparietals divided 3

3(2). Series of dark upper lateral blotches on tail .... *kurnbudj* Sadlier, Wombey and Braithwaite
Tail pattern without dark upper lateral blotches 4

4(3). Little or no indication of pale mid-lateral stripe 5
Pale mid-lateral stripe well developed, at least posteriorly 6

5(4). Nasals usually separated; dark latero-dorsal stripe much wider than vertebral stripe and enclosing a series of pale spots .... *uber* Storr
Nasals usually in contact; dark latero-dorsal stripe about as wide as vertebral stripe and not enclosing pale spots .... *pulchellus* Storr

6(4). Pale upper lateral dots tending to clump into large squarish spots; legs spotted with dark brown .... *mimetes* Storr
Pale upper lateral dots not clumping; legs longitudinally streaked 7

7(6). Less than 5 dark stripes on back .. 8
5 or more dark stripes on back .. 13

8(7). Dark vertebral stripe (if present) not pale edged 9

Dark vertebral stripe distinctly pale edged 10

9(8). Less than 30 midbody scale rows ... . *alleni* Storr

30 or more midbody scale rows .... *hilli* Storr

10(8). Pale mid-lateral stripe extending forward to lores .... *regius* Storr

Pale mid-lateral stripe seldom extending beyond forelimb and never past ear 11

11(10). 26 or less midbody scale rows .... *greeri* Storr

More than 26 midbody scale rows 12

12(11). 34 or more midbody scale rows .... *rutilans* Storr

Less than 34 midbody scale rows ... . *leonhardii* (Sternfeld)

13(7). Pale mid-lateral stripe extending forward to lores 14

Pale mid-lateral stripe not extending beyond forelimb 15

14(13). Nasals usually separated; subdigital lamellae under 4th toe 26-32 .... *septenarius* sp. nov.

Nasals usually in contact; subdigital lamellae under 4th toe 18-24 .... *serventyi* Storr

15(13). Dark vertebral stripe narrower than dark latero-dorsal stripe; 30 midbody scale rows .... *hebetior* Storr

Dark vertebral stripe as wide as or wider than dark latero-dorsal stripe; 30-40 midbody scale rows .... *militaris* Storr

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DESCRIPTION OF *HATI MAREGE,* A REPLICA 19TH CENTURY MAKASSAN PERAHU

NICK BURNINGHAM
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, NT 5794, Australia.

ABSTRACT

A description of *Hati Marege,* a replica 19th century Makassan *perahu padewakang* is presented. The hull form, construction, sail plan and materials are discussed and illustrated.

KEYWORDS: Makassan, *perahu padewakang,* Sulawesi, Indonesia, maritime technology, boat building.

INTRODUCTION

Hati Marege (Fig. 7, Frontispiece C) is a replica 19th century *perahu padewakang* built to re-enact the Makassan voyages to North Australia as a bicentennial project. This description is a supplement to a paper presenting the research and reconstruction of 19th century Makassan *perahu* design undertaken by the author prior to the construction of *Hati Marege* (Burningham 1987).

The *Hati Merege* project was instigated and realised by Peter Spillett of the Darwin Historical Society working as an associate of the Museums and Art Galleries of the Northern Territory. The project was supervised by the Museums' Director, Dr Colin Jack-Hinton. The contract for the construction of *Hati Marege* was awarded to Rustam A.M. Rustam selected his oldest step brother Haji Jafar to be the head builder or *pung'aha.* The models, drawings, lines and relative proportions for the construction were prepared by the author.

Construction was started in July 1987 and completed in November. *Hati Marege* was sailed from Ujung Pandang (Makassar) to Gove (Lat 12°S, Long 137°E,) Arnhem Land, Coburg Peninsula and finally to Darwin. The voyage took place during December 1987 and January 1988. The master was Mappagau' from Tanah Beru. The crew comprised seven *konjo* men from Tanah Beru and three Makassar men from Galesong.

Hati Marege is now held by the NT Museum of Arts and Sciences, Darwin, and has been accessioned into the Southeast Asian art and material culture collections.

This paper presents a description of *Hati Marege's* hull form, construction and sail plan with lines, and drawings. Lines were taken off by the author in March 1988.

The design of the traditional 19th century Makassan *perahu* was researched from material including contemporary written descriptions, sketches, models and rare photographs. Inference from 20th century South Sulawesi boat-building practice and consultation with living South Sulawesi boat builders also contributed to the reconstruction of the 19th century design (Burningham 1987).

It is not the practice of South Sulawesi boat builders to build from plans. Their shell construction technique does not readily allow a vessel to be built so that it strictly conforms to a designed set of lines because there are no frames to indicate the hull form during the construction of the plank shell.

For this reason *Hati Marege's* proposed design was presented to the boat builders as a number of drawings (reproduced in Burningham 1987), a set of relative proportions, a planked model and in verbal communication.

The reconstruction was discussed by these means with Rustam A.M., the contractor chosen to build the full size replica. It was made clear that the intention was not to impose an exact design but to broadly convey a design type and in particular to make clear the differences from 20th century traditional design. It was the responsibility of the contractor, Rustam, to convey the design to the man he chose as head builder (his oldest step brother Haji Jafar), to oversee construction and to find timbers suitably shaped to build such a vessel.

Agreement was reached that the vessel should be 13.5m in internal length. It is the convention in South Sulawesi that the agreed length is a minimum length that can be exceeded. Often the length of the keel is agreed but the hull length is not fixed because it depends largely on the rake and shape of the stem and stern post. Rustam agreed that the beam and depth should be in proportion to the length, resulting in a beam of approximately 4.25m to 4.5m and a depth (measured to the height of the highest straik which reaches the stem and stern post) of approximately 1.6m.

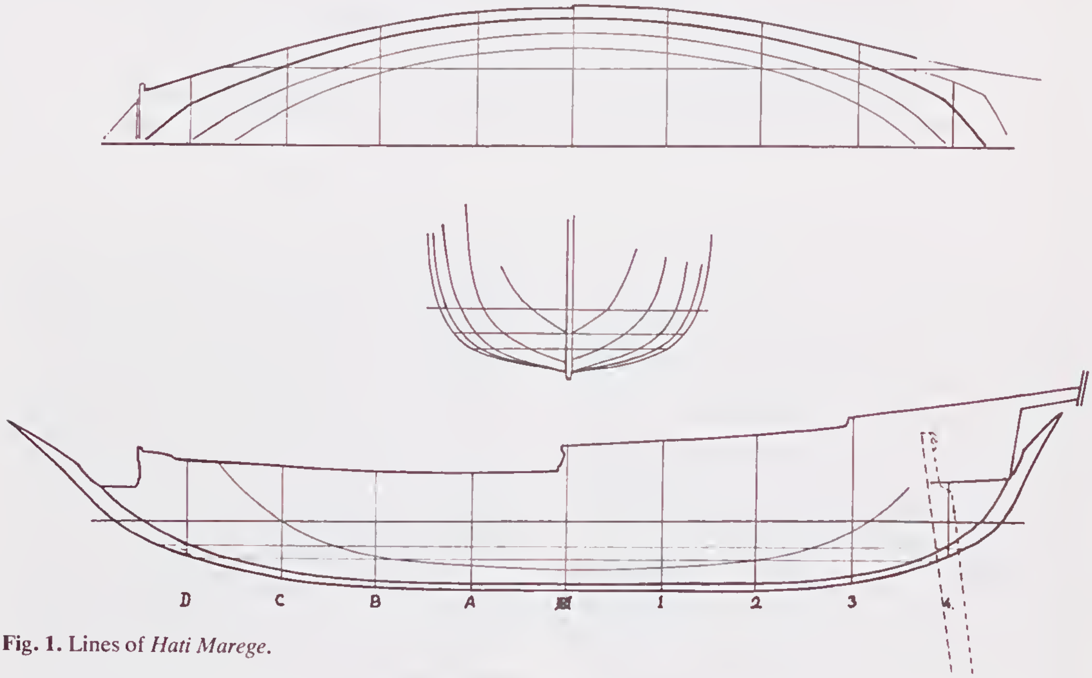

Fig. 1. Lines of *Hati Marege*.

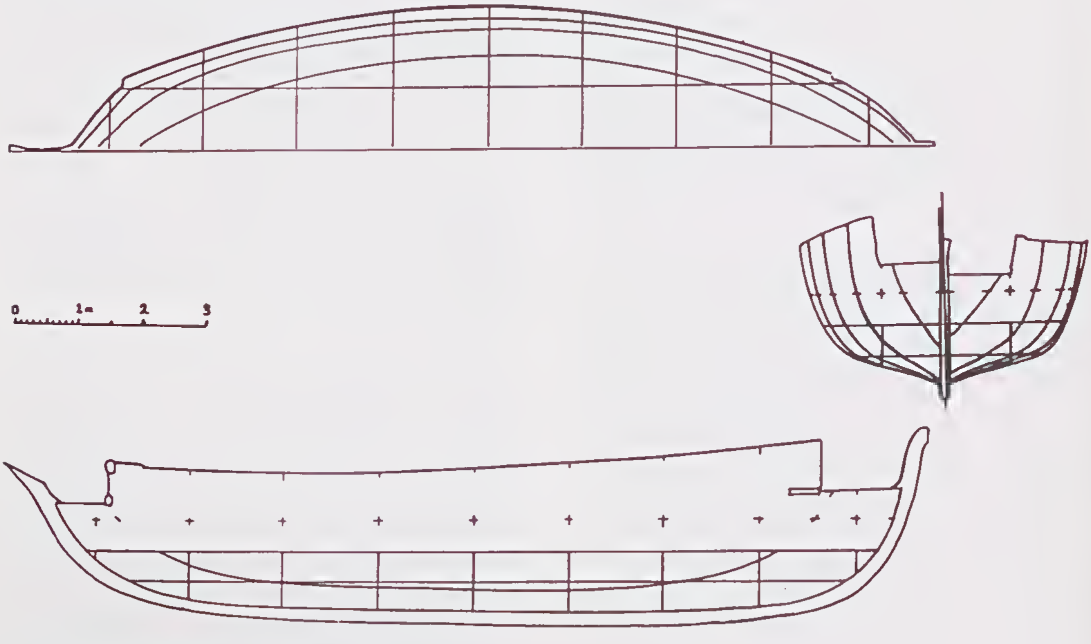

Fig. 2. Proposed lines for a *perahu padewakang*.

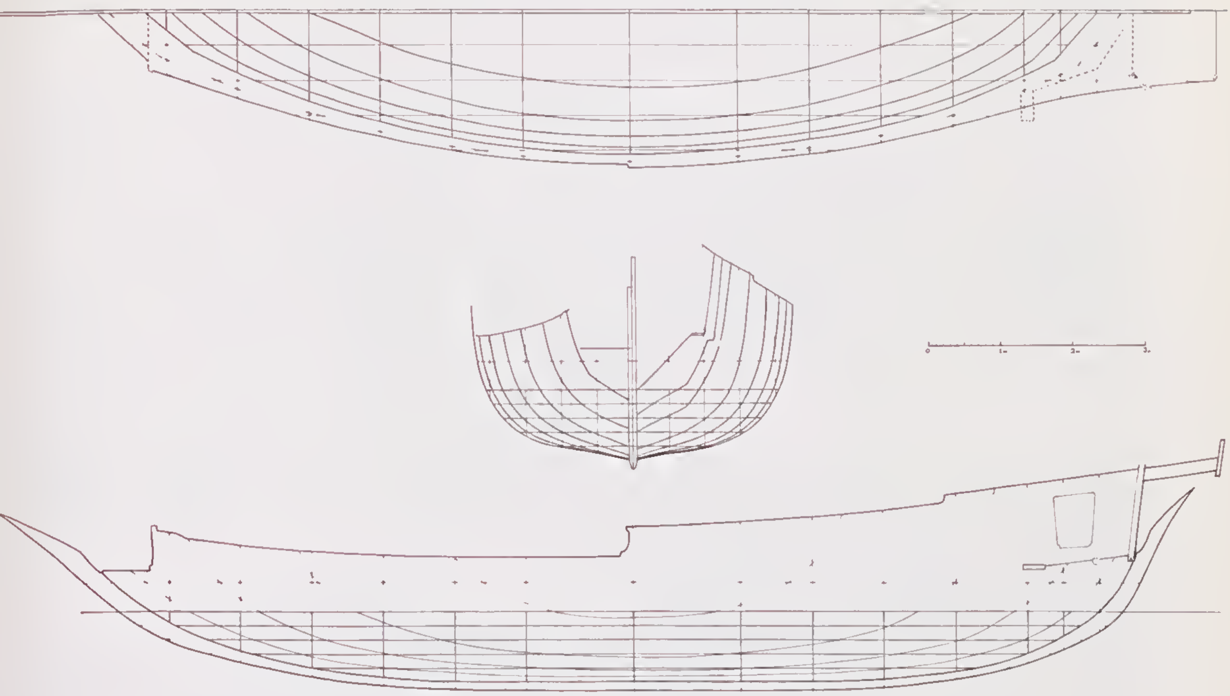

Fig. 3. Lines of *Hati Marege* showing detail of aft hull form.

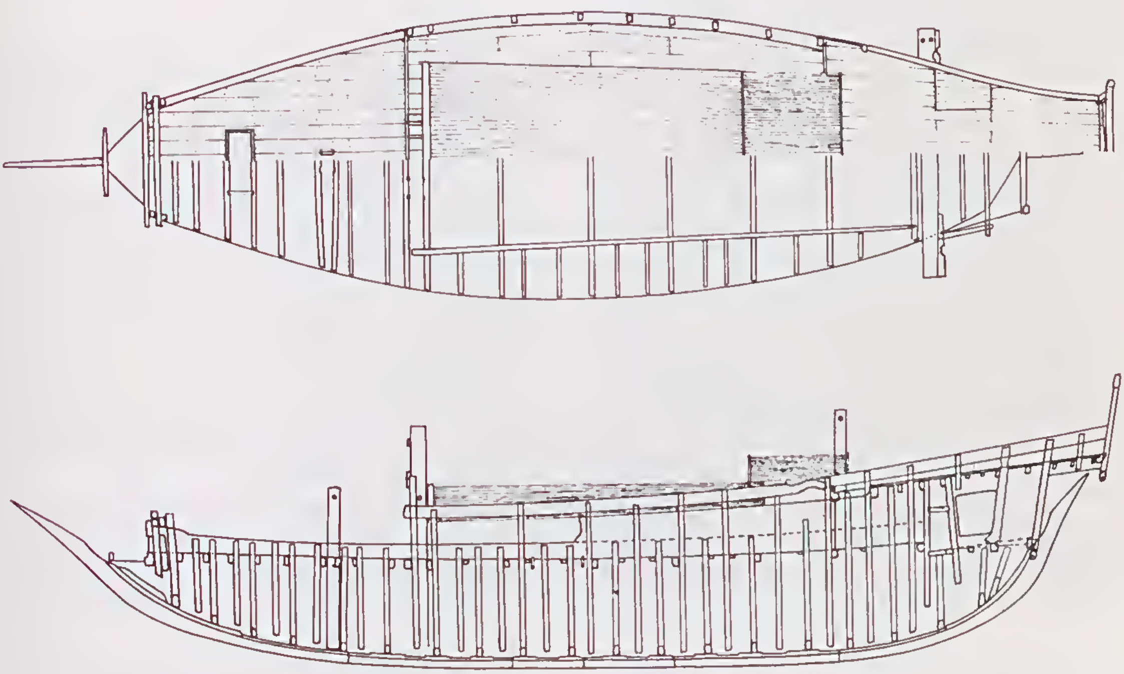

Fig. 4. Construction plan of *Hati Marege* showing keel structures frames, deck beams and deck planking.

The lines for a *perahu padewakang* of the dimensions 13.5m × 4.25m × 1.6m are shown here as Figure 1. The lines of *Hati Marege* are shown with sections at the same interval (Fig. 2).

The dimensions of *Hati Marege* are 14.25m × 4.5m × 1.3m. By comparison she is longer but with a very similar length to beam ratio. The depth is less. Figures 1 and 2 show very similar hull forms apart from the sheer. *Hati Marege* has a rather low waist and a considerable break in the sheer midships. There are differences in hull form in the entry, the midship section and in the run.

THE ENTRY

Hati Marege has more cut-away in her forefoot and a more raked stem. At station C the two sets of lines are very similar but *Hati Marege* has a longer, finer entry forward of station C. The stem joins the keel 210mm forward of C. Rustam said that it was originally intended to cut the stem shorter to give the designed length of 13.5m. However Haji Jafar decided to leave the stem long and this resulted in the long entry. To conform with the design in Figure 1 a stem with a more acute curve was required, but such stems are very difficult to find because of the modern taste for long raking stems (Rustam, pers. comm.). There has been a gradual change in design towards more raked stems which is still continuing (Horridge 1981: 67; Burningham 1987: 106).

MIDSHIP SECTION

The sections are similar. *Hati Marege* has slightly less deadrise, less hollow in the deadrise and a slightly harder turn to the bilge. She has a beamy and shallow section.

The first set of lines shown to Rustam incorporated a midsection more like *Hati Marege* (Burningham 1987: Fig. 17). Boat builders at Galesong commented that it was too shallow for a sea going trading vessel — it needed more deadrise. Rustam said it would be better with hollow in the deadrise. It seems that neither of these ideas were used by Haji Jafar. *Hati Marege* is in fact very shallow draughted. She was able to sail without ballast on a draught of approximately 0.8m.

THE RUN

The lines aft are very full. The form can be assessed from a second set of lines with more sections drawn (Fig. 3). The half stern angle on the 1 meter level line is 50° and the futtock lines meet this level at 33°.

There is a hard angle where the planking turns in to meet the stern post rabbett. This is a characteristic feature of both bow and stern of traditional South Sulawesi *perahu*. In *Hati Marege* it is very pronounced in the stern. The profiles of the stern post and rabbett on the sheer plan rise fairly abruptly from a point just aft of station 3 where the stern post joins the keel. There is therefore very little heel. To compensate for this the rudders are long to give sufficient lateral resistance aft. Rustam said that *Hati Marege* was given rudders 4.5m long, their length being equal to the beam, and this was according to a traditional formula. He went on to say that most vessels do not need or have such long rudders.

CONSTRUCTION

Hati Marege was built entirely without metal fastenings. This was done to make her as traditional as possible although nails were not unknown in 19th century *perahu* building. For example, Wallace remarked:

> "As soon as we began getting my prau ready I was obliged to give up collecting . . . I had a Ke workman to put in new ribs, for which I bought nails off a Bugis trader, at 8d a pound."
> (Wallace 1869: 285)

South Sulawesi *perahu* are now usually fastened with a large number of wooden dowels or "treenails" supplemented by a small number of mild steel bolts. Very large *perahu* have a greater proportion of bolts used in their fastening. Sometimes square sectioned "boat nails" are used but they are regarded as inferior to treenails in terms of strength (Haji Syukri and Syaharir, South Sulawesi pers. comm. 1984[1]). Where no bolts are used to fasten the planking a number of keel bolts are normally fitted except on the smallest perahu. *Hati Marege* has no keel bolts nor are there treenails or any other direct fastening of the floors to the keel.

The keel is fastened to the garboard straiks by internal dowels at 200mm intervals and the garboard are fastened to the floors. The garboards are very substantial timbers. Like

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[1] Haji Syukri and Syahirir are two of four brothers who together own probably the largest fleet of *perahu* still trading under sail.

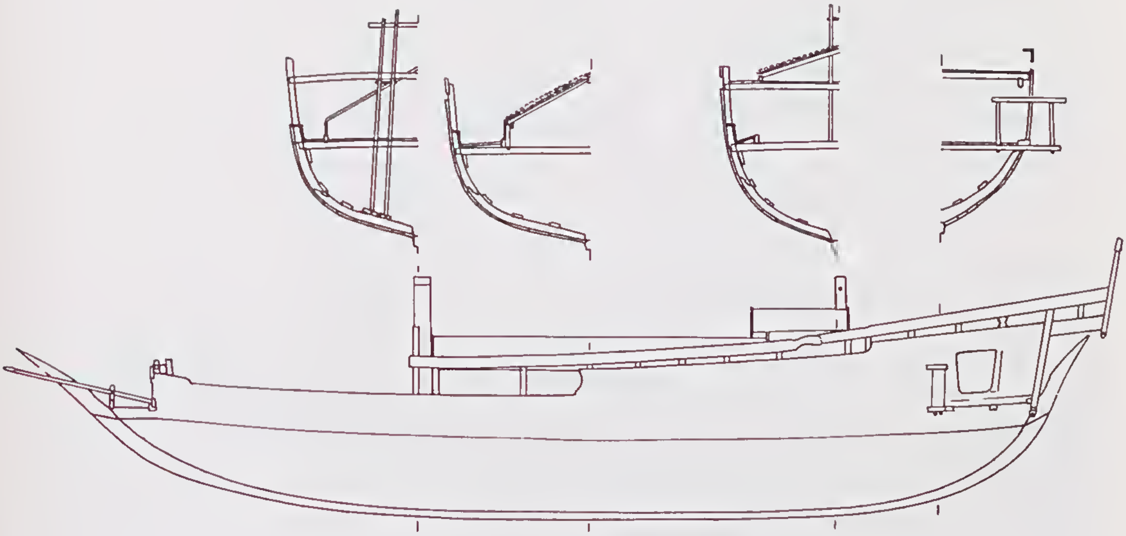

Fig. 5. Cross section of *Hati Marege* showing construction of frames, mast steps and rudder mounting.

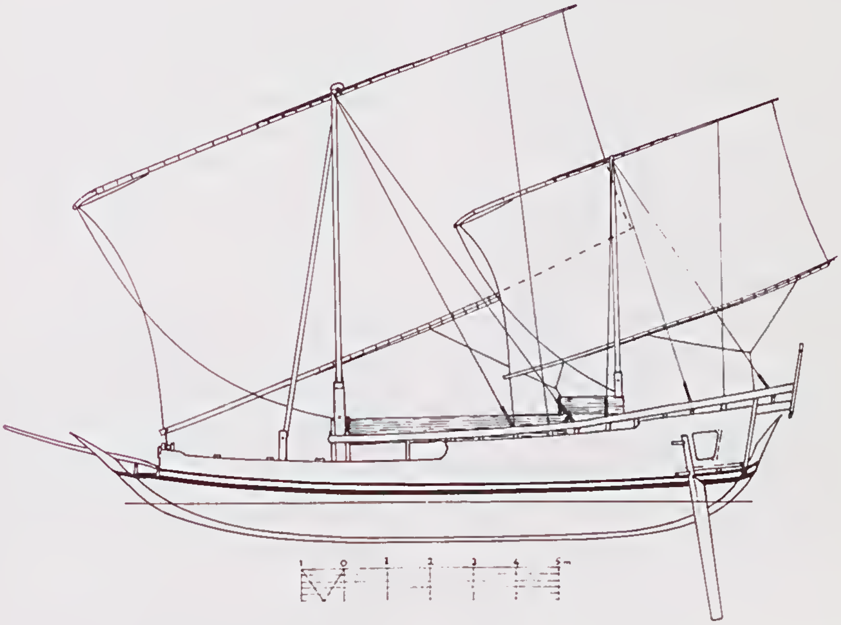

Fig. 6. Sail plan of *Hati Marege*.

the keel they are *kayu sappu (Eusideroxylon zwageri* — a type of iron wood) and approximately 70mm thick. The garboards are the only planks of this timber; the rest of the underwater body is *kayu bitti (Vitex pubescens)* while the top sides are a mix of *kayu bitti, kayu jati (Tectona grandis* — teak) and *kayu punaga (Callophyllum ionophyllum)*. The keel itself is three lengths of *kayu sappu* while the stem and stern post are large crooked pieces of *kayu bitti*. Both stem and stern post have natural holes in the timber projecting above the rabbett. This is supposed to bring good luck (Rustam pers. comm. 1988). A Bugis manuscript recently edited by Macknight and Mukhlis (1975) describes comparable vessels and seems to deal with this question. The translation of *pa'marung* as "bowsprit" should, however, be amended to "stempost". The relevant section would then read, "If there is a knot in the forward stempost..., it is all right... If the stempost has a hole straight through (it) as it extends upwards, it is all right".

The frames are *kayu bitti* and *kayu jati* and they are large timbers. The floors range in size from 150mm to 205mm moulding and 100mm to 120mm siding. The frames are mostly 350mm between centres. There are exceptions because the position of frames is determined by the alternately raised and lowered sections on the top of the keel (Fig. 4) called *tembuku* and *ruang* (see Horridge 1979:13 and Burningham 1987: 114). In *Hati Marege* the *tembuku* and *ruang* are 350mm in length except the raised *tembuku* at each end of the keel (these are 515mm forward, and 500mm aft), and the lowered *ruang* in the middle of the keel through which the vessels *pocci'* (navel) is bored, this is 370mm long. The floors sit on the *tembuku* and the first futtocks of the alternating half frames terminate at the garboard and align with the *ruang*.

The stringers are also substantial (approx 150mm x 50mm). They are coconut palm timber. It is questionable whether 19th century *perahu* had such structurally significant stringers. Haji Syukri (pers. comm. 1979) regarded the use of stringers to strengthen the hull as a new idea. Previously stringers had been lighter and poorly fastened because they served only to keep the cargo off the planking. The sheer stringers were normally stronger because they serve to support the deck beams. Some old *perahu lambo* have no stringers other than the sheer stringers (pers. obs.).

There is a planked foredeck and side decks around the cabin. Aft there is a high planked quarter deck or poop. Forward there is one small hatch and aft there are hatches for the helmsmen to see out if they are steering from inside the enclosed *ambeng* stern gallery. Cargo would be loaded through the cabin which has an easily removed bamboo slat floor. The same arrangement is normal on modern *perahu lambo*. Probably *Hati Marege* has a greater area of planked deck and a smaller area covered over by the thatched cabin than was commonly the case on 19th century trepang collecting *perahu* which seem to have had only bamboo slat decks. For example Searey (1907: 24) described such a vessel:

> "The hull is of wood, and the . . . deck roof and yards are made of bamboo . . . The deck is of split bamboo, worked together with wire or fibre, and can be rolled up at pleasure".

Above the deck level the gunwales are planked inside and outside the projecting top futtocks and there is a plank capping rail. This arrangement would have been considered innovative on a *perahu* ten years ago and is a new western introduction (pers. obs.). Possibly the deck layout design recognises that *Hati Marege* was destined for a more prestigious role, and that she would need relatively uncluttered planked decks which would not be too awkward for visiting dignitaries, who could hardly be expected to scamble over the thatched cabin roof.

THE RIG AND SAIL PLAN

Rustam felt that the mainsail was too small. Before building *Hati Marege* he was concerned that a properly proportioned mainsail (with booms slightly longer than the hull) would be very difficult to handle and that no-one living had experienee of handling such a sail. Presumably it was Rustam's decision to make an undersized sail but he said it was a pity that *Hati Marege's* looks were spoiled by the sail and by the break in the sheer mid-ships. According to members of the crew performance was not badly affected but she would not easily turn to windward without the mizzen set. This seems to indicate some lee helm.

Fig. 7. *Hati Marege* under sail. Photo: Dr Colin Jack-Hinton.

There is no wire rigging. The several running stays which support the masts are rotan with coir lanyards. The rotan is of fairly small diameter. In the past much larger rotan has been used for anchor lines (pers. obs.) and probably for running stays.

The halliards are hemp, although coir might have been more appropriate. Some lacing, bolt ropes and lanyards are rope made from the black fibres of the *ijok* palm *(Arenga pinnata)*.

DISCUSSION

Hati Marege is soundly constructed and she is probably an accurate reconstruction of the appearance of a 19th century Makassan *perahu*. She is very shallow draughted but, no doubt, some *perahu* were shallow draughted while others were deep draughted in the 19th century, with as much range of design as exists now.

It could be that her builders showed a tendency to retain 20th century design features with which they are familiar. In particular *Hati Marege* has the high stern of a 19th century vessel, but the lowest point of the sheer is near midships rather than forward. This was achieved by building a rather severe break in the sheer midships and by a higher bow than was normal in the 19th century.

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THE RUSA MERAH(1): REFLECTIONS ON A REVOLUTIONARY

JOHN J. COE
Northern Territory Museum of Arts and Sciences
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

In June 1948, the Malayan Communist Party, under the direction of its General Secretary, Chin Peng, launched its armed challenge to British colonial authority in Malaya. The Communist bid for power was destined to be unsuccessful. As leader of the 'armed struggle', much of the responsibility for the events surrounding the challenge must be attributed to Chin Peng. To mark the 40th Anniversary of the Communist challenge to power, this paper offers some observations on his revolutionary leadership. It draws upon a selection of secondary sources and personal interviews conducted by the author.

KEYWORDS: Chin Peng, Malaya, Malaysia, Communism; Communist Party of Malaya, revolution, armed struggle.

"Peace unto ye all!
I come as a friend, not as an enemy.
I come to seek my living, not to make war."
Malay Prayer
(Maxwell 1982:8)

According to Malay legend, the impenetrable jungles of the peninsula are inhabited by a pantheon of Spirits, known collectively as the *hantu hutan,* spirits of the forests. These formidable forces combine to waylay, seduce and haunt the unsuspecting traveller. Prospective wayfarers were, therefore, well advised to seek the blessings of these spectral guardians of the gloom (Maxwell 1982:8-9).

In more recent years, the forests were also the domain of a less ethereal presence, armed guerrillas of the Communist Party of Malaya (CPM) under the direction of their enigmatic General Secretary, Chin Peng (see Fig. 1). The embodiment of the *jinggi,* a guardian spirit of the deer, Chin Peng eluded capture, escaped death and developed the facility to confuse and confound his enemies. His activities remain shrouded in mystery, his fate and whereabouts unknown.

General Secretary Chin Peng, leader of the Communist revolution in Malaysia, remains the quintessential enigma.

Under his leadership, the Communist Party plunged Malaya into a period of political violence and crisis unprecedented in scope even by the war. Since the close of the so called "Emergency" Chin Peng's Communists have continued their "Revolution", albeit in sporadic form, from their jungle sanctuaries in north Malaya and southern Thailand.

During Chin Peng's period as political "Supremo", the CPM launched a revolution, suffered both military and political defeat, underwent a series of rectification campaigns, ideological traumas and two major divisions.

Under his tutelage, the Malayan Communist movement has, however, had a profound influence on the direction of Malaysian politics since 1945. His depleted forces still command the attentions of a sizeable component of the Malaysian Security Forces and the spectre of Communism still invokes considerable disquiet in both Malaysia and Singapore.

In an indirect sense, the CPM has been remarkably successful in achieving many of its stated aims and objectives. These successes have been achieved, ironically, at the expense of power sharing.

Clearly then, Chin Peng is a political leader well worthy of study. It is an interesting omission in the historiography of Malaysia therefore that little is known about

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[1] The Red Deer.

Fig. 1. Chin Peng at age 24 wearing the uniform of the Malayan People's Anti-Japanese Army.

him. To date there are no biographical accounts of either Chin Peng the man or Chin Peng the politician. Both the public and private face of the man remain shrouded in obscurity, an obscurity engendered both by circumstance and intent.

Given the paucity of material, this study does not presume to be a biography of the bicycle shop owner's son who aspired to politics. It is, rather, an unfinished portrait of a revolutionary. A portrait that might, hopefully, shed some insights into the life and times of Chin Peng, citizen.

To judge the revolutionary is to know something of the man. Unfortunately, this is where the published record begins to fall short. However, drawing upon a selection of secondary sources, the following resume of Chin Peng is proffered.

> *Ong Boon Hua.* (Sometimes Wang Wenhua) alias Chin Peng. Born 1922 in Sitiawan, Perak. Chin Peng was the second son of Hokkien immigrant parents from Fukien Province in Southeast China. His parents owned a bicycle agency. Educated to secondary level at both the Nan Hwa High School in Sitiawan and the Chun Lin High School, Penang. Known to be studious, he studied Chinese in the mornings and English in the afternoons, finishing school at 15. He joined the Communist movement at 18 cutting stencils for the propaganda department. After the Japanese invasion he became involved with the Malayan People's Anti-Japanese Army (MPAJA) rising to officer rank (Perak State Secretary and Central Executive Committee member). In this capacity he worked closely as liaison officer between the MPAJA and officers from Force 136. It is held in some quarters that he travelled to London as part of the MPAJA "Victory Contingent". Later he was awarded the Order of the British Empire for his services against the Japanese. In 1946–47 it is believed he travelled to either China or Hong Kong for discussions with Chinese Communist Party (CCP) officials. Elected Chairman of the Political Bureau (General Secretary) in 1947 following the Lai Tek scandal and presided over the Party's turn to armed struggle in 1948. In 1955 he initiated the unsuccessful Baling Peace Talks. In 1970–4 the Party split into three factions over, amongst other reasons, the question of his leadership. He retained his position as General Secretary of the CPM (Orthodox) faction.
>
> <u>Personal details:</u> Married (wife's name Li Chah). Height 5′7″. Slim build, fair complexion. Walks with a slight limp in right leg. Known to have been a smoker. Suffered severe and recurring illness (probably beriberi) in the jungle which, it is believed, necessitated medical treatment in China. Fluent in Malay, English, Mandarin and several Chinese dialects. Present location unconfirmed. (Compiled from a selection of references listed below, *esp.* Barber 1981; Biographical Cuttings; Chapman 1950; Cheah Boon Kheng 1979, 1983; Hanrahan 1971; Xiulan 1983).

Given that these biographical details are subject to question, the only reasonable deductions that can be made from them are that Chin Peng was of middle class background, reasonably well educated, enjoyed a comparatively rapid ascent into the leadership structure of the Communist organisation and at a young age had thrust upon him the responsibility of directing the movement through its most turbulent period.

In order to gain a deeper perspective of the man and his times, it behoves the student to look beyond the immediate biographical details and examine the question of education and other formative influences that doubtless contributed to determining the psyche, not only of the young Chin Peng, but the *weltanschauung* of his peers and later colleagues in arms.

The provincial town of Sitiawan is 11 kilometres from the beach resort and naval base at Lumut on the west coast of the peninsula. A short ferry ride across the Dindings Channel is the island of Pangkor.

Sitiawan is the heartland of the region known as "the Dindings" and serves as the entrepot for the resource rich hinterland of Perak, namely the tin belt of the Kinta Valley. Situated at the edge of the Dindings estuarine mudflats, Sitiawan looks out towards the curious moonscape of the Kinta mines to the east.

Socially and politically, the area is distinguished by its large, well established and close Chinese community. A community that has, in the past, been fractured by Kuomintang (KMT) backed Triads and the Malayan Communist Party (MCP) jockeying for power and influence over the region. (Blythe 1969:380).

Like its surrounds, Sitiawan is unremarkable, flat and neatly intersected by its only set of traffic lights. The recently constructed modern highway from Ipoh to Lumut rushes through the town under the gaze of the double storey rows of Chinese houses with their distinctive twin gables and red tiled roofs.

Born into a commercial family, the young Chin Peng may have had the opportunity to follow in the family tradition of commerce. It is recorded that he was studious and scholarly, indicating an above average intelligence.

He had both an English and Chinese education through which he would have been subject to the conflicting values of both nascent Chinese chauvinism and English colonialism. During his secondary school days, at the age of fourteen or fifteen, stories of soviets and peoples courts during the disturbances at the Batu Arang coal fields might well have stirred the imagination of the would be revolutionary.

The wide straight streets of Sitiawan and its flat surrounds, its mixture of European and Chinese commerce and the social mix of rural workers and the nascent proletariat of the Kinta mines, doubtless touched the sensitivities of the young idealist.

And where best to direct this radical energy? The choice, the KMT or MCP. Perhaps the latter were better organised, had more direct appeal or were intellectually more profound. Forsaking his relatively privileged and intellectual background, Chin Peng made his choice. At the age of eighteen he launched himself into a career in radical politics.

The reasons for so doing are, perhaps, not so difficult to fathom. Despite his middle class background, he was born into an area of mining and capital, an area with a burgeoning industrial proletariat and resurgent Chinese nationalism. It was, after all, the age of idealism.

Exactly when and how Chin Peng joined the Party the published record does not yet tell us. However during the war he quite obviously became drawn into the MPAJA at a senior level. His education, intelligence and experience doubtless contributed to his rapid promotion.

Chin Peng first appears in the historic record in the pages of Spencer Chapman's *The Jungle is Neutral*. Chapman was to describe his colleague at arms as ". . . Britain's most trusted guerrilla representative", and "My old friend . . ." (Chapman 1950:106, 220).

At the age of 22, Chin Peng found himself spokesman at the historically significant Blantan Conference between the MPAJA and Force 136. (Chapman 1950:225-6). His demeanour, intelligence and ability obviously impressed Chapman and his colleagues. Richard Broome recalled:

> We got in touch with the Communist organisation and in particular with Chin Peng, their number two man, who was really the organising brains in the field . . . we always found Chin Peng easier to talk to. He was a genuine Communist alright. But we always reckoned that we could trust his words. And he was very frank. And he was very different from many others that I'd met. (Interview with Richard Broome, Oral History Department of Singapore, 9 April 1984).

Thus he is seen as being a good administrator, a dedicated Communist and a man of integrity. After the war it is accepted by some writers that Chin Peng had been rewarded for his services to the war effort by the British and had attended the Victory Parade in London as part of the MPAJA contingent.

This claim has long been disputed by the distinguished Malayan psy-ops officer, Tan Sri C.C. Too, who stated in an interview in

1976 that Chin Peng in fact did not go to London (*New Nation* 6.1.76). To put his case more forcefully, in a recent letter to the *Far Eastern Economic Review* he claimed:

> Chin Peng never attended the Victory Parade in London in 1946. I was personally introduced to him at an indoor rally held on the premises of the MPAJA Ex-Comrades Association at Peel Road, Kuala Lumpur, to welcome the return of the MPAJA contingent from the Victory Parade (Tan Sri C.C. Too, Letters to the Editor, *Far Eastern Economic Review,* 3.12.87).

Be that as it may, the point is amply made that the details of Chin Peng's activities are subject to misinterpretation and debate. Suffice to say on the subject that on 6 January 1946, Earl Mountbatten presented campaign ribbons to eight MPAJA commanders, of whom Chin Peng was one.

During the open and legal struggle of 1945–48, the Party's leadership remained underground, leaving the front running in the capable hands of the convoluted network of Communist front agencies. The history of the personalities involved in these is elegantly detailed in Cheah Boon Kheng's study, *The Masked Comrades.*

Gerald de Cruz was one of the key figures in this front activity. It is worth noting his comments on Chin Peng:

> . . . we hero worshipped these patriots. These marvellous nationalists as we saw them. And it was this hero worshipping which made a tremendous impact on me. And after the whole of my pre-war world had been shattered, it was the example of these people that inspired me to believe that after the war we would be able to organise ourselves into an independent state and run that state efficiently . . . I found Chin Peng a very very warm and loveable character. He was quiet, he was unassuming, he always had a little smile on his face. He always seemed to be the perfect Gentleman. But later, when I got to know him better, I discovered that he had a core of steel, right inside him. Economic chaos first he said. Instead of calling for individual strikes as we've been doing before, we are going to call for nationwide strikes by occupation. All the rubber workers will be pulled out, Malaya's major industry. Then, all the tin workers will be pulled out while the first strike is unsettled. So you have the two major industries crippled. Then we'll call all the dock workers out and the country will be, by then, after a few months time, in a state of total, economic chaos. And mind you, through the Pan Malayan Federation of Trade Unions, 80% of the workers of Malaya were under the direct control of the Communist Party of Malaya. (Interview with Gerald de Cruz in *The End of Empire* Granada Television, 1985, Episode — Malaya).

De Cruz's testimony adds eloquent support for both Chin Peng's administrative abilities and his grasp of the political realities of Malaya. It also poses an intriguing question about his leadership style. De Cruz quite clearly casts Chin Peng in the role of a moderate though tough minded politician.

Several writers suggest however, that the Chin Peng ascendency heralded the triumph of the radicals over the moderate faction, hence the turn to armed struggle. For example, only recently C.C. Too suggested that internal factors within the MCP determined that Chin Peng had no choice but to resort to desperate measures:

> In short, the MCP was facing collapse and desperate measures were needed to keep the comrades from further deserting. In addition, with the 'abscondment' of Secretary-General Loi Tek, who had insisted upon the party taking to the 'semi-open, semi-legal peaceful struggle', the young militants headed by Chin Peng took over, while the hawks in the middle and lower ranks could no longer be restrained from taking matters into their own hands to show their disgust at the 'capitalist and effete policy' of Loi Tek' (Tan Sri C.C. Too: *op. cit.*).

Mr Chiu Chen is an ex Central Committee Member of the Communist Party of Malaysia (formerly CPM ML) and Deputy Commander of the Second Military Zone. In an extensive interview with this author he supported Too's argument:

> The Central Committee, led by Chin Peng, clarified why the lines were switched. In the view of Chin Peng, they (the Party) should not have given up their arms in 1945 and should have continued the armed struggle like the Vietnamese Communists (Interview with Chiu Chen, Betong, 2.12.87).

The published record generally accepts that Chin Peng, as described above, was a bookish, studious young man, possessed of above average intelligence and a good education. An unidentified intelligence officer who knew him described his temperament:

> His speech was very quiet, very calm. But he had a sort of presence, not the sort of arrogant presence, a sort of scholarly pre-

> sence which commands respect (Interview in *End of Empire,* Granada Television, 1985, Episode — Malaya).

In a separate interview another intelligence officer, possibly the same one, expanded:

> He was what you might call the scholarly type. He was well spoken and neither conceited nor rabble-rousing in his speech (Interview in *The Asia Magazine,* April 25, 1965).

Cheah Boon Kheng, in his study of the MPAJA, has suggested that Chin Peng was being groomed by Lai Tek as his second in command. He supports his argument by suggesting that Chin Peng was widely known ". . . as Lai Tek's little boy" and that his rapid promotion to the Central Committee and the Military High Command was attributed directly to Lai Tek's patronage (Cheah Boon Kheng 1983:92).

According to Cheah, Chin Peng was obviously personally selected by Lai Tek and admitted to the inner sanctums of the Party workings, in itself a conspicuous feat given Lai Tek's deviousness and notorious circumspection.

Yet, despite this apparent closeness, it is intriguing that Chin Peng is widely presented as being instrumental in exposing his mentor's perfidy to the Party. Cheah is convinced of Chin Peng's militancy:

> The militant wing of the MCP, led by Yeong Kuo and Chin Peng, had begun its investigations and was apparently encouraging Communist agitation and labour unrest to oust Lai Tek or make him change his moderate policies (Cheah Boon Kheng 1983: 257).

How then does the radical Chin Peng contrast with the picture of a sober, dedicated and clear thinking administrator? A man more likely to be moderate and circumspect in his actions. It begs the question as to why such a man should want or feel compelled to direct his fellows into a precipitous conflict with one of the world's major powers.

Possibly a moderate at heart, Chin Peng might well have been obliged to support the line of armed struggle by the Central Committee or, quite simply, events themselves dictated his actions.

Reluctantly or otherwise, Chin Peng was cast in the role of revolutionary leader at the head of the Malayan Races Liberation Army, whose avowed intent was to rid Malaya of the British and the creation of a socialist society. As a revolutionary, his leadership style, like that of his predecessor, was characterised by reclusivity.

The authoritative monthly, *Pan Malayan Review of Security Intelligence,* prepared by Special Branch, sheds a valuable insight into this leadership style. Paraphrasing the Central Committee's June 1949 resolutions, the Review stated:

> In regard to the problem whether or not the leaders should come into the open, it was resolved that, if deemed necessary, the Secretary General should alone disclose himself through the medium of the Party's newspaper and that no formation lower than the State Committee should be informed. (Special Branch 1949:397)

This intriguing, if ambiguous caveat on the public activities of the leadership structure of the Party stands in direct contradiction to the first and foremost obligation of a leader, namely, to lead. It is, arguably, difficult to lead by remote control and this was, in this writer's opinion, the core of the leadership problem with the Party.

Communist leadership in Malaya has traditionally been of a reclusive nature for both security and personal reasons. This very reclusivity had the consequence of alienating the leadership from the rank and file Party membership. The obsessive secrecy surrounding the activities of the Central Committee had another unforeseen effect, in that it also alienated the leaders from the very masses of which they purported to be at the vanguard.

This criticism of the leadership style of the Party is supported by Chiu Chen:

> There is a great difference between an armed struggle and a constitutional struggle. In armed struggle the emphasis is on secrecy for security sake. Because the leader is living in the jungle, the people cannot see him or have access to the CPM leadership. And the members who are in different units cannot have a chance to see the leadership. Secondly, a negative side of the style of leadership is that they adopted a style of leadership detached from the masses and the grass roots (Interview with Chiu Chen by the author, Betong, 2.12.87).

Party leaders were unable to project the necessary charisma requisite for nation building. Effectively denied legitimacy by the authorities, the Communists were portrayed to the masses as a shadowy, miasmic group intent on destroying Malayan society.

What of Chin Peng as a revolutionary commander? Chiu Chen served throughout the armed struggle:

> Since the June 20 incident, the armed struggle met with a lot of setbacks, a lot of failures, so in the end we were forced to retreat to the Thai border. From this fact alone shows the weaknesses of Chin Peng as a military commander *(ibid)*.

Given the complexities of the campaign and the effectiveness of British counter insurgency measures, Chiu is perhaps a harsh critic. Nonetheless, despite their undoubted successes, the Liberation Army was defeated on the field of battle. Ultimately, the test of a commander's prowess is his ability in the field. In this respect Chin Peng undeniably had his shortcomings.

What of Chin Peng the politician? In 1955 he emerged for the first and only time to public scrutiny at the Baling Peace Talks. For a brief few days he was in the light of the international media before stepping back into the forests.

The media accorded him notoriety. One commentator was moved to exclaim on seeing Chin Peng:

> All necks crane for a glimpse of the number one terrorist. There he is, that's him, Chin Peng, the man responsible for a brutal seven year campaign of murder and terrorism against the ordinary people of Malaya (*End of Empire,* Granada Television, 1985, Episode — Malaya).

Chin Peng had initiated the talks. His object in so doing was a gamble to regain the political initiative that was fast slipping away from the Communists. In a sense, this gamble must be seen as an act of supreme political courage. Loss of prestige, both within and outside the Party, would be the necessary corollary to failure.

The Government delegation, led by Tunku Abdul Rahman, was intransigent. The talks broke down. The Tunku succinctly came to the essence of the disagreement:

> We were fighting for independence. They were fighting to establish a Communist state (Interview with Tunku Abdul Rahman by the author, Penang, 18.3.87).

The failure of the talks, by all accounts, was a bitter blow to Chin Peng. He was to say to his old friend and former Force 136 colleague John Davis, who, in a reversal of roles was acting as liaison officer between Chin Peng's party and Government:

> I know that the Tunku said that there was to be no talk of terms, it was only to be surrender; I admit I know that. But you see, when people come out to talk, you always give a little bit, take a little bit, you always do it that way. And I assumed completely that he would. I can't understand why he didn't give way a little bit (Lapping 1985: 183-4).

The failure of the talks dissolved the Communist's last hope of achieving political influence in the country they had, in their own way, fought so hard for.

Concerning Chin Peng, the Tunku spoke of the quiet respect he had for a man who fought for a cause he believed in:

> . . . a man of principle . . . he is a kindly looking man, he doesn't look like a killer. He looked too clean to be a revolutionary, he looked more like a businessman . . .' (Interview with Tunku Abdul Rahman: *op. cit.*).

And, in typically generous and humourous fashion, when asked about Chin Peng's organisational ability, the Tunku replied, '. . . because it caused so much trouble, I assume it was good.' (ibid)

Davis described his encounter with Chin Peng on the lonely jungle fringe near Klian Intan:

> And behind them emerged Chin Peng, moving very slowly. He came up to me and we greeted each other in Cantonese and shook hands and strolled up the path to the waiting vehicles . . . Chin Peng was very changed from when I'd last known him. He'd become very much bulkier and heavier. And it was quite obvious after a short time that that was not mere fat. It was oedema from beriberi, which I think was somewhat to his credit. Many rumours had gone around about how he was living it up in Siam in complete comfort. This obviously was not true. He, a true leader, was still sticking by his men (Lapping 1985: 182-3).

At the close of the talks, Chin Peng wandered off into the forests, escorted a short way by his old friend Davis. That was on the 30 December. He has not been seen publicly since.

There is an interesting postscript to the story. It has been suggested to the writer by private sources that the British in fact had plans either to kill or capture Chin Peng after the talks in direct violation of the free passage terms of the talks. This is supported in Brian Lapping's book of the series *End of Empire,* in which he claims that both the Tunku and David Marshall were convinced that Davis' presence, as he returned to the jungle, was the factor that saved his life (Lapping 1985:184).

This is but idle speculation. But it is nonetheless interesting to contemplate on how very different the history of Malaya might have been had the story been true and put into effect.

The Baling Talks give an excellent insight into Chin Peng the man and Chin Peng the revolutionary. They reveal a hitherto undetermined political shrewdness juxtaposed against a lack of guile and a sensitivity that sat uncomfortably with failure.

Given that, by 1955, the Liberation Army was well on the retreat and the Communist goal of a socialist state was further away from realisation than ever, it is remarkable, to say the least, that Chin Peng's initiative could provoke and command such attention. The British were wary of it and the Tunku could have ignored it. The mere fact that the Talks were held at all must be seen as a political coup for Chin Peng.

The Tunku came to the talks briefed by the British, Chin Peng came with little else save candour and a willingness to parley. The Government delegation, from their position of strength, had no need for compromise nor, for understandable reasons, had they any reason to trust their opposites. Their position left Chin Peng with little room to manoeuvre:

> At the Baling Talks, Tunku Abdul Rahman and David Marshall and the others put forward the terms for the CPM members to surrender. These were terms we could not accept at all. This forced us to continue our struggle (Interview with Chiu Chen, *op. cit.*).

There were, however, several options available to Chin Peng. He could have tried to play for time by insisting on further discussions with his Committee. Alternatively he could have acceded to the "terms" and emerged from the forest as a "moderate" man at the head of a body of men and women prepared to work for the "peaceful" reconstruction of an independent Malaya, which would include, *inter alia,* a return to the open and legal struggle. He chose to do neither. His decision indicates both a commitment to principle and the saving of face as well as an absence of guile, arguably so important in political leadership.

Chin Peng's weakness was that he was not the consummate politician. His leadership style was too diffuse and it might be a case of being damned with faint praise when John Davis said of him:

> I always had a great deal of time for Chin Peng. He was by far the most intelligent of all the Communists, calm, polite, very friendly in fact, almost like a British Officer (Barber 1981:216).

His return to the forest signified the end of his political career and the demise of Communism as a creditable political force in Malaya. The Liberation Army retreated deeper into its jungle fastness around the Betong salient and Chin Peng slipped into obscurity. He became a shadowy and enigmatic figure even to his own followers:

> Ordinary members of the Party did not have the chance to see Chin Peng, so we didn't know much about him . . . Chin Peng went to China in 1961. Since then nobody has seen him. I have no idea where he is now . . . When I was in the old Party I was unable to ask 'Where is Chin Peng?' If I had, I would have been scolded by my superiors (Interview with Chiu Chen, *op. cit.*).

The Chin Peng-China nexus is intriguing. The region has been beset by persistent rumours that he returned and retired again. A cursory examination of the popular press in Singapore, Thailand and Malaysia on this issue will only serve to confuse the reader. One report in 1982 even went so far as to confidently announce his death (*New Nation,* 25.9.82).

These confused reports doubtless emanate, for variously dissimilar reasons, from a systematic campaign of disinformation by both the CPM and the authorities. From a Communist perspective, it would be deemed necessary to keep alive the symbol of Chin Peng as a sense of continuity and focal point for Party loyalty. For the authorities, any adverse or confused reporting would have the concomitant effect of lowering morale and confusing the lines of authority and legitimacy.

General consensus, as supported by Chiu Chen, would hold that Chin Peng returned to China around 1961 for medical treatment. Whether he returned is open to conjecture.

Arguably the most authoritative and plausible report of his whereabouts and state of health can be attributed to the former CPM Chairman, Musa Ahmad, who returned to Malaysia from Peking:

> Chin Peng was still healthy when I left Peking and I believe he is still alive (Encik Musa Ahmad, in *The Star*, 16.9.83).

Musa Ahmad said that both he and Chin Peng were members of the Chinese Politburo and that he used to meet Chin Peng often during his stay in Peking. He said that Chin Peng had no intentions of surrendering and wanted to continue to live in Peking (*The Star,* 16.9.83).

The question of Chin Peng's invisible leadership remains subject to conjecture and debate. Ex-guerrillas recently interviewed by this author are at a loss to explain his whereabouts. Inquiries made to agencies of the People's Republic have met with the expected, polite expressions of ignorance. Doubtless, in time, truth will prevail. Suffice to say at present that the Ariel nature of Chin Peng's presence must have had an unsettling effect on the direction of the Party and on the morale of its members.

To this end, the leadership question was drawn into sharp focus during the 1970's. In 1970, press reports indicated that a major schism in the Party was taking place. In fact, a bitter internal debate had been the precursor to a factionalisation that was to have serious repercussions for the Party and reflected directly on the leadership of the Malaysian Communist movement.

In September 1970, the 8th Regiment broke away from the Party to form the Communist Party of Malaya — Revolutionary Faction. After ongoing and fractious debate, on 1 August 1974, the Second Military Zone broke away to form the Communist Party of Malaya — Marxist–Leninist Faction (Interview with Mr 'A', Betong, 3.12.87).

The cause of the schism was both prosaic and tragic:

> The main cause of the split was that the old Central Committee adopted the line of rectification or purging the Party. They said that most of the new members recruited from Thailand and the border regions were enemy agents. Many of us did not agree with this view. So we said "if you continue to slaughter the new recruits, we will have a bad relationship with the people of the border region. So how are you going to survive?". This was the main point of contention between us and the old Committee. It was not so much of a conflict of political theory (Interview with Chiu Chen, *op. cit.*).

The accepted authority and legitimacy of the Party was no longer under question, it was actively under siege:

> The splinter Communist Party of Malaya (Marxism–Leninism) has issued a declaration of war on the Chin Peng led Communist Party of Malaya, calling for a revolt against the "old revisionist clique" which it accuses of crimes ranging from betrayal to murder. The strongly worded manifesto of the Marxist–Leninist faction also urged "friends in the Communist army and party" to differentiate between the "fragrant" and the "poisonous" flowers, to examine and expose all sins of the old leaders and strip them of their authority (*The Straits Times,* 24.10.74).

In this writer's opinion, the split was a natural consequence of the remote leadership style of the Central Committee. A disenchantment born out of years of frustration, alienation and perceived poor management. This view is supported by Chiu, who was himself to become one of the leaders of the CPM-ML:

> My general impression of Chin Peng's Central Committee is that they carried out certain lines that proved to be wrong. It shows that their ideology, method and approach to leadership was wrong. During both the anti-Japanese war and the anti-British war their ideological lines were either Leftist or too Right. They never rectified or admitted their wrongs. Especially during the rectification movement they refused to admit that they committed Leftist mistakes. I am most disappointed about that (Interview with Chiu Chen, *op. cit.).*

The disillusionment with Chin Peng appeared to be complete. One returned guerrilla, in a book on her experiences with the CPM during this period, was scathing in her criticism. In her account, Chin Peng is widely regarded as having abandoned the revolution in 1961 for a life of ease in Peking. She continues by stating that the *Liew Yit Fan,* (Open Central Committee of the CPM) statement issued in 1979 branded Chin Peng as a spy and collaborator of Lai Tek (Xiulan 1983:vii)

Given Chin Peng's closeness to Lai Tek, it is hardly surprising that his critics should use this ploy to discredit him. Given the nature of politics, especially the internal politics of closed parties, it is natural for leaders to try to identify with success and to absolve themselves of failure or guilt. The events of 1970–74 could not be described as high points in the Party's history. It was only natural that a scapegoat had to be found.

The split proved to be lasting. Despite repeated attempts, the CPM (Orthodox) faction was never able to reassert its authority. Malaysian Communism remained tri-partite until 5 December 1983 when the two breakaway factions merged to form the Communist Party of Malaysia, as opposed to the Orthodox faction which retained in its title "Malaya" (Interview with Mr 'A', Betong, 3.12.87).

On 11 April 1987, the CPM (Malaysia), through its military arm, the Second Military Zone of the Malaysian People's Liberation Army, successfully concluded a negotiated settlement with the Thai Fourth Army. On 28 April, 542 guerrillas emerged from the jungle, laid down their arms and equipment and attended a reconciliation ceremony at a remote jungle clearing near Betong with Thai military and civil dignitaries.

For a substantial number of Chin Peng's erstwhile followers, the armed struggle is over. It remains to be seen whether the remainder follow.

In balance then, how can General Secretary Chin Peng be best evaluated as a revolutionary leader?

The enigma that is Chin Peng raises several important points about the nature of revolutionary leadership and the conduct of revolutionary warfare.

In his classic treatise *On War,* General Carl von Clausewitz observed that military commanders need to have a "genius for war". Part of this genius included the ability to sustain his troops, ". . . by the spark in his breast, by the light of his spirit . . ." (Clausewitz 1982:145) In essence, he argued that the commander's authority could only be maintained through his ability to lead by example and by inspiration.

Aside from "military genius", the revolutionary leader needs astute political skills. It is axiomatic to suggest that it is incumbent upon the leader to mobilise political and civil support to sustain his challenge to authority.

To mobilise a people in the defence of their country requires political authority. To convince a people to take up arms against their country requires a totally different set of political skills and a totally different leadership style.

The successful revolutionary leader must be able to aggregate to himself and embody the hopes and aspirations of those whom he purports to lead. In his study of revolutionary leaders, Jean Lacouture suggests that ". . . authority can be exerted more effectively if embodied in a symbolic figure, a creator of collective identity and mobiliser of energies." (Lacouture 1970:8).

The Communist revolution in Malaya was a distinctively individual revolution. A conventional Maoist challenge to power led by unconventional men in an unconventional environment.

Chin Peng, in his capacity of General Secretary of the Communist Party, was the first amongst equals. Therefore, upon his shoulders must the responsibility for the success or otherwise of the revolution be laid.

There are several ways of adjudging Chin Peng's success as a revolutionary leader. From a straightforward perspective, he was unsuccessful in achieving his goal, inasmuch as he failed to establish a Communist Republic in Malaya. In this light it is tempting to dismiss him as a revolutionary failure.

To do so, however, would be to gainsay the complexities of Malaya's political economy; the intriguing question as to what extent his management style contributed to his own defeat; the direction the Communist movement took under his lengthy stewardship and finally, but by no means least, the indirect successes of the revolution.

Judged against Clausewitz's prescriptions, it is doubtful that he possessed a fully developed "genius for war". Notwithstanding, the revolution he directed occupied the attentions of some hundreds of thousands of opposing troops and police. Without the active support and backing of either the Soviet Union or the People's Republic of China he engaged one of the world's major military powers with a comparatively miniscule force for some twelve years. His guerrillas still had the capacity to force the Security Forces of an independent Malaysia to maintain an active and sizeable presence in northern Malaysia.

Judged against Lacouture's prescription, because of the peculiar heterogeneous mix that is Malaysia and his own distinctive leadership style, Chin Peng was unable to project himself as ". . . a creator of collective identity and mobiliser of energies". (Lacouture 1970:8). Nonetheless, the revolution had a direct effect on British policy in Malaya inasmuch as it decided the framework and timetable for independence, as well as shaping the future direction of both Singapore and Malaysia.

Chin Peng's leadership of the Party and the Liberation Army raises more questions than it answers. Reclusive, secretive, unassuming and deprecatory are all facets of his distinctive leadership style.

To be fair however, in the opinion of this writer, the Party had developed into a highly orthodox and structured hierarchical system, a system that mobilised against open and visible leadership.

The 1934 Constitution of the Party, for example, enshrined many of these structural rigidities. Article 3 spelled out in great detail the "Principles of Party Organisation and its Organisational System", which were founded on the Communist International and in the concept of democratic centralism. Section 3 contains the nub of these principles:

> Lower echelons must accept the decisions of senior party echelons, adhere to the iron discipline of the party, and execute the orders of the Communist International and the party leadership organs (Hanrahan 1971:153).

The rigid principles of democratic centralism were given contemporary expression recently. A senior and experienced veteran of the armed struggle, Mr Teck Hua, was a Section Commander with the CPM-ML. During an interview with the writer, Teck Hua was explicit in his faith in the Party leadership:

> Because we liked our Communist Party, we liked our leader Chin Peng . . . When we joined the CPM everybody must like our CPM and our leaders . . . our leaders can command us to fight the struggle . . . my opinion is I want freedom, I want democracy (Interview with Teck Hua, Betong, 2.12.87).

The structural rigidities inherent in the Party, coupled with the natural suspicion by fellow Committee members of any "Cult of Personality" tendencies after the Lai Tek affair, most likely acted as a constraint on Chin Peng's leadership.

Despite however, the immense difficulties of conducting a revolution in difficult terrain under demanding circumstances against an organised and formidable foe, Chin Peng was able to organise and maintain a relatively tight organisation in the field and imbue it with the conviction to keep going. For this, he deserves rightful recognition.

Although he never met Chin Peng, Chiu, like all his fellow Party members, had a deep sense of respect for the leadership structure of the Party:

> I felt great respect for Chin Peng as a leader of the Party. After the split, I felt very disappointed, very disillusioned about Chin Peng as a Party leader. Because there was such a big row in the Party and he, as leader of the Party could not calm or settle such rifts and rows within the Party so as to keep the Party intact (Interview with Chiu Chen, *op. cit.*).

It is perhaps a truism to say that Chin Peng was very much a product of his time. Unlike many of his more celebrated revolutionary contemporaries, Chin Peng was a home grown revolutionary leader. He did not have the dubious benefits of foreign training and contacts, nor, more importantly, did he have the *active* sponsorship of a well heeled patron. The Communist revolution in Malaya operated in an ideological, logistic and strategic vacuum. It is hardly surprising that mistakes were made.

Despite these mistakes the Communists considered that there were successes:

> There are two great achievements in the Party's history. Firstly, the anti-Japanese war united all the peoples of Malaya to fight against the Japanese. Unfortunately this achievement was betrayed by Lai Tek. Secondly, without the armed struggle led by the CPM. Malaya would not have gained its independence in 1957. Independence was part of the achievement of the CPM. Unfortunately the fruits of the struggle were usurped by others *(ibid).*

On the outskirts of Sitiawan, the local Rotary Club has erected a brightly painted sign on the highway welcoming visitors to their town. If Chin Peng were to revisit his hometown, he would find much changed.

There is still a cycle agency in Sitiawan, but there is also the Dindings Supermarket, a Chinese Emporium and several video repair shops. He might, perchance, remember playing outside John Gray's old warehouse on the main street and he would doubtless gaze in fascination at the obtrusive Cape Cod houses on the west side of town.

He would, however, more likely sit quietly in one of the old coffee houses, a stranger in his own land.

But it seems unlikely that he will ever return to the land in which he played a significant historical role. The merits of that role remain, as always, a matter of perception.

Whatever his failings, Chin Peng dignified his cause with an honesty and reserve that cannot be gainsayed. Like the deer of the forests that were at once his home and his battlefield, he remains an enigmatic figure. An anti-hero in an age of media stars.

Perhaps the most uninhibited comment about him was made to the writer by a young Chinese girl in a remote village in northern Malaya, ". . . My family knew Chin Peng — he was a good man".

Whilst there are many in Malaysia and Singapore who would not share these sentiments, there are few who would deny Chin Peng's place in history. The embodiment of the spirit of the fleetfooted and retiring deer, he rightly deserves the sobriquet — the Rusa Merah.

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TRANSFORMERS AND TERRORISTS — THE USAGE OF MALAGAN MASKS ON TABAR, NEW IRELAND, PAPUA NEW GUINEA

MICHAEL GUNN
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

The role of masks in the malagan ritual traditions of Tabar is examined in using data recorded on Tabar in 1983–84 together with earlier records from the Notsi, Nalik, Kara and Mandak regions of mainland New Ireland. From this data it will be shown that individual malagan masks are used for specific roles in taking village society across liminal phases such as death and social dislocation. In addition it will be shown how the ritual cleaning function of some malagan masks subverts history and accelerates the process by which men are converted to ancestors and ancestors then to masalai geographic markers. It will then be proposed that malagan masks are elements of transformation within a ritual vocabulary.

KEYWORDS: Papua New Guinea, New Ireland, Tabar, malagan, mask, ritual, art.

INTRODUCTION

Masks have generally been regarded as part of northern New Ireland's malagan ritual material culture, but their position and functions within the total repetoire of malagan traditions have not been clearly theorized in the literature.

Despite the increasing number of studies on the subject, few have advanced the interpretation of masking activities associated with malagan ritual traditions. Early workers such as Bühler and Powdermaker gave vignettes of mask activity, but it was not until Lewis (1969) and Brouwer (1980) that the individuality of malagan masks and their roles was fully recognized. Development beyond this point has been largely unsuccessful, due in part to the myopic nature (Lewis 1988) of some of the studies.

Comparison of historical data derived from the mainland of New Ireland with that recorded from Tabar in 1982–84 has enabled the identification of a number of roles served by malagan masking activity. From this vantage point it became apparent that the predominant use of malagan masks is to transform individuals and society, within both ritual contexts and outside in the secular world. Masks are used at the final reunification of a village society broken by a death; and are used to transform deceased individuals into clan ancestors. It appears that, as a consequence of their secular activity, malagan masks also transform clan ancestors into masalai boundary markers.

MALAGAN

Malagan ritual practices have been historically recorded from ten language groups in the north of New Ireland including the islands of Tabar and Lavongai or New Hanover (Helfrich 1973; Bodrogi 1987). Malagan is now extinct on Lavongai, and the remaining traditions in the rest of northern New Ireland are fragmentary. Off-shore Tabar, however, remains a reservoir of malagan traditions.

Malagan is not an homogeneous tradition, despite the coherence of the art works resulting from malagan ritual activity. Even the name varies in its scope from region to region. In the Mandak language the word *malagani* means "to write", or "to make a mark or an image on a plain surface" (Brouwer 1980:161). This concept apparently covers a wide range of artefacts, from ritual sculpture to masks to forms of behaviour associated with the ritual. However, *malagani* as a concept also includes fish traps and even typewriters, with the implication that, for the Mandak, any form of cultural activity could potentially be considered "malagan". On Tabar the term "to make a mark, to write" is *vataru,* quite distinct from *malangga. Bu*

Fig. 1. Mask *Matalala* following malagan operator Sola through Pekinberiu village during removal of taboos at *cukuavatir,* the penultimate commemorative ceremony. NGE 1983-4/31/8.

malangga refers to the contents of the group of 20 or so sub-traditions used to construct and display sculpture in honour of the dead. These contents include all sculpture and masks, as well as a number of social actions, songs, and dances.

Malagan on Tabar is a gestalt formed by at least twenty sub-traditions or "big-names" Each of these sub-traditions is transmitted to the next generation in *tabataba* (fragments or "strings") consisting of the reproductive rights to ten or twelve individual malagan sculptures (see Gunn 1984, 1987). Elements of malagan are individually owned, the rights generally inherited either from within the clan from the mother's brother, or from the father in the affinal clan.

Malagan balances marriage in Tabar's matrilineal society. Traditional malagan ceremonial ritual is used to bury or to honour the dead in affinal clans, the clan of the wife or husband. Maintenance of bonds between intermarrying clans had real relevance in earlier times when bush villages relied on coastal villages for access to salt-water and fish; sometimes the coastal people also had need for shelter in the easily defended villages up in the karst hill tops. This honouring of the affinal dead bestowed prestige upon the feast-giver and was traditionally the main road to high status on Tabar.

The people of Tabar still use a relatively extensive malagan ritual vocabulary to cope with transition at society's boundaries: when a living human becomes a dead ancestor, or where the fabric of society is torn by the death of a major member and must be rewoven. Briefly, the use of malagan on Tabar involves the following operations:

- a series of burial rites;
- a series of commemorative feasts to honour the dead;
- production and display of art works such as figures, carved boards, and other ritual objects in a strictly controlled setting;
- transmission from one generation to the next of the rights to own and operate malagan;
- separation of a community at the death of one of its members and a gradual reuniting of the community along evolved lines;
- use of masks for rites of social separation and reintegration;
- imposition and removal of taboos; the legitimation of land-use transactions;
- commitment of members of a community to work together on a project that would take several years to complete;
- use of masks and other techniques to raise funds and to publicise forthcoming malagan activity;
- acquisition, slaughtering, butchering, distribution, and public consumption of pigs.

MASKS IN MALAGAN

On Tabar today, rights to at least 60 different mask types are held by individual malagan owners. Most of these masks (*wanis*) are found in *Verim* (or *Varima*), one of twenty one more or less distinct sub-traditions. Other malagan sub-traditions such as *Kulepmu, Mandas, Malagacak* and *Marada* appear to utilize a static wooden head *kovkov* or a *ges* mask superimposed on a banana trunk body, rather than a masked man. However, as most large malagan ceremonies include a contribution from a *Verim* owner, few major ceremonies take place without the presence of at least a couple of *wanis* masks worn on the head of a man (they seem never to be worn by women).

Contrary to the impression given by Küchler (1987:241), a malagan mask emerges from the mask maker's interpretation of the verbal description given by the owner, who may have last seen the design some thirty years earlier. Masks should, according to the local people, be made by a malagan carver *tunumar*. In practice, only the important and technically difficult masks such as *malaganivis* are made by the *tunumar,* a less important mask would be made by the person who would wear it. In common with all Tabar malagan sculpture, a mask should be manufactured as an exact replica of the design originally inherited, even though the transference took place decades earlier. The final shape of the mask, however, is strongly influenced by current notions of mask manufacture, both in materials and design. A *tunumar* works in a style that develops over many years of interpreting the malagan owners' verbally given designs. Carving styles can be quite independent of the owner's design of the malagan, as became apparent when a Simberi man asked two *tunumar* in 1982 to each make a *Tangala* figure from his *Turu* malagan set. The resulting figures (see Gunn 1984:Figs. 8,9) were accepted as belonging to the owner's inherited rights, but it was a reflection of the strength of the owner's character that the acceptance was passed without comment.

For the people of Tabar, a mask, in common with any artefact, has a specific reason for its existence. No man spends time and energy chopping wood and assembling resins, ochres, bush paints, and other ingredients for absolutely no reason. A mask has a raison d'etre. Aspects of its character may be obsolete, in the sense that it may carry representations that no longer have any meaning, but in its entirety a mask has a purpose for its existence and that purpose becomes its meaning.

Meaning, in a mask used on Tabar today, is not located in an esoteric vocabulary comprising the patterns and symbolic referents found on the mask, nor is there much relevance found in the materials used in the construction of a mask, even though they may range to twenty or so components. For example, the mask *Kinikis,* used in Tatau village in 1982, had an oar on top, indicating a capsized canoe. But the commemorative ceremony in which this mask was used did not commemorate anyone lost at sea. The image was inherited, and was used because it had to be transmitted by public use and display to the next generation. The meaning of this mask, for the people using it, was found in its use.

Mask use in malagan of Tabar appears very similar to that recorded from the Notsi in 1952-54 by Phillip Lewis and from the Mandak in 1976-79 by Elisabeth Brouwer. This similarity is not very surprising, for it is due in large part to the wholesale importation of malagan traditions from Tabar to both the Notsi region (Lewis 1969:116) and to the Mandak (Brouwer 1980:220-235).

Masks on Tabar are predominantly used during two groupings of malagan ritual: *tutanua* — burial rites and the *aruaru* commemorative ceremonies.

1) *tutanua* are the rites of death and burial. White *tanua* masks signify the connection the dead man is making with the ancestral dead; black *tanua* masks sever the connection he had with the living.

White feather *tanua* masks, which on Tabar belong to the *Kulepmu* sub-traditions, are worn by men of the dead person's spouse's clan when they carry the coffin to the grave. When worn in this context, these *tanua* masks represent ancestral spirits at the burial but do not represent the dead man's "soul" or "image"; this concept is carried by *marumarua* figure sculpture. Several months after the interment, the final ceremony of the burial sequence *tutanua* is held. It culminates with the wearing and final destruction of black bark *tanua* masks, marking the complete separation of the dead man from the living villagers. At this point he becomes an ancestor, and as such his relationship to living society becomes subject to negotiable memory.

Society is now freed of burial taboos, yet it remains socially shattered, for a major pivot point of the community has vanished. When alive, the dead person was a connection for cognates to visit, now there is merely an empty space. As if to emphasize the point, half the houses in the village have been broken and the inhabitants have gone to live elsewhere. Desolation is obvious.

It would appear that amongst the northern Mandak the ostensible role of *tatanua* may have changed from the represention of the spirit of particular deceased individuals to a more secular role. Brenda Clay's account of the *tatanua* masked dancing tradition in the northern Mandak region interpreted *tatanua* as a "kind of malagan", a masked dance that speaks for malagan, that honours a place where there has been a malagan, and is held only at hamlets in which there has been a malagan display in the past (Clay 1987:63-65). Early German ethnographic accounts (Peekel 1928, Bühler 1933) indicated that the word *tatanua* incorporated the local names or variants for "spirit" *tanua* (called *miteno, tatanua, tutanua* in various locations in northern New Ireland). Current northern Mandak concepts indicate that "the masked *[tatanua]* dancer is said 'to look just like a true man', but not to represent an individual or his spirit." (Clay 1987:66). Among the Nalik speakers to the north, Heintze's work indicates that "*marua* [masks] are true malagans, whereas the *tatanua* are only 'half a malagan'" (1987:51-2).

Some of this apparently changed role of *tatanua* may be due to the recent importation of masked malagan activities into a region which had none 70 years previously (see Krämer 1925). The adoption of a masking tradition from another area as a secular or semi-secular dance is quite common in New Ireland. On Tabar in 1984, for example masked dances adopted from the Tolai of New Britain were used by children in formal dances in the village plaza immediately prior to the more traditional malagan activity.

2) *Aruaru* is a series of up to 12 malagan ceremonies operated in the name of several people that died a number of years previously. One function of this group of ceremonies is to acknowledge in public the reshaped and refocused society which evolved after the social vacuum created by death. When a leading person dies, several people then rise to attempt to fill the gap. The resultant struggle for succession polarises society and threatens to fragment it. This prolonged sequence of commemorative ceremonies becomes an ameliorating influence and is used to finally resolve the problems of succession by focussing on the next rising generation, the young people who inherit the malagan traditions.

The *aruaru* commemorative sequence of malagan ceremonies emphasises the production and transference of malagan sculpture in the name of the now distant dead. *Cirep,* the first ceremony of this commemorative sequence, has as its focal activity the ritualized transportation of a number of *saba* (Alstonia villosa) logs into the graveyard to be used later by the carvers to make *marumarua* images of the dead. Much of the ceremonial activity that occurs over the following few months is associated with feasts marking stages of the preparation of the malagan display house and the manufacture of malagan sculpture. Some of these ceremonies will involve the display of sculpture when a malagan owner feels that the time is right to transfer ownership of the sculpture to the next generation, but the majority of the malagan material is kept for the final major ceremonies of the *aruaru* sequence.

At various stages of the *aruaru* sequence, groups of masked men emerge from the graveyard to destroy property of the dead person's clan. This destruction is more representative than total and is spoken of as "cleaning the place". The clan's gardens would be raided by masked axemen and gathered food is taken back to the graveyard. Clan houses would be speared and have stones hurled at them, senior clansmen would be threatened with spears and insulted. The masked men act angry, as though they are ready for a fight, ready to kill a man. They speak of "killing the possessions of the dead man". These attacks are received with good humour, for they are perceived as part of the re-unification of the broken village. The possessions of the dead person which are part of living society are destroyed in his name, ritually removed from the dead man's hand to become the property of the living. His gardens now belong to those who took them over; his family houses are destroyed completely and his men's house is freed of his influence. As is the case with all ritual involving the dead in Tabar society, the masks used in these cleansing activities are worn by men of the affinal clans, those related by marriage to the dead person's clan.

The final phases in the erasure of the dead person's social existence occurs during *cukuavatir* (the erection and display of malagan sculpture), the penultimate public ceremony of the *aruaru* sequence. Two primary roles are performed by masks during this final ritualized social cleansing: opening the village for the masked cleaners to convert it to a non-tabooed state (see Fig. 1); and the removal of taboos on the graveyard area (see Frontispiece D). This latter taboo removal permits the temporary entry of women to the graveyard for the public display of malagan sculpture, indicating a freedom from the influence of the dead. Breaching each of these two realms (public village world and men's private graveyard world) is considered a separate activity and different masks are used for each task, although they may be worn consecutively by the one man.

After the graveyard is opened by the most senior mask type *(malaganivis)* worn by an actor, malagan sculpture and other art works are then hung for display in the towering malagan display house. Old traditional songs are sung for each malagan sub-tradition represented. To conclude *cukuavatir* a group of cleaning masks emerges from behind the malagan house in the graveyard to run into the village plaza and wreak final havoc amongst the clans-people and the property of the dead. Concluding this activity, the masked cleaners go to a rope strung up across the centre of the plaza joining the village to the graveyard and cut the rope into pieces, freeing the people from their dead.

Much prestige is at stake in a large series of ceremonies, so the operators will use groups of masked men to raise regional awareness of the ensuing malagan ceremonies. Men dress in red tops with green fibre decoration, wearing on their heads the characteristic pointed masks denoting the *ges,* legendary killers that would travel from one village to another, marauding and desecrating, holding any victim's liver in their mouths. Today, groups of *ges* may set out from two of the villages involved in a major malagan ceremony and stage a fight on neutral ground. Once a wound is sustained the two gangs return to their respective graveyards, satisfied with the ensuing publicity.

Ges are similar to the cleaners in their roles as the breakers of the continuity of profane life but differ from them in a number of ways. *Ges* have their own mythic charter to follow and are also widely recognized on the mainland as a separate malagan element (see Heintze 1987:43-44; Brouwer 1980). *Ges* is most often reported as a kind of bush spirit, known for anger and violence. In the Notsi area the *ges* is reported to be the spirit double of a living person, dwelling on the clan land and dying with its human counterpart (Powdermaker 1933, Heintze 1987). Interestingly, *ges* are often portrayed as figures and wooden heads as well as acted masks. *Pi* masks were recorded among Notsi by Lewis (1969:120) and on Tabar by Gunn in 1984, and as *Limipi* among the Mandak by Brouwer (1980). This mask is most often referred to as deaf or mad. With the Notsi and on Tabar this mask is associated with major events of discontinuity, hurling missiles in the direction of change: into the men's house at the beginning of circumcision confinement, out of the men's house into the public arena at the end of confinement.

Along with this initial activity of the *ges,* the *soser* fund-raising masks would become active, for operating a series of malagan ceremonies is very expensive. Pigs are pledged, then fed and cared for tenderly by those with obligations to discharge. Services of performers, carvers, and other workers are paid for with *rea* (lengths of traditional shell valuables), with tobacco, and with betel nut. To obtain additional shell currency, lime, dogs' teeth, money, and other essentials necessary for the operation of a good ceremony, this happy gang of extortionists swings into action. Alfred Bühler noted the activities of a similar gang wearing both wooden and bark masks at Tatau village in 1932 (Bühler 1933:249-50). This class of masks has been described from both the Notsi (Lewis 1969) and the Mandak (Brouwer 1980). Their "ceremonial terrorist nature" (Lewis 1969:135) is so different to those of the taboo removing masks that Lewis was prompted to speculate that there is in northern New Ireland "a hitherto unreported kind of secret society activity" (ibid.:135).

The techniques of the fund-raisers are varied but quite rigorously prescribed by the rules of each mask. For example the mask *Cikcikkelegum* acts at night and spears the sides of houses when people are asleep. When this mask is active, people move their beds to the centre of the house. *Gesnevnev* is a type of *ges* mask who carries a spear and *lengleng* shell rattle, extorting money when he finds people defecating in the bush. *Matnonnoc (Gegeh-pulel* to the Notsi, *Karunu* to the Mandak) begs money and collects food by crouching in the doorway of people's houses. He holds *lengleng* in one hand and a basket in the other and uses a wooden hook to pull at the sago leaf roof laths, people give money to preserve the integrity of their houses. *Nocmuc* (probably *Tuhteltutur* to the Notsi, *Le Vat Bobonu* to the Mandak) acts similarly, sitting in front of a family house holding a spear on his shoulder; women give him money. *Susuruvanua (Sulsulanua* to the Notsi, *Kokotosunu* to the Mandak) is more threatening, this mask goes about with a lighted bundle of coconut fronds and threatens to burn a house if not funded. *Tonokukkuc (Puhpor* to the Notsi, *Le Vat-Tongan* to the Mandak) goes into the men's house at night and tickles men in the ribs with a knife.

MASKS AS TRANSFORMERS AND THE SUBVERTERS OF HISTORY

The vast majority of malagan masks *(wanis)* on the Tabar Islands are part of the *Verim* group of malagan sub-traditions and are used for quite specific purposes during burial and at later commemorative ceremonies for the dead. Many of the roles of these masks are concerned with the rites of social separation and reintegration, following the death of a significant person within village society. Most senior amongst the masks are those involved with the removal of taboos from the graveyard at the conclusion of the commemorative malagan series, indicating freedom from the influence of the dead. Less important are those used to release the village and other public spaces from the socially dislocating effects of a death. Other masks are used as guards for senior masks, as cleaners to remove the presence of the dead from the village, to act as fund-raisers, and as agents for publicity.

From the usage presented above there appears to be at least three classes of transformer mask:

1. *tanua* masks: both white feather and black bark, are worn by men of the affinal clans to represent ancestral spirits during the *tutanua* group of burial ceremonies. This class of masks is used as a connection between the living with the dead, transforming individual corpses into subclan ancestors. As such these highly symbolic referents are considered extremely contagious and are either burnt or placed in the grave with the corpse.

2. taboo removers: the *malaganivis* major masks worn by men to open the graveyard do not transform individual men but instead are used to repair society. Men carry the masks and as actors operate the roles of taboo removal for the mask. They transform society by removing taboos from the graveyard, in effect negating the influence of the dead on society. Women and children can then temporarily enter the malagan area and graveyard to view the final malagan display. The clans-people of the dead now return to normal life. This class of mask belongs to the malagan ritual as operated by living men. As such, the mask is placed after use in its own display house in the public part of the graveyard. There it becomes an art object to be admired for its beauty or for its correctness. Masks used to free the public village of taboos do not transform the actors, but instead assist social transition by taking society across the boundary separating unresolved death from social reunification.

3. the destroyers — cleaners, *ges* and *pi:* these masks transform society by removing evidence of personal history, leaving room open for an ancestor's life to become negotiable. On Tabar, and with both the Notsi and Mandak of the mainland, the cleaners take two forms: those that attack people, houses, gardens and fruiting trees; and those that solicit funds by threatening houses.

Ges and pi operate in an atmosphere of potential violence. Some of their names may appear benign, but their work with spear, axe, knife and stone is not. As social transformers they are similar to the *malaganivis* taboo lifters but, rather than removing barriers to integration, this group erases by destruction. They are men wearing masks as agents, transforming village society by destroying evidence of the dead. They remove a person's relics, his personal history, and relegate him to the much more debateable position of ancestor.

Malagan's cleaners, the masked destroyers, choppers of fertile trees and wreckers of houses, neatly outline the distinction between a person's carefully accumulated malagan life and his now worthless secular life. His store of malagan begins to flourish, in effect a matured insurance policy. The consequences of his daily life now cause only divisive squabbling. His gardens may be partially cultivated, and now need tending by someone else. More significantly, the social polarization he had nurtured in recent years suddenly unravels. He is no longer the centre of his world. The networks that connected him to everyone else in the village are suddenly without a focus, without support; they need reweaving. In order to reweave society the old connections must first be broken and cleared away. This is the work of the cleaners.

By contrast to the collapse of his secular life upon death, a person's well-cultivated malagan life springs into action the moment he is dead. A man with a well developed malagan life would belong to at least two and more likely four or five sub-traditions of malagan, owning the *ciribor* (bone of pig) ownership rights to at least two of these. With this security of backing, his secular life dissolves away rapidly as his malagan life as an ancestor is constructed. His significance as a life force, as a producer, as a father and mother's brother, and as a big man, are now supplanted by his importance as a man of malagan, for it is now this aspect of his identity that is reconstructed and comes to first fruit with the burial ceremony where people sing their tribute to him through the songs of the malagan sub-traditions he owned. If a man owned the sub-traditions *Mandas, Kulepmu, Wawara,* and *Vuvil,* for example, then the songs and traditions used to bury and commemorate him will be from those malagans. The graveyard he is to be buried in will be that belonging to the malagan for which he owned *ciribor.* If he owned *ciribor* for two sub-traditions, then the burial procession will begin at the graveyard of one sub-tradition and finish at the other. His after-life is completely taken in hand by malagan: operated by his affines, his clanspeople, his successors; guided and controlled by a man very experienced in the operation of malagan ritual, a ritual master *(mi nguc).*

In the evening of his death, the first group of cleaners set out from the burial graveyard to make the first chop into the dead man's past life; they go to his garden and take out a selection of leaf from each crop growing there. This leaf is taken back to the village to be dumped in front of the *bo* death chair, where it would remain until the burial two days later. From this point on there is a systematic destruction of the person's past life.

The rapid erosion of a person's individual identity places him into a much more negotiable position as a disembodied and malaganized subclan ancestor. As such, a person's relationship to living society changes markedly. Rather than acting as agent for change and a nucleus in the subclan's struggle for social existence, he becomes a point in the ancestral constellation, a short-lived role used predominantly in claims for land-use right. The right of usufruct is granted to affines at marriage and, upon the extinction of a subclan, a closely related subclan will take over land use, rapidly forgetting the previous relation of ownership (cf. Küchler 1987:248 for a similar example with the Kara). From circumstantial evidence gathered on Tabar it appears that ancestors important for the consolidation of land ownership for a subclan become deified into *tandar* (masalai in tok pisin). As an ancestor, a man's past position in real life becomes increasingly subject to manoeuvres, and the evidence becomes progressively harder to locate. Consequently very few Tabar people can nominate an ancestor more than three generations old, for at this point the ancestor has become a *tandar* or masalai, part of a non-negotiable series of locations within or around the clan's land holdings. The mechanism for this final transformation is at present unknown, but as malagan ceremonies are operated on Tabar to acknowledge and consolidate change of land ownership from an extinct subclan to another closely related subclan, we would expect that masks are also used to effect this final transormation of ancestor to masalai.

Subversion of history and the use of terrorists on Tabar is a not part of a conscious attempt at revolutionizing the political system by destroying the evidence of people's pasts. Personal histories are deleted from secular life and supplanted by malagan activity where sculpture changes hands and pigs are killed so that the social structure can be realigned. In order to rid secular life of the dead person's presence, masked men remove the remaining evidence of his life — his personal history. In this way society is freed from the debris of a fallen tree and the forest can grow again.

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GENERAL COMMUNICATION

HISTORICAL MUSEOLOGY IN THE NORTHERN TERRITORY, AUSTRALIA

JOHN J. COE, SUE DIBBS AND GLENN COLE
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 0801, Australia.

ABSTRACT

The Northern Territory has a diverse and disparate community, comprising some 158 400 permanent residents, just under 1% of the Australian population. This community is spread over an area which is approximately one-sixth of the total continental land mass. Despite the modest size of the population and its scatterd distribution, the Northern Territory has a thriving museum infrastructure of some 31 museums which includes the publicly funded Museums and Art Galleries Board of the Northern Territory. The direction of the Territory's museum industry is guided by the Board, which was established as a Statutory Authority and is accountable to the Minister responsible for Museums. This paper discusses historical museum material culture in the Northern Territory, its organisation and future directions.

KEYWORDS: Museology, Museums, Regional Museums Programme, Material Culture, Heritage, History, Northern Territory, Australia.

INTRODUCTION

That high whig of English history, Lord Macaulay, observed:

> "... of all branches of human knowledge, History is the most complicated, and in a sense includes every other department in itself." (Johnson 1930).

Museology — the science, or perhaps more accurately, the art of museum practice — mirrors the complexities noted by Macaulay. Although museums are tangible expressions of a community's culture, the administration and operation of museums are often so diffuse that the role of the museum is frequently misunderstood by the public as a whole.

The popular concept of a museum as a repository of 'interesting worthwhile things' still, in large part, holds true. However the museum is intrinsically linked to the social milieu in which it operates and it behoves both museum operators and their public to arrive at a better understanding of each others' expectations.

In fulfilling its 'repository' role museums have traditionally been perceived as somewhat remote and esoteric institutions. However in the twentieth century, and in particular since the 1940s, the profile of museums throughout the world has broadened considerably. Increasingly higher levels of education, accelerated social change and increased societal wealth have altered the public's perceptions of and demands on museums.

In contemporary society it is not enough for a museum to serve as a storehouse of learned curiosities. The modern museum is obliged to provide a far broader range of services to the public than its earlier counterpart. As well as being places of research and learning, museums have become increasingly community oriented as educational resource facilities and centres for environmental and social research.

However the primary museum duty, that of acquiring, storing, researching and displaying society's material culture, remains paramount. Today's museums, whether major scientific organisations or local and cottage museums, play an important role in providing society with a sense of continuity, identity and destiny, thereby serving as a showplace for the cultural development of society.

In Australia the museum industry has made a major contribution to the development of this nation's sense of identity, and within the industry the role of the regional and local museum is well recognised:

> "Local museums are important. They provide the potential for keeping his-

> torical items close to their origins. They tap local enthusiasm. They provide a means for communities to explore and confirm their own identities. They are an important cultural outlet for creative and industrious citizens. They can supplement the local schools with displays of local history or natural history. They have the potential to become centres of cultural activity within the community." (Hutchinson 1985:5)

In recognition of the contribution made by the smaller museums to the cultural wealth of the community the various Australian State Museums offer a range of programmes of assistance to local museums. In line with the States, the Museums and Art Galleries Board of the Northern Territory has developed its Regional Museums Programme to service the 31 museums that presently constitute the Territory's own museum industry.

MUSEUM MATERIAL CULTURE IN THE NORTHERN TERRITORY

The scope of museum material culture in the Northern Territory is remarkably wide. Every regional centre has at least one museum and most of these museums reflect, in various degrees of specialisation, the particular history of the region.

What is particularly surprising about the Territory's museum industry is the quantity, diversity and quality of specialist museums included in the Regional Museums Programme. There are, for example, two aviation museums, an automobile museum, a military museum, a railway preservation museum and several museums of Aboriginal culture. These specialist museums make an important contribution to individual facets of Territory history and are extremely popular with the public.

A major weakness in the history collections of the Northern Territory is the scarcity of items of social history and domestic technology. In the Top End certainly, the pattern of European settlement tended to preclude the acquisition of such material. Because of their transient nature early settlers to the Territory did not necessarily bring with them the trappings of permanent settlement. Most of what was brought to the north was almost certainly taken back when the settlers returned south, and the little that remained was subject to the harsh ravages of climate, cyclone and war.

This phenomenon has resulted in collections biased mainly towards industry, mining, agrarian archaeology, communications and the Second World War. To supplement its social history collection the Board has had to rely on infrequent donations or purchases from interstate or local vendors. The Museum now has a valuable and extensive Northern Territory postal history and philatelic collection, a fine lace collection, a comprehensive wireless and radiophonic collection and a burgeoning accumulation of 'Territoriana'.

It is the policy of the History Division of the Museums and Art Galleries Board to concentrate on the acquisition of major items of Territory, national or international significance which would normally be beyond the resources or context of smaller museums. Consequently the Board does not compete with regional centres whose collections reflect a specific locality with its own history. Rather the Board encourages such collections and endeavours to enchance them by suggesting inter-museum transfer of collection items to those museums which have more appropriate interests in them.

The collections of material culture held by the Programme's 31 member museums are as diverse as the museums themselves. To date there has been no cohesive regional museum collection policy and, with the exception of the specialist museums, the general collection policy of individual member museums may be described as eclectic rather than selective. Many local museums have either actively pursued, or have had thrust upon them, the policy of collecting for the sake of collecting rather than trying to establish a representative collection of material culture related to the region.

Much discussion has been held through workshops, seminars and conferences to encourage a rational museum collection policy in the Northern Territory, with professional collection from the field, proper documentation of collections and, wherever possible, mutual co-operation to increase the body of knowledge of Territory history through the medium of museum collections.

There are certain themes in Territory history that are over-duplicated in local museums. The obvious duplications are in collections relating to the history of the Overland Telegraph Line, the mining industry and, to a lesser extent, the history of the Rev. John Flynn. Material culture relating to these themes is distributed throughout museums in the Northern Territory.

While this duplication is understandable, the excessive collection and display of such material can be tedious and unnecessary. It could be advantageous for museums to rationalise their collections in concert with other museums. In making this suggestion it is recognised and stressed that the Board in no way proposes an arbitrary policy of rationalisation which would be undesirable and certainly difficult to implement. Many of the collections contained in the museums have been donated by individuals under trust, which in itself raises a series of ethical questions as to the feasibility of tranferring these items away from individual museums. Notwithstanding, in cases of duplication within the individual collection, and after appropriate discussion with the donor, it might be feasible to achieve at least a partial transference of a collection.

To date the only heritage legislation applicable to Northern Territory museum activities is the *Native and Historical Objects and Areas Preservation Act* (1980). This ordinance was the subject of considerable discussion at the 1982 Regional Museums Conference. Many delegates to that Conference deemed that this ordinance was inadequate for their needs. The legislation has since been subject to review with the objective of redefining many of its provisions for general heritage protection.

It should be noted that the role of a museum is fundamentally different from that of other heritage agencies. The museum, as a repository for society's material culture, should pursue an active collection policy with the objective of gathering under its control an adequate and representative research and display collection.

As such, the museum may on occasion conflict with other heritage agencies which argue that the intrinsic value of some items of material culture can best be preserved by leaving the item *in situ* rather than removing it to a museum. This is a matter for ongoing debate and it is highly unlikely that any hard and fast policy can be developed to cover every contingency. It is suggested that each case should be examined on its merits.

The History Division

The History Division is responsible to the Director of the Museums and Art Galleries Board of the Northern Territory for developing and maintaining a collection of material culture that reflects the non-Aboriginal history of the Northern Territory.

The Curator of History was appointed in 1981. Until that time the functions of the museum historian had been filled, *inter alia,* by the Director. The appointment came at a time when the new Northern Territory Museum of Arts and Sciences was nearing completion at Bullocky Point in Darwin. The History Section, as it was then known, was part of the Division of Human Sciences. Subsequently the section was excised from this Division and established as an independent Department responsible to the Director. In 1987 it became a Division in its own right.

Since 1981 the History Division, in addition to the normal ongoing administration of collections, research and fieldwork, has opened two major history museums in Darwin, upgraded and installed displays in two branch museums in Alice Springs, acquired an aviation museum in Alice Springs, prepared numerous major and minor history displays, established the Regional Museums Programme and travelled several history displays throughout the Territory.

The Regional Museums Programme

The Regional Museums Programme was initiated in late 1982, when a two-day Regional Museums Conference was organised and hosted in Darwin by the Museums and Art Galleries Board. Representatives of some 20 museums, organisations and Government bodies attended this Conference. This enabled those representatives to meet with Museum staff to discuss the establishment of a Regional Museum Programme and provided them with a basic working knowledge of museum techniques and procedures. Proceedings of this Conference were subsequently distributed and an extension service was established by the Museum to provide advice and assistance to those in immediate need of such a service.

Over the next three years Museum staff visited all member museums and offered appropriate curatorial and conservation advice where requested. In 1984 a Regional Museums Field workshop visited centres from Daly Waters northwards and conducted a seminar in Katherine to discuss plans and designs for the development of the Katherine Museum. Field workshops were also held in Katherine, Tennant Creek and Alice Springs in 1986.

In April 1988 the Second Regional Museums Conference was conducted in Darwin. One delegate from each member museum was eligible for return travel and accommodation costs to enable Conference attendance, and additional delegates attended at their own expense. The three-day Conference featured lectures, talks and group discussions, conservation and display workshops, management panels and sessions on heritage strategies for museums.

A comprehensive survey of the Territory's regional museums was undertaken from 1984 to 1987. This survey was undertaken in three stages:

Preliminary Survey. Incorporating visits to all the relevant museums and basic analysis of their collections in addition to the abovementioned Field Workshops.

Research Component. Including assessment of similar programmes throughout the country; compilation of data on NT regional museums through a survey questionnaire; reports on all Museums and Art Galleries Board Regional Museums activities; forward planning strategies associated with curatorial, conservation and display programmes and methodology for analysing future funding requirements of regional museums in the Northern Territory.

Final Report. Listing and classification of regional museums in the NT; analysis of the structural condition of museum buildings throughout the Territory, with particular reference to environmental and security requirements and recommendations for renovation or restoration work required; conservation report and strategies; regional museum display strategies and techniques; analysis of the cost effectiveness of regional museums and their educational value and contribution to both the social development of the Northern Territory and to the tourist industry.

A three-tiered classification was developed to enable the Board to determine levels of assistance by the Board to Regional Museums:

Primary. Government and publicly funded museums and institutions. The Museums and Art Galleries Board and its branch museums are publicly funded institutions and therefore provide free access to the public. Other Government Departments also hold and display collections of material culture. To such institutions the Board is able, to the extent of its resources, to provide direct curatorial management and planning assistance and to arrange appropriate funding for conservation, display design and display production.

Secondary. Museums run by incorporated non-profit making cultural associations (National Trust, historical societies etc). To such organisations the Board is able to provide the same curatorial management services as above. However the expenditure of public monies for display purposes is limited and subject to government approval. The Board will however endeavour to represent these organisations to government in their applications for funding.

Tertiary. Museums which are privately funded, privately owned and profit making. For these the Board is unable to expend or arrange the expenditure of public monies. However it will provide, free of charge, some limited curatorial, conservation and management advice because of the importance of the collections and the recognised need to assist educational and tourist oriented bodies.

A key difference between the Northern Territory's Regional Museums Programme and similar programmes conducted elsewhere in Australia, is that all Territory museums, whether classified as Primary, Secondary or Tertiary, are automatically included in the Programme. There is no requirement for local or regional museums to qualify under formal set guidelines to be admitted to the Programme or to be eligible for appropriate levels of assistance.

Until 1986 the Regional Museums Programme was administered and effected solely by the Curator of History and staff of the Display Department. This workload placed a considerable strain on relevant staff and resources and it became apparent that it was appropriate to seek the appointment of additional staff to implement the range of activities of the Programme. Existing Museum staff were seconded to the positions of Regional

Museums Extension Officer and Graphic Designer. These staff members have enabled the Programme to provide an increasing array of services to member museums, and a regular informative Newsletter is compiled and forwarded to museums and other interested bodies.

A major goal of the History Division is the establishment of a Territory Register of Museums Collections. The objective of this Register will be to provide an accurate and detailed inventory of the material culture held in Northern Territory museums to enable future decisions on funding and protection to be made on an informed basis.

The Register will be a valuable addition to national heritage data and will also provide a means whereby insurance levels and stocktaking procedures can be established. It is anticipated that a catalogue of collections based on the Register might be published as part of the National Estate. It is not suggested that it should be mandatory for regional museums to register their collections, nor should it be considered that museums would lose their individual control over or responsibility for their collections. However, consideration may be given to guaranteeing increased protection and services from the Regional Museums Programme if individual museums participated in the Register.

The bulk of funding for Regional Museum Programme activities has been met from within the Board's annual budget as operational rather than special expenditure. Additional funding for the Programme has been provided by the Northern Territory Government's Heritage Programme.

Future Directions for Northern Territory Museums

It has always been difficult to place an accurate economic value on institutions such as museums and art galleries. Like the very notion of 'culture' itself, everybody knows they are good things, but few really know why.

As previously discussed, one of the characteristics of the social development of the Northern Territory is its inherent transience. Since Self Government in 1978 both the Northern Territory and Federal Governments have attempted to stabilise and enhance the Territory community. One of the enabling factors in this regard has been the generous attempts by both governments to enrich the cultural wellbeing of the community through arts centres, museums, arts grants and the like. It is increasingly accepted that the arts are a positive factor in the social and economic milieu of society.

Museums, in their role as repositories of society's material culture, are an integral component in the fabric of any culture. Museum collections should serve to enhance the cultural and intellectual spirit of the community, thereby helping to imbue that community with a sense of identity and direction. It can be argued therefore that museums have an indirect cultural benefit in providing a sense of stability and continuity as well as a direct economic spin-off, usually manifested in tourism.

The Northern Territory has a relatively young, small and diverse community spread over a significant proportion of the Australian land mass. It is a community struggling to assert its own sense of identity and its role within the broader national and international context. The local museum could and should be a main cultural axis around which the local community revolves just as, on a larger scale, the Museum of Arts and Sciences in Darwin has been the venue not only for high standard displays and monthly travelling exhibitions but also for cultural performances, films and other activities.

Although it is the aim of a museum to service the community in which it is based, a not inconsequential aspect of its activities is its attraction for visitors outside that community. It is commonly accepted that tourism is rapidly becoming a major industry not only of the Northern Territory but of Australia as a whole. Records provided by all museums in the Territory indicated that in the 1985–86 year, when 651 000 tourists came to the Territory, some 960 000 individual visits were made to museums. With a projected tourism figure of 1 million for 1988–89, it can confidently be assumed that museum attendance in the Territory will certainly exceed this figure.

It is obvious from the above figures that museums provide an important and significant back-up to maintaining tourist interest while visiting the Northern Territory and also offer a background to both residents and visitors to a greater understanding of the history, culture and natural and human resources of the Territory. It is anticipated that, with ongoing and adequate support, the Regional Museums Programme will enhance the value of these resources and provide long term insurance for valuable collections that constitute the material cultural heritage of the Northern Territory.

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Accepted 12 August 1988.

The Beagle, Records of the Northern Territory Museum of Arts and Sciences, 1988, 5(1): 191-198

BOOK REVIEWS

Toxic Plants and Animals — A Guide for Australia

Edited by Jeanette Covacevich, Peter Davie and John Pearn

Queensland Museum: Brisbane 1987 ISBN 0 724 22381 9

Pp. viii + 504; R.R.P.: $24.95

This book is the first attempt at a comprehensive review of Australia's toxic plants and animals. Because this volume is a compendium of research articles from diverse fields, the process of reviewing it has necessitated a combined input from a number of reviewers. Most of the chapters have therefore been dealt with as a separate entity.

The section on plants is a relatively small part but is reasonably adequate in dealing with poisonous plants which occur in the Northern Territory. The main chapter lists commonly encountered toxic plants arranged in family groups. This method of classification is very useful when researching a plant not included, as many similar poisonous properties and compounds often run in family groups. Information supplied has been obtained from published sources, unpublished records from the Queensland Herbarium and the authors' experiences, mainly from anecdotal evidence. Also there are six specific chapters, including mushrooms and toadstools, hallucinogenic fungi and very appropriately one on Oleander poisoning. As "Yellow Oleander" is potentially our most toxic plant when ingested, the chapter is a significant reference on this widely distributed shrub. All in all, this section of the book is a useful reference for handling day to day enquiries on poisonous plants.

The chapter on sponges by Ronald Southcott is essentially a review of the author's research of the 1970's and a few biochemical works, some of which are inappropriate. The article and the bibliography seem to imply that there has been little recent work on sponge toxicology and chemical defense which is quite incorrect. A number of biochemical attributes of sponges are mentioned in the text but the accompanying black and white photographs are of little use.

The Coelenterates are covered in 5 chapters; 2 concerning the Hydrozoa, 2 for the jellyfish and 1 for anemones and corals. In the first section on the Hydrozoa, by Ronald Southcott, the text adequately covers the fern-like hydroids, 2 siphonophores, 1 medusa, and the hard millepore corals. Noticeably there is a diagram on nematocyst function but no corresponding text. The second hydrozoan section, by Joseph Burnett, Gary Calton and Ronald Southcott, solely concerns the Bluebottle or Portuguese Man-of-War. Bluebottle swarms account for 80% of reported marine stings and the animal and effect of its sting is here covered in detail. In this chapter there is a good description of nematocyst action which should have been linked to the diagram in the previous section. In order to find information on jellyfish the reader must consult 3 sections. Ronald Southcott's chapter entitled "Jellyfish of Medical Importance" covers the common stinging scyphozoan genera in our waters, and nematocysts are described again. Despite its title, this chapter, which contrary to common acceptance groups the Cubozoa as part of the Scyphozoa, does not deal with the box jellyfish at all, but indicates they will be covered in the next chapter. Readers of Bob Hartwick's section on the "The Box Jellyfish" expecting more than an account of the life cycle of *Chironex fleckeri* will be disappointed. The excellence of the account not withstanding, is this the place for such a comprehensive description at the expense of the other problem box jellyfish? Fortunately, if the reader thinks to turn to the centre of the book, the Medical Review chapter provides data on these animals — but no pictures. The last Coelenterate section, on Anthozoa, is again by Southcott. With several somewhat surprising references it covers the stinging anemones and hard corals and coral abrasions. The captions for the 2 anemone photos are interchanged.

John Stanisic's chapter, "Cone Shells", is a fairly balanced summary of the current knowledge in respect of the Australian fauna, with emphasis on the problems of identification and precautions to be taken due to the lack of knowledge on the potency of most cone toxins. A number of cones known to cause painful wounds are not mentioned, however.

Information on the Blue-ringed Octopus is presented by John Short and Darryl Potter, and adequately summarises the 2 known species and the effects in human envenomation. For some reason the book contains 4 photos (black and white) of *Hapalochlaena maculosa* and none of *H. lunulata*.

The section on echinoderms by David Exton covers the three classes with venomous species. For a condensed account the section on asteroids and holothurians is adequate. The section on echinoids includes two of the most widely recognized venomous genera although no mention is made of six other genera (*Echinothrix, Centrostephanous, Asthenosoma, Areosoma, Tripneustes, Heterocentrotus, Salmacis*) which also have venomous pedicellariae. Their omission is serious since treatment of injury caused by species of some of these genera differs from that described for *Diadema* and *Toxopneustes*. The statement concerning the echinoid *Phormosoma busarium* seems out of place since most people would never come across it, as it is only obtainable by dredging in deep water. The black and white photograph of a holothurian is a poor choice to demonstrate morphology and one would expect it to show the Cuvierian Tubules which it does not.

The chapter on crustacea by Lyndon Llewllyn and Peter Davie is an interesting account of the possible effects of unwise ingestion of unusual marine crustaceans and will provide most readers with all the information that they would wish to know. The random element, in species, locality and time, is emphasised and clearly any attempt to make your own bouillabaisse is fraught with risk. Eating unusual crabs is equivalent to Russian roulette with one bullet in one chamber, drinking the soup with one in every other chamber. Australians have probably been protected by their natural gastronomic conservatism but are now becoming more experimental in their approach. The inherent dangers are well described, with the two types of poisoning, toxic and allergic, for which treatment is still largely symptomatic. The known toxins and allergins are discussed as are symptoms and recommended treatments. The numerous papers by Japanese workers imply the importance of crustacean toxicity in that country, perhaps the paucity of contributions by Australians is a good sign.

Venomous and poisonous fishes have six chapters to themselves. The first they share with other marine organisms in a very good summary by Clive Jones and Kurt Derbyshire of the risks to workers in trawl fisheries, (e.g. accidental envenomation, secondary infection, hypersensitivity), and notes on prevention. A key to the main groups of venomous fishes, with rather diagrammatic illustrations is then presented by Roland McKay, but it does not mention those juveniles which have venomous spines, such as the queenfish *Scomberoides*. The description and first aid notes for the east coast freshwater scorpionfish, the bullrout, by John Harris and John Pearn follows and it is both clear and complete (with an unusual spelling of pienickers).

Three chapters are devoted to ciguatoxin or fish poisoning, which is known from eastern Queensland and some parts of the N.T. Noel Gillespie gives a good, reasonably up-to-date summary of the problem and the paucity of published information on it in this country. His review of the possible origins of ciguatera which follows is more scholarly, and emphasises that research on ciguatera is continuing, with not all the answers known. Lewis' chapter unfortunately repeats most said by Gillespie, and gives a narrow view, that of southeast Queensland, in greater detail.

Colin Limpus has provided an historical perspective on a little known form of poisoning, that caused by ingesting sea turtles. Widely eaten, their flesh can occasionally be lethal to humans or other animals. The author has considered numerous medical aspects including toxicity, treatment and prevention of this problem which is caused by an unknown toxin, ciguatera-like in its erratic occurrence.

Two papers on sea snakes are presented in the marine animals section. The first of these, also by Colin Limpus, describes the sea snake fauna, its distribution, life style and diet. The author then describes the toxicology, venom action, symptoms and first aid. The second paper is a short article by Shantay Zimmerman and Harold Heatwole on olive sea snake venom which is a simple series of experiments assaying the effects and toxicity of this venom. Both of these chapters could have been incorporated with the consideration of other snakes.

The medical review chapter by John Williamson, Peter Fenner and Chris Acott is an excellent summary of the medical aspects of marine envenomations and ciguatera poisoning. The article is slightly biased towards jellyfish which is most fortunate as it makes up for the deficiencies in the earlier section of box jellyfish. Yet again there is a section on nematocyst function, the stinger hot line number is no longer current and the reference to soft coral stings must be an error.

The first of the chapters dealing with insects is "Moths and butterflies" by Ronald Southcott. In Australia nearly all the ill-effects caused by these animals on humans are the result of contact with their caterpillars. "Social insects with antisocial behaviour" by Ted Dahms is very relevant to the northern Australian situation where a large range of stings by these creatures are reported all the year round. The major culprits are the introduced Italian bee, *Apis mellifera,* paper-nest wasps *(Polistes* and *Ropalidia*), various kinds of ants (*Formicidae*) including the northern Australian ubiquitous Green Tree Ant. The chapter on "Whiplash rove beetles" by Geoff Monteith and Chris Argent is particularly relevant to the Northern Territory as the skin lesions caused by rove beetles of the genus *Paederus* have recently been reported from Katherine, Palumpa and Peppimenarti.

"Mites" by Ronald Southcott is a detailed account of mites, a majority of which also occur in the N.T. as obligatory or incidental parasites on man, or carry infectious human diseases. The ensuing 3 articles are on spiders, starting with a very informative chapter "An easy guide to common spiders of the northeast and their allies" by Robert Raven and Julie Gallon. A majority of the common N.T. species may be keyed to genera by using this key. This chapter further provides biological information and illustration for individual groups of spiders and their allies. The next two chapters, "The Redback spider" by the same authors as the previous chapter, and "Distribution of the funnel web spiders" by Mike Gray treat in detail the two best known Australian spider groups, the funnel web spiders incidentally do not occur in the N.T. The following chapter "Treatment of tick, scorpion and spider bites" by John Pearn provides very handy information for the layman. All in all the coverage is exhaustive, except for scorpions, ticks and centipedes, and one finds most of the common species encountered in the Northern Territory, particularly the Top End, covered in this book.

Frogs can provide a constant danger to the unwary, since most species possess defensive secretory glands in their skin. The secretions vary from being highly toxic to a minor irritant. Mike Tyler has provided an excellent overview of the types of skin secretions, their effects on man and other animals, and the treatment of the afflicted.

The venomous land snakes are introduced to us in a short article by Hal Cogger, who defines their distribution in terms of meteorological districts. Two excellent charts are also provided and these give a relatively straightforward means of identifying venomous and non-venomous species. The four chapters which follow are written by Julian White and deal with snake bite. These include: venom production and bite mechanisms, venom toxicity and actions, aspects of envenomation and management of bites. The chapters are well written, informatively illustrated and provide all the information you want to know about elapid snake bites. The last three chapters deal with particular groups of elapid species. Greg Mengden and Mark Fitzgerald show us the extraordinary diversity in the brown snakes and the difficulties of identifying them. John Pearn provides a description of the rough scaled snakes, the bite, effects of venom and treatment. Whereas, Jeanette Covacevich provides distributional and identification characteristics of the small-scaled snake and the taipan. All of the snake chapters are, however, of uneven quality with considerable variation in the amount of detail which is sometimes repetitive. One multiple author article would have been preferable.

The book concludes with Andrew Petrie's concise account of the role of Australian State and Territory Poison Information Centres and an interesting analysis of the numbers and variety of cases they deal with, which are shown to bear close resemblance to figures from the USA. Here it is also pointed out that such information is our best guide to the areas of greatest concern and yet the content of the book is curiously at odds with the statistics. About 8% of all cases handled are bites and stings and slightly less are from ingesting plants (and fungi). However, in the book 70 pages deal with plants whilst bites and stings claim 360. Of all bite and sting incidents only 1.5% are caused by snakes and yet 50% of this section, well over one third of the book, meticulously scrutinises every aspect of snake envenomation. In the whole book there are 48 coloured pictures of which 22 are snakes. In fact the illustrations are one of the book's weaknesses. A number of captions to black and white photographs still refer to coloured detail which indicates original plans were changed. Correspondingly the book's usefulness in promoting avoidance by recognition is severely reduced. The other fault is repetitiveness. The book is a compendium of separate articles and the editors have been negligent in permitting extensive duplication which coupled with the huge editorial bias on snakes must have been at the expense of more coloured photographs. The volume contains a wealth of knowledge but finding all that pertains to a particular group is not as straightforward as it should be since related information is often split into separate chapters occasionally with misleading titles.

For $24.95 it's a good book but it could have been a great book.

P. ALDERSLADE (coelenterates, molluscs, medical review, poison information centres); A. BRUCE (crustaceans); J. HOOPER (sponges); M. KING (frogs, snakes, turtles); H. LARSON (fish, ciguatera); M. MALIPATIL (insects, arachnids); L. VAIL (echinoderms)
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 0801, Australia.

I. MACKNEY (plants, fungi)
Royal Darwin Hospital,
GPO Box 41326, Casuarina, NT 0810, Australia.

Outrigger Canoes of Bali and Madura, Indonesia

by Adrian Horridge

Bishop Museum Press: Honolulu 1987 ISBN 0 930 89720 X

Pp.xiii + 178; 93 Figs; 1 Col. Pl; R.R.P.: $27.00

In his introduction Adrian Horridge states that this "study of outrigger canoes is deliberately intended to be an interdisciplinary study". The subjects which the author sets out to cover are "canoe construction, performance and history, canoe vocabulary and canoe ceremonies" (p. xii).

Primarily this volume provides an outstandingly detailed and technical description of the outrigger canoes of Bali, Madura and neighbouring areas. These canoes are varied, beautiful and some are spectacular. This study reveals that they are also sophisticated and evolved vessels. The technical descriptions are well illustrated with drawings and sketches.

The villages where the various designs of canoe can be found are listed and directions for reaching them given. The parts of the canoes are individually described and named, their design and construction is elaborated and details of various ceremonies are given.

The book is arranged in three parts. The first deals with Bali, the second deals with Madura and East Java, and the third part discusses the evolution of Pacific canoe rigs. This latter part is only indirectly connected with the main subject of the book and covers a somewhat contentious area.

In justifying the inclusion of a theory about the development Pacific canoe rigs, Horridge asserts that "the Low Balinese and Madurese languages are more akin to Polynesian than they are to any of the languages of Asia" (p. xi). This is a simplification which contrasts Balinese and Madurese with the mainland Indo-Chinese languages but discounts the many Austronesian languages of South East Asia.

Before setting out his theory on Pacific rigs Horridge describes and names the many rigs that can be found throughout Austronesian maritime technology and in this he improves on previous definitions because he takes note not only of sail shapes but of different setting and handling techniques that make sails functionally dissimilar. In this respect he gets away from the diffusionist desire to see all sails as essentially the same.

There is a brief discussion of previous theories about the development and distribution of Pacific rigs. These are theories about migration and the populating of the Pacific using canoe technology and terminology as evidence. Horridge points out some of the problems with these theories particularly Doran's recent ideas (Doran 1981).

Finally he puts forward his own ideas but these are no more based on evidence than Doran's ideas are in Horridge's assessment. The Horridge theory is imaginative but unprovable because it is based on pure speculation. We are invited: "Let us imagine what kind of a rig a sensible raft captain living in, say, Sulawesi 30,000 years ago would have had" (p.154). Of course we will never know.

Anyway it doesn't matter because "Outrigger Canoes of Bali and Madura" is an excellent tribute to these beautiful sailing craft and their builders.

Doran, E. 1981. *Wangka: Austronesian canoe origins.* Texas A & M University Press: Texas.

NICK BURNINGHAM
Northern Territory Museum of Arts
and Sciences,
GPO Box 4646,
Darwin, NT 0801, Australia.

Allozyme electrophoresis: A handbook for animal systematics and population studies

by B.J. Richardson, P.R. Baverstock and M. Adams

Academic Press: Sydney, Florida, London 1986 ISBN 0 125 87840 0
Pp. 401; R.R.P.: $60.00 (hard cover)

This excellent volume has been produced by three of Australia's leading biochemical geneticists. Perhaps an illustration of their combined experience is best shown by the diversity of organisms which they have studied in the past. These include dolphins, ungulates, marsupials (both dasyurid and macropodid), rodents, rabbits, bats, birds, reptiles (turtles, snakes and lizards), amphibians, fish, prawns, ticks, molluscs, and protozoan parasites. Many of these studies have been intensive population analyses or have involved the majority of taxa (in an Australian context) in many of these broader groups. The Systematics and Evolutionary Biology Unit at the South Australian Museum (run by P.R.B. and M.A.) can routinely analyse specimens for up to 70 enzyme systems, in what must be one of the world's most cost-effective biochemical laboratories.

So much for the authors, what about their book? This conveniently sized hardback volume has been organized into four parts and thirteen chapters. The parts are titled:

1. Project planning,
2. Collecting the data,
3. Analysing the data,
4. Other types of projects.

These titles represent to me what is the only real weakness in the volume, for they don't accurately reflect what they contain. This is a trifling criticism, but they appear to be unnecessary and to have been added, perhaps by the publishers, to fulfill the expectations of a handbook. Let us look at each of these four parts in turn and consider their worth.

The first section, "Project planning" (82 pages), belies its title as it is in fact more a genetic overview of the techniques to be used; i.e. population genetics theory and the methodology of statistical analysis from a population and systematics approach. Its six chapters cover: genetics, electrophoresis, population structures, systematics, statistical methods and finally, project planning and sampling strategies. The section title is relevant to the last chapter alone.

These chapters in particular reflect the level at which the book is aimed. They are well written, easy to read and clearly designed for post-graduate students and working scientists who wish to adopt an electrophoretic approach to their research, with a minimum of past experience.

The second section "Collecting the data" (187 pages) comes right to the point. This takes us through a most detailed yet readily understood breakdown of electrophoretic techniques. The chapters include: sample collection and handling preparation; electrophoretic methods; specific enzyme methods for cellulose acetate electrophoresis; and strategies.

Each of these chapters is filled with helpful tips and the minutae of electrophoretic technique gained from years of experience. Once again, the format ensures that the reader understands exactly what is going on, and the 15 plates in chapter 8 allow no misconceptions as to the equipment to be used. The reader is provided with the optimal experimental approach and the most cost-effective means of achieving it.

In the chapter on enzyme methodology the format of the volume changes to a series of "sheets", each of which deals with a separate enzyme system, the electrophoretic conditions, required staining and background information about the technique. This ensures that the reader can follow through a technique without an inadvertant mixup, although it necessarily breaks the continuity of the book. In the following chapter we return to the previous format and deal with the best and most economical methods which can be utilized.

If we consider the book as a whole at this point, we are struck by the developmental intricacies of what we consider to be a modern biochemical technique. For the basis of this volume is in fact not electrophoresis in general, but only one limited aspect of it. That is, the use of the cellulose acetate technique, and in particular, a gel form of this marketed under the brand name of "Cellogel". Undoubtedly, the authors regard this relatively expensive but most versatile media as the best thing since sliced bread. Indeed, by imposing this limitation on the volume, and not considering other media such as agarose, acrylamide and starch, they have been able to present a well defined methodology and itemise its known peculiarities. Such a unified approach could not be presented within the bounds of a laboratory handbook, if the diverse conditions for each of the base media were provided, most of which are different and not interchangeable. Nevertheless, while this limitation ensures repeatability, as the authors point out, much can be said for those biochemical laboratories which have the capacity to use a variety of support media.

In the third section of the book we turn to the means of "Analysing the data" (76 pages). This is comprised of two chapters:

population analysis using electrophoretic data; and analysis of electrophoretic data in systematics. There is little doubt that this section provides a highly readable account of the means by which we can answer the questions we have previously asked. Particular case studies are presented of population analyses which may exemplify a weakness or excellence of application. We also analyse the mechanisms of phylogenetic reconstruction, methods for calculating distances in varying conditions and the application of Hennigian phylogenetics.

The last section which contains a single chapter of 14 pages, simply shows us "Other biological uses for allozyme electrophoresis". This gives us an itemized account of how we can use electrophoresis in areas as diverse as meat substitution to that of parental testing. This section could well have been included as an appendix to the volume. It does give the impression of being "tacked on" at the end. In this respect, Appendix 2 may also have been given a different treatment. I find it difficult to understand why these most informative plates, which showed some beautiful examples of genetic phenomena and technical abnormalities, were simply lumped together at the end of the book as an appendix rather than being integrated into the text. To me these plates seem to have been wasted.

In summary, this volume has achieved what it set out to do. It has provided a handbook for those intending to use electrophoresis (albeit "Cellogel"), as a tool for answering practical questions on population structure analysis, systematics or specimen identification. Yet it does more than this. It integrates electrophoresis into evolutionary and systematic theory in a clearcut and straightforward manner. It is well bound, and well presented with excellent line drawings and informative photographs. To me, this volume is a must for any zoologist who wishes to use, or at least understand, the value of allozyme electrophoresis as an investigative technique.

MAX KING
Northern Territory Museum of Arts and
Sciences,
GPO BOX 4646,
Darwin, NT 0801, Australia.

GUIDE TO AUTHORS

Authors are advised to follow the layout and style in the most recent issue of *The Beagle*.

Manuscripts must be typewritten in English, double-spaced throughout, with a margin of at least 4cm on the left-hand side. Text should be on one side of good quality A4 bond paper. Where appropriate, articles should conform to the sequence: Title, Abstract, Keywords, Introduction, Materials and Methods, Text, Discussion. Acknowledgements, References.

The Title should be concise and informative and should not include names of new taxa. An abridged title (not exceeding 50 letter spaces) should be included for use as a running head.

The Abstract should not exceed 150 words, and should state concisely the scope of the work and give the principle findings.

Keywords, to facilitate information retrieval, of up to 10 in number should be chosen to outline the main subjects covered.

The Introduction, including a review of literature, should not exceed what is necessary to indicate the reason for the work and the essential background. Abbreviations used throughout the text may be explained at the end of the introductory material.

Footnotes are to be avoided, wherever possible, except in papers dealing with historical subjects.

The International System of units should be used.

In the descriptive text numbers from one to nine should be spelt out and figures used for numbers over 9. For associated groups, figures should be used consistently, e.g. 5 to 10, not five to 10.

Systematic papers must conform with the International Code of Zoological Nomenclature and, as far as possible, with their recommendations.

Synonymies should be given in the short form (taxon, author, date, page) and the full reference cited at the end of the paper.

TABLES

Tables should be numbered with arabic numerals and accompanied by a title. Horizontal rules are inserted only above and below column headings and at the foot of the table. Footnotes on tables should be kept to a minimum and be reserved for specific items in columns. All other explanatory material should be incorporated with the title.

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Line drawings, maps, graphs and photographs are generally regarded as "figures" and are to be numbered consecutively for interspersion through the text. Under special circumstances colour illustrations may be accepted. Drawings must be on drafting film or good quality board with appropriate lettering inserted. Black and white photographs must be sharp, of high contrast on glossy paper, and mounted on board. The author's name, title of paper and figure number must be indicated on the reverse side of all illustrations. Captions or legends should be typed together on pages at the end of the text.

CITATIONS AND REFERENCES

Citations of sources within the body of the text should include the author, year of publication and page reference (where appropriate), e.g. Drake 1976:2.

References should be arranged alphabetically and chronologically at the end of the paper. Titles of all references must be given in full and wherever possible citations given in BIOSIS format. Where an author has published more than one work referred to in the same year, the references should be appended with the letter (a), (b), etc. The following examples show the style to be followed:

Brake, B., McNeish, J. and Simmons, D. 1979. *Art of the Pacific*. Oxford University Press: Wellington.

Cogger, H.G. 1981. A Biogeographic Study of the Arnhem Land Herpetofauna. In: *Proceedings of the Melbourne Herpetological Symposium:* 148-155. Zoological Board of Victoria: Melbourne.

Kaeppler, A.L. 1963. Ceremonial masks: a Melanesian art style. *Journal of the Polynesian Society* 72(2): 118-138.

Roth, H.L. 1896. *The natives of Sarawak and British North Borneo*. 2 volumes. Truslove and Hanson: London. [Textual reference: Roth 1896 (II):22-26].

Skwarko, S.K. 1968. Mesozoic. In: Geology of the Katherine-Darwin Region, Northern Territory. *Bureau of Mineral Resources, Geology and Geophysics Bulletin* 82: 105-116.

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