Zootaxa 1224: 1–22 (2006)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

1224

Periclimenaeus nielbrucei sp. nov. (Crustacea: Decapoda: Pontoniinae), a new sponge associate from the Capricorn Islands, Queensland, with notes on related *Periclimenaeus* species

A.J. BRUCE

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

Abstract

Periclimenaeus nielbrucei **sp. nov.**, a coral reef sponge associate, is described from specimens from the Capricorn Islands, Great Barrier Reef, Queensland, Australia. The rostral dentition is unique in *Periclimenaeus*, with the dorsal carinal teeth diverging irregularly from the midline. The Australian *Periclimenaeus* fauna is now increased to 24 species.

Key words: *Periclimenaeus nielbrucei* **sp. nov.**, Crustacea, Caridea, Pontoniinae, Australia, Queensland, sponge associate

.

Introduction

The presence of the pontoniine shrimp genus *Periclimenaeus* Borradaile, 1915, in Australian waters was established by E.J. Miers (1884) when he described *Coralliocaris ? tridentatus* (now *Periclimenaeus tridentatus*), from Thursday Island, Torres Strait, Queensland, in his report on the crustaceans collected, by Dr R.W. Coppinger, Staff-Surgeon during the Indo-Pacific Surveying Voyage of H.M.S. *Alert*, 1881-2. A second species, *Coralliocaris hecate* Nobili, 1904 (now *Periclimenaeus hecate*) was reported from Cape Jaubert, Western Australia by Heinrich Balss (1921), reporting on the material of Dr E Mjöberg's Swedish Scientific Expedition to Australia (1910–1913). *Periclimenaeus* currently contains 45 species in the Indo-West Pacific region and is the second largest genus in the Pontoniinae. At least 22 species are reported to occur in Australian waters and 13 species have been previously recorded from Queensland, particularly from the coral reefs of the Great Barrier Reef.

The species of *Periclimenaeus* are associates of sponges and ascidians, although the

Accepted by J. Goy: 20 Apr. 2006; published: 5 Jun. 2006

hosts of several species are still unknown and the hosts of others are not identified to generic or species level. The present specimens were obtained from unidentified sponges and increase the number of Australian species to 23 and Queensland species to 14.

Abbreviations used: CL, postorbital carapace length; QM, Queensland Museum, Brisbane; RMNH, National Natural History Museum-Naturalis, Leiden; USNM, National Museum of Natural History, Washington; ZMA, Zoologisches Museum, Amsterdam.

Systematics

Crustacea Decapoda

Family Palaemonidae Rafinesque, 1815

Subfamily Pontoniinae Kingsley, 1878

Genus *Periclimenaeus* Borradaile, 1915

Periclimenaeus Borradaile, 1915: 207. — Borradaile, 1917: 378. — Holthuis, 1952: 114–115. — Bruce, 1995: 106–107.

Periclimenaeus nielbrucei sp. nov.

(Figs 1–6)

*Material examined***.**

(1) 1 ovig. ♀, **holotype** (dissected), QM W27987; 1♂ **allotype,** QM W27988; 1♀ **paratype**, unregistered, AJB #2670, Wreck Island, Capricorn Islands, Queensland, stn. NLB-7, 6 July 1978, coll. N.L. Bruce, from unidentified sponge, unregistered. (2) 1♀, paratype, AJB #2727, Heron Island, Capricorn Islands, Queensland, reef flat pool at low water, 14 August 1978, coll. D. Fisk, from unidentified sponge, RMNH D.51672.

Diagnosis

(2) Rostral dentition 11/0, with distal dorsal rostral teeth diverging irregularly alternatively to left and right.

Description

Holotype female (Fig. 1). *Rostrum* (Fig. 2C) well developed, straight, slightly depressed, about 0.45 of CL, dorsal carina well developed with11 large acute teeth, first tooth pre-orbital, first, second, fourth and sixth teeth in median plane, other teeth diverging to left and right (Fig. 5A), teeth increasing in size to seventh tooth, anterior teeth decreasing in size, tip acute, teeth with posterior border sparsely setose, lateral carinae feebly developed, ventral carina obsolete, ventral margin straight, unarmed, non-setose.

Carapace (Fig. 2A,B) smooth, with small postorbital tubercles, hepatic spine lacking, antennal spine well developed, slender, acute, marginal, with small rounded inferior orbital angle medially, anterolateral branchiostegite slightly produced, broadly rounded.

Abdomen without special features; first segment without anterodorsal lobe; sixth (Fig. 2H) segment about 0.3 of CL, 1.2 times length of fifth segment, broadened, depressed, posterolateral angle small, acute, posterolateral large, strongly produced, acute.

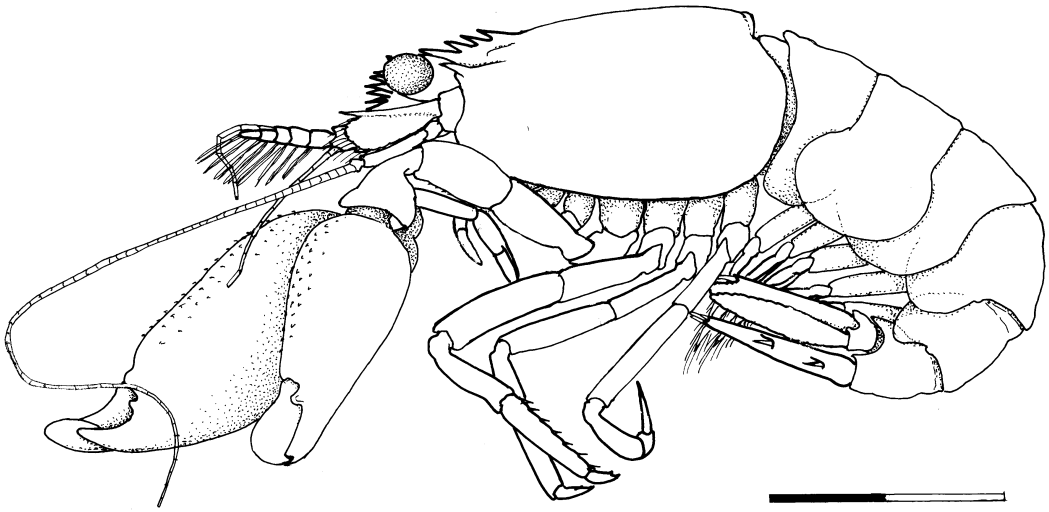

FIGURE 1. *Periclimenaeus nielbrucei* **sp. nov.**, holotype female, Wreck Island, Queensland. Scale bar in millimetres.

Telson (Fig. 2I) about 0.6 of CL, about 1.6 times longer than anterior width, lateral margins moderately convex, posteriorly convergent, with two pairs of subequal, submarginal dorsal spines, about 0.18 of telson length, at 0.18 and 0.5 of telson length, posterior margin (Fig. 2J) broadly convex, without median point, about 0.5 of anterior margin width, lateral telson spines small, about 0.25 of dorsal spine length, intermediate spines similar to dorsal spines, about 1.35 times dorsal spine length, submedian spines more slender, setulose, longer than intermediate spines.

Antennule (Fig. 2D) with proximal segment about 1.6 times central width, medial margin straight with well developed acute ventromedial tooth at 0.5 of length, distolateral angle produced, with acute distolateral tooth reaching about 0.6 of intermediate segment length, lateral margin expanded proximally, rounded, stylocerite acute, gaping, reaching about 0.5 of medial margin length, statocyst normal; intermediate and distal segments short, subequal in length, combined length about 0.6 of medial margin length, upper

flagellum biramous, proximal 3 segments fused, shorter free ramua with 3 segments, about 11 groups of aesthetascs, longer ramus with 6 segments; lower ramus filiform, with 11 segments.

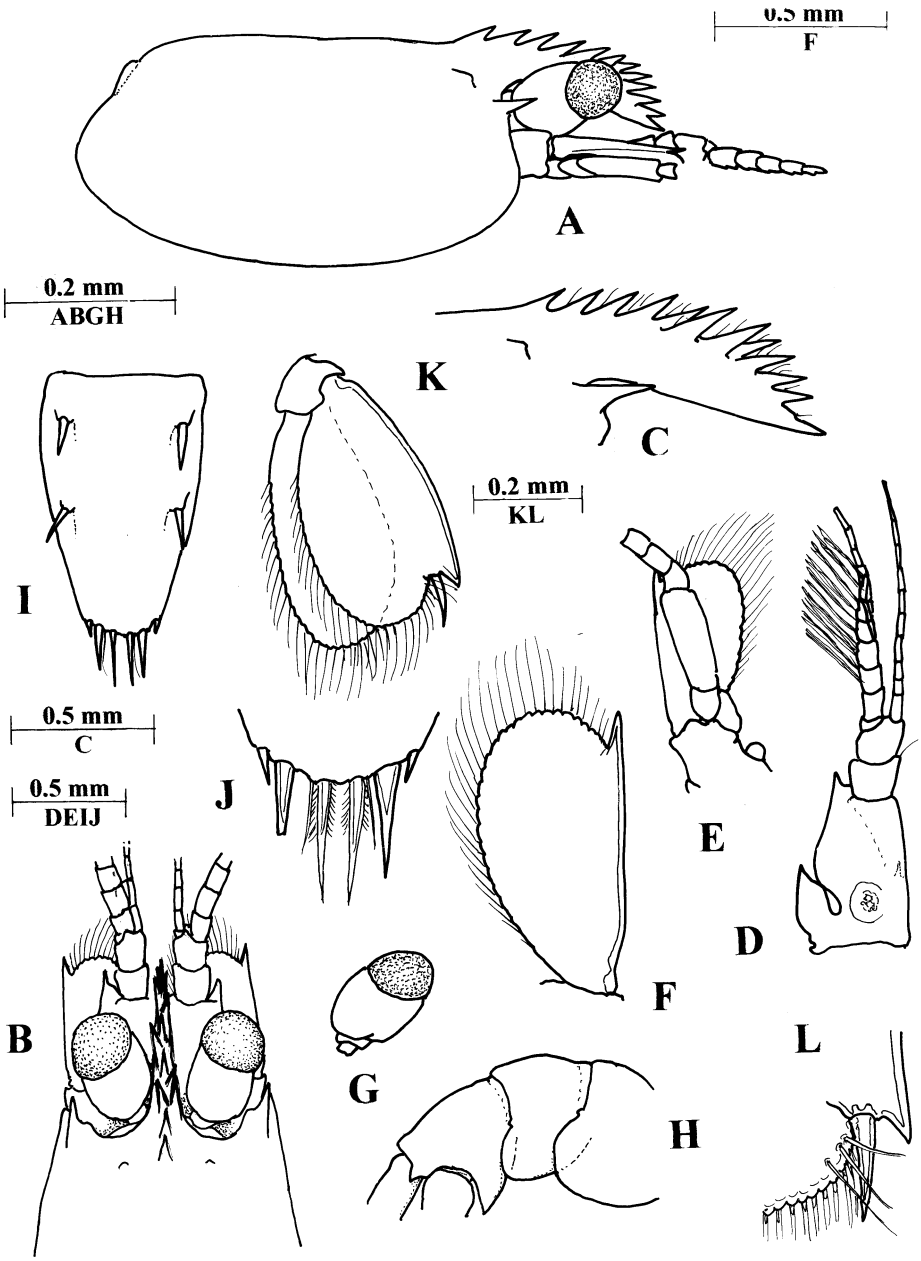

FIGURE 2. *Periclimenaeus nielbrucei* **sp. nov.**, holotype female, Wreck Island, Queensland.. A, carapace, eye and antennae. B, anterior carapace and appendages, dorsal. C, rostrum. D, antennule. E, antenna. F, scaphocerite. G, eye. H, fourth to sixth abdominal segments, lateral. I, telson. J, same, posterior spines. K, uropod. L, same, exopod, posterolateral angle.

Antenna (Fig. 2E) with basicerite laterally unarmed, with well developed antennal gland tubercle medially; carpocerite subcylindrical, flattened, about 3.2 times longer than wide, reaching to about 0.85 of scaphocerite length, merocerite and ischiocerite normal, short; scaphocerite (Fig. 2F) well developed, reaching to distal margin of intermediate antennular segment, lamella broad, rounded distally, about 2.0 times longer than wide, lateral margin straight, with well developed, slender acute tooth distally, about 0.15 of scaphocerite length, at 0.85 of lateral margin length, reaching to level of distal margin of lamella.

Ophthalmic somite without small median pigment spot.

Eye (Fig. 2G) with well pigmented hemispherical cornea, without accessory pigment spot, diameter about 0.16 of CL, stalk about as wide as long, width subequal to corneal diameter.

Mandible (Fig. 3A) slender, without palp, molar process (Fig. 3B) subcylindrical, distally oblique with pair of acute teeth posteriorly, separated by tuft of short setae, incisor process slender tapering distally, with five small acute distal teeth.

Maxillula (Fig. 3C) with feebly bilobed palp (Fig. 3D), upper lobe much smaller than lower, non-setose, lower lobe with small simple terminal seta, upper lacinia short, broad, distal and ventral margins confluent, with seven short simple spines and sparse setae distally, lower lacinia slender, tapering, with four long spiniform setae distally, several slender setae ventrally.

Maxilla (Fig. 3E) with simple flattened non-setose palp, about 4.0 times longer than basal width, basal endite bilobed, lobes robust, distal lobe with about 11 simple setae distally, proximal lobe smaller and shorter, with about 8 distal setae, coxal endite obsolete, margin broadly convex, scaphognathite narrow, anterior lobe about 1.5 times longer than basal width, posterior lobe about 1.5 times longer than anterior, 3.5 times longer than basal width.

First maxilliped (Fig. 3F) with palp similar to that of maxilla, basal endite fully fused with coxal, distal margin rounded, medial border straight, sparsely setose with serrulate spiniform setae, exopod normal, with slender flagellum with four plumose terminal setae, caridean lobe well developed, narrow, epipod well developed, bilobed, lobes rounded.

Second maxilliped (Fig. 3G) of normal form, dactylar segment about 3.5 times longer than broad, with serrulate medial spines, propodal segment slightly produced antero-medially, sparsely setose, carpus, merus and ischiobasis without special features, exopod normal, with four plumose terminal setae, epipod small rounded, without podobranch.

Third maxilliped (Fig. 3H) reaching to about end of carpocerite, with ischiomerus fully fused to basis, combined segment about 3.4 times longer than basal width, proximal medial margin expanded, convex, non-setose, distal two thirds tapering with long simple setae medially, penultimate segment 0.5 of antepenultimate segment length, sub-cylindrical, 3.4 times longer than wide, sparse finely serrulate spiniform setae medially, terminal segment about 0.6 of penultimate segment length, 3.0 times longer than basal

width, tapering distally, with serrulate spiniform setae, exopod with four plumose terminal setae, coxa not produced medially, with low rounded lateral plate, without arthrobranch.

Thoracic sternites narrow, unarmed.

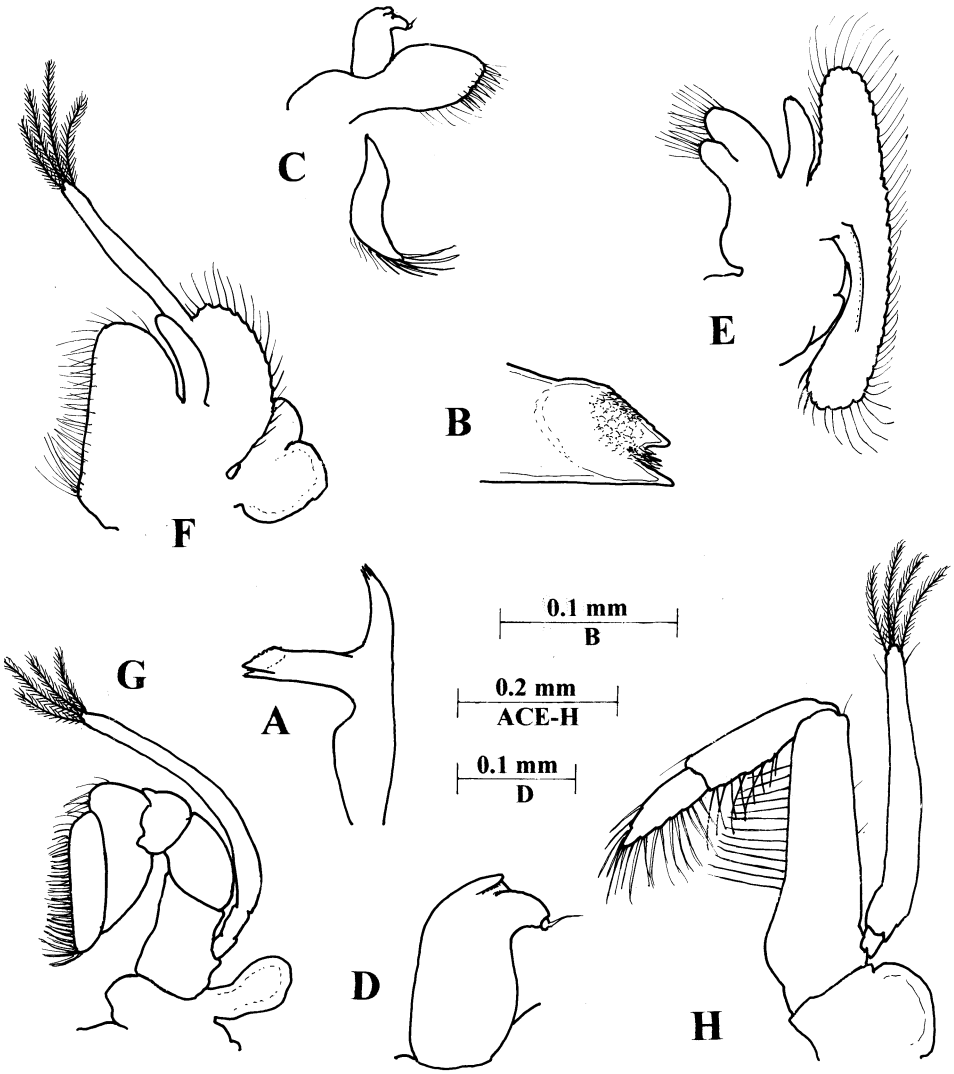

FIGURE 3. *Periclimenaeus nielbrucei* **sp. nov.**, holotype female, Wreck Island, Queensland.. A, mandible. B, molar process. C, maxillula, lower lacinia detached. D, same, palp. E, maxilla. F, first maxilliped. G, second maxilliped. H, third maxilliped.

First pereiopod (Fig. 4A) moderately robust, exceeding carpocerite by half carpus and chela length, chela (Fig. 4B) with palm about 2.0 times as long as deep, slightly compressed, fingers (Fig. 5B) about 0.65 of palm length, stout, with rounded bidentate tips (Fig. 5C), cutting edges lateral, mainly entire, distally feebly denticulate (Fig. 5D); carpus about 1.2 times chela length, 4.2 times longer than distal width, tapering slightly proximally; merus 1.2 times carpal length, 6.2 times longer than central width, uniform;

ischium subequal to chela length; basis and coxa without special features, coxa without ventromedial process.

Major second pereiopod (Fig. 4C) well developed, about 1.8 times CL, palm (Fig. 4D) finely covered with small acute denticles, numerous long setae distomedially, about 1.8 times longer than maximal depth, slightly swollen proximally, oval in section, fingers (Fig. 4E,F) 0.43 of palm length, sparsely setose; dactyl semicircular, 1.9 times longer than maximal depth, dorsal margin strongly convex, with stout acute hooked tip, cutting edge with well developed molar process proximally, distal cutting edge strongly concave, entire; carpus short, about 0.2 of palm length, narrow proximally, broadly expanded distally, unarmed; merus (Fig. 5E) about 0.37 of palm length, robust, 1.8 times longer than central depth, about 11 acute denticles ventrally; ischium 0.75 of meral length 1.75 times longer than distal width, tapering proximally, without ventral denticles; basis and coxa normal, without special features.

Minor second pereiopod (Fig. 4G) smaller than major, about 0.75 of major chela palm length, subequal to CL, palm compressed, covered with small denticles, numerous long setae distomedially, about 1.4 times longer than maximal depth, tapering strongly distally, fingers (Fig. 4H,I) 0.5 of palm length, dactylus semicircular, compressed, 2.0 tomes longer than maximal depth, with strong acute hooked tip, cutting edge straight, entire, fixed finger, 1.3 times longer than deep, ventrally with numerous short setae, with small acute hooked tip, cutting edge grooved, medial edge with small blunt tooth proximally, lateral edge unarmed; carpus 0.4 of palm length, distally expanded, unarmed; merus 0.5 of palm length, 1.8 times longer than central width, ventrally unarmed; ischium 1.2 times meral length, 2.5 times longer than distal width, ischium, basis and coxa without special features.

Third pereiopod (Fig. 4I) robust, exceeding scaphocerite by about half propod length; Dactylus (Fig. 5F) compressed, with well demarcated unguis, curved, about 3.0 times longer than basal width, 0.5 of length of dorsal margin of corpus, ventral margin concave with six small Acute denticles, corpus about 2.1 times longer than maximal depth, non-setose, dorsal margin feebly convex, ventral margin with small acute triangular distal accessory tooth, distal two thirds concave with 6 acute denticles, central pair larger than anterior or posterior denticles, anteroverted, posterior third convex, unarmed; propod (Fig. 4J) about 0.4 of CL, about 3.8 times longer than maximal depth, tapering distally, sparsely setose, with pair of short stout distoventral spines, 7 similar spines spaced along ventral border; carpus 0.78 of propod length, 2.7 times longer than distal width, tapering slightly proximally, unarmed; merus 1.1 times propod length, 3.0 times longer than wide, slightly broadened centrally, ventral margin with several small acute denticles distally; ischium about 0.9 of propod length, 3.0 times longer than distal width, tapering proximally, with single small acute ventral denticle distally; basis and coxa without special features.

Fourth pereiopod generally similar to third; dactyl more elongate(Fig. 5G), about 0.5 of propod length, unguis similar to third pereiopod, with 10 denticles, corpus 3.0 times longer than proximal width, with small acute distal accessory tooth, ventral margin mainly

concave, unarmed, convex proximally with several small denticles proximally; propod about 1.1 times third propod length, 4.8 times longer than proximal width, tapering slightly distally, with single distoventral spine, 2 slender ventral spines at about 0.3 and 0.66 of propod length; merus ventrally unarmed.

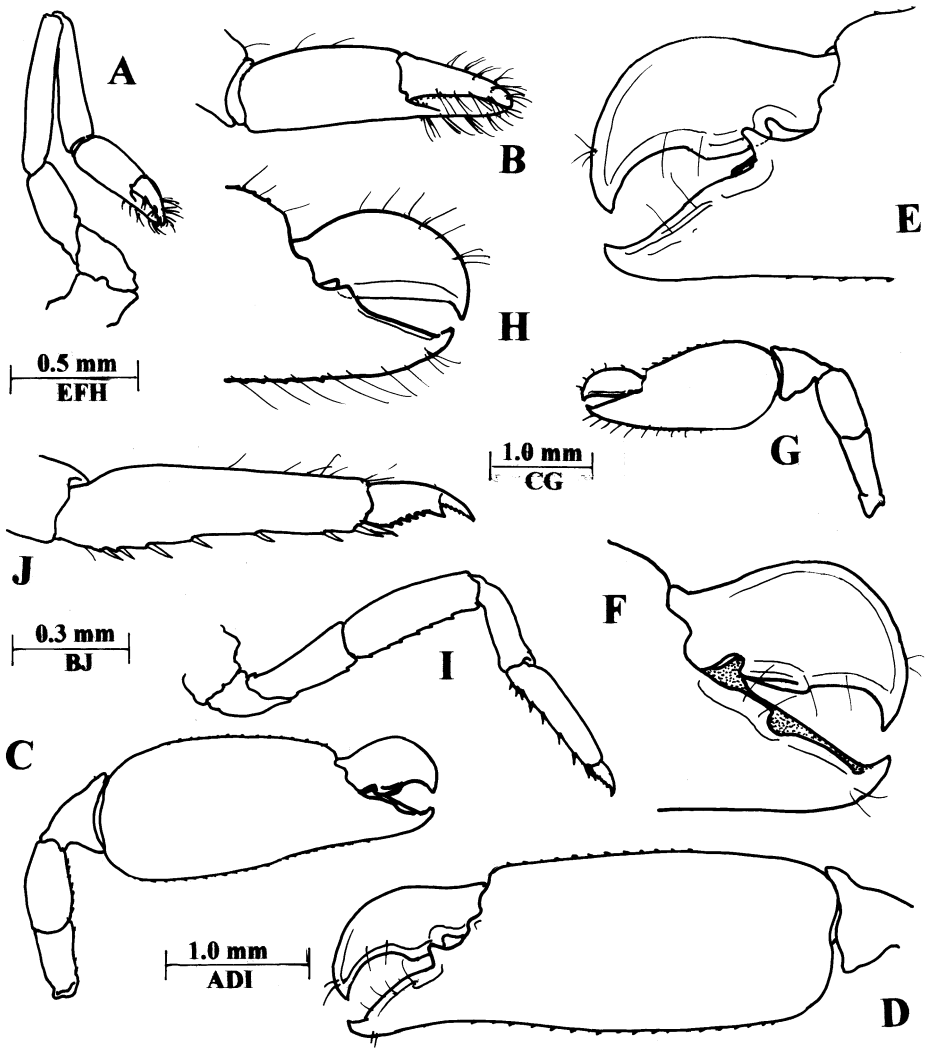

FIGURE 4. *Periclimenaeus nielbrucei* **sp. nov.**, holotype female, Wreck Island, Queensland. A, first pereiopod. B, same, chela. C, same fingers. D, major second pereiopod, chela. E, same, fingers, lateral. F, same, medial.. G, minor second pereiopod. . H, same, fingers. J, third pereiopod, propod and dactyl. J, same, propod and dactyl.

Fifth pereiopod with dactylus (Fig. 5I) more elongate, 1.2 times fourth dactylus length and 1.6 times third, 0.46 of propod length, unguis (Fig. 5J) well demarcated, 4.5 times longer than basal width, 0.37 of corpus length, with 9 small ventral denticles, mainly distally, corpus slender, 33.3 times longer than basal width, with small acute distal

accessory tooth, ventral margin sinuous, without` denticles; propod (Fig. 5H) about 1.25 times length of third propod, slightly bowed, 6.5 times longer than wide, with single distoventral spine, 2 slender spines distally; merus ventrally unarmed..

Pleopods without special features.

Uropod (Fig. 2K) with protopod unarmed, exopod 1.8 times longer than broad, with lateral margin slightly convex, unarmed, with well developed acute distolateral tooth (Fig. 2L) with large mobile spine medially, about 3.0 times tooth length, extending well beyond posterior margin of lamella, endopod about 0.95 of exopod length, 2.0 times longer than broad.

Ova normal, 2 only.

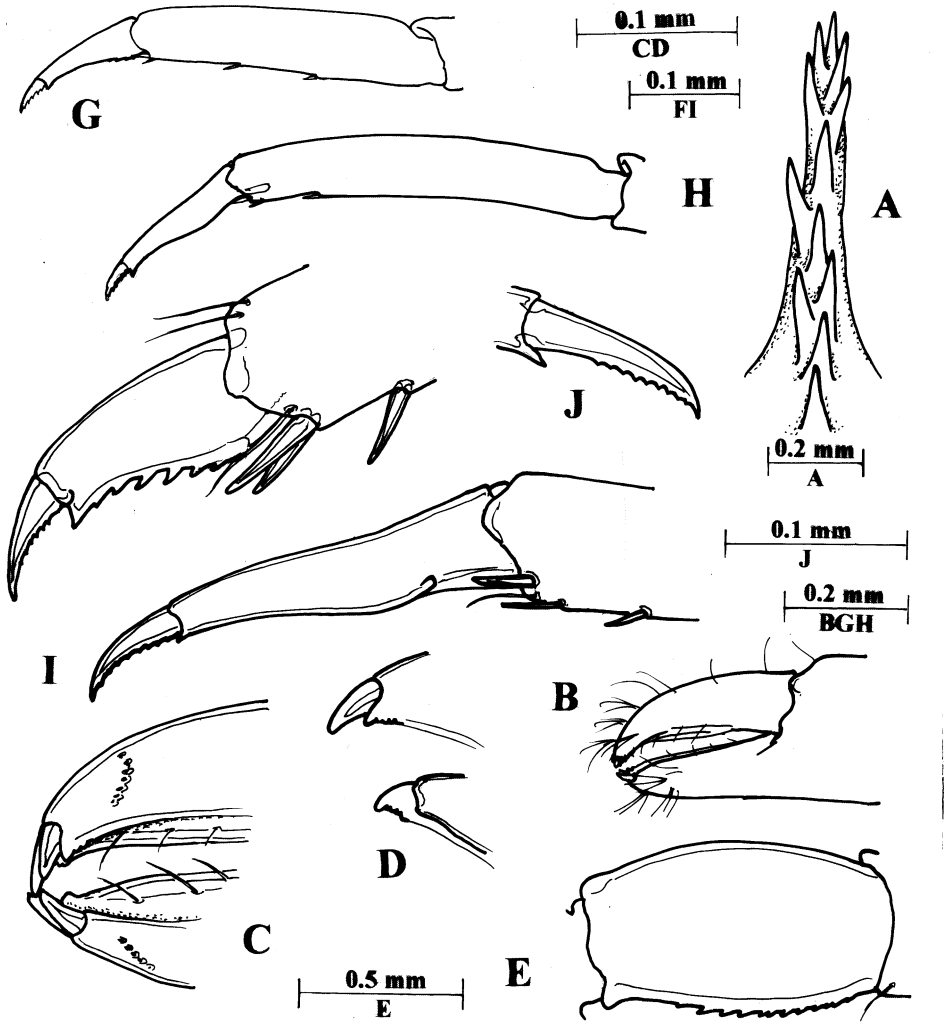

FIGURE 5. *Periclimenaeus nielbrucei* **sp. nov.**, holotype female, Wreck Island, Queensland. A, rostrum, dorsal. B, first pereiopod, fingers. C, same, tips of fingers. D, same, dactyl, details of dentition. E, major second pereiopod, merus. F, third pereiopod, dactyl and distal propod. G, fourth pereiopod, propod and dactyl. H, fifth pereiopod, propod and dactyl. I, same, distal propod and dactyl. J, same, distal corpus and unguis.

Allotype male. Generally similar to holotype, slightly smaller.
Rostrum with dentition of 11/0, with similarly divergent dorsal teeth.
Second pereiopods are also similar but relatively larger and more robust.

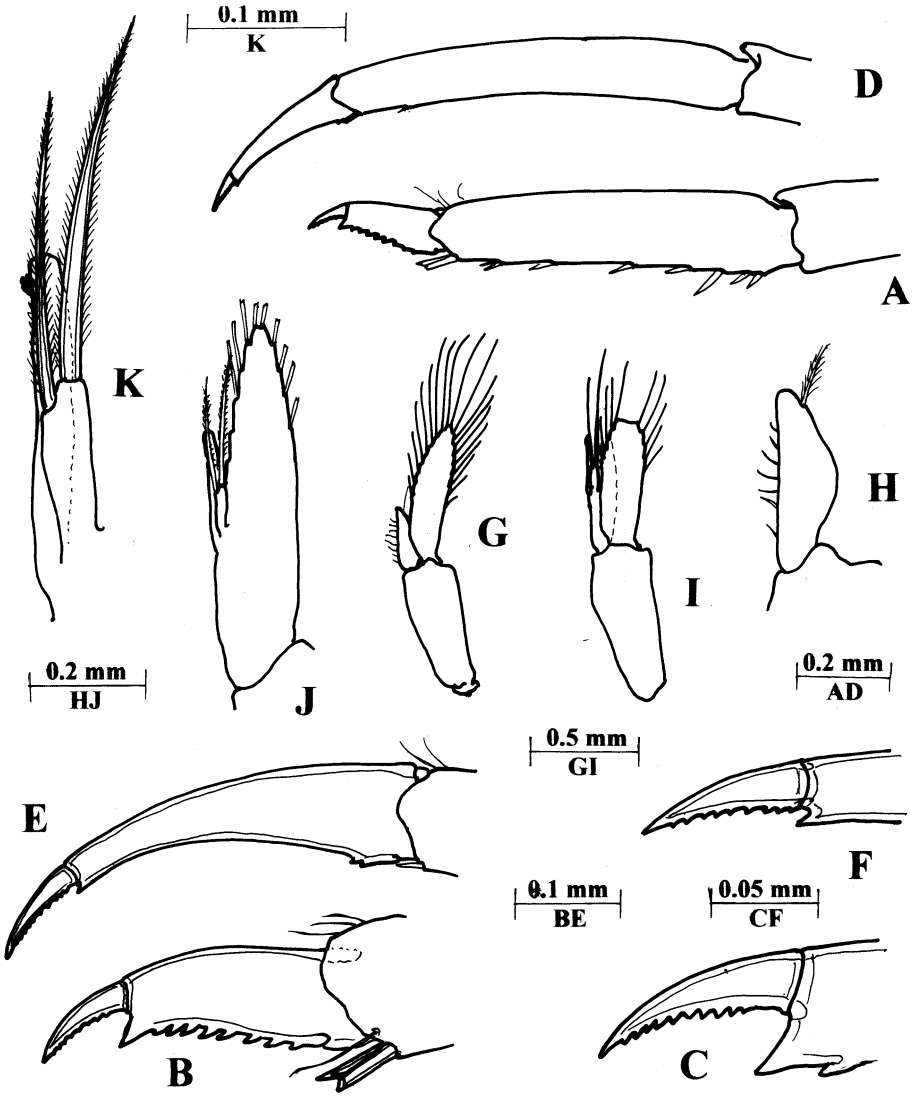

FIGURE 6. *Periclimenaeus nielbrucei* **sp. nov.**, allotype male, Wreck Island, Queensland. A, third pereiopod, propod and dactyl. B, same, dactyl and distal propod. C, same, unguis. D, fifth pereiopod, propod and dactyl. E, same, dactyl and distal propod. F, same, unguis. G, first pleopod. H, same, endopod. I, second pleopod. J, same, endopod. K, same, appendices masculina and interna.

Ambulatory pereiopods similar to holotype. Third pereiopod dactyl (Fig. 6B) 3.5 times longer than proximal depth, 0.35 of propod length, unguis (Fig. 6C) 0.45 of corpus length, with 8 small acute ventral denticles, corpus with well developed acute distal tooth, 8 well developed anteroverted ventral denticles, propod (Fig. 6A) 4.5 times longer than proximal

depth, with well developed pair of distoventral spines, smaller pair of preterminal ventral spines, six single ventral spines, smaller, except distinctly larger third spine. Fifth pereiopod dactyl (Fig. 6E) 5.0 times longer than proximal depth, about 0.45 of propod length, unguis (Fig. 6F) 0.31 of corpus length, with 10 small acute ventral denticles, corpus with small acute distal tooth, ventral margin concave with 2 minute proximal denticles, propod (Fig. 6D) bowed, about 7.3 times longer than proximal depth, with single small slender distoventral spine, 1 smaller preterminal ventral spine, rest of ventral margin unarmed.

First pleopod (Fig. 6G) with exopod subequal to basipodite length; endopod (Fig. 6H) half basipod length, 3.3 times longer than width, medial margin straight, with 7 short slender spinules, lateral margin convex with single short subterminal plumose seta.

Second pleopod (Fig. 6I) similar, slightly larger, endopod (Fig. 6J) about 0.8 of basipodite length, 4.0 times longer than wide, with appendices (Fig. 6K) at 0.3 of medial margin length, appendix interna far exceeding corpus of appendix masculina, about 0.33 of endopod length, with few distomedial cincinnuli, corpus of appendix masculina short, about 0.4 of appendix masculina length, 3.5 times longer than width, with long stout setulose terminal spiniform seta, about 2.2 times corpus length, single more slender preterminal distomedial spiniform seta, about 0.8 of terminal spine length.

Paratype female. No significant differences from holotype. Rostral dentition 11/0, fifth pereiopod dactyl with single minute, almost indiscernible denticle proximally on corpus, distal accessory tooth smaller, unguis with 7 small ventral denticles.

Measurements (mms)

(1) Female holotype, CL, 2.4; carapace and rostrum, 3.2; total body length (approx.), 9.0; major second pereiopod chela, 3.2; minor second pereiopod chela, 2.15; length of ovum, 0.5. Male, allotype, CL, 1.7; carapace and rostrum, 2.6; total body length (approx.), 7.0; major second pereiopod chela, 3.2; minor second pereiopod chela, 2.0. (2) female paratype, CL 1.7.

Host

Unidentified sponges [Porifera]..

Colouration

(1) transparent with feeble bluish tint, with white longitudinal stripe, bordered by red, along dorsal eyestalk.

Etymology

Named after my son, Dr Niel L Bruce, in appreciation of his help over many decades.

Systematic position

Periclimenaeus nielbrucei is most closely related to *P. holthuisi* Bruce (see Bruce, 1969). It shares with this species the following characters: supraorbital tubercles present, first abdominal segment lacking anterodorsal lobe, second pereiopods with cutting edges of fingers distally entire, minor second pereiopod with fixed finger not grooved along cutting edge, ambulatory dactyl biunguiculate, with denticulate unguis and corpus ventrally denticulate. It differs in the following characters: dorsal rostral teeth divergent, not linear, dentition 11/0, not 7/1; dactyl of third pereiopod with simple accessory tooth, not strongly compressed, multidenticulate; dactyls of fourth and fifth pereiopods increasingly elongate with strong reduction of ventral denticles of corpus, versus dactyls of third to fifth pereiopods all generally similar.

Remarks

The characteristic rostrum that immediately identifies this species might have been considered to be the result of abnormal regeneration after trauma or a genetic abnormality if based on a single specimen. Its occurrence in four specimens in two localities clearly indicated that it is a normal morphological feature of this species.

Discussion

Six species of *Periclimenaeus* have been reported from the Indo-West Pacific region with the dactylus of the ambulatory pereiopods ventrally denticulate: *P. rhodope* (Nobili, 1904), *P. arabicus* (Calman, 1939), *P. arthrodactylus* Holthuis, 1952, *P. uropodialis* Barnard, 1958, *P. holthuisi* Bruce, 1969, and *P. zanzibaricus* Bruce, 1969, supplementary descriptions of three species are given below.

Periclimenaeus nielbrucei appears most closely related to *P holthuisi* (see Holthuis, 1952, as *P. rhodope*). *Periclimenaeus holthuisi* is still known only from the holotype specimen. Through the kindness of Dr Dirk Platvoet, it has been possible to re-examine this specimen and its description is here slightly amplified..

***Periclimenaeus holthuisi* Bruce, 1969**

(Fig. 7A–F)

Periclimeneus rhodope — Holthuis, 1952: 125–129, figs. 54–55 bis.
Periclimenaeus holthuisi Bruce, 1969: 159–160. — Chace and Bruce, 1993: 92. — Li, 2000: 142.

Material examined

1 ovig. ♀, **holotype**, CL 7.1 mm, Siboga stn 248, Rumahlusi, Tioor Island, dredge to 54 m, 4/5 November 1899, ZMA De.102519**.**

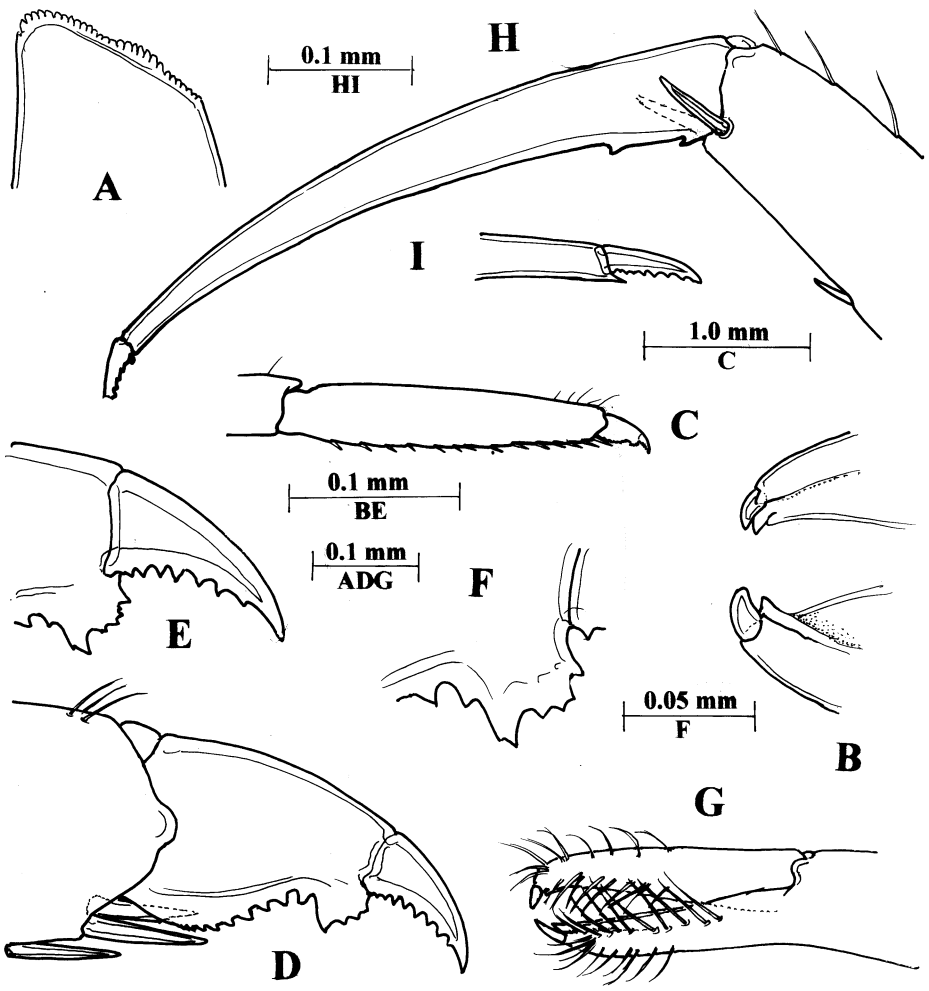

FIGURE 7. *Periclimenaeus holthuisi* Bruce, 1969, ovigerous female holotype. A, mandible, distal incisor process. B, first pereiopod, finger tips, dactyl uppermost. C, third pereiopod, propod and dactyl. D, same, distal propod and dactyl. E, fourth pereiopod, distal dactyl. F, same, dactylar accessory tooth. *Periclimenaeus arthrodactylus* Holthuis, 1952, ovigerous female holotype. G, first pereiopod, fingers of chela. H, fourth pereiopod, distal propod and dactyl. I, fifth pereiopod, distal dactyl.

Remarks

Body and anterior appendages intact, complete, with only left first pereiopod attached. Detached first pereiopod, both second pereiopods and five ambulatory pereiopods present. Also a full set of dissected mouthparts:

A broad, rounded inferior orbital angle is present; the first abdominal segment is without an anterodorsal lobe; the proximal segment of antennule with well developed ventromedial tooth. The incisor process (Fig. 7A) is obliquely truncate distally, with 32 minute subuniform teeth, medially acute, laterally rounded. The first pereiopod fingers are

densely setose with strongly hooked tips (Fig. 7B), with the cutting edges obsolete, the fixed finger is distally bidentate.. The second pereiopods have the cutting edges of the fingers entire, the minor second pereiopod chela is with the fixed finger non-cannulate. The third pereiopod has the dactyl (Fig. 7D) about 0.18 of the propod length, unguis (Fig. 7E) distinctly demarcated, robust, curved, about 2.3 times longer than basal width, with 8 small acute ventral denticles, corpus compressed, about 1.5 times longer than basal width, without basal process, dorsal margin feebly convex, ventral margin with laminar subquadrate accessory tooth (Fig. 7F) distally, ventral margin with 4 small acute denticles, proximal ventral margin of corpus with 8 small denticles, distal denticles erect, proximal denticles anteroverted; The propod (Fig. 7C) is about 5.0 times longer than wide, tapering slightly distally, with a pair of distoventral spines and 13 further spines evenly distributed along the ventral border. Fourth and fifth propods and dactyls similar, unguis/corpus denticulations 8/7, 8/8 respectively, propodal distoventral/ventral spines 2/7, 1/4, respectively, fifth propod with several distal setae.

The major second pereiopod chela has a length of 8.8 mm, the minor chela 5.0 mm. Ova 0.5 mm in length.

The accessory teeth of the ambulatory dactyls appear unique in this genus and resemble those of some species of *Onycocaris.* The species is known only from the holotype specimen, collected in 1899, and its host is unknown..

Periclimenaeus arthrodactylus **Holthuis, 1952**
(Fig. 7G–I)

Periclimenaeus arthrodactylus Holthuis, 1952: 122–125, figs. 51–53. — Li, 2000: 117, fig. 128.

Material examined

1 ovig. ♀, **holotype,** CL 2.1 mm, Siboga stn 37, Pulau Sailus ketjil, Indonesia, dredge to 18 m, 30/31 March 1899. ZMA De.102518.

Remarks

Body and anterior appendages intact, complete, except left eye (missing); without attached pereiopods. One detached first pereiopod, both second pereiopods and two ambulatory pereiopods. First to third maxillipeds *in situ.* One maxillula (without lower lacinia), one damaged maxilla (upper lacinia missing) only loose mouthparts preserved.

Small inferior orbital angle present; first abdominal segment without anterodorsal lobe; proximal segment of antennule with very long slender projecting ventromedial tooth; first pereiopod fingers (Fig. 7G) densely setose, fixed finger bidentate, cutting edges obsolete; fourth pereiopod dactyl (Fig. 7H) elongate, unguis clearly demarcated, tip missing, about 0.12 of corpus length, 3.3 times longer than basal width, with 4 small ventral denticles, corpus slightly curved, ventrally concave, about 7.0 times loner than

basal width, with two minute ventral denticles on proximal fifth, without setae; propod with well developed medial and lateral distoventral spines, three ventral spines, merus with 7 very small denticles ventrally; fifth pereiopod dactyl similar, unguis (Fig. 7I) with 6 small ventral denticles, corpus with small acute distal accessory tooth, with single minute denticle proximally; propod with single distal ventral spine only.

The holotype specimen was fully described by Holthuis (1952), who remarked on the "remarkable nature of the last three pereiopods". As he noted, only two ambulatory pereiopods were preserved. These were considered to be the third and fourth pereiopods. In my opinion, they are actually the fourth and fifth pereiopods and the details of the third pereiopod, particularly the dactyl, remain unknown. Holthuis does not mention the minute proximal ventral denticles on the ambulatory dactyls, and states that they are unarmed. They may be compared with the same appendages in *P. nielbrucei*, which show a considerable degree of dactylar variation, from third, relatively "normal" for the genus, short, and strongly denticulate, to fourth, more attenuated, with reduced denticulation, and fifth, very elongate, with loss of all denticulation from the corpus of the holotype. The dactyl of the third pereiopod of *P. arthrodactylus* may be expected to be shorter, with the corpus deeper and more strongly denticulate. The dactylar ungues are reported to be articulated, but that of the fourth pereiopod (Holthuis's third) appears to have sustained minor *in vivo* damage. The fifth appears undamaged and similar to the unguis in many other species of *Periclimenaeus*, with a small acute distal accessory tooth on the corpus.. The dactylus of the fifth pereiopod of *P. nielbrucei* exhibits a definite resemblance to those of *P. arthrodactylus.*

This species is still known only by the holotype specimen collected in 1899. Its host is unknown.

***Periclimenaeus zanzibaricus* Bruce, 1969**
(Fig. 8–9)

Periclimenaeus zanzibaricus Bruce, 1969: 174–175. — Bruce, 1976: 474.

Material examined

(1) 1 ov. ♀ **allotype,** RMNH D.51673; 4 Γ, 6 ovig. ♀, 1 ♀, 1 juv., Uroa, Unguja, Zanzibar, 21 March 1960, AJB 289A, AJB 289/1-12, unidentified sponge, shore pools at neap tide, paratypes, RMNH D. 51674**;** 1 spm, paratype, BMNH 2006. 407–408. (2) 1 ♂, 1 ovig. ♀, 2 juv, CLs 1.8, 2.5, 1.5, 1.5 mm, stn AJB/59, Myora, North Stradbroke Island, Queensland, 1 July 1969, QM W27989. (3) 1 ♂, 1 ov. ♀, CLs 1.9, 3.3 mm, Mombasa Island, Kenya, 11 December 1973, AJB 2086, seaward reef, reef pools, at LWS, USNM 1086753.

Remarks

Bruce (1969) provided only an un-illustrated preliminary description of this species, which has not been further reported since that date. The holotype was deposited in the Rijksmuseun van Natuurlijke Historie collection. Further specimens collected simultaneously with the type and other material has now been studied. *Periclimenaeus zanzibaricus* was initially considered most closely related to *P. rhodope* (Nobili 1904), which at that time was known with certainty only from Nobili's description and figures, the species referred to *P. rhodope* by Holthuis (1952) having been re-named *P. holthuisi* Bruce, 1969 (see above). Further details of *P. rhodope* were provided by Bruce (1974) after the re-examination of Nobili's type material held in the collections of the Muséum National d'Histoire Naturelle. The preliminary description of *P. zanzibaricus* may be amplified by the following details from dissected specimens QM W27989 (289/7 and 289/8). The allotype male of *P. zanzibaricus* is held in the collection of the Nationaal Natuurhistorisch Museum, Leiden, Crust.D.25615.

Description

Rostrum (Fig. 8B) slender, about 5.5.times longer than central depth, about 0. 4 of CL, reaching to distal margin of intermediate antennular segment, tip slightly up-turned, dentition 6-7/1, (one small specimen with 5/1, one with 6/0, but tip appears damaged), dorsal teeth all anterior to orbital margin, broadly acute, with 2–3 interdental setae, ventral margin straight, ventral tooth well developed, small, acute, projecting horizontally. Supraorbital tubercle well developed, strongly acute.

Carapace (Fig. 8A) with antennal spine robust, very acute, slightly postmarginal. Inferior orbital angle (Fig. 8C) well developed, broadly rounded, reflected below lateral orbital rim, with small rounded distomedial lobe.

First abdominal tergite without anteromedian lobe.

Telson (Fig. 8K) about 0.6 of CL, 2.5 times longer than anterior width, lateral margins convex, posteriorly convergent, with large submarginal dorsal spines at 0.13 and 0.22 of length, anterior spines 0.2 of telson length, anterior spines 1.18 times posterior spine length, posterior margin rounded with small acute median point, posterior spines (Fig. 8L) well developed, lateral spines subdorsal, about 0.33 of intermediate spine length, intermediate spine robust, about 0.25 of telson length, submedian spines more slender, densely setulose.

Antennular peduncle (Fig. 8D) with proximal segment of the peduncle with acute stylocerite reaching to about 0.5 of segment length, with small ventromedial tooth at similar level; anterolateral lobe (Fig. 8E) acutely produced as triangular process rather than rounded lobe with lateral tooth.

Antenna (Fig. 8F) with subcylindrical carpocerite, about 2.5 times longer than wide, reaching to about 7.2 of scaphocerite length; scaphocerite (Fig. 8G) about 4.3 times longer than wide, broadly rounded distally, with very robust distolateral tooth at 0.85 of length, about 0.16 of scaphocerite length and far exceeding lamella.

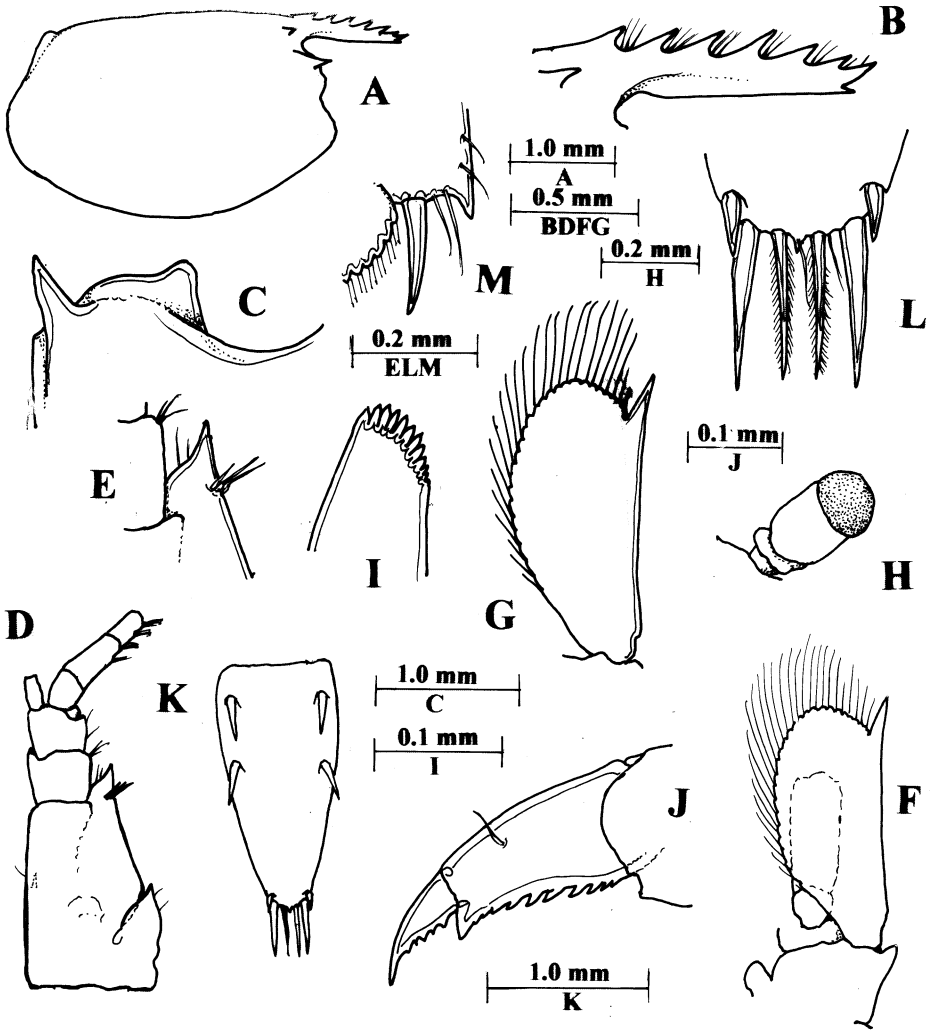

FIGURE 8. *Periclimenaeus zanzibaricus* Bruce, 1969, ovigerous female paratype, 289/7. A, carapace and rostrum. B, rostrum. C, left inferior orbital angle, dorsal. D, antennule. E, same, proximal segment, distolateral angle. F, antenna. G, same, scaphocerite. H, eye, dorsal. I. mandible, incisor process. J, third pereiopod, dactyl. K, telson. L, same, posterior spines. M, uropod, distolateral exopod.

Eye (Fig. 8H) with hemispherical cornea, well pigmented, with diameter about 0.8 of stalk length.

Mouthparts similar to those of *P. nielbrucei*, but incisor process (Fig. 8I) obliquely rounded distally with about 12 long acute teeth, largest laterally and of decreasing size medially.

First pereiopod (Fig. 9A) slender, reaching to exceed carpocerite by carpus and chela, chela (Fig. 9B) with palm about 3.0 times longer than wide, oval in section, slightly

swollen proximally, with fingers (Fig. 9C) about 0.45 of palm length, broad, distally rounded, with entire lateral cutting edges, tips with articulated ungues, flanked by small teeth; with numerous strong setae; carpus about 0.85 of merus length, .6.5 times longer than distal width, tapering uniformly proximally; merus 1.1 times carpus length, 8.5 times longer than maximal width; ischium slightly shorter than chela, about 2.6 times longer than width; basis and coxa normal, coxa without distoventral process.

Second pereiopods well developed, rather similar and slightly unequal.

Major second pereiopod with chela (Fig. 9D) about 1.10 of CL; with palm of chela subcylindrical, oval in section, twice as long as deep, dorsal and ventral margins sub-parallel, with strongly marked rounded shoulder dorsally over base of dactylus; fingers (Fig. 9E,F) 0.5 of palm length, dactylus about 0.6 of palm length, slender, about 3.0 times longer than maximal depth, compressed, distally up-turned, dorsal margin smoothly convex, with stout acute tip distally, cutting edge broadly convex with inconspicuous low thickening centrally over one third of length, distal third entire, not sharp, non-denticulate, fixed finger about 1.7 times longer than basal width, 0.85 of dactylus length, deeply grooved with small shallow fossa with thickened ventral flange proximally, medial margin with large acute tooth proximally, fingers with numerous long simple setae; carpus, merus, and proximal segments similar to *P. rhodope.*

Minor second pereiopod chela (Fig. 9H) similar, about 0.8 of major chela length; with palm of chela subcylindrical, oval in section, twice as long as deep, dorsal and ventral margins sub-parallel, with strongly marked rounded shoulder dorsally over base of dactylus, dactylus (Fig. 9I) about 0.58 of palm length, slender, about 3.0 times longer than maximal depth depth, compressed, distally in-turned, dorsal margin smoothly convex, with stout acute tip distally, cutting edge broadly convex with entire, sharp, non-denticulate, thickening posteriorly, fixed finger about 1.8 times longer than basal width, 0.95 of dactylus length, grooved with small depression with thickened edge proximally, medial margin with low acute tooth proximally, fingers with numerous long simple setae; carpus, merus, and proximal segments similar to *P. rhodope.*

Ambulatory pereiopods are generally similar to those of *P. rhodope:* third pereiopod with dactylus (Fig. 8J) about 0.3 of propod length, unguis (Fig. 9K) well demarcated, 3.0 times longer than basal width, 0.45 of dorsal corpus length, moderately curved, concave ventral margin with 5 small acute teeth, corpus 2.1 times basal width, dorsal margin feebly convex, ventral margin with strong, broad acute distoventral accessory tooth, about 0.33 of unguis length, ventral margin feebly convex with 10 small denticles, central denticles largest, most acute, distally directed; propod (Fig.9J) about 0.4 of CL, 5.0 times longer than proximal depth, tapering slightly distally, with 2 strong distoventral spines, 7 equally spaced ventral spines, most proximal ventral spine with 2 smaller adjacent accessory spines; proximal segments as in *P. rhodope.* Fourth and fifth pereiopods similar; fourth propod with pair of distoventral and 4 ventral spines, 1 accessory spine; fifth propod with numerous setae distally, 1 distoventral spine, 3 ventral spines; dactyls similar to third,

slightly more slender, denticulation slightly reduced, fifth dactyl not elongate. Pleopods and uropods without special features, as in *P. rhodope*, exopod of uropod with small acute distolateral tooth (Fig. 8M) with strong articulated spine separated by small gap. Ova numerous, of normal size, length about 0.5 mm. Largest male, CL 2.7 mm, largest female, 3.3 mm.

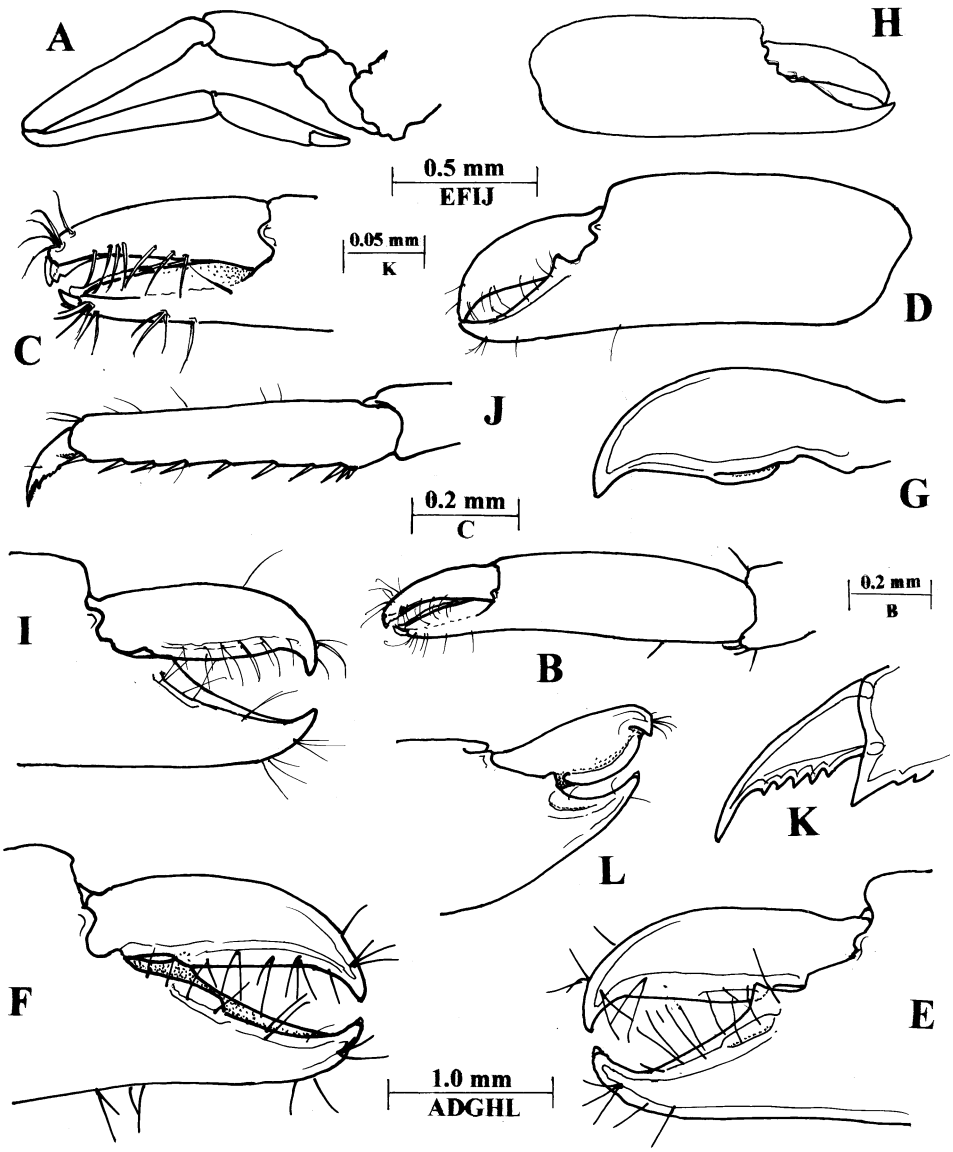

FIGURE 9. *Periclimenaeus zanzibaricus* Bruce, 1969, ovigerous female, paratype, 289/7. A, first pereiopod. B, same, chela. C, same, fingers. D, antennule. E, same, proximal segment, distolateral angle. F, antenna. G, scaphocerite. H, eye. I, mandible, incisor process. J, third pereiopod, dactyl. K, telson. L, same, posterior spines. M, uropod, exopod, distolateral angle.

The adult Myora specimens (QM W. 27989) also have a rostral dentition of 7/1 and exactly resemble the Zanzibar specimens except that the male major second pereiopod dactyl shows an elongated thickening, corresponding to the molar process, extending along almost the whole length of the dactylar cutting edge (Fig. 9L). This feature is less marked in the female, which more closely resembles the Indian Ocean material. The inferior orbital angles in the two lots of specimens are identical.

Although not mentioned in the original diagnosis of the genus (Borradaile, 1915), the most characteristic feature of the genus *Periclimenaeus* is "The dactylus of the larger second pereiopod with a molar tooth, socket in the fixed finger" (Holthuis, 1993), although it may be noted that a remarkably similar sound producing mechanism is also present in some species of *Coralliocaris* Stimpson and is well known in several alpheid genera. In *P. zanzibaricus* this mechanism is particularly poorly developed. The shapes of the fingers of the major and minor chela are also remarkably similar. This may illustrate the path by which the mechanism has evolved, from a simple thickening of the posterior part of the dactylar cutting edge opposing a longitudinal groove on that of the fixed finger. The molar process may have developed from this thickening, rather than a pre-existing tooth in this situation, as found in many other pontoniine shrimps.

The Indo-Pacific *Periclimenaeus rhodope* species group

Periclimenaeus nielbrucei is a member of a group of closely related species the first of which to be described was *P. rhodope* (Nobili, 1904). They are characterized by the presence of a supraorbital spine or tubercle, denticulate ungues on the ambulatory pereiopods and the corpus biunguiculate with a denticulate ventral margin. All are sponge associates except possibly *P. arthrodactylus* and *P. holthuisi* whose hosts are still unknown. A key for their identification is presented below. The Mexican species, *Periclimenaeus spinosus* Holthuis, 1951, may also be member of this group (Rios, 1986).

1 Exopod of uropod laterally dentate ..... *P. uropodialis* Barnard, 1958
- Exopod of uropod laterally unarmed 2
2. Distolateral spine of scaphocerite far exceeding lamella 3
- Distolateral spine of scaphocerite not exceeding lamella 6
3. Rostral dentition 5/0, ambulatory dactyls greater than half propod length .... *P. arthrodactylus* Holthuis, 1952
- Rostral dentition greater than 5/0, ambulatory dactyls less than half propod length 4
4. Third pereiopod dactyl long slender, carpus ventrally tuberculate; R. 6–9/0–1 .... *P. arabicus* Calman, 1939
- Third pereiopod dactyl short, robust**,** carpus ventrally non-tuberculate 5
5. Inferior orbital angle broadly rounded with small distomedian lobe; R. 6–7/1 .... *P. zanzibaricus* Bruce, 1969

- Inferior orbital angle broadly rounded, without distomedian lobe; R. 6–9/0–2..... ..... *P. rhodope* (Nobili, 1904)

6. Third pereiopod dactyl with accessory tooth strongly compressed, multidenticulate; R. 7/1.....*P. holthuisi* Bruce, 1969

- Third pereiopod dactyl with accessory tooth feebly compressed, simple; R.11/0 .... *P. nielbrucei* **sp. nov.**

Acknowledgements

I am most grateful to the collectors, Dr Niel Bruce and David Fisk, for the opportunity to study these specimens. Dr Dirk Platvoet kindly provided access to the specimens from the Siboga Expedition collections. This study was facilitated by support from the Australian Biological Resources Study.

References

Balss, H. (1921) Stomatopoda, Macrura, Paguridea und Galatheidea. Results of Dr. E. Mjöbergs Swedish Scientific Expeditions to Australia 1910-13. XXIX. *Kungliga Svenska Vetenskakademiens Handlingar,* 61 (10), 1–24.

Barnard, K.H. 1958 Further additions to the crustacea fauna list of Portuguese East Africa. *Memorias do Museu Dr. Alvaro de Castro*, 4, 3–23.

Borradaile, L.A. (1915) Notes on Carides. *Annals and Magazine of Natural History,* (8) 15, 205–213.

Borradaile, L.A. 1917 On the Pontoniinae. The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr J. Stanley Gardiner. *Transactions of the Linnean Society of London, Zoology,* (2) 17, 323–396.

Bruce, A.J. (1969) Preliminary descriptions of sixteen new species of the genus *Periclimenes* Costa, 1844 (Crustacea, Decapoda Natantia, Pontoniinae). *Zoologisches Mededelingen, Leiden*, 43 (20), 253–278.

Bruce, A.J. (1974) Observations upon some specimens of the genus *Periclimenaeus* Borradaile (Decapoda Natantia, Pontoniinae) originally described by G. Nobili. *Bulletin du Muséum national d'Histoire naturelle, Paris, (3), no. 258, Zool.* 180, 1557–1583.

Bruce, A.J. (1976) A Synopsis of the Pontoniinid Shrimp Fauna of central East Africa. *Journal of the Marine Biological Association of India*, 16 (2)(1974), 462–490.

Bruce, A.J. (1995) A Synopsis of the Indo-West Pacific Genera of the Pontoniinae (Crustacea: Decapoda: Palaemonidae). *Theses Zoologicae*, 25 (1994), 1–172.

Calman, W.T. (1939) Crustacea: Caridea. *The John Murray Expedition 1933–34, Scientific Reports*, 6, 183–224.

Chace, F.A., Jr., and A.J. Bruce. (1993) The Caridean Shrimps (Crustacea: Decapoda) of the *Albatross* Philippine Expedition 1907–1910, Part 6: Superfamily Palaemonoidea. *Smithsonian Contributions to Zoology,* 543, i–vii, 1–252.

Holthuis, L.B. (1951) A general Revision of the Palaemonidae (Crustacea Decapoda Natantia) of the Americas. II. The Subfamilies Euryrhynchinae and Pontoniinae. *Allan Hancock Foundation Publication, Occasional Paper*, 11, 1–332.

Holthuis, L.B. (1952) The Decapoda of the Siboga Expedition. Part XI. The Palaemonidae collected by the Siboga and Snellius Expeditions with remarks on other species. II. Subfamily Pontoniinae. *Siboga Expedition Monograph*, 39a[10], 1–252.

Holthuis, L. B. (1993) *The recent genera of the caridean and stenopodidean shrimps (Crustacea, Decapoda) with an appendix on the order Amphionidacea*. Nationaal Natuurhistorisch Museum, Leiden, 1–328.

Li, Xinzheng (2000). *Catalog of the Genera and Species of Pontoniinae* Kingsley, 1878. Xueyuan Press, Beijing, pp. 319.

Miers, E.J. (1884) *Crustacea. Report of the Zoological Collections made in the Indo-Pacific Ocean during the Voyage of H.M.S. "Alert" 1881–2*. 178–322, 513–575.

Nobili, G. (1904) Diagnoses préliminaires de vingt-huit espèces nouvelles de Stomatopodes et Décapodes Macroures de la Mer Rouge. *Bulletin du Muséum d'Histoire naturelle, Paris*, 10, 228–238.

Rios, R. (1986) Caridean shrimps of the Gulf of California. V. New records of species belonging to the subfamily Pontoniinae (Crustacea: Decapoda: Palaemonidae). *Proceedings of the Biological Society of Washington*, 99 (3), 429–434.

