

A re-description of *Periclimenaeus robustus* Borradaile, the type species of the genus *Periclimenaeus* Borradaile, 1915 (Crustacea: Decapoda: Pontoniinae)

Alexander J. BRUCE

Crustacea Section, Queensland Museum, P.O. Box 3300,
South Brisbane, Queensland, Australia 4101
E-mail: abruce@broad.net.au

Abstract: The type material of the pontoniine shrimp *Periclimenaeus robustus* Borradaile, 1915, is re-examined and the specimens re-described and illustrated. This species is the type species of the genus *Periclimenaeus* Borradaile, 1915, the second most speciose pontoniine genus, and is known only from the type material, which is now found to consist of two *Periclimenaeus* species.

Resumé : Une redescription de *Periclimenaeus robustus* Borradaile, l'espèce type du genre *Periclimenaeus* Borradaile, 1915 (Crustacea: Decapoda: Pontoniinae). Le matériel type de la crevette pontoniinae *Periclimenaeus robustus* Borradaile, 1915, est réexaminé et les spécimens sont re-décrits et illustrés. Cette espèce est l'espèce type du genre *Periclimenaeus* Borradaile, 1915, le deuxième genre de pontoniine avec le plus d'espèces et n'est connue que par le matériel type, qui apparaît maintenant constitué de deux espèces de *Periclimenaeus*.

Keywords: *Periclimenaeus robustus* Borradaile, 1915; Palaemonidae, Pontoniinae, Type material re-described.

Introduction

In 1915 L.A. Borradaile designated a new genus, *Periclimenaeus*, and described a new species of pontoniine shrimp from the Amirante Islands in the Indian Ocean, *Periclimenaeus robustus*, collected during the Western Indian Ocean Expeditions of Prof. J. Stanley Gardiner (Borradaile, 1915). The generic description was short and described mainly non-generic characters. His description of the species was even shorter, two and a half lines, and un-

illustrated, but did record the main morphological character of the genus, the fingers of the major second pereopod.

In 1917 Borradaile provided a more detailed description and illustrated the major features of the species. His figures included the general habitus, dorsal carapace and antennae, maxillae and maxillipeds: there were no figures of the ambulatory pereopods (Borradaile, 1917). There has been only a single further report of this species (Bruce, 1976), which provided no further details of the morphology. A further examination reveals this taxon to be distinct.

Periclimenaeus is the second most speciose genus of the Pontoniinae, with about 47 Indo-West Pacific species. Most species, whose hosts are known, are associates of sponges but many are found in association with colonial ascidians.

The genus as a whole may have a paraphyletic origin. As the type species of the genus, *Periclimenaeus robustus* is of particular taxonomic importance and the opportunity is now taken to provide a more detailed illustrated account of its morphology.

Re-examination of the type material readily indicated that it consisted of two distinct species. A larger species was clearly identifiable with Borradaile's descriptions and figures and a smaller species, which unfortunately remains unidentifiable.

The type material is held in the collections of the Zoology Museum, Cambridge, U.K., and I am most grateful to Dr R. Preece for the opportunity to examine Borradaile's specimens. Unfortunately the specimens are in poor and incomplete condition.

Abbreviations used: CL, postorbital carapace length; UMZC, University Museum of Zoology, Cambridge, U.K.; QM, Queensland Museum, Brisbane.

Systematics

Family PALAEMONIDAE Rafinesque, 1815

Subfamily Pontoniinae Kingsley, 1878

Genus *Periclimenaeus* Borradaile, 1915

Periclimenaeus robustus Borradaile, 1915

(Figs 1-3)

Periclimenaeus robustus Borradaile, 1915: 213.

Periclimenaeus robustus – Borradaile, 1917: 324, 378, pl. 55, fig. 20; Holthuis, 1952: 131; Bruce, 1984: 146; Müller, 1993: 62; Li, 2000: 134, fig. 161

Periclimenaeus (*Periclimenaeus*) *robustus* – Kemp, 1922: 167.

nec Periclimenaeus robustus – Bruce, 1976: 473

Material

1 ovig. ♀, Amirante Islands, Seychelle Islands, 71 m, UMZC I.9593.1

The specimen is in an incomplete fragmentary state. Carapace and antennae are separated from the thoracic sternites, which are fragmented, and from the abdomen; all mouthparts are missing; one detached incomplete first pereopod, both second pereopods and two ambulatory pereopods and right uropod only are preserved.

Diagnosis

A medium sized *Periclimenaeus*. Rostrum well developed, lamina deep, strongly dentate, dentition 9/0, carapace without supraorbital spines or tubercles; inferior orbital angle distinct; first abdominal tergite with well developed anteromedian lobe; first pereopod slender, carpus shorter

than merus, less than double chela length; major second pereopod large, with well developed dactylar molar process, cutting edge distally entire, and fixed finger with fossa, medial surface of palm spinulate, merus ventrally spinulate; minor second pereopod small, dactyl semicircular, cutting edge convex, entire, tip acute, fixed finger angular with grooved entire cutting edge, palm strongly compressed, ventral margin markedly convex, medial surface densely spinulate, merus ventrally spinulate; ambulatory pereopods with dactyls biunguiculate, corpus with ventral margin entire, propods with paired short stout distoventral spines and ventral spines; uropod with exopod laterally unarmed, with acute tooth and large mobile spine medially; telson with two pairs of small dorsal spines at 0.1 and 0.5 of telson length, posterior spines missing.

Description

A medium sized species of *Periclimenaeus* of subcylindrical body form.

Rostrum (Fig. 1B) well developed, about 0.37 of CL, slightly depressed, straight, reaching to distal margin of intermediate segment of antennular peduncle (Fig. 1A), with stout midrib, dorsal carina well developed, with nine long slender semi-erect distally directed teeth, first tooth situated posterior to orbital margin, increasing in size distally from first tooth to eighth, ninth tooth slightly smaller than eighth, reaching to level of stout acute rostral tip, proximal dorsal margin of teeth with 2-3 long slender simple setae, lateral carinae obsolete, ventral margin straight, un-armed, non-setose. Carapace glabrous, smooth, without supraorbital spines or tubercles (Fig. 1A), inferior orbital angle distinct, small, antennal spine well developed, acute, marginal, anterolateral angle bluntly rectangular, not produced.

Abdomen with large semicircular anteromedian dorsal lobe on first tergite (Fig. 1GH). Posterior segments normal, pleura broadly rounded, sixth segment with posteroventral angle large, subacute.

Telson (Fig. 1I) about 0.57 of CL, 2.1 times longer than anterior width, with two pairs of small dorsal spines, about 0.1 of telson length, at about 0.1 and 0.5 of telson length, lateral margins feebly convex, converging to rounded posterior margin, about 0.4 of anterior width, posterior marginal spines mainly missing, lateral spines about half length of dorsal spines, submedian spine robust, broken.

Antennule (Fig. 1D) normal, without special features; proximal segment of peduncle with well developed distolateral tooth, reaching to half length of intermediate segment, stylocerite short, broad, acute, reaching to half segment length; intermediate and distal segments short, subequal, combined length about half proximal segment length, upper flagellum biramous, with four proximal segments fused, short ramus with two free segments.

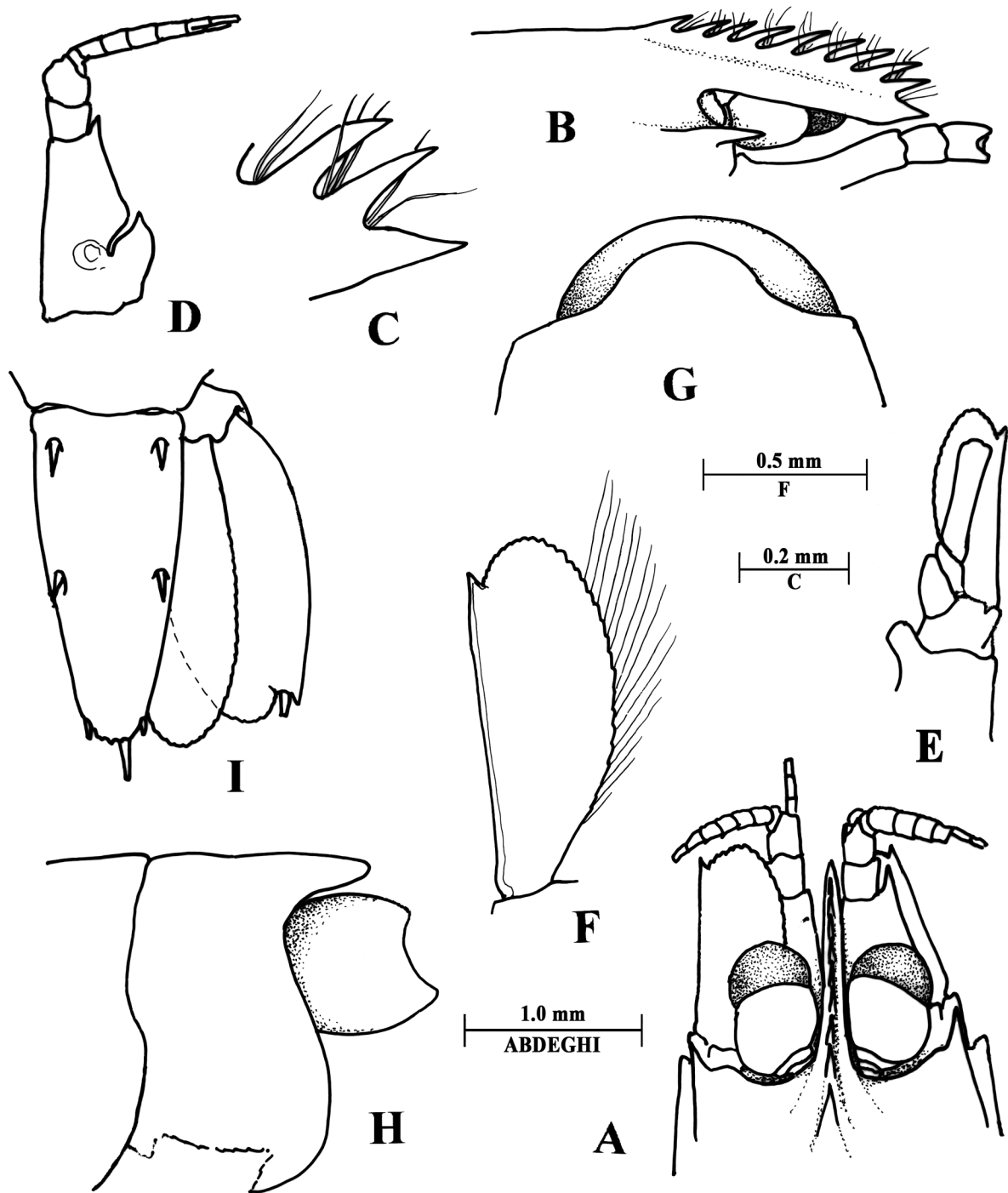


Figure 1. *Periclimenaeus robustus* Borradaile, ovigerous female holotype. **A.** Anterior carapace, rostrum and antennae, dorsal. **B.** Rostrum and orbital region, lateral. **C.** Distal rostral teeth. **D.** Antennule. **E.** Antenna. **F.** Scaphocerite. **G.** First abdominal tergite, dorsal. **H.** Same, lateral. **I.** Telson and right uropod.

Figure 1. *Periclimenaeus robustus* Borradaile, holotype femelle ovigère. **A.** Partie antérieure de la carapace, rostre et antennes, vue dorsale. **B.** Rostre et région orbitale, vue latérale. **C.** Dents distales du rostre. **D.** Antennule. **E.** Antenne. **F.** Scaphocérite. **G.** Premier tergite abdominal, vue dorsale. **H.** Idem, vue latérale. **I.** Telson et uropode droit.

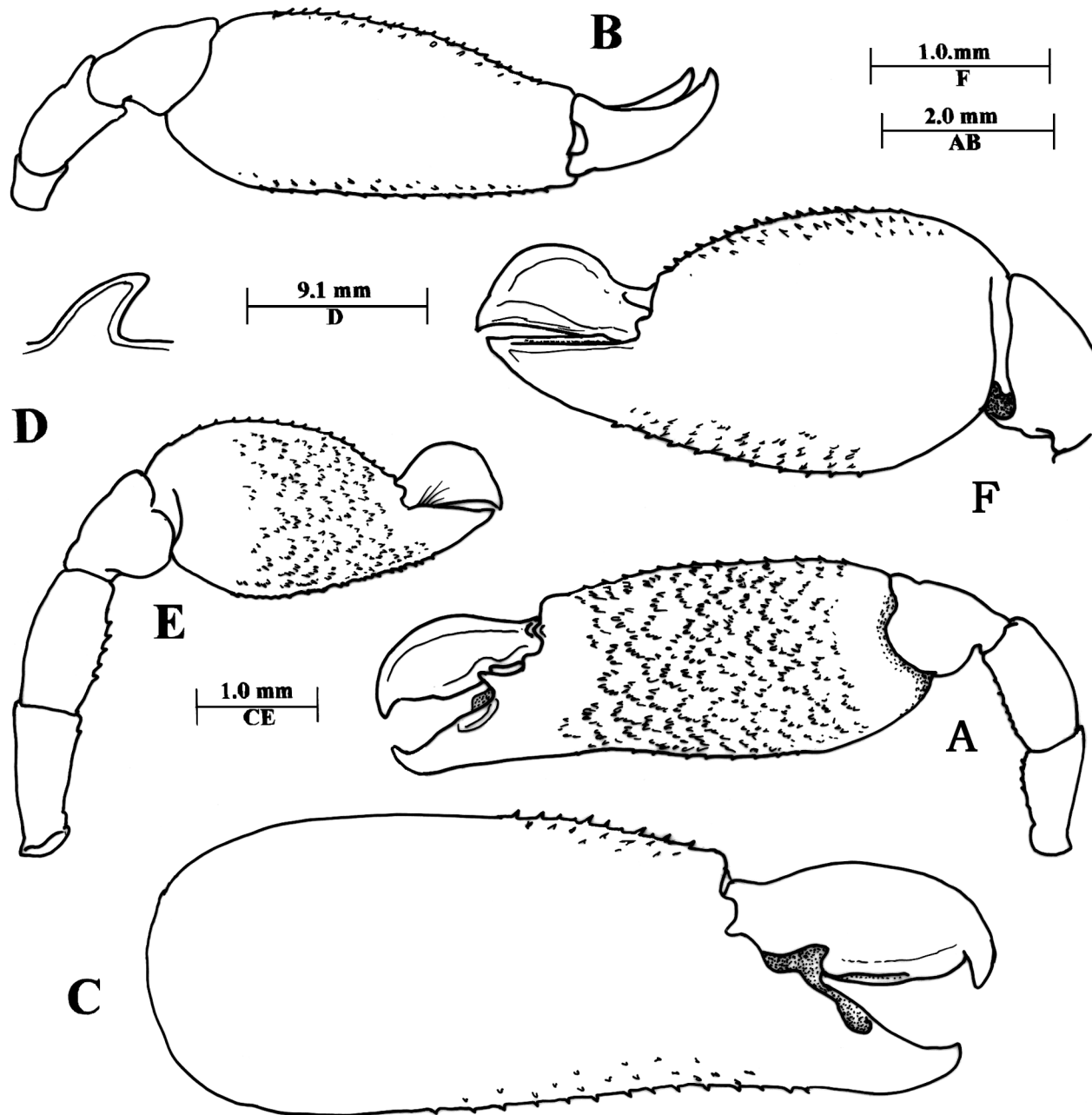


Figure 2. *Periclimenaeus robustus* Borradaile, ovigerous female holotype. A. Major second pereiopod, dorsal. B. Same, lateral. C. Same, chela, ventral. D. Same, palmar spine. E. Minor second pereiopod, dorsal. F. Same, chela, ventral.

Figure 2. *Periclimenaeus robustus* Borradaile, holotype femelle ovigère. A. Second péréiopode principal, vue dorsale. B. Idem, vue latérale. C. Idem, pince, vue ventrale. D. Idem, épine palmaire. E. Second péréiopode mineur, vue dorsale. F. Idem, pince, vue ventrale.

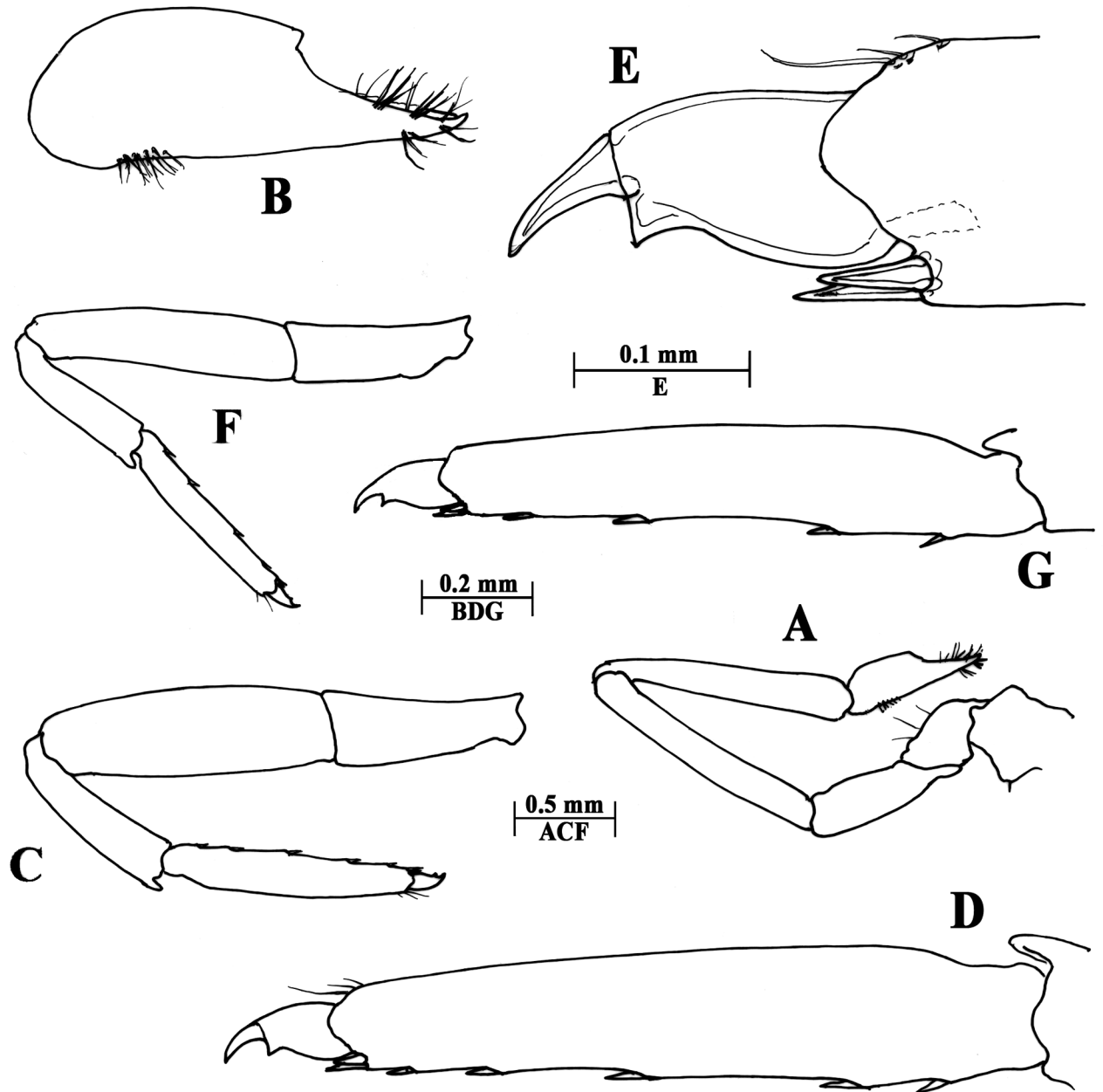


Figure 3. *Periclimenaeus robustus* Borradaile, ovigerous female holotype. A. First pereopod. B. Same, chela. C. Third pereopod. D. Same, propod and dactyl. E. Same, distal propod and dactyl. F. Fourth pereopod. G. Same, propod and dactyl.

Figure 3. *Periclimenaeus robustus* Borradaile, holotype femelle ovigère. A. Premier péréiopode. B. Idem, pince. C. Troisième péréiopode. D. Idem, propode et dactyle. E. Idem, partie distale du propode et dactyle. F. Quatrième péréiopode. G. Idem, propode et dactyle.

Antenna (Fig. 1E) with basicerite unarmed, carpocerite subcylindrical, about four times longer than central width, not reaching distolateral spine of scaphocerite, scaphocerite (Fig. 1F) normal, small, reaching to about middle of distal segment of antennular peduncle, about 2.5 times longer than greatest width, at about half scaphocerite length, with small broad acute distolateral tooth at 0.85 of length.

Eye normal, with well pigmented hemispherical, slightly oblique cornea.

All mouthparts now missing.

First pereopod (Fig. 3A) slender; chela (Fig. 3B) with palm strongly compressed, about twice as long as deep, dorsal margin strongly convex, ventral border straight, with sparse slender cleaning setae proximally, dactylus missing, fixed finger slender, about 0.6 of palm length, not subspatulate, with small hooked tip, cutting edge entire; carpus subcylindrical, about 1.85 times chela length, 8.0 times longer than central width, slightly expanding distally; merus subequal to carpus length, about 6.5 times longer than central width; ischium about 0.6 of merus length; basis and coxa without special features.

Second pereopods well developed, markedly unequal and dissimilar. Major second pereopod (Fig. 2AB) (right) with chela (Fig. 2C) massive, about 1.88 times CL, palm oval in section, twice as long as maximal depth, tapering slightly distally, medial surface and dorsal and ventral margins densely covered by semi-reticulate pattern of small acute distally directed tubercles (Fig. 2D); fingers up-curved (Fig. 2B), without tubercles; dactylus compressed, about half palm length, 2.2 times longer than maximal depth, dorsal margin convex, ventral margin with low molar process on central third, poorly demarkated distally, distal cutting edge entire, tip with stout hooked tooth; fixed finger about 1.5 times longer than basal width, with well developed fossa proximally, dorsal margin of fossa with acute tooth, distal cutting edge carinate, entire, with small feebly hooked acute tip; carpus short, about 0.33 of palm length, broadly expanded distally, proximal width about 0.33 of distal width, non-tuberculate; merus robust, about 0.33 of palm length, twice as long as central depth, ventral surface tuberculate as in palm, ischium similar, subequal to meral length, about 2.4 times longer than distal width, tapering proximally, ventrally tuberculate. Minor second pereopod (left) (Fig. 2E) with chela (Fig. 2F) about 0.77 of CL, 0.8 of major chela length, palm about 1.4 times longer than deep, dorsal and ventral margins strongly convex, ventral border subcarinate, medial surface and dorsal and ventral margins densely tuberculate as in major chela; dactylus semicircular, strongly compressed, non-tuberculate, about 0.5 of palm length, slightly over reaching fixed finger, dorsal margin strongly convex, cutting edge near straight, unarmed, tip, stout, acute, feebly hooked; fixed

finger triangular, about 1.7 times longer than basal width, non-tuberculate, distally acute, cutting edge deeply grooved; carpus short, broadly expanded distally, about 0.5 of palm length, strongly tapered proximally, non-tuberculate; merus and ischium robust, subequal, about 0.57 of palm length, merus ventrally tuberculate, ischium with single tubercle.

Ambulatory pereiopods without special features. Third pereopod (Fig. 3C) with dactyl biunguiculate (Fig. 3E), about 0.18 of propod length, unguis distinct from corpus, twice as long as basal width, without ventral denticulations, corpus 1.5 times longer than maximal depth, strongly compressed, dorsal margin moderately convex, ventral margin with broad, acute distal accessory tooth, proximal ventral border convex, entire, without acute basal process, without sensory setae; propod (Fig. 3D) about 0.35 of CL, 5.5 times longer than proximal depth, tapering slightly distally, with pair of short robust spines distally, ventral margin with five similar spines along length; carpus about 0.7 of propod length, 4.0 times longer than central width, unarmed; merus robust, about 1.2 times propod length, 3.4 times longer than central width, unarmed; ischium, subequal to carpal length, 2.7 times longer than distal width, tapering proximally. Fourth pereopod (Fig. 3F, G) smaller, less robust than third pereopod, generally similar, propod about 0.8 of third propod length, 5.5 times longer than width, with similar paired distoventral spines and four ventral spines.

Pleopods all without rami.

Uropod (Fig. 1I) with protopodite unarmed posterolaterally; exopod subequal to telson length, twice as long as broad, lateral margin convex, unarmed, with small acute tooth and large curved mobile spine distally; endopod length similar to exopod, 2.6 times longer than broad.

Measurements

Postorbital carapace length, 3.2 mm; major second pereopod chela, 6.15 mm; minor second pereopod chela, 2.6 mm; length of ovum, 0.55 mm.

Host and colouration

Unknown.

Distribution

Known from the single type specimen.

Remarks

Periclimenaeus robustus is unfortunately still only known from the type specimen, but a reasonably complete description can now be presented. Borradaile (1917) provided illustrations of the maxillae and maxillipeds, but unfortunately not of the mandibles, which are no longer preserved.

Of the mouthparts of *Periclimenaeus* species these are the most taxonomically useful structures. In particular, the incisor process may show significant reduction or expansion in different species. Its host was also not recorded. It is most likely to have been a sponge as some of the related species are known to be sponge associates (*P. ardeae*, *P. djiboutensis*, *P. orontes* and *P. palauensis*) and none have been reported from ascidians.

The Kenyan specimen referred to *P. robustus* by Bruce (1976) has been re-examined and found to be incorrectly identified and will be reported upon elsewhere.

Periclimenaeus sp.
(Fig. 4)

Material examined

1 ♂, Amirante Islands, Seychelle Islands, 71 m, UMZC I.9593.2

The specimen has a CL of 0.95 mm and has all pereopods detached, with only two second pereopods preserved (There are two similar minor second pereopods, indicating that there was a further specimen).

Remarks

The rostrum (Fig. 4B) is slender and reaches to the middle of the proximal segment of the antennular peduncle, with six small acute dorsal teeth and a small distal ventral tooth; carapace (Fig. 4A) with small supraorbital tubercles, inferior orbital angle distinct; first abdominal tergite without anterodorsal lobe; antennule (Fig. 4C) with well developed distolateral tooth on proximal segment; scaphocerite (Fig. 4D) with well developed distolateral tooth reaching almost to distal margin of lamella, which exceeds the carapocerite; major second pereopod (Fig. 4E) with palm of chela sparsely tuberculate, fingers with well developed molar process and fossa, merus ventrally spinulate, minor second pereopod (Fig. 4F) similar, dactylus (Fig. 4G) slightly over-reaching fixed finger, semicircular, cutting edge convex, entire, fitting into deep groove on fixed finger; appendix masculina with corpus obsolete, with single long spine; exopod of uropod (Fig. 4H) laterally with acute distal tooth and large spinule medially, telson (Fig. 4I) with two pairs of dorsal spines at about 0.1 and 0.5 of telson length, posterior dorsal spines larger than anterior spines, posterior marginal spines with lateral spines minute, intermediate and submedian spines well developed, submedian longer than intermediate spines.

Without the ambulatory pereopods the specimen cannot be identified. From the features available it appears close to *Periclimenaeus rastrifer* Bruce, 1980, *P. leptodactylus* Fujino and Miyake, 1968 and *P. tchesunovi* Duris, 1990. From these related species *Periclimenaeus leptodactylus*

differs in having a rostral dentition of 8/1 and the anterior and posterior dorsal telson spines of similar size (Miyake & Fujino, 1968) versus 6/1, posterior telson spines larger than anterior. *Periclimenaeus rastrifer* and *P. tchesunovi* both differ in having the lamella of the scaphocerite clearly exceeding the tip of the distolateral tooth (Bruce, 1980; Duris, 1990) versus not exceeding the distal margin of the lamella.

Discussion

The discovery that the type specimen of *Periclimenaeus robustus* has a well developed anteromedian dorsal lobe on the first abdominal tergite indicates that it belongs to a small group of similarly equipped species: *P. palauensis* Miyake & Fujino, 1968, *P. spinimanus* Bruce, 1969, 1978a, *Periclimenaeus ardeae* Bruce, 1970, 1978b, *P. djiboutensis* Bruce, 1970, *P. lobiferus* Bruce, 1978b, and *P. orontes* Bruce, 1986.

Periclimenaeus djiboutensis is rather isolated from the other species in the presence of a distinct dorsolateral lobe on the basicerite, a feature not reported in any other species of the genus. The minor second pereopod dactyl is distally bidentate. The dorsal telson spines are all situated on the proximal fifth of the telson. The distoventral surface of the dorsal telson spine has minute serrations, only otherwise known in *P. uropodialis* Barnard, a not closely related species (Barnard, 1958).

Periclimenaeus lobiferus has the rostrum not depressed, with the ventral margin convex; the dorsal telson spines are all on anterior half, but not the anterior fifth, the first pereopod is robust, dactyl less than half the palm length and without a dorsal setal tuft; the third pereopod is robust, the propod with very stout spines and the dactyl ventrally denticulate. Host unknown.

Periclimenaeus orontes has similarly robust first pereopod chela, but the fingers are about half the palm length. The dactyl of the minor second pereopod is subcircular with the distodorsal edge produced into a sharp carina and the ambulatory dactyls have the accessory tooth minute.

Periclimenaeus ardeae and *P. palauensis* are closely related and both have slender first pereopods. In both, the dactylus bears a characteristic dense tuft of fine setae, not known in any other species (Bruce, 1978b, fig. 31E). In *P. palauensis* the palm and dactyl of the first pereopod are compressed and expanded, characters not found in *P. ardeae* (Bruce, 1970; Miyake & Fujino, 1968). The second pereopod chelae are also non-tuberculate in *P. palauensis*.

Periclimenaeus ardeae is similar to *P. robustus* in many features. On account of the damaged nature of the only first pereopod, it is not known if the dactyl in *P. robustus* is provided with a setal tuft as in *P. ardeae*. In *P. ardeae* the rostrum (Fig 5A) is less stout, more lanceolate, and the dactyl

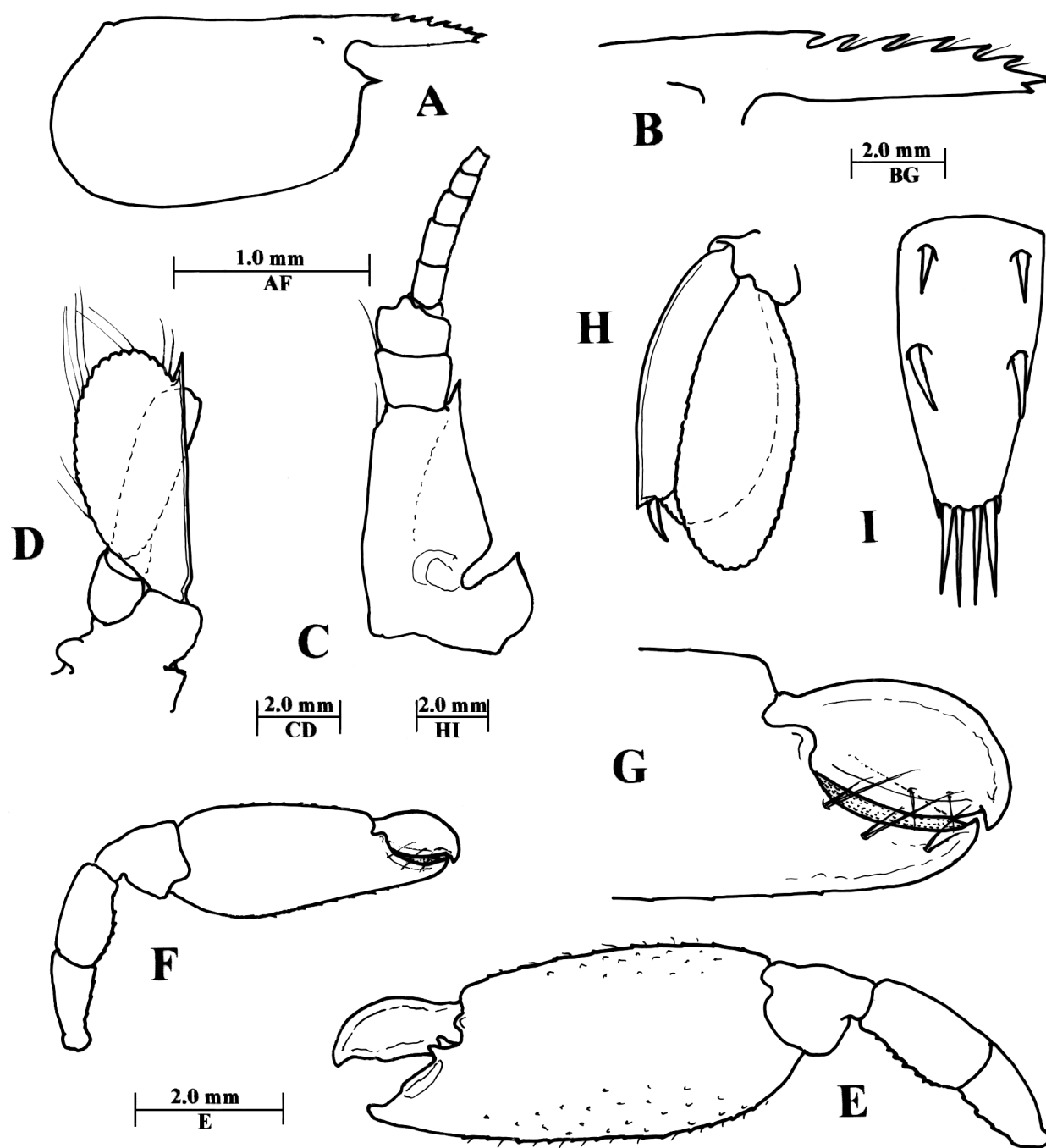


Figure 4. *Periclimenaeus* sp., male, Amirante Islands. **A.** Carapace and rostrum. **B.** Rostrum. **C.** Antennule. **D.** Antenna. **E.** Major second pereiopod. **F.** Minor second pereiopod. **G.** Same, fingers. **H.** Uropod. **I.** Telson.

Figure 4. *Periclimenaeus* sp., mâle, Amirante Islands. **A.** Carapace et rostrum. **B.** Rostre. **C.** Antennule. **D.** Antenne. **E.** Second péréiopode principal. **F.** Second péréiopode mineur. **G.** Idem, doigts. **H.** Uropode. **I.** Telson.

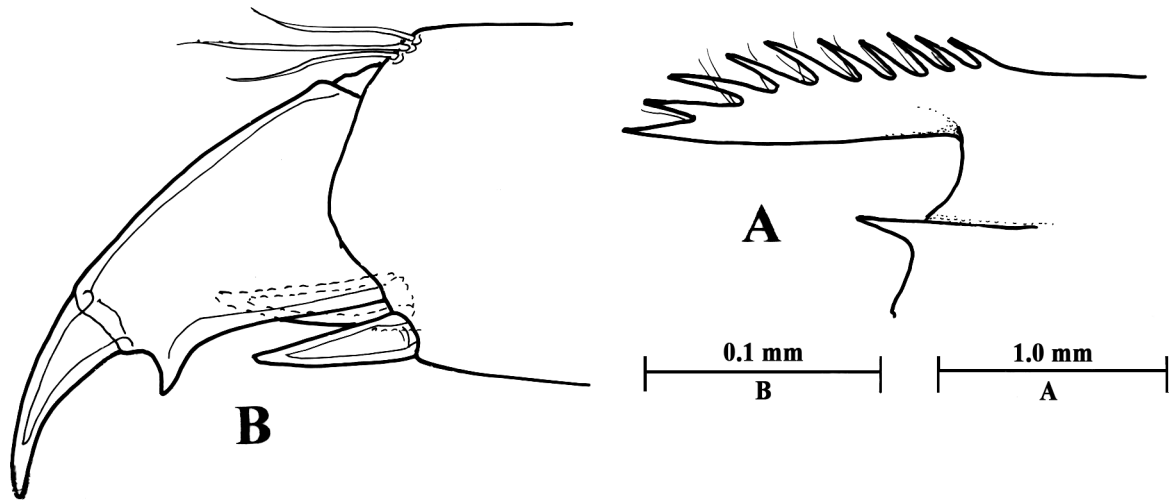


Figure 5. *Periclimenaeus ardeae* Bruce. Heron Island, Queensland, QM W. 27967. **A.** Rostrum, ovigerous female, CL 3.75 mm. **B.** Third pereopod dactyl, male, CL 2.5 mm.

Figure 5. *Periclimenaeus ardeae* Bruce. Heron Island, Queensland, QM W. 27967. **A.** Rostre, female ovigère, CL 3,75 mm. **B.** Dactyle du troisième périopode, mâle, CL 2,5 mm.

of the minor second pereopod about 0.4 of the palm length, with the palm about 1.5 times longer than the maximal depth. The third pereopod dactyl is also similar but the accessory tooth is more slender, less triangular and distally curved (Fig. 5B). (Bruce, pers. obs.). *Periclimenaeus ardeae* may prove to be synonymous with *P. robustus* but in view of the fact that the former is a shallow water coral reef species from the western Pacific region and the latter a deeper water inter-reefal species from the western Indian Ocean, it is considered advisable to maintain their separate status until further material of *P. robustus* is available for study.

Periclimenaeus spinimanus is readily separated from the other species of this group by the presence of a dense spinulation of the in-life upper surfaces of the second pereopod chelae, with long slender spines.

Key to the species of the *Periclimenaeus robustus* species group

(First abdominal tergite with anterodorsal lobe)

1. Dorsal telson spines all on anterior half of telson, basicerite with well developed dorsolateral lobe, R. 7-9/0 . . . *P. djiboutensis* Bruce
- Dorsal telson spines not all on anterior half of telson, basicerite without well developed dorsolateral lobe . . . 2
2. Ambulatory dactyls with corpus ventrally denticulate, R. 9/0 . . . *P. lobiferus* Bruce
- Ambulatory dactyls with corpus ventrally non-denticulate . . . 3

3. Second pereopod chelae glabrous, R. 7/0 . . . *P. palauensis* Miyake & Fujino
- Second pereopod chelae spinulate . . . 4
4. Second pereopod dactyls distodorsally sharply carinate, R. 5/0 . . . *P. orontes* Bruce
- Second pereopod dactyls not distodorsally carinate, R. 8-9/0-1 . . . 5
5. Dorsal surfaces of second pereopod chelae densely covered with long slender spines, including dorsal margin of dactylus, R. 9/1 . . . *P. spinimanus* Bruce, 1969
- Dorsal surfaces of second pereopod chelae with small short acute tubercles only . . . 6
6. Rostral midrib slender, lanceolate, dorsal carina shallow, tip slenderly acute, ventral margin smoothly convex, R. 8-9/0 . . . *P. ardeae* Bruce
- Rostrum midrib robust, deep, tip broadly acute, ventral margin straight, R. 9/0 . . . *P. robustus* Borradaile

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