

SOME CALLIANASSIDAE AND UPOGEBIIDAE FROM AUSTRALIA WITH DESCRIPTION OF FOUR NEW SPECIES (CRUSTACEA: DECAPODA: THALASSINIDEA)

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Abstract

Ngoc-Ho, N., 1994. Some Callianassidae and Upogebiidae from Australia with description of four new species (Crustacea: Decapoda: Thalassinidea). *Memoirs of the Museum of Victoria* 54: 51–78.

New thalassinidean material from Australia has provided five species of Callianassidae and six of Upogebiidae, four new to science: *Callianassa joculatrix* De Man, *C. lewtonae* sp. nov., *C. propinqua* De Man, *C. sibogae* De Man, *Neocallichirus denticulatus* sp. nov., *Gebiacantha ceratophora* (De Man), *G. poorei* sp. nov., *G. priochea* Sakai, *Upogebia anacanthus* sp. nov., *U. giralia* Poore and Griffin, *U. tractabilis* (Hale).

Most of the species are described and figured. The new species are dealt with in detail; variations and other characteristics of the remaining ones are discussed. *Gebiacantha priochea* Sakai is unusual in possession of two types of males.

Introduction

This work gives further information on the thalassinidean fauna of northern Australia synthesised by Poore and Griffin (1979) and by Sakai (1984, 1988, 1993). New material from the collections of the Museum of Victoria, Melbourne and the Queensland Museum, Brisbane has been captured on the North-west shelf and Queensland. Five species of Callianassidae and six of Upogebiidae are identified, four new.

Manning and Felder (1991) were probably right in stating that the genus *Callianassa* 'comprises a heterogeneous assemblage of taxa', and analysis of American species led them to conclude 'that the genus *Callianassa* was a composite of numerous genera and that the family Callianassidae as currently defined (see de Saint Laurent, 1973) also was a composite'. They provided a key to subfamilies and American genera of the Callianassidae and seemed regrettably to have limited their consideration almost exclusively to American callianassids. Many Indo-West Pacific species seem not to fit well into the scheme devised by Manning and Felder. As an example, *Callianassa joculatrix* De Man and *C. sibogae* De Man can be differentiated using their diagnosis only on the possession of a minute rostral spine, scarcely an adequate generic character. A reconsideration of the Indo-Pacific Callianassidae will be taken up. For the time being, the nominal genus *Callianassa* is provisionally used as currently defined (e.g. by De Man, 1928 or de Saint Laurent, 1973) but one species is

provisionally assigned to *Neocallichirus* Sakai.

A diagnosis of *Gebiacantha* Ngoc-Ho, 1989 is given in English with a key to species.

Morphological characters used in the description of the mandible, epipods and gill structures of the Upogebiidae were figured and discussed by Ngoc-Ho (1981). For drawing, appendages are laid flat between two microslides or cover-glasses when needed, but the telson and uropods always are.

The measurements given (in mm) in the descriptions are: carapace length (cl.) measured from tip of the rostrum to posterior border of the carapace, and total length (tl.) measured from tip of the rostrum to posterior border of the telson.

The material examined come from the collections of the Australian Museum, Sydney (AM), Muséum national d'Histoire naturelle, Paris (MNH), Museum of Victoria, Melbourne (NMV), Queensland Museum, Brisbane (QM), South Australian Museum, Adelaide (SAMA), Western Australian Museum, Perth (WAM) and Zoologisch Museum, Universiteit van Amsterdam (ZMA).

Callianassidae Dana, 1852

Callianassa Leach, 1814

Callianassa joculatrix De Man

Callianassa joculatrix De Man, 1905 : 610. — Poore and Griffin, 1979: 266, fig. 28. — Sakai, 1988: 53 (key). — Ngoc-Ho, 1991: 287, fig. 3.

Callianassa (Cheramus) joculatrix. — De Man, 1928: 26, 98, 130–137, figs 19, 19a–m (nec. fig. 19b). — McNeil, 1968: 26.

Material examined. Lectotype (selected by Ngoc-Ho, 1991): Indonesia: Labuan Tring Bay (8°44.5'S, 116°2.5'E), 18–27 m, mud, corals, coral sand, ZMA De 102,444 (female, tl. 14.5 mm).

Paralectotypes: ZMA De 102,444 (1 male, 8 females).

Other material. Queensland, NE of Townsville (19°3'S, 146°52'E), 23 m, muddy sand, dredge, G. C. B. Poore and H. Lew Ton on RV *The Harry Messel*, 24 Nov 1982 (stn AIMS 1), NMV J 22656 (31 males, cl. 2–3.5 mm, tl. 6–11 mm and 19 females (5 ovig.), cl. 2–3.5 mm, tl. 6.5–11.5 mm); (18°56'S, 146°50'E), 24 m, (stn AIMS 2), NMV J 22657 (3 males, cl. 2.5–3 mm, tl. 7.5–10 mm and 4 females (1 ovig.), cl. 2.5–3 mm, tl. 7.5–10 mm). Pandora Reef (18°49'S, 146°26'E), deep leeward slope, 12 m, sediment cover, epifauna scarce, M. Riddle, corer, Jul 1985, NMV J 22676 (1 juv., cl. 1.5 mm, 3 females, cl. 3–4 mm, tl. 9–12 mm); Oct 1985, NMV J 22677 (1 female, cl. 2.5 mm, tl. 7.5 mm), NMV J 22678 (2 females, cl. 2–3 mm, tl. 7–8 mm); Feb 1986, NMV J 22679 (3 juv., cl. 1.5–2 mm, 1 female, cl. 3.5 mm, tl. 8 mm); NMV J 22680 (5 juv., cl. 1–2 mm); transition between coral and sediment, NMV J 22681 (4 juv., cl. 1–1.5 mm, 1 female, cl. 2 mm, tl. 6 mm); Jul 1985, 10 m, NMV J 22682 (1 juv., cl. 1.5 mm, 1 male, cl. 3 mm, tl. 8.5 mm); reef flat, coral rubble, 1 m, NMV J 22683 (1 male, cl. 2 mm, tl. 5.5 mm, 1 female, cl. 2.5 mm, tl. 8.5 mm).

Distribution. Indonesia, north-west and north-east Australia, New Caledonia (east and south).

Remarks. These specimens are smaller than all those previously recorded with no adults larger than 12 mm in total length. Other material from Queensland reached a total length of 14.5 mm (Poore and Griffin, 1979). A female of 18.3 mm from Indonesia (De Man, 1928) and abundant material from New Caledonia (Ngoc-Ho, 1991), reaching 18.5 mm, are significantly larger.

Callianassa lewtonae sp. nov.

Figure 1

Material examined. 2 ovig. females, tl. 19 mm and 19.5 mm.

Holotype. Queensland, Britomart Reef, reef front (18°17'S, 146°38'E), 15 m, crinoids, G. C. B. Poore and H. Lew Ton on RV *The Harry Messel*, 27 Nov 1982, SCUBA (stn AIMS 57), NMV J 22659 (ovig. female, cl. 5 mm, tl. 19.5 mm).

Paratypes. Queensland. NE of Townsville (18°43'S, 146°45'E), 34 m, muddy sand, dredge, G. C. B. Poore and H. Lew Ton on *The Harry Messel*, 24 Nov 1982 (stn AIMS 4), MNHN-Th 1247 (1 ovig. female, cl. 5 mm, tl. 19 mm). Pandora Reef (18°49'S, 146°26'E), reef flat, 1 m, coral

rubble, M. Riddle, corer, May 1986, NMV J22684 (1 female, cl. 4.5 mm, tl. 16 mm).

Description. Rostrum longer in holotype than in paratype, approximately triangular with acute tip, about half length of eye-stalks; cornea elongated laterally, well pigmented.

Antennule with first peduncular article slightly longer than second, third article 3 times longer. Antennal peduncle nearly as long as antennular, terminal article about half length of penultimate. Maxilliped 1: endopod rounded, very small, epipod large with truncate anterior lobe. Maxilliped 3: ischium-merus combined about 1.5 as long as broad; ischium twice as long as merus with row of about 12 spinules on mesial surface; merus unarmed, twice as broad as long, inner lateral and distal borders fused, strongly lobed.

Chelipeds both of same morphology and nearly same size: ischium with 5–6 ventral spinules; merus as long as ischium, unarmed (or with median ventral spinule in paratype (NMV J22684); carpus subtriangular, unarmed, comparatively more slender in left and smaller cheliped than in right; palm slightly longer than fixed finger, latter with 5 denticles on cutting edge; dactylus slender, weakly incurved.

Pereopod 3: carpus triangular, propodus with moderate rounded posterior lobe and small longitudinal carina on external surface.

Telson about as long as wide, greatest width at proximal third, posterolateral angles rounded, posterior margin nearly straight.

Uropod: both endopod and exopod slightly longer than telson; endopod with lateral margins nearly parallel and posterior margin rounded; broadened posterior margin of exopod with small dorsal setose lobe.

Etymology. The species is named for Helen Lew Ton, Museum of Victoria, who collected the material.

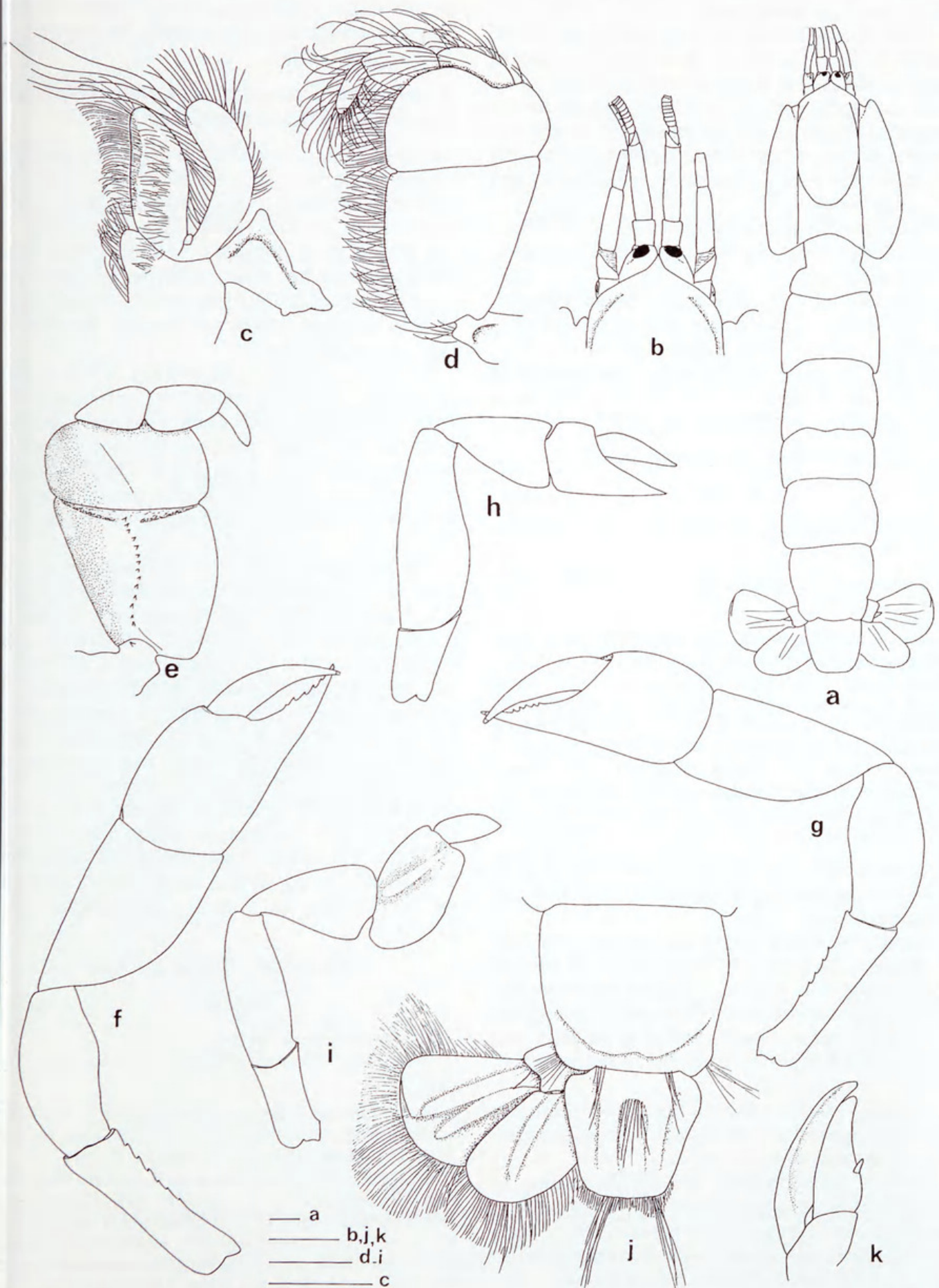
Remarks. This new taxon is similar to *Callianassa amboinensis* De Man, 1888 in the shape of the eyes, maxilliped 3, telson and uropods. It can be differentiated from it by:

1, the antennular and antennal peduncles are

Figure 1. *Callianassa lewtonae* sp. nov. Holotype, ovig. female, tl. 19.5 mm (NMV J22659); b, f–k. Paratype, ovig. female, tl. 19 mm (MNHN-Th 1247); a, e–e.

a, body in dorsal view; b, anterior part of carapace; c, maxilliped 1; d, maxilliped 3, external view; e, same, mesial view; f and g, right and left cheliped 1; h, cheliped 2; i, pereopod 3; j, telson and left uropod; k, pleopod 3.

Scale lines: 1 mm.



of about the same length (antennular peduncle longer in *C. amboinensis*);

2, the operculiform "ischium-merus combined" of the third maxilliped is more than 1.5 times as long as broad (1.2 times in *amboinensis*);

3, chelipeds are more slender with merus unarmed (bearing spinules on ventral border); its carpus is longer than the palm (about half length of palm); its cutting edge of dactylus is unarmed (denticulated);

4, the propodus of pereopod 3 has a large ventroposterior lobe and a longitudinal carina on external surface.

Species such as *C. lewtonae* with the first pair of chelipeds of about the same size and morphology are rare in the genus *Callianassa*. Nevertheless, it can be noted that the type material of this new species includes only females, and males may not share this peculiarity.

Callianassa propinqua De Man

Figure 2

Callianassa propinqua De Man, 1905: 609. — Ngoc-Ho, 1991: 290, fig. 4.

Callianassa (Cheramus) propinqua. — De Man, 1928b: 127, figs 18–18d.

Material examined. Western Australia, North-west Shelf, between Port Hedland and Dampier (18°41'S, 118°39'E), 134 m, muddy sand, WHOI epibenthic sled, G. C. B. Poore and H. M. Lew Ton on RV *Soela*, 4 Jun 1983 (stn NWA 21), MNHN-Th 1254 (1 male, cl. 3.5 mm, tl. 14 mm and 1 female, cl. 4 mm, tl. 15 mm); (18°50'S, 117°39'E), 178 m, shelly sand, 6 Jun 1983 (stn NWA 29), NMV J22660 (1 male, cl. 2 mm, tl. 7.5 mm and 1 ovig. female, cl. 3 mm, tl. 10.5 mm); (19°5'S, 117°26'E), 120 m, muddy sand, 12 Jun 1983 (stn NWA 52), NMV J22661 (2 male, cl. 3–3.5 mm, tl. 10.5–12.5 mm).

Supplementary description. Antennal peduncle overreaching antennular peduncle for about half of last article.

Large cheliped slightly stouter in males than in females. Ischium and merus with 6–8 ventral spines and 0–6 ventral spinules respectively. Fixed finger and dactylus unarmed, tip slightly curved in males. Small cheliped: ischium and merus with 4–5 and 0–2 ventral spinules respectively.

Pleopod 1 uniramous and pleopod 2 biramous, of about the same size in males as in females, absent in male of tl. 7.5 mm.

Telson approximately two-thirds as long as sixth abdominal segment and a little longer than broad; posterolateral angles rounded, with 2 spinules on each side; posterior border weakly convex, slightly wider in males than in females, with median spinule.

Uropod: endopod linguiform, about as long as telson; exopod almost 1.5 times longer, subrectangular, setose dorsal lobe small, near upper part of posterior border.

Distribution. Indonesia (Kwandang Bay), New Caledonia, Australia (North-west Shelf).

Remarks. This material agrees with the holotype examined previously, a female of tl. 13 mm, and also with the male specimen (MNHN-Th 1201) from New Caledonia (see Ngoc-Ho, 1991). At the same time, it provides the first female large cheliped, missing in the holotype. In males and females, the spination of the meral ventral border of this cheliped varies and smaller specimens carry fewer spinules.

De Man (1928) considered *Callianassa propinqua* as closely related to *C. praedatrix* De Man, 1905 whose holotype is examined and figured (fig. 2a). This specimen, lacking the small first cheliped, is not a female as De Man stated (1928), but a male of tl. 23 mm, with gonopores on the fifth coxae and rudimentary pleopods (figs 2b, 2c).

The male large cheliped of *Callianassa propinqua* and *C. praedatrix* (see De Man, 1928, fig. 22c; Ngoc-Ho 1991, fig. 4g) are very similar as are the carapace and abdomen. The two can still be differentiated by the maxilliped 3, the telson and uropods; maxillipeds 3 of both are similar in having a median spine on the distal border of the ischium (De Man, 1928, fig. 22b; Ngoc-Ho 1991, fig. 4d), but the ischium and merus are more expanded laterally in *C. praedatrix*. Also, the sixth abdominal segment is shorter in *C. praedatrix* than in *C. propinqua*, measuring less than 1.5 times the length of the telson. Likewise, the uropod in *C. praedatrix* is comparatively stouter and shorter (fig. 2a) than in *C. propinqua* (fig. 2f).

Callianassa sibogae De Man

Figure 3

Callianassa Sibogae De Man, 1905: 613.

Callianassa (?Cheramus) Sibogae. — De Man, 1928: 124, fig. 17–17e.

Material examined. Holotype. Indonesia (7°46'S, 114°30'E), Siboga Expedition, 330 m, bottom mud, ZMA De 102.439 (male, cl. 6.8 mm, tl. 22.8 mm, without P1, P3, P4).

Western Australia. North-west Shelf, between Port Hedland and Dampier (18°41'S, 118°39'E), 134 m, muddy sand, WHOI epibenthic sled, G. C. B. Poore and H. M. Lew Ton on RV *Soela*, 4 Jun 1983 (stn NWA 21), NMV J22662 (1 male, cl. 4 mm, tl. 13 mm; 1 female, cl. 5.5 mm, tl. 18 mm); (18°45'S, 118°24'E), 142 m, trawl, 5 Jun 1983 (stn NWA 23), MNHN-Th 1248 (1 female, cl. 4 mm, tl. 13 mm).

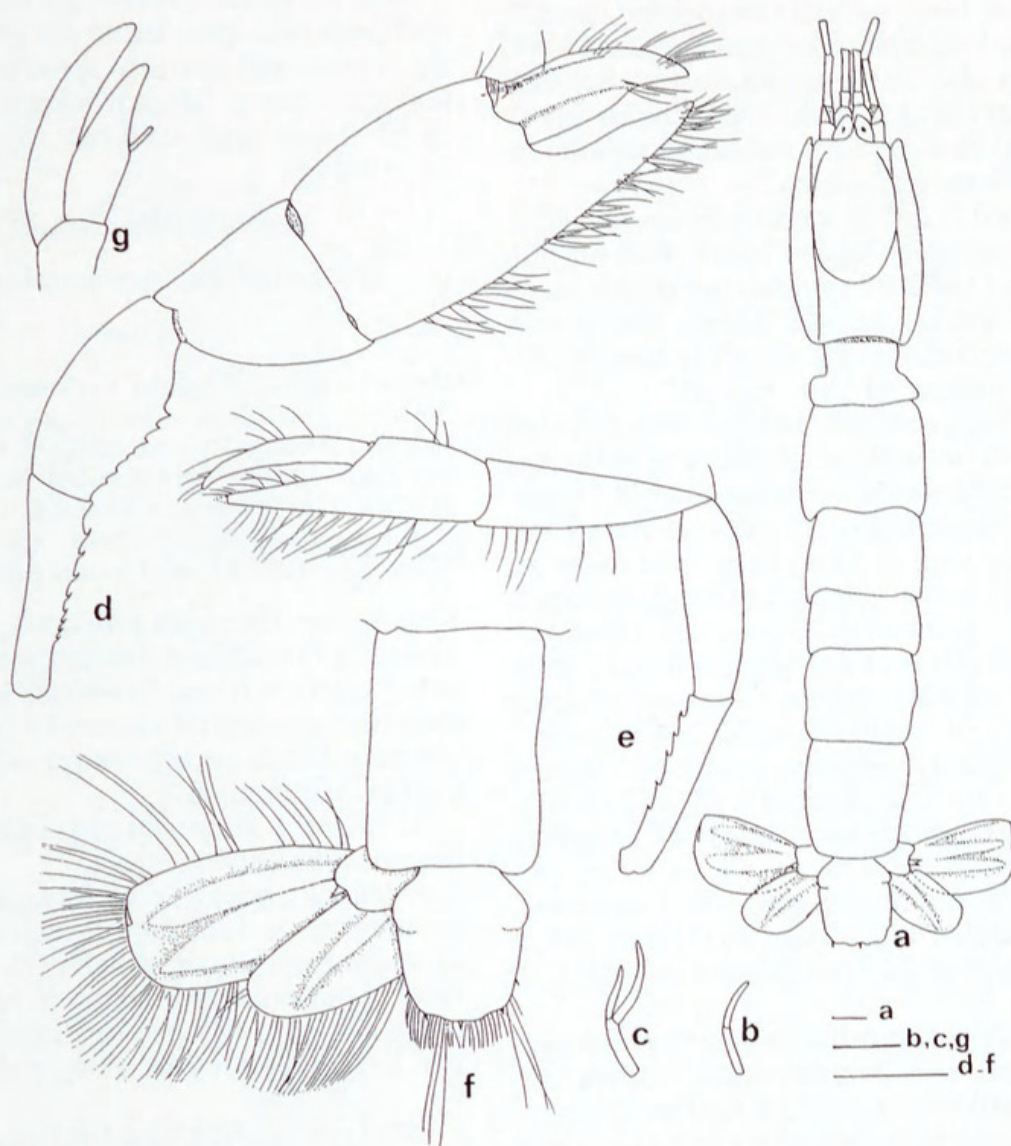


Figure 2. *Callianassa praedatrix* De Man. Holotype, male, tl. 23 mm (ZMA-De 102 433): a, body in dorsal view; b, pleopod 1; c, pleopod 2.

Callianassa propinqua De Man. Female, tl. 15 mm (MNHN-Th 1254): d, large cheliped 1; e, small cheliped 1; f, telson and left uropod; g, pleopod 3.

Scale lines: 1 mm.

Description. Carapace with rostrum pointed anteriorly, a little compressed laterally, as long as eye stalks. Second abdominal segment (fig. 3a) broader than long, with terga expanded laterally into narrow longitudinal strip on each side. Third and fourth abdominal segments broader than long, lateral tergal expansion less conspicuous.

Antennal peduncle overreaching antennular peduncle by its last article.

Maxilliped 3: ischium nearly twice as long as broad and twice as long as merus with longitudinal row of about 22 spinules near outer lateral margin of mesial surface. Merus longer than broad, inner lateral margin slightly convex, distal margin oblique, slightly curved.

Female large cheliped: ischium with 5 ventral spinules. Merus with small proximal spine and larger one near middle of ventral margin. Carpus triangular, about as long as merus. Palm almost 1.5 times as long as fixed finger and dactylus, both fingers of same length, slender, unarmed, with slightly incurved tip. Female small cheliped: ischium and merus of nearly same length, ischium with 5 ventral spinules, merus with 1 spine near middle of ventral margin; carpus over 3 times as long as broad; palm shorter than slender fixed finger and dactylus, latter slightly curved.

Pereopod 3: propodus slender, not expanded ventrally.

Pleopod 1 uniramous, pleopod 2 biramous, larger in females of tl. 13 mm and 18 mm than in male holotype of 22.8 mm, absent in male of tl. 13 mm.

Telson longer than broad, posterolateral angles rounded, each with 2 minute spinules often broken off, posterior margin with median spinule.

Uropod: endopod somewhat triangular, about as long as telson; exopod with rounded posterior border and small dorsal setose lobe, longer than telson, up to about 1.5 times longer in specimen of tl. 18 mm.

Distribution. Indonesia, Australia (North-west Shelf).

Remarks. Besides providing the morphology of the female first chelipeds, the material studied confirms De Man's view of the species' distinguishing characters. They are: laterally compressed acuminate rostrum, laterally expanded abdominal terga especially on the second segment, maxilliped 3 with a relatively narrow ischium-merus, telson longer than broad, and uropods longer than the telson with exopod of an ovoid shape. Among these features, the first two are likely to be the most reliable. As for the uropods,

the exopod is longer and more slender in larger specimens.

From the material studied, in females, both first chelipeds bear spinules on the ventral border of the ischium and a median spine on the same border of the merus. Other articles are unarmed; the fixed finger and dactylus are slender, with incurved tip.

Neocallichirus Sakai, 1988

Neocallichirus denticulatus sp. nov.

Figure 4

Material examined. 2 females, tl. 19 mm and 20.5 mm.

Holotype. Queensland NE of Townsville (18°56'S, 146°50'E), 24 m, muddy sand, dredge, G. C. B. Poore and H. Lew Ton on RV *The Harry Messel*, 24 Nov 1982 (stn AIMS 2), NMV J22658 (female, cl. 6.5 mm, tl. 20.5 mm).

Paratype. Queensland (18°50'S, 146°47'E), 26 m (stn AIMS 3), MNHN-Th 1246 (1 female, cl. 5.5 mm, tl. 19 mm).

Description. Carapace produced anteriorly into triangular downturned rostrum and spine on each side, posterior to eye. Eye-stalks slightly shorter than first segment of antennular peduncle, with obtuse mesiodistal tip; cornea well pigmented, convex, subterminal.

Abdomen with second and sixth segments the largest, sixth slightly larger.

Antennular peduncle with last segment twice as long as penultimate. Antennal peduncle exceeding antennular by half of its last segment, latter about two-thirds length of penultimate.

Maxilliped 1: endopod small and rounded; epipod large, anterior lobe elongated with pointed tip.

Maxilliped 2: with small epipod.

Maxilliped 3: ischium-merus combined as moderately broad plate; ischium over twice as long as merus with curved row of about 17 spinules on mesial surface; merus unarmed, inner lateral margin curved; carpus broadened distally; propodus about as long as wide with rounded lower margin; dactylus slender, about as long as propodus and one-fourth as broad.

Large cheliped: ischium and merus of approximately same length, with 10 and 8 spinules respectively; carpus about half length of palm, unarmed; palm with lower margin denticulated throughout in specimen of tl. 20.5 mm, with few proximal denticles in specimen of tl. 19 mm; fixed finger and dactylus about half length of palm, both with incurved tip, fixed finger with serrated cutting edge, same border of dactylus with denticles and 1 or 2 larger triangular teeth.

Small cheliped: ischium slightly shorter than

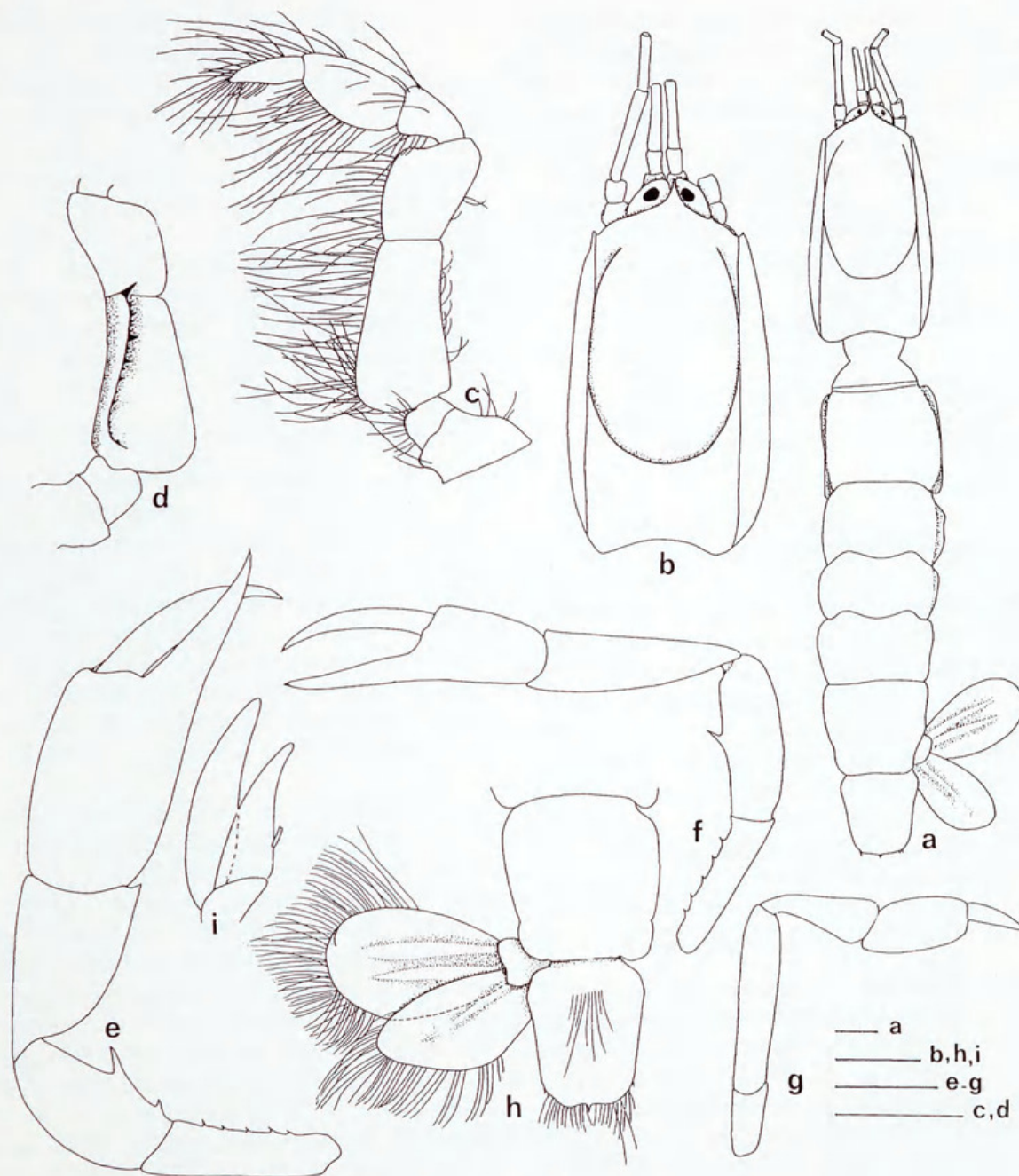


Figure 3. *Callianassa sibogae* De Man. Female, tl. 18 mm (NMV J22662): a, c, d, i. Female, tl. 13 mm (MNHN-Th 1248): b, e-h.

a, body in dorsal view; b, carapace, dorsal view; c, maxilliped 3, external view; d, same, basis, ischium and merus, mesial view; e, large cheliped 1; f, small cheliped 1; g, pereopod 3; h, telson and left uropod; i, pleopod 3.

Scale lines: 1 mm.



merus with 7–8 lower denticles; carpus 1.5 times as long as palm, both unarmed; fixed finger and dactylus about as long as palm, both with incurved tip, cutting edge of fixed finger bearing 3–4 denticles.

Pereopod 3: propodus with ventroposterior lobe not exceeding lower margin of carpus.

Female pleopod 1 small, uniramous.

Female pleopod 2 biramous, endopod shorter bearing small appendix interna.

Telson about half length of sixth abdominal segment and as long as wide, widest at proximal third, tapering posteriorly to weakly convex posterior margin.

Uropod: endopod lanceolate, widest proximally and about 1.5 times length of telson; exopod longer than endopod, twice as long as telson, posterior margin broadened, dorsal setose lobe large.

Distribution. Australia (north Queensland).

Remarks. This new taxon resembles species of the genus *Corallianassa* Manning, 1991 in possessing a trispinous frontal margin, in the morphology of maxilliped 3 and of the uropods that are longer than the telson. Nevertheless, while the frontal margin is strongly spinous in Manning's genus, anterior spines are small in *N. denticulatus* and the rostrum is downturned. Furthermore, the palm of its larger pereopod 1 bears ventral denticles whilst it is unarmed in *Corallianassa*.

According to Manning and Fielder's key (1991) and its appendages, the present species is more closely related to *Neocallichirus* Sakai where it is provisionally placed. It differs from the diagnosis of *Neocallichirus* (Sakai, 1988; Manning and Fielder, 1991) by its rounded eyes (dish-shaped in typical *Neocallichirus*) and the slender uropod endopod, longer than the telson.

Neocallichirus denticulatus can be differentiated from other Australian species of *Neocallichirus*, *N. horneri* Sakai, 1988, *N. caechabitor*, Sakai, 1988, *N. darwinensis* Sakai, 1988 and *N. limosa* (Poore, 1979) by:

1, trispinous frontal margin;

2, uropod endopod more slender and longer than telson; and

3, except for *N. darwinensis*, uropod exopod proportionally much longer and nearly twice as long as telson.

The weakly trispinous frontal margin, the ventral denticulation of pereopod 1 palm, the length of the uropods bring this species near to the American *N. rathbunae* (Schmitt, 1935). The two differ in the following features:

1, rostral spine downturned in *N. denticulatus* (straight in *N. rathbunae*);

2, rounded eyes (dish-shaped);

3, ventral border of pereopod 1 carpus unarmed (denticulated); and

4, uropod endopod oblong, slender (nearly quadrate).

Upogebiidae Borradaile, 1903

Gebiacantha Ngoc-Ho, 1989

Diagnosis. One or many infrarostral spines. Anterolateral border of carapace with 2 or more spinules. Posterior border of telson more or less concave. Mandible without acute anterior tooth. Maxilliped 1 without epipod, maxilliped 3 with small epipod or (rarely) without, mesial surface of ischium with longitudinal row of fine spinules representing vestigial *crista dentata*. Gill filaments relatively narrow and undivided (making single row on each side of rachis). Pereopod 1 subcheliform, carpus and propodus with numerous spines, fixed finger a spiniform projection, not exceeding half length of dactylus. Coxae of pereopod 1–3 or pereopod 1–4 with mesial spines or spinules. Uropod relatively long, exopod always longer than telson.

Remarks. As stated by Ngoc-Ho (1989) a subdivision of the Upogebiidae is considered very difficult by many authors (De Saint Laurent and Le Loeuff, 1979; Sakai, 1982; Williams, 1986) and requires precise criteria. In *Gebiacantha* the morphology of the rostrum, pereopods, telson and uropods, the mouth appendages and

Figure 4. *Neocallichirus denticulatus* sp. nov. Holotype, female, tl. 20.5 mm (NMV J22658): a–e, j–n. Female, tl. 19 mm (MNHN-Th 1246): f–i.

a, body in dorsal view; b and c, anterior part of carapace, dorsal and lateral view; d, pleopod 1; e, pleopod 2; f, maxilliped 1; g, maxilliped 2; h, maxilliped 3, external view; i, basis, ischium and merus of same, mesial view; j, large cheliped 1; k, small cheliped 1; l, pereopod 3; m, telson and left uropod; n, pleopod 3.

Scale lines: 1 mm.

branchial filaments are taken into account. These are homogeneous in the family and any variation should be of evolutionary significance. The genus is defined by the combination of characters listed in the diagnosis.

Fifteen species of *Gebiakantha* have now been described: *G. talismani* (Bouvier, 1915, type species), *G. ceratophora* (De Man, 1905), *G. monoceros* (De Man, 1905), *G. acanthochela*

(Sakai, 1967), *G. acutispina* (de Saint Laurent and Ngoc-Ho, 1979 of which *G. niugini* Poore, 1982 is a junior synonym), *G. plantae* (Sakai, 1982), *G. arabica* Ngoc-Ho, 1989, *G. lagonensis* Ngoc-Ho, 1989, *G. laurentae* Ngoc-Ho, 1989, *G. reunionensis* Ngoc-Ho, 1989, *G. richeri* Ngoc-Ho, 1989, *G. poorei* sp. nov., *G. priochela* Sakai, 1993, *G. lifuensis* Ngoc-Ho, 1994 (?), *G. multispinosa* Ngoc-Ho, 1994 (?).

Table 1. Distinguishing characters between *Gebiakantha priochela* and *G. plantae*.

	<i>G. priochela</i>		<i>G. plantae</i>	
Infrarostral spine	2–3		2–4	
Spines on anterolateral border of carapace	5–7		1–3	
Spines on antennal peduncle articles 1, 3 and 4	1, 2–4, 3–4		0, 1, 2–3	
Male pereopod 1	stout type	slender type	stout type	slender type
External tubercles on lower margin of propodus	large	small	small	small
External distal spines between dactylus and fixed finger	1	1	absent	absent
Mesial spines and tubercles	tubercles + spinules	2 rows of spines	tubercles + spinules	3 rows of spines
Ratio of lengths of fixed finger : dactyl	1:10	1:4	1:8	1:4
Dorsal border of dactylus	with quadrate plates		with corneous carina	
Female pereopod 1				
Large carpal subdistal spines	3		3	
Row of mesial spines on propodus	1–2		3	
Dorsal border of dactylus	with tubercles		with tubercles	
External surface of dactylus	few tubercles		tuberculate carina	
Mesial surface of dactylus	small tubercles		tuberculate carina	

Key to species of *Gebiakantha*

1. Exopod of uropod hardly longer than telson, posterior border nearly straight, not continuous with lateral external border; posterior border of telson moderately concave medially 2
- Exopod of uropod at least 1.5 times as long as telson, posterior border rounded, continuous with lateral external border; posterior border of telson strongly concave medially 10
2. 5 spinules or more on anterolateral border of carapace 3
- 2–4 spinules on anterolateral border of carapace 8
3. 1–3 infrarostral spines 4
- 3–4 infrarostral spines 5
4. 2 small rostral spines; 4 longitudinal rows of 10–12 spines on mesial surface of propodus of pereopod 1. Japan *G. acanthochela*
- 2 large rostral spines; 3 longitudinal rows of 5–8 spines on mesial surface of propodus of pereopod 1. Australia *G. poorei*

5. Telson about 1.5 times as broad as long 6
- Telson about as broad as long 7
6. 4 spinules on each lateral shoulder of cervical groove; 6 longitudinal rows of 6–10 spines on mesial surface of pereopod 1 propodus. New Caledonia *G. multispinosa*
- 1 spine on each lateral shoulder of cervical groove; 4 longitudinal rows of 3–8 spines on mesial surface of pereopod 1 propodus. New Caledonia *G. lifuensis*
7. 1–2 spines on each lateral shoulder of cervical groove; 3 longitudinal rows of 4–8 spines in mesial dorsal part of pereopod 1 propodus; male pereopod 1 not dimorphic. East Atlantic *G. talismani*
- 1 spine on each lateral shoulder of cervical groove; 1–3 longitudinal rows of 2–9 spines on mesial surface of pereopod 1 propodus; male pereopod 1 dimorphic with 'stout' and 'slender' types, dactylus of both with transverse dorsal corneous ridges. Australia *G. priochela*
8. Pereopod 1 propodus with mesial surface unarmed except for row of dorsal spines (single infrarostral spine). Indo-Pacific *G. monoceros*
- Pereopod 1 propodus with numerous spines on mesial surface 9
9. 2–3 large infrarostral spines; male pereopod 1 dimorphic with 'stout' and 'slender' type, both with longitudinal dorsal corneous carina on dactylus; fixed finger less than quarter length of dactylus. Madagascar *G. plantae*
- 1–2 small infrarostral spines; male pereopod 1 without longitudinal dorsal corneous carina on dactylus; fixed finger about third length of dactylus, cutting edge denticulated. Gulf of Suez *G. arabica*
10. Mesial surface of pereopod 1 propodus not twisted, carpus and propodus not especially setose 11
- Pereopod 1 propodus twisted, with main part of mesial surface turned upwards; carpus and propodus bearing numerous long setae dorsally 13
11. 1 ventral spine on article 1 of antennular peduncle 12
- 2–3 ventral spines on article 1 of antennular peduncle; 1–3 infrarostral spines; rostrum over 1.5 times as long as broad; spines of moderate size or spinules on mesial surface of pereopod 1 propodus; a large ventral spine behind fixed finger in both sexes. Reunion Island *G. reunionensis*
12. 3 infrarostral spines; rostrum approximately triangular and as long as largest breadth; long and sharp spines on mesial surface of pereopod 1 propodus with 2–3 large ventral spines behind fixed finger. North-west Australia, Papua New Guinea *G. acutispina*
- 1–2 infrarostral spines; rostrum approximately egg-shaped, about 1.5 times as long as broad; small or large ventral spine on pereopod 1 propodus, behind fixed finger. Indonesia, Queensland (Australia) *G. ceratophora*
13. Large teeth on lateral margin of rostrum; proximodorsal part of pereopod 1 propodus not protruding backwards over carpus 14
- Small teeth on lateral margin of rostrum; proximodorsal part of pereopod 1 propodus with prominent backward projection over carpus; mesial surface unarmed between dorsal and ventral row of spines; setae moderately long and dense on carpus and propodus. Indonesia *G. laurentae*
14. Mesial surface of pereopod 1 propodus with 2–3 spinules between dorsal and ventral row of spines; long and dense setae on carpus and propodus; single transverse carina on telson. New Caledonia *G. lagonensis*
- Mesial surface of pereopod 1 propodus with numerous spines; very long and dense setae on carpus and propodus; double transverse carina on telson. New Caledonia *G. richeri*

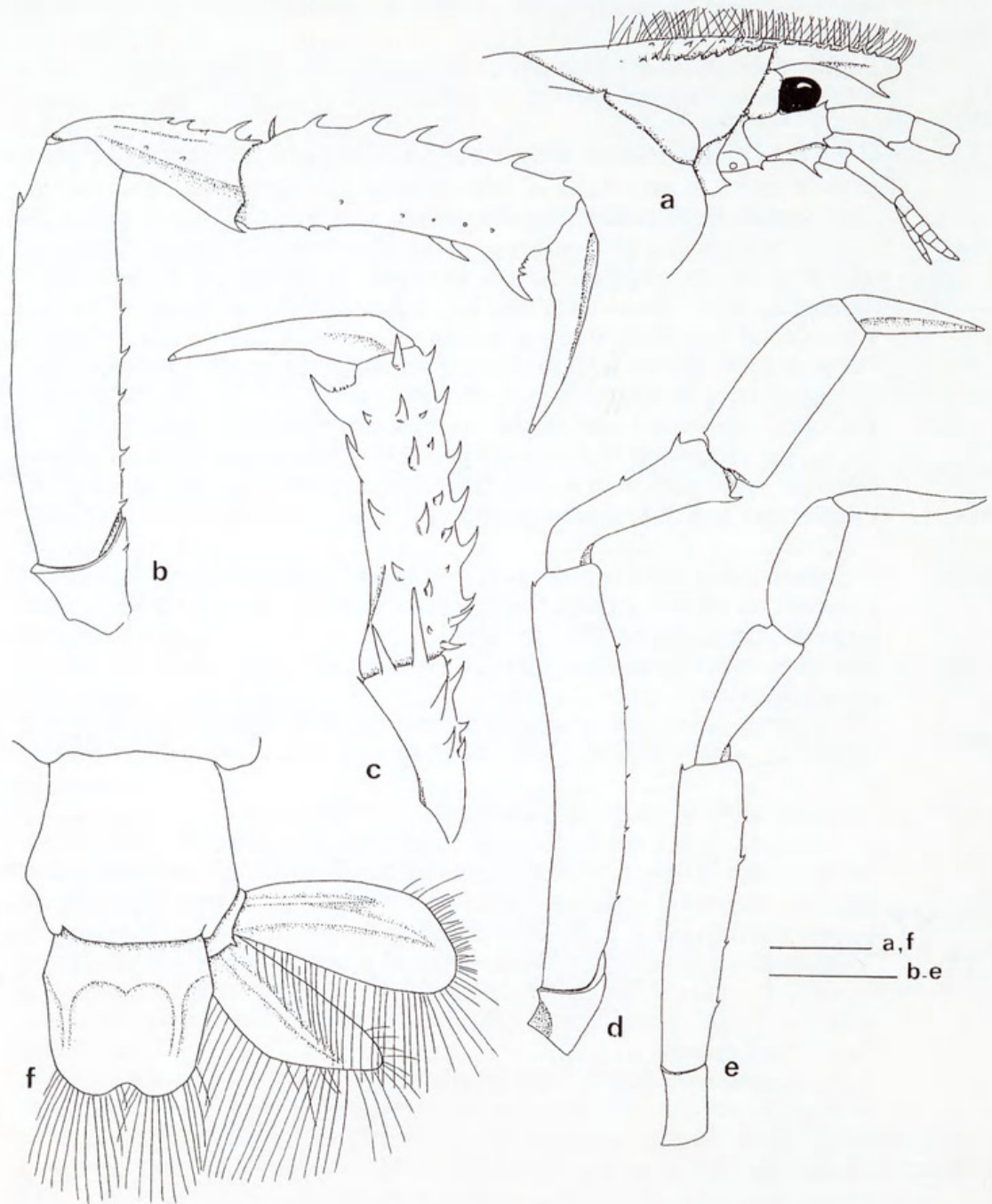


Figure 5. *Gebiacantha ceratophora* De Man. Male, tl. 7.5 mm (NMV J17918): a, anterior part of carapace, lateral view; b, pereopod 1, external view; c, distal articles of pereopod 1, mesial view; d, pereopod 2; e, pereopod 3; f, telson and right uropod.

Scale lines: 0.5 mm.

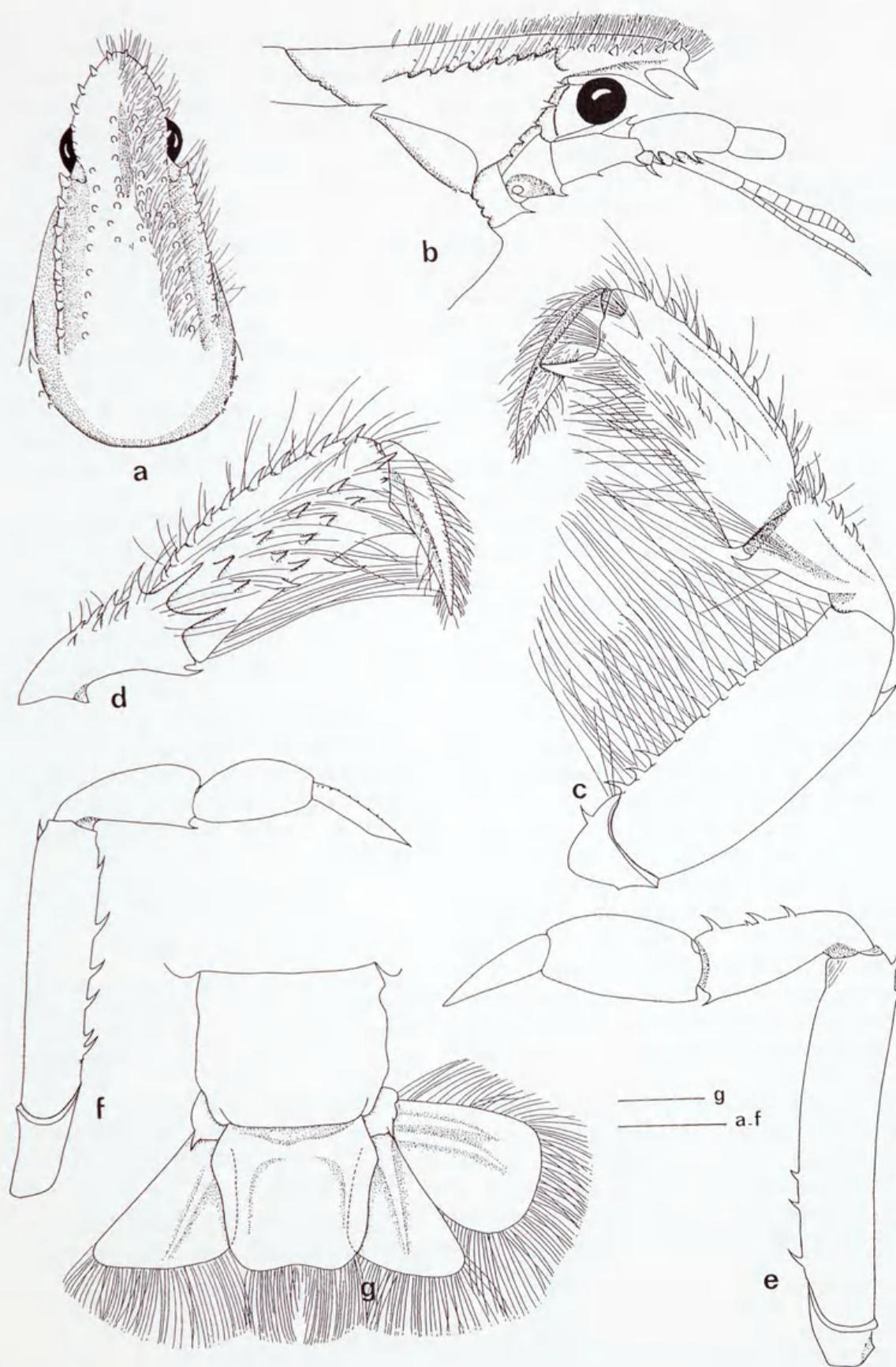


Figure 6. *Gebiacantha poorei* sp. nov. Holotype, male, tl. 14 mm (NMV J17919): a, b, anterior part of carapace, dorsal and lateral view; c, pereopod 1, external view; d, distal articles of same, mesial view; e, pereopod 2; f, pereopod 3; g, telson and uropods.
Scale lines: 1 mm.

Gebiacantha ceratophora (De Man)

Figure 5

Upogebia (*Upogebia*) *ceratophora* De Man, 1905: 602; 1928: 69, figs 9–9g; — Sakai, 1982: 49 (in part), 105.

Upogebia ceratophora. — de Saint Laurent and Ngoc-Ho, 1979: 63, figs 6–8, 22–24.

Gebiacantha ceratophora. — Ngoc-Ho, 1989: 122.

Material examined. Queensland, NE of Townsville (19°3'S, 146°52'E), 23 m, muddy sand, dredge, G. C. B. Poore and H. Lew Ton on RV *The Harry Messel*, 24 Nov 1982 (stn AIMS 1), NMV J17918 (1 male, cl. 3 mm, tl. 7.5 mm); 18°24'S, 146°39'E (stn AIMS 7), NMV J17917 (1 male, cl. 3.5 mm, tl. 8 mm). Pandora Reef, leeward slope (18°49'S, 146°26'E), 10 m, transition between coral and sediment, M. Riddle, corer, Jul 1985, NMV J22686 (1 male, cl. 3.5 mm, tl. 9 mm).

Description. Rostrum approximately 1.5 times as long as broad, projecting far beyond eyes, armed with slender infrarostral spine and another anterior spinule in specimen NMV J22686; 7–8 small teeth dorsally on each lateral border. Lateral ridges of gastric region each with 9–10 spinules; anterolateral border of carapace with 3–4 spinules. Cervical groove moderately deep, shoulder lateral to it bearing 1 spine and 3 spinules on each side.

Antennule: peduncular article 1 with ventral spine; flagella short. Antenna: peduncular article 1, 3 and 4 each with ventral spine; peduncular article 2 with 2 dorsal spinules; scale hardly separated from peduncle, terminating in spinule.

Pereopod 1 slender and subcheliform. Ischium with ventral spine. Merus more than 4 times as long as broad, carrying dorsal subdistal spine, 7–8 spines and spinules on ventral margin. Carpus bearing fine longitudinal groove on upper part of external surface; small ventral and 2 large mesial distal spines; 3 spines and 3 spinules along or near dorsal border. Propodus about 3.5 times as long as broad, 6 dorsal spines and few denticles on proximal third of ventral margin; external surface with few small tubercles in ventral part; mesial surface with 2 longitudinal rows of spines and spinules in dorsal half, lower one terminating in large spine near articulation with

dactylus; spinule near base and large ventral spine behind fixed finger, latter spine followed posteriorly by 2 smaller ones; fixed finger small, quarter length of dactylus, cutting edge with denticles proximally. Dactylus bearing corneous tip and fine longitudinal dorsal groove; cutting edge smooth.

Pereopod 2: merus more than 5 times as long as broad with dorsal subdistal and 5 ventral spinules. Carpus bearing spinule near middle of dorsal border, dorsal subdistal and ventral subdistal spines. Dactylus with corneous tip.

Pereopod 3: merus with dorsal distal and 4 ventral spinules. Dactylus lanceolate.

Telson slightly shorter than sixth abdominal segment with faint inverted U-shaped carina on dorsal surface; posterior margin well concave medially.

Uropods: both exopod and endopod slender, longer than telson; protopod with spinule.

Distribution. Indonesia, Australia (Queensland).

Remarks. The new material agrees with the description and figures of De Man (1928) and de Saint Laurent and Ngoc-Ho (1979). These are the first males known and they differ from the types, both females, only in the large mesial spines behind the first pereopod fixed finger. The key to species of *Gebiacantha* has been amended to account for the new characteristics of *G. ceratophora*.

Gebiacantha poorei sp. nov.

Figure 6

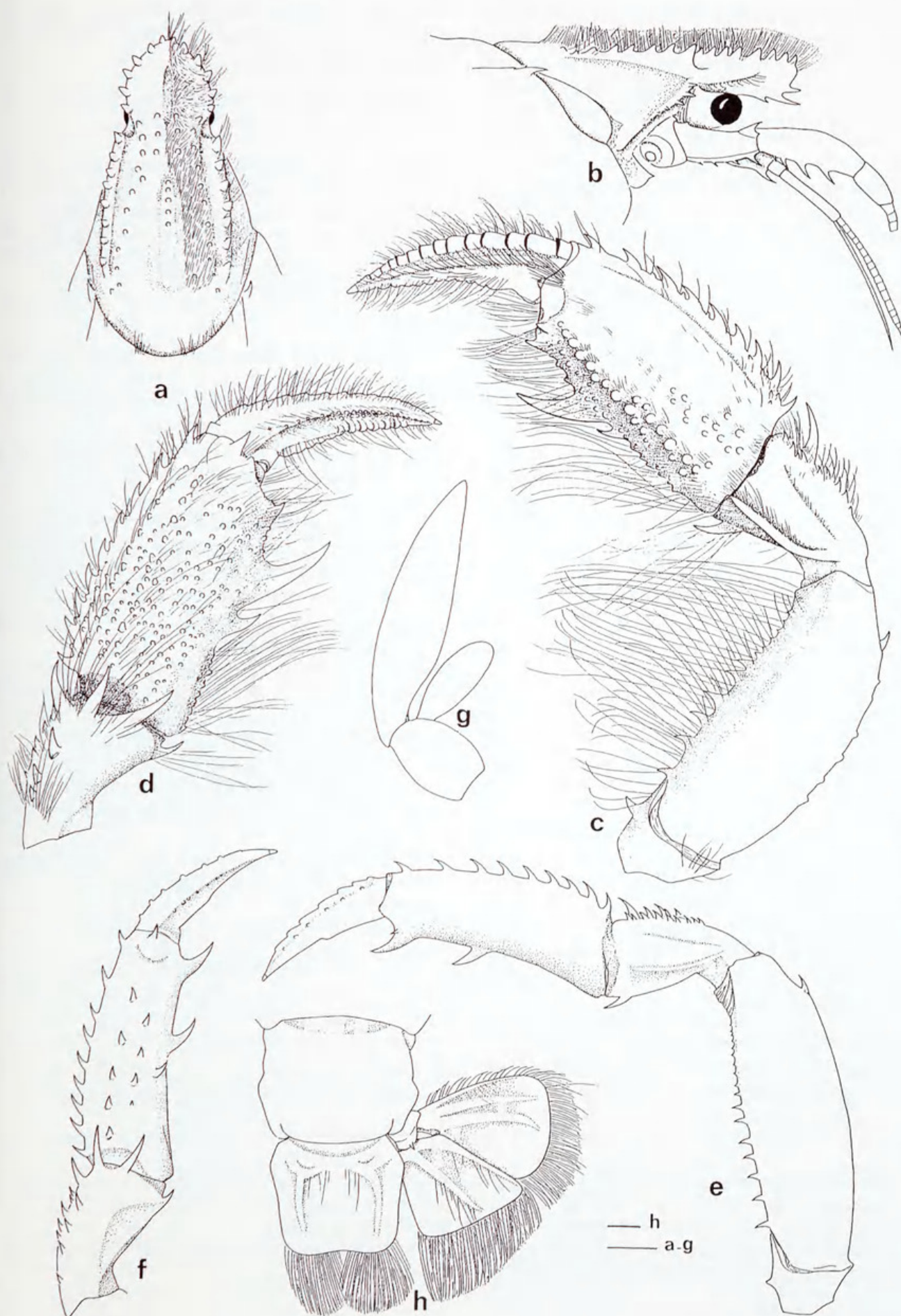
Material examined. Holotype. Queensland, NE of Townsville (18°50'S, 146°47'E), 23 m, muddy sand, dredge, G. C. B. Poore and H. M. Lew Ton on RV *The Harry Messel*, 24 Nov 1982 (stn AIMS 3), NMV J17919 (male, cl. 5.5 mm, tl. 14 mm).

Other material. Type locality, NMV J22667 (male, cl. 2.5 mm, tl. 7 mm); NE of Townsville (18°43'S, 146°45'E), 34 m (stn AIMS 4), NMV J17921 (1 male, cl. 4 mm, tl. 10.5 mm without P1).

Description. Rostrum slightly longer than broad, rounded apically, projecting beyond eyes; dorsal

Figure 7. *Gebiacantha priocheila* Sakai. Male, tl. 28 mm (NMV J22663): a–d, g, h; female, tl. 26 mm (NMV J22664): e, f. a, b, anterior part of carapace in dorsal and lateral view; c and e, pereopod 1, external view; d and f, distal part of same, mesial view; g, pleopod 2; h, telson and right uropod.

Scale lines: 1 mm.



surface with fine longitudinal median groove bordered with rounded tubercles and 6–7 spiniform teeth on each lateral border; 2 large ventral spines. Gastric region with most tubercles along-side lateral grooves; lateral ridges with 8 spiniform teeth. Cervical groove deep bearing large spine and 2–3 denticles on each side near intersection with linea thalassinica. Anterolateral border of carapace with 5 spines and spinules. Ventrolateral border of carapace near base of epistome with 3–4 denticles; epistome terminating ventrally in distal spine.

Antennule: peduncular article 1 with ventral spine. Antenna: peduncular articles 1, 3 and 4 with 1, 2 and 3 ventral spines respectively; scale terminating in 2 spinules.

Pereopod 1 subcheliform. Ischium with ventral spine. Merus nearly 3 times as long as broad, bearing dorsal subdistal and 8 large ventral spines. Carpus carrying fine longitudinal groove on upper part of external surface, with ventral subdistal, dorsal subdistal and 2 large mesial distal spines; 7 spines and spinules along or near dorsal margin. Propodus approximately 2.5 times as long as broad, dorsal border bearing 9 spines, mesial surface with 2 longitudinal rows of 5 and 6 spines each with foremost sitting near articulation with dactylus; large slender spine near the middle of ventral margin, smaller spine at its base and another one behind it; fixed finger about one-third as long as dactylus, unarmed. Dactylus with corneous tip, very slight longitudinal dorsal groove on external surface and few small median tubercles mesially.

Pereopod 2: merus with 2 dorsal subdistal spines and 3 spines on proximal third of ventral margin. Carpus bearing 4 spines on dorsal margin and ventral distal spine.

Pereopod 3: merus with dorsal subdistal spine, spinule and 6 spines on ventral margin. Carpus with ventral distal spine. Dactylus carrying few small tubercles dorsally.

Telson slightly shorter than sixth abdominal segment, with very faint inverted U-shaped carina dorsally; posterolateral corners rounded, posterior margin weakly concave medially.

Uropod: exopod rounded, endopod approximately triangular, both little longer than telson; protopod with spinule.

Etymology. The species is named for Gary C. B. Poore who collected the material.

Remarks. The spination of the rostrum, anterolateral border of the carapace and antennal peduncle plus the shape of the telson and uropods place this new species close to *Gebiacantha acanthochela* Sakai, 1967 from Japan. It differs from Sakai's species in:

1, a shorter rostrum with larger infrarostral spines;

2, pereopod 1 more slender and with fewer spines: propodus about 2.5 times as long as broad, armed with 9 dorsal spines and two rows of 5 and 6 mesial spines each (propodus twice as long as broad with 12–13 dorsal spines and three rows of 9–10 mesial spines each in *G. acanthochela*);

3, dactylus of pereopod 1 with an unarmed dorsal margin and a smooth external surface (with 3 proximal tubercles on dorsal margin and a distinct carina on external surface); and

4, propodus of pereopod 2 unarmed dorsally (with a proximal spine).

In the shape and spination of its rostrum and pereopod 1, this new taxon is also similar to *G. arabica* Ngoc-Ho, 1989 from the Gulf of Suez. It differs from the Gulf species in:

1, its larger infrarostral spines;

2, anterolateral border of the carapace armed with 5 spines and spinules (with 2 spinules only in *G. arabica*);

3, antennal articles 1 and 3 bear 1 and 2 spines respectively (0, 1 spine respectively in *G. arabica*); and

4, the different shape of the uropods.

Gebiacantha priochea Sakai

Figures 7, 8

Gebiacantha priochea Sakai, 1989: 100–105, figs 7–9.

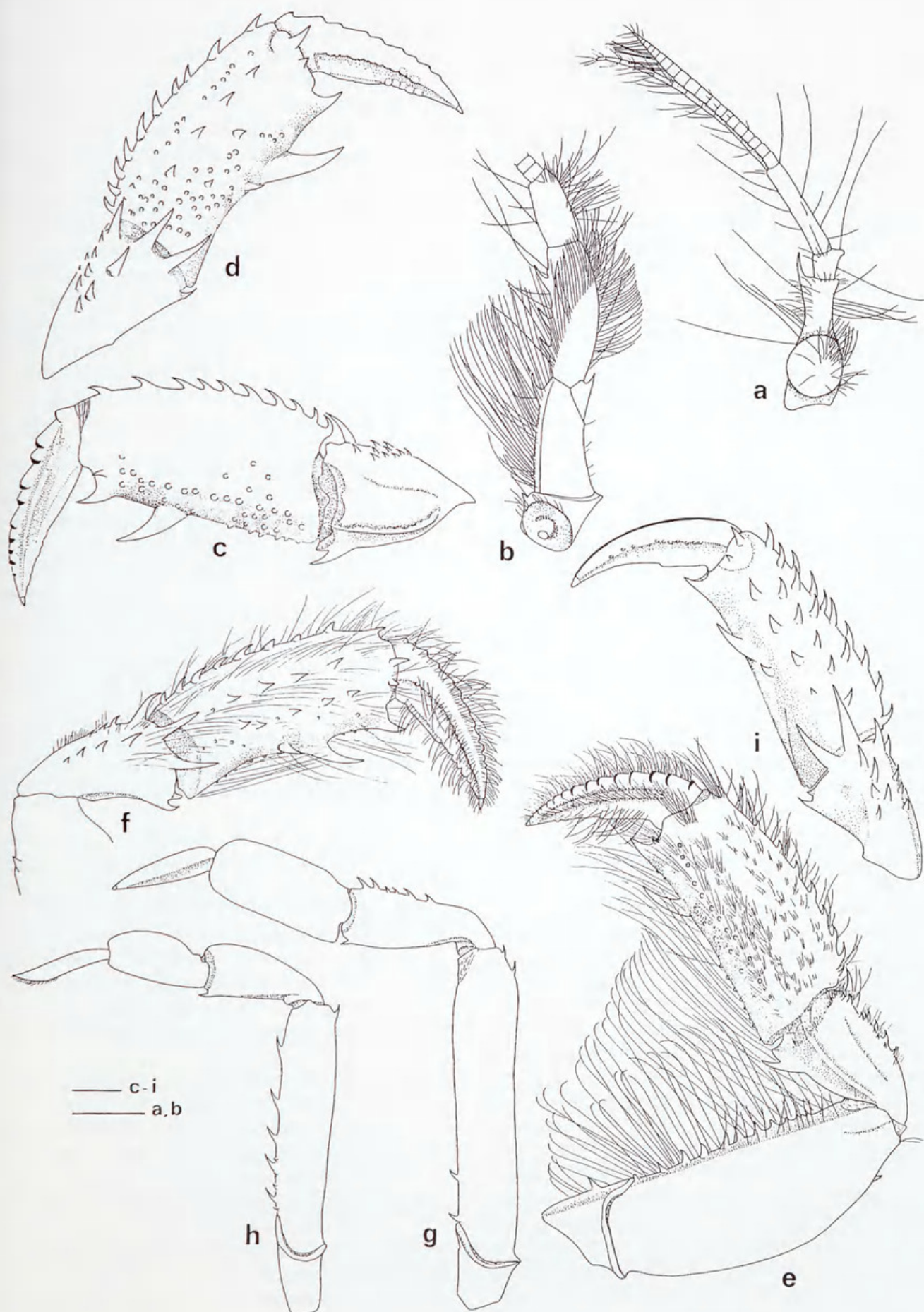
Material examined. Western Australia, North-west Shelf (19°48'S, 117°45'E), D. Tranter, 0100 h, 8 Nov 1983,

Figure 8. *Gebiacantha priochea* Sakai. Male, tl. 27 mm (MNHN-Th 1252): a, b. Male, tl. 26 mm (MNHN-Th 1252): c, d. Male, tl. 28.5 mm (NMV J17920): e, f. Male, tl. 27 mm (MNHN-Th 1250): g, h.

Gebiacantha plantae (Sakai). Paratype male, cl. 12 mm (MNHN-Th 569): i.

a, antennule; b, antenna; c and e, distal part of pereopod 1 and whole appendage respectively, external view; d, f and i, distal part of pereopod 1, mesial view; g and h, pereopod 2 and 3.

Scale lines: 1 mm.



surface dip net (water depth 50 m), NMV J22663 (1 male, cl. 10 mm, tl. 28 mm); NMV J22664 (2 males, cl. 10.5 mm, tl. 28 mm and 2 females, cl. 9.5 mm, tl. 26 mm); MNHN-Th 1250 (1 male, cl. 10 mm, tl. 27 mm and 1 female, cl. 9 mm, tl. 25 mm); NMV J17913 (10 males, cl. 9.5–10.5 mm, tl. 25.5–28 mm); NMV J17914 (25 females, cl. 6.5–10.5 mm, tl. 20.5–28 mm); MNHN-Th 1251 (6 males, cl. 9.5–10.5 mm, tl. 25.5–28 mm and 8 females, cl. 6.5–10 mm, tl. 20.5–28 mm).

Western Australia. North-west Shelf, between Dampier and Port Hedland (19°56.8'S, 117°53.4'E), CSIRO Division of Fisheries, trawl, 22 Apr 1983 (stn NWA 116), 42 m, NMV J17922 (4 males, cl. 9.5–11 mm, tl. 25.5–28.5 mm).

Queensland, NE of Townsville (19°3'S, 146°52'E), 23 m, muddy sand, dredge, G. C. B. Poore and H. Lew Ton on RV *The Harry Messel*, 24 Nov 1982, NMV J17916 (2 males, cl. 13.5–14.5 mm, tl. 36–38.5 mm), 45 km NE of Townsville, 27 m, A. Birtles and P. Arnold, 10 Apr 1979, NMV J17920 (3 males, cl. 10.5–11.5 mm, tl. 26.5–28.5 mm); MNHN-Th 1252 (2 males, cl. 10–10.5 mm, tl. 26–27 mm and 1 female, cl. 10 mm, tl. 25.5 mm); NMV J22665 (1 female, cl. 9 mm, tl. 24 mm and 5 males, cl. 9.5–10.5 mm, tl. 24.5–26 mm); NMV J22666 (1 male, cl. 11.5 mm, tl. 29 mm).

Description. Rostrum rounded anteriorly, about as long as wide at base, projecting far beyond eyes; dorsal surface with very faint median longitudinal groove and 6–7 large spiniform teeth on each lateral margin; ventral surface with 2–3 (rarely 4) slender spines pointing forward. Gastric region bearing small rounded tubercles, 2–5 of them on top of faint median carina on posterior half, others alongside lateral grooves; lateral ridges carrying 7–8 spiniform teeth. Antero-lateral border of carapace with 5–7 spines and spinules. Cervical groove deep, with large spine on each side, near intersection with linea thalassinica, latter extending to posterior border of carapace.

Antennule: first peduncular article with large ventral distal spine. Antenna: peduncular article 1, 3 and 4 bearing respectively 1, 2–4 and 3–4 spines, scale terminating in 2 spinules.

Pereopod 1 subcheliform, sexually dimorphic.

Male of 'stout type' (figs 7c, 7d). Ischium with ventral spine. Merus about 2.5 times as long as broad at midlength, dorsal margin with subdistal spine and 3–6 small tubercles in median part; ventral margin bearing 5–7 large spines in proximal two-thirds and 5–7 spinules distally. Carpus with external longitudinal tuberculate crest terminating in pointed tip in lower half and fine longitudinal groove in upper part; 4 large subdistal spines: one ventral, 1 dorsal and 2 mesial; upper mesial spine followed posteriorly by 3–5 smaller ones, and 7–9 spinules externally, near dorsal carpal margin. Propodus approximately twice as long as broad, dorsal margin bearing 9–11 spines and few spinules or tubercles; ven-

tral margin denticulate, with spine near middle and much larger one in front of it; external surface carrying fine longitudinal groove near dorsal margin, proximal rounded tubercles medially, longitudinal row of large tubercles together with smaller ones and spinules in lower part; ventral subdistal spine just above fixed finger; mesial surface bearing numerous small tubercles, some spinuliform, and large spine in middle of distal border, near articulation with dactylus; fixed finger very small, hardly resembling spine. Dactylus about two-thirds length of propodus, with corneous tip; dorsal margin carrying longitudinal row of quadrate plates, larger ones proximally and with corneous anterior edge; weak median smooth longitudinal carina on external surface and longitudinal row of small tubercles mesially; cutting edge dentate on whole extent, bearing, in addition, 7–8 faint, semicircular teeth on distal half of mesial surface.

Males of 'slender type' (figs 8c, 8d, 8e, 8f). Merus without dorsal tubercles. Propodus over twice as long as broad at midlength (figs 8e, 8f) or slightly stouter (figs 8c, 8d) with 9–11 spines on dorsal margin, variable number of tubercles and large spine near middle of ventral margin; external surface with small tubercles in ventral part, many in longitudinal row and distal spinule near base of fixed finger; mesial surface carrying 2 longitudinal rows of spines and variable number of tubercles; 2 distal spines near articulation with dactylus and ventral spine behind large one of ventral border; fixed finger about one-fourth as long as dactylus, cutting edge unarmed. Dactylus as in 'stout type'.

Females (figs 7e, 7f). Pereopod 1 more slender than in males. Ischium with ventral spine. Merus, about 3 times as long as broad, carrying dorsal subdistal spine, 5–6 proximal spines and 6–8 spinules distally on ventral margin. Carpus, as in males, with ventral, dorsal and 2 mesial subdistal spines; upper mesial spine followed posteriorly by 4–5 smaller ones and external to them, 6–9 spines or spinules; smooth longitudinal crest in lower half and fine longitudinal groove in upper half of external surface. Propodus about 2.5 times as long as broad at midlength, with 9–11 spines on dorsal margin; ventral margin with few tubercles proximally and large spine near distal third; external surface unarmed except for small subdistal spine near base of fixed finger; 1–2 longitudinal rows of spines on mesial surface, lower one with 1–3 spines; large subdistal spine near articulation with dactylus and another just behind large ventral spine; fixed

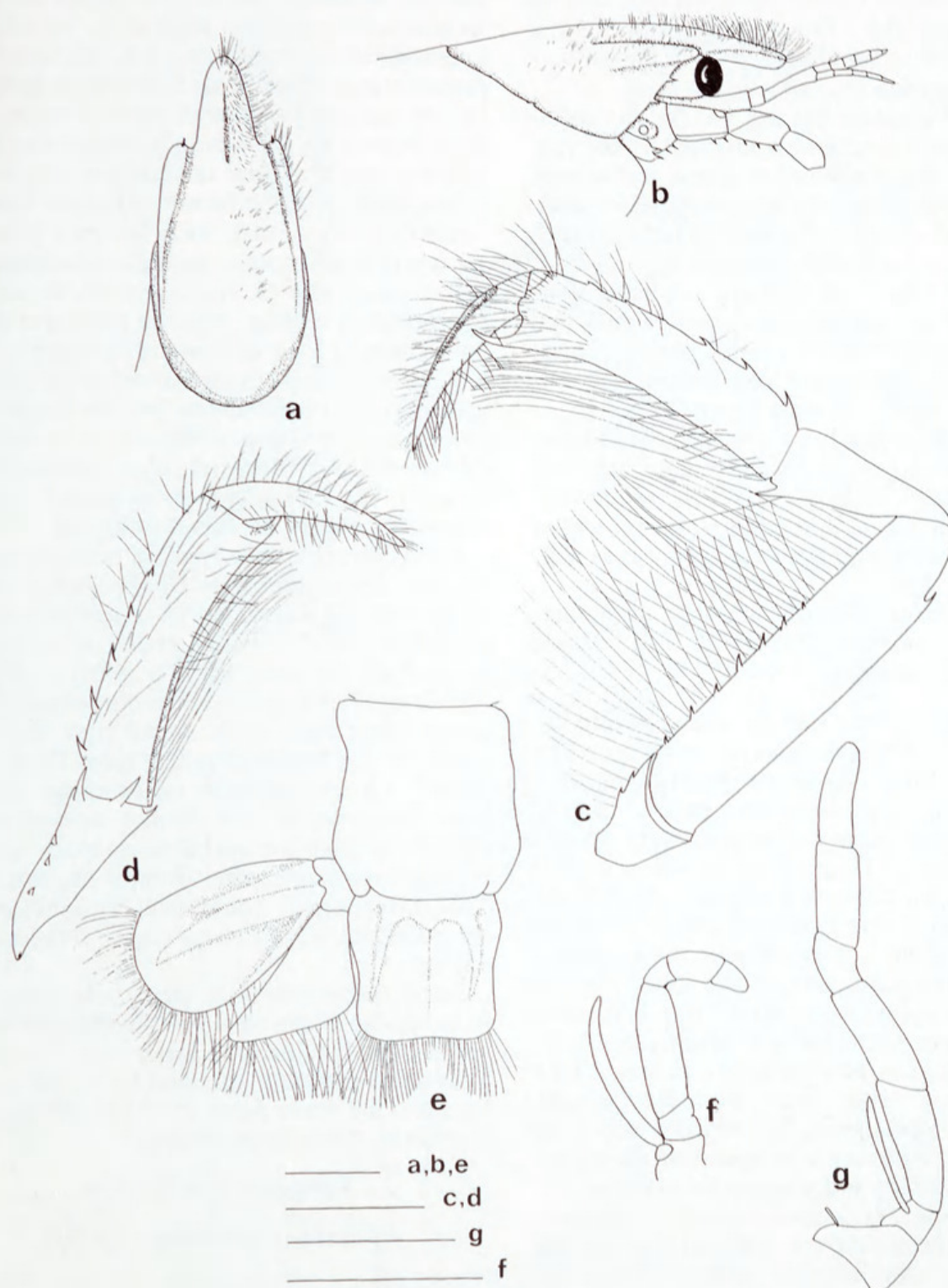


Figure 9. *Upogebia anacanthus* sp. nov. Holotype, male, tl. 7.5 mm (NMV J22668): a–e. Juv., tl. 6 mm (NMV J22670): f, g.

a and b, anterior part of carapace, dorsal and lateral view; c, pereopod 1, external view; d, distal part of pereopod 1, mesial view; e, telson and left uropod; f, maxilliped 2; g: maxilliped 3.

Scale lines: 0.5 mm.

finger longer than in males and about one-third as long as dactylus, cutting edge unarmed. Dactylus with corneous tip and corneous tubercles on dorsal margin; fine tuberculate crest on external surface and few small tubercles on mesial surface, cutting edge smooth.

Pereopod 2: merus bearing 1–2 dorsal subdistal spines and 1–3 spines on proximal half of ventral margin. Carpus with 3–6 dorsal and ventral subdistal spine. Propodus approximately rectangular, dorsal and ventral margins nearly parallel, unarmed. Dactylus with corneous tip.

Pereopod 3: merus with dorsal subdistal spine, 5–8 spines and number of scattered proximal spinules and tubercles on ventral margin. Carpus with ventral distal spine. Dactylus bearing pectiform setae distally on ventral margin.

Telson approximately as long as sixth abdominal segment and slightly broader than long, with faint inverted U-shaped carina; lateral borders convex in proximal third; posterolateral angles rounded, posterior border weakly concave medially.

Uropod: exopod approximately triangular, endopod trapezoidal, protopod with spinule hanging over endopod.

Remarks. This taxon can be placed within the first group of *Gebiacaantha* species proposed by Ngoc-Ho (1989). These are species with relatively short uropods whose exopod hardly overreaches the telson and with a nearly straight posterior margin; the posterior border of the telson is weakly concave medially. Within the group, the most closely related to *G. priochela* is *G. plantae* (Sakai, 1982). Furthermore, examination of the paratypes of the latter species revealed a male with pereopod 1 (fig. 8i) resembling in many ways that of a female (see Ngoc-Ho, 1989: fig. 3e). This male of *G. plantae* of the 'slender type' differs from the holotype male (Ngoc-Ho, 1989: figs 3c, 3d), which seems of the 'stout type', in having more spines on the propodal mesial surface and a longer fixed finger.

Both species, *G. priochela* and *G. plantae*, therefore have two types of males. Table 1 shows that although the 'slender' male pereopod 1 is very similar to that of the female in *G. plantae*, it differs by the presence of a dorsal corneous carina on the dactylus, a feature it shares with the male of the 'stout type'.

G. priochela can be distinguished from *G. plantae* in having more spines on the anterolateral border of the carapace and on the third article of the antenna. Furthermore, in males of

either the 'stout' or 'slender' type, the dactylus of pereopod 1 allows easy differentiation of the two species; its dorsal border bears quadrate plates with anterior corneous edge in *G. priochela*, a longitudinal corneous carina in *G. plantae*. These probably represent a male stridulating apparatus in both species. Females of the new taxon differ from those of *G. plantae* in having fewer spines on the propodal mesial surface of pereopod 1.

Morphology of the female pereopod 1 is similar in *G. plantae*, *G. priochela* and a few other species of *Gebiacaantha* such as *G. talismani*, *G. ceratophora* and *G. reunionensis*. In all, this appendage is slender with the propodus nearly three times as long as broad at midlength, bearing 1–3 rows of spines on the mesial surface. The dactylus is also slender, over half the length of the propodus, often with a tuberculate or dentate dorsal border and with tubercles both externally and mesially. The similarity in the pereopod 1 may be related to ecology but this is unknown.

The existence of two types of males in upogebids has been reported in *Upogebia pugnax* De Man, 1905 (Ngoc-Ho, 1991), *U. edulis* Ngoc-Ho and Chan, 1992. Usually males of both types come from the same locality. Only in *G. priochela* are they imperfectly geographically separated. Most males of the 'stout type' were collected on the North-west Shelf but three were taken in Queensland with males of the 'slender type'. Preserved in 75% alcohol, western specimens have a whitish and firm carapace while it is pink-brown and softer in most eastern ones. This difference in colour and firmness of the carapace may be due to habitat or fixation conditions.

Some specimens of *G. priochela* were collected on the North-west Shelf with a surface dip net at 0100 h where the water was 50 m deep. They were probably attracted to the surface by light and the water depth indicates that they are capable of effective swimming.

Upogebia Leach, 1814

Upogebia anacanthus sp. nov.

Figure 9

Material examined. Holotype. Queensland, NE of Townsville (18°43'S, 146°45'E), 34 m, muddy sand, dredge, G. C. B. Poore and H. M. Lew Ton on RV *The Harry Messel*, 24 Nov 1982 (stn AIMS 4), NMV J22668 (male juv., cl. 3 mm, tl. 7.5 mm).

Paratype. Type locality, MNHN-Th 1253 (male juv. cl. 2.5 mm, tl. 6 mm).

Other material. Pandora Reef (18°49'S, 146°26'E), deep

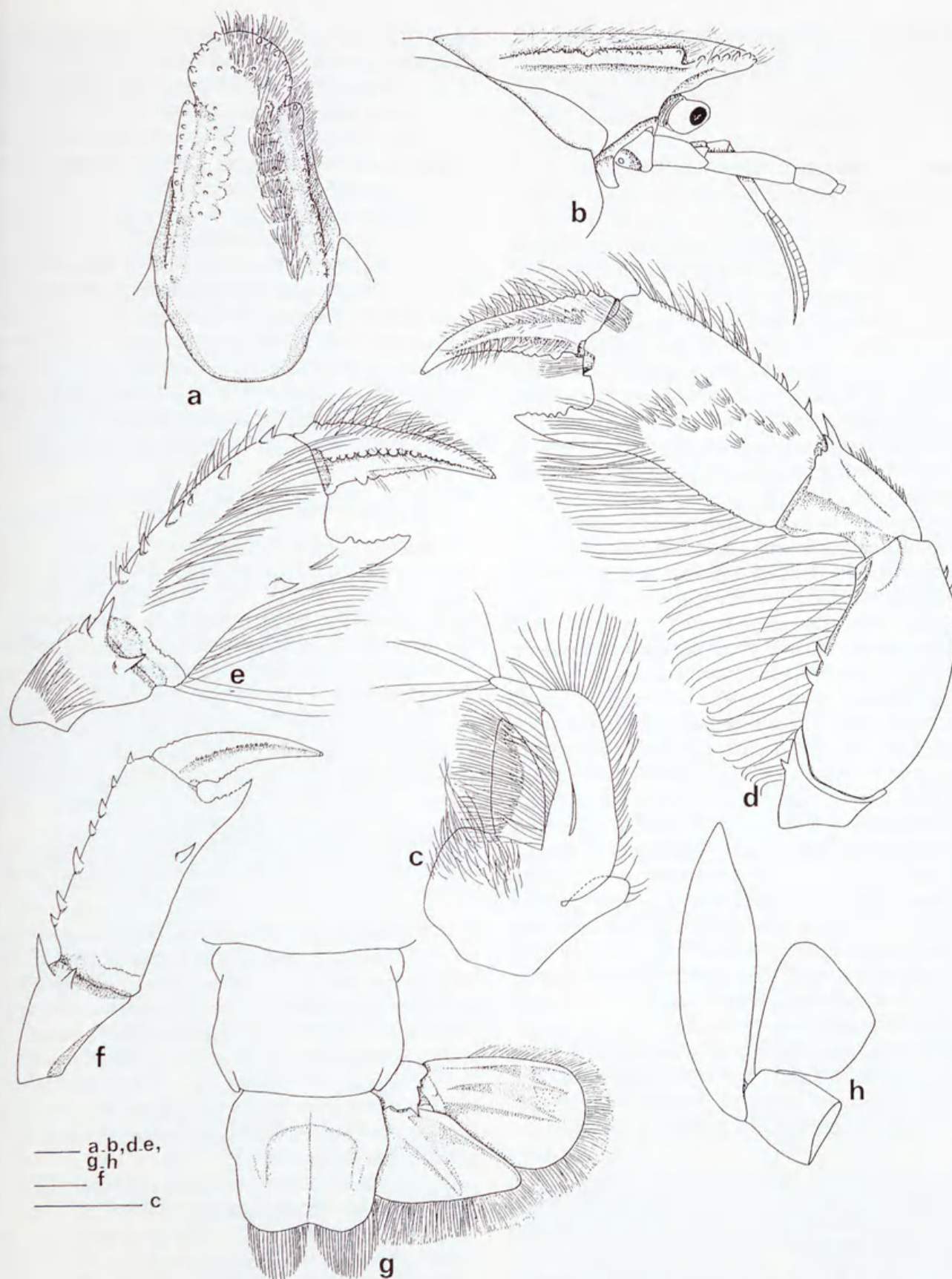


Figure 10. *Upogebia giralia* Poore and Griffin. Male, tl. 31.5 mm: a-e, h. Male, tl. 29.5 mm: g. Female, tl. 31 mm: f (MNHN-Th 1249).

a, b, anterior part of carapace in dorsal and lateral view; c, maxilliped 1; d, pereopod 1, external view; e and f, distal articles of same, mesial view; g, telson and left uropod; h, pleopod 2.

Scale lines: 1 mm.

leeward slope, 12 m, sediment cover, epifauna scarce, M. Riddle, corer, Feb 1986, NMV J22670 (5 juv. without P1, cl. 2–2.5 mm, tl. 5–6 mm); 10 m, transition between coral and sediment, May 1986, NMV J22671 (2 juv. without P1, cl. 2 mm, tl. 5 mm and 6 mm).

Description. Rostrum rounded apically, about 1.5 times as long as broad at base and twice as long as eye-stalk; lateral margins tapering distally, unarmed; fine longitudinal median groove on dorsal surface. Gastric region also unarmed, lateral grooves long and fine, lateral ridges terminating in small distal spinule in holotype, unarmed in paratype. Anterolateral border of carapace with 2 spinules. Cervical groove moderately deep with lateral spinule on each side; linea thalassinica invisible.

Antennule: peduncle unarmed. Antenna: peduncular article 1, 3 and 4 bearing 1–2, 2 and 3 spinules respectively.

Epistome with 2 spinules at apex.

Maxillipeds 1–3 with epipod; exopod of maxillipeds 2 and 3 (figs 9f, 9g), unusual in family, provided only with basal article and without flagellum.

Pereopod 1 subcheliform and slender. Ischium with 2 ventral spinules. Dorsal subdistal and 6–7 ventral spines on merus. Carpus bearing small ventral subdistal, 2 large mesial subdistal spines and 3 spinules along dorsal margin. Propodus more than 4 times as long as broad, mesial surface with 5 spines on dorsal margin, larger ones proximally, and distal spinule near articulation with dactylus; fixed finger about quarter length of dactylus, slender, tip upturned, cutting edge unarmed. Dactylus two-thirds as long as propodus with faint longitudinal dorsal groove on external surface, unarmed.

Pereopod 2: merus with 2 dorsal subdistal and 6 ventral spinules. Carpus bearing dorsal and ventral distal spinule.

Telson approximately square, posterolateral angles rounded and posterior margin nearly straight; very faint inverted U-shaped carina and faint longitudinal median groove on dorsal surface.

Uropod: exopod longer than telson, posterior border rounded, endopod approximately triangular, protopod with rounded tubercle.

Etymology. The species name refers to the absence of teeth or spines from the rostrum.

Remarks. In the shape of its rostrum and pereopod 1, *Upogebia anacanthus* is similar to *U. contigua* Bozic and de Saint Laurent, 1972 from the

Gulf of Guinea. It differs from the latter species in having more spines on the anterolateral border of the carapace and on the propodus of pereopod 1. Besides, the exopods of maxillipeds 1 and 3 have no flagellum in *U. anacanthus* and its uropods are hardly longer than the telson whilst they are nearly twice the length of the telson in *U. contigua*.

This new taxon has characteristics bringing it near to *Gebiacantha* Ngoc-Ho. These are the spination of the anterolateral border of carapace and antennal peduncle and also the shape of pereopod 1 and uropods. Nevertheless, *U. anacanthus* has no infrarostral spines and can be differentiated from species of *Gebiacantha* by the absence of a flagellum on maxillipeds 2, 3 and by its quadrate telson with a nearly straight posterior margin.

Upogebia giralia Poore and Griffin

Figure 10

Upogebia giralia Poore and Griffin, 1979: 297, fig. 49.

Material examined. Holotype. Western Australia, Learmonth, mangroves, A. M. Douglas and G. F. Mees, 20 May 1960, WAM 123–75 (male, broken, cl. 14 mm).

Paratype. Same locality, WAM 124–75 (female, cl. 6 mm).

Other material. Queensland. Harmer Creek (11°50'S, 142°57'E), P. Davie and J. Short, 31 Oct 1990, QM W16830 (7 males, cl. 7–10 mm, tl. 18.5–30 mm; 9 females, 2 ovig., 1 without abdomen, cl. 7–10 mm, tl. 20–30 mm); MNHN-Th 1249 (2 males, cl. 10–12 mm, tl. 29.5–31.5 mm; 2 ovig. females, cl. 10–10.5 mm, tl. 30–31 mm).

Northern Territory. Mickitts Creek, near Darwin, in thick mud, P. Davie, 30 Jun 1982, QM W10906 (1 male broken, cl. 7 mm, 1 female broken, cl. 12 mm).

Description. Rostrum broadly rounded anteriorly, slightly longer than broad at base and twice as long as eye stalk, with 5–6 small spiniform teeth on each lateral side; dorsal surface with few tubercles. Gastric region with small tubercles alongside shallow and narrow lateral grooves; fine lateral ridges bearing 13–14 tubercles. Cervical groove deep, linea thalassinica extending to posterior border of carapace. Anterolateral border of carapace unarmed.

Antennule and antenna, peduncle unarmed.

Mandible without anteromesial tooth.

Maxilliped 1 (fig. 10c) with large epipod.

Maxilliped 3 without epipod.

Paired arthrobranches of type C, with 2 tubular filaments on each side of rachis on maxilliped 3 to pereopod 4; single pleurobranch on thoracic segment of pereopod 5.

Pereopod 1: Ischium with ventral spine. Merus bearing 1 or (seldom) 2 dorsal subdistal and 2–4

ventral spines. Carpus with fine longitudinal groove on upper part of external surface and 4 subdistal spines: large dorsal, large mesial and 2 smaller external. Propodus nearly twice as long as broad, stouter and more dilated distally in males than in females with few external rounded tubercles on proximal half of ventral border; distal spine, sharp or obtuse, on external surface between base of fixed finger and dactylus; mesial surface with row of 6–7 dorsal spines and large ventral spine behind fixed finger; fixed finger about half length of dactylus, with 4–6 rounded teeth on cutting edge, larger ones proximally. Dactylus approximately two-thirds as long as propodus, with 3–4 dorsal tubercles, few proximal denticles externally and median tuberculate carina on mesial surface; cutting edge dentate in median part.

Pereopod 2 with dorsal subdistal spine on merus.

Pleopods 2–5: exopod slender, lanceolate; endopod approximately quadrate and two-thirds as long as exopod.

Telson about 1.2 times as broad as long, lateral border convex proximally, posterolateral angles rounded, posterior border concave in median part; very faint inverted U-shaped carina and fine median groove on dorsal surface.

Uropod: endopod trapezoidal; exopod longer than telson, posterior border rounded; protopod with spinule hanging over endopod.

Distribution. Northern Australia from north-west Western Australia, Northern Territory to Northern Queensland.

Remarks. Poore and Griffin (1979) compared *Upogebia giralia* with *U. dromana* Poore and Griffin, 1979, also from Australia as both species have obsolete lateral ridges of the carapace. This species was also considered similar to *U. osiridis* Nobili, 1904 from the Red Sea in the shape of its rostrum.

U. giralia is at present the only known Australian species of *Upogebia* provided with a pleurobranch on the eighth thoracic segment (pereopod 5). Besides this characteristic, it has also pleopods (fig. 10h) whose quadrate endopod has never been reported in Australian upogebiids. The usual morphology of the pleopod in the Upogebiidae is depicted in fig. 7g. Another feature worth being pointed out is the presence of asymmetrical pereopods 1 in a male of tl. 28.5 mm. Its right appendage, much smaller than the left, is probably regenerated, and that is very rarely found in the Upogebiidae. It would seem

that these burrowing crustaceans can hardly survive, even temporarily, with a single cheliped.

U. giralia belongs to a group of six upogebiid species characterised by the presence of a pleurobranch on the thoracic segment of the fifth pereopod. They are: *U. africana* (Ortmann, 1894), *U. allobranchus* Ngoc-Ho, 1991, *U. capensis* (Krauss, 1843), *U. giralia* Poore and Griffin, 1979, *U. lenzrichtersi* Sakai, 1982, and *U. stellata* (Montagu, 1808). Their other common characters are: two arthrobranchs, each with two filaments on each side of the rachis (type C, see Ngoc-Ho, 1981) on maxilliped 3 to pereopod 4; mandible with a small mesioanterior tooth or unarmed; epipod on maxillipeds 2–3 or 1–2; pereopod 1 subcheliform; telson slightly broader than long, weakly concave medially; endopod of uropod trapezoidal; exopod with more or less rounded posterior border, a little longer than telson, protopod with a spinule.

On the basis of the epipods on maxillipeds, these species can be divided into two groups:

1. Species without or with a minute (and disregarded) epipod on maxilliped 1, with an epipod on maxillipeds 2 and 3. These include: *U. africana*, *U. allobranchus*, *U. capensis*, *U. lenzrichtersi*, *U. stellata*. They also share the presence of a spine on the anterolateral border of the carapace and the scale of the antenna terminating in a spinule.

2. Species with a large epipodial lobe on maxilliped 1, without epipod on maxilliped 3. *U. giralia* is at present the only known species of this group. It has no spine on the anterolateral border of the carapace and its antennal scale is unarmed apically. This species has also pleopods with an endopod of unusual quadrangular shape.

Sakai (1982: 105) stated *U. giralia* should be placed in the genus *Wolffogebia* Sakai. Study of new materials of *W. phuketensis* and *W. inermis* has discovered supplementary characters of *Wolffogebia*. (Ngoc-Ho, 1994). *U. giralia* shares with these two:

- 1, absence of a median longitudinal groove on the rostrum;

- 2, absence of a spine on the anterolateral margin of the carapace together with a subcheliform pereopod 1; and

- 3, a large epipodial lobe on maxilliped 1, maxilliped 3 without epipod.

Differences are:

- 1, the rostral median carina (very slight in *W. phuketensis*, type species, and in *W. inermis*) is absent in *U. giralia* and replaced by a narrow longitudinal non-setose area;

2, maxillipeds 2 and 3 with an exopod of usual morphology, terminating in a short flagellum (exopod of maxillipeds 2 and 3 without a flagellum in *W. phuketensis* and *W. inermis*);

3, arthrobranch of type C with double series of small filaments on each side of the rachis (of type A with a single series of large lamellae on each side of the rachis); and

4, pleurobranch on thoracic segment of pereopod 5 (pleurobranch absent).

Differences in maxillipeds 2 and 3 morphology, in the structure of the arthrobranches and especially in the possession of an extra pleurobranch on pereopod 5 are considered of great evolutionary importance and separate *U. giralia* from other species of *Wolffoebia*. *U. giralia* is more likely to take its place within the small group of six *Upoebia* species mentioned above. Nevertheless, absence of median rostral groove and the unusually coupled characters, subcheliform pereopod 1 and anterolateral border of carapace unarmed, suggest similarity of *U. giralia* and others of the group to *Wolffoebia*.

Upoebia tractabilis (Hale)

Figure 11

Upoebia (*Calliadne*) *tractabilis* Hale, 1941: 276–277, fig. 11. — Poore and Griffin, 1979: 307–309, fig. 55.

Upoebia (*Upoebia*) *tractabilis*. — Sakai, 1982: 16–17, figs 1e, 2c–e.

Upoebia tractabilis. — Sakai, 1993: 91.

Material examined. Holotype. South Australia, St Vincent Gulf, SAMA C888 (ovig. female, cl. 7 mm, tl. 21 mm much damaged, broken into two pieces).

Other material. Same locality, SAMA C4103 (14 males, cl. 2.5–5.5 mm, tl. 7–14.5 mm, 20 females, 11 ovig., cl. 4–6 mm, tl. 9.5–17.5 mm); MNHN-Th 1266 (1 male, cl. 4.5 mm, tl. 13 mm, 2 ovig. females, cl. 5 mm and 5.5 mm, tl. 15 mm and 16 mm).

Queensland. South side of Seaforth I. (20°28'S, 149°02'E), subtidal in staghorn coral, P. Davie and J. Short, 24 Mar 1987, QM W14407 (1 female juv., cl. 3 mm, tl. 8.5 mm).

Description. Rostrum triangular, short, about half as long as broad at base and hardly reaching extremity of eye, with median groove and 4–5 spinules on each lateral border. Gastric region bearing small rounded tubercles with most alongside shallow lateral grooves; lateral ridges each with distal spinule and 7–12 spiniform tubercles. Anterolateral border of carapace unarmed. Cervical groove moderately deep and linea thalassinica invisible posterior to it.

Maxilliped 1 (fig. 11e) with exopod flattened distally bearing setae of 2 lengths, the longer on external border; epipod absent.

Maxilliped 2 (fig. 11f) with minute epipod standing upright on coxa bearing 1 or 2 setae.

Maxilliped 3 without epipod.

Pereopod 1 cheliform. Ischium with 0–1 ventral spine; 4–8 ventral spines and spinules on merus. Carpus with ventral spine and dorsal subdistal spinule on mesial surface. Propodus, about twice as long as broad, often with small subdistal spinule on upper border; fixed finger slender, unarmed. Dactylus, about half length of propodus, with incurved tip and 4–6 denticles in median part of cutting edge.

Telson longer than sixth abdominal segment and approximately as long as broad; posterior border rounded in juvenile specimen from Queensland (fig. 11c), slightly convex in others, faint inverted U-shaped carina dorsally.

Uropod: endopod shorter than telson, posterior margin nearly straight; exopod slightly longer than telson, with proximal spinule, posterior margin rounded; protopod also with spinule.

Distribution. Australia (St Vincent Gulf and Queensland).

Remarks. The holotype of *U. tractabilis* was examined with material captured at the same time by Hale, and a few figures are (figs 11d, 11e, 11f) added to those given in the original description (Hale, 1941: fig. 11). There is a mistake in the lettering of Hale's fig. 11c and 11d which should be inverted. Fig. 11c actually represents 'the inner view of the left chela' on which the mesiodistal spine of the carpus is visible. The outer view of the same cheliped is here depicted in fig. 11d.

Hale reported the presence of a subdistal spine on the upper border of the cheliped propodus which can be seen in the holotype (with some difficulty on the left which is slightly damaged at that level) and is often present in the other material captured at the same locality (SAMA C 4103).

The Queensland specimen studied agrees with the holotype and Hale's other material in spite of the rounded posterior border of the telson which is probably due to its young age. It especially agrees in the uncommon morphology of maxilliped 1 whose exopod is slightly flattened distally with setae of two lengths and maxilliped 2 whose epipod is small and not folded laterally as compared with what is usually reported in the family, e.g. in *U. laemanu* (fig. 12d).

Another species with similar maxillipeds 1 and 2 (epipod on maxilliped 2 is here slightly larger) and coming from a nearby area is the New Caledonian *U. stenorhynchus* Ngoc-Ho (1991:

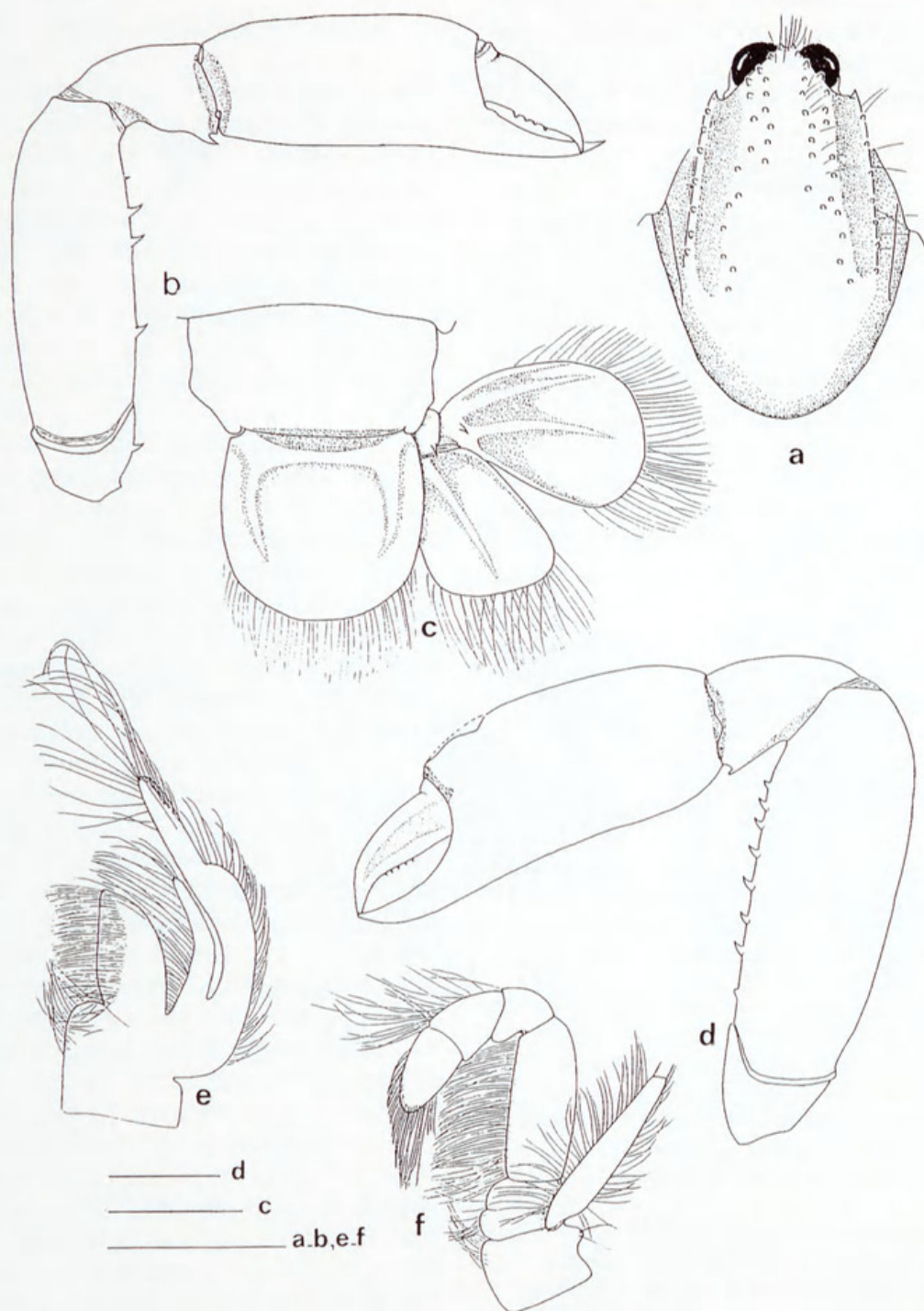


Figure 11. *Upogebia tractabilis* Hale. Female juv., tl. 8.5 mm (QM W14407): a–c. Holotype, ovig. female (SAMA C888): d. Ovig. female, tl. 15 mm (MNHN-Th 1266): e, f.

a, anterior part of carapace, dorsal view; b and d, pereopod 1, external view; c, telson and right uropod; e and f, maxilliped 1 and 2 respectively.

Scale lines: 1 mm.

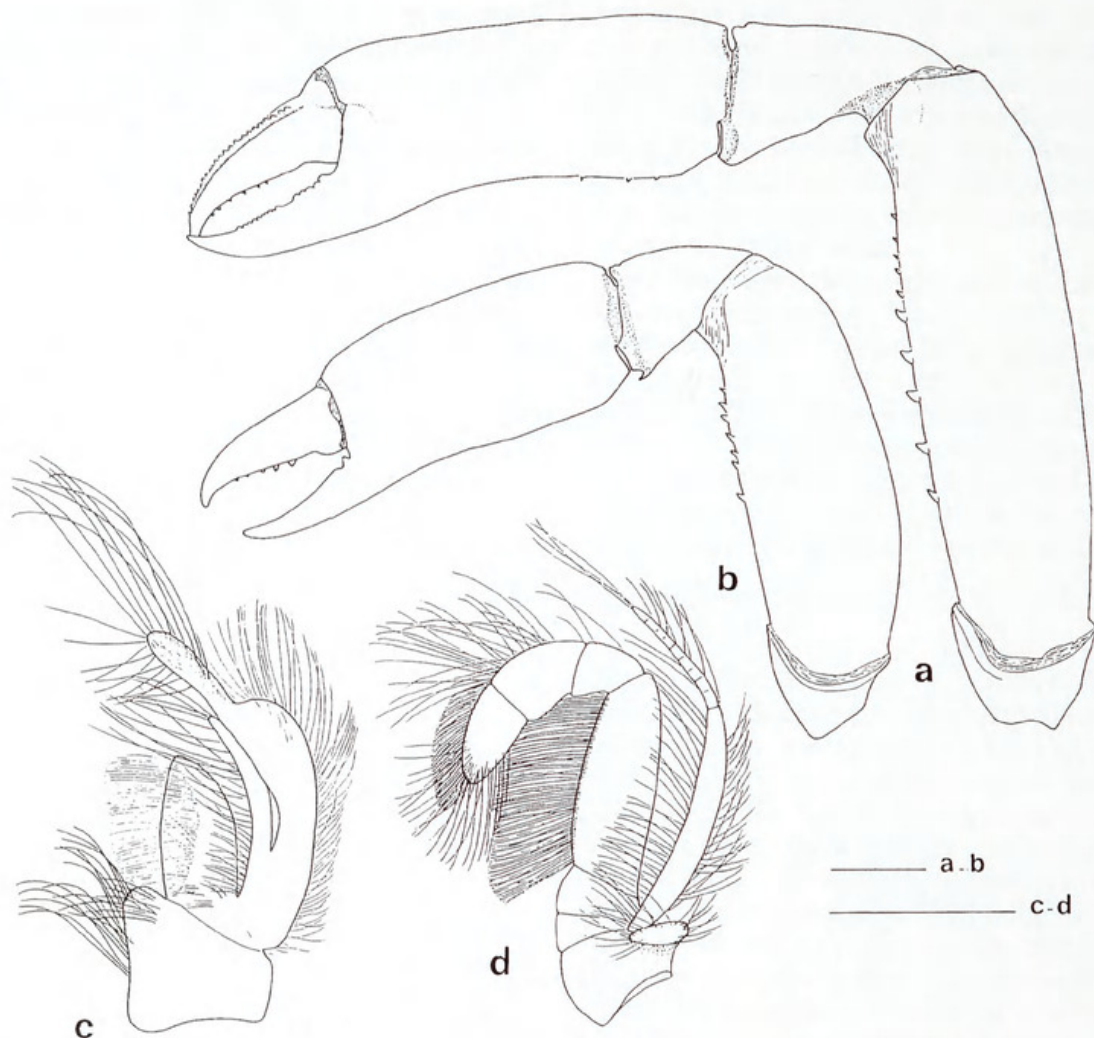


Figure 12. *Upogebia balmaorum* Ngoc-Ho. Paratype, ovig. female, tl. 32.5 mm (MNHN-Th 1064): a, pereopod 1, external view.

Upogebia laemanu Ngoc-Ho. Paratype, ovig. female, tl. 24.5 mm (MNHN-Th 906): b, pereopod 1, external view; c and d, maxilliped 1 and 2 respectively.

Scale lines: 1 mm.

307, fig. 11). It is similar to *U. tractabilis* in all cephalic appendages, the three maxillipeds and uropods. They differ in:

1, rostrum longer and narrower in *U. stenorhynchus*;

2, different spinulation of male pereopod 1: lower border of merus with spinules or granules in *U. stenorhynchus* (with spines in *U. tractabilis*); propodus with ventral tubercles (smooth); fixed finger with 6–7 teeth on proximal half (unarmed); dactylus with a proximal dorsal tooth, another proximal tooth on cutting edge, mesial surface with a median row of rounded tubercles (smooth upper border, 2–4 teeth in median part of cutting edge, mesial surface unarmed); and

3, telson with rounded posterior border (with nearly straight posterior border in adults).

Sakai (1993) synonymised *U. balmaorum* Ngoc-Ho, 1990 and *U. laemanu* Ngoc-Ho, 1990 from the Seychelles with *U. tractabilis*. These three are apparently closely related but comparison of the type material of *U. tractabilis* with those of the two Seychelles' species confirms their distinctiveness. Table I in Ngoc-Ho (1990) gave the main differentiating characters between the three; the following can be added.

Fig. 11d and Figs 12a, 12b represent pereopods 1 of the holotype of *U. tractabilis* (tl. 21 mm) and paratypes of *U. balmaorum* (tl. 32.5 mm), *U. laemanu* (tl. 24.5 mm), all ovigerous females. They show that pereopod 1 of *U. balmaorum* is much more slender, has numerous ventral meral spines, an unarmed carpus and distinctive spinulation on its dactylus and fixed finger. More similarity can be found between pereopods 1 of the two other species, but *U. tractabilis* can be differentiated from *U. laemanu* and *U. balmaorum* on the maxilliped 2 as shown below.

All three possess a maxilliped 1 (fig. 11e, 12c) without epipod and an unusual exopod slightly enlarged distally and bearing setae of two lengths. Maxilliped 2 in both *U. balmaorum* and *U. laemanu* (fig. 12d) has the ordinary morphology of most upogebioid species, especially the relatively large epipod folded laterally and provided with numerous setae. In contrast, maxilliped 2 in *U. tractabilis* (fig. 11f) has a shape so far reported in very few species, that is, its minute unfolded epipod bears almost no setae.

As stated previously (Ngoc-Ho, 1989), variation in upogebioid mouth appendages or branchial structure is probably of evolutionary significance and can be of taxonomic value. The difference in the maxilliped 2 morphology, i.e., the quasi-

absence of an epipod on maxilliped 2 of the Australian species, is likely to show that *U. tractabilis* on the one hand and *U. balmaorum* and *U. laemanu* on the other are in different phylogenetic groups. It is therefore concluded that *U. tractabilis*, *U. laemanu* and *U. balmaorum* are distinct species.

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References

- Borradaile, L.A., 1903. On the classification of the Thalassinidea. *Annals and Magazine of Natural History* (7)12: 534–551.
- Bouvier, E.-L., 1915. Thalassinidés nouveaux capturés au large des côtes soudanaises par le 'Talisman'. *Bulletin du Muséum national d'Histoire naturelle*, 21(6): 182–185.
- Bozic, B. and de Saint Laurent, M., 1972. Description et position systématique d'*Upogebia contigua* sp. nov. du golfe de Guinée (Crustacea Decapoda Callianassidae). *Bulletin du Muséum national d'Histoire naturelle* (3e série), 35 (Zoologie 29): 339–346, figs 1–10.
- Dana, J.D., 1852. Macroura. Conspectus Crustaceorum and Conspectus of the Crustacea of the Exploring Expedition under Capt C. Wilkes, U.S.N. *Proceedings of the Academy of Natural Sciences of Philadelphia* 6: 10–28.
- De Man, J.G., 1888. Bericht über die im Indischen Archipel von Dr. J. Brock gesammelten Decapoden und Stomatopoden. *Archiv für Naturgeschichte* 53: 215–600, pls 7–22a.
- De Man, J.G., 1905. Diagnoses of new species of macrurous decapod Crustacea from the 'Siboga Expedition'. *Tijdschrift der Nederlandsche dierkundige vereeniging* 9(2): 587–614.
- De Man, J.G., 1928. The Decapoda of the Siboga Expedition. Part VII. The Thalassinidae and Callianassidae collected by the Siboga-Expedition with some remarks on the Laomedidae. *Siboga Expeditie* 39a6: 1–187, pls 1–20.
- Hale, H.M., 1941. Decapod Crustacea. *B.A.N.Z. Antarctic Research Expedition 1929–1931 Report B*, 4(9): 257–285, figs 1–16, pl. 3.
- Krauss, F., 1843. *Die Sudafricanischen Crustaceen*. Stuttgart. pp. 68, pls 4.
- Leach, W.E., 1914. Crustaceology in Brewster, D. (ed.), *Edinburgh Encyclopaedia* 7(2): 385–437.

- Manning, R.B., 1987. Notes on Western Atlantic Callianassidae (Crustacea: Decapoda: Thalassinidea). *Proceedings of the Biological Society of Washington* 100(2): 386–401.
- Manning, R.B. and Felder, D.L., 1991. Revision of the American Callianassidae (Crustacea: Decapoda: Thalassinidea). *Proceedings of the Biological Society of Washington* 104(4): 764–792.
- McNeil, F.A., 1968. Crustacea, Decapoda and Stomatopoda. *Great Barrier Reef Expedition 1928–29, Scientific Reports* 7(1): 1–98, figs 1–2, pls 1–2.
- Montagu, G., 1808. Description of several marine animals found in the south coast of Devonshire. *Transactions of the Linnean Society, London* 9: 81–114, pls 2–8.
- Ngoc-Ho, N., 1981. A taxonomic study of the larvae of four thalassinid species (Decapoda, Thalassinidea) from the Gulf of Mexico. *Bulletin of the British Museum (Natural History) (Zoology)* 40(5): 237–273, figs 1–17.
- Ngoc-Ho, N., 1989. Sur le genre *Gebiaca* gen. nov. avec la description de cinq espèces nouvelles (Crustacea, Thalassinidea, Upogebiidae). *Bulletin du Muséum national d'Histoire naturelle* 11(4), (section A): 117–145, figs 1–9.
- Ngoc-Ho, N., 1990. Nine Indo-Pacific species of *Upogebia* Leach (Crustacea: Thalassinidea: Upogebiidae). *Journal of Natural History* 24: 965–985.
- Ngoc-Ho, N., 1991. Sur quelques Callianassidae et Upogebiidae de Nouvelle-Calédonie (Crustacea, Thalassinidea). Pp. 281–311, figs 1–11 in Richer de Forges, B. (ed.), *Le benthos des fonds meubles des lagons de Nouvelle-Calédonie*. Vol. 1. ORSTOM Editions: Paris.
- Ngoc-Ho, N., 1994. Notes on some Indo-Pacific Upogebiidae with description of four new species. *Memoirs of the Queensland Museum* in press.
- Nobili, G., 1904. Diagnoses préliminaires de vingt-huit espèces nouvelles de stomatopodes et de décapodes macroures de la Mer Rouge. *Bulletin du Muséum d'Histoire naturelle* 5: 228–237.
- Ortmann, A.E., 1894. Crustaceen. In: Semon, R., *Zoologische Forschungsreisen in Australien und dem Malayischen Archipel*. *Denkschriften der Medicinisch-naturwissenschaftlichen Gesellschaft zu Jena* 8: 1–80, pls 1–13.
- Poore, G.C.B., 1982. *Upogebia niugini* (Crustacea) a new shrimp from Papua New Guinea. *Proceedings of the Royal Society of Victoria* 94(4): 169–172, figs 1, 2.
- Poore, G.C.B. and Griffin, D.J.G., 1979. The Thalassinidea (Crustacea: Decapoda) of Australia. *Records of the Australian Museum* 32(6): 217–321, figs 1–56.
- Sakai, K., 1967. Three new species of Thalassinidea (Decapoda Crustacea) from Japan. *Researches on Crustacea* 3: 39–51, pls 3–5.
- Sakai, K., 1982. Revision of Upogebiidae (Decapoda, Thalassinidea) in the Indo-West Pacific Region. *Researches on Crustacea, Special Number* 1: 1–106, figs 1–20, pls A–G.
- Sakai, K., 1984. Some thalassinideans (Decapoda: Crustacea) from Heron Is., Queensland, eastern Australia, and a new species of *Gourretia* from East Africa. *The Beagle* 1(11): 95–108, figs 1–7.
- Sakai, K., 1988. A new genus and five new species of Callianassidae (Crustacea: Decapoda: Thalassinidea) from Northern Australia. *The Beagle* 5(1): 51–69.
- Sakai, K., 1993. On a collection of Upogebiidae (Crustacea, Thalassinidea) from the Northern Territory Museum, Australia, with the description of two new species. *The Beagle* 10(1): 87–114.
- Saint Laurent, M. de, 1973. Sur la systématique et la phylogénie des Thalassinidea: définition des familles des Callianassidae et des Upogebiidae et diagnose de cinq genres nouveaux (Crustacea Decapoda). *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences (série D)* 277: 513–516.
- Saint Laurent, M. de and Ngoc-Ho, N., 1979. Description de deux espèces nouvelles du genre *Upogebia* Leach, 1814 (Decapoda, Upogebiidae). *Crustaceana* 37(1): 57–70, figs 1–40.
- Schmitt, W.L., 1935. Mud shrimps of the Atlantic coast of North America. *Smithsonian Miscellaneous Collections* 93(2): 1–21, pls 1–4.



1994. "Some Callianassidae and Upogebiidae from Australia with description of four new species (Crustacea: Decapoda: Thalassinidea)." *Memoirs of the Museum of Victoria* 54, 51–78.

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