A re-examination of *Periclimenaeus trispinosus* Bruce and *P. orbitospinatus* Bruce (Crustacea: Decapoda: Pontoniinae)

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Key words: Crustacea; Decapoda; Pontoniinae; Indo-West Pacific; *Periclimenaeus*; *Apopontonia*; types; re-descriptions; synonymy.
The holotype specimens of *Periclimenaeus trispinosus* Bruce, 1969, and *Periclimenaeus orbitospinatus* Bruce, 1969, are re-examined, re-described and illustrated. *Apopontonia tridentata* Bruce, 1988, is a junior synonym of *Periclimenaeus orbitospinatus,* which is transferred to the genus *Apopontonia.*

Introduction

The genus *Periclimenaeus* Borradaile, 1915, is the second most speciose genus of the subfamily Pontoniinae Costa,1844. The majority of species, found in tropical waters throughout the world, are associates of sponges, particularly those found on coral reefs, and a smaller number live as heterosexual pairs in the common cloacal cavity of colonial tunicates. About 50 species are now known from the Indo-West Pacific region. Many are rarely collected and several are known from the type specimens only. The species present a wide range of differences in minute details of their morphology. To adequately analyse the relationships between the species, detailed descriptions are essential. The following remarks will amplify the preliminary descriptions of two species provided some 30 years ago.

RMNH refers to the Rijksmuseum van Natuurlijke Historie (now Nationaal Natuurhistorisch Museum, Leiden).

Pontoniinae Costa, 1844

Periclimenaeus trispinosus (Bruce, 1969)
(figs 1-3)

Restricted synonymy:
Periclimenaeus trispinosus Bruce, 1969: 169-170.

Material.—. Holotype, (RMNH D.25613) 1 ovig.♀, Mkokotoni, Unguja, Zanzibar, trawl, 24.i 1961, 25.5-27 m, sandy bottom, coll. A.J.Bruce.

Description. — Small pontoniine shrimp, with glabrous subcylindrical body, lacking right minor second pereiopod, one third, both fourth and one fifth pereiopods.

Carapace (fig. 1A) smooth, without epigastric or hepatic spines, supraorbital spines, tubercles or ridges. Rostrum (fig. 1D) about 0.4 of carapace length, reaching to about distal end of proximal segment of antennular peduncle, exceeding anteroverted corneal margin, slender, straight, compressed, slightly depressed, with eight acute dorsal teeth, with numerous simple interdental setae, first tooth situated on carapace,

teeth increasing slightly in size distally, without distinct lateral carinae, inferior margin straight, unarmed, non-setose, inferior orbital angle obsolete, antennal spine well developed, marginal, with two similar subequal spines posterodorsally(fig. 1C), anterolateral margin of branchiostegite not produced, broadly rounded.

Abdomen well developed, first segment with small median anterodorsal lobe, fitting beneath posterior carapace margin, pleura of first three segments large, broadly rounded, fourth and fifth small, rounded, feebly produced, sixth short, about 0.7 of length of fifth, length subequal to depth, depressed, with acute posterolateral and blunter posteroventral angles. Telson (fig. 1H) about 0.45 of carapace length, twice as long as wide, lateral margins convex, greatest width at about half length, posteriorly convergent, with 2 pairs of large subequal submarginal dorsal spines (fig. 1I), 0.1 of telson length, at 0.24 and 0.55 of length, posterior margin (fig. 1J) about half anterior margin width, broadly convex without median point, lateral posterior spines small, marginal, preterminal, about 0.2 of intermediate spine length, intermediate spines well developed, stout, 0.15 of telson length, submedian spines slender, subequal to intermediate spine length, setulose.

Antennule (fig. 1E) with peduncle short, exceeding carpocerite and rostrum, proximal segment about 2.3 times longer than greatest width, lateral margin straight, tapering slightly distally, with small distolateral lobe with slender acute distolateral tooth, without ventromedial tooth, stylocerite short, acute, reaching to about 0.45 of segment length, statocyst normal, with small granular statolith; intermediate and distal segments short, robust, subequal, together about 0.6 of proximal segment length; flagella short, subequal to peduncle length, upper flagellum biramous, proximal 3 segments of rami fused, stout, short ramus single segmented, with about 9 groups of aesthetascs, longer ramus with five segments, lower flagellum simple, with nine slender subcylindrical segments.

Antenna (fig. 1F) short, with carpocerite reaching to distal margin of intermediate segment of antennular peduncle; basicerite normal, unarmed, with tubercular aperture to antennal gland medially; carpocerite subcylindrical, 4.5 times longer than distal width, far exceeding scaphocerite; scaphocerite reduced, reaching to about 0.6 of carpocerite length, about 3.6 times longer than wide, maximal width at about half length, tapering distally, lamella distally narrowly rounded, lateral margin straight with long, slender acute tooth distally (fig. 1G), not exceeding anterior margin of lamella.

Eye (fig. 1B) with cornea hemispherical, well pigmented, oblique, diameter about 0.16 of carapace length, without accessory pigment spot, stalk about 1.5 times longer than width, subcylindrical,

Mandible (fig. 2A) with stout corpus, without palp, incisor process greatly reduced, short, acute, without teeth, molar process well developed, stout, subcylindrical, very obliquely truncated distally, with acute postero-dorsal tooth. Maxillula (fig. 2B) with short simple palp (fig. 2C), distoventrally with minute setose tubercle; upper lacinia broadly oval, distoventral border with 8 short simple spines, proximal ventral border with setae; lower lacinia small, short, tapering with 5 slender spines distally. Maxilla (fig. 2D) with long slender tapering palp, without terminal seta, with 2 short setae proximolaterally, basal endite simple with 6 simple terminal setae, coxal endite obsolete, scaphognathite damaged. First maxilliped (fig. 2E) with palp dam-

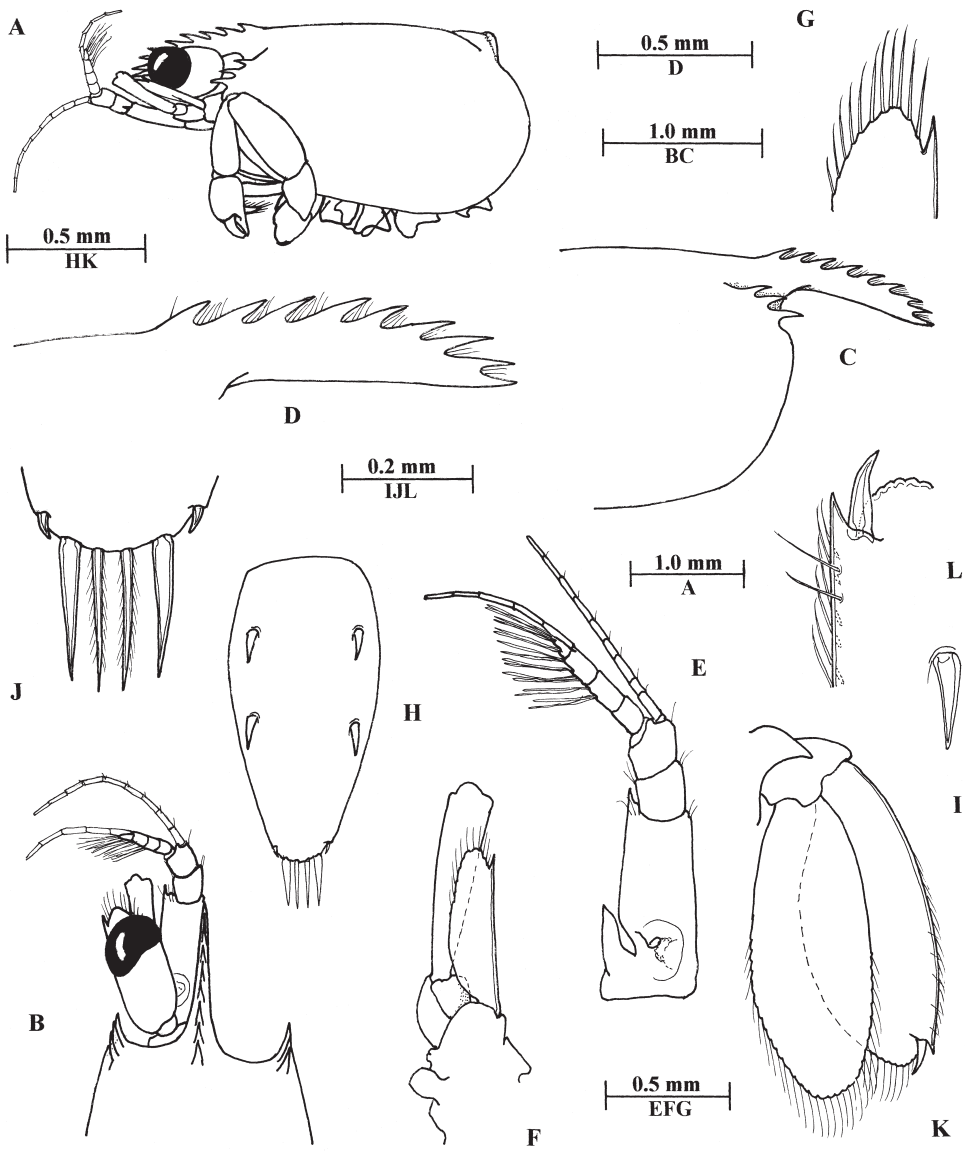

Fig. 1. *Periclimenaeus trispinosus* Bruce, 1969, ovigerous holotype female, Zanzibar, (RMNH D. 25613). A, carapace and appendages; B, anterior carapace, left eye and antennae, dorsal; C, anterior carapace and rostrum, lateral; D, rostrum; E, antennule; F, antenna; G, distal scaphocerite; H, telson; I, same. dorsal spine; J, same, posterior spines; K, uropod; L, same, posterolateral exopod.

aged, basal and coxal endites completely fused, combined segment narrow, sparsely setose along distomedial margin, setae simple, exopod well developed, with 5 plumose setae distally, caridean lobe small, epipod oval, deeply bilobed, without podobranch. Second pereiopod (fig. 2F) with endopod of normal form, dactylar segment narrow, with numerous setulose spines medially, exopod slender, with 5

plumose terminal setae, coxa not medially produced, with well developed oval epipod laterally. Third maxilliped (fig. 2G) reaching to about proximal end of carpocerite, with ischiomerus completely fused to basis, combined segment about 2.7 times longer than proximal width, tapering distally, lateral margin non-setose, medial margin with 11-12 simple setae distally, penultimate segment 0.6 of antepenultimate segment length, subcylindrical, 3.4 times longer than wide, several small groups of simple setae medially, two small spines distodorsally, terminal segment 0.7 of penultimate segment length 2.5 times longer than basal width, tapering to blunt distal point, ventral margin with numerous spiniform setulose setae, exopod as in second maxilliped, with several additional short plumose setae distolaterally, coxal segment broad, not medially produced, with large low oval lateral plate, without arthrobranch.

Thoracic sternites narrow, unarmed.

First pereiopod (fig. 3A) short, stout, exceeding carpocerite by about carpus and chela; chela (fig. 3B) about 1.5 times longer than deep, compressed, dorsal margin convex, ventral border straight, sparsely setose, fingers robust, simple, dactylus short, stout, about 0.66 of palm length, strongly curved, 2.0 times longer than basal width, tapering strongly to acute bidentate tip, slightly over-reaching fixed finger, dorsal margin convex, cutting edge concave, sharp, entire, fixed finger smaller than dactylus, 2.0 times longer than basal width, cutting edge sharp, entire, tip bidentate; carpus 1.1 times chela length, 3.0 times longer than distal width, tapering proximally, merus robust, 2.4 times longer than maximal width, situated at 2.5 of length, tapering distally, 1.2 times carpus length, unarmed; ischium short, 0.5 of merus length, robust, unarmed; basis and coxa stout, short, without special features, coxa without ventral process.

Major second pereiopod (fig. 2C) well developed with greatly enlarged chela; chela (fig. 2D) with palm glabrous, densely tuberculate dorsally, rugose ventrally, 2.1 times longer than deep, oval in section, tapering slightly distally, fingers (fig. 2E) strongly twisted medially, dactylus robust, stout proximally, compressed, about 2.3 times longer than deep, slightly exceeding fixed finger, dorsal margin strongly convex, carinate distally, with stout blunt strongly hooked tip, cutting edge distally sharp, entire, proximally with large molar process, with concave ventral surface, fixed finger stout proximally, compressed distally, ventrally carinate, length subequal to basal width, with stout blunt strongly hooked tip, distal half of cutting edge sharp, entire, proximal half with deep fossa, proximal dorsal margin with large and small acute teeth, ventral margin with small tooth only; carpus about 0.3 of palm length, 1.5 times longer than wide, distally expanded, ventrally excavate, strongly tapered proximally, sparsely tuberculate ventrally; merus subequal to carpus length, 1.7 times longer than central width, sparsely tuberculate ventrally; ischium about 0.9 of merus length, 2.5 times longer than distal width, tapering strongly proximally, feebly tuberculate ventrally; basis and coxa normal, robust, without special features. Minor second pereiopod lacking.

Third pereiopod (fig. 2F) detached; dactylus (fig. 2H) with unguis very short, stout, strongly compressed, unguis distinct, very robust, about 1.25 times longer than basal width, with up-turned tip, dorsal margin convex with seven stout blunt denticles extending over whole length, ventral border strongly sinuous, unarmed; corpus

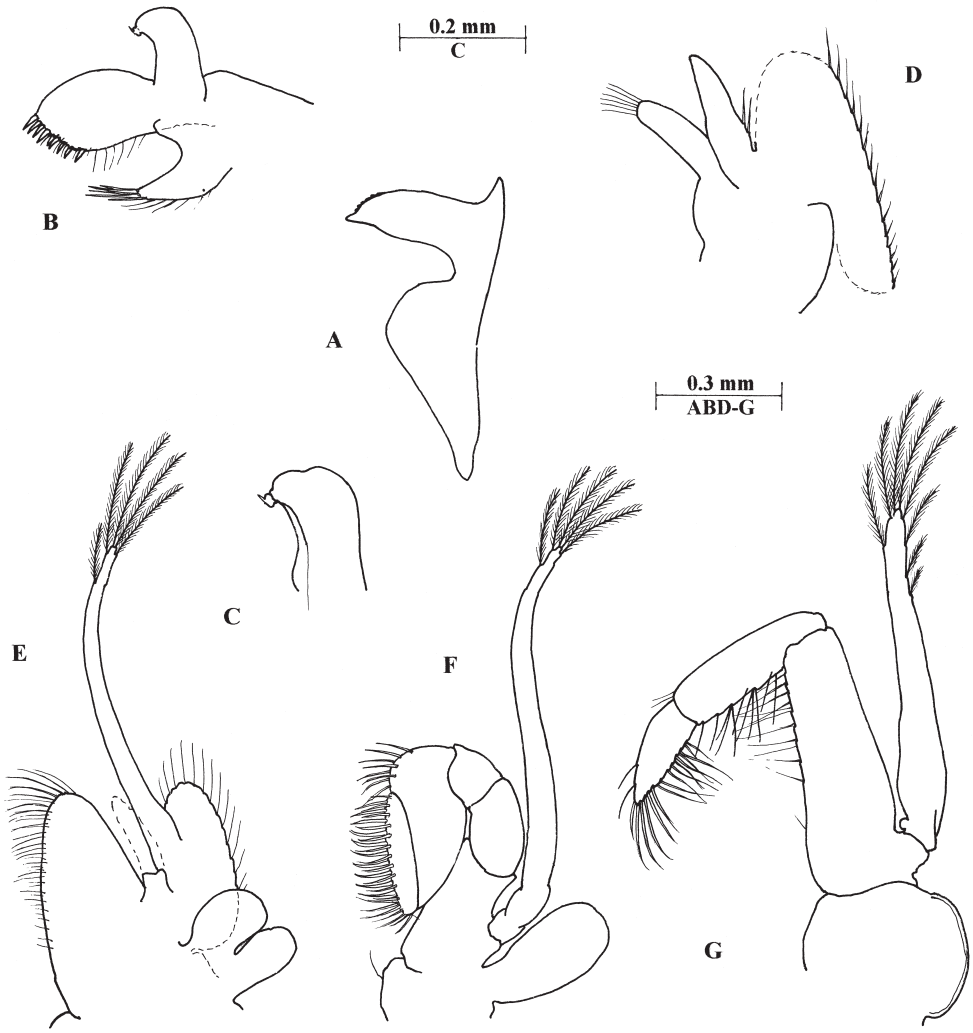

Fig. 2. *Periclimenaeus trispinosus* Bruce, 1969, ovigerous holotype female. A, mandible; B, maxillula; C, same, palp; D, maxilla, damaged; E, first maxilliped; F, second maxilliped; G, third maxilliped.

as long as basal width, distal width 0.4 of proximal width, dorsal margin feebly convex, ventral margin feebly concave with small preterminal acute accessory tooth, without basal tooth, with pair of short sensory setae distolaterally; propod (fig. 2G) about 0.3 of carapace length, strongly compressed, glabrous, 4.5 times dactylus length, 1.9 times longer than maximal width, situated at 2.5 of length, dorsal margin strongly angulate, tapering strongly distally, ventral border straight, with pair of stout distoventral spines, larger medial spine subequal to length of dorsal margin of corpus of unguis, lateral spine 0.8 of medial spine length, ventral border with three small spines, about 0.4 of medial distal spine length; carpus 1.3 times propod length, strongly compressed, 2.0 times longer than distal width, distal width subequal to

maximal propod width, tapering proximally, unarmed; merus robust, subequal to carpus length, 2.1 times longer than wide, maximal width at half length, unarmed; ischium subequal to propod length, 1.8 times longer than distal width, tapering proximally; basis and coxa robust, without special features. Fourth pereiopods missing. Fifth pereiopod slender, dactyl (fig. 3J) slender, biunguiculate, unguis simple, about 2.5 times longer than basal width, of similar length to third pereiopod unguis, corpus about 1.25 times longer than basal width, distal width 0.28 of basal width, with accessory tooth smaller than on third pereiopod dactylus; propod (fig. 3I) about 6.0 times longer than dactylus, 4.5 times longer than maximal width, tapering slightly distally, with single slender setiform spine distoventrally, several groups of setae distoventrally, without ventral spines.

Uropod (fig. 1K) with protopod unarmed posterolaterally; exopod about 2.5 times longer than wide, lateral margin convex, setose, unarmed, with small acute distolateral tooth (fig. 1L) reaching to level of distal border of exopod, with larger medially curved mobile spine medially, without distinct diaeresis; endopod subequal to exopod length.

Measurements.— Post orbital carapace length, 2.8 mm; major chela length, 5.0 mm. Length of eyed ovum, 0.5 mm.

Host.— Porifera, indet.

Systematic Position.— *Periclimenaeus trispinosus* occupies an isolated position in the genus *Periclimenaeus* (Borradaile). The presence of a pair of additional post-antennal spines on each side of the carapace and the form of the ambulatory dactyl of the third pereiopod are unique within the genus. The presence of an anterodorsal median lobe on the first abdominal tergite, the reduced incisor process of the mandible and the short swollen propod of the first pereiopod are also unusual features found in few other species. The first abdominal segment lobe is found in *P. ardeae* Bruce, 1970, *P. djiboutensis* Bruce,1970, *P. lobiferus* Bruce, 1978, *P. orontes* Bruce, 1986, and *P. spinimanus* Bruce, 1969. Reduced incisor processes of the mandibles are reported in *P. spinimanus*. A short swollen third ambulatory propod is also present in the deep water species, *P. jeancharcoti* Bruce, 1991b, from 375-450 m, which also has the unguis dorsally transversely ribbed, but not acutely tuberculate. The East Pacific species, *P. pacificus* Holthuis, 1951, has a mandible that appears very similar to that of *P. trispinosus*, but does not show any close resemblance in any other features. Reduced incisor processes are also present in *P. pearsei* (Schmidt, 1932) and *P. hancocki* Holthuis, 1951, but the molar processes are not as in *P. tridentatus.*

Remarks.— Colouration in life noted as whitish.

Distribution.— Known from the type locality only, at 25.5-27 m.

Apopontonia orbitospinata (Bruce, 1969)
(fig. 4)

Restricted synonymy:
Periclimenaeus orbitospinatus Bruce, 1969: 160-161.
Apopontonia tridentata Bruce, 1988: 1270-1276, figs. 4-7.

Material.— Holotype, (RMNH D. 256161 ovig.♀, 18 miles NW of Mornington Island, Gulf of Carpentaria, Australia, trawl, 13 June 1967, 18-27 m, coll. G.O.Moore,

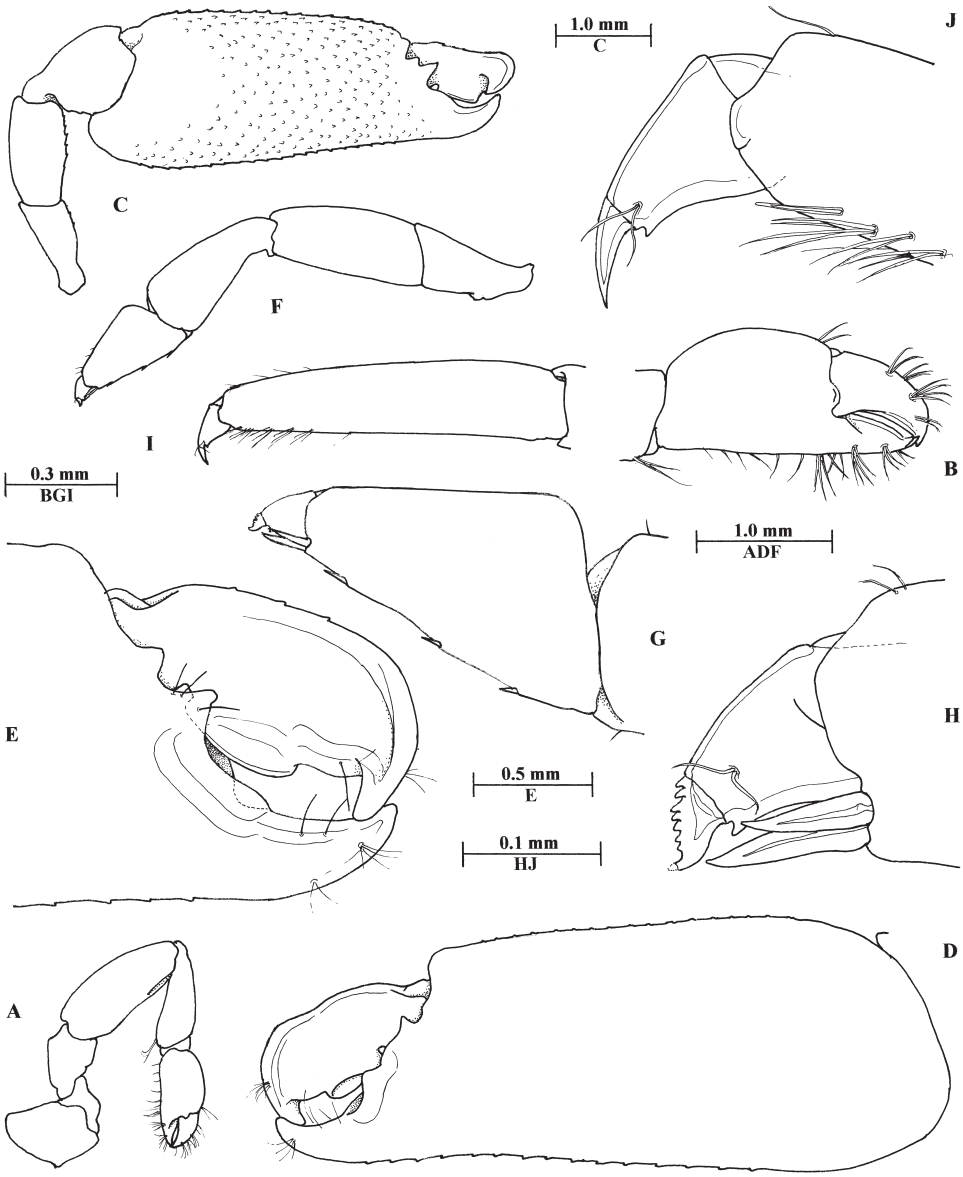

Fig. 3. *Periclimenaeus trispinosus* Bruce, 1969, ovigerous holotype female. A, first pereiopod; B, same, chela; C, major second pereiopod; D, same, chela, ventral aspect; E, same, fingers, dorsal; F, third pereiopod; G, same, propod and dactylus; H, same, dactylus and distal propod; I, fifth pereiopod; J, same, dactylus and distal propod.

Description.— The single specimen is almost complete, lacking only the left eye, with all appendages attached. It agrees closely with the description and illustrations of the specimen of *Apopontonia tridentata* provided in Bruce (1988), from the Australian Northwest Shelf. That specimen, also an ovig. ♀, was complete except for the

major second pereiopod, which is here described and illustrated. The statement in Bruce (1969) that the lateral margin of the exopod of the uropod is unarmed is incorrect and this appendage bears numerous distolateral spines as described in Bruce (1988).

Major second pereiopod (fig. 4A) well developed with large chela, about 1.75 times carapace length, 1.3 times minor chela length. Chela (fig. 4B) swollen, oval in section, smooth, glabrous, about 1.5 times longer than deep, maximum depth centrally, tapering feebly proximally and distally; dactylus (fig. 4CD) about 0.6 of palm length, 2.7 times longer than central depth, compressed, dorsal margin strongly convex, tip acute (broken), cutting edge distally feebly concave, sharp, entire, proximally broadened, with medial and lateral expansions enclosing deep fossa, with sparse simple setae; fixed finger (fig. 4CD) slightly exceeding dactylus, compressed, deep, about as long as depth, with stout hooked tip, cutting edge distally sharp, entire, feebly concave, proximally raised, with flanged medial and lateral margins enclosing depressed central area; carpus short, stout, about 0.25 of chela length, as long as distal width, distally excavate, unarmed; merus stout, unarmed, 1.5 times longer than distal width, about 0.4 of palm length, ischium about 0.6 of merus length, 1.3 times longer than distal width, tapering proximally, unarmed; basis stout, subequal to ischium length; coxa robust, both without special features.

Measurements.— Postorbital carapace length, 2.0 mm; second pereiopod, major chela, 3.5 mm, minor chela, 2.7 mm. Length of eyed ovum approx 0.5 mm.

Colouration.— Colouration in life noted as transparent, with diffuse orange spots over second pereiopod chelae.

Host.— Porifera, indet.

Distribution.— Known only from tropical Australian waters: the Northwest Shelf and Gulf of Carpentaria. Bathymetric range: 18-54 m.

Remarks.— The re-examination of the holotype of *Periclimenaeus orbitospinatus* after 30 years leaves no doubt that it is conspecific with *Apopontonia tridentata* and the two species should therefore be placed in the same genus. The genus in which the species should be placed is less apparent.

The armament of the fingers of the major second pereiopod (fig. 4E) are remarkable, with a distinct fossa proximally on the dactylus opposing a raised molar process with a concave occlusal surface on the fixed finger, the floor of which is apparently soft and poorly calcified. The mechanism represents the reverse of the condition found in *Periclimenaeus* species, in which the molar process is on the dactylus and the fossa on the fixed finger. The structures are presumably a similar sound-producing mechanism. The second pereiopod chelae in general, and particularly the armament of the fingers of the major chela, in the present specimen is similar to that found in *A. dubia* Bruce (see Bruce 1981, 1983, 1991a), but differ from those of *A. falcirostris* Bruce (see Bruce 1976) in which they are small, subequal and similar, without fossae or processes on the fingers. This mechanism is therefore not a diagnostic character of the genus as originally described. Similar processes and fossae are also found in *Climeniperaeus truncoideus* (Chace & Bruce, 1996), but not the otherwise similar and possibly closely related, but poorly known species, *Periclimenaeus truncatus* (Rathbun, 1906). These species and all species except *A. dubia* also have deep orbits under very well developed supraorbital teeth.

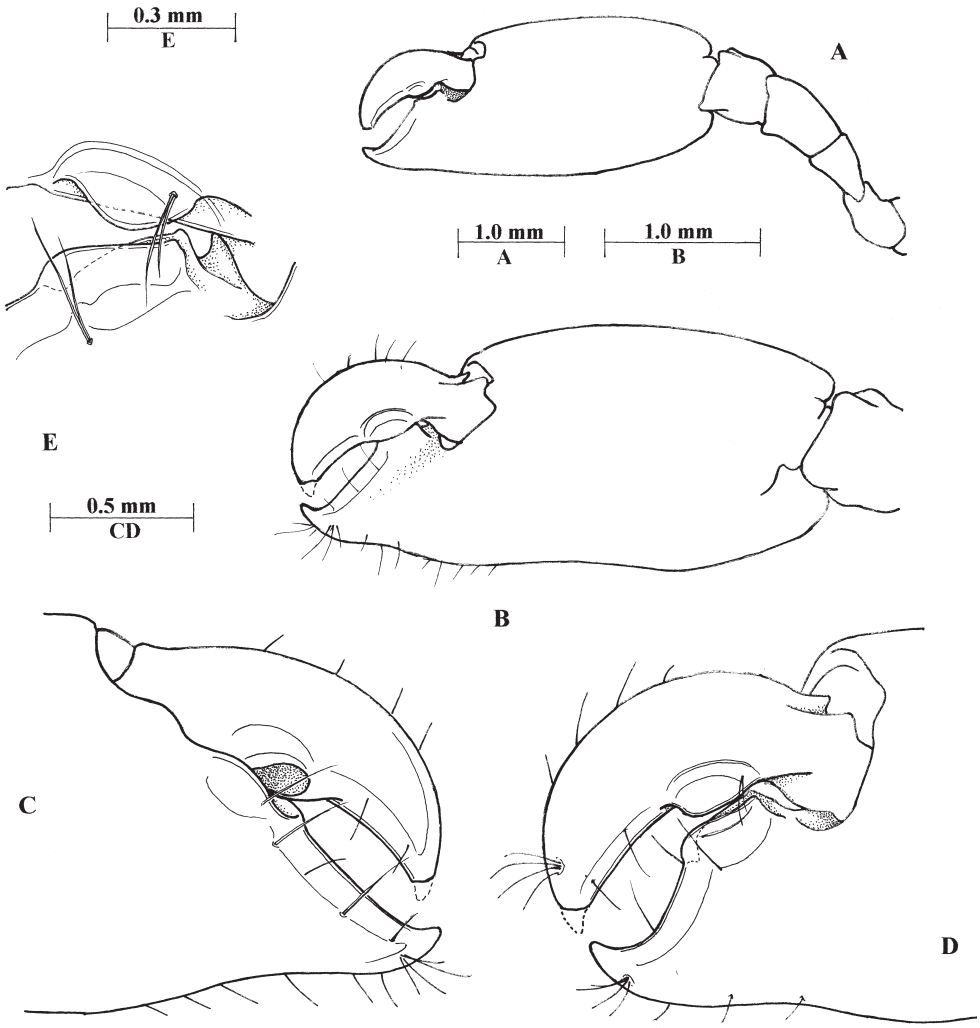

Fig. 4. *Apopontonia orbitispinata* (Bruce, 1969), ovigerous holotype female, Gulf of Carpentaria, (RMNH D. 25616). Major second pereiopod. A, whole limb, ventral; B, same, chela, ventral; C, same, fingers, dorsal; D, same, ventral; E, same, detail of proximal cutting edges, dactylus uppermost.

The type species of the genus, *Apopontonia falcirostris*, differs from the two other species presently placed in the genus in that the second pereiopods are small, subequal, similar, feebly armed and quite without the process and fossa found on the fingers of the major pereiopod of the other species. The second pereiopods in *Apopontonia orbitospinata* and *A. dubia* are well developed, large, unequal and dissimilar, with modified fingers on the major chela, which also shows much similarity to that of *Climeniperaeus truncoides*, although they both lack the conspicuous lateral flange on the minor second pereiopod dactyl present in that species. It seems possible that the other species may eventually be placed in *Climeniperaeus*. On the basis of the detailed

Table 1. Comparison of some major characters of *Apopontonia* species with *Climenipereaus* truncatus and *Periclimaeus* truncoideus. (■ = present; □ = absent).

Genus	*Apopontonia*			Climeni peraeus	Periclim enaeus
Species	*dubia*	*orbito-spinata*	*falci-rostris*	*truncatus*	*truncoi deus*
Rostral dentition	5/(1)	0/1	4/1	6/1	4-5/0
Rostrum without dorsal teeth	□	■	□	□	□
Well developed deep orbits	□	■	■	■	■
Well developed supraorbital teeth	□	■	■	■	■
P2 chelae small, subequal, similar	■	□	□	□	□
P2 chelae large, unequal dissimilar	□	■	■	■	■
Major and minor P2 fingers simple	■	□	□	□	□
Major P2 fingers ornate	□	■	■	■	■
Major P2 dactyl with molar process	□	■	■	■	□

description and figures of *Periclimenaeus truncoideus* specimens from Indonesia by Holthuis (1952) and the Philippines by Chace & Bruce (1993), these specimens can not be retained in *Periclimenaeus* and were transferred to a new genus *Climeniperaeus* by Bruce (1996). Holthuis notes that the original description of *Periclimenaeus truncatus* by Rathbun (1906) is "rather short and the photograph of the type is quite useless". Re-examination of the holotype (Chace & Bruce 1993) indicated that it is closely similar to *Periclimenaeus truncoideus* and so the species should possibly be placed in the same genus. However, the re-description of the major second pereiopod fingers does not indicate the presence of the characteristic mechanism found in *P. truncoideus.* used as a character in the diagnosis of *Climeniperaeus*, and the absence of a dactylar molar process was confirmed by Chace (pers. comm.), for which reason *P. truncatus* was not transferred to the genus *Climeniperaeus* and was retained in the genus *Periclimenaeus.*

The rostral dentition presents some problems, particularly with reference to *Periclimenaeus truncatus.* Which tooth represents the actual tip of the rostrum is not always readily apparent. In this species, known only from the holotype specimen, Chace & Bruce (1993) describe the distal rostrum as having a vertical row of three teeth, as shown in Rathbuns's illustration (Rathbun, 1906: fig. 70). The central tooth of these three is here taken as the rostral tip, with the lower tooth as a ventral rostral tooth and the upper tooth as the distal tooth of the dorsal series. The ventral tooth appears in Rathbun's figure to be somewhat more posteriorly situated than the overlying teeth. The ventral rostral margin appears distinctly convex, and not concave as in *Climeniperaeus.* However, the rostral dentition could also be interpreted as being without ventral teeth and with seven dorsal teeth, with the distal dorsal teeth overreaching the rostral tip. On the same basis, the dentition of *A. falcirostris* might be five dorsal and no ventral teeth. *Apontonia orbitospinata* might similarly be given a rostral dentition of one dorsal and no ventral teeth. Some of the major features of these taxa are summarised in Table 1.

The species presently referred to *Apopontonia* all appear to be rare and are known from a few specimens only. Their small size may be a contributory factor. They are probably all sponge associates, although this is confirmed only for *A. dubia*, with *Ircinia* and *Spongia* as hosts, and *A. orbitospinata* from unidentified Porifera. *Climeniperaeus truncoideus* has been found in association with *Biemna fortis* (Topsent).

The following key will facilitate the identification of the species presently attributed to the genus *Apopontonia*:

Apopontonia Bruce, 1977

Apopontonia Bruce,1976: 301-302; Holthuis, 1993: 130-132; Bruce; 31-32.

Key to species of the genus *Apopontonia* Bruce

1. Supraorbital teeth absent, R.5/(1); (Queensland, Australia; New Caledonia) ..... ***A. dubia*** Bruce
- Large supraorbital teeth present 2
2. Rostrum multidentate dorsally, with strong, recurved ventral tooth; R. 4/1; (Madagascar; Maldive Islands; Queensland, Australia) ..... ***A. falcirostris*** Bruce
- Rostrum with bifid tip, otherwise edentate, R.0/1; (tropical Australian waters) ..... ***A. orbitospinata*** (Bruce)

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