

**A REPORT ON A SMALL COLLECTION OF SHRIMPS
FROM THE KENYA NATIONAL MARINE PARKS AT
MALINDI, WITH NOTES ON SELECTED SPECIES**

by

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With 23 text-figures

The marine caridean fauna of East Africa has been little studied. Prior to World War 1, German authors produced a number of general studies but the emphasis of these papers was on crabs. Most of the carideans are reported from Zanzibar. Hilgendorf (1869) reported two unidentified species of *Alpheus* from Zanzibar. Pfeffer (1889) reported *Coralliocaris graminea* also from Zanzibar and in 1894 Ortmann added the hippolytid *Saron marmoratus*. Lenz (1905) reported three pontoniine shrimps, two hippolytids and six alpheids from Zanzibar. In 1905 also, Nobili reported *Gelastocaris paronae* from Zanzibar. The first World War terminated these studies and there seems to have been little further interest until Taramelli (1955) reported again on the crustacea of Zanzibar, recording five species of shrimps, three of which were not previously recorded.

The present study is based upon the results of collecting from shallow water in the Casuarina Point and Watamu National Marine Parks at Malindi, Kenya, over a period of three days during spring tide conditions, in March, 1973. Collections were kept as generalized as possible and no special efforts were made to concentrate on special habitats. A total of 67 species are represented in the material collected, but these are considered to represent only a small portion of the total variety present. The collection is noteworthy for the presence of a number of rare or little known species as well as one new species, but also for the absence of a considerable number of common and well known shrimps that have been found to be widespread on East African coasts. It is probable that further collections could readily double or even treble the number of species known from the Parks.

The positions of the localities at which collections were made are approximately (i) Casuarina Point, 3° 16.5'S 40° 08.5'E; (ii) Watamu Park, 3° 22.0'S 40° 00.5'E (fig. 1). The material obtained has been deposited in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden.

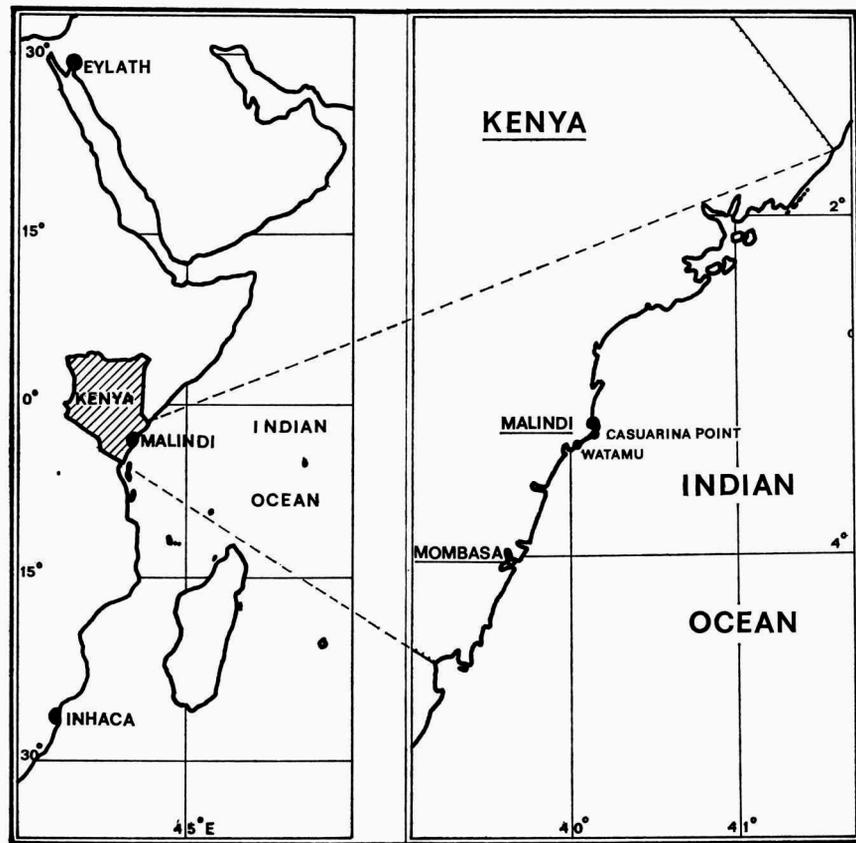


Fig. 1. African east coast, with detail of Kenyan coast.

I. SYSTEMATIC ACCOUNT OF SPECIES COLLECTED

RHYNCHOCINETIDAE

Rhynchocinetes hendersoni Kemp

Rhynchocinetes hendersoni Kemp, 1925: 263 (key), 265-270, figs. 3-7; Gordon, 1935: 82-83, 88 (key); Holthuis, 1952: 11, 80.

Material examined. — Casuarina Point, 31-7-73, 1 ♂, 1 juv. ♂. The specimens were collected from a large colony of *Millepora* at a depth of 1 m below LWS.

Distribution. — Known in the Indian Ocean, only from South India and the Gulf of Manaar. Also reported from Bali and Fiji. Not previously recorded from East Africa.

Remarks. — Numerous other specimens were also observed in the same

Millepora colony but avoided capture. Many specimens of *Saron marmoratus* were also present. The colour pattern is basically pale reddish with numerous small white patches, with whitish streaks along the dorsal margins of the pereopods. The large specimen, with enlarged first pereopods, had a rostral formula of $\frac{2-2}{7}/3$ and the smaller specimen $\frac{2-2}{8}/2$. The fine striae of the carapace and abdomen and the lateral spine of fifth abdominal segment were distinct.

PALAEMONIDAE: PONTONIINAE

Palaemonella rotumana (Borradaile)

Periclimenes rotumanus Borradaile, 1898: 1005, pl. 63 figs. 5-5b.

Palaemonella rotumana Bruce, 1970: 276-279, fig. 2, pl. 1 fig. 1e-f.

Material examined. — Watamu, 8-3-73, 1 ♂; 9-3-73, 4 (2 ovig. ♀): 1 ♂. Casuarina Point, 10-3-73, 1 ♂; 1 juv; 1 ♂; 1 ♂, 1 ovig. ♀. Specimens were obtained from corals collected in 0.5-2 fm or from the dead bases of coral colonies. One specimen was obtained from the base of an alcyonarian.

Distribution. — Common and widespread throughout the Indo-West Pacific region, but not previously recorded from Kenya. It has been reported from Zanzibar (Bruce, 1965).

Remarks. — One of the commonest pontoniine shrimps, found in a wide variety of habitats from coral reefs to muddy bays and extending from shore pools to a depth of 70 m. This species has also recently extended its range through the Suez Canal into the Eastern Mediterranean Sea.

Vir orientalis (Dana)

Palaemonella orientalis Dana, 1852: 26.

Vir orientalis Bruce, 1972: 64, 65-67, fig. 1.

Material examined. — Watamu, 9-3-73, 1 ♂, 1 ovig. ♀, 1 juv. The specimens were collected together from a colony of *Acropora* from a depth of 2 fm.

Distribution. — Previously reported from the Sulu Sea, Fiji and Hawaii in the Pacific Ocean and from the Andaman Islands in the Indian Ocean. This species has not been previously recorded from Kenya.

Remarks. — This species has previously been recorded in association with the coral *Pocillopora damicornis* (L.) and the association with *Acropora* represents a new host genus record. The presence of adult male, ovigerous female and a juvenile suggests that the association is not accidental, although the typical host for this species appears to be *Pocillopora* spp.

Periclimenes petitthouarsii (Audouin)

Palaemon Petitthouarsii Audouin, 1825: 91.

Periclimenes (*Harpilius*) *petitthouarsi* Holthuis, 1952: 12, 78-79.

Periclimenes petitthouarsi Bruce, 1971: 2, 4-5.

Material examined. — Casuarina Point, 10-3-73, 1 ♂; 1 ♂; 1 ov. ♀. Associated with live or dead corals, the present specimens were obtained from a colony of *Seriatopora* and two colonies of *Acropora*.

Distribution. — This species is found only in the western Indian Ocean, Persian Gulf, Aden and Red Sea. It has not previously been reported from Kenya but has been found as far South as the Comoro Islands.

Remarks. — This species is replaced throughout the rest of the Indo-West Pacific region by *P. spiniferus* (De Man). Both species appear to be free-living browsers. *P. spiniferus* occurs in Madagascar, the Seychelle Islands and Aldabra.

Periclimenes lutescens auct.

Harpilius lutescens Kemp, 1922: 235-237, figs. 72-73.

Periclimenes (*Harpilius*) *lutescens* Patton, 1966: 275, 288 (tab. 1), 290 (tab. 2).

Periclimenes lutescens Bruce, 1971: 2, 5; 1975: 27, fig. 15.

Material examined. — Watamu, 8-3-73, 1 ♂; 1 ovig. ♀; 9-3-73, 1 ♂, 1 ovig. ♀, 1 juv. All specimens were obtained from *Acropora* colonies, from 2-6 m.

Distribution. — Known from the Red Sea to the Great Barrier Reef. Previously reported only from the Comoro Islands in the Western Indian Ocean and not previously recorded from Kenya.

Remarks. — The species has been confused recently with *P. consobrinus* De Man (see below), and some records need to be checked. The specimen of *P. lutescens* recorded by Bruce (1971) from the Comoro Islands (27 November, 1964) from *Pocillopora*, proved to be *P. consobrinus* on re-examination, but the other records of *P. lutescens* from the Comoro Islands are correct. This species can be readily separated from *P. consobrinus* on morphological details and also by the characteristic colouration (Bruce, 1975).

Periclimenes grandis (Stimpson) (fig. 2)

Anchistia grandis Stimpson, 1860: 39.

Periclimenes (*Ancylocaris*) *grandis* Kemp, 1922: 171 (key), 210-214, figs. 58, 59, pl. 7 fig. 10.

Periclimenes (*Harpilius*) *grandis* Holthuis, 1952: 11, 79-81; Barnard, 1955: 48.

Periclimenes grandis Bruce, 1971: 2, 6; 1973: 132-133.

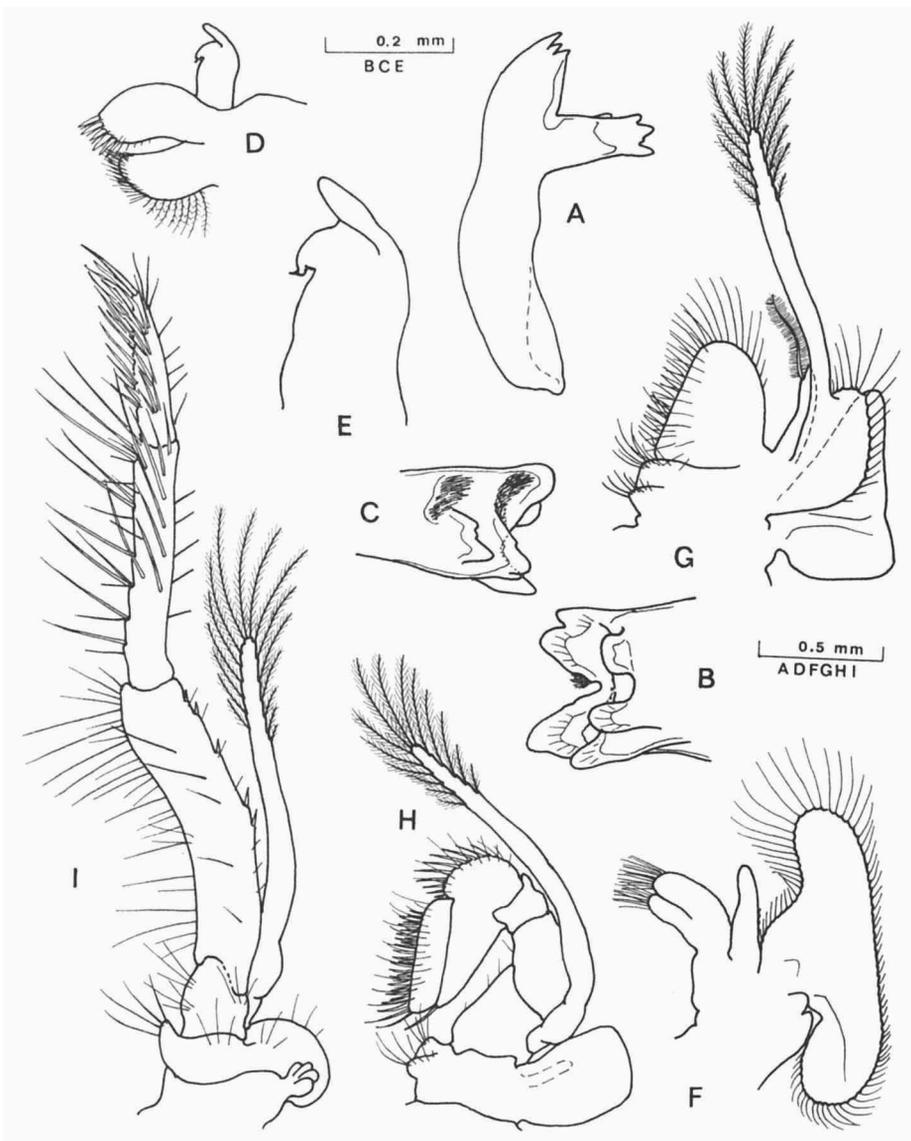


Fig. 2. *Periclimenes grandis* (Stimpson). A, mandible; B, left molar process; D, maxillula; E, palp of maxillula; F, maxilla; G, first maxilliped; H, second maxilliped; I, third maxilliped.

Material examined. — Watamu, 8-3-71, 4 (1 ovig. ♀). Shallow pools on algal crest of reef, under stones.

Distribution. — Widespread from East Africa to the Australian Great Barrier Reef. This species has not been previously reported from Kenya but

has been recorded from Zanzibar (Lenz, 1905) and Dar es Salaam (Ortmann, 1895) and also the Seychelle Islands and Comoro Islands.

Remarks. — This species is a common free-living predator of small marine organisms and feeds readily on small isopods and amphipods, as well as fish and mollusc muscle under aquarium conditions.

In his report on the Pontoniinae of the Indian Museum, Kemp (1922) segregated a number of species into what he termed the "*P. grandis* group". The best known species of this group, *P. grandis* and *P. elegans* (Paulson), are free-living active predators and feed readily on live material in captivity, thereby contrasting with the majority of the species of the genus which are now known to live in permanent associations with a wide variety of marine invertebrates. In many of these species the mouthparts have undergone varying degrees of modification, but such specializations have not been found in *P. grandis*. The mouthparts closely resemble those found in the primitive genus *Palaemonella* (Bruce, 1971), from which they differ principally only in the loss of the mandibular palp.

The mandible is robust with a short stout broad incisor process with three short teeth distally. The medial edge is sharp. The molar processes are also robust, distally truncated, with large blunt teeth and few setae. The maxillula has the palp distinctly bilobed, with a long slender upper lobe. The lower lobe is short and bears a minute seta proximally. The upper lacinia is slender with about eight stout spines and a few setae distally. The lower lacinia is short and blunt distally with numerous short simple setae and also some longer sparsely plumose setae ventrally. The maxilla has an elongated, blunt, non-setose palp, with a few minute setae on the middle of its lateral border. The basal endite is deeply bilobed with the distal lobe distinctly larger than the proximal lobe. Each lobe bears numerous slender simple setae distally. The coxal endite is completely lacking and a slight eminence of the medial border indicates its situation. The scaphognathite is normal, about 2.5 times longer than broad, with the antero-medial border deeply concave. The first maxilliped has a slender tapering palp with an acute tip. A long slender, densely plumose seta arises preterminally from the medial border. The basal endite is broad, 1.3 times longer than wide and distinctly separated from the coxal endite by a deep notch. The distal and medial margins are provided with numerous simple or finely setulose setae. The coxal endite is well developed, subquadrate with numerous long coarsely setulose setae arising from the distal angle and shorter simple spiniform setae from a transverse row at the proximal angle. The exopod is well developed with a broad flagellum provided with four long plumose terminal setae and five similar distal setae in each margin. The caridean lobe is rather small, but the epipod is large and trian-

gular, reaching to the level of the anterior margin of the caridean lobe. The second maxilliped is of normal form with a fairly broad dactylar segment, about 3.4 times longer than wide, and densely provided with short, stout, finely serrated spines along the medial border. The propodal segment has a broadly rounded anterior margin bearing about ten long simple spines and a few setae. The carpus, merus and ischio-basis show no special features. The exopod is similar to that of the first maxilliped. The coxa has the medial margin produced into small upper and lower lobes, each bearing a group of simple setae. The epipod is subrectangular and with a rudimentary podobranch. The third maxilliped is moderately robust. The exopod has the ischio-merus distinct from the basis and strongly bowed, about five times longer than the width, which is approximately uniform. The distal half of the lateral border bears five isolated spines in the dissected specimen, and the medial border bears numerous long fine simple setae. The penultimate segment is broad, 0.7 of the length of the ischio-merus, and 5.5 times longer than broad. It bears numerous long slender finely serrated spiniform setae along the ventromedial and ventro-lateral margins. The terminal segment is about 0.6 of the length of the penultimate segment and tapers distally, terminating in a stout simple spine. The ventral surface is provided with numerous groups of serrated spines, which increase in length, and serrations towards the tip of the segment. The basis is unmodified and bears a few setae medially. The exopod is well developed, similar to those on the first and second maxillipeds but with more numerous plumose setae distally. The coxa is produced into a small distinct rounded lobe medially, bearing a few simple setae. A well developed rounded epipod is present laterally and also a small multilamellar arthrobranch.

In comparison with the commensal species of *Periclimenes*, the following features of the mouthparts of *P. grandis* are of particular importance:

1. Mandible: robust with stout molar process with large blunt teeth.
2. Maxillula: palp deeply bilobed; laciniae not broadened.
3. Maxilla: distal lobe of basal endite broader than proximal.
4. Maxilliped I: slender setiferous palp; distinct basal and coxal endites; small caridean lobe with large epipod.
5. Maxilliped II: coxa produced medially, with setose lobe: a rudimentary podobranch present.
6. Maxilliped III: ischio-merus distinct from basis; small functional arthrobranch.
7. Exopods: functional, flagella broad with numerous plumose setae.

In most of the commensal species basal and coxal endites of the first maxilliped are completely fused and the palp is without a plumose seta. In

the third maxilliped, the ischio-merus and basis are completely fused and the arthrobranch is rudimentary or lacking. The exopods usually have slender flagella with only the four terminal plumose setae, as are also found in the larval stages of pontoniid shrimps, and probably only have a reduced functional importance.

Periclimenes consobrinus (De Man)

Harpilius consobrinus De Man, 1902: 836-840, pl. 26 fig. 54.

Periclimenes consobrinus Bruce, 1972: 403, 409, 412 (key), fig. 1b.

Material examined. — Watamu, 8-3-73, 1 ovig. ♀; 1 ovig. ♀; 1 ovig. ♀. All specimens were obtained from *Pocillopora damicornis* (L).

Distribution. — Records of this species have been confused with *P. lutescens* (see above), and the only definite records are from Ternate and Djakarta, Indonesia and from the Comoro Islands in the western Indian Ocean.

Remarks. — *P. consobrinus* and *P. lutescens* are closely related coral associates. The former is associated with *Pocillopora* and the latter with *Acropora*. The colour patterns (Bruce, 1975) are quite distinctive but morphological differences are small, though constant (Bruce, 1972). Many of the earlier records of *P. lutescens* need to be re-examined.

Periclimenes psamathe (De Man)

Urocaris psamathe De Man, 1902: 816-818, pl. 25 fig. 51.

Periclimenes (Ancylocaris) psamathe Kemp, 1922: 168 (key), 173.

Periclimenes psamathe Bruce, 1970: 541-543, fig. 3.

Material examined. — Watamu, 9-3-73, 1 juv. From *Aglaophenia* sp. (Hydrozoa), from 4 m.

Distribution. — Chagos and Maldivé Islands, Indonesia, New Guinea and New Caledonia. Not previously recorded from western Indian Ocean.

Remarks. — Previously found in association with the gorgonian *Mopsella ellisi* Hickson, the present occurrence constitutes a new host record and the first association of this species and a hydroid coelenterate. The specimen was collected with the specimens of *Periclimenes galene*. However, the single specimen is juvenile and the association may represent an atypical association.

Periclimenes soror Nobili

Periclimenes soror Nobili, 1904: 232; Gordon, 1939: 395-400, figs. 1-3; Bruce, 1972: 64, 68.

Periclimenes (Periclimenes) soror Holthuis, 1952: 9, 51-53, fig. 17.

Material examined. — Casuarina Point, 10-3-73, 4 juv.; 11 (2 ovig. ♀). The juveniles were obtained from an *Acanthaster planci* (L.) and the adults from *Culcita schmiedeliana* (Retzius), at 1-2 fm.

Distribution. — Common and widespread from East Africa to Hawaii. This species has previously been recorded from Andromache Reef, Mombasa (Bruce, 1971).

Remarks. — A well known associate of shallow water starfish.

Periclimenes seychellensis Borradaile

Periclimenes (Falciger) seychellensis Borradaile, 1915: 212.

Periclimenes (Ancylocaris) seychellensis Bruce, 1971: 2-8.

Material examined. — Watamu, 8-3-73, 2 juv. Both specimens obtained from *Cymodocea* fronds at 1 fm.

Distribution. — Previously recorded from the Red Sea, Madagascar and Moçambique, this species has not been previously recorded from Kenya. Also known from the Seychelle Islands, Gulf of Manaar, Andaman Islands, Singapore and Papua.

Remarks. — This species is also free-living and usually associated with algae, either attached or at times floating freely. It is probably a micro-predator.

Periclimenes diversipes Kemp

Periclimenes (Ancylocaris) diversipes Kemp, 1922: 169, 179-184, fig. 36-39.

Periclimenes (Harpilius) diversipes Holthuis, 1952: 11.

Periclimenes diversipes Bruce, 1971: 2, 9-10; 1972: 93.

Material examined. — Watamu, 8-3-73, 1 ♀. From *Goniopora* sp., from 3 fm.

Distribution. — Known from several localities in the western Indian Ocean, from the Red Sea and Aden to the Comoro Islands, including the Andaman Islands and the Gulf of Manaar. Previously recorded from Maziwi Island, Tanzania, by Bruce (1972), and also known from the Great Barrier Reef.

Remarks. — This species is a common associate of a wide range of coral genera. This single specimen corresponds to Kemp's class of *a d* chelae on the second pereopods.

Periclimenes inornatus Kemp

Periclimenes (Ancylocaris) inornatus, Kemp, 1922: 170 (key), 191-194, fig. 43-46.

Periclimenes inornatus Bruce, 1971: 2, 10.

Material examined. — Watamu, 8-3-73, 9 juv. All obtained from a single specimen of the anemone, *Radianthus ritteri* (Kweitnowski), at 1 fm depth.

Distribution. — Known with certainty only from the Indian Ocean, the Andaman and Seychelle Islands, the Maldivian and Comoro Islands.

Remarks. — All records above were found in association with "giant anemones". In life the shrimps were highly transparent as previously reported by Kemp.

Periclimenes galene Holthuis (figs. 3, 4)

Periclimenes (Harpilius) galene Holthuis, 1952: 11, 62-64, fig. 24.

Material examined. — Watamu, 8-3-73, 10 juv. All were obtained from a clump of "fire weed" *Aglaophenia* sp. (Hydrozoa) at a depth of 2 fm.

Distribution. — Previously known only from the original record from Indonesia.

Remarks. — *Periclimenes galene* was known previously only from the three type specimens collected by the Snellius Expedition to Indonesia in 1930 and their discovery in Kenya represents a great extension in the geographical range of this species. The association of this species with the hydroid "fire coral" *Aglaophenia* is also of particular interest as it represents the first occurrence of a species of *Periclimenes* with a hydroid coelenterate.

A detailed description of this species has been provided by Holthuis (1952) and the present specimens are in close agreement. The rostrum is in all cases, long and slender and carries from 4 to 7 dorsal teeth. There are no ventral teeth. A small mobile epigastric spine is generally present, but is absent from some specimens. The proximal segment of the antennular peduncle is without a ventro-medial tooth.

The mouth parts of *P. galene* have not been described. The mandible is slender and without a palp. The incisor process is narrow with three terminal teeth. The molar processes are more robust. One is obliquely truncated, with two stout teeth posteriorly and a fringe of stout setae round the dorsal and anterior aspects with a tuft of setae antero-ventrally. The other is squarely truncated, with a large anterior tooth and a smaller posterior tooth, and a fringe of setae anteriorly and dorsally and also a group postero-ventrally. The maxillula is normally developed with a bilobed palp, bearing a simple seta on the proximal lobe. The upper lacinia bears about seven finely serrulate short spines with hooked tips and numerous short serrulate setae.

The lower lacinia is slender, with three long spines with serrulate lateral margins distally as well as a few setae. The maxilla has a short, simple non-setiferous palp. The basal endite is well developed, simple, with usually six simple setae distally, although in some specimens only proximal and distal setae were present. The coxal endite is represented by a small rounded lobe.

The scaphocerite is well developed, moderately broad, about three times longer than wide. The three maxillipeds bear normally developed exopods, each with four plumose setae distally only. The first maxilliped has a short non-setose palp. The basal endite is broadly developed with numerous slender, feebly plumose setae along the straight medial border. The coxal endite is

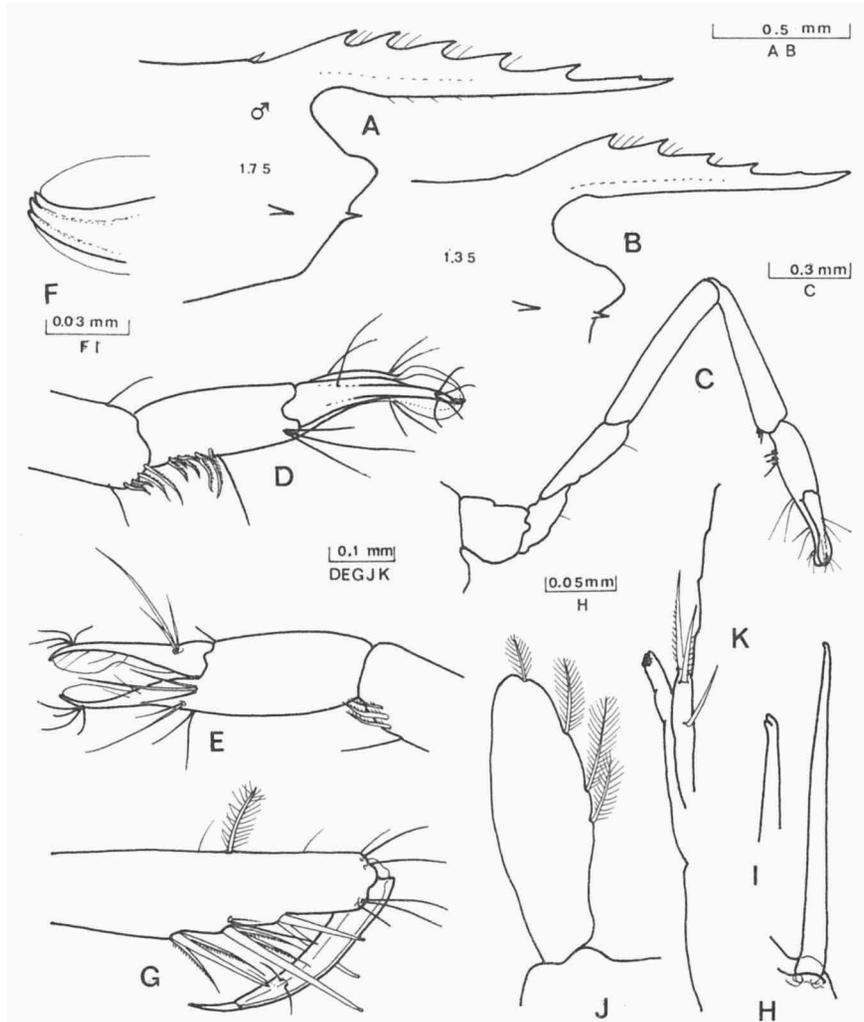


Fig. 3. *Periclimenes galene* Holthuis. A, rostrum and anterior carapace of male, CL. 1.75 mm; B, idem of juvenile, CL. 1.35 mm; C, first pereiopod; D, chela of first pereiopod, dorsal aspect; E, of medial aspect; F, tip of dactylus of first pereiopod; G, dactylus and distal propodus of third pereiopod; H, disto-ventral spine of propodus of third pereiopod; I, tip of spine; J, endopod of male first pereiopod; K, appendix masculina and appendix interna of male second pleopod.

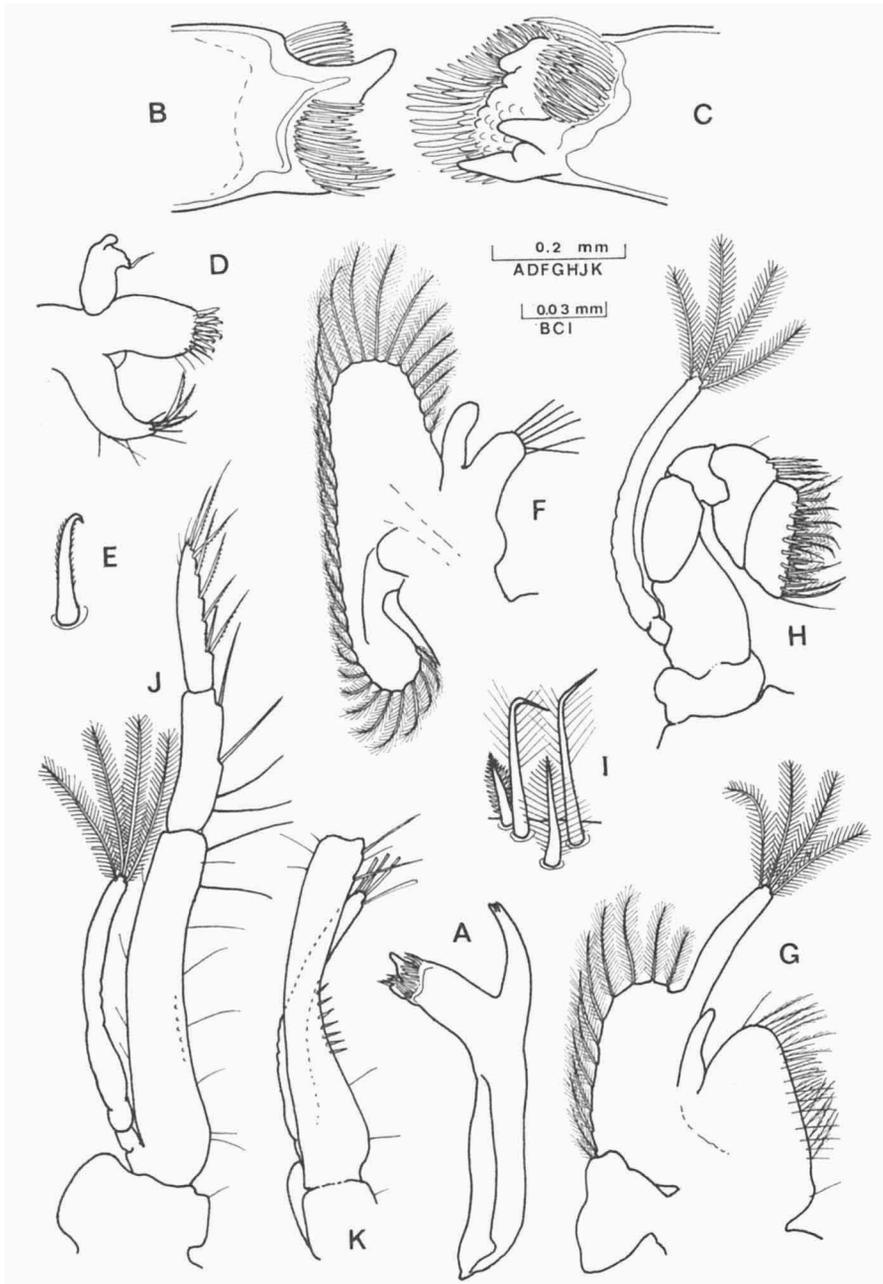


Fig. 4. *Periclimenes galene* Holthuis. A, mandible; B, molar process, C, molar process; D, maxillula; E, distal spine of upper lacinia of maxillula; F, maxilla; G, first maxilliped; H, second maxilliped; I, propodal spines of second maxilliped; J, third maxilliped; K, medial aspect of ischio-merus of third maxilliped.

feebly developed as a small rounded prominence separated by a feeble indentation of the medial border from the basal portion. The caridean lobe is well developed and a small triangular epipod is also present. The second maxilliped has the propod twice as long as wide, with the medial border provided with three types of stout spines: a), short spine, with long plumose setules over its whole length. b), long spine, with bent bare tips, with setules along the middle third only. c), short stout spines, with stout serrulated borders. The propod bears 3-4 finely plumose setae at its disto-medial angle and the carpus, merus and ischio-basis are normal. The coxa is not medially produced and the epipod is obsolescent, represented by a feeble lateral lobe only. The third maxilliped is normal, but sparsely setose. The antepenultimate segment bears a row of 7-8 short stout upright setae along the middle third of its dorsal medial border. The epipod is well developed and without an arthrobranch.

The first pereopods are as previously described. The tips of the fingers are broadly expanded to form small scoops and the extremity of the fingers bears three small recurved teeth. The coxa is without a medial process and the sternite lacks a median spine.

The ambulatory pereopods are prehensile and have the propod slightly expanded distally, with long slender simple setae ventrally. These setae have slightly hooked bifid tips. The fifth pereopod also has several shorter finely serrulate setae disto-ventrally.

In the male, the endopod of the first pleopod is about three times longer than wide, distally rounded, without a median lobule and with four plumose setae on the disto-medial border. On the second pleopod, the appendix interna distinctly exceeds the appendix masculina which is five times longer than wide. It bears three spines only, terminal and subterminal, which are feebly setulose and one at the middle of the ventral aspect, which is simple.

Periclimenes galene is closely related to the Atlantic species *P. platalea* Holthuis, 1951, and appears to be not closely related to any other of the Indo-West Pacific species of the genus. It is remarkable particularly for the prehensile form of the third to fifth pereopods, which have not been noted in any other species of the genus, and in the virtual absence of the epipod of the second maxilliped. The second maxillipeds were removed from four specimens of *P. galene* and in all cases the epipod was obsolescent or absent. The absence of this epipod has also not been recorded in the genus *Periclimenes*, but a marked reduction in the size of the epipod is also apparent in the related *P. platalea*.

This is the second record of the occurrence of this species, the first in the Indian Ocean, and the first time that the host animal has been identified.

Periclimenes imperator Bruce

Periclimenes imperator Bruce, 1966: 53-62, figs. 23-25.

Material examined. — Casuarina Point, 10-3-73, 1 juv. The single specimen was found on the dorsal aspect of the holothurian *Bohadschia* sp., at a depth of 1 m.

Distribution. — First recorded from Zanzibar, this species has not been previously recorded from Kenya. Also known from Mozambique, Madagascar, the Seychelle Islands, the Red Sea, New Caledonia, North East Australia and Hawaii.

Remarks. — As in the present case, the juveniles are often found in association with holothurians, but the adults are typically associated with the large swimming nudibranchs of the genus *Hexabranchnus*. Other holothurian hosts include *Stichopus* (Bruce, 1971); this shrimp has also been found on the nudibranch *Dendrodoris* (Castro, 1971). It is one of the most beautifully coloured shrimps and has the same red and white colour pattern on both nudibranchs and holothurian hosts. The association with *Bohadschia* constitutes a new host record.

Periclimenes zanzibaricus Bruce

Periclimenes zanzibaricus Bruce, 1967: 62-72, figs. 26-29.

Material examined. — Casuarina Point, 10-3-73. 1 ♂, 2 ovig. ♀. From *Echinothrix calamaris* (Pallas) (Echinoidea).

Distribution. — First recorded from Zanzibar, this species has not previously been recorded from Kenya. Also known from the Seychelle Islands and Western Australia.

Remarks. — This species is a common associate of diademid echinoderms and has also been found on *Diadema*, *Astropyga* and *Centrostephanus*.

Periclimenes kempi Bruce

Periclimenes kempi Bruce, 1969: 261-263.

Material examined. — Watamu, 8-3-73, 1 ♂, 1 ♀. From unidentified alcyonarian.

Distribution. — Previously reported from Hurghada, Red Sea, only.

Remarks. — The type specimens were also found in association with alcyonarians. Not previously recorded from East Africa waters.

Periclimenes watamuae sp. nov. (figs. 5, 6)

Material examined. — Watamu, 8-3-73, 1 ♂, 1 ♀. From unidentified alcyonarian, depth of 2 m.

Description. — A small shrimp, closely related to *Periclimenes diversipes* Kemp (form c, d), so that a detailed description is not necessary.

The rostrum is slender, with the rostral formula 5/1 in the female and 5/0 in the male. The antennae, carapace, abdomen and caudal fan show no significant differences from *P. diversipes*.

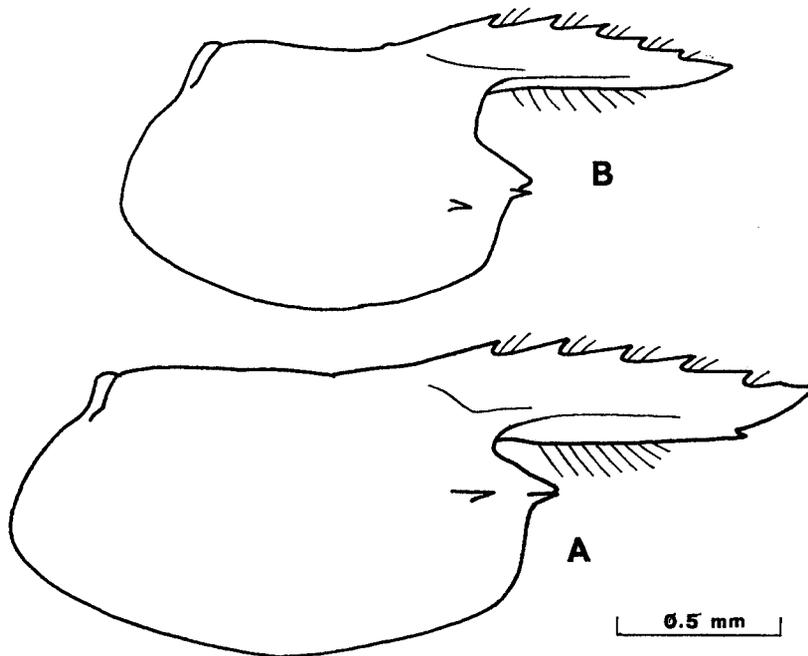


Fig. 5. *Periclimenes watamuae* sp. nov. A, carapace and rostrum of female, holotype; B, carapace and rostrum of male, allotype.

The third maxilliped has a well developed exopod with four plumose, segmented terminal setae. The epipod is well developed and no arthrobranch can be detected. The ischio-merus and basis are fused, but the line of junction is feebly indicated. The whole segment is about six times longer than broad, with three stout finely setulose setae on the distal third of the medial border and a few simple setae proximally. The penultimate segment is three times as long broad, with two stout finely serrulate spines on the medial border. The terminal segment is slightly shorter than the penultimate segment, with two groups of short serrated spines on the medial border and three large spines distally.

The first pereopod is slender. The chela has a subcylindrical palm, about

twice as long as wide, with slender fingers, slightly gaping, not subspatulate, with entire blunt cutting edges, equal to about 0.75 of the length of the palm. The dactylus is sparsely setose but the fixed finger is provided with numer-

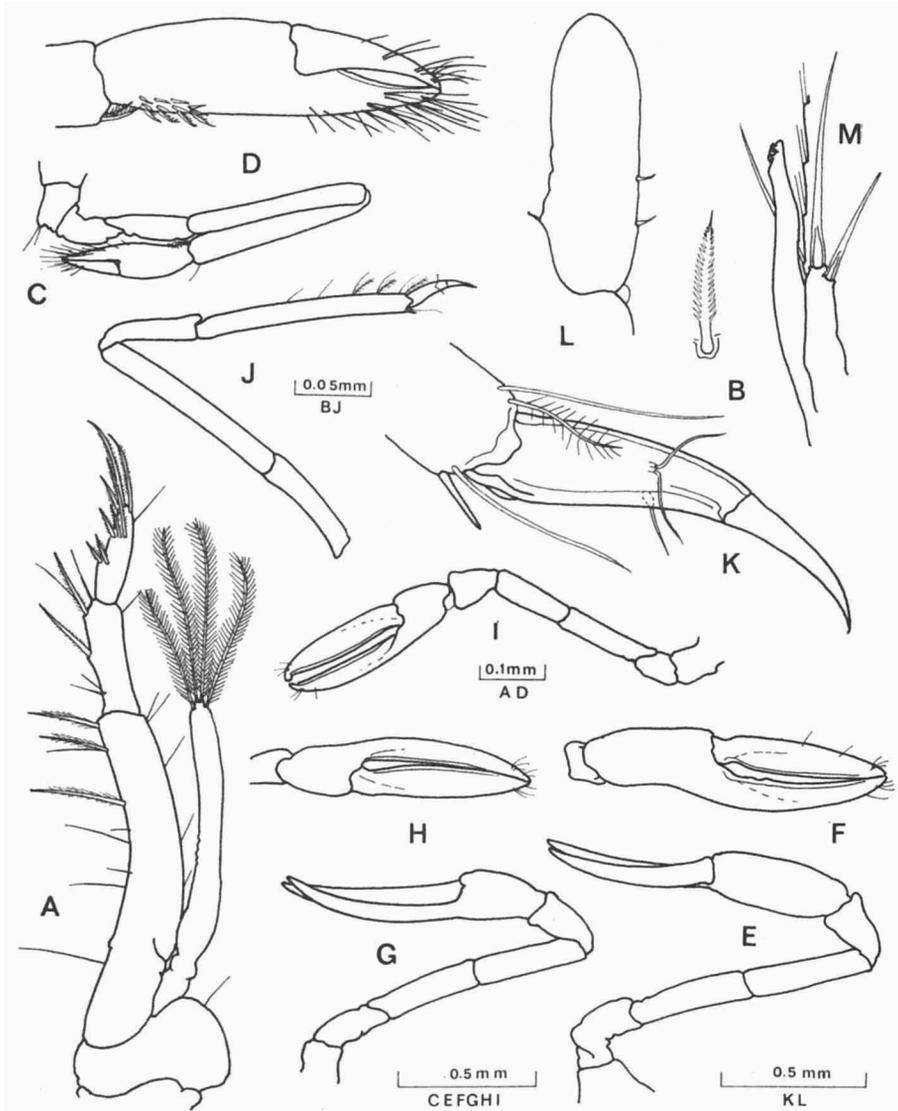


Fig. 6. *Periclimenes watamuae* sp. nov. A, third maxilliped; B, spine of terminal segment of third maxilliped; C, first pereiopod; D, chela of first pereiopod; E, second pereiopod, female right; F, chela of same; G, second pereiopod, female, left; H, chela of same; I, male second pereiopod; J, third pereiopod; K, dactylus of third pereiopod; L, endopod of male first pleopod; M, appendix masculina, and appendix interna of male second pleopod.

ous groups of long finely serrated setae. The carpus and merus are slender, with the merus slightly shorter than the carpus, which is a little less than 1.5 times the length of the chela. The ischium and merus show no special features, and the coxa has only a very small medial setose process. The fourth thoracic sternite is unarmed.

The second pereopods are similar but unequal and show a close resemblance to those of *P. diversipes* form c, d. In the major second pereopod of the female, the palm is twice as long as wide, expanding gradually distally, and 0.7 of the length of the fingers, which are slender, shallowly spatulate with entire cutting edges that gape proximally. The chela of the minor second pereopod is generally similar but the palm is 1.5 times longer than wide and only 0.4 of the length of the fingers which are subequal to those of the major chela. The cutting edge of the fixed finger of the major chela has a feeble indication of a small tooth proximally. The tip of the fingers are simple. The carpus is short and stout, 1.5 times longer than wide distally where it is slightly expanded, and equal to about half the length of the palm of the major chela. The merus is slightly shorter than the palm, 4.3 times longer than wide and unarmed. The ischium is subequal to the merus and also unarmed. Basis and coxa show no special features. The minor second pereopod shows no significant differences on these segments, which are slightly shorter and more slender only. The second pereopods of the male are similar but less robust and the tips of the fingers are more distinct.

The ambulatory pereopods are slender. On the third pereopod the dactylus is slender, almost five times longer than wide proximally, with a well developed unguis, equal to 0.6 of the length of the corpus. There are no accessory spines, but two setae are present on the lateral aspects of the corpus and one ventro-medially. The propod is about 11 times longer than wide, with a single disto-ventral spine only. The upper border bears a few simple and some plumose setae only. The carpus, merus and ischium show no special features and are unarmed. The fourth and fifth pereopods are similar.

In the male, the endopod of the first pleopod is three times longer than wide, distally rounded, non-lobulate, with two small spines on the proximal half of the medial border and without plumose setae. On the second pleopod, the appendix masculina is short, about 2.5 times longer than wide, with a single, long, stout, simple terminal spine, almost twice the length of the appendix, with a similar but shorter subterminal medial spine. The appendix interna is twice the length of the appendix masculina, slender, tapering, with 3-4 terminal cincinnuli.

Types. — The female specimen is designated as the holotype. The holotype and allotype are deposited in the collections of the Rijksmuseum van

Natuurlijke Historie, Leiden, registration number Crust. D 30945.

Measurements. — Post-orbital carapace length, holotype, 1.35 mm, allotype, 0.95 mm.

Host. — An unidentified alcyonarian.

Colouration. — Transparent, without special markings.

Remarks. — *Periclimenes watamuae* may be distinguished from *P. diversipes* Kemp by the details of the pereiopods. The first pereiopod has the fingers distinctly shorter than the palm, gaping, with an indistinct entire cutting edge. In *P. diversipes* the fingers are subequal to the palm, somewhat subspatulate, with a sharp pectinate cutting edge. The coxa in *P. diversipes* is provided with a conspicuously produced setose median ventral process, that is obsolescent in *P. watamuae*. The second pereiopods resemble the c and d types of chela in *P. diversipes* but in *P. watamuae*, the fingers of the chelae are always longer than the palm. The carpus is also always shorter than the palm. The fingers also appear to gape proximally, which seems not to occur in *P. diversipes*. Kemp (1922) states that the dactylus of *P. diversipes* is moderately stout, from one third to one quarter of the length of the propod. In *P. watamuae*, the dactylus is also about one third of the length of the propod, but is distinctly slender, being about five times as long as the width across the base.

Periclimenes watamuae is also closely related to *P. kempi* Bruce, a species that is also known to be an associate of alcyonaria, and which has been previously recorded only from Hurghada, in the Red Sea. It differs from *P. watamuae* in the first pereiopods, in which the fingers are longer than the palm, markedly subspatulate with entire sharp cutting edges, and the presence of a slender medial ventral process on the coxa. In the second pereiopods the fingers are short and broadly subspatulate with entire cutting edge, equal to about 0.3 of the length of the palm in the major chela and 0.6 in the minor.

The small shrimp *Propontonia pellucida* Bruce also shows a marked resemblance to *P. watamuae* and *P. kempi* and is similarly highly transparent and associated with alcyonarians. It can readily be distinguished from both *Periclimenes* species by the complete absence of an exopod on the third maxilliped.

The function of the unusual second pereiopods is obscure, but the fingers appear to move with a scissor-like action, the cutting edges shearing across each other. In most species of *Periclimenes*, the fingers of the second pereiopods appear to exert a gripping action, which is often made more effective by the presence of distinct teeth.

Periclimenes sp. (fig. 7)

Material examined. — Watamu, 8-3-73, several, damaged. From *Goniopora* sp. (Scleractinia), 3 fm.

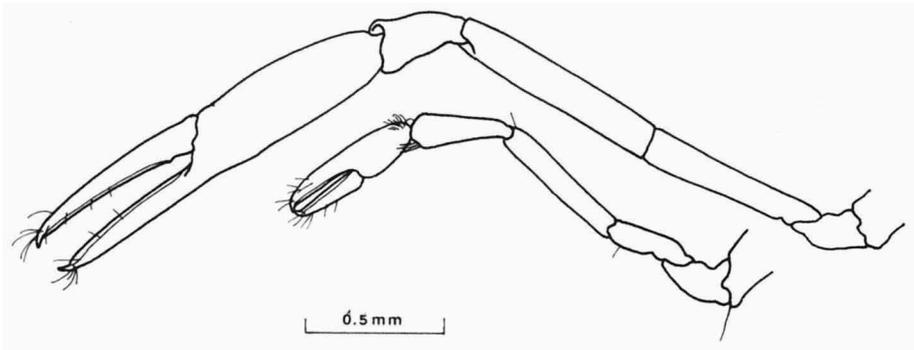


Fig. 7. *Periclimenes* sp. A, first pereopod; B, second pereopod.

These specimens are unfortunately in a bad state of preservation and can not be identified with certainty. There is a close general resemblance in size and shape to *P. diversipes* Kemp and *P. watamuae* but the first and second pereopods indicate that the specimens can not be referred to those species and are also distinct from the closely related species *P. mahei* Bruce and *P. madreporae* Bruce. It seems probable that they represent a new species but it is considered that the designation of a new species on the basis of the present material is unjustified.

The rostrum in all specimens is badly damaged but appears to have been similar to *P. diversipes* with a formula of $\frac{4-5}{1-0}$. The first pereopods have normal chelae, with entire cutting edge, non-subspatulate, with the fingers, which are relatively feebly setose, subequal to the palm. The carpus is much shorter than in *P. diversipes*, equal to about 0.75 of the length of the chela, which is subequal to the merus. The ischium and basis are normal and the coxa bears a small medial process as in *P. watamuae*. The fourth thoracic sternite is unarmed. The second pereopods are represented only by the major chelae. These are quite distinct from *P. diversipes* and *P. watamuae*, with slender fingers with small hooked tips, entire cutting edges except for a small tooth proximally on the dactylus. The fingers are subequal to the length of the palm. The carpus is half the length of the palm and unarmed. The merus is subequal to the length of the palm and is also unarmed. The ambulatory pereopods, particularly the dactyls, closely resemble those of *P. watamuae*.

The status of this species must await the collection of further material in good condition. It has been noted in the course of examining many colonies of *Goniopora* from a wide varieties of localities in the Indo-West Pacific region that this coral, which is one of the small number in which the polyps are expanded by day, rarely produces specimens of shrimps. The mono-specific genus *Hamopontonia* was found in association with *Goniopora* in Hong Kong waters, but this has not so far been found to occur elsewhere. *Periclimenes diversipes* Kemp may occasionally be found on *Goniopora* (Bruce, unpubl.)

Anchistus miersi (De Man)

Harpilius miersi De Man, 1888: 274, pl. 17 figs. 6-10.

Anchistus miersi Kemp, 1922: 249 (key), 255-256, fig. 85 — Holthuis, 1952: 13, 110-111, fig. 45.

Material examined. — Casuarina point, 10-3-73, 1 ♂, 1 ovig. ♀. From *Tridacna squamosa* Lam. (Pelecypoda).

Distribution. — Widespread in the Indo-West Pacific region from the Red Sea to the Gambier Archipelago. Previously recorded in the western Indian Ocean only from the Chagos and Maldivé Archipelagos (Borradaile, 1917) and the Seychelle Islands (Bruce, in press).

Remarks. — Both specimens were conspicuously provided with large blue spots.

Anchistus demani Kemp

Anchistus demani Kemp, 1922: 249 (key), 256-259, figs. 86-88.

Material examined. — Watamu, 9-3-73, 1 ♀; Casuarina Point, 10-3-73, 1 ♂, ovig. ♀. From *Tridacna maxima* (Röding) (Pelecypoda).

Distribution. — First recorded from the Andaman Islands, this species has since only been reported from the Marshall Islands, and Thailand. There have been no records of the species from East Africa.

Remarks. — The Thailand specimens were also found in association with *Tridacna maxima*. This species is similarly coloured to *A. miersi*, but is in general distinctly smaller.

Periclimenaeus hecate (Nobili) (figs. 8-11)

Coralliocaris hecate Nobili, 1904: 232; 1906: 58, pl. 3 fig. 2.

Material examined. — Watamu, 8-3-73, 1 ♂, 1 ovig. ♀. Casuarina Point, 10-3-73, 1 ♂. The Watamu pair of specimens were found in *Diplosoma ?modestum* Michaelsen (Ascidiacea). The host of the Casuarina Point specimen

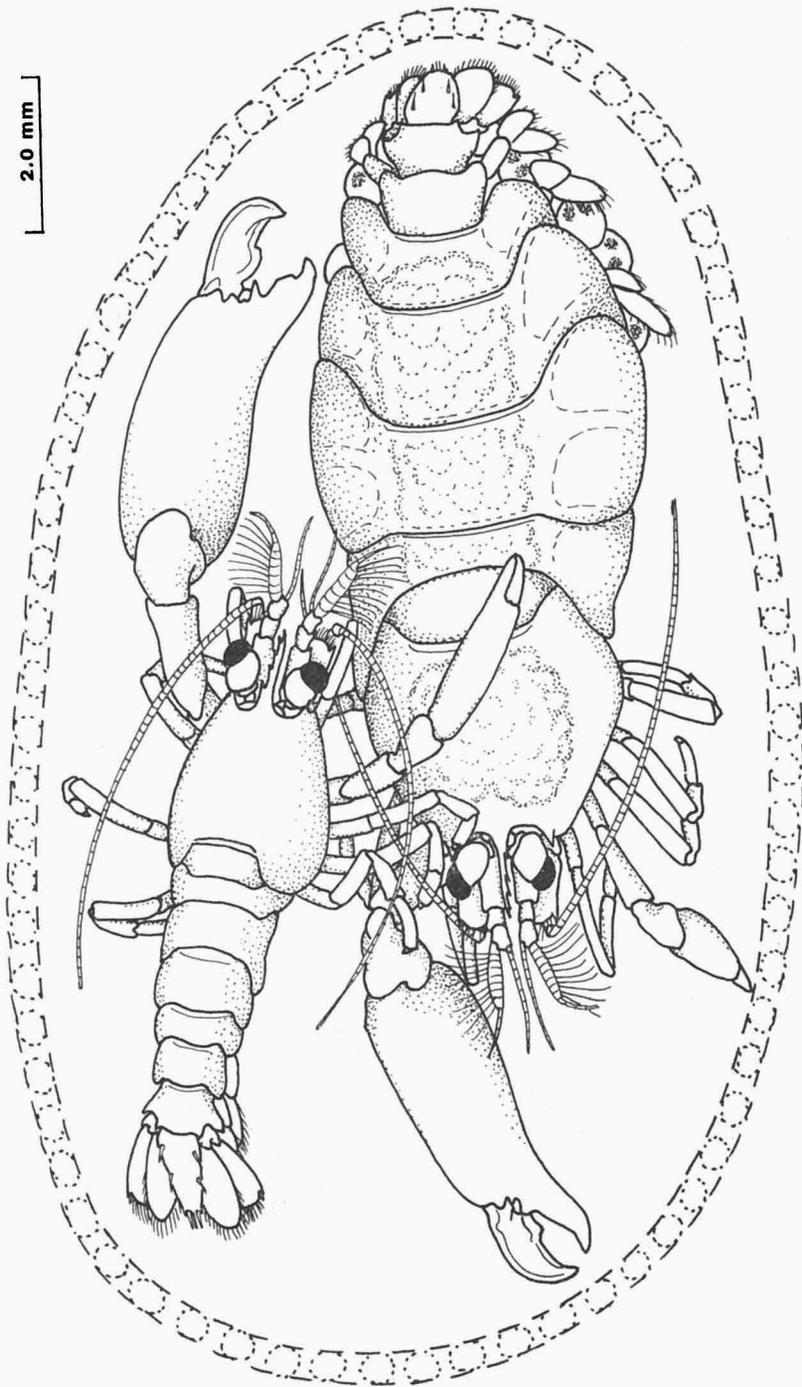


Fig. 8. *Periclimenaeus hecate* (Nobili). Male and ovigerous female, with outline of compound ascidian host indicated.

was not observed as the specimen was found free, during the course of examination of a *Seriatopora* colony.

Distribution. — Djibouti, Red Sea, ? Western Australia.

Remarks. — The rediscovery of *Periclimenaeus hecate* is of particular interest. This species is known with certainty only from the type specimens

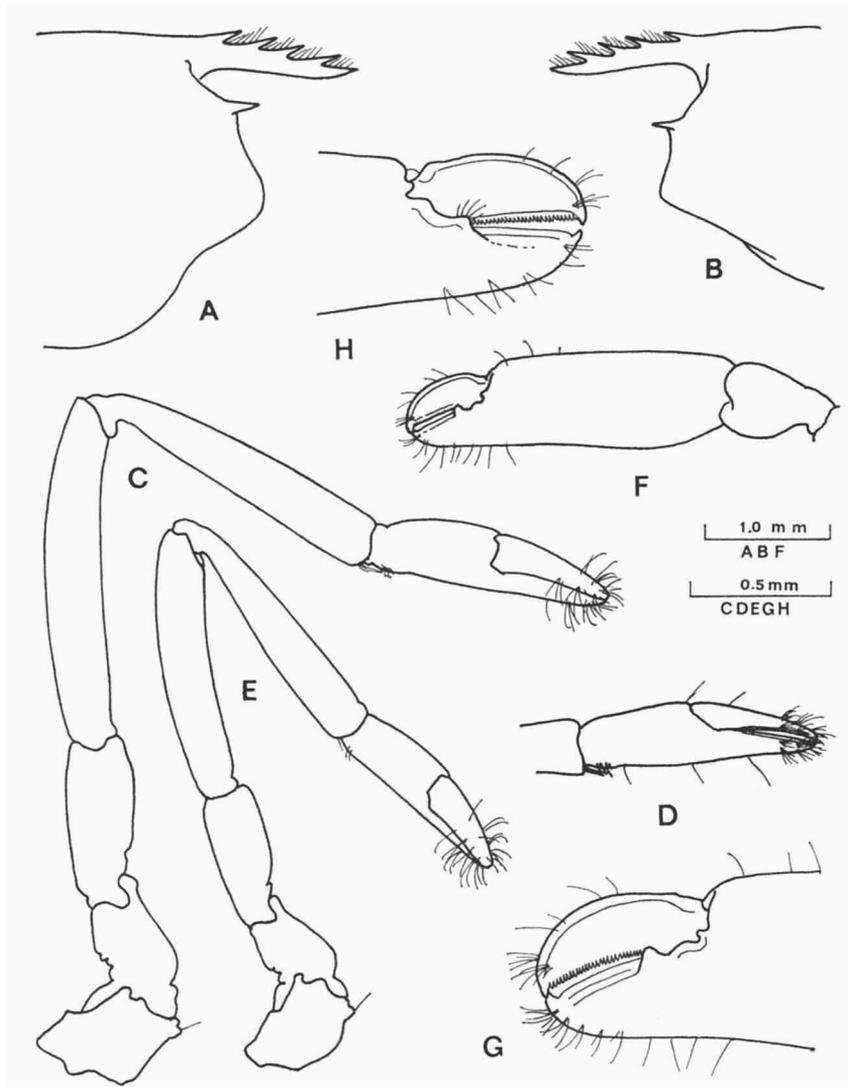


Fig. 9. *Periclimenaeus hecate* (Nobili). A, anterior carapace and rostrum, female; B, id., male; C, first pereiopod, female; D, chela of same; E, first pereiopod, male; F, carpus and chela of minor second pereiopod, male; G, fingers of same; H, fingers of chela of minor second pereiopod, female.

from Djibouti (Nobili, 1904, 1906) and also a dubious record from Western Australia (Balss, 1921). Nobili's type specimens were recently re-described (Bruce, 1975a). The present record establishes the association of this species with a tunicate host, in contrast to the majority of species of this genus, which are found in sponges, and increases the probability that the related species, *P. tridentatus* and others, are similarly associated. The Watamu specimens were found in a tiny colony of *Displosoma* sp., probably *D. modestum* Michaelsen, forming a small purplish coloured sac on the base of a colony of *Acropora*. The small sac was only large enough to form a thin walled envelope covering the pair of shrimps, which were also purple tinted. Unfortunately, the host of the second ovigerous female was not observed, but was probably the same tunicate.

The Kenyan specimens agree closely with the previous reports and do not need to be described in detail, but a few points of special systematic importance may be mentioned.

The mouthparts of *P. hecate* have not been previously described and are of special interest in view of the association of this species with a tunicate and not a sponge host. The mouthparts of the ovigerous female are described in detail. The mandible is moderately robust and lacks a palp. The molar process is well developed. On one side it is truncated distally, with a large blunt tooth anteriorly and a smaller tooth posteriorly, with a central hollow densely fringed with setae dorsally. On the opposite side the molar process is very obliquely truncated, with two strong teeth separated by a deep notch posteriorly and a further stout tooth ventrally. The incisor process is also well developed with four acute distal teeth, the lateral tooth being slightly larger than the others. The maxillula has a distinctly bilobed palp, with a short sinuous seta on the lower lobe. The upper lacinia is broad with a row of about nine stout teeth distally and numerous finely plumose setae. The distal teeth are completely fused to the lacinia. The lower lacinia is more slender, with two long stout plumose spines and several shorter setae. The maxilla has a well developed palp which bears a single finely plumose basal seta on one side but not on the other. The basal distal endite is elongated, broadly truncated distally, simple, with about 17 slender setae distally. The proximal coxal endite is absent but a rounded prominence is present on the proximal part of the medial border. The scaphocerite is slender, narrow distally and about 2.7 times longer than broad. The three pairs of maxillipeds have normally developed exopods, each bearing four plumose distal setae only. The first maxilliped has a slender palp with a long very finely plumose subterminal seta. The basal and coxal endites are completely fused, without any notch, and the distal and medial margins are bordered by stout finely

setulose setae. The caridean lobe is well developed and a small, deeply bilobed epipod is also present. The second maxilliped is of normal type. The distal segment of the endopod is about three times longer than wide with stout finely

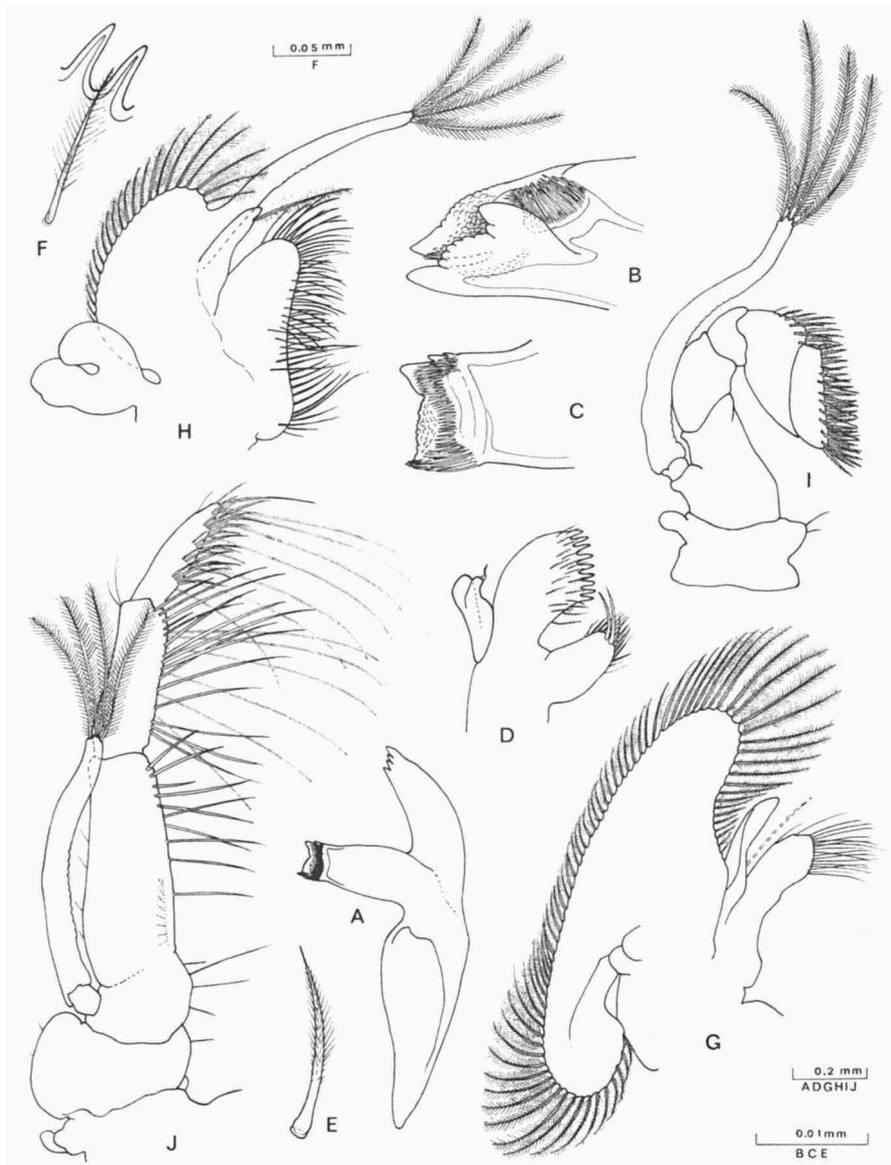


Fig. 10. *Periclimenaeus hecate* (Nobili). A, mandible; B, molar process; C, molar process; D, maxillula; E, distal setae of lower lacinia of maxillula; F, seta and distal teeth of upper lacinia; G, maxilla; H, first maxilliped; J, third maxilliped.

serrulate spines along the medial border. The disto-medial angle of the penultimate segment also bears several similar setae. The ischium and merus are completely fused. The coxa has a distinct process medially and a small epipod is present laterally. The third maxilliped has the ischiomerus and basis almost completely fused. The segment tapers slightly distally and is about 3.2 times longer than wide. The basal part is slightly produced medially with a few simple setae. The ischio-meral part is almost straight with longer, stouter, simple setae. The proximal part of the dorsal aspect of the ischiomerus bears a row of short erect submarginal setae. The penultimate segment is 1.8 times longer than broad and more than half the length of the antepenultimate segment. The medial border is provided with two rows of long setae. The spines of the ventral row are shorter and more robust and finely setulose, of approximately equal length to the segment. The spines of the dorsal row are much more slender and longer, about 1.5 times the length of the segment and more finely setulose. The terminal segment is about four times longer than broad, and 0.8 times the length of the penultimate segment. The ventro-medial margin bears five groups of short coarsely serrulate setae and the dorso-medial margin bears seven long slender setae similar to the preceding segment. The coxa is not produced medially but a rounded epipod is present laterally. A small rudimentary arthrobranch is also present.

The details of the oral appendages are of considerable systematic importance in assessing the relationships of pontoniine genera and species. Variation in several features of systematic importance was noted in the present specimens, in which the mouthparts were completely removed from both sides. The differences are summarized below.

Mandibles and maxillulae. No variation.

Maxillae. In the paired male, one of the endites was distinctly bifid and both palps were setiferous. In the ovigerous female, it has already been noted that only one palp carried a long fairly plumose seta. In the isolated male, both palps were setiferous.

First maxilliped. In the paired male, one palp only is setiferous and in the isolated male, both are setiferous.

Second maxilliped. In the isolated male, the epipods were of normal size and much larger than in the ovigerous female. In the paired male, both epipods appeared to be absent, but may have been detached in dissection.

Third maxilliped. No rudiments of arthrobranches could be seen in the paired male specimen, but these were discernible in the isolated male.

In all three specimens the exopods of the maxilliped bore four plumose setae distally. The thoracic sternites of the second and third segments are broad, so that the coxae of the second and third maxillipeds are widely separated. The fourth thoracic sternite is less broad and is unarmed.

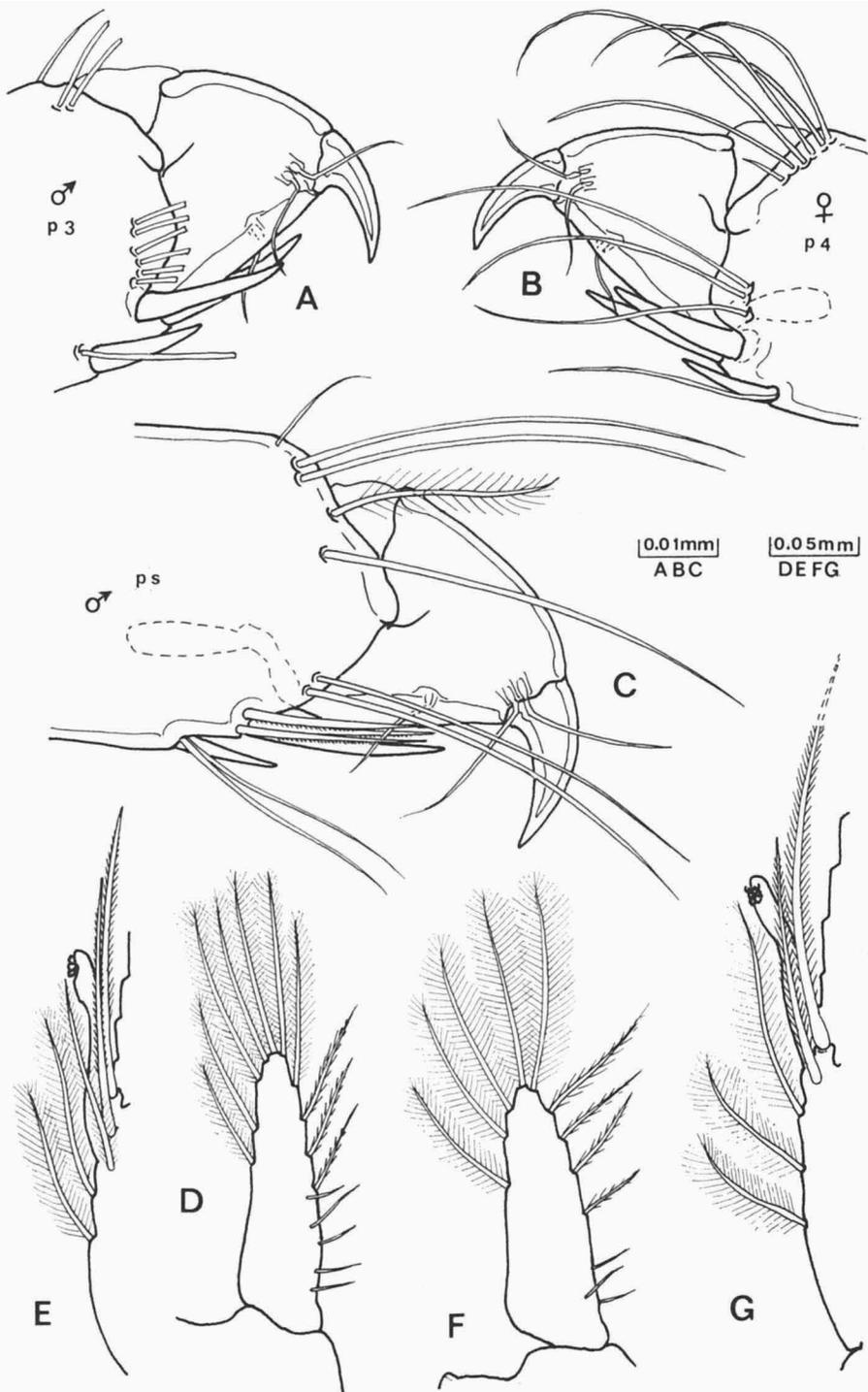


Fig. 11. *Periclimenaeus hecate* (Nobili). A, terminal propodus and dactylus of paired male; B, same, paired female; C, same, isolated male; D, endopod of first pleopod from paired male; E, appendix masculina and appendix interna of second pleopod of same; F, endopod of first pleopod from isolated male; G, appendix masculina and appendix interna of second pleopod from same.

In *P. hecate* and related species, the first pereiopods, the fingers of the minor second pereiopod and the dactyls of the ambulatory pereiopods are of special importance and modifications of these appendages are probably a direct result of the influence of the host animals upon the evolution of the commensal shrimp. The morphological differences probably also reflect the specificity of the association.

The first pereiopods in pontoniine shrimps are particularly concerned with feeding rather than with attack or defense, or catching prey in the case of the predatory species. In *P. hecate* there are no significant differences between the first pereiopods of the male and female specimens. The palm is subcylindrical and subequal to the length of the fingers, which are broad, with entire, slightly gaping cutting edges and very small hooked teeth distally. The carpus is 1.3 to 1.4 times the length of the palm, and slightly longer than the merus. The ischium, basis and coxa show no special features, but a very small medial setose lobe is present on the coxa.

The major second pereiopod is specialized for sound production, with a very well developed molar process on the dactylus, opposing a deep fossa on the fixed finger. The chela is similar in both sexes but is distinctly larger in the relatively smaller male specimen. The chelae of the minor second pereiopods are also similar in the male and the female and are of approximately similar size. The dactylus is subequal to the length of the fixed finger, three times longer than deep in the male and 2.6 times in the female, with a small but distinct acute hooked tip distally and a straight cutting edge with about 30 small teeth distributed uniformly along its length. The fixed finger has a single small blunt tooth proximally and an entire cutting edge.

The ambulatory pereiopods of the three specimens are all present and have been carefully compared. The morphology of the dactylus is consistent on each of the three pereiopods, regardless of sex. The corpus of the dactylus is short, about as long as broad proximally, with a distinctly demarcated, strongly hooked unguis. The corpus is moderately compressed, with a pair of well developed sensory setae distally on the lateral aspect and a single similar seta near the middle of the ventral margin on the medial aspect. There are no accessory spines and the ventral border of the corpus is entire, sharp and almost straight. The propods are provided with numerous long simple setae distally. The disto-ventral ends of the third and fourth pereiopods are armed with a pair of stout terminal spines and a single small sub-terminal spine. On the fifth pereiopod, the distal lateral spine is replaced by a group of stout finely serrulate setae.

The first and second pleopods of the two male specimens have also been compared and show some minor variations. The endopod of the first pereiopod

pod is slender and slightly tapering, 3.0-3.5 times longer than wide, with 5.7 plumose setae disto-laterally, three finely setulose setae disto-medially and 3-5 short simple setae on the proximal half of the medial border. The appendix masculina on the second pleopod is extremely short and partly fused with the ramus of the endopod. It bears two long finely serrulate setae. In one specimen the subterminal seta is of similar length to the terminal seta, and in the other, the subterminal seta is about twice the length of the other. The appendix interna is of normal length and is about six times the length of the appendix masculina.

The study of these three specimens of *P. hecate* indicates that there is little significant individual or sexual variation in the characters considered to be of systematic importance in the pereopods but some variations may occur in the oral appendages between individuals or between left and right sides in the same individual.

This species has been considered to be a synonym of *P. tridentatus* (Miers), but the differences in the morphology of the dactyls of the ambulatory pereopods indicate that the two species are distinct, although closely related.

***Philarius gerlachei* (Nobili)**

Harpilius gerlachei Nobili, 1905: 160; Kemp, 1922: 220 (key), 238-239, fig. 74-75.

Philarius gerlachei Holthuis, 1952: 15, 152-153, fig. 69.

Material examined. — Casuarina Point, 10-3-73, 1 ♂. The single example was obtained from *Acropora* sp., from 1.5 m.

Distribution. — Previously recorded from several Red Sea localities, Persian Gulf, Gulf of Manaar, Seychelle Islands, Borneo, Samoa, Gilbert and Marshall Islands, and Queensland, Australia. Not previously recorded from East Africa.

Remarks. — This species is a well known commensal, invariably associated with corals of the genus *Acropora*, closely resembling *Periclimenes lutescens*, in its general morphology and habitus, general but much less common.

***Ischnopontonia lophos* (Barnard)**

Philarius lophos Barnard, 1962: 242-243, fig. 2.

Ischnopontonia lophos Bruce, 1966: 585-595, figs. 1-5.

Material examined. — Watamu, 8-3-73, 1 ♂, 1 ovig. ♀, 4 juv. From *Galaxea fascicularis* (L.) (Scleractinia), from 4 m.

Distribution. — Mozambique; Zanzibar; Comoro Islands; Aldabra; Farquhar and the Seychelle Islands; Singapore; Pulau Perhentian Besar,

Malaysia; Queensland, Australia. Not previously recorded from Kenya.

Remarks. — This species was first recorded from Inhaca Island, Mozambique, and was subsequently found to be common in East African waters. It is known only from the coral *Galaxea fascicularis*.

Platycaris latirostris Holthuis

Platycaris latirostris Holthuis, 1952: 16, 173-176, figs. 85-88 (key); Bruce, 1966: 1-9, figs. 1-5.

Material examined. — Watamu, 8-3-73, 1 ♂, 3 ovig. ♀, 2 ♀, 1 juv. From *Galaxea fascicularis* (L.) (Scleractinia), from 4 m.

Distribution. — Recorded from several localities in Zanzibar and from Mafia and Tanga in Tanzania. Also known from the type locality at Flores in Indonesia. Not previously recorded from Kenya.

Remarks. — These specimens were found in association with the above species and are similarly known only from this specific host coral.

Jocaste japonica (Ortmann)

Coralliocaris superba var. *japonica* Ortmann, 1890: 509.

Jocaste lucina Holthuis, 1952: 17, 193-195, fig. 94 (partim); Bruce, 1969: 300, fig. 1.

Material examined. — Watamu, 8-3-73, 13 spms. (5 ovig. ♀); 3 spms. (1 ovig. ♀); 2 spms. Watamu, 9-3-73, 6 spms. (4 ovig. ♀); Casuarina Point, 10-3-73, 4 ovig. ♀; 10 spms. (2 ovig. ♀). All specimens were obtained from *Acropora* corals from 2-6 m.

Distribution. — Recorded from several localities in the western and central Indian Ocean to Japan, New Caledonia and the western Pacific. Previously recorded from Zanzibar and Tanga and Pangani in Tanzania, but not from Kenya.

Remarks. — Until recently considered a synonym of *J. lucina* (Nobili) and many of the existing records of both species need to be re-examined.

Jocaste lucina (Nobili)

Coralliocaris lucina Nobili, 1901: 15.

Jocaste lucina Holthuis, 1952: 17, 193-195, fig. 94 (partim); Patton, 1966: 278-279, 288 tab. 2, 292, fig. 3a; Bruce, 1969: 301, fig. 2.

Material examined. — Watamu, 8-3-73, 9 spms. (2 ovig. ♀); 3 juv.; 1 ♂, 1 ♀, 1 juv.; 6 spms., (no ovig. ♀); 3 spms. (no ovig. ♀). Casuarina Point 10-3-73, 6 spms. (1 ovig. ♀, 2 juv.); 2 juv. All specimens were obtained from *Acropora* corals from 2-6 m.

Distribution. — Common and widespread throughout the Indo-West Pacific region from the Red Sea and East Africa to Tahiti. Previously recorded from Zanzibar but not from Kenya.

Remarks. — *Jocaste lucina* has also been recorded from Mozambique by Barnard (1950), but it is not certain that the single specimen is not *J. japonica*, which at that time was considered a synonym of *J. lucina* Nobili. The distinction of the two species was clarified by Patton (1966).

Coralliocaris graminea (Dana)

Oedipus graminea Dana, 1852: 25.

Coralliocaris graminea Ortmann, 1894: 16; Kemp, 1922: 269 (key), 269-274, figs. 96-97.

Oedipus gramineus var. Pfeffer, 1889: 34.

Material examined. — Casuarina Point, 10-3-73, 1 ♂, 2 ovig. ♀. From *Acropora* sp., from 2 m.

Distribution. — Common throughout the whole Indo-West Pacific region. Not previously recorded from Kenya but recorded from Zanzibar by Pfeffer and Dar es Salaam by Ortmann.

Remarks. — One of the commonest coral-associated shrimps, this bright green species is almost always found in colonies of branching *Acropora*.

Coralliocaris superba (Dana)

Oedipus superba Dana, 1852: 25.

Coralliocaris superba Kemp, 1922: 269 (key), 272-274, figs. 98-99.

Material examined. — Watamu, 8-3-73, 1 ♂, 1 ♀ juvenile; 1 ♂, 1 ovig. ♀; Casuarina Point, 10-3-73, 20, 2 ovig. ♀, 2 juv.; 1 ♂, 1 ovig. ♀. All specimens were obtained from *Acropora* spp. (Scleractinia) from 2-5 m.

Distribution. — Common and widespread throughout the Indo-West Pacific region from the Red Sea to Tahiti. Not previously recorded from East African coastal waters.

Remarks. — Like the above species, this shrimp, which typically has a striking porcelain-white body, is almost always found in *Acropora* colonies.

Coralliocaris venusta Kemp (fig. 12)

Coralliocaris venusta Kemp, 1922: 269 (key), 274-276, figs. 100-101.

Material examined. — Watamu, 9-3-73, 1; Casuarina Point, 10-3-73, 1 ♂, 1 ovig. ♀. From *Acropora* sp. (Scleractinia), from 2 m.

Distribution. — Recorded only from the Red Sea; Gulf of Manaar;

Indonesia; Queensland, Australia and Samoa. Not previously recorded from the East African coast.

Remarks. — Like most of the species of *Coralliocaris*, this shrimp is an

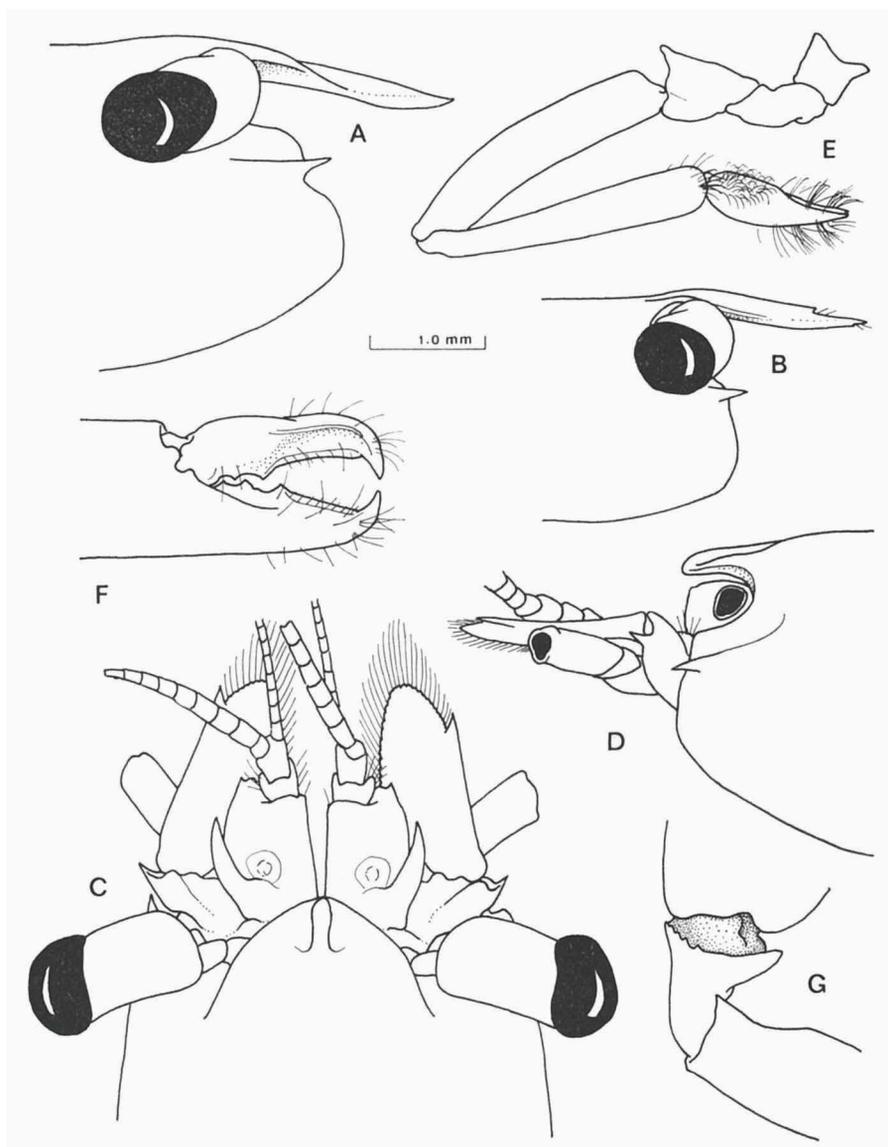


Fig. 12. *Coralliocaris venusta* Kemp. A, anterior carapace and rostrum, normal female; B, same, normal male; C, anterior carapace, rostrum and antennae, female dorsal aspect; D, same, lateral aspect; E, first pereiopod; F, fingers of second pereiopod; G, carpal region of second pereiopod.

obligatory associate of acroporid corals. The male specimen had a single dorsal rostral tooth but the rostrum of the female was without teeth. The colour of the body pattern consisted of fine striae composed of small black chromatophores.

Although first reported from Thalayiram Paar in the Gulf of Manaar by Kemp (1922) there have been no subsequent records of this species from the Indian Ocean. Holthuis (1952) has reported specimens from Indonesia and Patton (1966) from the Great Barrier Reef, and the latter author noted considerable variation in the dentition of the rostrum.

Considerable variation also occurs in the rostra of the present specimens. In the Watamu juvenile pair, the male and female have 1/1 and 0/1 rostral teeth respectively and the rostra extend to the middle of the distal segment of the antennal peduncle. In the adult pair from Casuarina Point the male and female have 1/1 and 0/0 respectively and the juvenile has also 0/0. The rostrum extends to the distal border of the proximal segment of the antennular peduncle in the ovigerous female and to the middle of the distal segment in the male. The single small juvenile has 1/0 rostral teeth. These specimens all agree closely with the description of *C. venusta* as given by Kemp. In life, they were all inconspicuously coloured, being a translucent whitish shade with a fine pattern of alternating minute lines of black and white chromatophores over the carapace and abdomen. These lines are generally more or less longitudinal laterally but form whorls over the dorsal aspects, particularly of the carapace.

The single ovigerous female from Casuarina Point was without this colour pattern and differs markedly from the other specimens in the absence of the rostrum, the frontal margin being smoothly rounded in dorsal view, as is the rostral process in lateral view. It is possible that this specimen may represent a distinct species, but this cannot be confirmed due to the lack of the associated male. If the rostrum is not a character of specific value, it would appear to be of developmental rather than traumatic origin on account of the perfect symmetry.

The first pereopod is slender with the carpus slightly longer than the merus and the fingers subequal to the length of the palm of the chela, as described by Kemp. The ischium is produced to a blunt point disto-dorsally and is compressed. The proximal end of the merus is truncated and articulates with the ventral part of the end of the ischium. The ischio-meral joint is highly mobile, a condition which does not generally occur in pontonine shrimps, where this joint is usually semi-ankylosed. The basis bears a small ventral process but the coxa is without any process. The first pereopod is exactly the same as in the other specimens of *C. venusta*. The second pereio-

Pods also show no distinctive features. The dactylus is swollen proximally with a single tooth on the cutting edge proximally and a distinct lateral carina and an acute, strongly hooked tip. The fixed finger has two proximal teeth on the cutting edge. The carpus bears a few small denticulations on the anterior margin and the medial process is well developed but rather blunt. The second pereopods also show no significant differences from the other *C. venusta* specimens.

It has been found in collections from elsewhere in the Indian and Pacific Oceans, that two distinct colour forms of this species appear to exist. In addition to the pattern noted above (α), another type (β), characterized by large opalescent white patches on the body also occurs. The two forms are often found in the same localities. The associated males, females and juveniles are always of the same colour pattern, which is best developed in the larger ovigerous females. There is insufficient evidence to indicate whether each colour pattern is associated with a particular series of *Acropora* host species. It is possible that these two colour forms may represent sibling species, as the colour patterns of most pontoniine shrimps are highly consistent and not subject to marked variations. Even in the event of specimens being found on an atypical host animal, the normal pattern of the species is usually maintained. The relationship of these two colour forms can only be established by the collection of further material from carefully identified hosts, together with a record of the colouration of the specimens. For convenience, the form with conspicuous opalescent white patches has been designated as the β form and the form with a pattern of fine striae and whorls is referred to as the α form. The existence of pairs of closely related species has already been noted in the Pontoniinae, for example *Jocaste lucina* (Nobili) and *J. japonica* (Ortmann) and *Harpiliopsis depressa* (Stimpson) and *H. spinigera* (Ortmann). In both these pairs, the two species may be found to occur together on the same host coral. In the *Harpiliopsis* spp. the specimens are most easily separated by their colour patterns, but can also be distinguished by their morphological characters. The α and β forms of *C. venusta*, in contrast, are most readily separable by their colour patterns and can not at present be separated on a morphological basis, but do not occur in mixed groups on a single host coral.

Harpiliopsis beaupresii (Audouin)

Palaemon beaupresii Audouin, 1825: 91.

Harpilius beaupresi Kemp, 1922: 228 (key), 229-231, figs. 67-68.

Harpiliopsis beaupresi Holthuis, 1952: 16, 181-182, fig. 89.

Material examined. — Watamu, 8-3-73, 1 juv.; 1 damaged spm.; 1 ♂.

1 ovig. ♀; 1 juv.; Casuarina Point, 10-3-73, 7 with 2 ovig. ♀, 1 juv.; 1 ♂. From *Stylophora mordax* (Dana) (Scleractinia), from 2-4 fm.

Distribution. — Common and widespread throughout the Indo-West Pacific region. Not previously recorded from Kenya. Previously recorded from Delagoa Bay, Mozambique (Barnard, 1950) but not otherwise recorded from the East African coast.

Remarks. — One of the commonest coral-associated species, generally found in association with pocilloporid corals.

Harpiliopsis depressa (Stimpson)

Harpilius depressus Stimpson, 1860: 38; Kemp, 1922: 228 (key), 231-234, figs. 69-70.
Harpiliopsis depressus Holthuis, 1952: 16, 182-184, fig. 90.

Material examined. — Watamu, 8-3-73, 1 spm. From *Pocillopora damicornis* (L.) (Scleractinia), from 4 m.

Distribution. — Common and widespread throughout the whole Indo-West Pacific region, and extending into the Eastern Pacific region (Holthuis, 1951). Not previously recorded from Kenya, but reported from Delagoa Bay, Mozambique (Barnard, 1950).

Remarks. — This species was the first pontonine shrimp to be reported as associated with living corals (Dana, 1852).

Harpiliopsis spinigera (Ortmann)

Anchistia spinigera Ortmann, 1890: 511, pl. 36 fig. 23.
Harpilius depressus var. *gracilis* Kemp, 1922: 234-235, fig. 71.
Harpiliopsis depressus var. *spinigerus* Holthuis, 1952: 16, 184-185.

Material examined. — Casuarina Point, 10-3-73, 1 ♂, 1 ovig. ♀; 3 juv. From *Stylophora mordax* (Dana) (Scleractinia), from 2 m.

Distribution. — Previously recorded only from Samoa, Celebes and Andaman Islands. Not previously recorded from Kenya.

Remarks. — Three readily separable species of *Harpiliopsis* occur in East African waters and all three may occur together in the same host corals. The identification of the present material with Ortmann's species is to be dealt with in a separate publication.

Propontonia pellucida Bruce

Propontonia pellucida Bruce, 1969: 141-150, figs. 1-5.

Material examined. — Casuarina Point, 10-3-73, 2 ♂, 2 ovig. ♀. From *Sarcophyton elegans* Moser (Alcyonacea), from 3 m.

Distribution. — Known only from the type locality, the Island of Remire, Amirante Islands, Seychelles. Not previously recorded from Kenya.

Remarks. — The original specimens were found in association with *Sarcophyton crassicaule* Moser, and the present association represents a new host record. The specimens were of glassy transparency when alive.

Hamodactyloides incompletus (Holthuis) figs. 13-15)

Hamodactylus incompletus Holthuis, 1958: 11-13, fig. 4.

Material examined. — Watamu, 9-3-73, 1 ovig. ♀. From *Millepora dichotoma* Forskål (Hydrozoa), at 3 fms.

Distribution. — Known only from the holotype from Sharm el Sheikh, Sinai, Red Sea.

Remarks. — The holotype specimen, also an ovigerous female, was incomplete when first described, lacking both of the second pereopods.

The discovery of a second specimen of this species, known only from the incomplete holotype, is of particular interest as it establishes the identity of the host and enables the description of its morphology to be completed confirming the conclusions of Fujino (1973) in the separation of the genus *Hamodactyloides* from *Hamodactylus* Holthuis.

Holthuis (1958) has described the species, with the exception of the second pereopods and the present specimen agrees closely with his description. It is slightly damaged and lacks the third to fifth pereopods on the left side. The rostrum bears five well developed dorsal teeth, all situated anteriorly to the orbital margin, and has no ventral teeth. The antennal spine is smaller than the hepatic spine, which is situated at approximately the same level. The proximal segment of the antennular peduncle has a slender spine on the antero-lateral margin as well as a distinct disto-lateral spine. The stylocerite is slender and reaches to the level of the middle of the medial border.

The mouthparts also show little difference from the original description. The molar process of the mandible is very obliquely truncated, with the proximal border provided with numerous bristle-like setae. The distal border has two characteristic teeth. The smaller tooth is situated on the anterior aspect and bears two small, very acute accessory teeth, and the larger tooth on the posterior border bears four acute denticles. The notch separating these two teeth bears five stout spines. The incisor process bears four teeth distally, the central pair being slightly smaller than the outer teeth. The maxillula has the palp feebly bilobed, with a single slender seta on lower lobe. The upper lacinia bears six very acute strong simple spines distally and a few feebly plumose setae. The lower lacinia has about 7-8 long slender, more densely

plumose setae. The maxilla has a tapering non-setose palp. The endite is broad and simple, with a single terminal seta. The scaphognathite is very broad anteriorly with a narrow posterior lobe. The first maxilliped has a

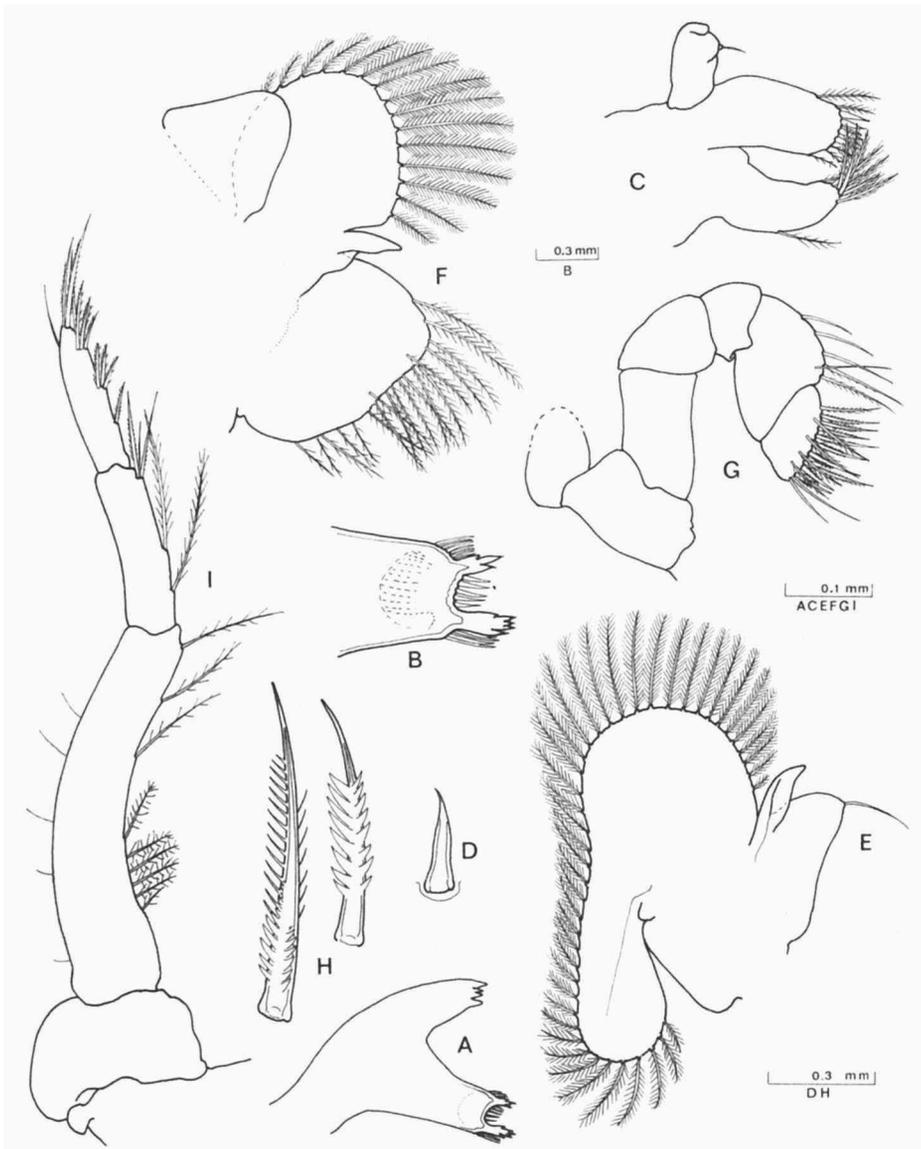


Fig. 13. *Hamodactyloides incompletus* (Holthuis). A, mandible; B, molar process; C, maxillula; D, distal spine of upper lacinia of maxillula; E, maxilla; F, first maxilliped; G, second maxilliped; H, propodal spines of same; I, third maxilliped.

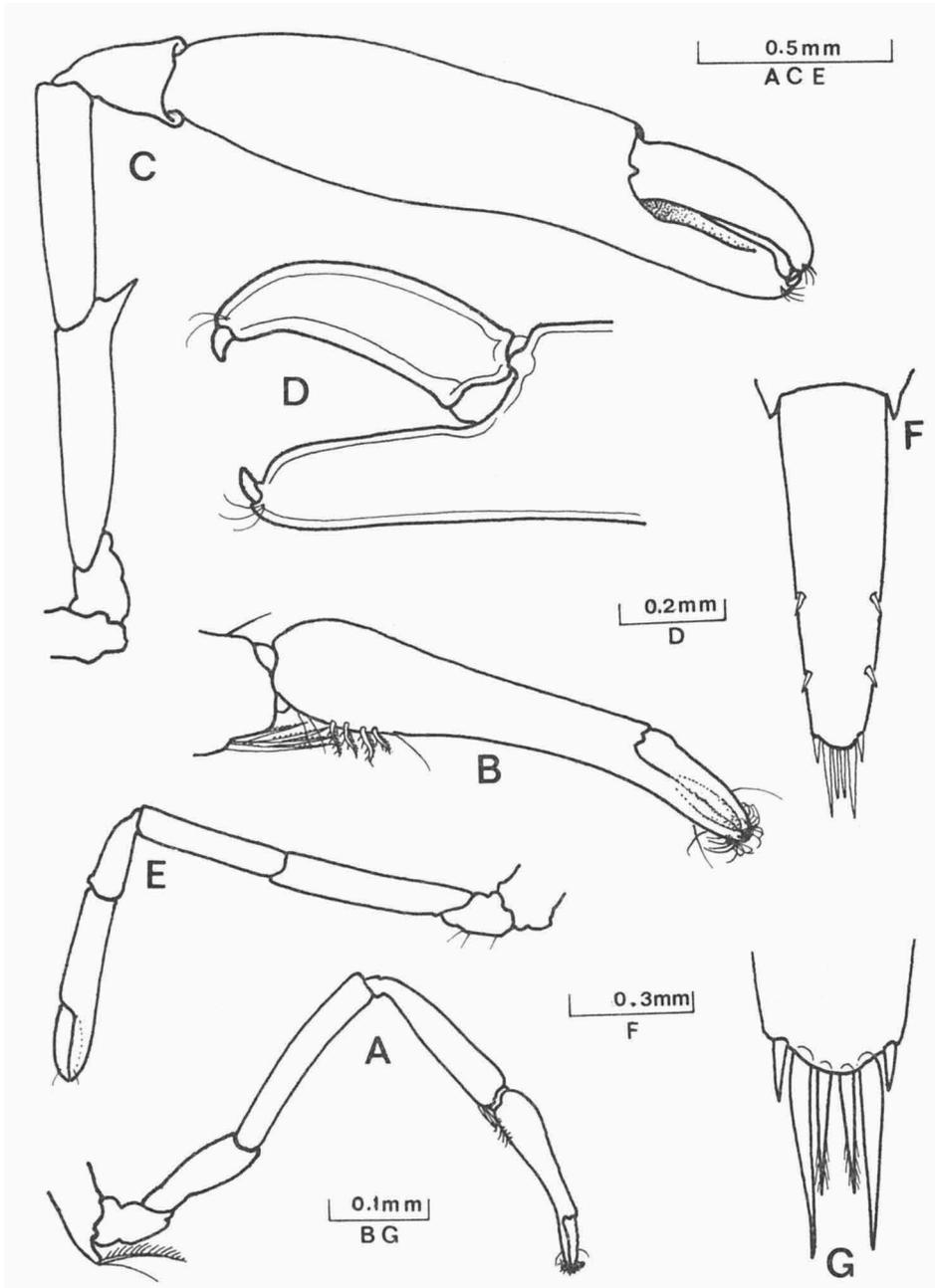


Fig. 14. *Hamodactyloides incompletus* (Holthuis). A, first pereiopod; B, chela of same; C, major second pereiopod; D, fingers of same; E, minor second pereiopod; F, telson; G, posterior spines.

short non-setose tapering palp. Coxal and basal endites are fused without any indication of a division and the medial border is sparsely provided with long slender feebly setulose setae. The caridean lobe is rounded and there is no trace of an exopod. The epipod is present, probably feebly bilobed but damaged in dissection. The second maxilliped is without any trace of the exopod but a small rounded epipod is present. The propod is small, with a small number of stout spines medially. The shorter stouter spines are provided with rows of strong teeth and the longer spines are pectinate. The anterior lateral margin of the carpus bears 5-6 long slender, simple or sparsely setulose, spines. The third maxilliped is without an exopod but bears the rudiment of an arthrobranch. The distal segment bears a few groups of short spines, serrulate along their margin. The penultimate segment is feebly spinose, with long slender spines with few setules. The ischio-merus is completely fused to the basis. The medial border has a few long slender spines distally, with a row of short plumose spines proximally.

The first pereopod is as described by Holthuis except that the fingers are feebly subspatulate. In medial view the tips appears gaping but the laterally situated cutting edges are finely and irregularly dentate. Numerous coarsely serrated setae are present distally. The coxa bears a long slender medial process with a strong spinulate spine and a simple seta distally.

The second pereopods are similar, but very unequal. The larger chela is robust with the palm smooth, subcylindrical, 3.3 times longer than wide, and slightly dilated proximally. The fingers are stout, compressed, about 0.4 of the length of the palm, with small strongly hooked acute tips. The cutting edges are straight and that of the dactylus fits into a groove on the fixed finger. The carpus is short and stout, 1.8 times longer than wide, expanded distally and unarmed. The merus is subcylindrical, 4.5 times longer than wide, a little more than half the length of the palm and unarmed. The ischium is slender, 4.7 times longer than wide, 1.1 times the length of the merus and with a very strong acute disto-ventral spine. The basis and coxa present no special features. The minor second pereopod is similar, but the chela is only slightly more than a quarter of the length of the larger chela, with the fingers 0.6 of the length of the palm, and subequal to the carpus. The merus and ischium are correspondingly slender and the ischium lacks the acute disto-ventral spine.

The ambulatory pereopods are as described. The dactylus is highly mobile. In the semi-flexed position (fig. 15a) the proximal part of the ventral border is concealed within the end of the propod. This part consists of a very thick, strongly chitinized oval plate with a pair of slender distally directed processes (fig. 15a). It appears to be rigidly attached to the rest of the dactylus.

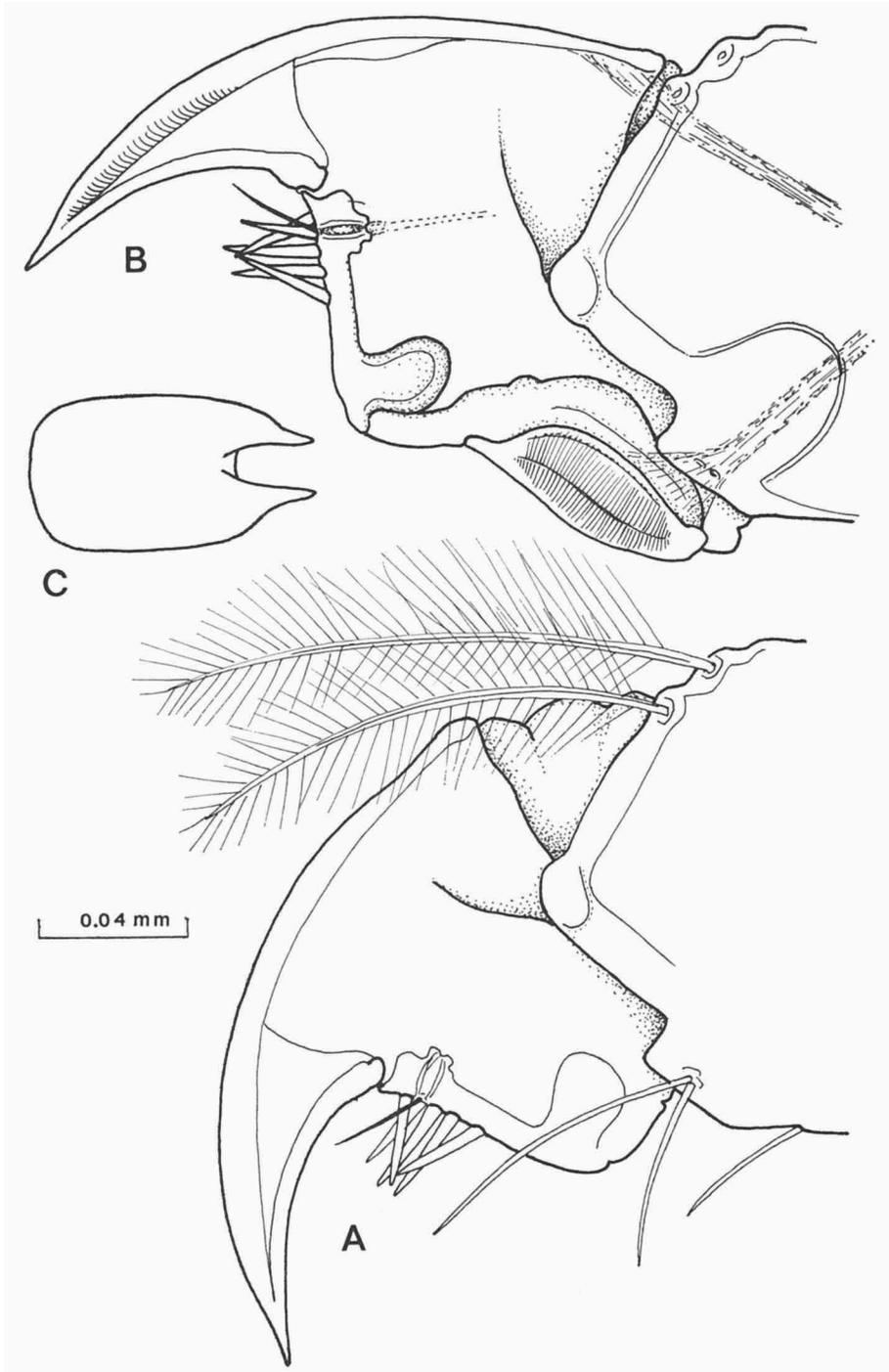


Fig. 15. *Hamodactyloides incompletus* (Holthuis). A, dactylus of third pereopod, flexed; B, same, extended, setae omitted; C, basal plaque of dactylus, ventral aspect.

Extension of the dactylus (fig. 15b) causes this plate to withdraw from the end of the propod and become fully exposed. Hyper-extension of the dactylus renders the basal plate increasingly conspicuous, with the posterior part of the anterior margin of the dactylus becoming recessed into the end of the propod until further extension is prevented by the contact of a lateral ridge on the dactylus coming into contact with the distal margin of the propod. Movement of the dactylus occurs through an arc of approximately 125° . The ventral margin of the dactylus, anterior to the basal plate, is blunt, narrowed anteriorly but broadened posteriorly by a strongly chitinized transverse bar. The narrower part bears five stout spines and a slender seta arising from a (?) sensory organ. The unguis is distinct from the corpus of the dactylus and is smooth and very acute. The distal ends of the propods bear several long plumose setae and the disto-ventral borders bear a single small spine on the third and fourth pereopods but none was discernable on the fifth.

The telson is slender, 3.2 times longer than the greatest width and tapering gradually posteriorly. The dorsal spines are situated at 0.6 and 0.8 of the telson length. The lateral posterior spines are slightly larger and more robust than the dorsal, about 0.3 of the length of the intermediate spines. The submedian spines are 0.6 of their length and are feebly setulose distally.

Twelve ova are present, with the greatest length of 0.4 mm.

The rediscovery of *Hamodactyloides incompletus* indicates that *H. ishigakiensis* Fujino is extremely closely related and may eventually prove to be within the natural range of variation of Holthuis' species. With reference to the characters distinguishing *H. ishigakiensis* from *H. incompletus* given by Fujino (1973) the present material is referred to *H. incompletus* on account of (i) the presence of an epipod on the second maxilliped, (ii) five dorsal rostral teeth, (iii) the slender stylocerite, (iv) the presence of two disto-lateral teeth on the proximal segment of the antennular peduncle.

The pereopods closely resemble Fujino's description for *H. ishigakiensis* and no significant differences can be detected. The details of the second pereopods appear to correspond exactly in the two species. In addition, the Malindi material shows a closer resemblance to the Japanese specimen in the molar process of the mandible and in the armament of the disto-lateral angle of the antennular peduncle and even the endite of the maxilla, which are all features that may show individual variations in some species of pontonine shrimps and the account of the morphology of the molar process often depends upon whether the left or right appendage is dissected. It is therefore considered that the study of a wider range of material is necessary to clarify the relationship between *H. incompletus* and *H. ishigakiensis*.

GNATHOPHYLLIDAE

Gnathophyllum americanum Guérin

Gnathophyllum americanum Guérin, 1856: 20; atlas: viii, pl. 2 fig. 14.
Gnathophyllum fasciolatum Stimpson, 1860: 28; Barnard, 1950: 765-767, fig. 146;
Ledoyer, 1968: 70, pl. 12 figs. 1-10, 19c; Monod, 1971: 183, 185, fig. 85.

Material examined. — Casuarina Point, 31-7-73, 1 ovig. ♀. Under stones on exposed reef flat, at LWS.

Distribution. — Circumtropical. Previously recorded from South Africa, Mozambique and Madagascar, but not from Kenya or Tanzania.

Remarks. — Many specimens were observed under loose coral rock on the reef flat, often in association with ophiuroids, but were not collected. The present specimen had three dorsal rostral teeth. The characteristic brown and yellow banded colour pattern renders this species conspicuous in the pools under reef stones.

ALPHEIDAE

Alpheopsis equalis Coutière

Alpheopsis equalis Coutière, 1896: 382.

Material examined. — Watamu, 8-3-73, 1 spm. Beneath dead coral rock blocks on exposed reef.

Distribution. — Widespread but uncommon throughout Indo-West Pacific region, from the Red Sea to Hawaii. Not previously recorded from East Africa.

Remarks. — The specimen was whitish in colour, with transverse red bands across the abdominal segments.

Athanas dimorphus Ortmann

Athanas dimorphus Ortmann, 1894: 12, pl. 1 fig. 1.

Material examined. — Casuarina Point, 10-3-73, 4 spms. and 2 spms. Under dead coral blocks on exposed reef.

Distribution. — This species was originally described from specimens from Dar es Salaam and has been reported from Perim, Suez, Djibouti, New Caledonia and Fiji. It has not been previously reported from Kenya.

Remarks. — This species was abundant under stones.

Athanas indicus Coutière

Arete dorsalis indicus Coutière, 1903: 84, figs. 25-30.

Arete indicus Coutière, 1905: 863, figs. 134-135; Barnard, 1956: 7.

Material examined. — Casuarina Point, 10-3-73, 2 spms. From *Echinometra mathaei* (Blainville) (Echinoidea).

Distribution. — Common throughout the Indian Ocean and western Pacific Ocean. This species has been previously recorded from the western Indian Ocean, at Inhaca, Mozambique and Tuléar, Madagascar.

Remarks. — This species is dark purple in colour, with pale longitudinal streaks, closely resembling the colour of its host. It has not been previously recorded from Kenyan or Tanzanian waters.

Salmoneus cristatus (Coutière)

Jousseaumea cristata Coutière, 1897: 233.

Salmoneus cristatus Holthuis, 1958: 18-20, fig. 7; Banner & Banner, 1966: 40-42, fig. 10.

Material examined. — Casuarina Point, 10-3-73, 1 spm. Under dead coral blocks on exposed reef.

Distribution. — First described from Djibouti, this species has since been reported only from Eylath, Red Sea, and Phuket, Thailand. There have been no previous records from East Africa.

Remarks. — Some members of this genus may be associates of annelids (Edmondson, 1946) and numerous examples of *Eurythoe* were found under stones on the reef flat where this specimen was collected.

Metalpheus paragracilis (Coutière)

Alpheus paragracilis Coutière, 1897: 149.

Material examined. — Watamu, 9-3-73, 1 spm.; 2 spms. Poisoned pools on exposed reef.

Distribution. — Recorded from the Marshall, Samoan, Cook, Society, Line and Hawaiian Islands. The original records were from the Indian Ocean. Not previously recorded from Kenya or Tanzania, but has been reported from Tuléar and Nosy Bé, Madagascar. Also reported from St. Helena in the South Atlantic Ocean (Chace, 1966).

Remarks. — The Watamu specimen was infected by a *Thompsonia*-like sacculinid parasite.

Alpheus lottini Guérin

Alpheus lottini Guérin, 1830: 38, pl. 3 fig. 3; Barnard, 1950: 748, fig. 141 e-j.

Alpheus ventrosus H. Milne-Edwards, 1837: 352.

Material examined. — Watamu, 8-3-73, 1 ♂, 1 ovig. ♀; 1 ♂, 1 ovig. ♀; 1 ovig. ♀, 2 juv.; 1 ♂, 1 ovig. ♀, 1 juv. Casuarina Point, 10-3-73, 1 ♂, 1 ♂, 1 ♂. The Watamu specimens were obtained from the corals *Pocillopora danae* Verrill and *P. verrucosa* (Ellis & Solander). The Casuarina Point specimens were from *Stylophora pistillata* (Esper) and *Seriatopora hystrix* Dana.

Distribution. — Common and widespread throughout the whole Indo-West Pacific in pocilloporid host corals, extending also to the Gulf of California. It has been previously recorded from Mozambique, Madagascar and the Seychelles. Recorded from Zanzibar by Hilgendorf (1878).

Remarks. — This shrimp is one of the largest and more conspicuous of the coral associated alpheids, generally bright orange red in colour with a dark brown or black dorsal stripe.

***Alpheus frontalis* H. Milne Edwards**

Alpheus frontalis H. Milne Edwards, 1837: 356.

Material examined. — Watamu, 9-3-73, 1 ♂, 1 ovig. ♀. Casuarina Point, 10-3-73, 1 ♀. Under dead coral blocks, 0-1 fm., in long felted tubes of *Oscillatoria*.

Distribution. — Throughout Indo-West Pacific region from Red Sea and Mauritius to Tahiti. Also recorded from the Seychelle Islands but not previously recorded from Kenya or Tanzania.

***Alpheus laevisculus* Dana**

Alpheus edwardsi var. *laevisculus* Dana, 1852: 543, pl. 34 fig. 3.

Material examined. — Casuarina Point, 10-3-73, 4 spms. (1 ovig. ♀). Poisoned pools at low water on exposed reef.

Distribution. — This species has not been previously recorded from Kenya or Tanzania, but has been reported from South Africa and Mauritius. It was originally described from Wake Island.

***Alpheus pacificus* Dana**

Alpheus pacificus Dana, 1852: 544, pl. 34 fig. 5.

Material examined. — Casuarina Point, 9-3-73, 41 spms. 10-3-73, 1 ♂, 1 ovig. ♀. From poisoned pools at low water on exposed reef.

Distribution. — Throughout the Indo-West Pacific region as far east as Clipperton Island. Previously recorded from Zanzibar by Hilgendorf (1878). Not previously recorded from Kenya.

Remarks. — The commonest species of snapping shrimp in the exposed reef at low water.

Alpheus parvirostris Dana

Alpheus parvirostris Dana, 1852: 551, pl. 35 fig. 3.

Material examined. — Watamu, 9-3-73, 3 spms.; (1 ovig. ♀). From poisoned pool on exposed reef.

Distribution. — Common throughout most of the Indo-West Pacific region. Recorded from numerous localities in the western Indian Ocean, including Mozambique, Madagascar, Mauritius and the Seychelle Islands but not previously recorded from Kenya or Tanzania.

Alpheus crassimanus Heller

Alpheus crassimanus Heller, 1865: 107, pl. 10 fig. 2; Barnard, 1950: 756, fig. 144.

Material examined. — Casuarina Point, 10-3-73, 1 spm. Obtained from a coral rock burrow, on exposed reef.

Distribution. — Reported from Djibouti, Madagascar and South Africa in the Western Indian Ocean. Not previously recorded from Kenya or Tanzania. Its range extends eastward to the Hawaiian Islands. It has also been reported from the Suez Canal and in the Mediterranean Sea near Tunis (Forest & Guinot, 1956).

Alpheus macrochirus Richters

Alpheus macrochirus Richters, 1880: 164, pl. 17 figs. 31-33; Ortmann, 1890: 485.

Material examined. — Watamu, 9-3-73, 1 spm. Casuarina Point, 10-3-73, 5 spms. Watamu specimen from base of a colony of the coral *Pocillopora danae* Verrill, other specimens from under stones.

Distribution. — Originally recorded from Mauritius, this species has since been reported from Dar es Salaam, but has not yet been recorded from Kenya. It is also known from South Africa, Madagascar and the Maldivic Islands as far as Tahiti.

Remarks. — Coutière has also reported this species from Fernando-Velosa and the Congo and also from the Gulf of California.

Alpheus paracrinitus Miers

Alpheus paracrinitus Miers, 1881: 365, pl. 16 fig. 6.

Alpheus bengalensis Holthuis, 1958: 25.

Material examined. — Watamu, 9-3-73, 1 spm. From poisoned pool on exposed reef.

Distribution. — Widely distributed throughout the Indo-West Pacific

region. This species has been previously reported from the Red Sea and the Indian Ocean but has not been recorded from Kenya or Tanzania. It was originally described from the eastern Atlantic.

Alpheus microstylus (Bate)

Betaeus microstylus Bate, 1888: 566, pl. 101 fig. 6.

Alpheus microstylus Coutière, 1905: 884, pl. 76 fig. 23.

Material examined. — Under stones on exposed gravelly reef.

Distribution. — Reported only from the Red Sea and the Maldivé Islands in the Indian Ocean, but widespread in the western Pacific Ocean. This species has not been previously reported from Kenya or Tanzania.

Remarks. — In life the specimens are a uniform bright yellow colour.

Alpheus eulimene De Man

Alpheus eulimene De Man, 1909: 101.

Material examined. — Watamu, 9-3-73, 1 ♂. From poisoned pool on exposed reef.

Distribution. — Originally reported from Waigeu Island, Indonesia, and since recorded from the Mariana Archipelago (Banner, 1956). New to both Kenya and Tanzania.

Remarks. — This record appears to be only the third for this species.

Alpheus dolorus Banner

Alpheus dolorus Banner, 1956: 363, fig. 21.

Material examined. — Watamu, 9-3-73, 1 spm. Poisoned pool on exposed reef.

Distribution. — Known only from the Mariana, Marshall, Cook and Society Islands in the Pacific Ocean. Not previously recorded from the Indian Ocean.

Alpheus sp., **edwardsi** group

Material examined. — Watamu, 8-3-73, 1 ♀ incomplete; 9-3-73, 1 ♀.

Remarks. — Both sexes, with both first pereopods, are necessary for the identification of species of this group and the identification of these specimens was therefore not possible.

Racilius compressus Paulson

Racilius compressus Paulson, 1875: 107, pl. 14 fig. 2; Barnard, 1958: 732; Bruce, 1972: 92.

Material examined. — Watamu, 8-3-73, 5 ♂, 4 ovig. ♀. From *Galaxea fascicularis* (L.) (Scleractinia), from 1-3 fm.

Distribution. — Common in the Indian Ocean, extending to Thailand and the Australian Great Barrier Reef. Previously reported from Zanzibar; Maziwi Island, Pangani, Tanganyika and Ras Iwatine, Mombasa, Kenya. Also known from Mozambique, Aldabra and the Seychelle Islands.

Remarks. — This species is common in the oculinid coral *Galaxea fascicularis* (L.) and may exceptionally occur in *G. clavus* (Dana), but has not been found in association with any other coral hosts.

Synalpheus sp. cf. **gambarelloides** (Nardo)

Material examined. — Watamu, 8-3-73, 14 spms. Obtained from poisoned pools on exposed reef.

Remarks. — The exact status of these specimens is uncertain and is undergoing further study. The species group to which these specimens belong has not been previously recorded from African waters.

Synalpheus charon (Heller)

Alpheus charon Heller, 1862: 272, pl. 3 figs. 21-22.

Synalpheus charon Coutière, 1899: 264, figs. 331-332, 332 bis.

Material examined. — Casuarina Point, 10-3-73, 1 ♂, 1 ovig. ♀, 1 ♂, 1 ovig. ♀. Both pairs from the coral *Stylophora pistillata* (Esper), the second host being transitional to *S. mordax* (Dana).

Distribution. — Common in pocilloporid corals from the Red Sea and Mozambique to Hawaii. This species has not been previously reported from Kenya or Tanzania. Its range also includes the Gulf of California.

Remarks. — The live specimens are a bright orange red colour.

Synalpheus tumidomanus (Paulson)

Alpheus tumidomanus Paulson, 1975: 101, pl. 13 fig. 2.

Synalpheus tumidomanus Coutière, 1909: 24, fig. 5.

Material examined. — Casuarina Point, 10-3-73, 2 spms. From *Stylophora pistillata* (Esper) (Scleractinia), form transitional to *S. mordax* (Dana).

Distribution. — Originally recorded from the Red Sea, but the exact distribution is uncertain. Also reported from Ceylon, Indonesia and Palau. Banner & Banner (1966) record specimens from Thailand and several Pacific atolls.

Synalpheus cf. ancistrorhynchus De Man

Synalpheus ancistrorhynchus De Man, 1909: 124.

Material examined. — Casuarina Point, 10-3-73, 1 ♂, 1 ovig. ♀. The specimens were found in cavities in a small sponge.

Distribution. — The holotype of *S. ancistrorhynchus* was reported from the Aru Islands, Indonesia.

Remarks. — The specimens do not correspond exactly to the original description and are undergoing further study.

HIPPOLYTIDAE

Saron marmoratus (Olivier)

Palaemon marmoratus Olivier, 1811: 663.

Hippolyte marmorata Ortmann, 1890: 497, pl. 36 fig. 18.

Saron gibberosus Lenz, 1905: 382.

Saron marmoratus Coutière, 1900: 187; Barnard, 1950: 688-690, fig. 128 a-b; Holthuis, 1947: 6, 25-29; Miyake & Hayashi, 1966: 143-6, fig. 1-3 a-c.

Material examined. — Watamu, 9-3-73, 1 juv. ♂, 1 juv. Casuarina Point, 10-3-73, 1 ♂. From dead coral colonies, 2-4 m.

Distribution. — Widespread and common throughout the whole Indo-West Pacific region from the Red Sea and Mozambique to Hawaii. This species has not been previously recorded from Kenya but has been reported from Zanzibar by Ortmann, Coutière, Lenz and Taramelli (1955).

Remarks. — The specimens each have two well developed spines on the merus of the ambulatory pereopods.

Saron neglectus De Man

Saron neglectus De Man, 1902: 854, pl. 26 fig. 58; Kemp, 1914: 87; Holthuis, 1947: 6, 30-31; Miyake & Hayashi, 1966: 146-150, fig. 2, 3 d-f.

Material examined. — Watamu, 9-3-73, 14 spms. (2 ♂, 3 ovig. ♀, 9 juv.) Casuarina Point, 10-3-73, 1 juv., 3 juv. The Watamu specimens were all collected from a colony of the hydroid *Millepora dichotoma* Forskål, depth 6 m and the Casuarina Point specimens from a coral, *Seriatopora* sp., from 3 m depth.

Distribution. — Widespread in Indo-West Pacific region but fewer records than the above species. Reported from Red Sea, Madagascar, Seychelle Islands, Andaman Islands, Indonesia, Ryukyu Islands, Japan and New Caledonia. Not previously recorded from East Africa.

Remarks. — The specimens each have only a single well developed spine

on the merus of the ambulatory pereopods. The two species of *Saron* are most easily distinguished by the colour pattern in life. These patterns are well illustrated by Miyake & Hayashi (1966), who distinctly show the characteristic eyespot on the exopod of the uropod of this species.

Hippolyte ventricosa H. Milne Edwards

Hippolyte ventricosus H. Milne Edwards, 1837: 371; Kemp, 1914: 96, pl. 2 figs. 1-3.
Hippolyte ventricosa Holthuis, 1947: 16, 55-58, figs. 7-9; Hayashi & Miyake, 1968: 140-144, fig. 10; Ledoyer, 1970: 124, pl. 6 pl. 22c.

Material examined. — Watamu, 8-3-73, 12 spms. (6 ovig. ♀). *Sargassum* and *Cymodocea* beds, depth 2 m.

Distribution. — Red Sea and Mozambique, Madagascar, South India, Andaman Islands, Singapore, Indonesia, Japan and the Great Barrier Reef, New South Wales and South Australia. This species has not been previously recorded from Kenya or Tanzanian waters.

Remarks. — This species is a common inhabitant of weed beds and is characteristically a uniform brilliant green colour. Caught with *Thor paschalis*.

Hippolyte commensalis Kemp

Hippolyte commensalis Kemp, 1925: 331-334, figs. 21-22.

Material examined. — Watamu 8-3-73, 1 juv. From a small yellow-brown alcyonarian, depth 3 m.

Distribution. — Known only from the original records from the Andaman and Nicobar Islands. A new record for East Africa.

Remarks. — The specimen agrees closely with the description given by Kemp (1925). In life the colouration was a very pale brown with numerous irregular short stripes of white. The original specimens were also found in association with alcyonarians.

Thor paschalis (Heller) (fig. 22 B)

Hippolyte paschalis Heller, 1862: 276, pl. 3 fig. 24; Lenz, 1905: 382.
Thor paschalis Kemp, 1914, 94: pl. 1 figs. 6-10; Holthuis, 1947: 14, 49-50; Ledoyer, 1970: 121, 125, pl. 8.

Material examined. — Watamu, 8-3-73, 3 ♂. *Sargassum* and *Cymodocea* beds. From 2 m depth.

Distribution. — Red Sea, Madagascar, Indian Ocean, Indonesia, Singapore and the Mariana Islands. This species has been previously recorded from Zanzibar by Lenz, but not from Kenya.

Remarks. — This species appears to be a cryptically coloured associate of the sea grass beds and is similarly coloured to *T. maldivensis*, in contrast to *T. spinosus* and *T. amboinensis*, which are strikingly coloured associates of coelenterates.

Thor amboinensis (De Man) (fig. 22 C)

Hippolyte amboinensis De Man, 1888: 535.

Thor amboinensis Kemp, 1916: 388, fig. 1, pl. 36 fig. 1; Miyake & Hayashi, 1966: 152-154, figs. 5-6; Ledoyer, 1968: 73, pl. 5 figs. 1A-6A.

Material examined. — Casuarina Point, 10-3-73, 2 ♂, 3 juv.; 1 ♂, 1 ovig. ♀. From *Seriatopora* sp. and *Stylophora mordax* (Dana) (Scleractinia), depth 2-3 m.

Distribution. — Madagascar, Andaman and Nicobar Islands, Ryukyu and Palau Islands. Not previously recorded from East Africa.

Remarks. — Several authors have reported the association of this species with giant anemones but its association with corals has not been previously recorded. The colour pattern of the specimen from corals is exactly the same as those from anemones, as described by Kemp (1916) and Miyake & Fujino (1966), and illustrated by Bruce (1975).

Thor maldivensis Borradaile (fig. 22 A, 23)

Thor maldivensis Borradaile, 1917: 401, pl. 58 fig. 6; Kemp, 1916: 391; Edmondson, 1946, 252, fig. 135d.

Material examined. — Watamu, 8-3-73, 1 ♂. From dead coral bases, 3-4 m.

Distribution. — Known only from the Maldive Islands, Andaman Islands, Bali and Hawaii. Not previously recorded from East Africa.

Remarks. — Several of the published records of the species actually refer to *T. spinosus* Boone, see under that species.

Thor spinosus Boone (figs. 16-21, 23)

Thor spinosus Boone, 1935: 192, pl. 52.

Material examined. — Watamu, 9-3-73, 19 spms (7 ovig. ♀). From *Millepora dichotoma* Forskål (Hydrozoa), at 4 fms.

Distribution. — Not previously recorded from East Africa. Known from Bali and Obi Latoe, Indonesia; Amami and Gesu-juma, Japan; and Hawaii.

Remarks. — This species was first described on the basis of a single specimen collected from Temukus Roads, Bali, Indonesia in 1931 (Boone, 1935). There have been no further specimens referred to this species, which Holt-huis (1947) considered to be a synonym of *T. maldivensis* Borradaile.

In the course of the collection of specimens from the Malindi Marine Parks it was found that two species resembling *T. maldivensis* were obtained. The smaller species was cryptically coloured and rather inconspicuous but the other was distinctly larger and with a striking colour pattern, and although mor-

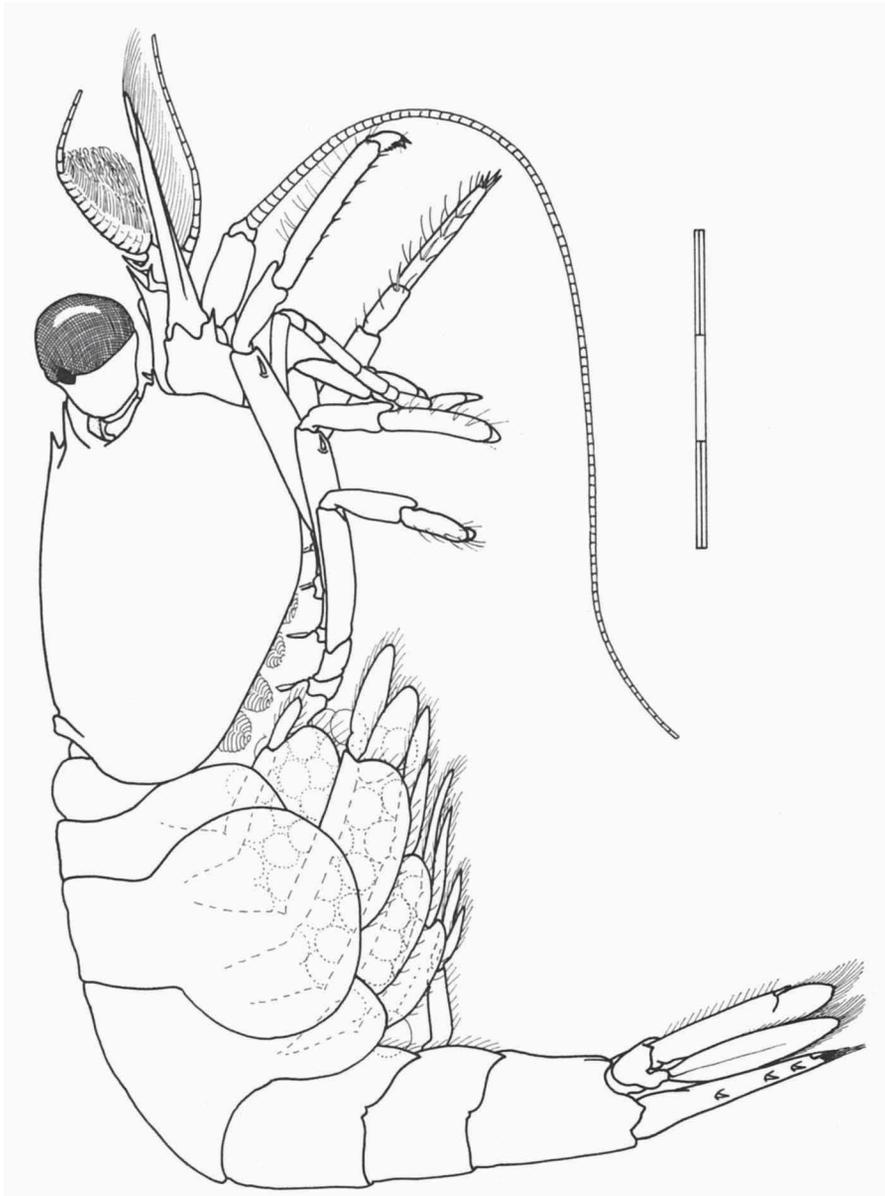


Fig. 16. *Thor spinosus* Boone. Ovigerous female. Scale in mms.

phologically similar, was clearly a separate species. Subsequent examination showed that the cryptically coloured species should be referred to *T. maldivensis* and the other to *T. spinosus*.

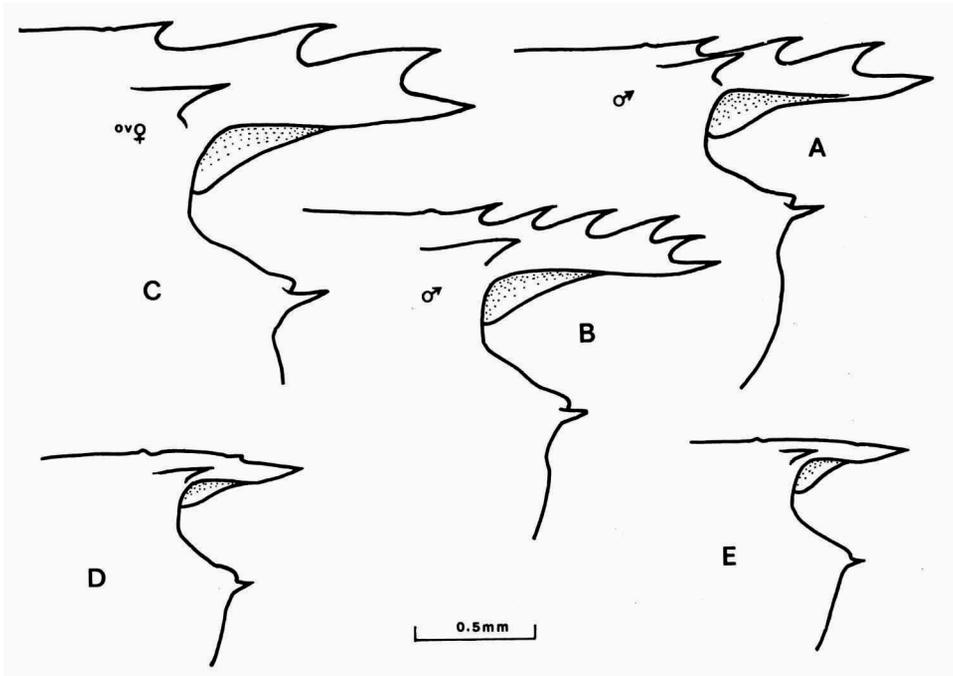


Fig. 17. *Thor spinosus* Boone, rostra. A-B, males; C, ovigerous female; D-E, juveniles.

The present specimens agree fully with the description given by Boone. In Boone's specimen the rostrum was provided with three large dorsal teeth. In the Malindi material the majority of adult specimens also have three dorsal teeth, but two males have four and five teeth respectively and one ovigerous female has four teeth. In all the adult specimens, the rostral teeth are large and broadly acute. The number of teeth is smaller in juveniles and the smallest may have a rostrum devoid of dorsal teeth. In all specimens the supra-orbital spines are well developed and broad, and the antennal spine is slender. The pleura of the fourth and fifth abdominal segments are postero-ventrally acute. The telson is about 1.2 times the length of the sixth abdominal segment, with three pairs of small lateral spines. The posterior margin of the telson is acute with a small median point, with two pairs of spines laterally and two pairs of plumose setae centrally. The lateral spines are half the length of the medial spines, which are half the length of the submedian setae.

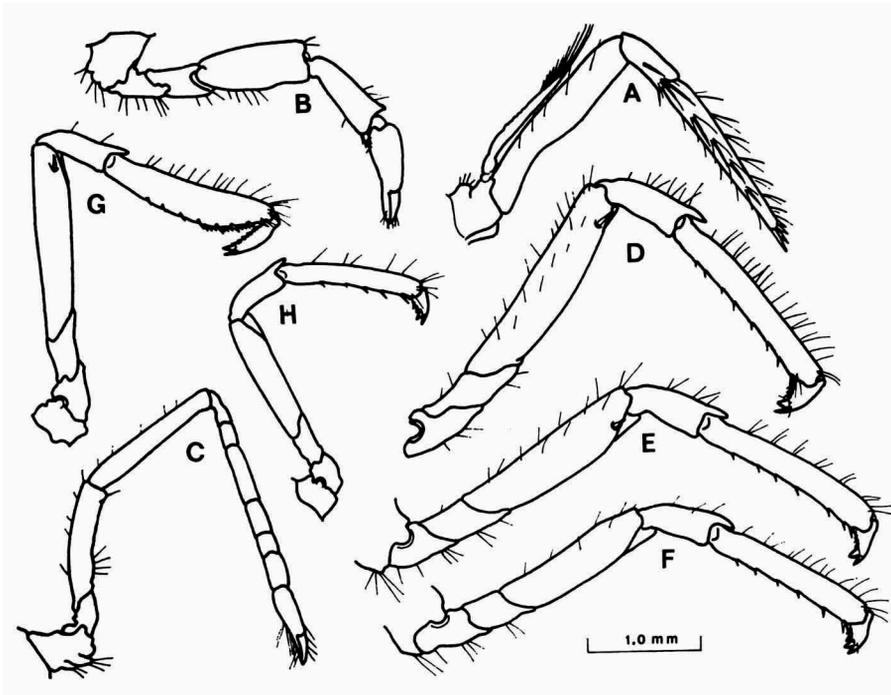


Fig. 18. *Thor spinosus* Boone. A, third maxilliped, male; B, first pereopod; C, second pereopod; D-F, third to fifth pereopods, female; G-H, third and fifth pereopods, male.

The antennules and antennae are as described by Boone, but a small erect tooth is present at the proximal lateral aspect of the stylocerite. The third maxilliped and first pereopod are also as described. The second pereopods have the carpus subdivided into six articles as noted by Holthuis (1947).

In the female, the ambulatory pereopods are robust. The dactylus is short and stout, with a slender distinct unguis. The ventral border is armed with spines, the most distal being particularly large and stouter than the unguis. In addition to this accessory spine, the ventral margin bears five, three and two smaller spines on the third, fourth and fifth pereopods respectively. The propods bear a row of 9-7 small ventral spines and the carpus is unarmed. On the third and fourth pereopods the merus bears a mobile disto-lateral spine which is lacking from the fifth pereopod. In the male, the propodus and dactylus of the third pereopod are modified and are prehensile. The dactylus is elongated, with five slender accessory spines. The distal end of the propodus, which is markedly broadened, bears numerous stout erect spines, which occlude with the ventral border of the dactylus.

The endopod of the male first pleopod is bluntly lanceolate, twice as

long as broad, with nine slender spines along the medial border, with five similar but shorter spines along the lateral border and with a single plumose seta proximally on the lateral border. The appendix masculina of the second pleopod is well developed, three times longer than broad and more than half the length of the endopod. The distal half of the ventral aspect bears three longitudinal rows of long finely setulose setae. The appendix interna is well developed, only slightly exceeding half the length of the appendix masculina.

Thor spinosus Boone may be separated from *T. maldivensis* Borradaile by the marked difference in the shape and dentition of the rostrum. In addition, the spinulation of the merus on the ambulatory pereiopods is different in the

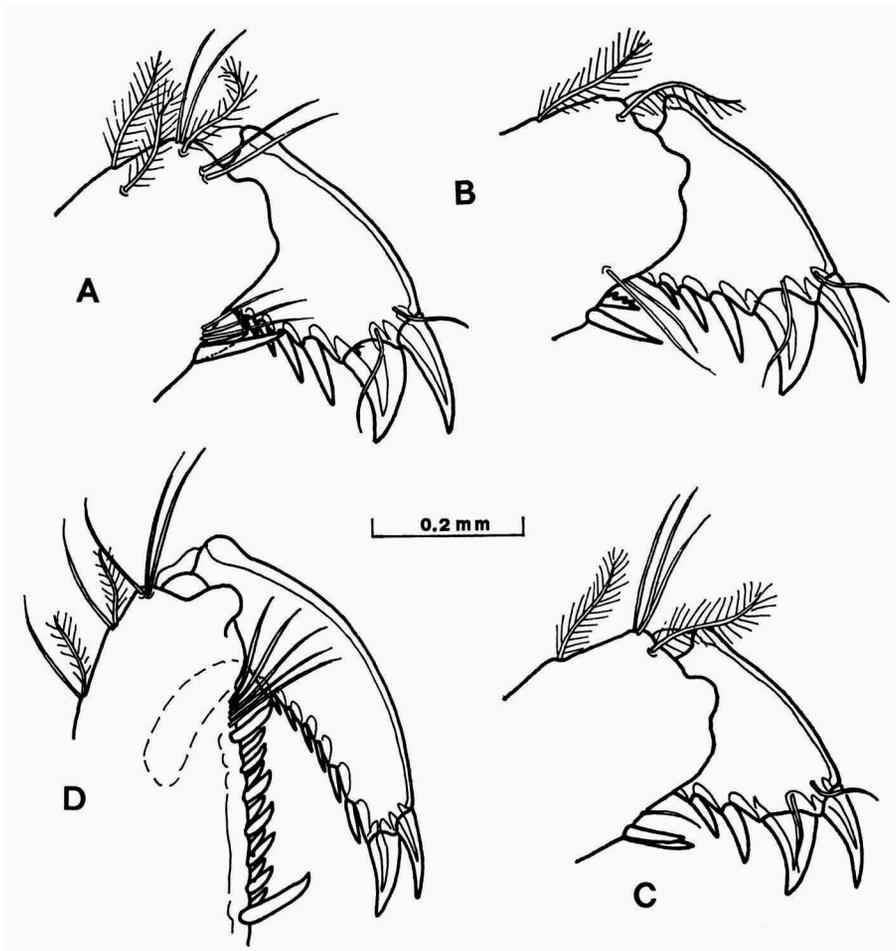


Fig. 19. *Thor spinosus* Boone. A-C, dactylus of third to fifth pereiopods, female; D, dactylus of third pereiopods, male.

two species. In *T. maldivensis* only the third pereiopod is provided with a disto-lateral meral spine. In the specimen of *T. maldivensis* from Malindi the base of the stylocerite bears a small tubercle rather than an acute tooth.

The colour pattern of these two closely related species provided the easiest methods of separation in the field. *T. spinosus* has a ground colour of dark olive brown with a superimposed pattern of fine striae, with lateral margins of minute red chromatophores and with a row of larger bluish-white chromatophores down the centre. A pair of small dorso-lateral, dark bluish-red eyespots is present on the third abdominal tergite and a pair of similar but larger spots is present on the endopods of the uropod. A single large median

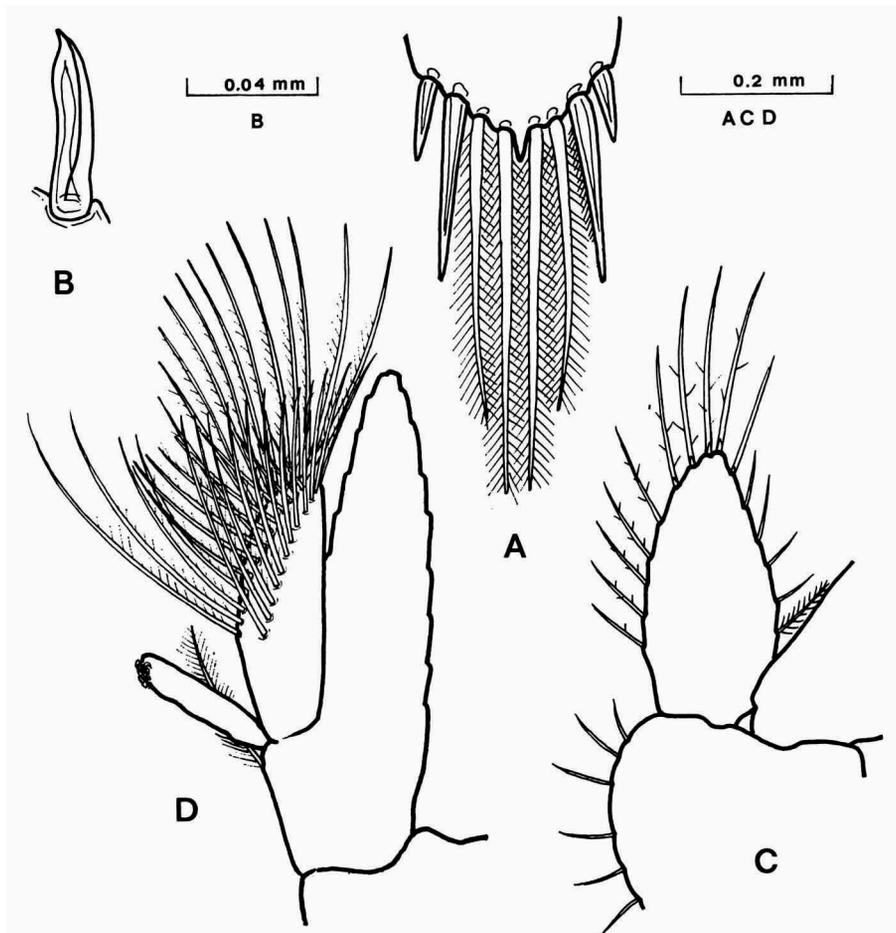


Fig. 20. *Thor spinosus* Boone. A, terminal telson spines; B, disto-ventral spine of propodus of male third pereiopod; C, endopod of male first pleopod; D, endopod of male second pleopod.

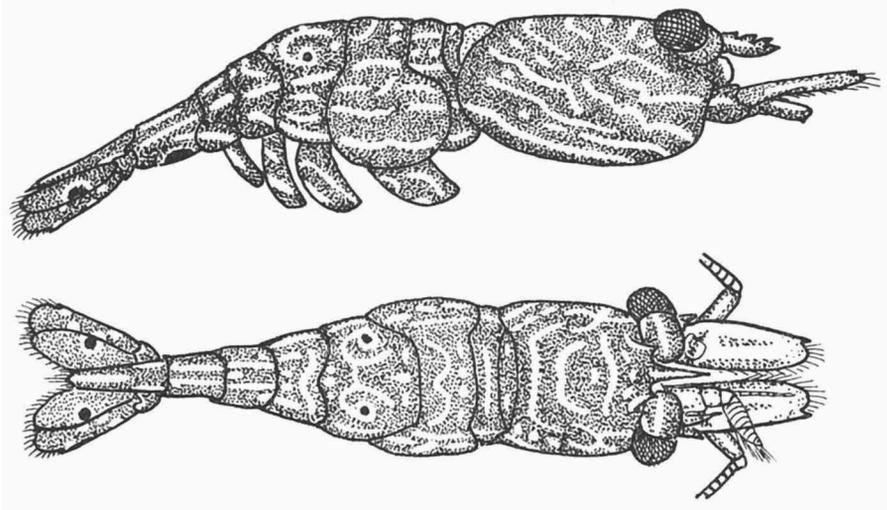


Fig. 21. *Thor spinosus* Boone, colour pattern.

ventral spot is also present on the sixth abdominal segment. The pereiopods are olive brown with fine white longitudinal striae. In contrast, *T. maldivensis*, which also appears to be a rather smaller species, is cryptically coloured, with a random mixture of small patches of brown and white chromatophores with transparent zones.

The reinstatement of *Thor spinosus* raises to six the number of species of this genus known from the Indo-West Pacific region, one species still being of uncertain taxonomic status. The species may be identified by the following key:

The Indo-West Pacific species of the genus *Thor* Kingsley

- | | |
|--|----------------------------------|
| 1. Supraorbital spines well developed | 2 |
| — Supraorbital spines absent | 3 |
| 2. One dorsal rostral tooth only; merus of fourth pereiopod without a disto-lateral spine | <i>T. maldivensis</i> Borr. |
| — Adults with 3-5 dorsal rostral teeth; merus of fourth pereiopod with a disto-lateral spine | <i>T. spinosus</i> Boone |
| 3. Stylocerite with a small acute lateral process proximally | 4 |
| — Stylocerite without such process | <i>T. paschalis</i> Heller |
| 4. Telson with 3-4 pairs of well developed dorsal spines | 5 |
| — Telson with one pair of minute dorsal spines only | <i>T. intermedius</i> Holthuis |
| 5. Third to fifth pereiopods with 1, 1, 0 meral spines respectively. <i>T. amboinensis</i> De Man | |
| — Third to fifth pereiopods with 4, 2, 1, meral spines respectively | <i>Thor</i> sp. Miyake & Hayashi |

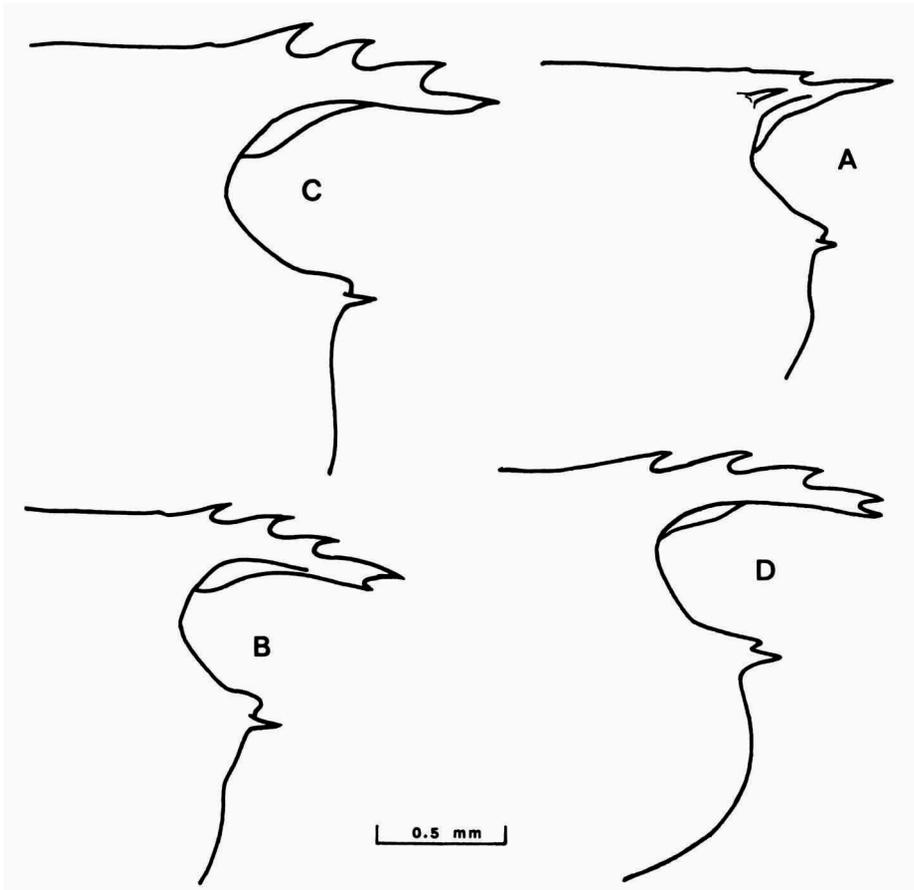


Fig. 22. Rostra of *Thor* species. A, *T. maldivensis* Borradaile; B, *T. paschalis* (Heller); C, *T. amboinensis* De Man; D, *T. intermedius* Holthuis, holotype.

Thor spinosus has so far been reported only from Bali. In addition to the present specimens from Kenya, specimens from Port Glaud, Mahé, Seychelle Islands (Stn. 14, 7 April 1966, coll. A. J. Bruce) have also been examined. These specimens were obtained from a colony of *Millepora tenera*. The specimens reported upon in the Siboga Expedition report have also been re-examined. The specimens from Stn. 115, north Celebes, have been found to belong to *T. spinosus* (S. Pinkster, in litt.) and the Snellius specimen from Obi latoe is also *T. spinosus*, while the Leiden Museum specimen from an unknown locality is *T. maldivensis* (L. B. Holthuis, in litt.). The illustration provided by Edmondson (1946) of a specimen from Hawaii indicates that it is correctly referred to *T. maldivensis* and not *T. spinosus*. Kemp's (1916)

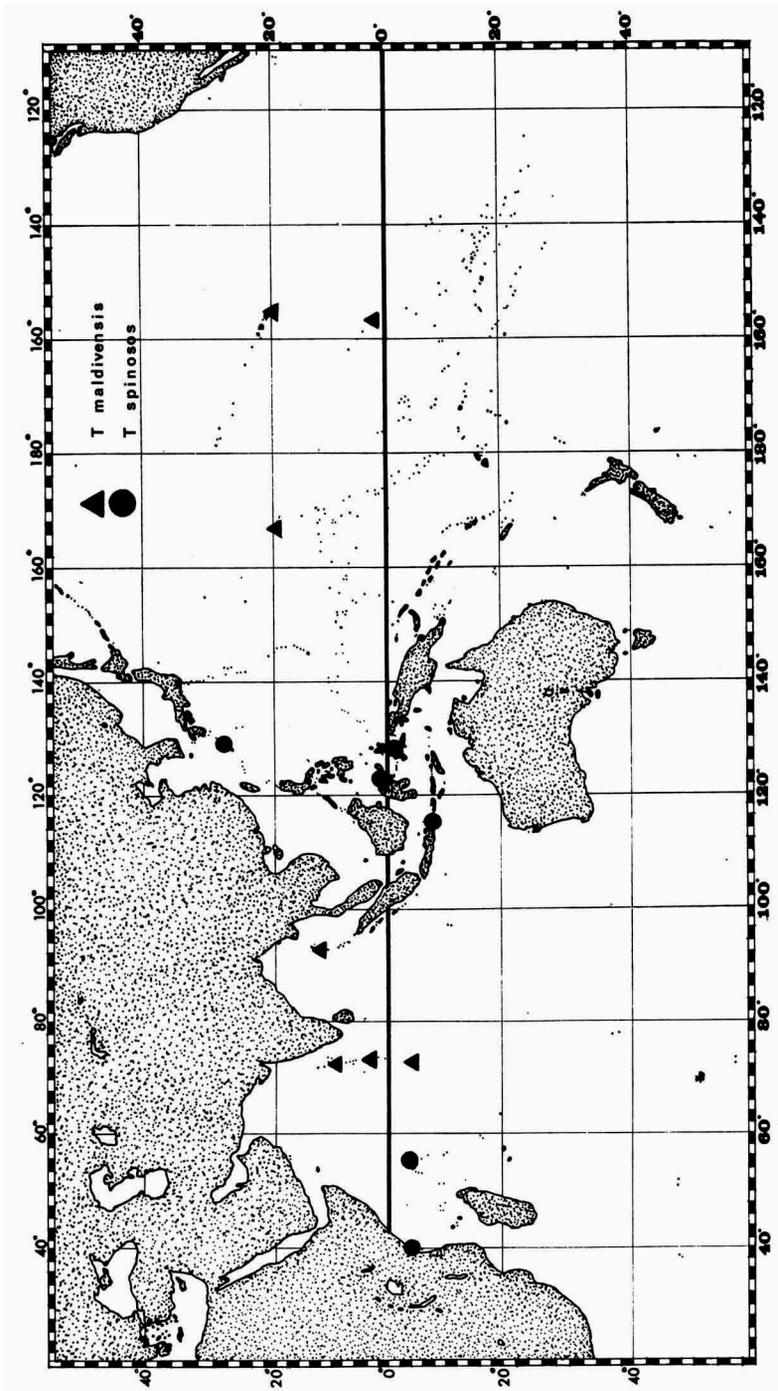


Fig. 23. The distribution of *Thor spinosus* Boone and *Thor maldivensis* Borradaile.

specimen is also clearly correctly identified as *T. maldivensis* as only a single dorsal rostral tooth is present, but the specimen reported by Miyake & Hayashi (1966) should probably be referred to *T. spinosus*. It differs slightly from the Indian Ocean specimens in that a small spine is also present on the merus of the fifth pereopod. The distribution of the two species is illustrated in fig. 23, and it is probable that both will be found to occur throughout the whole Indo-West Pacific region. The specimens reported upon by Holthuis (1953) need to be re-examined, but Edmondson's specimens from Waikiki, Wake and Christmas Islands, now in the collections of the Bishop Museum, Honolulu, have been re-examined and found correctly referred to *T. maldivensis*.

Hippolysmata vittata Stimpson

Hippolysmata vittata Stimpson, 1860: 26, Barnard, 1950: 710-711, fig 132 a-c.

Material examined. — Watamu, 9-3-73, 9 juvs. Under stones on reef exposed by L. W. S. tide.

Distribution. — Red Sea, South Africa, and Madagascar, to Indonesia and Japan, and the Australian Great Barrier Reef. Not previously recorded from Kenya or Tanzania.

Remarks. — A common and well known species that is very characteristic of the "under stone" habitat of exposed coral reefs. The usual colour pattern of fine longitudinal bands of red was noted.

PROCESSIDAE

Processa hawaiiensis (Dana)

Nika hawaiiensis Dana, 1852: 20; 1852a: 538; Manning & Chace, 1971: 13.

Processa hawaiiensis Rathbun, 1906: 912.

Material examined. — Watamu, 9-3-73, 35 spms. (7 ovig. ♀), from sand pools on exposed algal crest of reef.

Distribution. — Known only from Maui and Oahu, Hawaii and Clipperton Island. Not previously recorded from the Indian Ocean.

Remarks. — I am grateful to Dr. I. Hayashi for the identification of these specimens, which will be reported upon in detail in his forthcoming revision of the Indo-West Pacific Processidae.

PANDALIDAE

Chlorocurtis jactans (Nobili)

Virbius (?) *jactans* Nobili, 1904: 230.

Chlorocurtis miser Kemp, 1925: 280-282.

Chlorocurtis jactans Holthuis, 1955: 127, fig. 91; Ledoyer, 1968: 67, pl. 1 figs. 1A-4A, pl. 14B.

Material examined. — Watamu, 8-3-73, 1 ovig. ♀, 1 ovig. ♀, obtained from *Cymodocea* and *Sargassum* beds. Depth 2-3 m.

Distribution. — Known only from the Red Sea, Madagascar and Andaman Islands. Not previously recorded from Kenyan or Tanzanian waters.

Remarks. — The specimens were cryptically coloured in life, rather resembling the specimens of *Thor paschalis* with which they were obtained.

II. ZOOGEOGRAPHICAL COMPARISONS

The fauna represented by the Marine Park collections is derived from a restricted geographical locality and can therefore be best compared to similarly restricted collections, rather than with reports derived from extensive regional collections, such as those of the Siboga expedition. Two localities in the west of the Indo-Pacific region have been studied and are suitable for approximate comparisons with the Malindi fauna. Macnae & Kalk (1958) have provided a list of the Caridea collected from Inhaca Island, in southern Mozambique, and Holthuis (1958) has reported upon collections of shrimps from Eylath on the Gulf of Aqaba. The Inhaca report is based upon collections acquired over many years and may be expected to be moderately complete. The Eylath report is also based upon collections made from 1949-1956, but it seems probable that many more species could be discovered. The Malindi material, based upon only three days collecting, is certainly very far from being a completely representative collection and it is to be expected that many more species remain to be collected. Many of the species known to be abundant along the East African coast, such as *Leander tenuicornis* (Say) and *Periclimenes brevicarpalis* (Schenkel), are expected to occur within the Marine Park limits. The present collections do indicate that a very rich caridean fauna is present, but it is probable that further collecting could at least double the number of species recorded from the parks.

Inhaca Island is situated near the south western limit of the Indo-West Pacific region and lacks the abundant development of coral reefs found in warmer waters to the north. This is probably the primary cause of the lower species diversity found there. The Eylath fauna is typical of the main Indo-West Pacific region and only a single Red Sea endemic form (*Hippolyte proteus*) is represented, although the status of some species as endemics remains dubious, for example *Aretopsis aegyptiaca*.

The fauna of the three regions are summarized in the tables 1 and 2. The combined faunal list consists of 110 species, of which 36 only (33%) occur at Inhaca, whereas 43 (39%) are found at Eylath. Malindi shows a distinctly richer fauna with 67 species (61%). Very few species occur in common to

all three regions, although undoubtedly further collecting would increase the number. Four species of pontoniine shrimp, four alpheidids and one hippolytid (8.2%) are represented at each of the three localities. All occur throughout the entire Indo-West Pacific region and three of them, *Harpiliopsis depressa*, *Synalpheus charon* and *Alpheus lottini*, even range as far as the western American seaboard.

Of the 67 Malindi species, 13 (12%) are also found at Inhaca Island. Similarly, 21 (31%) of the Malindi species have also been reported from Eylath, and it is certain that many of the Eylath species not reported from Malindi will in due course be found there. The five additional species, *Ischnopontonia lophos*, *Gnathophyllum americanum*, *Athanas indicus*, *Racilius compressus* and *Hippolysmata vittata* are all species that may be expected to be found in the Red Sea and probably will also occur at Eylath. Only a single species, *Alpheus collumianus*, has been found at Inhaca and Eylath, but not at Malindi. It is unlikely that this widely distributed species will be absent from Malindi.

TABLE 1

	Inhaca	Malindi	Eylath
Total number of species		110	
Number of species present	36(33%)	67(61%)	43(39%)
Species exclusively present	22(20%)	42(38%)	21(19%)
		9(8.2%)	
Species occurring in common	13(12%)		21(19%)

TABLE 2

Family	Inhaca	Malindi	Eylath
Rhynchocinetidae	0	1	0
Palaemonidae, Palaemoninae	2	0	1
Pontoniinae	10	32	12
Gnathophyllidae	2	1	0
Alpheidae	14	22	25
Hippolytidae	4	9	4
Processidae	3	1	1
Pandalidae	0	1	0
Crangonidae	1	0	0

TABLE 3

The caridean fauna of Inhaca, Malindi and Eylath.

	Inhaca	Malindi	Eylath
RHYNCHOCINETIDAE			
<i>Rhynchocinetes hendersoni</i> Kemp	—	×	—
PALAEMONIDAE: PALAEMONINAE			
<i>Leander tenuicornis</i> (Say)	×	—	—
<i>Palaemon concinnus</i> Dana	×	—	—
<i>pacificus</i> (Stimpson)	—	—	×
PALAEMONIDAE: PONTONIINAE			
<i>Palaemonella rotumana</i> (Borradaile)	—	×	—
<i>Vir orientalis</i> (Dana)	—	×	—
<i>Periclimenes brevicarpalis</i> (Schenkel)	×	—	—
<i>consobrinus</i> De Man	—	×	—
<i>demani</i> Kemp	×	—	—
<i>diversipes</i> Kemp	—	×	—
<i>galene</i> Holthuis	—	×	—
<i>grandis</i> (Stimpson)	×	×	×
<i>imperator</i> Bruce	—	×	—
<i>inornatus</i> Kemp	—	×	—
<i>kempi</i> Bruce	—	×	—
<i>longirostris</i> (Borradaile)	—	—	×
<i>lutescens</i> auct.	—	×	×
<i>petitthouarsii</i> (Audouin)	—	×	×
<i>psamathe</i> (De Man)	—	×	—
<i>rex</i> Kemp	×	—	—
<i>seychellensis</i> Borradaile	—	×	—
<i>soror</i> Nobili	—	×	—
<i>zanzibaricus</i> Bruce	—	×	—
<i>watamuae</i> sp. nov.	—	×	—
<i>Anchistus custos</i> (Forskål)	×	—	—
<i>miersi</i> (De Man)	—	×	—
<i>demani</i> Kemp	—	×	—
<i>Periclimenaeus hecate</i> (Nobili)	—	×	—
<i>tridentatus</i> (Miers)	×	—	—
<i>Philarius gerlachei</i> (Nobili)	—	×	—
<i>imperialis</i> (Kubo)	—	—	×
<i>Ischnopontonia lophos</i> (Barnard)	×	×	—
<i>Platycaris latirostris</i> Holthuis	—	×	—
<i>Jocaste japonica</i> (Ortmann)	—	×	—
<i>lucina</i> (Nobili)	×	×	×
<i>Coralliocaris graminea</i> (Dana)	—	×	—
<i>macrophthalma</i> (H. Milne-Edwards)	—	—	×
<i>superba</i> (Dana)	—	×	×
<i>venusta</i> Kemp	—	×	—
<i>Harpiliopsis beaupresii</i> (Audouin)	×	×	×
<i>depressa</i> (Stimpson)	×	×	×
<i>spingera</i> (Ortmann)	—	×	—

	Inhaca	Malindi	Eylath
<i>Pontoniopsis comanthi</i> Borradaile	—	—	×
<i>Pontonia ascidicola</i> Borradaile	—	—	×
<i>Propontonia pellucida</i> Bruce	—	×	—
<i>Hamodactyloides incompletus</i> (Holthuis)	—	×	—
GNATHOPHYLLIDAE			
<i>Gnathophyllum americanum</i> Guérin	×	×	—
<i>Hymenocera picta</i> Dana	×	—	—
ALPHEIDAE			
<i>Alpheopsis equalis</i> Coutière	—	×	×
<i>Athanas djiboutensis</i> Coutière	—	—	×
<i>dimorphus</i> Ortmann	—	×	—
<i>indicus</i> (Coutière)	×	×	×
<i>minikoiensis</i> Coutière (cf.)	×	—	—
<i>Aretopsis aegyptiaca</i> Ramadan	—	—	×
<i>Automate gardineri</i> Coutière	—	—	×
<i>Salmoneus cristatus</i> (Coutière)	—	×	×
<i>sibogae</i> (De Man)	—	—	×
<i>Racilius compressus</i> Paulson	×	×	—
<i>Synalpheus ancistrorhynchus</i> De Man	—	×	—
<i>anisocheir</i> Stebbing	×	—	—
<i>charon</i> (Heller)	—	—	—
sp., cf. <i>gambarrelloides</i> (Nardo)	—	×	—
<i>hululensis</i> Coutière	—	—	×
<i>jedanensis</i> De Man (cf.)	×	—	—
<i>paulsoni</i> Nobili	—	—	×
<i>tumidomanus</i> (Paulson)	—	×	×
<i>Metalpheus paragracilis</i> (Coutière)	—	×	—
<i>Alpheus alcyone</i> De Man	—	—	×
<i>bucephaloides</i> Nobili	—	—	×
<i>bullatus</i> Barnard	×	—	—
<i>collumianus</i> Stimpson	×	—	×
<i>crassimanus</i> Heller	×	×	×
<i>diadema</i> Dana	—	—	×
<i>dolorus</i> Banner	—	×	—
<i>edwardsii</i> Audouin	×	?	—
<i>ehlersii</i> De Man	—	—	×
<i>eulimene</i> De Man	—	×	—
<i>frontalis</i> H. Milne-Edwards	—	×	×
<i>gracilis</i> Heller	—	—	×
<i>laeviusculus</i> Dana	—	×	×
<i>lanceloti</i> Coutière	—	—	×
<i>longicarinatus</i> Hilgendorf	×	—	—
<i>lottini</i> Guérin	×	×	×
<i>macrochirus</i> Richters	—	×	—
<i>microstylus</i> Bate	—	×	×
<i>pacificus</i> Dana	—	×	×
<i>paracrinitus</i> Miers	—	×	—
<i>parvirostris</i> Dana	—	×	×
<i>rapacida</i> De Man	×	—	—
<i>rapax</i> Fabricius	×	—	—

	Inhaca	Malindi	Eylath
HIPPOLYTIDAE			
<i>Saron marmoratus</i> (Olivier)	×	×	×
<i>neglectus</i> De Man	—	×	—
<i>Hippolyte commensalis</i> Kemp	—	×	—
<i>kraussiana</i> (Stimpson)	—	—	×
<i>proteus</i> (Paulson)	—	—	×
<i>ventricosa</i> H. Milne-Edwards	—	×	—
<i>Thor amboinensis</i> De Man	—	×	—
<i>maldivensis</i> Borradaile	—	×	—
<i>paschalis</i> (Heller)	—	×	×
<i>spinosus</i> Boone	—	×	—
<i>Latreutes pygmaeus</i> Nobili	×	—	—
<i>Hippolysmata vittata</i> Stimpson	×	×	—
<i>Lysmata trisetacea</i> (Heller)	—	—	×
PROCESSIDAE			
<i>Nikoides danai</i> Paulson	×	—	—
<i>coutierei</i> Nobili	—	—	×
<i>hawaiiensis</i> (Dana)	—	×	—
<i>japonica</i> (De Haan)	×	—	—
<i>Nikoides danai</i> Paulson	×	—	—
PANDALIDAE			
<i>Chlorotocus jactans</i> Nobili	—	×	—
CRANGONIDAE			
<i>Pontophilus pilosus</i> Kemp	×	—	—

III. "COMMENSALISM"

Out of the 67 species collected it may be noted that 37 (57%) are known to live in "commensal" associations with other marine invertebrates, although the exact trophic status of several species is still rather obscure. Garth (1974) has indicated the criteria for considering shrimps to be obligatory commensals are (i) that they should not be found apart from their host, (ii) that breeding adults should be present and that (iii) the associations should be consistently recurrent. On these criteria, the commensal status of the majority of the shrimps collected can be considered as satisfactorily established. The status of some of the free-living species is less clearly delineated. *Rhynchocinetes* species may frequently appear in aggregations in coral (and also in caves) but these appear to be active mainly at night when they leave these shelters and forage independently. *Saron neglectus* may behave similarly, but *S. marmoratus* is commonly found in dead coral or under coral rocks. *Gnathophyllum* contains free-living and commensal species

associated with echinoderms. *Gnathophyllum americanum* has been observed feeding upon the paxillae of asteroids under aquarium conditions and the unusual third maxillipeds appear to be specifically adapted to this purpose. The free-living alpheid shrimps are probably mainly burrowers but some of the species collected may have been associated with gobies, as has been found in some of the Inhaca and Eylath species. The associations of the various shrimps are summarized in table 4.

TABLE 4
Commensalism among the shrimps collected

	Rhynchocinetidae	Palaemonidae Pontoninae	Gnathophyllidae	Alpheidae	Hippolytidae	Processidae	Pandalidae	Total	%
Free-living	1	4	1	16	5	1	1	29	45%
Commensal	Sponges	-	1	-	2	-	-	3	4.5%
	Hydroids	-	2	-	-	2	-	4	6.0%
	Anemones	-	1	-	-	-	-	1	1.5%
	Alcyonarians	-	2	-	-	1	-	3	4.5%
	Gorgonians	-	1	-	-	-	-	1	1.5%
	Corals	-	16	-	3	1	-	20	30.0%
	Molluscs	-	2	-	-	-	-	2	3.0%
	Echinoderms	-	3	-	1	-	-	4	6.0%
Number of species and percentage of commensals	1	32 88%	1	21 24%	9 44%	1	1	67	57.0%

Table 4 clearly indicates the predominance of commensalism among the pontonine shrimps in comparison with the representatives of the Alpheidae and Hippolytidae collected. Further details of the associations of pontonine shrimps with their acroporid coral hosts are provided in table 5.

TABLE 5

Association of pontoniine shrimps with individual colonies (numbered 1 to 14) of *Acropora* corals

Host No. →	Acropora coral host type												colonies occupied		
	<i>A. hyacinthus divaricata</i> '			<i>A. hyacinthus reticulata</i> '				<i>A. hyacinthus armata</i> ' group				<i>A. patula</i>			
Shrimp ↓	1	3	6	5	10	11	12	14	2	4	7	13	8	9	%
<i>Vir orientalis</i>	-	-	-	-	-	-	-	-	-	-	+	-	-	-	7.1
<i>Periclimenes lutescens</i>	-	-	-	-	-	-	-	-	+	+	+	-	-	-	21
<i>Philarius gerlachei</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	7.1
<i>Jocaste lucina</i>	+	+	+	+	+	-	-	-	+	-	-	-	-	+	50
<i>Jocaste japonica</i>	+	-	+	+	+	-	-	-	-	-	-	-	+	+	43
<i>Coralliocaris graminea</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	7.1
<i>Coralliocaris superba</i>	+	-	+	-	-	+	-	+	-	-	-	-	-	+	28.5
<i>Coralliocaris venusta</i>	-	-	-	-	-	-	+	-	-	-	-	+	-	-	14
No. of species per colony	3	1	3	3	3	1	2	1	2	1	2	1	1	3	
Average No. of species per colony	2.33			2.0				1.50				2.0			

'transitional form

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