

Periclimenes johnsoni sp.nov., a new species of shrimp from Singapore (Crustacea: Decapoda: Palaemonidae)

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ABSTRACT: A new species of palaemonid shrimp, *Periclimenes johnsoni*, is described and illustrated. Previously referred to *P. calmani*, it occurs commonly in *Enhalus* beds around Singapore. A member of the '*Periclimenes grandis* species group', it is easily separable from all other species by the very feeble development of the second pereiopods and the bidentate distolateral angle of the proximal segment of the antennular peduncle. *P. calmani* is considered to be a Red Sea endemic species and *P. johnsoni* is known at present only from Singapore.

RESUME: Une nouvelle espèce de crevette palaemonide, *Periclimenes johnsoni* sp.nov., est décrite et illustrée. Précédemment attribuée à *P. calmani*, cette espèce est commune dans les bancs d'*Enhalus* près de Singapour. Appartenant au groupe '*Periclimenes grandis*', elle peut être facilement distinguée de *P. calmani*, et de toutes les autres espèces du groupe, par le très faible développement du second péréiopode et par l'angle distolateral bidenté du segment proximal du pédoncule antennulaire. *P. calmani* est considérée comme une espèce endémique de la Mer Rouge et *P. johnsoni* n'est connu jusqu'à présent que de Singapour.

1. INTRODUCTION

Through the kindness of Mrs Yang Chan Man, of the Zoological Reference Collection of the National University of Singapore, it has been possible to re-examine some of the specimens referred by D.S.Johnson (1961, 1976) to *Periclimenes calmani*. *P. calmani* Tattersall 1921 has been recently redescribed following the examination of syntypic material in the collections of the British Museum (Natural History) by Bruce (in press). The specimens referred to *P. calmani* by Johnson were clearly separable from Tattersall's *P. calmani* and could not be referred to any of the presently known species of *Periclimenes*. The specimens are now described as new, and are named in recognition of the

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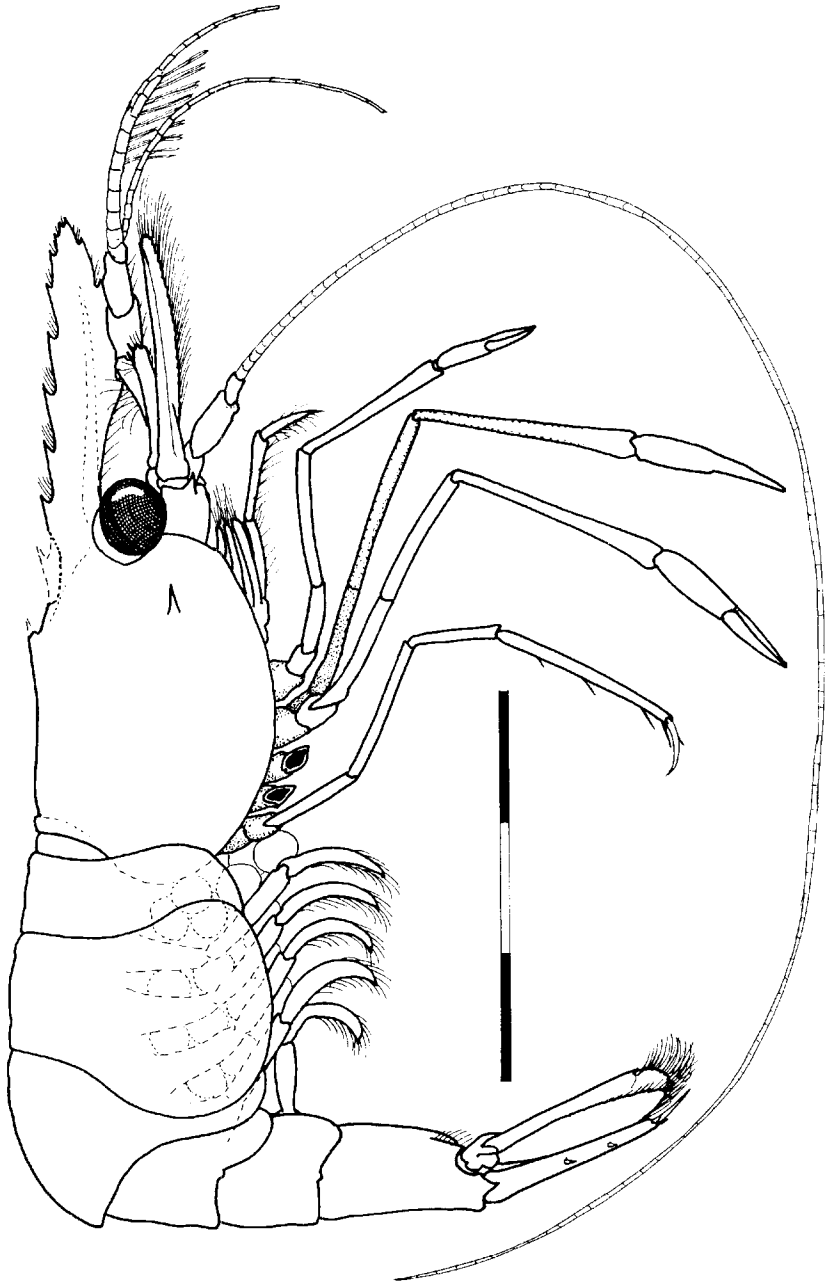


Figure 1. *Periclimenes johnsoni* sp.nov., holotype female, Pasir Laba, Singapore.
Scale bar in mm.

important contribution of the late Professor D.S.Johnson to knowledge of tropical decapod crustacea.

2. TAXONOMIC ACCOUNT

Periclimenes johnsoni sp.nov. (Figs 1-5)

Material. 9 spms (3 ovig. ♀, 1 ♀, 5♂), Pasir Laba, Singapore, 1°21'N, 103°38'E; April 1966, coll. D.S.Johnson, ZRC 1986-18-26, J.G891-G909. 4 ovig. ♀, same locality, April 1966, coll. D.S.Johnson, ZRC 1986. 27-34, J.G891-909.

Description. A small sized slenderly built shrimp, of subcylindrical body form. Carapace smooth, glabrous. Rostrum subequal to postorbital carapace length, horizontal or slightly upturned in females, about 1.3 times longer in males; compressed, moderately deep in females, more slender in males; dorsal carina well developed with 8-9 acute teeth, extending over anterior carapace, with first tooth situated posterior to orbital margin, interspaces decreasing in size distally, proximally setose; teeth decreasing in size distally; ventral carina convex with 4-5 acute teeth on distal half, with median row of setae proximal to first ventral tooth and numerous submarginal setae over distal half; lateral carinae feebly developed. Carapace with well developed epigastric tooth at about 0.3 of carapace length; supraorbital spines lacking, orbit feebly developed without postorbital ridge; inferior orbital angle acutely produced, short, exceeded by slender marginal antennal spine; hepatic spine well developed, at slightly lower level than antennal spine in lateral view, anterior to epigastric tooth level and posterior to first rostral tooth; anterolateral margin of branchiostegite not produced, bluntly rounded.

Abdomen smooth, glabrous; third segment not posterodorsally produced, fifth segment about 0.6 of sixth segment length, sixth about 1.7 times longer than deep, slightly more slender in males; posteroventral and posterolateral angles acutely produced, pleura all broadly rounded, first to third expanded in ovigerous females. Telson about 1.15 of sixth segment length, 3.0 times longer than anterior width, sides convergent posteriorly, posterior border about 0.3 of anterior width, angularly produced, borders sinuous, with small, slender, acute median point; two pairs of small dorsal spines at about 0.5 and 0.7 of telson length; three pairs of posterior spines present, lateral spines small, slightly smaller than dorsal spines, intermediate spines well developed, about 0.25 of telson length, about 4.5 times longer than lateral spines, submedian spines slender, about 0.4 of intermediate spine length, medially and laterally setulose.

Antennule with peduncle slightly exceeded by rostrum in adult female; proximal segment about 2.4 times longer than central width, stylocerite acute, slender, not reaching half segment length, distolateral lobe produced, with small

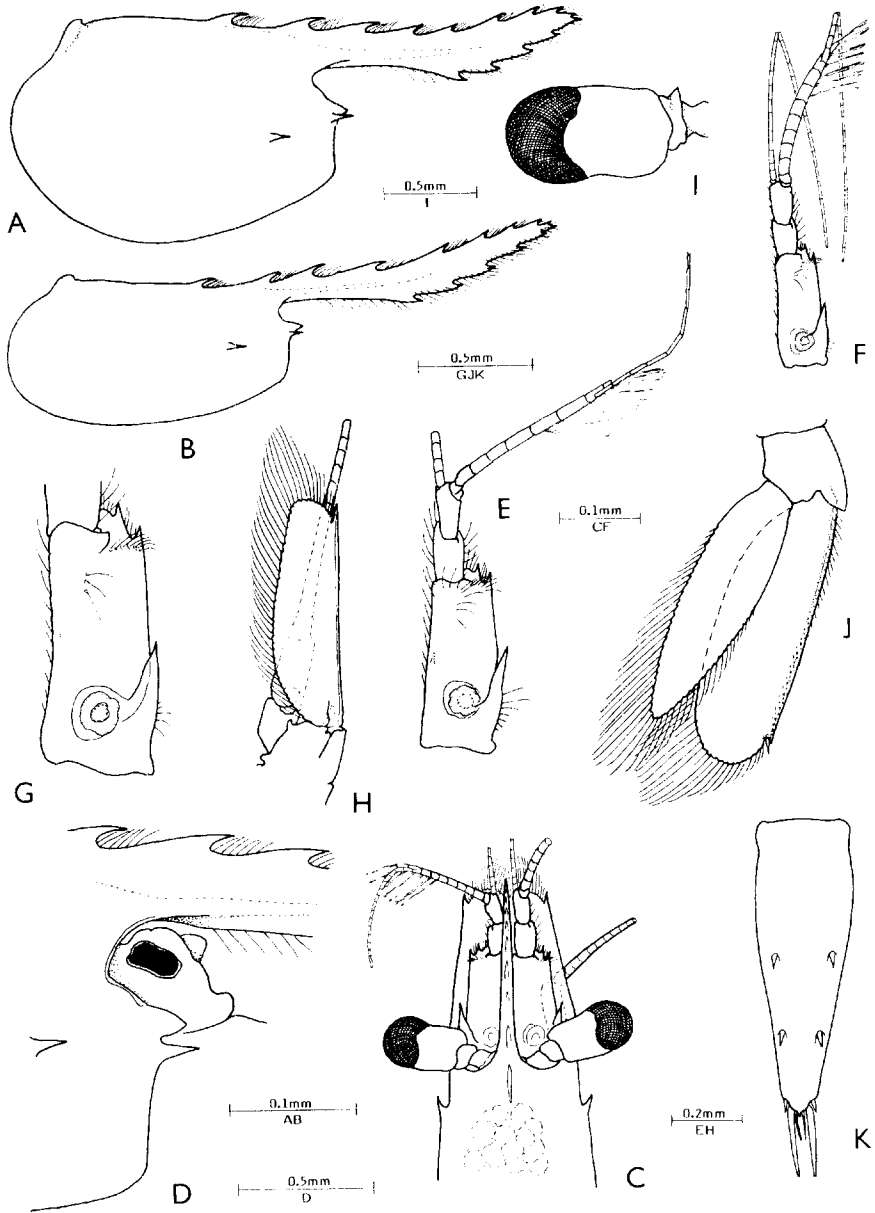


Figure 2. *Perclimenes johnsoni* sp. nov., A, B, carapace and rostrum. C, carapace, rostrum and antennae, dorsal. D, carapace, orbital region. E, F, antennule. G, same, proximal peduncular segment. H, antenna. I, eye. J, uropod. K, telson. A, C-E, H-K, paratype ovigerous female. B, F, G paratype male.

acute tooth, lateral margin straight, with small distolateral tooth, medial border setose with small acute ventral tooth, statocyst normally developed, with subcircular statolith; intermediate and distal segments subequal, obliquely articulated, with feeble lateral lobes, together equal to about 0.6 of proximal segment length; upper flagellum slender, biramous, with proximal segments of rami fused, 7 in female, 8 in male, shorter free ramus with two free segments, longer ramus filiform; with numerous slender segments, damaged in females, about 17, about 20 in males, longer ramus also filiform, about 17 in females and 30 segments in males; about 7 groups of aesthetascs present.

Antenna with robust basicerite, with strong distolateral tooth; merocerite and ischiocerite short, carpocerite reaching to about 0.4 of scaphocerite length, about 2.0 times longer than broad, flagellum long and slender, about 6.0 times postorbital carapace length; scaphocerite subequal to antennular peduncle, about 3.5 times longer than greatest width, situated at about 0.4 of length, lateral border straight, with strong distolateral tooth, not exceeding broadly rounded distal lamina.

Eye with globular cornea, with distinct accessory pigment spot dorsally; stalk slightly compressed, about 1.2 times longer than broad, about 0.95 of corneal width.

Epistome unarmed, without special features.

Mandible (right) with robust corpus, devoid of palp; molar process stout, obliquely truncate distally, with stout blunt teeth, no apparent setae; incisor process broad, with three stout acute teeth distally, central tooth smaller than others. Maxillula with feebly bilobed palp, lower lobe with small hooked seta; upper lacinia not expanded, with 7 stout simple spines distally and some setulose setae ventrally; lower lacinia lost in dissection. Maxilla with acutely pointed palp with single short plumose seta on lateral margin; basal endite bilobed, proximal endite narrower than distal, with about 8 to 10 simple setae respectively; scaphognathite about 3.0 times longer than broad, posterior lobe well developed, anterior lobe narrow, medial margin strongly concave. First maxilliped with subcylindrical palp, acutely pointed distally, with single long setulose seta on medial border; basal endite broadly rounded, sparsely setose with simple setae medially, feebly setulose setae distally; coxal endite separated from basal by deep notch, feebly bilobed, angular, sparsely setose, with simple setae; exopod well developed with small distinct caridean lobe, distal flagellum with numerous plumose setae; epipod large, broadly triangular. Second maxilliped of normal form; dactylar segment narrow, densely armed with coarsely serrulate spines, propodal segment broad, with simple spines distomedially, carpus with acute lobe distomedially, ischiomerus and basis normal, exopod with well developed flagellum with numerous plumose setae distally, coxa medially rounded, with slender simple setae, with small subrectangular epipod without podobranch laterally. Third maxilliped slightly exceeds distal carpocerite; ischiomerus feebly separated from basis, uniform, about 5.4 times longer than broad, compressed,

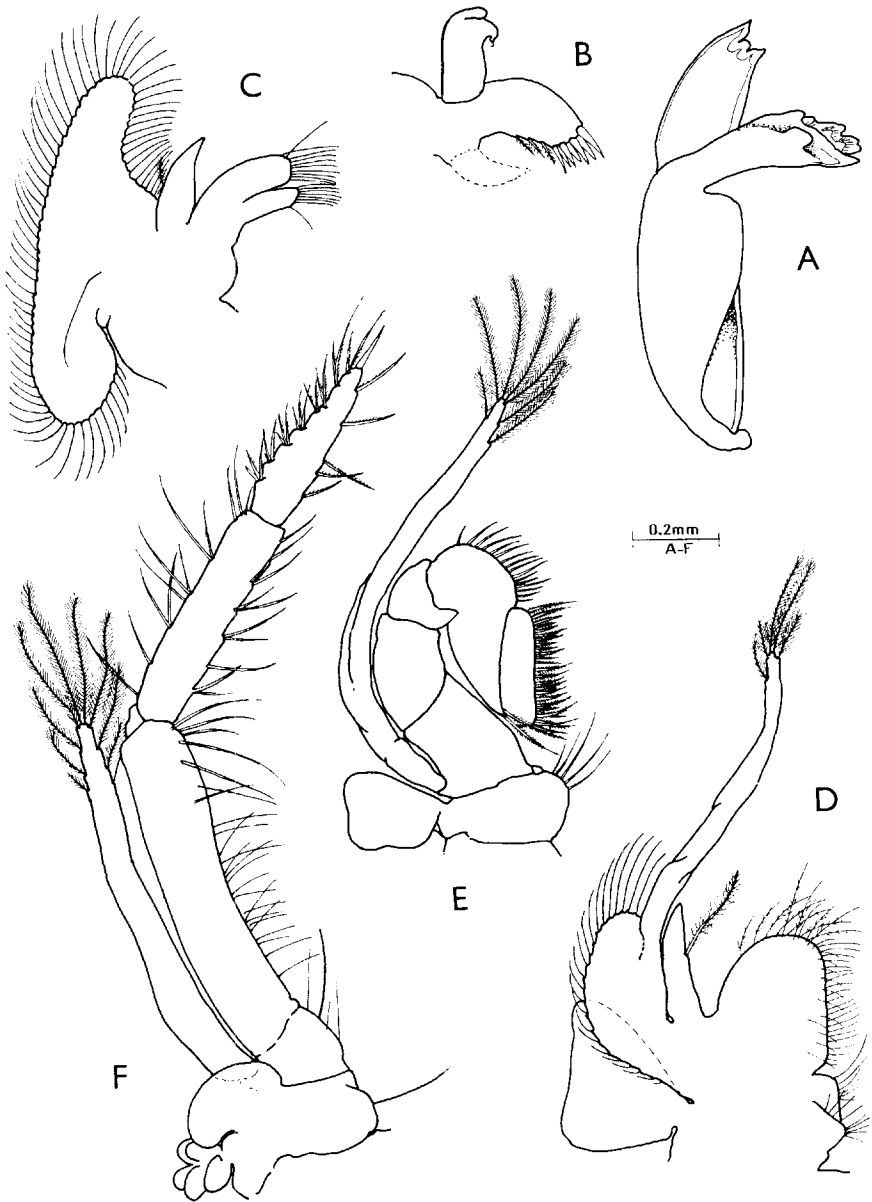


Figure 3. *Periclimenes johnsoni* sp.nov., ovigerous female paratype. A, mandible. B, maxillula. C, maxilla. D, first maxilliped. E, second maxilliped. F, third maxilliped.

feebly bowed, sparsely setose medially, penultimate segment about 4.2 times longer than broad, about 0.7 of ischiomeral length, with numerous groups of slender simple spines, distal segment tapering, about 3.5 times longer than proximal width, 0.5 of ischiomeral length, with short simple apical spine distally and numerous groups of finely serrulate spines; basis with medial border convex, sparsely setose; exopod with well developed flagellum with numerous plumose setae distally; coxa medially convex, not produced, with single long seta, with large oval lateral plate and small arthrobranch.

Fourth thoracic sternite with short, stout, tapering median process; posterior segments unarmed, narrow.

First pereopods slender, exceeding, carpoperite by about 0.5 of carpus length; chela with palm subcylindrical, slightly compressed, about twice as long as deep, with few transverse rows of short, serrulate cleaning setae proximally; fingers slender, tapering, subequal to palm length, dactylus about 5.0 times longer than proximal width, with small acute hooked tip, fixed finger similar, cutting edges gaping for proximal fourth, blunt, distal three fourth sharp, entire, unarmed; carpus about 1.4 times chela length, about 6.0 times longer than distal width, tapering proximally, with several serrulate cleaning setae distally; merus about 0.9 of carpus length, uniform, about 6.5 times longer than central width; ischium about half carpus length, about 4.0 times longer than central width, basis slightly shorter than ischium, coxa without medial process.

Second pereopods small and slender, subequal and similar, exceeding carpoperite by carpus and chela, and scaphocerite by distal third of carpus and chela. Chela equal to about 0.6 of postorbital carapace length in adult female, palm subcylindrical, smooth, slightly compressed, twice as long as deep; dactylus subequal to palm length, about 5.0 times longer than proximal width, with small acute, hooked tip, cutting edge straight, distal two thirds sharp, entire, proximal third blunt, with two small rounded teeth; fixed finger similar, with two small blunt teeth on proximal fourth and distal three fourths sharply carinate; carpus about 1.25 of palm length, slender, unarmed, 7.0 times longer than distal width, tapering proximally; merus about 0.8 of chela length, without distoventral tooth, about 8.5 times longer than distal width, tapering slightly proximally; ischium subequal to chela length, slender, unarmed, about 11.0 times longer than distal width; basis and coxa without special features. Male second pereopod similar, more slender, with less robust and smaller chela, equal to about 0.6 of postorbital carapace length, palm about 2.6 times longer than deep, dactyle equal to 0.85 of palm length, dentition similar to female, but proximal tooth on fixed finger feebly bidentate; carpus about 1.4 of chela length; merus and ischium subequal, slightly shorter than chela.

Ambulatory pereopods moderately slender, with third exceeding carpoperite

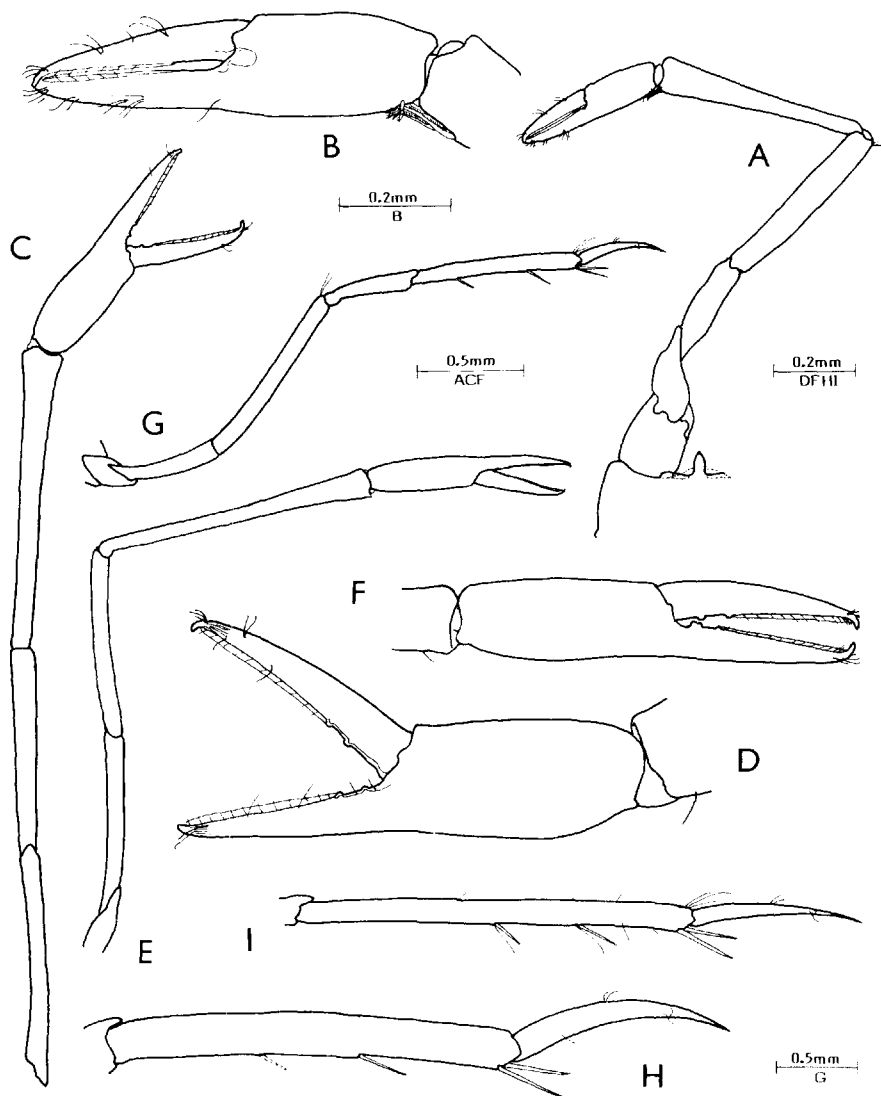


Figure 4. *Periclimenes johnsoni* sp. nov., A, first pereiopod. B, same, chela. C, second pereiopod. D, same, chela. E, second pereiopod. F, same, chela. G, third pereiopod. H, same, propod and dactyl. I, same, (?). A-D, G, ovigerous female paratype. E, F, male paratype. I, ovigerous female paratype (?), detached.

by propod and dactyl; in female, dactyl with corpus and unguis distinct, corpus slender and curved, about 6.0 times longer than proximal depth, unarmed, with two short dorsal setae at about 0.6 of dorsal margin length, submarginal ventral seta at about 0.3 of ventral margin length, with medial and lateral setae distally, unguis slender and acute, unarmed, about 0.3 of corpus length, 5.0 times longer than proximal width; propod about 1.9 times dactyl length, about 9.5 times longer than wide, uniform, with pair of long, slender, simple, distoventral spines, equal to about 0.18 of propod length, with two single shorter ventral spines; carpus equal to about 0.6 of propod length, about 5.5 times longer than wide, unarmed; merus about 1.1 times propod length, about 11.5 times longer than wide centrally, uniform, unarmed; ischium about 0.6 of propod length, unarmed; basis and coxa normal. Fourth and fifth pereopods similar, distal propod of fifth with serrulate cleaning setae laterally. Male with ambulatory pereopods more slender; dactyl about 7.5 times longer than deep; third to fifth propods in ratio: 1:1.25:1.4.

Male first pleopod with endopod elongate and slender, subuniform, about 3.4 times longer than distal width, distolateral margin with 8 short plumose setae, proximal half of medial margin with six setae proximally, some long, plumose, others shorter and spiniform, with three short curved spines distally. Male second pleopod with appendix masculina reaching to about 0.8 of endopod length, slightly exceeded by appendix interna, corpus slender, about 6.5 times longer than distal width, subcylindrical, slightly tapering proximally, with four spinulose spines distally and 10 simple spines along ventral surface; appendix interna with few distal concinni.

Uropod with propod bluntly produced posterolaterally; exopod about 3.2 times longer than broad, lateral border straight, with ventral submarginal row of setae, with small acute tooth distally with mobile spine medially, distinctly exceeding posterior telson border; endopod narrow, about 3.5 times longer than broad, shorter than exopod.

Ova few, about 45, of normal size.

An ovigerous female with both second pereopods attached is selected as holotype. The eight other specimens are designated as paratypes. The specimens are deposited in the Zoological Reference Collection of the National University, Singapore, except for one ovigerous female placed in the collection of the Northern Territory Museum, Darwin, catalogue number NTM Cr.0040188.

Measurements (mm). Ovigerous female, holotype: total length (approx.) 11.7; carapace and rostrum 4.7; postorbital carapace 2.1; major second pereopod, chela 1.2; minor second pereopod chela 1.1; length of ova 0.6. Male, allotype: total length (approx.) 8.5; carapace and rostrum 3.5; postorbital carapace length 1.5; major second pereopod, chela 1.0; minor second pereopod, chela 0.9. The largest female specimen had a post orbital carapace length of 2.3 mm.

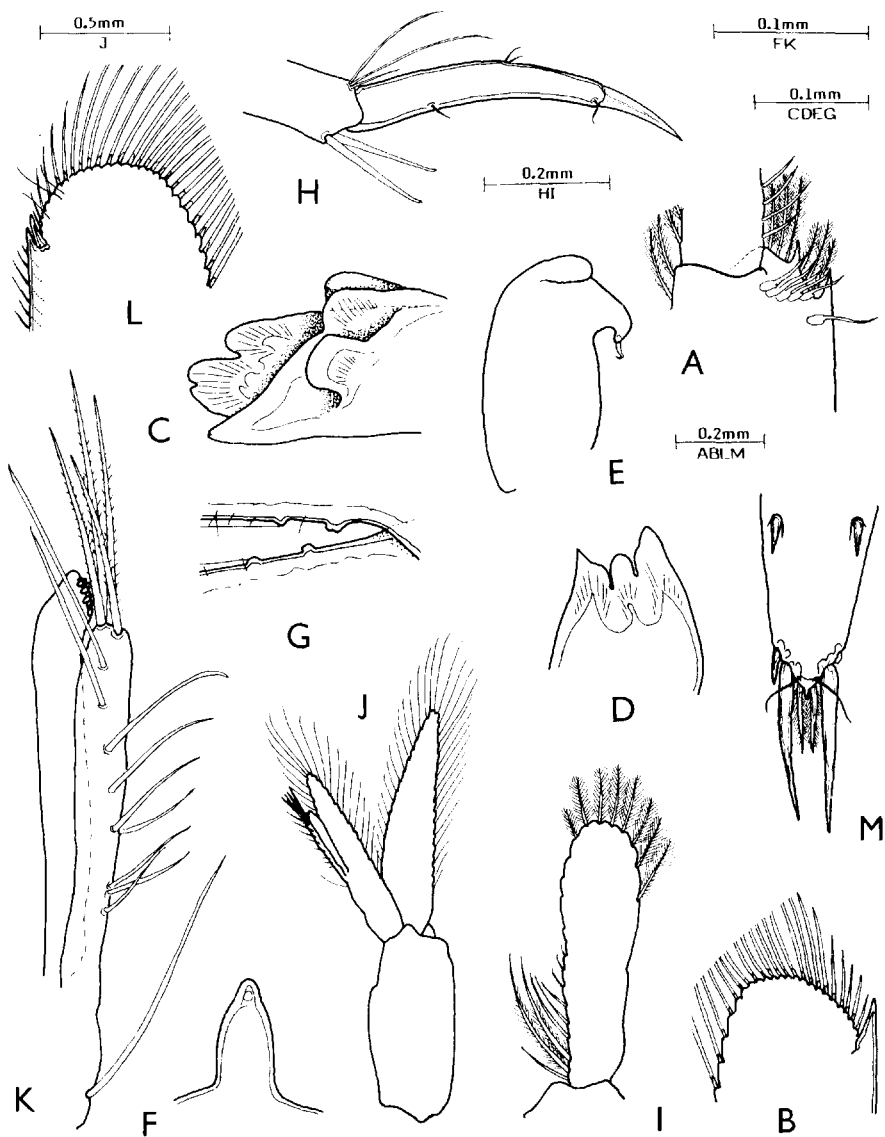


Figure 5. *Periclimenes johnsoni* sp.nov., A, proximal segment of antennular peduncle, distolateral angle. B, scaphocerite, distal end. C, mandible, molar process. D, same, incisor process. E, maxillula, palp. F, median process of fourth thoracic sternite. G, second pereopod, proximal dentition of fingers. H, dactyl of (?) third pereopod. I, first pleopod, endopod. J, second pleopod. K, same, appendix masculina and appendix interna. L, uropod, distal endopod. M, telson, posterior spines. A-H, L, M, ovigerous female paratype. I-K, male paratype.

Colouration. No data.

Systematic position. Important features in assessing the systematic position of *P. johnsoni* are (i) the presence of a median fourth thoracic sternal process, (ii) absence of distoventral meral teeth on the second pereopods and (iii) the absence of supraorbital spines, tubercles and postorbital ridges. These features are shared particularly with both *P. calmani* Tattersall and *P. leptopus* Kemp. From both these species, *P. johnsoni* can be readily separated by the presence of two distolateral teeth on the proximal segment of the antennular peduncle. *P. leptopus* differs from both *P. johnsoni* and *P. calmani* in the absence of spines on the ventral margins of the propods of the ambulatory pereopods and also has a comparatively short rostrum, with an epigastric tooth and 7 or 8 dorsal and 2 ventral teeth only (Kemp 1922). *P. leptopus* also has second pereopods with the fingers of the chela distinctly exceeding the palm length.

For comparison with *P. calmani* Tattersall, *P. johnsoni* shows a number of characteristic morphological differences. Those are outlined in the following table.

<i>P. johnsoni</i> sp.nov.	<i>P. calmani</i> Tattersall
1. Epigastric tooth at about 0.3 of postorbital carapace length.	Epigastric tooth at about 0.2 of postorbital carapace length.
2. Rostral dentition 9-10/4-5.	Rostral dentition 7-8/4-5.
3. Distolateral angle of proximal segment of antennular peduncle bidentate.	Distolateral angle of proximal segment of antennular peduncle with single tooth only.
4. Scaphocerite scarcely exceeding antennular peduncle.	Scaphocerite distinctly exceeding antennular peduncle.
5. Fourth thoracic median sternal process short and stout.	Fourth thoracic median sternal process long and slender.
6. Second pereopods with chela much shorter than postorbital carapace length, with fingers subequal to palm; carpus much longer than chela.	Second pereopods with chela subequal to postorbital carapace length, fingers much shorter than palm; carpus slightly shorter than chela.
7. Ambulatory propods with pair of long distoventral spines and two single ventral spines.	Propods of ambulatory pereopods with pair of distoventral spines and 3-4 single ventral spines, of normal length.
8. Pleura of fifth abdominal segment broadly rounded.	Pleura of fifth abdominal segment with small posterior point.

3. DISCUSSION

Johnson (1961), in his review of the Singapore carideans reports a species of *Periclimenes* as common in the mangrove channels of the Jurong area and in the *Enhalus* beds of Tanjong Gup. Initially identified as *P. calmani* Tattersall, the specimens described above are the only specimens presently available that were collected and studied by Johnson. In his 1976 paper, Johnson refers under *P. calmani* to his 1961 data 'in part', without clarifying the status of his remark, but implying that he considered his original material to consist of more than one species. Johnson (1961) followed Holthuis (1952) in including *P. leptopus* Kemp as a provisional synonym of *P. calmani* and his record of *P. calmani* from the Andaman Islands (Tab. 1, p. 75) refers to Kemp's species, the only known occurrence of *P. leptopus*, which appears sufficiently characterized to be considered a valid species. It would appear probable that Holthuis's specimens from Indonesia should be referred to a distinct species of the same group. They are at least clearly distinct from *P. johnsoni* and the absence of spines on the ambulatory pereiopods is sufficient to distinguish them from *P. calmani*. *Periclimenes calmani* is thus known with certainty only from Suez Canal and Sudanese Red Sea region (Tattersall 1921, Balss 1927, Gurney 1927, 1927a) and the eastern Mediterranean (Monod 1930, 1932) as a result of migration through the Suez Canal.

The '*Periclimenes grandis* species group' was originally designated by Kemp (1922) and contained twelve species that include some of the commonest Indo-West Pacific coral reef shrimps (*P. grandis* (Stimpson) and *P. elegans* (Paulson)). Most of the species are free-living micropredators and only a single obligatorily commensal species was included (*P. anymone* De Man). Only a single non-Indo-West Pacific form was included (*P. holmesi* Nobili), which has since been transferred to the genus *Palaemonella* (Holthuis, 1951).

Kemp's original definition of the group was based on the presence of supraorbital spines, unarmed fingers of first pereiopods, distoventral tooth of merus of second pereiopods, narrow scaphocerite with distolateral tooth exceeding lamella. Other features that render the species of Kemp's group readily identifiable are the presence of (i) well-developed rostrum with at least 7 dorsal and 2 ventral teeth, without elevated basal crest, (ii) epigastric spine, (iii) slender subequal, similar second pereiopods with dentate carpi, and (iv) ambulatory pereiopods with slender simple dactyls, usually with spinulate propods. Further examination of species with these characters showed that they also shared a further conspicuous feature not found in most commensal species, a longer finger-like median process on the fourth thoracic sternite, extending ventrally between the bases and coxae of the first pereiopods. This feature has also been found in a number of other Indo-West Pacific *Periclimenes* species, but does not occur in any of the New World species (F.A.Chace, personal communication). Some of the Indo-West Pacific species are of very similar morphology to the species of Kemp's

group and readily included, such as *P. demani* Kemp, which differs only in that the distolateral tooth of the scaphocerite fails to exceed the lamella. Other species differ principally in the absence of supraorbital spines and more feeble development of the second pereiopods, with the loss of the distoventral meral tooth. Kemp's term is now used to include all species with a distinct slender median process on the fourth thoracic sternite. Of the species originally included by Kemp, *P. holmesi* Nobili, as noted above, has been transferred to the genus *Palaemonella*; *P. proximus* Kemp and *P. affinis* Borradaile have been synonymized with *P. longirostris* Borradaile (Holthuis 1958) and *P. vitiensis* Borradaile with *P. grandis* (Stimpson), leaving *P. elegans* (Paulson), *P. grandis* (Stimpson), *P. agag* Kemp, *P. andamanensis* Kemp, *P. suvativensis* Borradaile and *P. amymone* De Man, together with the little known *P. ensifrons* (Dana, 1852). The latter may well be an abnormal specimen of *P. grandis* or *P. elegans* with changes in the carpus of the second pereiopods resulting from regeneration of the appendage after autotomy.

The median process of the fourth thoracic sternite is interpreted as a primitive character as it is also conspicuous in the genus *Palaemonella*, from which *Periclimenes* is distinguishable in many species, such as *P. grandis* or *P. elegans*, only by the presence of a mandibular palp. The process is also present in the free living palaemonid genera such as *Palaemon* and *Macrobrachium* although absent in *Leander* and *Leandrites*, but is generally absent from most commensal species.

A key to the species of the reinterpreted '*Periclimenes grandis* group' is given in Bruce (in press), which may be amended to include *P. johnsoni* by the addition of the following couplet:

- 17. Post-orbital ridge distinct *P. darwiniensis* Bruce
- Without post-orbital ridge 18
- 18. Proximal segment of antennular peduncle with distolateral angle unidentate; second pereiopods well developed, with chelae subequal to postorbital carapace length, longer than carpus; R.1+7-8/4-5 *P. calmani* Tattersall
- Proximal segment of antennular peduncle distolaterally bidentate; second pereiopods feebly developed, chela about half postorbital carapace length, much shorter than carpus; R.1+8-9/4- 5 *P. johnsoni* sp.nov.

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