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A new cnidarian-associated palaemonid shrimp from Port Essington, Cobourg Peninsula, Australia

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ABSTRACT: A new species of palaemonid shrimp, *Periclimenes venustus*, from the Cobourg Peninsula, Australia, is described and illustrated and its systematic position discussed. A member of the '*P. aesopius* species group', it is associated with cnidarians (actiniarians, cerianthids and scleractinians), and is most readily recognised by its distinctive life colour pattern. Large preserved specimens may be distinguished from the closely related *P. holthuisi* Bruce, by the dentition of the fingers of the second pereiopod chelae, and smaller specimens by the spinulation of the ambulatory propods. The members of the '*P. aesopius* species group' are usually conspicuously coloured, with characteristic species-specific patterns particularly well developed on the third abdominal tergite. These patterns are illustrated for six species of this group.

1. INTRODUCTION

In the course of a survey of the marine fauna of Port Essington, situated in the Gurig Marine Park on the Cobourg Peninsula, numerous specimens of a conspicuously patterned shrimp were collected that were initially considered to be a distinctly coloured variant of *Periclimenes holthuisi* Bruce. In addition, some specimens of *P. holthuisi* were collected nearby in which the colour pattern was identical with specimens collected from the type locality, Hong Kong. Specimens of the equally brilliantly coloured and closely related *P. magnificus* were also collected and it was noted that shrimps of one colour pattern were always associated with other shrimps of the same pattern and that females of one pattern were always with males of the same pattern. The collection of large female specimens indicated that the fingers of the chela of the second pereiopod possessed a characteristic series of acute recurved teeth that are only poorly developed in most smaller specimens. These denticles were always associated with a characteristic spinulation of the ambulatory propod, which was also associated with the characteristic colour pattern and present in small specimens in which the colour pattern had been lost through alcohol preservation.

2. DESCRIPTION

Periclimenes venustus sp. nov. (Figs. 1-6)

Material examined. (i) 3 spms., Coral Bay, Port Essington, Cobourg Peninsula, Northern Territory, ? depth, 13 September 1985, coll. J.E.N. Veron, NTM Cr.003224. (ii) 2 spms., stn. CP/72, Table Head, Port Essington, 3m, 13 September 1985, coll. C. Hood, NTM Cr.003228. (iii) 6 spms. (1 ovig. female), stn. CP/74, Berkely Bay, Port Essington, 3m, 14 September 1985, coll. J.E.N. Veron. NTM Cr.003230. (iv) 1 male, 1 female, 1 juv., stn. CP/74, Berkely Bay, Port Essington, 3m, 14 September 1985, coll. C. Hood, NTM Cr.003229. (xiii) 1 male, 1 juv., Scott Reef, Western Australia, ? m, September 1984, coll. J.E.N. Veron, NTM Cr.006080. (v) 3 spms., stn. CP/76, Coral Bay, Port Essington, 11°11.2'S., 132°02.8'E, ? m, 15 September, 1985, coll. L.Vail, R.Williams, NTM Cr.006340. (vi) 1 spm., stn. CP/81, Kennedy Bay, Port Essington, 2.5m, 17 September 1985, coll. C.Hood, NTM CR.006341. (vii) 1 spm., stn. CP/82, Coral Bay, Port Essington, ? m, 18 September 1985, coll. P.Alderslade, R.Williams, NTM Cr.006341. (viii) 1 spm, stn. CP/82, Coral Bay, Port Essington, ? m, 18 September 1985, coll. P.Alderslade, R.Williams, NTM Cr.006340. (ix) 1 spm., stn. CP/82, Coral Bay, Port Essington, ? m, 18 September 1985,

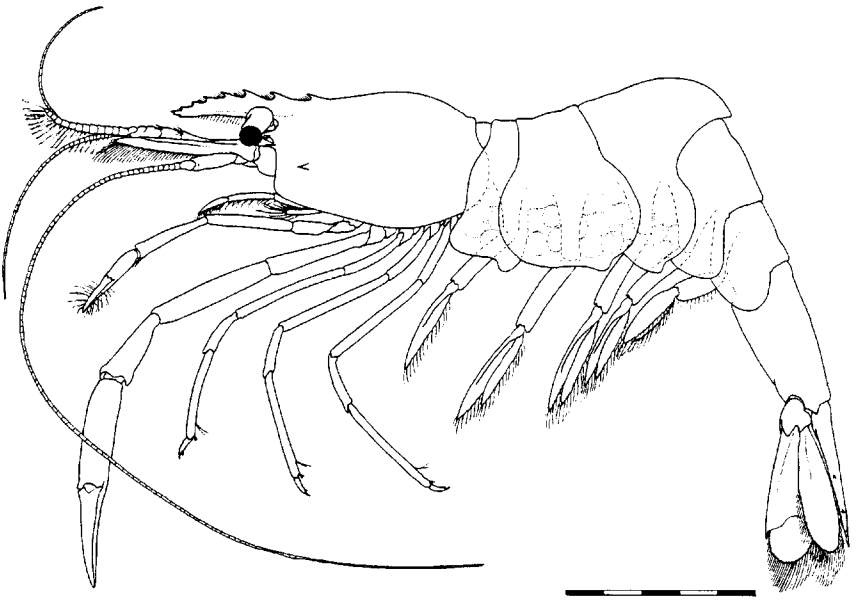

Figure 1. *Periclimenes venustus* sp. nov., holotype female, stn. CP/97, Port Essington. Scale bar in millimeters.

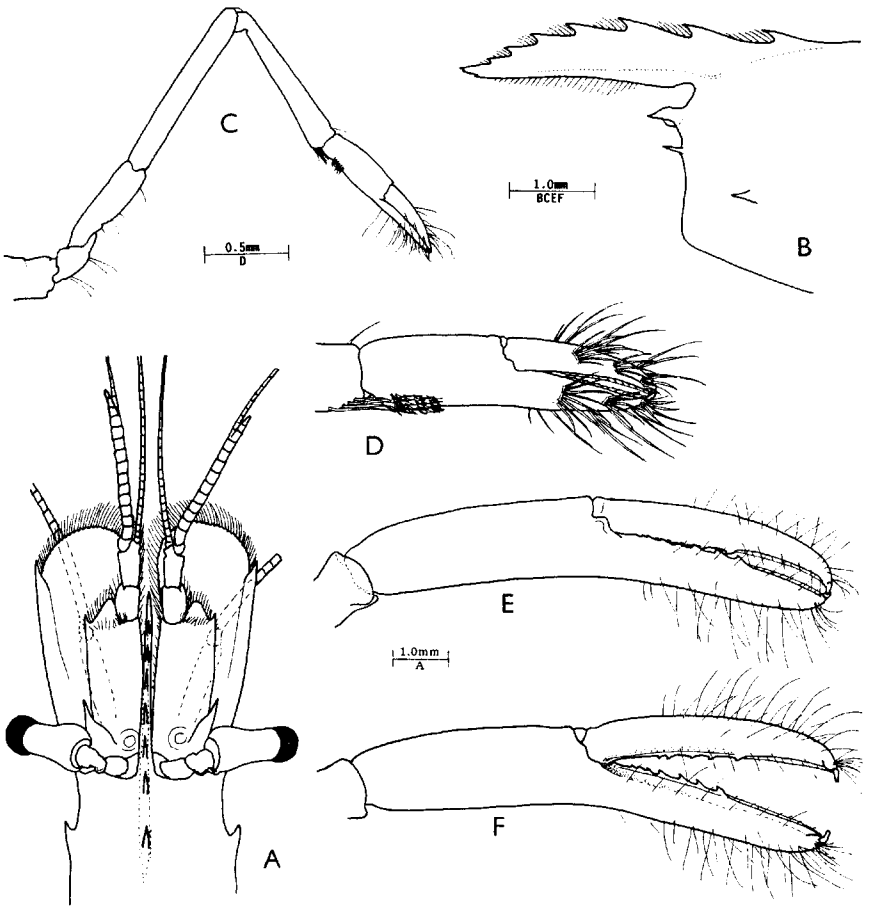

Figure 2. *Periclimenes venustus* sp. nov., holotype female. A, anterior carapace, rostrum and appendages, dorsal. B, anterior carapace and rostrum, lateral. C, first pereiopod. D, same, chela. E, second pereiopod, major chela, dorsal. F, same, minor chela, ventral aspect.

coll. R.Williams, NTM Cr.006337. (x) 1 spm., stn. CP/82, Coral Bay, Port Essington, ? m, 18 September 1985, coll. P.Alderslade, R.Williams, NTM Cr.006338. (xi) 1 spm., *idem*, NTM Cr.006339. (xii) 2 female, *idem*, NTM Cr.006342. (xiii) 2 spms., *idem*, NTM Cr.006345. (xiv) 1 ovig. female, stn. CP/98, Coral Bay, Port Essington, ? m, 13 September 1986, coll. C.Johnson, P.Davie, NTM Cr.004170.

Description. A medium sized, slenderly built shrimp, of moderately compressed body form.

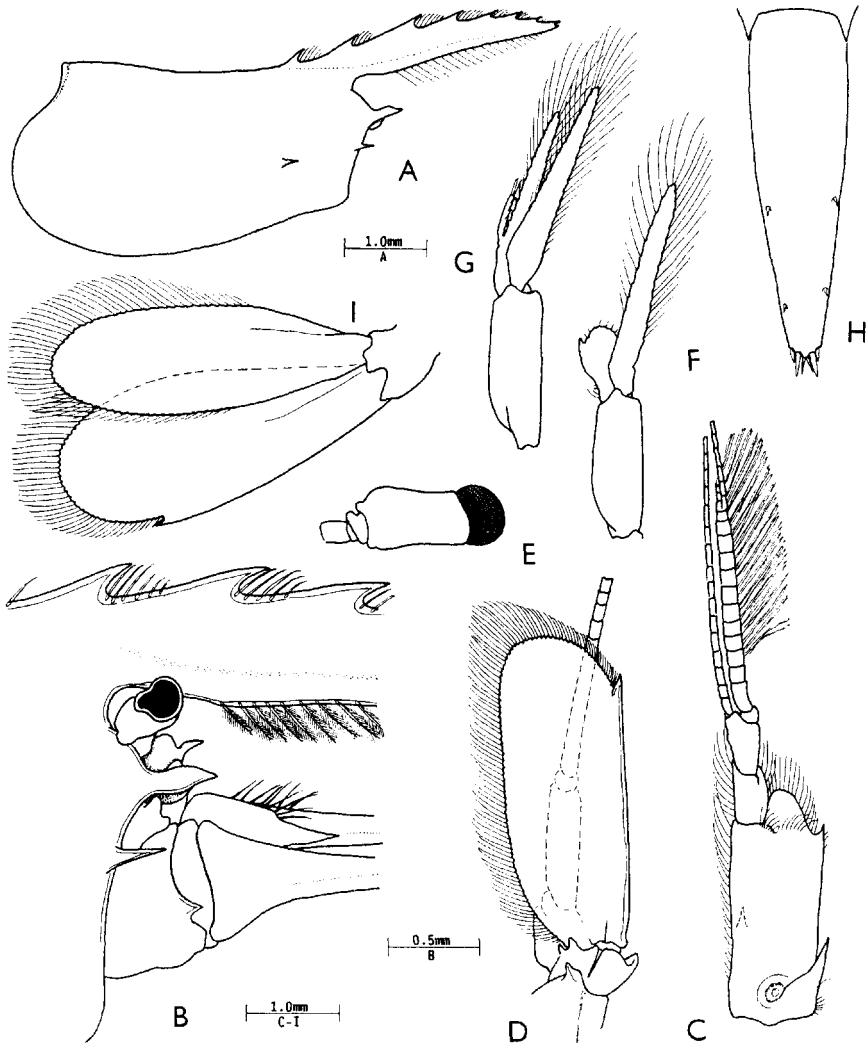

Figure 3. *Periclimenes venustus* sp. nov. A, carapace and rostrum, lateral. B, orbital region of carapace. C, antennule. D, antenna. E, eye. F, first pleopod. G, second pleopod. H, telson. I, uropod. AGF, male paratype. BCDEHI, female paratype.

Rostrum slender, arched, tapering, reaching to about distal margin of intermediate segment of antennular peduncle, horizontal in females, slightly elevated in males, dorsal carina well developed, extending onto anterior fourth of carapace, with acute dorsal teeth, decreasing in size distally, first tooth in epigastric position, second tooth of over posterior orbital margin, lateral carinae feebly

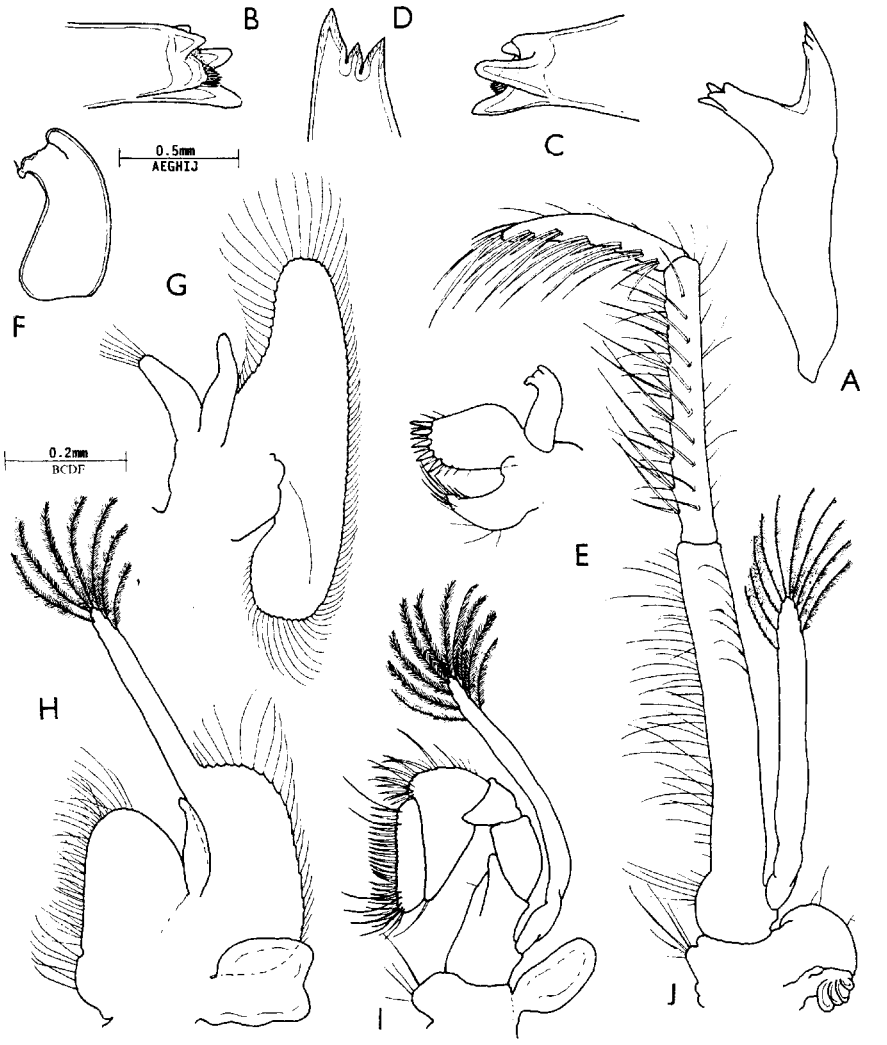

Figure 4. *Periclimenes venustus* sp. nov., female paratype. A, mandible. B, same, molar process, ventral. C, same, dorsal. D, same, incisor process. E, maxillula. F, same, palp. G, maxilla. H, first maxilliped. I, second maxilliped. J, third maxilliped.

developed, ventral carina obsolete, ventral margin straight or feebly concave, with median row of plumose seteae, with 0-2 very small acute teeth at extreme tip. Carapace glabrous, smooth, orbital notch distinct, inferior orbital angle acutely produced, with distinct inner ventral flange, supraorbital spines absent, antennal spine well developed, slender, marginal, well below and shorter than

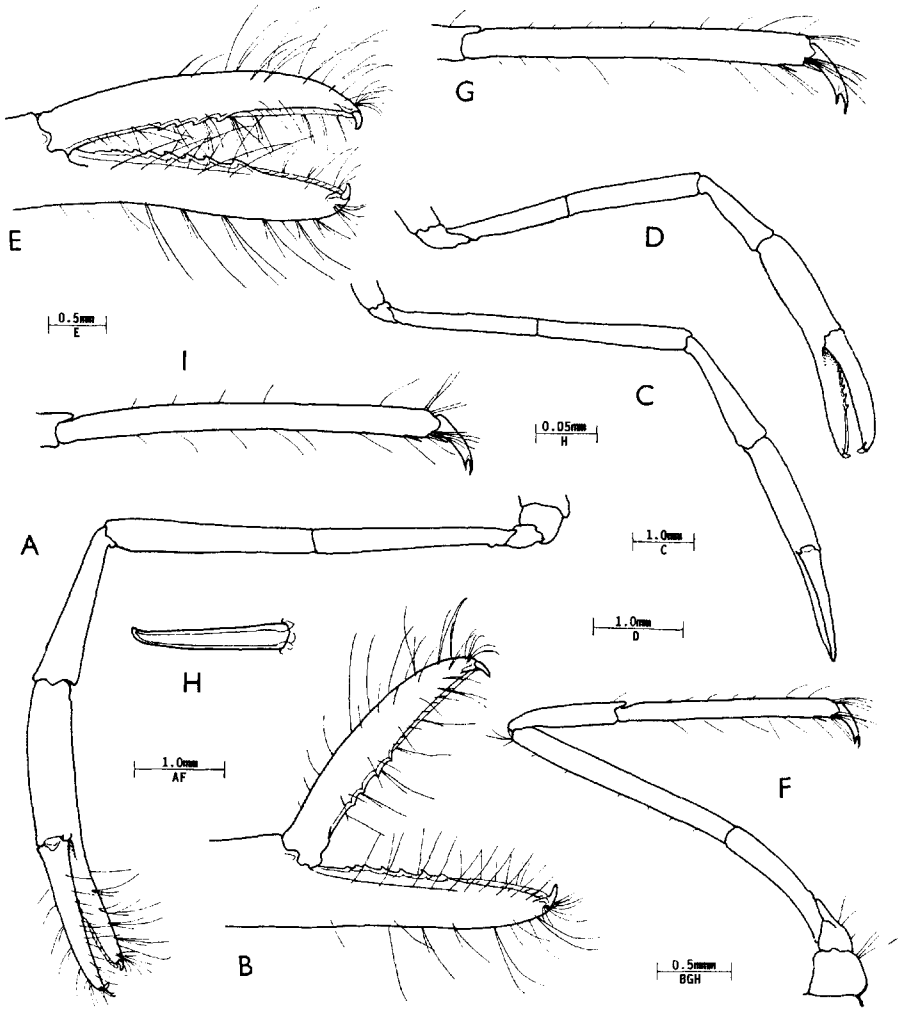

Figure 5. *Periclimenes venustus* sp. nov. A, major second pereiopod. B, same, fingers. C, minor second pereiopod. D, major (?) second pereiopod. E, same, fingers. F, third pereiopod. G, same, propod and dactyl. H, same, distoventral propodal spine. I, fifth pereiopod, propod and dactyl. ABC, male paratype. DEFGHI, female paratype.

inferior orbital angle, hepatic spine robust, distinctly behind and below antennal spine; anterolateral margin of branchiostegite bluntly angular. Rostrum about 0.55 of postorbital carapace length in females, 0.75 in males.

Abdomen distinctly compressed, glabrous, smooth; third segment posterodorsally produced, sixth segment about 2.1 times longer than fifth, 2.0 times

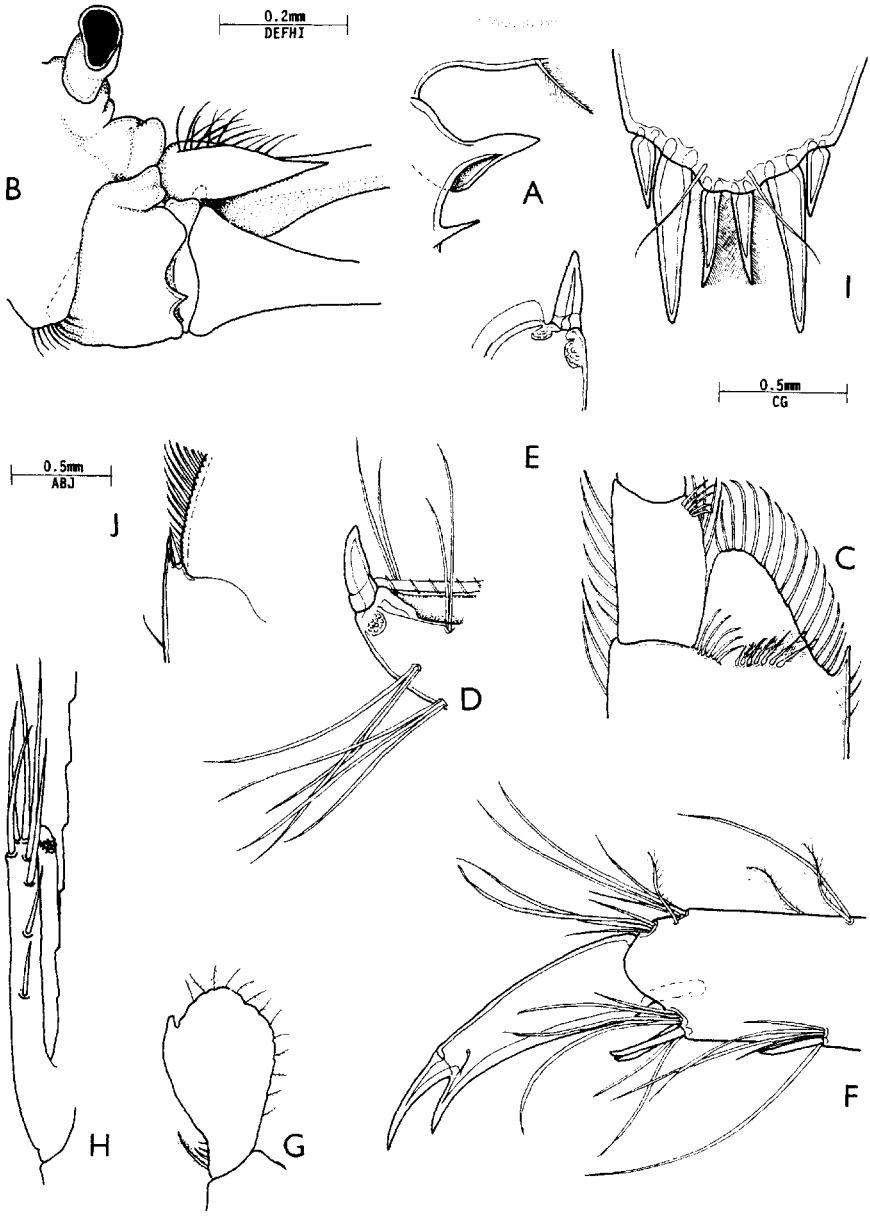

Figure 6. *Periclimenes venustus* sp. nov. A, inferior orbital angle. B, basicerite and ophthalmic somite, right lateral. C, antennule, distolateral angle of proximal penduncular segment. D, second pereiopod, tip of dactyl. E, same, fixed finger. F, third pereiopod, distal propod and dactyl. G, first pleopod, endopod. H, second pleopod, appendices masculina and interna. I, posterior telson spines. J, uropod, posterolateral angle of exopod. ABCDEFIJ, paratype female. GH, paratype male.

longer than deep, strongly compressed, posterolateral and posteroventral angles acute. Telson about 0.9 times length of sixth segment, about 3.6 times longer than anterior width, lateral margins feebly convex, convergent, with 2 pairs of small dorsal spines, at about 0.55 and 0.8 of length, posterior margin about 0.33 of anterior width, slightly produced centrally, without median point, lateral posterior spines short, 2.0 times longer than dorsal spines, intermediate spines robust, about 0.07 of telson length, 2.25 times lateral spine length, submedian spines stout, setulose, about 0.55 of intermediate spine length, with 2 simple distodorsal setae.

Antennule with peduncle exceeding rostrum by length of distal segment; proximal segment about 2.0 times longer than wide, margins subparallel; medial margin straight, strongly setose, with acute ventromedial tooth; lateral margins straight, feebly setose distally, with small acute distolateral tooth, with large setose anterolateral lobe medially, reaching to about 0.7 of intermediate penduncular segment length; stylocerite slender, acute, reaching to about 0.4 of segment length, statocyst well developed, with discoid statolith; intermediate segment short, about 1.5 times longer than broad, with moderately developed setose lateral lobe, obliquely articulated with distal segment; distal segment about 1.8 times longer than broad, 1.25 times length of intermediate segment, both segments combined length about 0.6 of proximal segment length; upper flagellum well developed, biramous, rami fused for proximal 12-13 segments, shorter free ramus with 2-3 segments, about 25-27 groups of aesthetascs, longer ramus slender, filiform, about subequal to postorbital carapace length; lower flagellum, slender, filiform, about 1.5 times postorbital carapace length.

Antenna with basicerite robust, with stout acute lateral tooth, coxal segment with distinct dorsal lobe that articulates with ventral flange of inferior orbital angle; ischiocerite and merocerite normal, carpocerite about 3.5 times longer than broad, reaching to about 0.5 of scaphocerite length, flagellum well developed, slender, about 4.5 times postorbital carapace length: scaphocerite large, distinctly exceeding antennular penduncle, about 2.5 times longer than broad, medial and lateral margins subparallel, distal lamella broadly rounded, far exceeding distolateral tooth.

Ophthalmic somite with well developed acute angulate 'bec ocellaire'. Eye with well developed globular cornea, without distinct accessory pigment spot, about 0.6 times longer than diameter, slightly obliquely orientated on stalk; podophthalmite about 1.75 times longer than proximal width, subcylindrical, tapering slightly distally, proximal width subequal to corneal diameter, basiophthalmite with small proximal posterior plate articulating with dorsolateral rim of orbital notch.

Epistome with pair of small submedian bosses. Mandible (right) with corpus moderately robust, without palp; molar process moderately slender, with 5 blunt teeth, posterior 2 larger than anterior 3, separated by setose process; incisor process tapering to oblique row of 3 acute teeth, central tooth smallest, distal

tooth largest. Maxillula with feebly bilobed palp, lower lobe with small rounded process with single short simple terminal seta; upper lacinia moderately broad, distally rounded, with 9 stout simple marginal spines and numerous setae; lower lacinia slender, tapering, with few long slender feebly serrulate spiniform setae distally. Maxilla with slender, simple, tapering non-setose palp, basal endite with single slender tapering distal lobe with 6 simple terminal setae, coxal endite obsolete; scaphognathite well developed, about 2.8 times longer than broad, posterior lobe large, rounded, about 0.3 of scaphognathite length, anterior lobe tapering distally, medial margin concave. First maxilliped with short, slender, simple, non-setose palp; basal endite large, broadly rounded, with numerous slender, feebly setulose setae along medial margins; coxal endite small, rounded, with 6 long slender setae only, separated by small notch from basal endite; exopod well developed, flagellum broad, with 7 plumose setae distally, caridean lobe large and broad; epipod subrectangular, feebly notched laterally. Second maxilliped with normal endopod, dactylar segment about 4.0 times longer than broad, with strong serrulate spines along medial margin, propodal segment broad, distomedial angle feebly produced, with about 10 stout feebly serrulate spines; carpus, merus and ischio-basis normal; exopod with broad flagellum with about 10 plumose setae distally; coxa angularly produced medially, with simple setae; epipod oval, without podobranch. Third maxilliped with endopod relatively short, slender, extending distally to about level of distal end of carpocerite, ischiomerus and basis fused; antepenultimate segment about 8.0 times longer than central width, uniform, with numerous groups of long serrulate spiniform setae ventromedially and ventrally, terminal segment tapering to long slender simple distal spine, about 6.5 times longer than proximal width, 0.5 of antepenultimate segment length, with numerous transverse rows of strong serrulate spiniform setae; exopod with flagellum broad, with about 10 plumose setae distally; coxa with feebly rounded, setose ventromedial process, large oval lateral plate, small quadrilamellar arthrobranch.

Third thoracic sternite broad; fourth thoracic sternite without finger-like median process; fifth sternite narrower, with pair of triangular teeth posteriorly. posterior sternites slightly broader.

First pereiopod moderately robust, extending anteriorly to exceed scaphocerite by length of chela; chela with palm smooth, slightly compressed, about 0.45 times longer than deep, with 5-6 transverse rows of serrulate cleaning setae proximally; fingers subequal to palm length, compresed, about 4.5 times longer than proximal depth, with small hooked tips, entire, sharp cutting edges, with numerous short transverse rows of long simple setae; carpus subequal or slightly longer than chela, about 5.3 times longer than distal width, tapering proximally, with serrulate distoventral cleaning setae; merus 1.2 of chela length, uniform, unarmed, about 8.0 times longer than central width; ischium about 0.56 of merus length, 3.6 times longer than distal width, narrower proximally, obliquely articulated with basis, sparsely setose; basis about 0.6 of ischium length, sparsely setose; coxa without ventromedial process.

Second pereiopods well developed, subequal and similar, slender, reaching distally to exceed scaphocerite by chela and distal 0.7 of carpus; chela slightly bowed, with palm oval in section, smooth, about 3.2 times longer than deep, fingers subequal to palm length, moderately compressed, with numerous long simple setae, dactyl about 6.5 times longer than proximal depth, laterally situated cutting edge with 0-8 small acute recurved teeth proximally, distal edge entire, sharp, with stout hooked terminal tooth arising from raised plate, separated by distinct notch from distal cutting edge, fixed finger similar; carpus about 0.75 of palm length in females, subequal in males, 3.5-4.0 times longer than distal width, tapered proximally, feebly expanded distally, unarmed; merus slightly longer than palm, 1.1 times palm length in females, 1.28-1.25 in males, 8.0 times longer than central width, distoventrally unarmed; ischium subequal to merus length, about 8.5 times longer than width distally, tapering proximally, unarmed; basis and coxa without special features.

Ambulatory pereiopods slender, third reaching distally to exceed scaphocerite by dactyl and distal fifth of propod; dactyl compressed, about 5.0 times longer than basal depth, unguis distinctly demarcated, slender, curved, about 4.0 times longer than basal width, about 0.45 of corpus length, simple, corpus about 3.3 times longer than proximal depth, with slender acute distoventral tooth, about 0.25 of corpus length, 0.5 of unguis length, ventral edge sharply carinate, with single short distolateral seta; propod about 4.5 times dactyl length, uniform, about 11.5 times longer than wide, with pair of short distoventral spines and single distal ventral spine, with scattered long simple setae; carpus about 0.5 of propod length, with distodorsal lobe, unarmed; merus about 1.1 of propod length, 12.2 times longer than central width, uniform, unarmed; ischium about 0.65 of propod length, unarmed; basis and coxa without special features. Fourth and fifth pereiopods similar, slightly longer, propods with pair of distoventral spines, single distal ventral spine only, fifth propod about 1.2 times fourth propod length.

Pleopods of ovigerous females with rami slender. Male first pleopod with basipodite about 2.6 times longer than wide, exopod slender, 8.0 times longer than broad, 1.5 times basipodite length; endopod short, 0.3 of exopod length, proximally narrow, distally expanded, oval, about 1.75 times longer than broad, with small distomedial lobule, distal and lateral margins with about 12 short sparsely setulose setae, proximal medial border with single long plumose setae, 3 short curved spines. Second pleopod with basipodite about 3.0 times longer than broad, 1.2 times first basipodite length; exopod subequal to first exopod length; endopod about 0.9 of exopod length, slender, with appendices at 0.25 of medial margin length, reaching to about 0.5 of endopod length, appendix interna slender, subcylindrical with few distal cincinnuli only, slightly exceeding appendix masculina; appendix masculina with corpus subcylindrical, about 9.0 times longer than wide, with 2 slender simple terminal spines, 2 similar preterminal ventral spines, 3 distal ventral spines, of decreasing length proximally.

Uropod with distolateral protopodite angular; exopod extending well beyond tip of telson spines, broad, 2.5 times longer than wide, lateral margin feebly convex, with slender distolateral tooth, with longer slender mobile spine medially; endopod about 0.9 of exopod length, 3.0 times longer than broad.

Ova numerous, about 180, and small.

Types. The ovigerous female specimen from stn. CP/97 is selected as holotype, no associated allotype male was collected. Paratype specimens from stn. CP/82 are deposited in the collections of the British Museum (Nat. Hist.) BMNH 38041, Rijksmuseum van Natuurlijke Historie, Leiden, D.1990: 37, and the National Museum of Natural History, Washington, USNM 239286.

Measurements (mm). Holotype female, total body length, 24.0; carapace and rostrum, 7.9; postorbital carapace, 5.1; chela of major second pereiopod, 5.7; chela of minor second pereiopod, 5.6; length of ovum, 0.7.

Hosts. Most specimens were collected from unidentified anemones, but three lots (stns. CP/71, CP/82 and the Scott Reef specimens) were collected from the scleractinian *Heliofungia actiniformis* (L.).

Colouration. Body and appendages highly transparent, with pattern largely of small associated blue and white chromatophores. Carapace with rostrum transparent, posterolateral region and branchiostegite with pattern of scattered blue-white-blue groups of chromatophores; abdomen dorsally transparent, with large oval or heart-shaped white patch over posterior half of third segment, broadest anteriorly, frequently with rectangular pattern of four pinkish patches, anterior pair often confluent, first three pleura of ovigerous female with vertical, contiguous, white anterior and blue posterior patches, posterior sixth segment with two white chromatophores dorsally, blue at posterolateral angles; telson with pair of blue and white chromatophores at middle of lateral margin, tip purple-blue; uropod with blue and white chromatophores on protopodite, rami with anterior half transparent, posterior half largely white, with distal third of exopod bluish white, with purple-blue peripheral margin. Antennal flagella and scaphocerite transparent; antennal penduncle with blue and white chromatophores at distal end of distal segment, laterally on intermediate segment, medially and laterally to statocyst. Eye with transverse row of blue-white-blue dots distodorsally. First and second pereiopods with chelae largely white, somewhat mottled, with hinge region and finger tips purple; carpus white, distally with purple ring, proximally transparent; merus distally white with purple marginal ring, proximally transparent; ischium transparent. Ambulatory pereiopods transparent; pleopods transparent, with blue and white chromatophores at base and distally on basipodites. Ova pale grey-green.

Colouration variable in development, less well developed in males and

juveniles. Juveniles may often have a rectangular pattern of four blue chromatophores only on dorsum of third abdominal segment.

Distribution. Port Essington, Cobourg Peninsula, Northern Territory; Scott Reef, Western Australia.

Etymology. From Latin, *venustus*, beautiful.

Systematic position. Periclimenes venustus is most closely related to *P. holthuisi* Bruce, 1969, first reported from Hong Kong and since widely recorded from many Indo-West Pacific localities. Well grown male and female specimens of *P. venustus* can be readily distinguished from *P. holthuisi* by the presence of series of conspicuous short, recurved, acute teeth along the proximal 0.6 of the cutting edges of the fingers of the second pereiopods. Re-examination of a number of large *P. holthuisi* specimens from the type locality and other localities has not provided any specimens with a similar dactylar dentition. In adult specimens with the characteristic armament of the second pereiopod fingers and also in those specimens in which it is less well developed, the two species may be separated by the spinulation of the propod of ambulatory pereiopods. In *P. venustus*, this segment bears only a pair of short distoventral spines and a single short spine on the distal ventral margin. In *P. holthuisi*, the distoventral spines are much longer and there are numerous long spines along the ventral border of the propod. The specimens are most easily separated in life by their characteristic colour patterns.

3. DISCUSSION

The identification of *P. venustus* and its close similarity to *P. holthuisi* (Bruce, 1982, 1969) suggests that some of the records of the latter species should, where possible, be re-examined, as many have been based on preserved material in which the most striking feature, the colour pattern, had been long lost. The characteristic colour patterns of *P. venustus* and the closely related species, *P. aesopius* (Bate), *P. holthuisi, P. longicarpus* Bruce & Svoboda, *P. magnificus* Bruce, and *P. tosaensis* Kubo, all appear to be species specific and, when available, the easiest way to separate species. In most of these species the most characteristic feature of the colour pattern is superimposed on the tergum of the third abdominal segment, which is often posterodorsally produced, effectively increasing in surface area, and in some species, such as *P. aesopius*, distinctly compressed. Underwater photographers have also produced evidence that a number of other patterns exist in the Indo-West Pacific region, which suggests the existance of a complex of closely related, morphologically very similar species. Unfortunately, the specimens are generally not preserved for precise

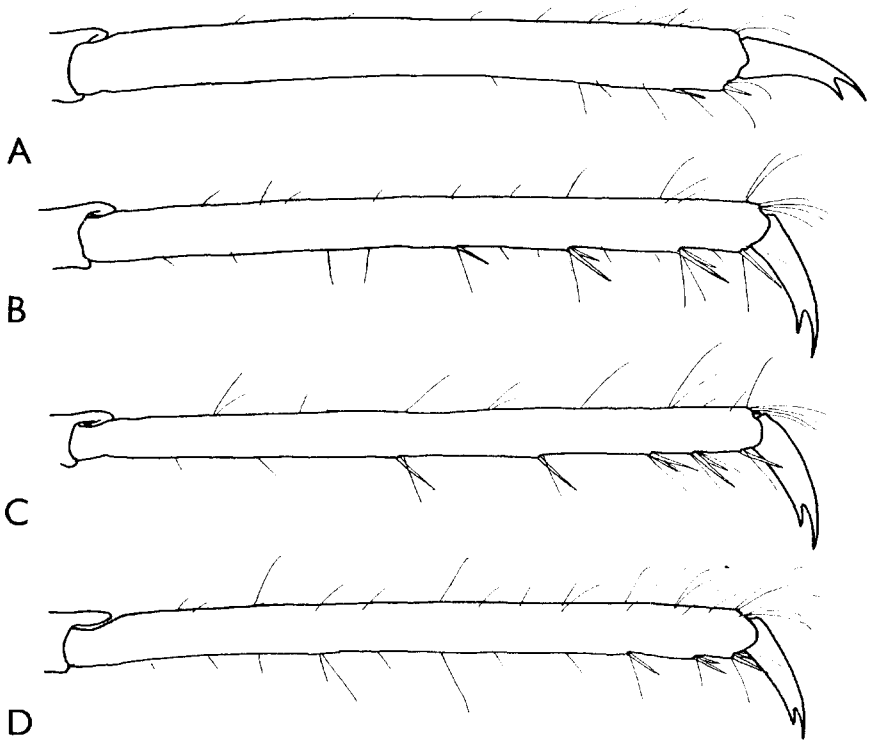

Figure 7. Third ambulatory pereiopods, ovigerous females, dactyl and propod. A, *Periclimenes venustus* sp. nov. B, *Periclimenes holthuisi* Bruce, Coral Bay, Port Essington. C, *Periclimenes holthuisi* Bruce, Hong Kong (type locality). D, *Periclimenes magnificus* Bruce, Port Essington.

identification. While all seem to be associated with coelenterates, the hosts frequently also remain unidentified, so that it is not possible to confirm that any colour patterns are associated with specific host species. The relationships of the different colour patterns, host preferences and morphological details remain to be clarified. The behaviour of the various colour forms suggest that they may represent species-level taxa rather than intraspecific polymorphic colour variations, as the male of each colour pattern is always associated with a female of the same pattern, and often with juveniles also of the same pattern. Morphologically similar species of a different colour pattern may often be collected separately, but in close proximity. While several of the species in the *aesopius* group appear readily distinguishable on morphological grounds, *P. holthuisi* appears to represent the focal point for a complex of sibling species.

The adult specimens of the *P. aesopius* group may be separated by the following key:

1. Ambulatory dactyls simple; R. 1 + 7-10/2 . . . . . *P. tosaensis* Kubo
   Ambulatory dactyls biunguiculate 2
2. Carapace with 2-3 postorbital teeth; R. 2-3 + 6-7/2-4 . . *P. aesopius* (Bate)
   Carapace with 0-1 postorbital teeth 3
3. Carapace of second pereiopod distinctly longer than chela; without epigastric tooth; R.5-6/0-2 . . . . . *P. longicarpus* Bruce & Svoboda
   Carpus of second pereiopod, shorter than chela 4
4. Fingers of second pereiopod with series (5-7) of small acute recurved teeth; ambulatory pereiopods with short distoventral spines; R 1 + 5-7/0-2 *P. venustus* sp. nov.
   Fingers of second pereiopod without series of small acute recurved teeth; ambulatory pereiopods with long distoventral spines 5
5. Second pereiopod with chelae bowed, carpus about 0.6 of palm length, R.1+ 7-8/1-2 . . . . . *P. magnificus* Bruce
   Second pereiopods with chelae not bowed, carpus subequal to palm length; R.1(-2)+8-11/2-4 . . . . . *P. holthuisi* Bruce

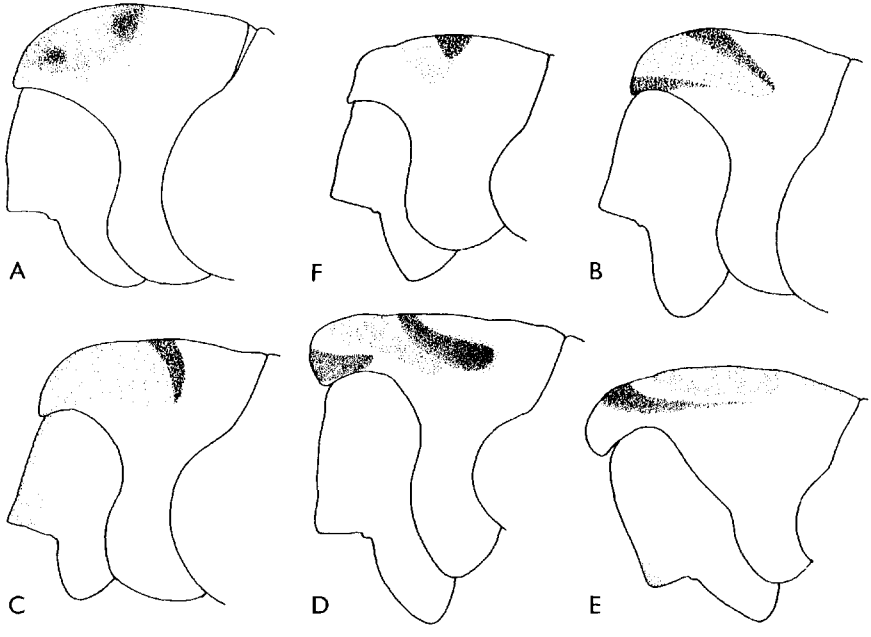

Figure 8. Third abdominal segment, lateral aspect: colour patterns. A, *Periclimenes venustus* sp. nov. B, *Periclimenes holthuisi* Bruce. C, *Periclimenes magnificus* Bruce. D, *Periclimenes longicarpus* Bruce & Svoboda. E, *Periclimenes aesopius* (Bate). F, *Periclimenes tosaensis* Kubo. Fine stippling, white; heavy stippling, pink or blue (A), orange-red (B, C), blue-purple (D, F), red brown (E).

ACKNOWLEDGEMENTS

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