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FURTHER PRELIMINARY DESCRIPTIONS OF NEW SPECIES OF THE GENUS *PERICLIMENAEUS* BORRADAILE, 1915, (CRUSTACEA, DECAPODA NATANTIA, PONTONIINAE)

by

A. J. BRUCE.

Division of Fisheries and Oceanography, C.S.I.R.O., 427 Oxley Avenue, Redcliffe,
Queensland, Australia

In a recent paper preliminary descriptions were given of ten new species of the genus *Periclimenaeus* Borradaile from the Indo-West-Pacific region (Bruce, 1969). The recent acquisition of further material has provided three new species of the same genus from the Great Barrier Reef and two other new species have also been discovered. Preliminary descriptions of these new species, based primarily on the undissected holotype specimens, are now provided.

All specimens, whose hosts were noted, were obtained from sponges, some of which are in the process of identification.

The holotype specimens will be deposited in the collections of the Rijksmuseum van Natuurlijke Historie, Leiden, except where they are part of the collections of another museum.

***Periclimenaeus bidentatus* sp. nov.**

Description. — A small, relatively slenderly built species. Body generally smooth. Rostrum well developed, slender, acute, reaching to base of intermediate segment of antennular peduncle, straight, slightly depressed. Dorsal margin with seven long slender acute teeth, the most posterior situated over the orbital margin. Ventral margin feebly convex, toothless. Midrib indistinct. Epigastric spine absent. Small acute supraorbital tubercles present. Orbit feebly developed. Inferior orbital angle feebly developed, blunt. Antennal spine robust, situated over inferior orbital angle. Anterolateral angle of carapace broadly rounded. Sixth abdominal segment about 1.5 times longer than deep. Pleura of first four segments rounded; fifth bluntly subrec-

tangular; sixth acutely expanded. Telson normal, moderately narrow, with dorsal spines at 0.1 and 0.5 of telson length and three pairs of terminal spines.

Basal segment of antennule broad basally and narrow distally, lateral border strongly concave, anterior margin produced laterally with long slender tooth. Medial border straight. Stylocerite very broad and leaf-like, acute distally. Distal segment about 1.5 times length of intermediate segment, combined lengths equal to two thirds of medial border. Flagella normal. Basicerite with small lateral spine. Carpocerite robust, short, only reaching to 0.6 of scaphocerite and not exceeding basal segment of antennule. Scaphocerite slightly exceeding antennular peduncle, broadest centrally with rounded anterior margin, lateral border straight, terminating in a very long strong spine, extending far beyond lamella and equal to about one fourth of the length of the lateral border. Eyes normal; cornea hemispherical, strongly oblique; stalk short, slightly flattened dorsoventrally, slightly narrower than cornea.

First pereiopods slender, exceeding carpocerite by 0.4 of merus, carpus and chela. Chela slender with subcylindrical palm; fingers slender, tapering, 0.6 times length of palm. Carpus about 1.5 times length of chela, subequal to merus. Second pereiopods not greatly enlarged, slightly unequal, generally similar. Major second pereiopod with palm of chela swollen proximally and compressed, tapering distally, feebly spinulate along dorsal and ventral borders and with spinules arranged in transverse rows over the dorsal aspect. Fingers about two-sevenths of length of palm. Dactylus expanded and laminar, outer border evenly rounded, cutting edge convex with feebly developed molar process proximally; tip hooked with two robust teeth. Fixed finger acute with groove along cutting edge for molar process of dactylus, with a small process proximally on dorsal lip of cutting edge. Carpus short and stout, excavated anteriorly, about one third of length of palm, unarmed, Merus spinulate along ventral border, unarmed distoventrally. Minor chela similar but smaller with even feebler development of dactylar molar process. Ambulatory pereiopods robust. Dactylus biunguiculate, short and stout, with minute spinules along the ventral border proximally. Propod of third pereiopod with six stout spines ventrally, carpus and merus unarmed. Fourth and fifth pereiopods more slender with unarmed propodus. Uropods normal; basipod blunt distolaterally, lateral border of exopod entire, straight, with distal tooth and long mobile spinule.

Colour. — Mainly transparent.

Host. — Littoral sponges.

Distribution. — Great Barrier Reef, Australia; East Africa.

Type. — Holotype, an ovigerous female, from Heron Island, Capricorn Group, Great Barrier Reef, Queensland, Australia; littoral; 2 December 1966, coll. A. J. Bruce.

Remarks. — *Periclimenaeus bidentatus* may be distinguished from all other species of the genus by the tips of the dactyls of the second pereopods which are distinctly doubled. The distal spine of the scaphocerite is also unusually large and resembles that of the American species *P. caraibicus* Holthuis. In its general features, *P. bidentatus* resembles *P. rhodope* (Nobili).

***Periclimenaeus djiboutensis* sp. nov.**

Description. — Specimens damaged, lacking many appendages. Medium sized, with a generally smooth body.

Rostrum well developed, slender, acute, slightly depressed, reaching almost to distal border of basal segment of antennular peduncle. Dorsal margin with seven short acute teeth, all anterior to the orbital margin. Ventral margin without teeth, straight. Midrib indistinct. Epigastric, hepatic and supraorbital spines absent. Orbit feebly developed. Inferior orbital angle obsolescent. Antennal spine well developed, slender, acute; situated over inferior orbital angle. Anterolateral angle slightly produced, obtuse, rounded. Sixth abdominal segment about twice as long as deep. Pleura of first five abdominal segments rounded. Pleura of sixth segment produced, blunt. Telson 2.6 times longer than anterior width, tapering posteriorly. Two pairs of dorsal spines present on anterior eighth of the telson length, posterior spines longer than anterior spines and submarginal, anterior spines situated more closely to midline than posterior and close to anterior margin. Two pairs of long, subequal terminal telson spines present.

Basal segment of antennular peduncle broad basally and narrowed distally, lateral border slightly convex, anterior margin produced acute, lateral angle blunt, posterior lateral border convex; stylocerite short, broad, acute. Intermediate and terminal segments short, equal to about half the length of the proximal segment. Flagella normal, short. Basicerite with round flattened lamina laterally. Carpocerite extending to distal border of intermediate segment of antennular peduncle, slender, subcylindrical. Scaphocerite slender, extending to base of distal segment of antennular peduncle, lateral border straight with strong distal spine, slightly exceeding the rounded anterior margin of the lamella. Eyes normal, cornea hemispherical, strongly oblique, stalk short and stout, swollen proximally.

First pereopods slender, exceeding carpocerite by five eighths of the length of the merus, carpus and chela. Chela slender, slightly swollen proximally, about five times longer than wide: fingers short, stout; dactylus about

one fifth of length of palm, cupped, with three acute teeth distally, arching over the fixed finger, which is straight, about half the length of the dactylus and bears three slender acute, spiniform processes distally which meet the tip of the dactylus. Numerous setae are present on the fingers. Chela about 0.6 times of length of carpus. Carpus slightly shorter than merus. Major second pereopods missing. Minor second pereopod with palm subcylindrical, slightly compressed, swollen proximally, smooth: fingers slender, tapering, setose, slightly shorter than palm, tips acute, strongly curved, cutting edges entire with a small acute tooth proximally on the fixed finger. Carpus short and stout, expanded distally, about half length of palm. Merus robust, ventrally spinulate, about 1.3 times longer than carpus. All ambulatory pereopods detached, one preserved, robust, dactylus short and stout with a small recurved accessory spine. Propodus tapering distally bearing a single terminal spine. Carpus and merus unarmed. Uropods normal; basipodite blunt distolaterally; exopod with lateral border feebly convex, unarmed, with a small acute tooth and mobile spinule distally.

Colour. — Unknown.

Host. — Not recorded.

Distribution. — Jibuti.

Type. — Holotype, an ovigerous female, with paratypes, from Jibuti, French Somaliland; no further details.

Remarks. — *Periclimenaeus djiboutensis* may be distinguished from all other species of the genus so far described by the characteristic form of the chela of the first pereopod, which is of a type so far unknown in the subfamily Pontoniinae. In the absence of supraorbital spines and ventral rostral teeth, with the posterior pair of dorsal telson spines situated on the anterior half of the telson, the new species bears some resemblance to *P. fimbriatus* Borradaile but can be readily separated from that species by the distribution of the dorsal telson spines, their difference in size and relatively much shorter lengths. In *P. fimbriatus* the lateral terminal spines are well developed and subterminal, and the intermediate and terminal spines are equal to about half the telson length. The minor second pereopod in *P. fimbriatus* is of a different type and the exact systematic position of *P. djiboutensis* will have to await the discovery of further specimens with the major second pereopod.

***Periclimenaeus hebedactylus* sp. nov.**

Description. — A medium-sized species, moderately slender. Body generally smooth.

Rostrum well developed, straight, slender slightly depressed, reaching

almost to distal end of basal segment of antennular peduncle. Dorsal margin feebly convex with seven acute teeth, all situated anteriorly to the orbital margin, increasing slightly in size anteriorly except for the most distal tooth which is distinctly smaller than the preceding tooth. The ventral border is feebly concave and without teeth. Epigastric, hepatic and supraorbital spines absent. Orbit feebly developed. Inferior angle obsolescent. Antennal spine well developed, situated over inferior orbital angle, long, slender, acute, exceeding basicerite. Anterolateral angle of carapace obtusely rounded. First abdominal segment with non-articular surface broadly produced anteriorly in the dorsal midline. Sixth segment about twice as long as deep. Pleura of first five segments rounded. Pleuron of sixth segment acutely expanded posteriorly. Telson nearly three times longer than greatest breadth, tapering posteriorly. Two pairs of large subequal dorsal spines present, anterior pair at 0.1 and the posterior pair at 0.25 of the telson length. The posterior spines are submarginal and the anterior spines are slightly closer to the midline. Three pairs of terminal spines are present. The lateral spines are short and preterminal situated at 0.75 of the telson length. The intermediate and submedian spines are slender and longer than the dorsal spines.

Basal segment of antennule is broad basally and narrows distally, lateral border feebly concave, with anterior margin produced, with a small acute lateral tooth; posterior lateral angle rounded; stylocerite short and broad, feebly pointed. Intermediate and distal segments subequal, short, together equal to half the length of basal segment. Flagella normal, short basicerite unarmed. Carpocerite, slender, subcylindrical, reaching to middle of intermediate segment of antennular peduncle. Scaphocerite slightly exceeding carpocerite, reaching to proximal border of distal segment of antennular peduncle, broadest centrally with rounded anterior border; lateral border straight with small acute distal tooth, not exceeding lamella. The eye is normal not exceeding tip of rostrum, with a hemispherical, strongly oblique cornea; stalk short and stout, subcylindrical, slightly swollen proximally.

First pereopod robust, exceeding carpocerite by about half length of merus, carpus and chela. Chela with subcylindrical, slightly compressed palm; fingers slender, tapering, subequal to palm, cutting edges central, entire. Carpus about 1.4 times length of chela and slightly shorter than merus. Second pereopods markedly unequal, especially in male, and dissimilar. Major second pereopod with palm of chela subcylindrical, strongly tuberculate dorsally, with tubercles ranged in transverse rows. The lateral border is produced posteriorly to the dactylar hinge, feebly in the male and strongly and acutely in the female. The fingers are short and robust. The dactylus, compressed with semi-circular outer margin, is between one fifth and one

third of the length of the palm in male and female respectively with a stout molar process on the cutting edge proximally. The tip of the dactylus far exceeds the fixed finger and is markedly truncated. The fixed finger is short, and tapering with feebly hooked tip, cutting edge straight with large fossa proximally. Dorsal border of cutting edge with a large acute tooth proximally and a smaller blunt tooth ventrally. Carpus short, stout, excavated anteriorly. Merus spinulate along ventral border, about 1.25 times length of carpus, unarmed distoventrally. Minor second pereopod small. Chela in male tapering distally and compressed, tuberculate dorsally, and acutely produced proximally to dactylar hinge. Fingers similar to major pereopod but without dactylar molar process, and with fixed finger distally blunt. Carpus and merus similar to major pereopod but merus only feebly spinulate in female. Ambulatory pereopods robust. Dactylus short and stout, biunguiculate, with ventral border spinulate proximally to accessory tooth. Propodus tapering distally, with a few stout spines ventrally on third pereopod. Carpus and merus unarmed. Uropods normal, basipodite distolaterally blunt; lateral border of exopod feebly convex, entire, with a small acute tooth distally.

Colour. — Translucent white.

Host. — Sublittoral sponges.

Distribution. — East Africa.

Type. — Holotype, a female, with ovigerous female paratype, from Makunduchi, Zanzibar; 50 fms; 8 August 1960; coll. J. H. Wickstead.

Remarks. — *Periclimenaeus hebedactylus* may be distinguished from all other species of the genus by the characteristic truncated tips of the dactyls of the second pereopods which distinctly overreach the stout blunt fixed fingers in both sexes. In the form of the telson *P. hebedactylus* shows some resemblance to *P. fimbriatus* Borradaile, but may be readily distinguished from that species which has much longer telson spines and the molar process of the major second pereopod is situated on the fixed finger. *P. hebedactylus* in its general features also shows some resemblance to *P. minutus* Holthuis, although the first pereopod and the ambulatory pereopods are much more slender and spinulation of the telson is quite distinct. The dactylus of the second pereopods in *P. minutus* is normal in form and the cutting edge of the dactylus of the minor second pereopod is pectinate.

***Periclimenaeus ardeae* sp. nov.**

Description. — A moderately large, stoutly built species. Body generally smooth. Rostrum well developed, slender acute, exceeding intermediate segment of antennular peduncle, slightly depressed. Dorsal margin with eight

slender, acute teeth, all anterior to orbital margin and increasing in length anteriorly. Ventral margin feebly convex, toothless. No distinguishable midrib. Epigastric and supraorbital spines absent. Orbit feebly developed. Inferior orbital angle small and blunt. Antennal spine robust, long and acute, situated over inferior orbital angle and exceeding basicerite anteriorly. Anterolateral angle obtusely rounded. First abdominal segment with rounded laminar process projecting anteriorly from the dorsomedian edge of the non-articular portion of the tergite, overlying the posterior half of the rounded articular surface. Sixth abdominal segment about twice as long as deep, posterior lateral angles feebly acute. Pleura of first four segments rounded; fifth bluntly angled, sixth produced and acute. Telson moderately broad. Dorsal spines well developed, subequal, equal to one eighth of the telson length, anterior pair at one eighth and posterior pair at five eighths of the telson length. Three pairs of terminal spines are present, the lateral spines about three fifths of the length of the stout intermediate spines; submedian spine slightly shorter and more slender than intermediate spines.

Basal segment of antennular peduncle broad posteriorly, tapering anteriorly, medial border straight, anterior lateral border straight, posterior lateral border convex; feeble anterodistal lobe laterally with an acute lateral tooth; stylocerite broad, acutely pointed distally. Intermediate and distal segments subequal, equal to half length of basal segment. Flagella normal. Basicerite unarmed. Carpocerite slender, distinctly exceeding basal segment of antennular peduncle. Scaphocerite well developed, lateral border feebly concave with robust divergent distal tooth; anterior margin of lamella produced beyond spine, feebly angulated with medial border, and reaching almost to end of antennular peduncle. Eyes with oblique hemispherical cornea; stalk subcylindrical, short, slightly swollen proximally.

First pereopod robust, exceeding carpocerite by length of carpus and chela. Chela stout and with compressed palm. Fingers subequal to palm, tips slender, strongly hooked, cutting edges entire. Dactylus rather expanded proximally and bearing a large tuft of setae on the middle third of the dorsal border. Fixed finger slender and tapering with numerous tufts of setae. Carpus about 1.7 times the length of the chela and less than half as wide proximally as distally where it is subequal to the breadth of the palm of the chela. Merus subequal to carpus. Second pereopods very unequal and dissimilar. Major second pereopod robust with palm subcylindrical, tapering slightly distally and slightly compressed. Fingers slightly less than half the length of palm. Dactylus deep and flattened, curved inwards and with a hooked tip. Cutting edge with a molar process proximally which is continuous with the cutting edge anteriorly. Fixed finger tapering, inwardly

curved and with a hooked tip. Cutting edge with a fossa for the dactylar molar process on the proximal half, with a blunt process dorsally proximal to the molar process. Chela generally spinulate, most markedly along the dorsomedian aspects, where long slender spines also occur on the dactylus, and along the ventral border. Carpus about one third of the length of palm, deeply excavated anteriorly, and unarmed. Merus about 1.3 times the length of carpus, blunt distoventrally and spinulate along the ventral border. Chela of smaller second pereopod about half the length of the major chela. Palm swollen, tapering abruptly distally. Fingers about half the length of palm and without hooked tips. Dactylus strongly compressed with semicircular dorsal border and a slightly concave cutting edge. Fixed finger tapering to an acute point, with a slightly convex cutting edge. Cutting edges of the fingers entire and minor chela generally spinulate in the same way as the major chela. Ambulatory pereopods robust. Dactyls stout with distinct accessory spines. Propodus of third pereopod tapering distally and with six stout spines ventrally. Carpus and merus unarmed. Fourth and fifth pereopods similar but with fewer spines on the propod. Uropods normal, basipod blunt distolaterally; lateral border convex with acute distal tooth and large mobile spinule distally.

Colour. — Transparent with orange tinge especially on chelae.

Host. — Littoral sponges.

Distribution. — Great Barrier Reef, Australia.

Type. — Holotype, an ovigerous female, with allotype, from Heron Island, Capricorn Group, Great Barrier Reef, Queensland, Australia; littoral; 3 December 1968; coll. A. J. Bruce.

Remarks. — *Periclimenacus ardeae* may be distinguished from all species of the genus so far described by the presence of the medial dorsal anteriorly directed process on the first abdominal segment. The function of this process is obscure but it appears probable that it may fit into a space beneath the posterior dorsal edge of the carapace.

Periclimenacus ardeae is most closely related to *P. pulauensis* Miyake & Fujino, 1968, which is similar in its general morphology but differs in numerous small details of rostrum, antennal spine, antennal peduncles and telson. The most important differences are that in *P. ardeae* the chela of the first pereopod is less broadened and the fingers have hooked tips and the chelae of the second pereopod are covered with long slender spinules on the dorsomedial aspects.

Periclimenaeus ornatus sp. nov.

Description. — A moderately sized, slenderly built species. Body generally smooth. Rostrum slender, acute, slightly depressed, not reaching to the distal border of the basal segment of the antennular peduncle. Six slender acute dorsal teeth present, all in advance of orbital margin; fourth and fifth teeth longer than the others. Ventral margin feebly convex, toothless. No distinct midrib. Epigastric and supraorbital spines absent. Orbit feebly developed. Inferior orbital angle small and rounded. Antennal spine acute, situated over inferior orbital angle. Anterolateral angle of carapace obtusely rounded. Sixth abdominal segment about twice as long as deep. Pleura of first five segments rounded. Posteroventral angle of sixth segment bluntly rounded, posterolateral angle spinous. Telson moderately broad, tapering, with two pairs of submarginal, subequal dorsal spines situated at 0.4 and 0.6 of the telson length from anterior margin. Three pairs of terminal telson spines; lateral spines slightly smaller than dorsal spines and half of length of intermediate spines; submedian spines slender.

Basal segment of antennular peduncle long and slender, tapering anteriorly; anterior margin produced as narrow lobe bearing a large acute tooth; lateral border concave; stylocerite short, leaf-like, reaching to about one third of the segment length. Intermediate and distal segments longer than broad, subequal, together equal to about half the length of the basal segment. Flagella slender, short. Basicerite unarmed. Carpocerite slender, exceeding rostrum but not exceeding basal antennular segment. Scaphocerite well developed, not broadened, exceeding intermediate segment of the antennular peduncle, with large distolateral tooth distinctly overreaching the lamella, lateral border straight. Eye slender, elongated; with markedly oblique cornea, slightly narrower than proximal width of stalk.

First pereiopods moderately stout; merus reaches to distal end of carpo-cerite. Chela robust; palm subcylindrical with very short stout deflexed fingers equal to about one third of the palm length. Carpus slender, expanded distally, about 1.1 times length of chela and 0.75 times length of merus. Second pereiopods dissimilar, slightly unequal. Major second pereiopod with well developed chela with smooth, high, compressed palm. Fingers about half the length of the palm, slender, with hooked tips. Dactylus with a single large acute tooth on proximal third of cutting edge, distal cutting edge entire, blunt. Fixed finger with a small blunt tubercle on dorsal aspect of cutting edge proximally, with a low obtuse tooth more distally, separated by a fossa into which the acute dactylar tooth opposes; cutting edge blunt. Minor second pereiopod smaller and less robust, with slender, gaping fingers with hooked

tips, subequal to palm. Cutting edge of dactylus bears a row of discrete flat-topped tubercles throughout its length, except for extreme tip. The cutting edge of the fixed finger bears a double row of similar tubercles, the inner row bearing about twice as many as the outer row, with more irregularly distributed tubercles proximally. The carpus is about one third of the length of the palm, expanded distally and dorsally excavated; unarmed but feebly spinulate ventrally. The merus is about 1.5 times the length of the carpus, ventrally spinulate and unarmed. Ambulatory pereopods slender, third much longer than fifth, exceeding antennular peduncle by half the propod. Dactylus short, biunguiculate. Propodus slender, tapering distally, unarmed. Merus robust, unarmed. Uropods normal. Basipod blunt distolaterally. Exopod with lateral border strongly convex with large acute distal tooth and strong mobile spine.

Colour. — Chocolate brown with white spots.

Host. — Littoral sponges.

Distribution. — Great Barrier Reef. East Africa.

Type. — Holotype, an ovigerous female, with allotype and a pair of paratypes, from Heron Island, Capricorn Group, Great Barrier Reef, Queensland, Australia; littoral; 2 December 1968; coll. A. J. Bruce.

Remarks. — This unusual species of *Periclimenaeus* may be readily distinguished from the majority of species of the genus by the absence of a molar process on the dactylus of the major second pereopod. The only other species without a molar process in this position are *Periclimenaeus novaezealandiae* (Borradaile, 1916) and *P. odontodactylus* Fujino & Miyake, 1968.

Periclimenaeus ornatus may be immediately separated from both these species by the armament of the cutting edges of the fingers of the minor second pereopod, which is without parallel in the subfamily Pontiinae. *P. ornatus* is most closely related to *P. odontodactylus* and the form of the rostrum, eyes and antennae are similar in the two species, which must be considered as primitive members of the genus. *P. ornatus*, however, differs from *P. odontodactylus* in the form of the first pereopods, the dactyls of the ambulatory pereopods, the positions of the dorsal spines of the telson as well as in the second pereopods. *P. novaezealandiae*, as noted by Borradaile, closely resembles a species of *Periclimenes*, except for the absence of an hepatic spine, and must be considered an even more primitive species of the genus *Periclimenaeus*. It may be readily identified by the presence of three post-orbital rostral teeth dorsally and a pair of teeth ventrally.

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