

A re-description of *Periclimenaeus hebedactylus* Bruce, 1970 (Crustacea: Decapoda: Palaemonidae)

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Key words: Crustacea; Decapoda; Caridea; Palaemonidae; *Periclimenaeus hebedactylus* Bruce, 1970; sponge associate; Indo-West Pacific; re-description; types.

Periclimenaeus hebedactylus Bruce, 1970 (Crustacea: Decapoda: Palaemonidae), known only from the type specimens, is re-described and illustrated, and its systematic position is discussed. The sex of the holotype is corrected.

Introduction

In 1960 a pair of *Periclimenaeus* specimens was collected from a sponge at over 90 m depth off the southern end of Unguja, Zanzibar. In 1970 a preliminary description of these shrimps, given the name of *Periclimenaeus hebedactylus*, was provided by Bruce. No further specimens of this species have been reported in the half century since their first capture. Originally the specimens were compared to *Periclimenaeus fimbriatus* Borradaile, 1915 (now placed in the genus *Paraclimenaeus* Bruce, 1988), and *Periclimenaeus minutus* Holthuis, 1952. Of the 57 Indo-West Pacific species currently referred to *Periclimenaeus*, 21 were described prior to *P. hebedactylus* (together with 4 other congeners; see Bruce, 1970) and a further 31 species have been described since 1970, the majority from relatively shallow waters around coral reefs. The original preliminary description was un-illustrated and inadequate for detailed comparison with several of these species and a more detailed illustrated report is now provided.

Abbreviations used: CL, postorbital carapace length; RMNH, Naturalis Biodiversity Center, Leiden (previously Rijksmuseum van Natuurlijke Historie).

Systematics

Family Palaemonidae Rafinesque, 1815

Subfamily Pontoninae Kingsley, 1878

Genus *Periclimenaeus* Borradaile, 1915

Periclimenaeus hebedactylus Bruce, 1970

(figs 1-58)

Periclimenaeus hebedactylus Bruce, 1970: 308-310; Bruce, 1976: 472; Chace & Bruce, 1993: 52; De Grave, & Fransen, 2011: 358.

Material. — Zanzibar. — 1 ♂, holotype, RMNH D 51597, 1 ovigerous ♀, allotype, RMNH D 53333, FRV *Manihine*, off Makunduchi, southern end of Unguja, Zanzibar, trawl, 91.5 m, coll. J.H. Wickstead, 8.viii.1960, AJB# 278.

Diagnosis.— Rostral dentition 5–7/0, carapace with small supraorbital shoulder, postero-median depression with central convexity, overlapped by well developed antero medial dorsal lobe of first abdominal segment, proximal segment of antennular peduncle without ventro-medial tooth, antennal basicerite with dorso-lateral tooth, without dorso-lateral plate, incisor process of mandible slender with four small teeth distally, maxilla with distal endite slender, first pereiopod chela with slender fingers with cutting edges entire, second pereiopods very unequal, palm of chela densely tuberculate, dactyl compressed, with tip, strongly produced, bidentate, densely sclerotised, cutting edge entire, fixed finger stout, with well developed fossa, tip feebly bifid, sclerotised, ambulatory dactyls biunguiculate, ventral margin of unguis unarmed, ventral margin of corpus acutely denticulate, without proximal tooth or protuberance, telson with dorsal spines at 0.11 and 0.24 of telson length, lateral posterior spines preterminal, at 0.76 of telson length, uropodal exopod without serrations.

Description of ovigerous female allotype.— A small slender pontoniine shrimp of slightly compressed body form.

Rostrum slender, straight, slightly depressed, about 0.25 of CL, dorsal carina with five acute pre-orbital teeth, similar but decreasing in size slightly distally, with numerous short plumose interdental setae, ventral margin non-carinate, feebly sinuous, unarmed, non-setose.

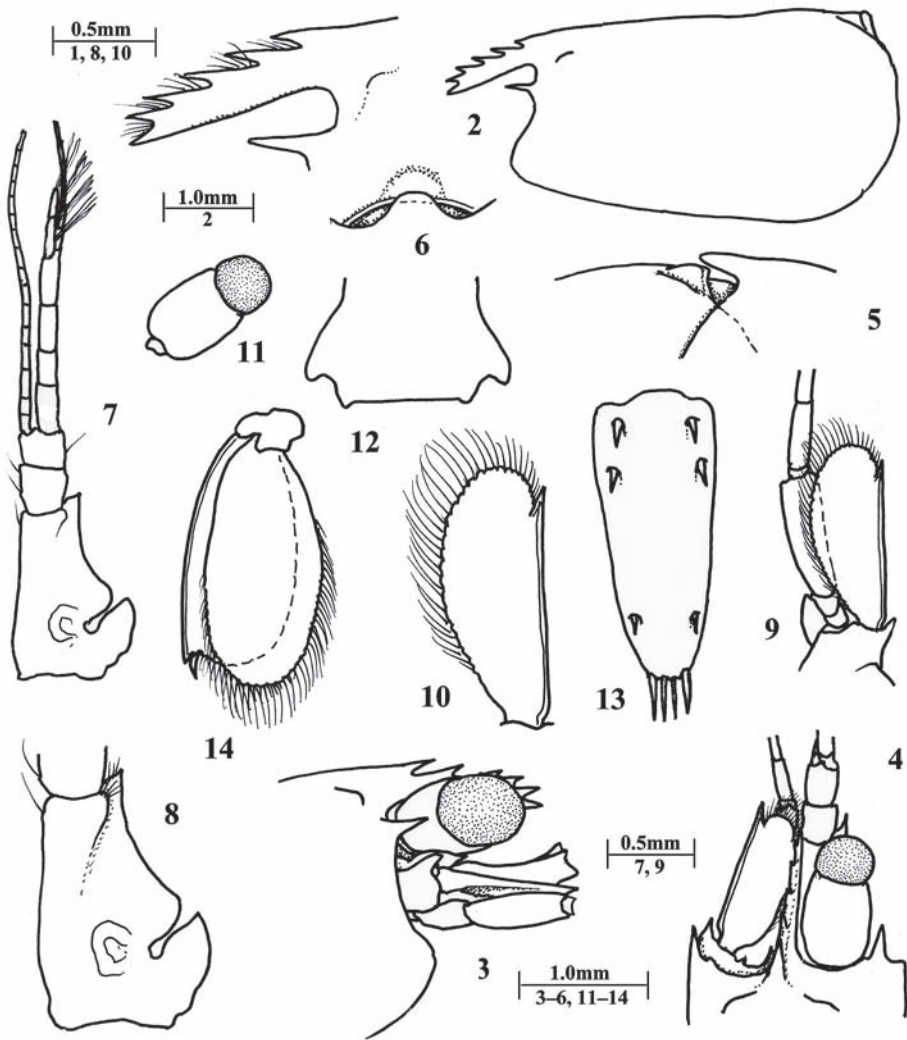
Carapace smooth, glabrous, without post-rostral, epigastric teeth or hepatic spine, without supraorbital tooth or tubercle but with small rounded supraorbital “shoulder”, antennal tooth well developed, paraorbital in position, with small acute inferior orbital angle medially, orbit feebly developed, posterior median margin of carapace depressed, centrally convex, surrounded by shallow sulcus, anterolateral margin slightly produced, rounded.

Abdomen smooth, glabrous, with first tergite with well developed rounded dorsal antero-median lobe, ventrally concave, which fits over postero-median convexity of carapace; pleura of first four segments broadly rounded, fifth slightly posteriorly produced; sixth segment about 0.22 of CL, subequal to fifth segment length, posterolateral angle feebly bluntly produced, posteroventral angle produced, rounded.

Telson about 0.5 of CL, 2.4 times longer than anterior width, lateral margins feebly convex, slightly convergent posteriorly, posterior margin about 0.33 of anterior width, convex without median process, with two pairs of similar small dorsal spines, about 0.07 of telson length, at 0.11 and 0.24 of telson length, anterior pair slightly closer to midline than posterior pair, lateral posterior spines slightly smaller than dorsal spines, sub-dorsal, at 0.76 of telson length, posterior margin with intermediate and submedian spines only, intermediate spines robust, about 0.15 of telson length, simple, submedian spines slender, slightly shorter than intermediate spines, densely plumose.

Eye with well pigmented globular cornea, slightly oblique, diameter about 0.14 of CL, without discernible accessory pigment spot, stalk about 1.3 times longer than width.

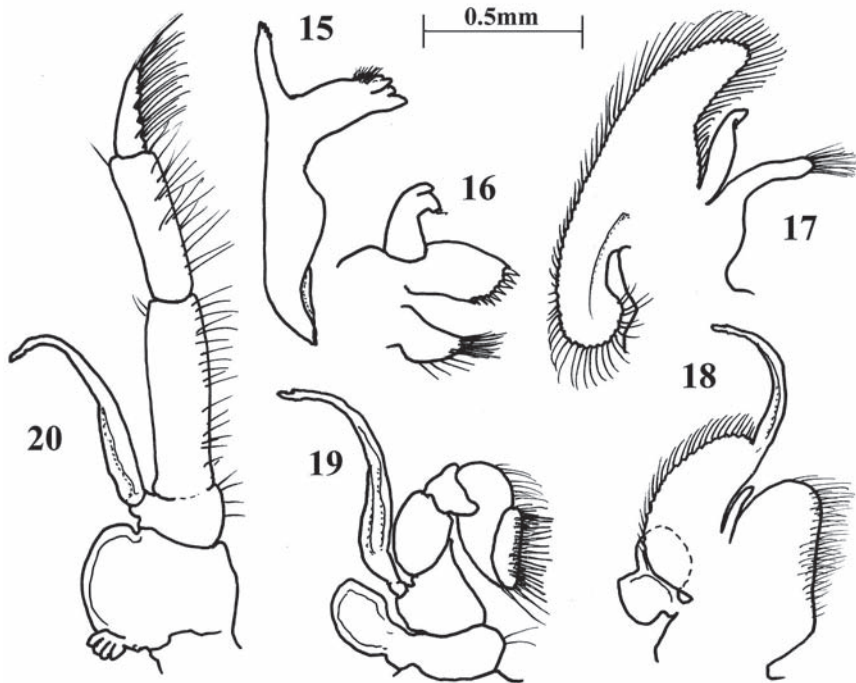
Antennule normal, with proximal segment of peduncle robust, 1.6 times longer than central width, medial margin straight, sparsely setose, with slender ventromedial tooth at about half length, lateral margin broadly expanded, distolateral angle acutely produced, distal lateral margin concave, proximally rounded, stylocerite well developed, phylliform, statocyst normal, intermediate segment about 0.3 of proximal segment length, as long as maximal width, distal segment about 0.75 of intermediate



Figs 1-14. *Periclimenaeus hebedactylus* Bruce, 1970, ovigerous female allotype, off Makunduchi, Zanzibar, 91.5 m, RMNH D 53333. 1, rostrum; 2, carapace; 3, anterior carapace and appendages, dorsal; 4, anterior carapace and appendages, lateral; 5, antero-median dorsal lobe, posterior carapace, lateral; 6, idem, dorsal; 7, antennule; 8, idem, proximal segment; 9, antenna; 10, scaphocerite; 11, eye, dorsal; 12, sixth somite, dorsal; 13, telson; 14, uropod.

segment length, upper flagellum biramous with four slender proximal segments fused, slightly longer than proximal segment length, short free ramus with two segments, four groups of aesthetascs, longer ramus with six (plus) segments, lower flagellum filiform with about 16 segments.

Antenna normal, with basicerite robust with acute dorso-lateral tooth, carapocerite subcylindrical, 3.4 times longer than distal width, reaching to about level of base of



Figs 15-20. *Periclimenaeus hebedactylus* Bruce, 1970, ovigerous female allotype, off Makunduchi, Zanzibar, 91.5 m, RMNH D 53333. 15, mandible; 16, maxillula; 17, maxilla; 18, first maxilliped; 19, second maxilliped; 20, third maxilliped.

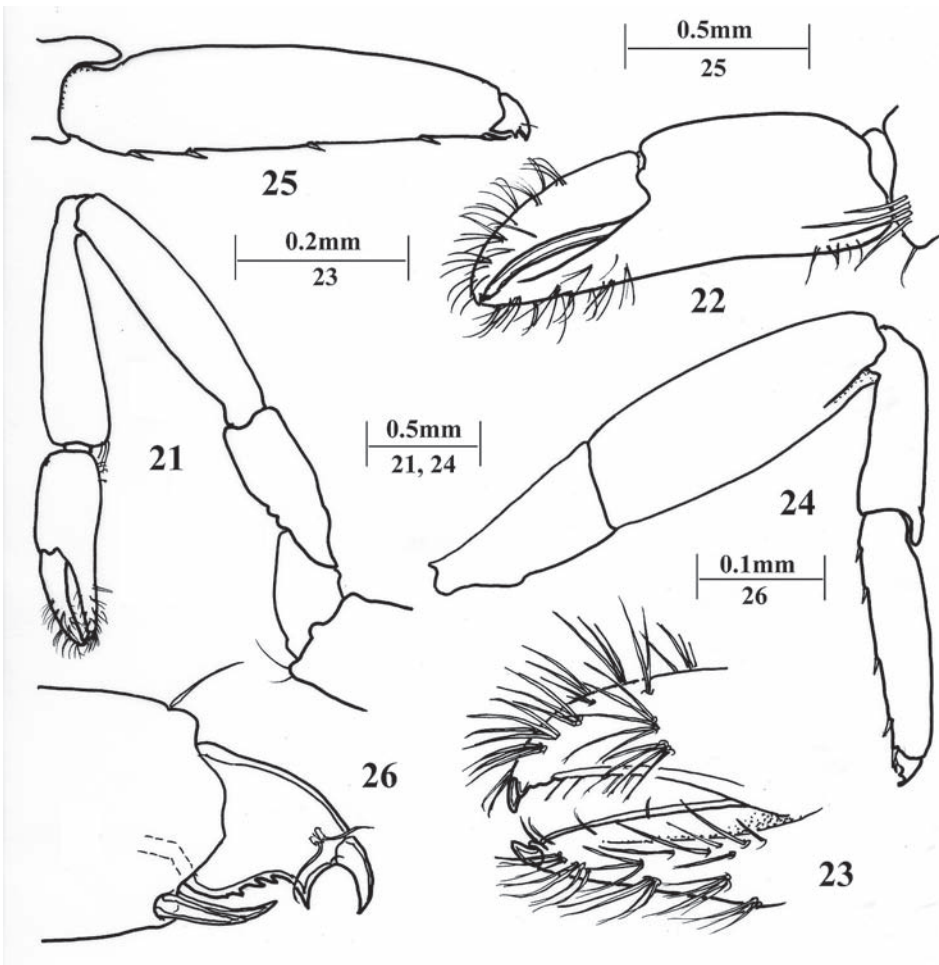
scaphocerite disto-lateral tooth, scaphocerite well developed, 2.6 times longer than maximal width, distal margin broadly rounded, well exceeding lateral tooth, lateral margin straight, with strong distal tooth at about 0.84 of length, tooth 0.1 of scaphocerite length.

Mandible with slender corpus, without palp, molar process robust, obliquely truncate distally with conspicuous anterior tuft of spiniform setae, incisor process slender, obliquely truncate distally with four small acute subequal teeth.

Maxillula with feebly bilobed palp, lower lobe with small ventral tubercle with minute terminal seta, upper lacinia normal, twice as long as wide, distal border obliquely rounded with eight short stout simple spines and several spiniform setae, lower lacinia subcylindrical, tapering distally, terminally blunt, with numerous long simple spiniform setae.

Maxilla with slender elongate flattened tapering palp without preterminal seta, with basal endite elongate slender subcylindrical with about 10 simple terminal setae, proximal medial margin concave, non-setose, coxal endite obsolete, scaphocerite normally developed, 3.3 times longer than wide, anterior lobe tapering distally, medially concave, posterior lobe about 0.5 of anterior lobe length.

First maxilliped with short slender non-setiferous subcylindrical palp, basal and coxal endites fused, broad, distally rounded, medial margin straight, densely setose,

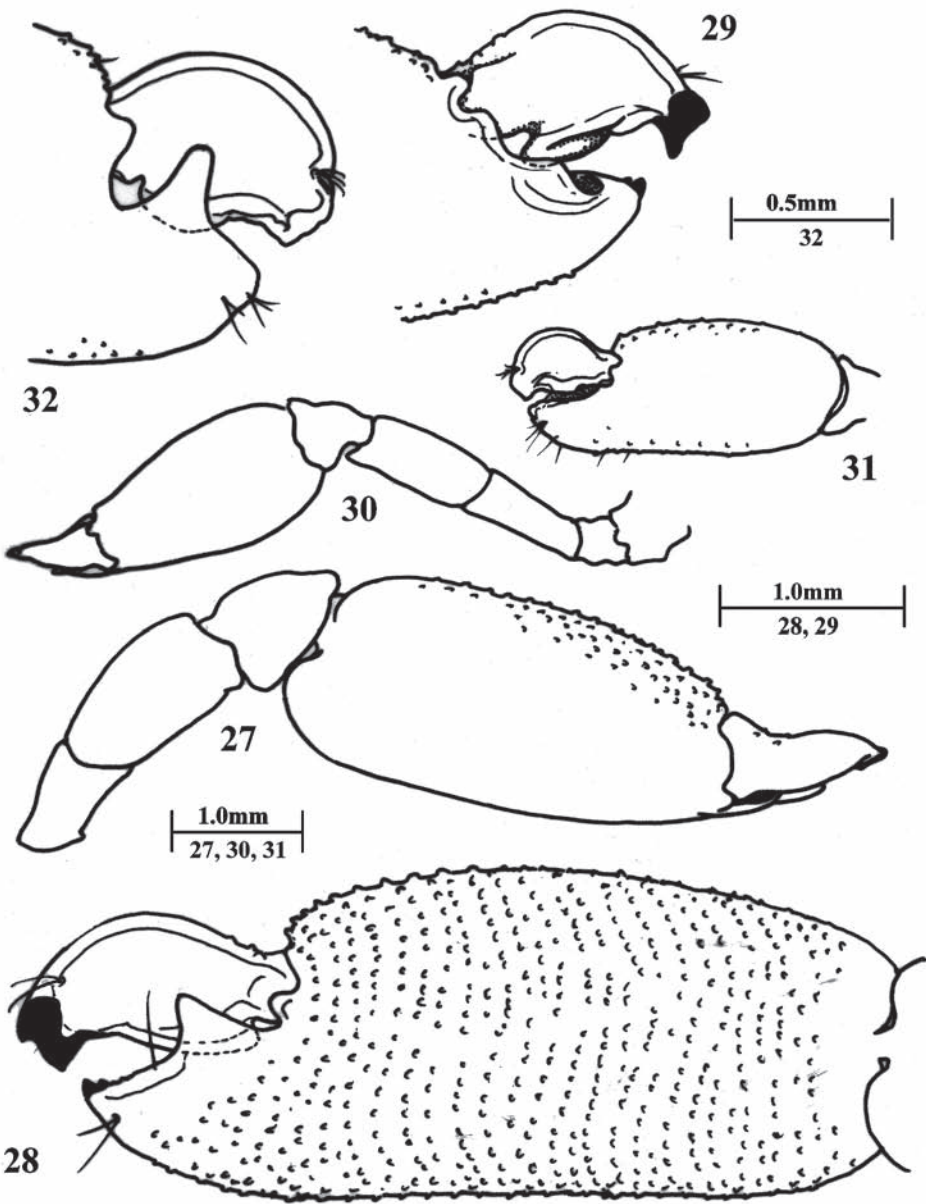


Figs 21-26. *Periclimenaeus hebedactylus* Bruce, 1970, ovigerous female allotype, off Makunduchi, Zanzibar, 91.5 m, RMNH D 53333. 21, first pereiopod; 22, idem, chela; 23, idem, fingers; 24, third pereiopod; 25, third pereiopod, propod and dactyl; 26, idem, distal propod and dactyl.

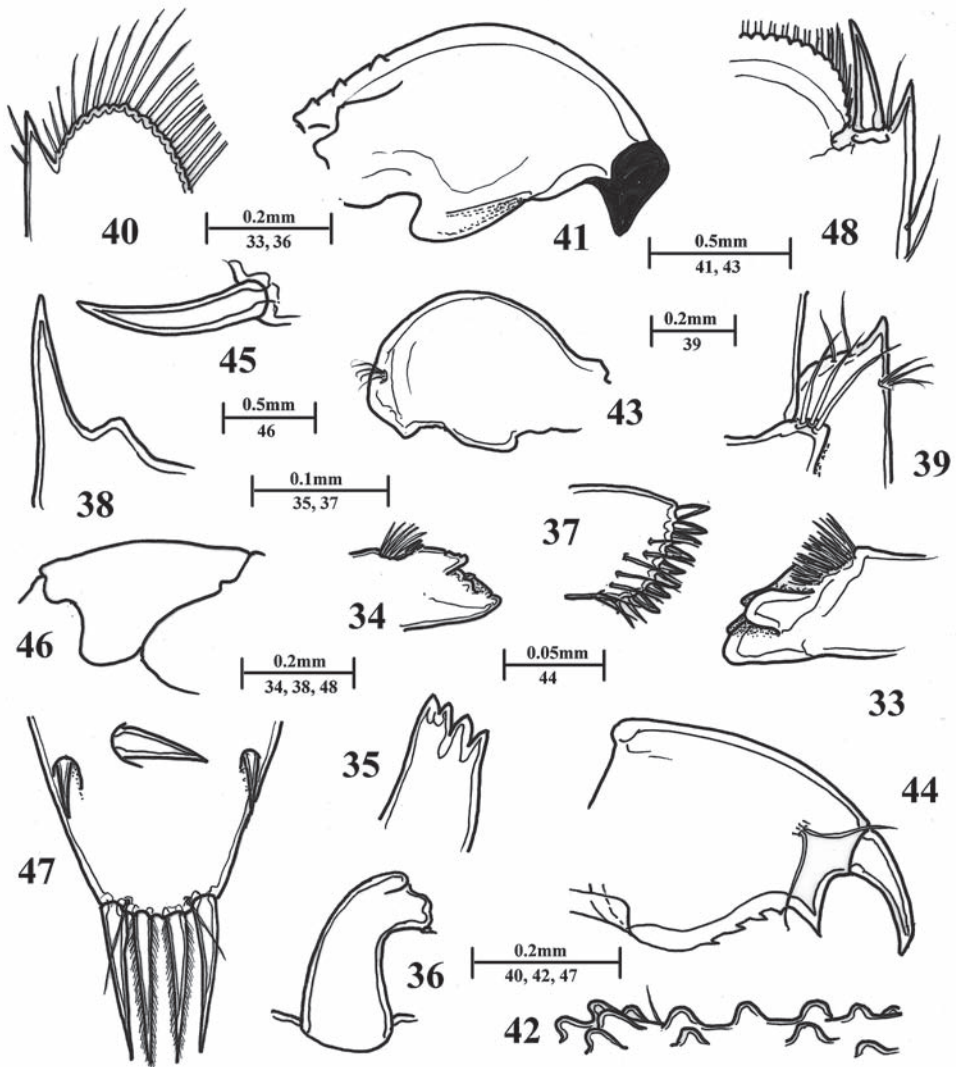
with feebly setulose slender setae, exopod with slender flagellum with four plumose terminal setae (lost in dissection), caridean lobe well developed, epipod bilobed with rounded lobes, distal lobe slightly larger.

Second maxilliped of normal form, dactylar segment with dense serrulate spines, propodal segment broadly rounded distally, sparsely setose; carpus, merus and ischiobasis without special features, exopod with slender flagellum with four plumose terminal setae (lost in dissection), coxa medially rounded, with suboval epipod laterally, without podobranch.

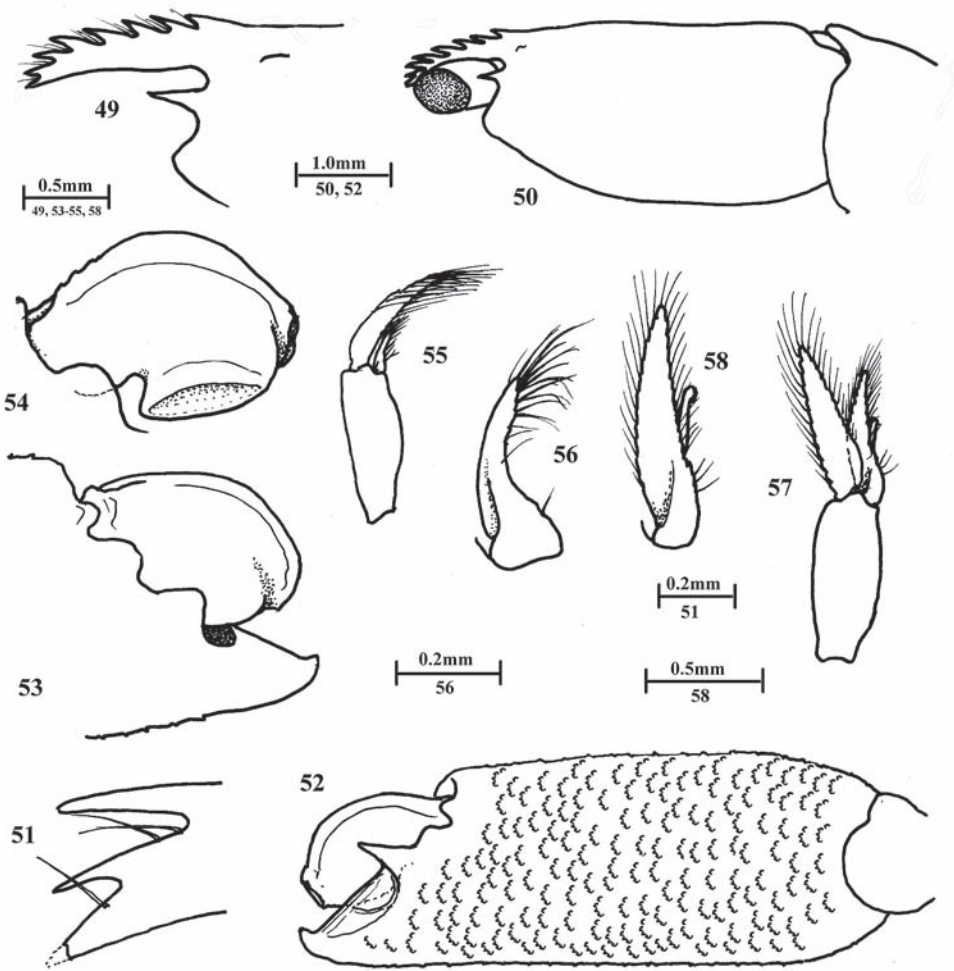
Third maxilliped reaching to end of carpoperite, with ischiomerus indistinctly separated from basis. Ischiomerus 3.3 times longer than wide, uniform, medial margin sparsely setose with short simple setae, lateral margin almost devoid of setae, carpus



Figs 27-32. *Periclimenaeus hebedactylus* Bruce, 1970, ovigerous female allotype, off Makunduchi, Zanzibar, 91.5 m, RMNH D 53333. 27, major second pereiopod; 28, idem, chela, dorsal; 29, idem, fingers; 30, minor second pereiopod; 31, idem, chela, ventral; 32, idem, fingers.



Figs 33-48. *Periclimenaeus hebedactylus* Bruce, 1970, ovigerous female allotype, off Makunduchi, Zanzibar, 91.5 m, RMNH D 53333. 33, molar process, dorsal; 34, idem, ventral; 35, incisor process; 36, maxillula, palp; 37, idem, upper lacinia, distal; 38, inferior orbital angle, dorsal; 39, antennule, proximal segment, distolateral angle; 40, scaphocerite, distal; 41, major second pereiopod dactyl; 42, idem, distal palmar tubercles; 43, minor second pereiopod dactyl; 44, third pereiopod dactyl; 45, idem, distolateral propodal spine; 46, sixth abdominal segment, lateral; 47, posterior telson spines, dorsal spine inset; 48, exopod of uropod, distolateral angle.



Figs 49-58. *Periclimenaeus hebedactylus* Bruce, 1970, male holotype, off Makunduchi, Zanzibar, 91.5 m, RMNH D 51597. 49, rostrum; 50, carapace and rostrum; 51, tip of rostrum; 52, second pereiopod chela, dorsal; 53, idem, fingers, ventral; 54, idem, dorsal; 55, first pleopod; 56, idem, endopod; 57, second pleopod; 58, idem, endopod.

subcylindrical, 3.5 times longer than width, 0.8 of ischiomeral length, with more numerous setae medially, terminal segment about half ischiomeral segment length, tapering distally, with slender terminal spine, medial border with about six transverse rows of serrulate setae, basis with medial margin convex, sparsely setose, exopod with slender flagellum, with lamellar lateral expansion proximally, coxa with medial margin feebly convex, non-setose, lateral margin with well developed rounded lateral plate and small quadrilamellar arthrobranch.

Thoracic sternites unarmed, 1-3 broad, 4-8 narrow.

First pereiopod slender, exceeding carpocerite by carpus and chela; chela with palm subcylindrical, oval in section, 1.5 times longer than deep, with sparse cleaning setae proximo-ventrally, fingers slender, about 3.0 times longer than proximal depth, subequal to palm length, cutting edges lateral, entire, tips feebly hooked with small distinct unguis with small adjacent accessory teeth; carpus 1.25 times chela length, 3.8 times longer than distal width, tapering strongly proximally, with few long cleaning setae distoventrally; merus 1.1 times carpus length, 1.4 times chela length, 4.2 times longer than central width; proximal segments without special features, ischium 0.9 of chela length, basis 0.65 of chela length, coxa with small rounded sparsely setose distoventral process.

Second pereiopods with chelae large, grossly unequal.

Major second pereiopod (right) massive, 1.2 times CL, oval in section, slightly swollen centrally, twice as long as deep, dorsal surface densely covered in irregular transverse rows of well developed mainly rounded tubercles, tubercles smaller and sparser on ventral surface, dactyl moderately compressed, extending well beyond fixed finger, with sparse tubercles proximally, almost half of palm length, about twice as long as central depth, dorsal margin broadly convex, proximal ventral margin with elongated molar process, posteriorly produced, anterior cutting edge short straight, entire, tip markedly broadened, compressed, sparsely setose, densely sclerotised, almost black, bidentate, with smaller distal subacute tooth and larger acute proximal tooth, fixed finger stout proximally, 1.2 times longer than deep, with deep fossa proximally, distal cutting edge entire, proximal dorsal edge with large blunt process, ventral cutting edge with low, tip stout, feebly bidentate, densely sclerotised, cutting edge obsolete; carpus 0.33 of palm length, feebly excavate distally, strongly tapered proximally, unarmed, non-tuberculate; merus about 0.4 of palm length, twice as long a major width, tapering proximally, with four small acute ventral tubercles; ischium about 0.25 of palm length, 1.5 times longer than distal width, tapering proximally, non-tuberculate; basis and coxa robust, without special features.

Minor second pereiopod (left) generally similar to major chela, smaller, about 0.7 of CL, 0.57 of major chela length, palm of chela subcylindrical, oval in section, densely spinulate dorsally, about 1.8 times longer than deep; dactyl 0.5 of palm length, well exceeding fixed finger, semicircular, compressed, about 1.8 times longer than deep, lateral border strongly convex, tip truncate, feebly hooked, cutting edge proximally convex, distally concave, entire; fixed finger short, stout, about 0.38 of palm length, cutting edge longitudinally grooved, dorsal margin with large elongate blunt tooth, ventral margin unarmed, tip bluntly rounded; proximal segments similar to major chela but smaller.

Third pereiopod moderately robust, exceeding carpocerite by propod and dactyl, dactyl short, about 0.12 of propod length, compressed, unguis about 0.4 of corpus dorsal margin length, 2.4 times longer than basal width, strongly curved, unarmed, corpus 1.2 times longer than greatest depth, dorsal margin moderately convex, ventral margin strongly convex with well developed acute accessory tooth distally, well removed from base of unguis, distal border concave, distal proximal ventral margin with five acute denticles, central three larger with smaller denticle proximally and distally; propod about 0.33 of CL, sparsely setose, 4.2 times longer than deep, tapering slightly distally, with paired distoventral spines, unequal, larger spine length about half of distal propod width, ventral margin with four well spaced spines, decreasing in size proximally;

carpus 0.7 of propod length, 3.0 times longer than distal width, tapering slightly proximally, unarmed; merus robust, 1.25 times propod length, 2.8 times longer than central width, tapering slightly proximally and distally, unarmed; ischium subequal to carpus length, 0.7 of propod length, greatest length twice maximal width, tapering strongly proximally, unarmed; basis and coxa robust, without special features. Fourth and fifth pereopods generally similar to third but segments shorter and more slender.

Pleopods without special features.

Uropods with protopodite posterolaterally rounded, exopod about 0.8 of telson length, twice as long as wide, lateral margin feebly convex proximally, unarmed, with submarginal ventral setae, with small acute distal tooth, with larger spine medially, without distinct diaeresis, distal lamella reduced, broadly rounded; endopod extending well beyond exopod, 2.2 times longer than broad.

Description of male holotype.— Lacking minor second pereopod and all ambulatory pereopods except fourth left pereopod. Generally similar to allotype, smaller and more slender with relatively larger second pereopod chela.

Rostrum 0.22 of CL, slender, slightly exceeding anteroverted eyes, tip missing, dentition 7/0, teeth all acute, similar, distal dorsal tooth reduced. Carapace similar to allotype with small supraorbital shoulder, posterodorsal margin as in allotype, depressed, with central convexity fitting under antero dorsal median lobe of first abdominal tergite. Second pereopod chela 1.83 times CL, palm 2.2 times longer than deep, dorsal surface densely covered with small acute tubercles, generally arranged in small arcs, extending on to fingers, fingers about 0.82 of palm length, dactyl compressed, with tip missing, dorsal margin strongly convex, cutting edge with stout molar process, distal cutting edge incomplete, entire, fixed finger stout, with well developed fossa proximally, tip stout, bluntly recurved, simple, un-sclerotized, proximal segments as allotype. Fourth pereopod as allotype. First pleopod basipodite about 2.8 times longer than wide, exopod of subequal length, endopod 0.33 of exopod length, concave medially, robust proximally, tapering distally, distally and distal half of medial margin with numerous slender setae. Second pleopod about 1.2 times first pleopod length, 2.5 times longer than wide, exopod subequal to basipodite length, endopod 0.8 of exopod length, without appendix masculina, appendix interna at 0.4 of medial margin length, 0.25 of exopod length, with few distomedial cincinnuli. Uropods and telson as in allotype.

Measurements (mms).— Holotype male, postorbital carapace length 3.6, carapace and rostrum 4.75, total body length 11.8, major second pereopod chela 6.5. Allotype female, postorbital carapace length 3.7, carapace and rostrum 4.5, total body length 11.5 (approx), major second pereopod chela 4.4, minor second pereopod chela 2.5, ova 3, length 0.5.

Colouration.— Translucent white (Bruce, 1970).

Host.— Unidentified sponge.

Systematic position.— The systematic position of *Periclimenaeus hebedactylus* is not readily discernible. It could be associated with the *P. robustus* species group, but as noted by Ďuriš, Horká & Hoc (2009) this is surely a polyphyletic grouping of several unrelated species sharing the common characteristic of an antero-median dorsal lobe on the first abdominal tergite. The presence of this lobe could well have been overlooked in some of the other species descriptions. From the original description it is clear that the tips of the dactyls of the second pereopods were generally similar although the

tip of the single major dactyl is now missing. Of the 10 species now included in this group, *P. hebedactylus* most closely resembles *P. robustus* Borradaile, 1915. *Periclimenaeus hebedactylus* is readily separated from *P. robustus* by the morphological differences in the second pereopod chelae, particularly the strongly sclerotised truncated tips of the dactyls and the absence of ventral denticles on the corpus of the ambulatory dactyls. It may be distinguished from *P. lobiferus* Bruce, 1978a and *P. ardeae* Bruce, 1970 and *P. palauensis* Miyake & Fujino, 1968, by the absence of a very discrete tuft of setae in the first pereopod dactyl; from *P. gorgonidarum* (Balss, 1913)*, *P. uropodialis* Barnard, 1958 and *P. nufu* Āuriš, Horká & Hoc, 2009, by the lack of serrations on the uropodal exopod; from *P. echinimanus* Āuriš, Horká & Al-Horani, 2011, by the simple non-denticulate unguis on the ambulatory pereopods and lack of ventral rostral teeth and of supraorbital teeth; from *P. djiboutensis* Bruce, 1970 by the lack of a well marked dorso-lateral lobe on the basicerite; from *P. orontes* Bruce, 1986 by the strongly biunguiculate ambulatory dactyl with ventrally denticulate corpus (versus feebly biunguiculate dactyl with unarmed corpus).

Remarks.— The holotype specimen was originally designated as a female on account of its smaller size with more massive major second pereopod chela. The pleopods were not examined in detail and the second pleopod has now been found to be without an appendix masculina. The specimen could therefore be an immature female but the massive second pereopod chela makes this unlikely. In *Periclimenaeus* species the corpus of the appendix masculina is generally small with 1-3 robust spines distally. In some sponge associated pontoniine genera, such as *Periclimenoides*, *Onycocaris* or *Typton*, the corpus may be reduced or completely absent but in the latter case a single spine may arise directly from the endopod. In *Paraclimenaeus* Bruce, 1995, the corpus is completely absent and there are no spines (Bruce, 1995). The condition of the present specimen may also be an extreme form in which even the spine has been lost.

The disposition of the telson spines in *P. hebedactylus* is unique among the Indo-West Pacific species of the genus with the two pairs of dorsal spines on the anterior fourth of the telson and the lateral posterior spines far in advance of the posterior telson margin at about 0.76 of the telson length. In four of the 57 species the lateral posterior spines are slightly removed from the posterior telson margin, *P. djiboutensis*, *P. nufu*, *P. orontes*, and *P. palauensis*. All except the last named also have a well developed anterior median lobe on the first abdominal tergite with a corresponding depression on the posterior carapace, as in *P. hebedactylus*.

Most of the 57 Indo-West Pacific *Periclimenaeus* species have been collected from shallow waters, often associated with coral reefs. Eight, possibly nine, species are known to occur in more than 50 m but only *P. jeancharcoti* Bruce, 1991, has been reported from a greater depth than *P. hebedactylus*: *P. djiboutensis*, from Port Dauphin, Madagascar, at 80-85 m (Bruce, 1978a); *P. hecate* (Nobili, 1904) from Moroni, Grande Comore, 60 m (Bruce, 1978b); *P. jeancharcoti*, from New Caledonia, 375-450 m (Bruce, 1991), but mainly from shallow water, 3-37 m (Fransen, 2006); *P. lobiferus*, from the Mozambique Channel, 80-85 m (Bruce, 1978a); *P. minutus*, off Somalia, 9°33'N 50°59'E to 9°36'N 51°01'E, 73-80 m (Bruce, 1978b); *P. quadridentatus* (Rathbun, 1906), from Auau

* see Addendum

Channel, between Maui and Lanai Islands, Hawaiian Islands, 51-79 m (Rathbun, 1906); and *P. robustus*, from the Amirante Islands, Seychelle Islands, 52-70 m (Borradaile, 1915, 1917); and possibly also *P. rastrifer* Bruce, 1980, from the northern South China Sea, with 19 spms, from 35-54 m (Li, Bruce and Manning, 2005), the latter again mainly known from shallow waters.

Addendum

Periclimenes gorgonidarum Balss, 1913 has recently been transferred to the monospecific genus *Isopericlimenaeus* Marin, 2012.

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