

**NOTES ON SOME INDO-PACIFIC PONTONIINAE III-IX
DESCRIPTIONS OF SOME NEW GENERA AND SPECIES
FROM THE WESTERN INDIAN OCEAN AND THE
SOUTH CHINA SEA ¹⁾**

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With 29 text-figures

CONTENTS

Introduction	I
III. <i>Anapontonia denticauda</i> Bruce, 1966, from the western Indian Ocean	2
IV. <i>Mesopontonia gorgoniophila</i> gen. nov., sp. nov., from the South China Sea	13
V. <i>Metapontonia fungiacola</i> gen. nov., sp. nov., from the western Indian Ocean	23
VI. The genus <i>Tuleariocaris</i> Hipeau-Jacotte with the description of a new species, <i>Tuleariocaris zanzibarica</i> sp. nov., from East Africa and New Caledonia	32
VII. <i>Periclimenes antonbruunii</i> sp. nov., from the Comores	44
VIII. <i>Periclimenes imperator</i> sp. nov., from the Red Sea, the western Indian Ocean, and Hawaii	53
IX. <i>Periclimenes zanzibaricus</i> sp. nov., from the western Indian Ocean	62
Literature cited	72

INTRODUCTION

Collections of pontoniid shrimps made by the author in the western Indian Ocean from 1959 to 1962 have indicated that a rich fauna belonging to this subfamily is to be found on the coral reefs of East Africa and the oceanic islands. Subsequently collections made in the South China Sea have indicated that knowledge of the Pontoniinae is still far from complete. The opportunity is taken in this paper to describe some of the more interesting forms, all of which, except one, have been found in association with invertebrate hosts. Nos. I and II of this series of notes have been published in *Crustaceana* (Bruce, 1966, 1966a).

In addition to the individuals mentioned in the separate parts of this paper, the author particularly wishes to thank the Directors and staffs of the East African Marine Fisheries Research Organization, Zanzibar and

1) Contribution No. 12 from the Fisheries Research Station, Hong Kong.

the Fisheries Research Station, Hong Kong for their help and advice. Special acknowledgement must also be made to the National Science Foundation which enabled the author to take part aboard the R.V. "Anton Bruun" in the U.S. Programme in Biology for the International Indian Ocean Expedition in 1964.

III. ANAPONTONIA DENTICAUDA BRUCE, 1966, FROM THE WESTERN INDIAN OCEAN

Collections of pontoniid shrimps made in the western Indian Ocean between 1959 and 1964 provided several examples of a small coral-inhabiting species that could not be referred to any of the described genera. The new genus erected for its inclusion increases to eleven the number of Indo-Pacific genera known to be associated with corals. The other genera are *Periclimenes* Costa, *Philarius* Holthuis, *Platycaris* Holthuis, *Metapontonia* Bruce, *Harpiliopsis* Borradaile, *Fennera* Holthuis, *Coralliocaris* Stimpson, *Jocaste* Holthuis, *Cavicheles* Holthuis, and *Paratypton* Balss. *Anapontonia* is closest to *Philarius* although it occurs on the same host as does *Platycaris*.

Anapontonia Bruce, 1966

Anapontonia Bruce, 1966b: 584, 595-598.

Commensal pontoniid shrimps associated with corals. Body strongly compressed with short, dorsally toothed rostrum. Carapace smooth, lacking supra-orbital, antennal and hepatic spines. Antero-lateral angle of carapace produced. Abdomen smooth with rounded pleura. Telson elongated with three pairs of terminal spines; dorsal spines absent. Eyes short with rounded cornea. Antennae reduced. Basal segment of antennular peduncle broad with acute stylocerite and pointed disto-lateral angle; intermediate and distal segments very short. Upper flagellum short, with single ramus only. Scaphocerite with very strong disto-lateral spine and reduced lamella; basicerite unarmed. Mandible without palp; incisor process short. Maxillula with bifid palp and well developed laciniae. Maxilla with well developed palp, narrow scaphognathite; endite absent. First maxilliped with well developed palp, reduced exopod with a well developed caridean lobe, and a large simple epipod. Second maxilliped with reduced exopod and no epipod. Third maxilliped with reduced, rod-like exopod, small epipod and a rudimentary arthrobranch. First pereopods robust, with well developed chelae. Second pereopods with similar, symmetrical chelae. Last three pereopods stout with simple, strongly curved dactyls. Thoracic sternites unarmed. Exopod of uropod provided with strong curved spines laterally.

Type species: *Anapontonia denticauda* Bruce, 1966.

Anapontonia denticauda Bruce, 1966 (fig. 1-4)

Anapontonia denticauda Bruce, 1966b: 595-597.

Material examined. — Pange Reef, off west coast of Zanzibar Island, 21 March 1962. — two adults and three juveniles.

Bawi Island, off west coast of Zanzibar, 9 September 1959. — two adults.

Fumba, west coast of Zanzibar Island, 5 September 1959. — two adults.

Pamanzi Reef, Isle de Mayotte, Comores, R. V. "Anton Bruun", Cruise 9, 24 November 1964. — one adult female.

Description. — The holotype female has a strongly compressed body. The rostrum is short and depressed with a well developed midrib which is continuous with the orbital margin. The lower border of the rostrum is convex so that the tip is directed anteriorly. The dorsal border bears a

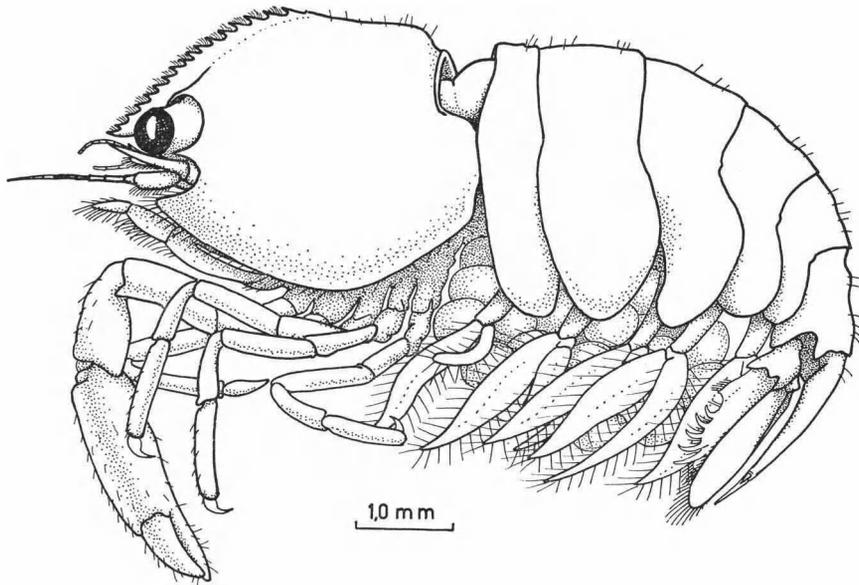


Fig. 1. *Anapontonia denticauda* Bruce, holotype female.

regular series of teeth that continue posteriorly across the anterior half of the carapace as a well defined post-rostral carina. Seventeen teeth are present and the interspaces bear numerous setae. The carapace is smooth but bears a few setae dorsally and around its ventral margins. Supra-orbital, hepatic and antennal spines are absent. The inferior orbital angle is a slender acute process that is directed slightly upward. The antero-lateral angle of the carapace is produced anteriorly and reaches the level of the middle of the carapocerite. The posterior angle of the branchiostegite is truncated.

The pleura of the first five abdominal segments are rounded and that of the sixth is bluntly angled. The posterior borders of the abdominal segments

are transverse and not produced. The maximum length of the sixth segment is twice the length of the fifth and slightly more than two thirds of the length of the telson. The lateral borders of the telson are convergent, most markedly in the posterior half. The posterior border is rounded and lacks a small acute median process. There are three pairs of terminal spines. The submedian pair are the longest, almost one third of the length of the telson, and are slender. The intermediate pair are robust and slightly shorter than the submedian spines. The lateral spines are short and about one fifth of the length of the intermediate spines. There are no dorsal spines on the telson but numerous fine setae are present especially around the lateral and posterior margins.

The eyestalks are short and reach anteriorly to the level of the distal end of the carpocerite. The cornea is hemispherical and its diameter is about two thirds of the maximum width of the peduncle.

The antennule is much reduced. The basal segment of the antennular peduncle is almost invisible in lateral view and just reaches to the level of the distal end of the carpocerite. It is one and one third times longer than its maximum width. The stylocerite is broad and acutely pointed and reaches anteriorly for two thirds of the length of the basal segment. The antero-lateral angle of the basal segment is produced as a broad acute point that exceeds the length of the second and third segments of the peduncle combined. The anterior and lateral margins of the basal segment and the stylocerite bear numerous long setae. The basal segment lacks a ventro-medial spine but an elongated setose lobe is present at its base ventrally. The intermediate segment of the peduncle is twice as broad as long and its antero-lateral angle is produced anteriorly as a blunt setose lobe that exceeds the level of the lateral border of the distal peduncular segment. The anterior margin is also strongly setose. The distal segment is also about twice as wide as long and about two thirds of the length of the intermediate segment. The lower antennular flagellum is short and slender and consists of six segments only. Its length is equal to that of the carpocerite. The upper flagellum is also short and equal to one and one half times the length of the lower flagellum. It consists of five stout proximal segments and five slender distal segments. The proximal segments bear eleven groups of sensory setae. There is no trace of a second flagellum.

The scaphocerite has a very robust antero-lateral spine which greatly exceeds the lamella and reaches anteriorly to the level of the tip of the rostrum. The lamella is much reduced, equal in length to two thirds of the lateral border of the scaphocerite, and reaches the level of the anterior end of the carpocerite. The carpocerite is cylindrical and half the length of the

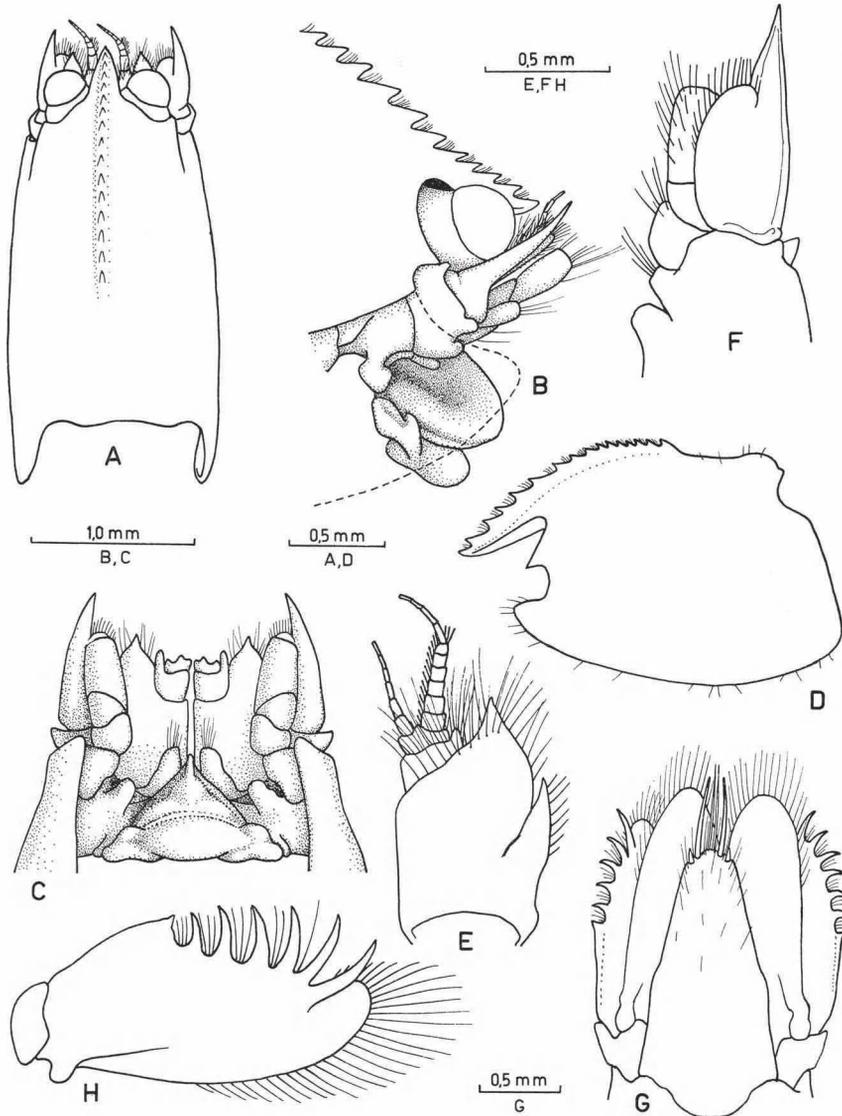


Fig. 2. *Anapontonia denticauda* Bruce. A-C, E, F, paratype female from Bawi Island; D, paratype male from Fumba; G, H, holotype female. A, dorsal view of carapace and antennae; B, lateral view of anterior end of carapace with anterolateral angle of branchiostegite removed; C, ventral view of antennal peduncles and epistomial region; D, lateral view of carapace; E, antennule; F, antennal peduncle; G, telson and uropods, dorsal view; H, exopod of right uropod, lateral view.

lateral border of the stylocerite. The basicerite is unarmed but the ventro-lateral angle is slightly produced. The antennal flagellum is reduced and slender and about three times the carpocerite in length.

The epistome is unusually large for a pontoniid shrimp and extends anteriorly to the level of the anterior margin of the cornea. It consists of a dorsal portion with a sharp, curved, anterior laminar edge and a transverse ventral portion with a transverse groove separating the two parts.

The mandibles lack palps. The molar processes are robust and asymmetrical with sharp cutting edges and teeth but no setae, see fig. 3B, C. The incisor processes are reduced and have two small teeth distally. The margin between these teeth and the molar process is sharp. The maxillula has a well developed bifid palp. The upper lacinia is slender and bears three stout spines distally. The lower lacinia is broader and tapering and bears several long setae distally and a few short ones along its anterior border. The maxilla lacks an endite. The palp is well developed, slender and non-setose. The scaphognathite is also well developed, narrow and elongated posteriorly. A small, rigid lobe is present at the base of its medial border. The first maxilliped has a short non-setose palp. A distinct notch separates the endites of coxa and basis which bear numerous long setae along their medial edges. The exopod is reduced and bears only four very short setae distally. A well developed, broad, rounded caridean lobe is present. A large simple epipod is also present. The second maxilliped is normal in shape and provided with numerous robust spines and setae along the medial border of its terminal and penultimate segment. The exopod is short and provided with rudimentary setae. The epipod is absent. The third maxilliped exceeds the carpocerite by the length of the terminal segment. The antepenultimate segment is broad and straight and three times longer than its maximum width. It is provided with a dense fringe of short setae along the proximal two thirds of its medial border and numerous long setae around its distal end. The penultimate segment is a little less than half the antepenultimate segment in length and twice as long as wide; it bears numerous long setae on medial and lateral margins. The terminal segment is four fifths of the antepenultimate segment in length, and three times longer than wide. It tapers distally and bears many long setae especially medially and distally. A rigid scale-like exopod is present, three quarters of the antepenultimate segment in length. It is expanded in its proximal half and the distal half tapers to a point bearing four reduced setae. A small epipod is present and there is a rudimentary arthrobranch.

The first pereopods are robust and exceed the antero-lateral angle of the carapace by the length of carpus and chela. The fingers are pointed with

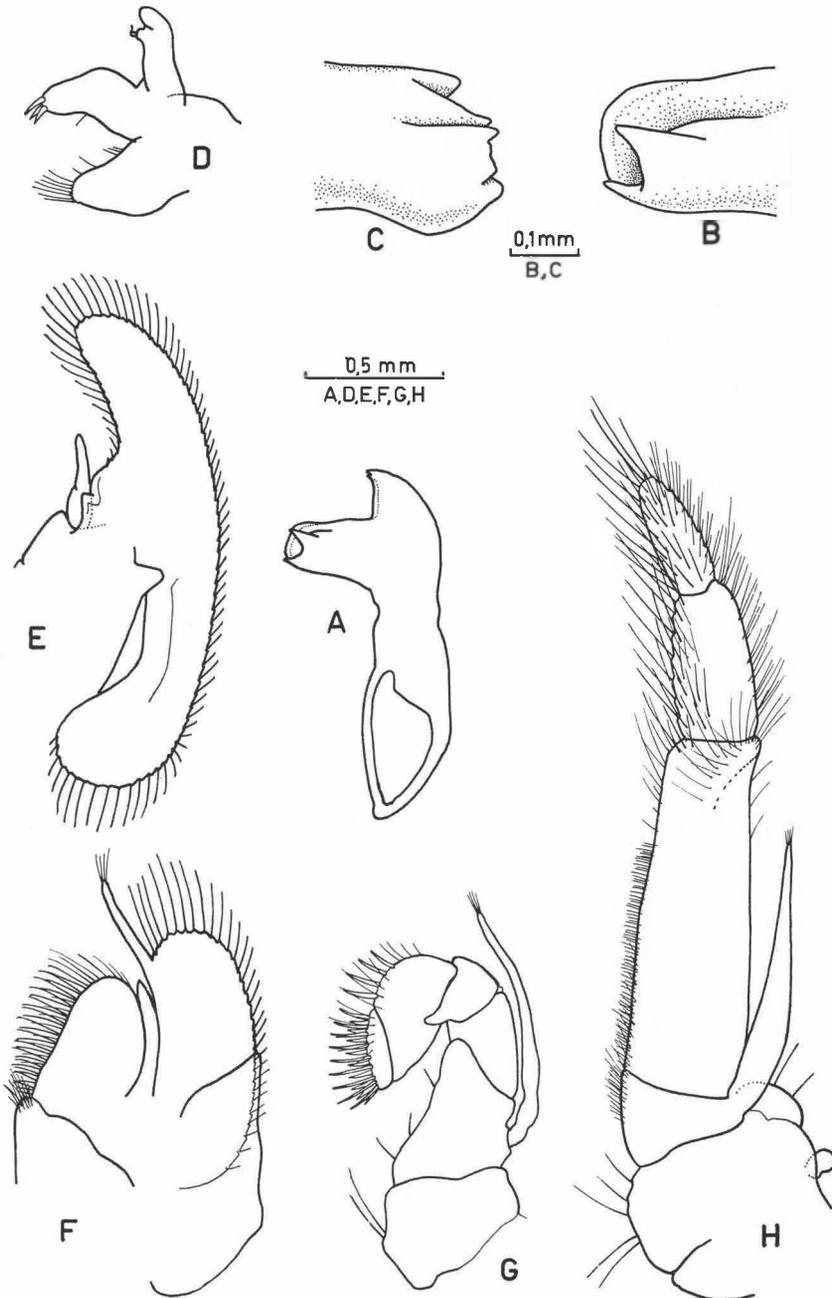


Fig. 3. *Anapontonia denticauda* Bruce, paratype female from Bawi Island. A, mandible; B, molar process, right mandible; C, molar process, left mandible; D, maxillula; E, maxilla; F, first maxilliped; G, second maxilliped; H, third maxilliped.

entire cutting edges and are half the palm in length. The palm is cylindrical. The carpus is one and one third times the length of the chela. Its length is four times its width at the distal end. Its width at the proximal end is half that at the distal end. The merus is slightly longer than the length of the carpus and is similarly unarmed. The ischium is four fifths of the length of the merus. Merus and ischium are both provided with numerous setae. The second pereiopods are small and robust. They are similar in shape but the left is slightly larger than the right. They exceed the level of the distal end of the carpoperite by the whole of the carpus and chela. The palm of the chela is cylindrical and one and a half times the length of the fingers. The fingers are robust with sharp cutting edges and slightly hooked tips. The free finger bears two blunt teeth on the distal half of its cutting edge and the fixed finger three small teeth on its middle third. The first and third of these teeth are acute while the second is blunt. The palm bears numerous setae and the fingers are markedly setose. The carpus is about four fifths of the length of the palm, twice as wide distally as proximally and unarmed although the disto-ventral angle is produced slightly as a blunt angle. The merus is slightly longer than the carpus and is also unarmed, with the disto-ventral angle produced as a blunt lobe. The ischium is subequal to the carpus in length. The third to fifth pereiopods are robust and decrease in length posteriorly. The third pereiopod exceeds the level of the distal end of the carpoperite by the whole of the dactylus and propodus. All segments lack spines but bear numerous slender setae. The dactyli are simple and strongly curved with a distinct unguis. A slight basal protuberance is present, which retracts into the propodus on flexion. The maximum length of the dactylus is about one third of the length of the propodus. The propodus is about five times longer than wide and slightly curved. The carpus is two thirds of the length of the propodus in the first pereiopod and the merus is subequal to the propodus. It is unarmed. The ischium is three quarters of the length of the merus. The propodus of the third pereiopod is subequal to the carpus of the first pereiopod. The propodi of the third to fifth pereiopods are in the ratio of 45: 41: 38, and the meri 46: 42: 40.

The thoracic sternites are narrow and unarmed.

The endopod and exopods of the second to fifth pleopods are long and slender and provided with appendices internae. The exopod of the first pleopod is similar but the endopod is shorter, about half the length of the exopod, curved externally behind the exopod, and lacking an appendix interna. The endopod of the uropod exceeds the tip of the telson by slightly more than one quarter of the telson length. It is broad with a rounded posterior end. The exopod is shorter than the endopod by one eleventh

of the telson length. The distal half of the lateral border is provided with strong, fixed spines which increase in size and length distally. Five spines are present on the right and six on the left. The proximal half of the lateral border is sharply carinate and ends distally in an acute point. Numerous setae are present along the lateral border and between the spines. The terminal portion of the lamella is reduced and rounded and fringed with setae.

Measurements (in mm). — Post-orbital carapace length, 2.65 ; total length of carapace and rostrum, 3.68; length of fifth abdominal segment, 0.53; length of sixth abdominal segment, 1.00; telson length, 1.65; maximum telson width, 0.64; chela of left second pereopod, 2.60; chela of right second pereopod, 2.50; propodus of third pereopod, 0.70; propodus of fourth pereopod, 0.62; propodus of fifth pereopod, 0.57; diameter of ova, 0.60.

The allotype male is similar to the holotype but distinctly smaller. There are fourteen teeth on the dorsal series and a space equivalent to a single tooth is present proximally to the tip of the rostrum. The first pleopod has a narrow endopod with a terminal plumose seta, two similar medial and three similar lateral setae all situated on the distal third. There are also three shorter non-plumose setae on the medial border. The second pleopod has an appendix interna and appendix masculina. The appendix masculina is one and one half times the length of the appendix interna and half the length of the endopod. It bears two long smooth terminal spines equal to about four fifths of its own length. Three similar long spines are present on the distal third laterally and three, decreasing in length proximally, are present on the medial side. The exopod of the uropod bears five spines on each side of the outer border.

The other specimens examined showed few differences. The male from Bawi and the female from Fumba each had seven spines on the exopod of the uropod. The smallest juveniles from Pange had three on each side while the larger juvenile had four. The female from the Comores had six on each side. The number of teeth on the rostrum and dorsum of the carapace also showed some variation. The holotype had the maximum number of seventeen and the allotype had the smallest number for an adult specimen, fourteen only. The female from the Comores had fifteen and that from Fumba, sixteen. The juveniles had fewer teeth, the two smaller having twelve and the larger, fourteen.

The largest specimen examined is the female from Bawi Island, which has a post-orbital carapace length of 3.2 mm.

Types. — The holotype, the adult female from Pange Reef, Zanzibar, intact, has been deposited in the British Museum (Natural History) (Reg. No. 1965. V. 26.1). A paratype, also from Pange Reef, has been deposited in the Rijksmuseum van Natuurlijke Historie, Leiden (Reg. No. Crust. D.

21238) and the specimen from the Comores in the U.S. National Museum, Smithsonian Institution, Washington, D.C.

Colour. — The colour of the female from Pange was noted as follows. Eyes and ophthalmic somite, rostrum and anterior dorsal part of carapace, white; median postero-dorsal region of carapace transparent; intermediate lateral aspect white and the ventral lateral aspects finely dotted with red. Dorsal half of abdomen white; pleura transparent with fine red spots; caudal fan transparent. Antennae transparent, also first pereiopod. Second pereiopod with patches of light greenish yellow on a transparent background

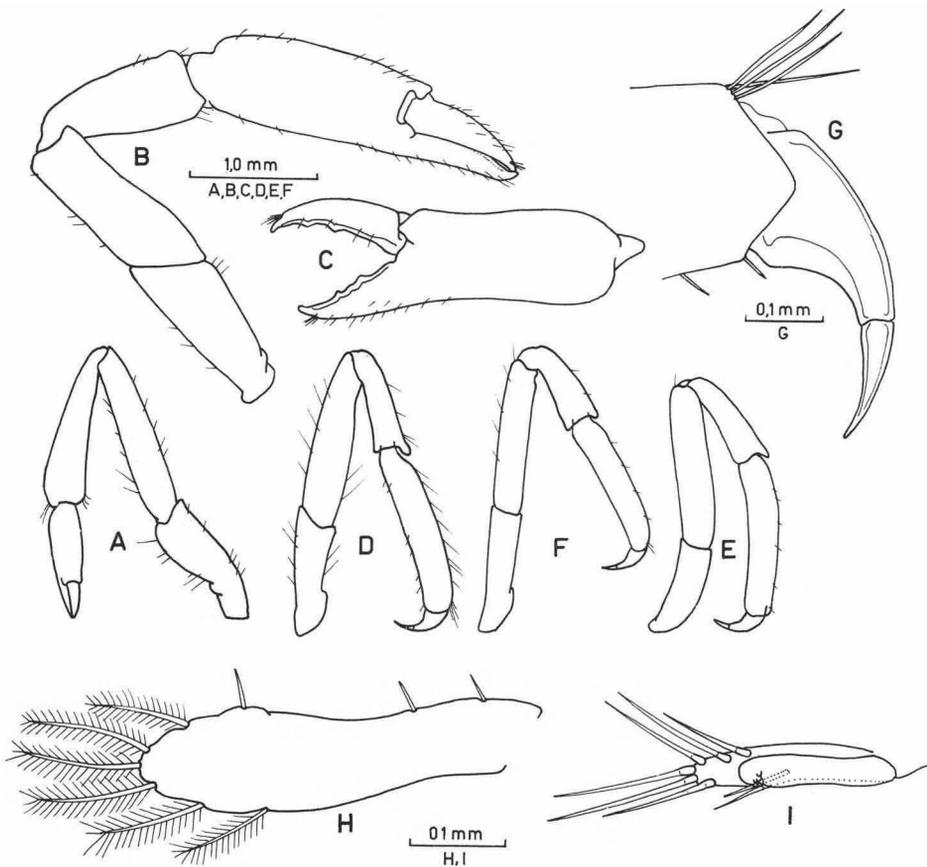


Fig. 4. *Anapontonia denticauda* Bruce. A-G, paratype female from Bawi Island; H, I, paratype male from Fumba. A, first pereiopod; B, second pereiopod; C, chela of second pereiopod; D, third pereiopod; E, fourth pereiopod; F, fifth pereiopod; G, dactylus of third pereiopod; H, endopod of first pleopod of male; I, appendix interna and appendix masculina of second pleopod of male.

on carpus, merus and ischium. Che lae with light preenish-yellow fingers and dorsal and ventral borders so that seen dorsally it appears greenish-yellow with a transparent centre to the palm. Third to fifth pereopods with dactylus, propodus and carpus light yellow-green. Peduncle of pleopods and the margins of the rami also light greenish-yellow. The juveniles from Pange were similar to the female except that all appendages were transparent except for the bases of third to fifth pereopods which were heavily spotted with red. The pleura of the abdominal segments were mainly transparent but also spotted with red especially posteriorly. The lower half of the branchiostegite was greenish-yellow.

The specimen from the Comores was generally similar to the Pange juvenile except that the lower half of the branchiostegite was colourless. The white of the carapace was marked along the dorsal midline and along the sides of the carapace at the level of the inferior orbital angle and it also extended along the lateral aspect of the antennal scale. The base of the fingers of the second pereopod and the outer aspect of the palm are also white. The first pereopod and the merus and ischium of the second to fifth pereopods are pale yellow.

Ecological data. — All specimens were obtained from the oculinid coral *Galaxea fascicularis* (L.). This host is abundant in the western Indian Ocean just below low water spring tide level in suitable localities. Colonies vary in size from 3 to 4 inches in diameter to more than one foot. Small colonies appear to contain only a pair of shrimps. The only occasion when a colony provided more than a pair was at Pange when a particularly large colony was examined and three juveniles were also found to be present. In the case of the Comores specimen, the male was probably left in a part of the colony that was incompletely removed.

The shrimps appear to be naturally rare. During the period 1959 to 1962 a large number of colonies of *Galaxea fascicularis* were examined and only nine specimens were obtained. Further colonies were examined in 1964 over a wide area of the western Indian Ocean but only a single further specimen was obtained.

Anapontonia denticauda may also be found in the same colonies as the pontoniid *Platycaris latirostris* Holthuis and the alpheid *Racilius compressus* Paulson. *Platycaris* attaches itself to the columnar corallites and is sluggish. *Anapontonia* is also sluggish and is found at the base of the columns. In one case the specimen was found in a small atypical hollow in the transverse septum of the coral and in another the specimen was in a depression below the level of the transverse septum. It appears possible that the growth of the coral may result in the shrimp becoming enclosed in a cavity.

Discussion. — In its general features the new genus closely resembles the genus *Philarius* Holthuis, 1952, which is also associated with corals. The two genera have the following major features in common: a compressed toothed rostrum reaching beyond the eyes; absence of hepatic spines; rounded first to fifth abdominal pleura; absence of mandibular palp; presence of exopod on third maxilliped; well developed scaphocerite with disto-lateral spine exceeding lamella; symmetrical first pereopods with unsegmented carpi; subequal similar second pereopods with cylindrical palms and simple strongly curved dactyli on third to fifth pereopods.

The differences between the two genera are contrasted in the following table.

<i>Philarius</i> Holthuis	<i>Anapontonia</i> gen. nov.
Body form slightly depressed.	Body strongly compressed.
Well developed antennal spine close to inferior orbital angle.	Antennal spine absent.
Two pairs of dorsal spines on telson.	No dorsal spines on telson.
Incisor process of mandible well developed.	Incisor process of mandible reduced.
Well developed simple endite present on maxilla.	No endite present on maxilla.
Epipod present on second maxilliped.	No epipod on second maxilliped.
Well developed exopods on all maxillipeds.	Exopods reduced on all maxillipeds.
No arthrobranch at base of third maxilliped.	Rudimentary arthrobranch present at base of third maxilliped.
Lateral aspect of exopod of uropod feebly armed.	Lateral aspect of exopod of uropod strongly armed with a series of strong fixed, curved spines.

The caudal fan in *Anapontonia denticauda* is unique in the Pontoniinae, the presence of two pairs of dorsal spines on the telson being almost universal in this subfamily. Although in other genera, such as *Typton* Costa (*T. serratus* Holthuis, 1951, and *T. prionurus* Holthuis, 1951) and *Periclimenaeus* Borradaile (*P. uropodialis* Barnard, 1958) the distal part of the lateral border of the exopod of the uropod may be strongly serrated, and in *P. truncatus* (Rathbun) bears a series of posteriorly directed, mobile spines (Holthuis, 1952), the presence of a series of large, fixed strongly curved spines has not been previously reported.

The scaphocerite is unusual in form and resembles that of *Onycocaris* Nobili (cf. Holthuis, 1952) but reduction of the antenna has proceeded much further than in that genus.

IV. MESOPONTONIA GORGONIOPHILA GEN. NOV., SP. NOV., FROM THE
SOUTH CHINA SEA

In the course of the survey of the northern South China Sea at present being carried out by the R.V. "Cape St. Mary" of the Fisheries Research Station, Hong Kong, a number of small shrimps were obtained at two stations, in each case on a gorgonian. Although showing a superficial resemblance to some species of the genus *Periclimenes* Costa, the absence of an exopod on the third maxilliped in these specimens excluded the possibility of their belonging to that genus. Subsequent examination showed that they could be referred to none of the present genera of the Pontoniinae and a new genus is now erected for their inclusion.

Mesopontonia gen. nov.

Small commensal pontoniid shrimps associated with gorgonians. Body normal in shape. Well developed toothed rostrum. Carapace smooth, lacking supra-orbital and antennal spines. Abdomen smooth with rounded pleura. Telson elongate, with three pairs of terminal spines and two pairs of dorsal spines. Eyes well developed with globular cornea. Basal segment of antennular peduncle broad with well developed stylocerite and antero-lateral spine. Two distal segments short. Upper antennular flagellum with short median and long lateral rami, fused at their bases. Scaphocerite broad, with strong antero-lateral tooth which is exceeded by the lamella. Mandible without palp, molar process slender, with processes and bristles; incisor process slender with 3 or 4 teeth. Maxillula with bilobed palp. Maxilla with well developed palp and bilobed endite. First maxilliped with setose palp, well developed exopod with caridean lobe and a bilobed epipod. Second maxilliped with well developed exopod and a simple epipod. Third maxilliped lacking exopod but with epipod and a small arthrobranch. First pereopods rather robust and short. Second pereopods long, slender and asymmetrical. Last three pereopods slender, dactyli curved and biunguiculate. No median ventral process on fourth thoracic sternite. Endopod of first pleopod in male, oval with setose disto-lateral border. Appendix masculina with long terminal and disto-medial setae. Uropods normal.

Type species: *Mesopontonia gorgoniophila* sp. nov.

Mesopontonia gorgoniophila sp. nov. (fig. 5-9)

Material examined. — 21° 47.7' N 116° 28.5' E to 21° 43.3' N 116° 28.0' E; 64-72 fms; Granton Trawl; coarse sand bottom; 10 January 1964. R.V. "Cape St. Mary", Cr. 1/64, Stn. 49, Trawl T./142. Hydrographic Stn. No. 48. — 18 specimens, including 11 ovigerous females.

21° 42.0' N 116° 30.0' E to 21° 29.0' N 116° 30.0' E; 76-100 fms; Granton Trawl; coarse sand bottom; 24 August 1964. R.V. "Cape St. Mary" Cr. 4/64, Stn. 143, Trawl T./227. Hydrographic Stn. No. 142. — 43 specimens, including 15 ovigerous females.

Description. — The rostrum is shallow and directed straight forwards. It is slightly sinuous and extends anteriorly a little beyond the distal end of the antennular peduncle. The rostrum is subequal to the post-orbital carapace length. It does not exceed the anterior margin of the scaphocerite. The first two teeth are situated on the carapace and are mobile. They are separated by a gap twice as large as that occurring between the second and third teeth. The teeth distal to the fourth tooth are situated at increasing intervals along the dorsal margin of the rostrum. The number of rostral teeth varies slightly but the majority of specimens have 8 dorsal and 2 ventral teeth. In these,

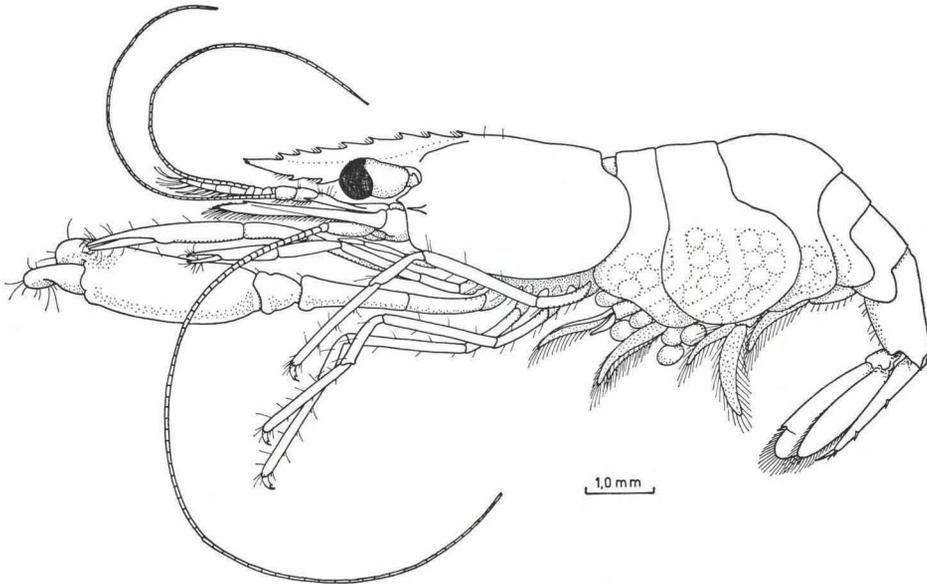


Fig. 5. *Mesopontonia gorgoniophila* gen. nov., sp. nov., female in lateral view.

the tip of the rostrum is bare but in those specimens with 9 dorsal teeth the additional tooth is usually small and subapical. In the 49 specimens with intact rostra the distribution of dorsal and ventral spines was as follows: 10/1 (1 sp.), 9/3 (4 sp.), 9/2 (13 sp.), 8/3 (2 sp.), 8/2 (19 sp.), 8/1 (1 sp.), 7/2 (3 sp.), 7/1 (1 sp.). The ventral teeth are situated on the distal half of rostrum and are smaller in size than the main rostral series, of which the third and fourth are usually slightly larger than those anteriorly or posteriorly. The proximal half of the ventral margin of the rostrum is slightly concave. The rostrum lacks a distinct midrib.

The carapace is smooth and has an acute inferior orbital process. There is no supra-orbital spine but a well developed hepatic spine is present ventrally and posterior to the inferior orbital process. There is no antennal spine. The antero-lateral angle of the carapace is bluntly angulated.

The abdomen has the pleura of all segments smoothly rounded. The third segment is produced posteriorly in the dorsal midline and presents a humped appearance. The sixth segment is about 1.5 times the length of the fifth and is 1.6 times longer than wide. The telson is 1.2 times as long as the sixth abdominal segment. It is narrow and three times longer than its basal width. The lateral margins are parallel for the anterior two fifths and convergent for the posterior three fifths. It is armed terminally with pairs of short stout lateral spines, long slender intermediate spines and submedian plumose spines whose lengths are in the ratio of 5 : 11 : 23. There are two pairs of small dorsal spines, the anterior pair being situated in front of the middle of the telson. The two pairs of spines lie at positions of 42% and 65% of the telson length, measured from the anterior end of the telson. The posterior extremity of the telson is produced into a small terminal protuberance that supports the submedian spines and also bears a minute acute apical process.

The eyes are stout, with a globular cornea that is subequal in length to the peduncle. No ocellus is discernible.

The basal segment of the antennular peduncle extends beyond the anterior margin of the cornea by about a quarter of its length. It has an acute slender stylocerite that reaches the middle of its length. The lateral border of the segment is slightly convex and there is a strong antero-lateral spine present that extends anteriorly to the level of the middle of the intermediate segment. The anterior margin is produced forward as an acute lobe, of half the length of the antero-lateral spine, with a concave lateral margin. The intermediate segment is sub-cylindrical and, viewed dorsally, it is about a quarter of the length of the basal segment. The joint with the terminal segment is very oblique and the intermediate segment extends ventrally beneath the terminal joint, which, when viewed dorsally, appears about one and a half times the length of the intermediate segment. The intermediate and distal segments together are only equal to two thirds of the length of the basal segment. The lower flagellum is long and slender and 1.5 times the carapace length. The upper flagella are fused for 0.2 times the carapace length, the shorter ramus being 0.6 times the carapace length and the longer about five times the carapace length.

The scaphocerite extends with the antero-lateral spine beyond the end of the antennular peduncle. The lateral border is feebly concave and its distal spine is strong. The lamella terminates anteriorly in a blunt rounded angle

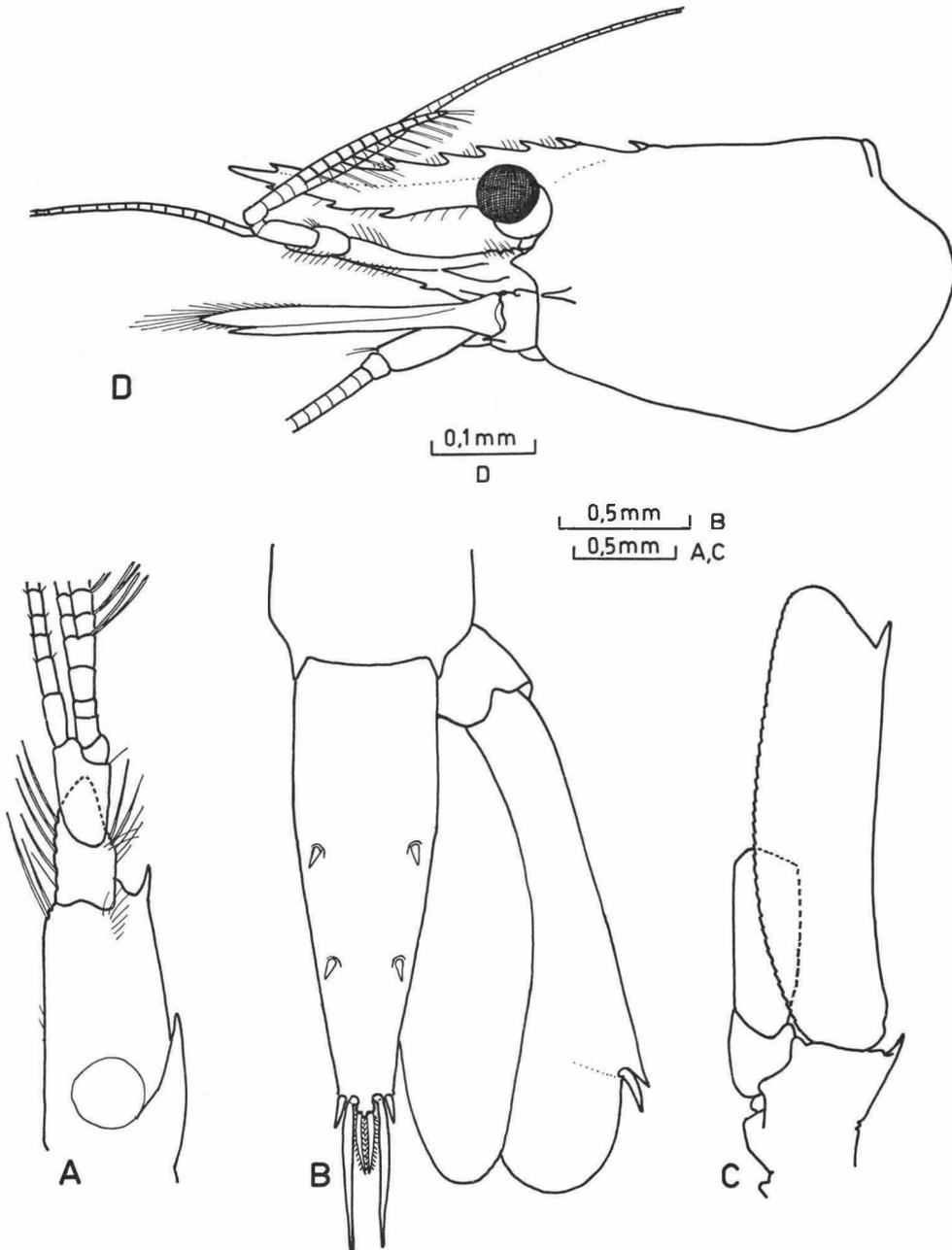


Fig. 6. *Mesopontonia gorgoniophila* gen. nov., sp. nov. A, antennular peduncle; B, telson and right uropod; C, antennal peduncle; D, carapace and antennae.

which extends well beyond the antero-lateral spine. The scaphocerite is 3.6 times longer than its maximum width, which lies near the middle of its length. The carpoperite extends anteriorly almost to the level of the anterior end of the basal antennular segment.

The mandibles lack palps. The incisor processes are well developed and have three teeth on the left side and four on the right. The outer teeth are larger than the inner. The molar processes are also well developed and are asymmetrical. The arrangement of teeth and bristles is shown in fig. 7 C, D. The maxillula has a bilobed palp. The median process appears segmented distally and bears a single short seta. The lateral lobe is rounded. The upper lacinia is robust and bears short spines distally and some longer setae along its lower border. The lower lacinia is tapering and bears numerous long setae along the distal and lower borders and a few along its upper border. The endite of the maxilla is divided for a quarter of its length, each portion bearing a tuft of setae distally. The palp is short and blunt and the scaphognathite is well developed. The first maxilliped has a well developed exopodite with a distinct caridean lobe. The coxal and basal endites are fused. The palp is normal in shape, blunt distally and bears a single plumose seta subterminally on its medial border. The epipod is bilobed. The second maxilliped is of typical pontoniid shape. The exopod is well developed and a simple epipod is present without a podobranch. The third maxilliped extends to just beyond the distal margin of the basal segment of the antennal peduncle. The distal segment is slightly more than half the penultimate segment in length. There is no exopod but a simple epipod is present and also a small arthrobranch.

The first pereopod extends beyond the scaphocerite by the length of the fingers. The fingers are half the length of the palm and are very slender and tapering. The cutting edges are simple. The chela is 1.2 times the length of the carpus and the same length as the merus. The ischium is nearly half the length of the merus. A short setiferous process is present medially on the basis. The second pereopods are markedly asymmetrical. The larger pereopod is robust and smooth and the distal border of the carpus extends to the level of the end of the antennular peduncle. The palm is about three times the length of the fingers, which are curved inwards in relation to the axis of the chela, the dactylus being situated ventrally. The ventral edge of the dactylus bears a longitudinal carina along its distal two thirds and a well marked hooked distal tooth. The cutting edge bears a single tooth at the distal end of the proximal third. This tooth opposes the gap between two teeth situated in a similar position on the cutting edge of the fixed finger which also bears a robust hooked distal tooth. The cutting edges of the fingers

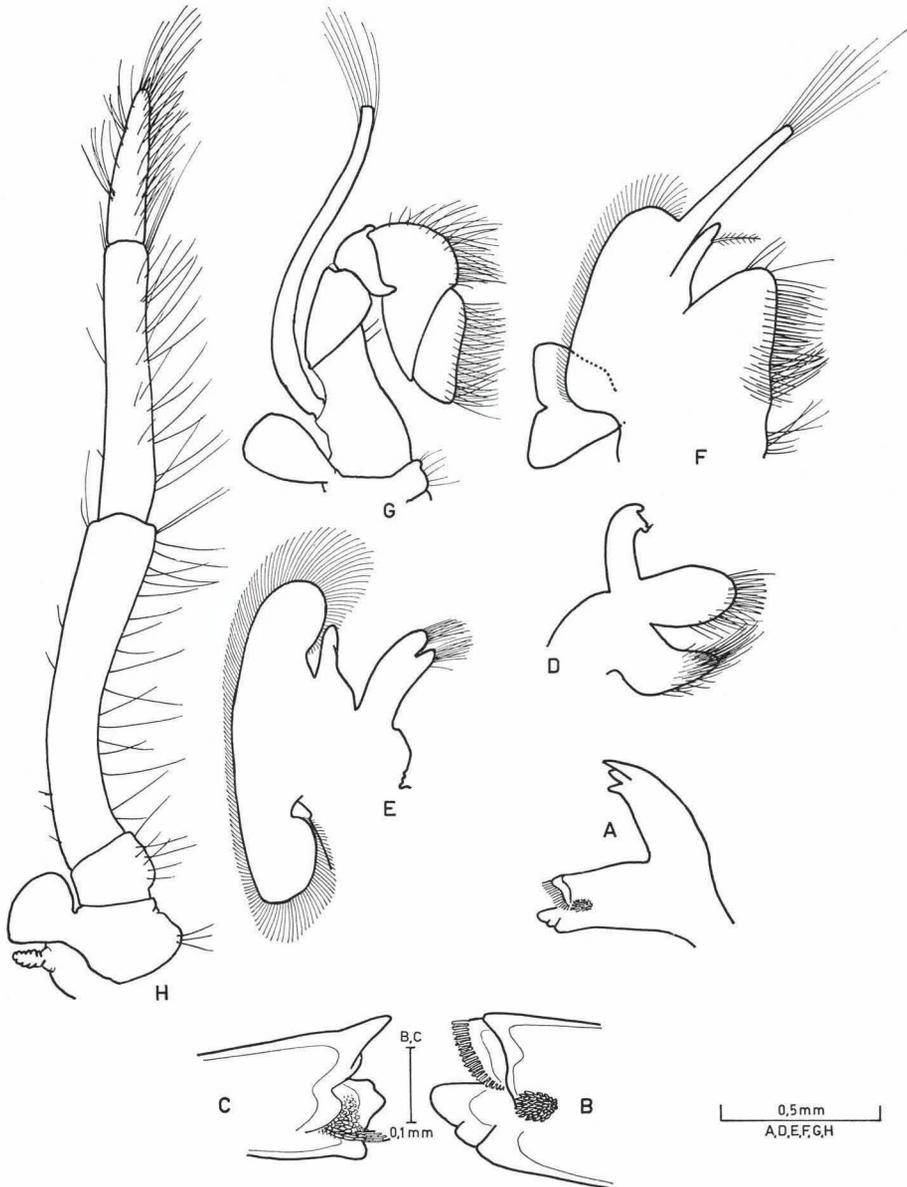


Fig. 7. *Mesopontonia gorgoniophila* gen. nov., sp. nov. A, mandible; B, right molar process; C, left molar process; D, maxillula; E, maxilla; F, first maxilliped; G, second maxilliped; H, third maxilliped.

are separated by notches from the terminal teeth. The palm is subcircular in section and slightly wider basally than distally. The fingers are convex over their outer aspects and compressed over their inner portions. The palm is about five times the length of the carpus which is twice as wide distally as near its base. The merus is two and a third times the length of the carpus and about half the length of the palm. The ischium is five sixths of the length of the merus. All the segments are unarmed. The smaller second pereopod is shorter and more slender. It reaches beyond the scaphocerite by the whole of the chela. The fingers are similar and about two thirds of the length of the palm, which is sub-cylindrical. The fingers have unarmed cutting edges and strongly hooked tips. The carpus is 0.8 times the length of the palm and is twice as broad distally as proximally. The merus is one and a half times the length of the carpus and 1.1 times the length of the ischium. All segments are unarmed. The third pereopod extends beyond the scaphocerite by two fifths of the propodus. The dactylus is biunguiculate and the accessory spine is about half the length of the main spine. Its length is about three times its width at its base and it is one seventh of the length of the propodus. At the base of the accessory spine there arises a pair of short setae on each side. The propodus is 24 times as long as wide and bears a pair of short stout spines at its disto-ventral end and four single spines along its ventral border. The carpus is half the length of the propodus. The merus is eight ninths of the length of the propodus and the ischium nearly half the length of the merus. Carpus, merus and ischium are all unarmed. The fourth and fifth pereopods are similar but increase slightly in length posteriorly. The propodi are in the ratio of 84 : 85 : 90 from third to fifth legs. The ventral spinulation also varies, the fourth has ventrally two pairs of spines and three single spines while the fifth has a single distal spine, a subterminal pair and three single spines. The distal end of the propodus of the fifth pereopod is also provided with numerous long setose bristles and plumose setae. The dactyli of the fourth and fifth pereopods are similar to those of the third except that they increase slightly in length posteriorly.

The sternite of the third maxilliped is unarmed. A pair of small triangular processes are present immediately posteriorly to the first pereopods and a pair of large triangular processes, separated by a narrow vertical fissure, are present posterior to the second pereopods.

The pleopods of the female are typical of the genus. They are biramous on the second to fifth abdominal segments with well developed appendices internae. The first pleopod has a reduced endopod bearing numerous long setae. In the male the first pleopod bears a reduced endopod in the form of a simple lobe with four short setae on the distal half of the external margin

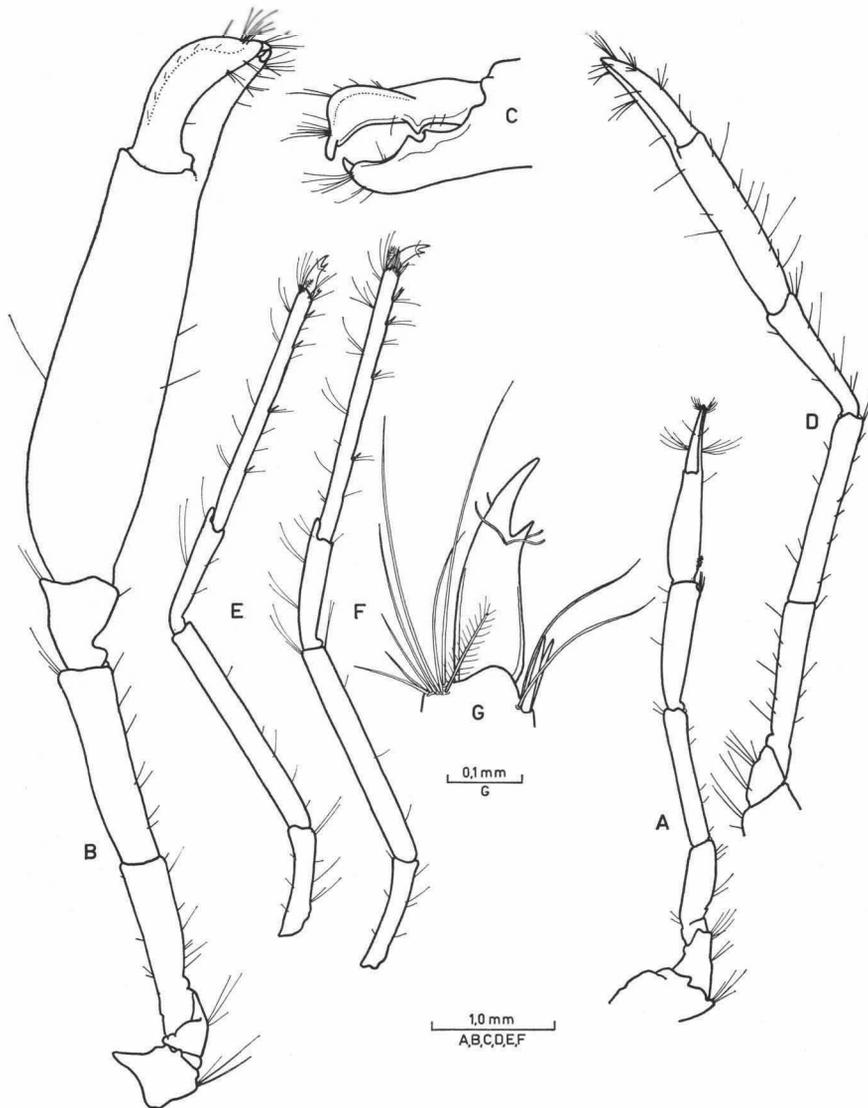


Fig. 8. *Mesopontonia gorgoniophila* gen. nov., sp. nov. A, first pereiopod; B, larger second pereiopod, medial aspect; C, fingers of chela of larger second pereiopod, lateral aspect; D, smaller second pereiopod; E, third pereiopod; F, fifth pereiopod; G, dactylus of third pereiopod.

and a seta and two small spines on the basal half of the inner margin. The second pleopod has both rami well developed and the inner ramus bears an appendix masculina and an appendix interna. The former bears two long simple setae and a shorter setose bristle terminally. Its medial border bears three spines distally which decrease in size proximally. A small curved bristle is also present subterminally. The appendix interna is one and a half times the length of the appendix masculina. The uropods are of normal type. The exopod has a straight setose lateral border terminating in a small acute tooth with a longer mobile spine immediately adjacent. The endopod is narrower and slightly shorter than the exopod. Both are distinctly longer than the telson.

Colour. — The shrimps were transparent, without any striking colour pattern when freshly collected from pink and dark red hosts.

Size. — The largest specimen obtained from the first station listed was an ovigerous female with a post-orbital carapace length of 3.5 mm.

Type. — A specimen from Cr. 1/64, Stn. 49, has been selected as holotype. It has been deposited at the British Museum (Natural History) (Reg. No. 1965. V. 21. 3) together with further paratypes (Reg. No. 1965. V. 21. 4-6). Other paratypes have been deposited at the Rijksmuseum van Natuurlijke Historie, Leiden (Reg. No. Crust. D. 21217).

Host. — The specimens from Cr. 1/64, Stn. 49 were obtained on a bushy gorgonian *Melithea* ? *albitincta* Ridley and those from Cr. 4/64, Stn. 143, from a fan-shaped gorgonian, *Acabaria frondosa* (Brundin).

Ecological data. — The bottom water samples taken at the same stations yielded the following values:

Hydrographic Station	Temperature	Salinity	Oxygen
48	22.00° C	34.56%	4.30 ml/l., (88% satd.)
142	17.74° C	34.58%	5.70 ml/l., (113% satd.)

The specimens obtained from *Melithea* were found in association with nine specimens of an undescribed species of *Periclimenes* and numerous galatheids.

Discussion. — Although of typical pontoniid appearance and closely resembling some species of *Periclimenes* Costa in their general morphology, the genus *Mesopontonia* is at once separated from the majority of the genera of the Pontoniinae by the lack of an exopod on the third maxilliped. Out of twenty five genera that have been previously reported from the Indo-West-Pacific region only the following four, *Hamodactylus* Holthuis, *Anchistioides* Paulson, *Pontonides* Borradaile and *Paratypton* Balss, lack an exopod on the third maxilliped (Holthuis, 1952). Six other genera, *Waldola* Holthuis,

Neopontonides Holthuis, *Veleronia* Holthuis, *Balssia* Kemp, *Coutiereia* Nobili and *Pseudocoutiereia* Holthuis, occurring outside the Indo-West-Pacific region are also known, in which the exopod of the third maxilliped is missing (Holthuis, 1951).

Amongst the Indo-West-Pacific genera, the new genus shows most resemblance to *Anchistioides*, as it possesses a well developed exopod on the second maxilliped and a strongly toothed rostrum. It is, however, easily distinguished by the absence of an antennal spine, the presence of an endite on the maxilla, the normal development of the exopod on the first maxilliped, the absence of an appendix interna from the first male pleopod and the normal pontoninid complement of terminal spines on the telson.

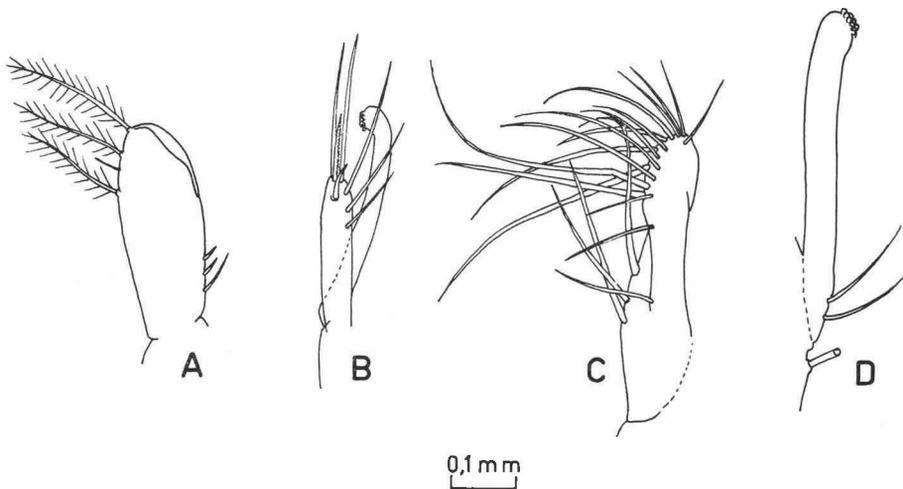


Fig. 9. *Mesopontonia gorgoniophila* gen. nov., sp. nov. A, endopod of male first pleopod; B, appendix masculina and appendix interna; C, endopod of female first pleopod; D, appendix interna of female second pleopod.

Mesopontonia appears to be more closely related to the Eastern Pacific genus *Waldola* which has been reported only from the west coast of America from Mexico to Colombia (Holthuis, 1952). It shares the following characteristics with *Waldola*: presence of a well developed toothed rostrum and scaphocerite, presence of a hepatic and absence of an antennal spine, absence of a mandibular palp, absence of an exopod from the third maxilliped and well developed strongly asymmetrical second pereiopods. *Mesopontonia* may be easily separated from *Waldola* by a number of differences, the most important being the presence of a well developed exopod on the second maxilliped. Other differences are the possession of a bifid endite on the

maxilla, which is simple in *Waldola*; biunguiculate dactyli on third to fifth pereopods, which are simple in *Waldola*, and the presence of an arthrobranch on the third maxilliped, which is lacking in *Waldola*.

The related genera may conveniently be separated from *Mesopontonia* by the following key to the genera of Pontoniinae lacking a mandibular palp and without an exopod on the third maxilliped, based on Holthuis (1952):

1. Scaphocerite normally developed 2
- Scaphocerite greatly reduced *Paratypton*
2. Pleura of first five abdominal segments broadly rounded or bluntly pointed 3
- Pleura of at least fourth and fifth abdominal segments produced to a distinct sharp point *Balssia*, *Coutierea*, *Pseudocoutierea*
3. Hepatic spine present 4
- Hepatic spine absent *Anchistioides*, *Neopontonides*, *Pontonides*, *Veleronia*
4. Antennal spine present, dactylus of second pereopod much longer than fixed finger, hook-shaped *Hamodactylus*
- Antennal spine absent 5
5. Exopod absent from second maxilliped and arthrobranch absent from third maxilliped *Waldola*
- Exopod present on second maxilliped and arthrobranch present on third maxilliped *Mesopontonia*

Although gorgonians are abundant in the Indo-West-Pacific region there appear to be no satisfactory records of Pontoniinid shrimps being associated with them. The record of *Periclimenaeus gorgonidarum* (Balss, 1915) is based only on a single female and the host is not identified. The two specimens obtained by Kubo (1940) were also only found together with gorgonians. *Periclimenaeus* species are usually numerous in the cavities in sponges which are frequently damaged in trawl or dredge hauls with the result that the shrimps may be found free or falsely associated with other invertebrates in the catch. In the case of *Mesopontonia* there is no possibility of error because of the large numbers of specimens found in the hosts and the absence of any found free in the catches. Three genera of the Pontoniinae have been reported to be associated with gorgonians outside the Indo-West-Pacific region: *Balssia*, *Neopontonides* and *Veleronia*. It is interesting to note that they all lack exopods on the third maxillipeds and thus belong to the same group as *Mesopontonia*.

Acknowledgements. — It is a pleasure to thank Professor H. Utinomi for his identification of the gorgonian hosts.

V. METAPONTONIA FUNGIACOLA GEN. NOV., SP. NOV., FROM THE WESTERN INDIAN OCEAN

During the ninth cruise of the R.V. "Anton Bruun" in the western Indian Ocean, in 1964, as part of the U.S. Programme in Biology for the Internatio-

nal Indian Ocean Expedition, collections of Pontoniid shrimps were made at a number of island stations. In the material obtained was a single example of a small shrimp that could not be referred to any described genus of the Pontoniinae.

The specimen was obtained from a species of *Fungia* collected in the Comores. Shrimps have been reported previously on *Fungia* on the Great Barrier Reef but these have never been described (Stephenson, Stephenson, Tandy & Spender, 1931). It is not known with certainty that they belong to the Pontoniinae although this is probable. No other family of shrimps has yet been reported as associated with *Fungia*.

Metapontonia gen. nov.

Commensal pontoniid shrimps associated with corals. Body cylindrical with a short toothless rostrum. Carapace smooth with a single large post-rostral tooth. Antennal spine robust; supraorbital and hepatic spines absent. Antero-lateral angle of carapace produced anteriorly and extending antero-medially ventrally to the antennal peduncles. Abdomen smooth, with rounded pleura. Telson elongated with two pairs of lateral spines and three pairs of terminal spines. Eyes short with globular cornea. Basal segment of antennular peduncle narrow with acute stylocerite and spinose antero-lateral angle. Intermediate and distal segments short; flagella all short. Scaphocerite broad, lamella exceeding small antero-lateral spine, basicerite unarmed, flagellum short. Mandible without palp; well developed toothed incisor process; molar process slender, terminating in an acute tooth. Maxillula with well developed bifid palp and upper lacinia; lower lacinia truncate. Maxilla with well developed palp, narrow scaphognathite and reduced truncated non-setose endite. First maxilliped with short palp, a reduced exopod with a well developed caridean lobe and a bilobed epipod. Second maxilliped with a short exopod and lacking an epipod. Third maxilliped with antepenultimate segment broad and concave; exopod rudimentary; epipod and arthrobranch absent. First pereopods slender with well developed chelae. Second pereopods with robust, similar, asymmetrical chelae. Last three pereopods stout with simple, strongly curved dactyli. Thoracic sternites unarmed. Exopod of uropod with a disto-lateral mobile spinule only.

Type species: *Metapontonia fungiacola* sp. nov.

Metapontonia fungiacola sp. nov. (fig. 10-12)

Material examined. — Pamanzi Reef, Mayotte Island, Comore Archipelago; from among 27 specimens of *Fungia* sp. (madrepore corals); depth 2 fathoms; 1964; coll. R.U. Gooding. One slightly damaged specimen, probably female, with a bopyrid parasite

in the right branchial chamber. This specimen, the holotype, is partially dissected, and has been deposited with the U.S. National Museum, Smithsonian Institution, Washington, D.C., U.S.A.

Description. — The rostrum is very short, not reaching the distal margin of the basal segment of the antennular peduncle. The eyes extend beyond the tip of the rostrum when directed forward. The dorsal margin of the rostrum is distinctly concave and the ventral margin is convex so that it is slightly up-curved. Dorsal and ventral margins are unarmed. The lamina is slightly bi-laterally compressed and oval in section without any midrib. The carapace is smooth and has a single large triangular tooth situated at the level of the posterior orbital margin. The basal length of this tooth is about a quarter of the post-orbital carapace length. The orbital margins are sharply defined and continuous with a very well developed antennal spine which is directed slightly upwards. The inferior orbital angle is a small rounded lobe situated deep to the antennal spine. Supra-orbital and hepatic spines are absent. The antero-lateral angle of the carapace is produced anteriorly as an elongated rounded lobe that extends forwards beneath the antennal peduncles to meet the corresponding lobe of the opposite side in the mid-line, thereby enclosing all the oral appendages. The posterior angle of the branchiostegite is slightly produced.

The pleura of the abdominal segments are all rounded. The pleuron of the first segment is produced anteriorly as a narrow lobe. The posterior border of the third abdominal segment is not produced dorsally. The maximum length of the sixth segment is slightly less than twice the length of the fifth and about four fifths of the length of the telson. The lateral borders of the telson are slightly convex and bear two pairs of small spines. The anterior pair is situated distinctly posteriorly to the middle of the telson at 55% of its length from the anterior margin and the posterior pair is situated at 81% of its length. The posterior margin is rounded, with a small acute median process, and bears three pairs of spines. The outer pair is short, stout and acute and similar to the dorso-lateral telson spines. The intermediate pair is robust and blunt and about twice the length of the lateral spines. The submedian spines are long and slender, about three times the length of the lateral spines, and are densely setose.

The eyestalks are short and widest basally. The cornea is globular and shorter than the eyestalk. There is no ocellus.

The basal segment of the antennular peduncle exceeds the anterior margin of the cornea by one third of its length. It is about two and one third times longer than wide and its lateral margin bears a broad, acutely pointed stylocerite that attains the level of the middle of the segment. The anterior margin

of the segment bears a sharp spine-like tooth that reaches the level of the middle of the lateral border of the intermediate segment. There is no tooth present on the median ventral aspect of the segment. The intermediate segment is short and unarmed. The distal segment is about twice the length of the intermediate and the two together are a little less than two thirds of the length of the basal segment. The antennular flagella are short, the lower flagellum having eleven segments and being subequal to the peduncle in length. The fused portion of the upper flagellum consists of three robust segments. The shorter free ramus has only a single segment and the longer has four slender segments.

The scaphocerite exceeds the antennular peduncle by a third of its length. The lamella is twice as long as wide, and extends beyond the small distolateral tooth by two-sevenths of its length. Its greatest width lies posterior to the middle of its length. The carpocerite is robust and cylindrical and is a little shorter than the lateral border of the scaphocerite. The lateral aspect of the basicerite is unarmed. The antennal flagellum is short and slender, slightly exceeding the post-orbital carapace length but not reaching the posterior margin of the carapace.

The mandible lacks a palp. The incisor process is large and laminar, its distal border bearing one greatly enlarged tooth and three smaller acute teeth. The molar process is slender and tapers to an acute tooth-like process with a small clump of bristles posteriorly. The maxillula has a well developed bifid palp. The upper lacinia is broad and has a row of stout spines with hooked tips distally. The lower lacinia is reduced and is in the form of a truncated chisel-like process, about twice as wide as long. The maxilla has the endite reduced to a broad chisel-like lobe similar to the lower lacinia of the maxillula. The palp is well developed, slender and non-setose. The scaphognathite is also well developed, narrow, and elongated posteriorly. The first maxilliped has a short non-setose palp. The endites of coxa and basis are not separated. The exopod is short with a broad, distally rounded caridean lobe. A large, feebly bilobed epipod is present. The second maxilliped is normal in shape with a well developed setose exopod, but lacks an epipod. The third maxilliped is short and broad. The ischium is strongly concave medially (slightly flattened in fig. 12G) and about five times longer than its distal breadth. The medial border bears a few slender setae along the proximal half. The penultimate segment is short and slightly longer than broad; it is about one fifth of the ischium in length. Its medial border bears a few slender setae. The distal segment is almost one and a half times the penultimate segment in length. It tapers distally and its basal width is a little less than a third of its length. Its medial border is provided with numerous

setae which are short and robust proximally, with setose edges and bearing spatulate tips with serrated edges, while distally they are long, slender and smooth. A reduced exopod, devoid of setae, and half the length of the ischium, is present but there is no epipod or arthrobranch.

The first pereiopods are long and slender. The merus extends anteriorly almost to the distal end of the antennular peduncle. The fingers are three fifths of the length of the palm and have sharp, entire cutting edges and hooked tips. They are provided with numerous setose bristles. The carpus is one and two thirds times the length of the chela and increases in width

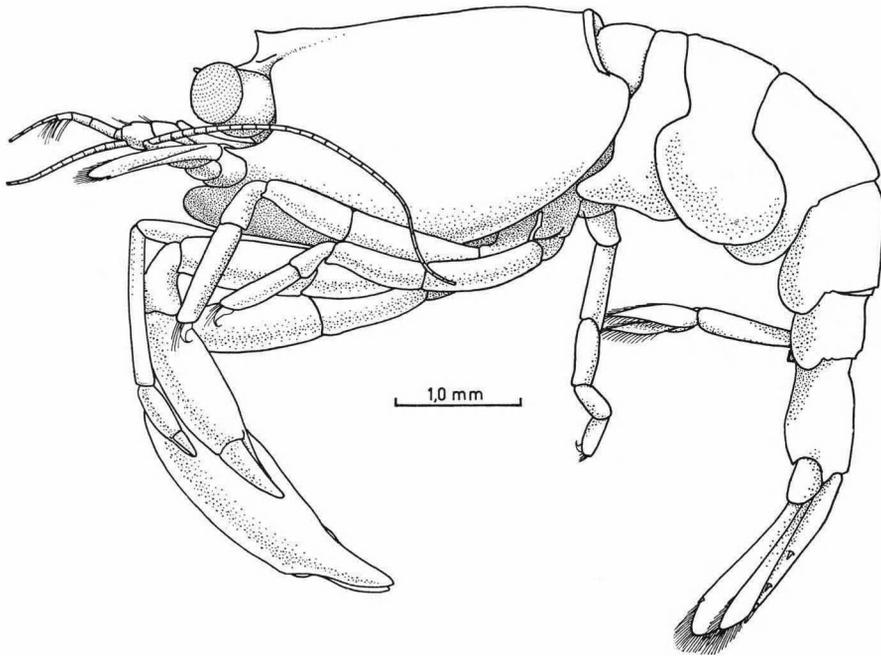


Fig. 10. *Metapontonia fungiicola* gen. nov., sp. nov., holotype.

distally. The carpus is nine tenths of the length of the merus and both segments are unarmed. Ischium and basis are subequal and are half the length of the carpus. The second pereiopods are similar and robust but are asymmetrical, the right being considerably larger than the left. They approximately exceed the antennular peduncles by the whole chelae. The fingers of the chelae are half the length of the palm, which is subcylindrical and slightly swollen in its middle portion. In the larger chela the proximal half of the cutting edge of the fixed finger bears a large very acute tooth distally and a smaller more obtuse tooth proximally. A single tooth is present on the

cutting edge of the free finger, which opposes between the two teeth on the fixed finger. The tips of the fingers are strongly hooked and the distal halves of the cutting edges are concave and gape widely when the fingers are closed. The cutting edge of the free finger is sharp but that of the fixed finger is bluntly rounded. The smaller finger is similar but the teeth are less robust. The carpus is one third of the length of the palm, twice as wide distally as proximally and unarmed. The ischium is 1.3 times the length of the merus and 1.6 times the length of the carpus. The smaller chela also has the carpus about one third of the chela in length but merus and ischium are subequal and one and one half times the length of the carpus. The third to fifth pereopods are robust and similar to each other, the third being the longest. All segments are unarmed and lack spines but a group of plumose setae is present at the distal end of the propodus of each limb. The third pereopod is the longest and exceeds the antennular peduncle by the dactylus. The dactyli of each limb are small, with a simple and strongly hooked unguis. A small basal protuberance is present but retracts into the propodus when the dactylus is flexed. The propodus of the third pereopod is four and one half times longer than wide. The propodus of the fourth pereopod is about three fifths of the length of that of the third and slightly shorter than that of the fifth. In the fifth pereopod the ratio of segments from dactylus to ischium is 5 : 32 : 18 : 28 : 32.

The anterior pleopods are missing from the specimen. The posterior pleopods have a well developed appendix on the endopod. The uropods are slender and exceed the telson by a quarter of its length. The exopod is slightly longer than the endopod and bears a single small mobile spinule at the distal end of its lateral border but lacks an acute fixed tooth.

Measurements (in mm). — Postorbital carapace length, 2.60; total length of carapace and rostrum, 3.18; length of 5th abdominal segment, 0.50; length of 6th abdominal segment, 0.97; telson length, 1.37; telson width, 0.46; lower antennular flagellum, 0.88; antennal flagellum, 2.55; major chela, 2.50; minor chela, 1.80; propodus of third pereopod, 0.85.

Colour. — Examined when recently dead, the shrimp was a dull opaque white with a few fine red spots over the pterygostomial region. The cornea was white.

Discussion. — With a cylindrical toothless rostrum, absence of a hepatic spine, rounded abdominal pleura, simple dactylus without large basal protuberance on third to fifth pereopods, well developed scaphocerite and lack of a mandibular palp, the new genus shares many characteristics with the genera *Pontoniopsis* Borradaile, *Pontonia* Latreille and *Platycaris* Holt-huis, all of which are found in the Indo-Pacific region.

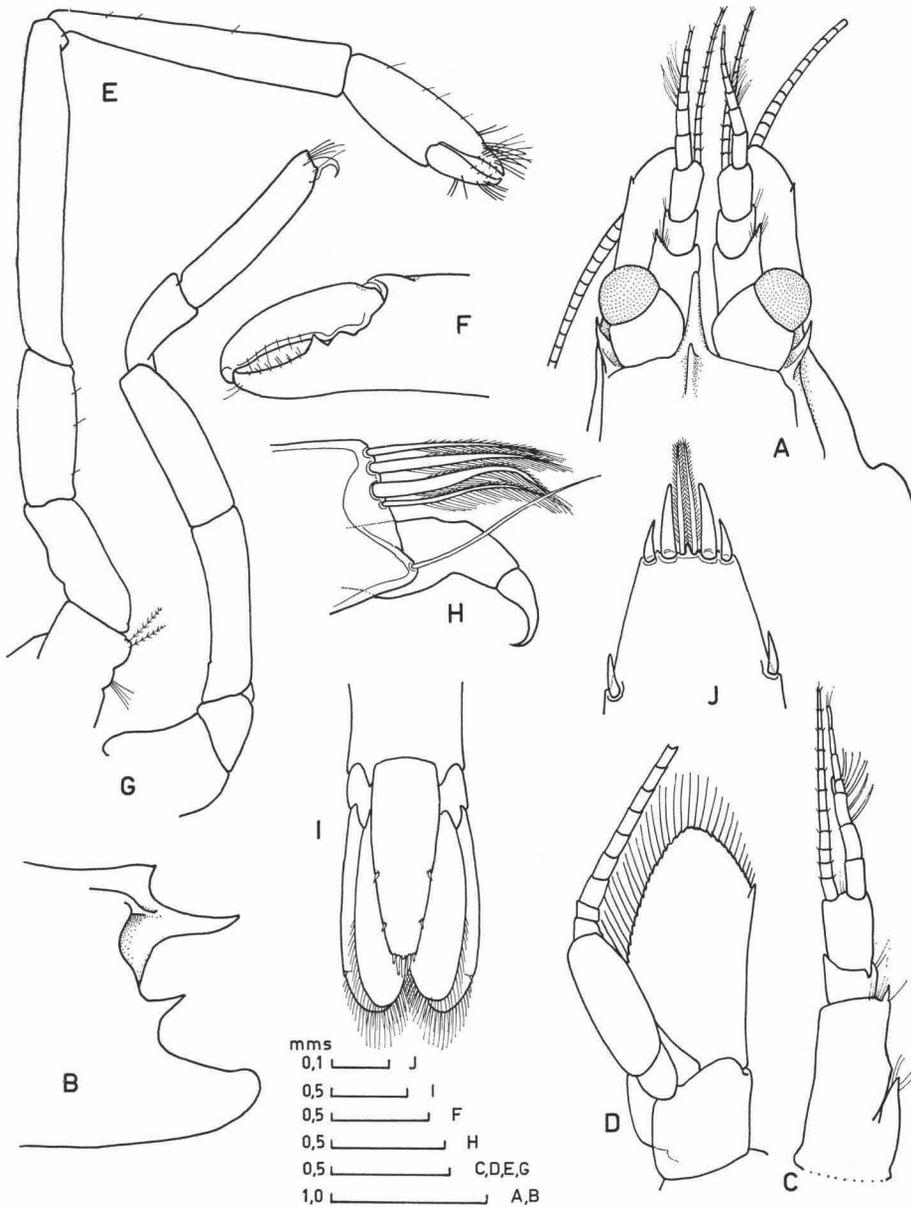


Fig. 11. *Metapontonia fungiacola* gen. nov., sp. nov., holotype. A, anterior part of body in dorsal view; B, anterior part of carapace in lateral view; C, antennule; D, antenna; E, first pereiopod; F, fingers of larger second pereiopod; G, fifth pereiopod; H, dactylus of fifth pereiopod; I, telson and uropods; J, posterior end of telson.

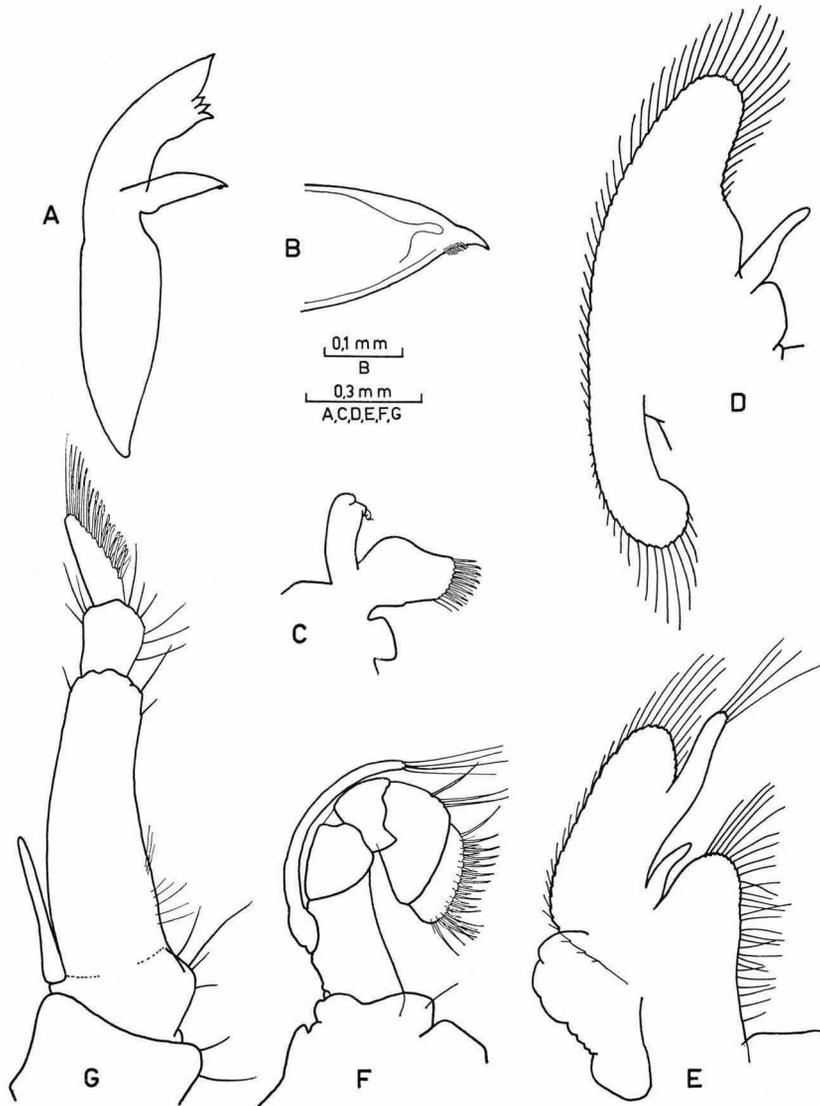


Fig. 12. *Metapontonia fungiicola* gen. nov., sp. nov., holotype. A, mandible; B, molar process of mandible; C, maxillula; D, maxilla; E, first maxilliped; F, second maxilliped; G, third maxilliped.

Of these three genera only *Platycaris* is known to be associated with corals, and is restricted to the single species *Galaxea fascicularis* (L.) (cf. Bruce, 1966a). The following characters of the genus *Platycaris* render it easily separable from *Metapontonia*: compressed body with broad rostrum; absence

of antennal spine, and anteriorly produced pterygostomial region of carapace; broad telson; well developed molar process; elongated lower lacinia to maxillula; broad scaphognathite, well developed exopods on all maxillipeds with epipods on second and third and an arthrobranch on the third maxilliped.

Although the Eastern Pacific and Atlantic species of *Pontonia* occur mainly in molluscs, most of the Indo-West Pacific species are found in tunicates (Holthuis, 1952). *Pontonia* shows less resemblance to *Metapontonia* than *Platycaris*. Characters which separate *Pontonia* from *Metapontonia* are the well developed molar process of the mandible; the well developed lower lacinia of the maxillula; the presence of a bifid endite on the maxilla; well developed exopods and epipods on all maxillipeds and the biunguiculate dactyli of the third to fifth pereopods.

The genus *Pontoniopsis* includes only a single species, *P. comanthi* Borradaile, and is associated with crinoids. It shows considerable resemblance to *Metapontonia*. The well developed molar process of the mandible; the bifid endite of the maxilla; the well developed exopods of the maxillipeds with the presence of an epipod on the second maxilliped, the broad rostrum and the absence of the anteriorly produced pterygostomial region all render *Pontoniopsis* easily separable from *Metapontonia*. The rostrum of *Pontoniopsis* does bear a dorsal carina and so shows some resemblance to *Metapontonia*. Other characters in common are the narrow telson, with small dorsal spines, and the absence of an arthrobranch from the third maxilliped. The form of the lower lacinia of the maxillula is not known in *Pontoniopsis*.

In the reduction of the exopod of the third maxilliped *Metapontonia* approaches the condition found in *Anchistioides* Paulson, which lacks an exopod on the third maxilliped, but which has a well developed exopod on the second maxilliped. *Anchistioides* shows even more extreme reduction of the endites of the maxilla than is found in *Metapontonia* and also lacks an epipod on the third maxilliped, although one is present on the second.

Although *Metapontonia* has many characters in common with the genera discussed above, the form of the antero-lateral angle of the carapace is unique in the Pontoniinae. The two antero-lateral lobes, when they meet in the midline beneath the antennal peduncles, entirely enclose all the oral appendages, which are usually easily visible when most Pontoniinid shrimps are seen in lateral view. When examined in ventral view the antepenultimate segments of the third maxillipeds, which are well separated at their bases, are seen to form an operculum with a large central subcircular aperture. In the intact specimen the medial border of the ischium of the third maxilliped is more strongly concave than shown in fig. 12G in which it has been slightly flattened. The form of the lower lacinia of the maxillula and the similar

form of the endite of the maxilla, together with the absence of epipods from second and third maxillipeds, also appear to be without parallel in the Pontoniinae.

Metapontonia may conveniently be separated from the related genera by the following key to that section of the Pontoniinae containing the genera without mandibular palp, with well developed scaphocerite, with exopods on all maxillipeds, without large basal protuberances on third to fifth pereopods, with rounded abdominal pleura, without hepatic spine, and with the rostrum toothless, cylindrical or depressed.

- | | |
|---|---------------------|
| 1. Dactyli of third to fifth pereopods strongly curved and simple | 2 |
| — Dactyli of third to fifth pereopods not strongly curved; biunguiculate | 3 |
| 2. Body strongly depressed; antero-lateral angle of carapace not produced; arthrobranch on third maxilliped; second pereopods symmetrical | <i>Platycaris</i> |
| — Body not strongly depressed; antero-lateral angle of carapace strongly produced; arthrobranch on third maxilliped absent; pereopods asymmetrical | <i>Metapontonia</i> |
| 3. Telson narrow with very small dorsal spines; distolateral margin of exopod of uropod with fixed tooth and mobile spine | <i>Pontoniopsis</i> |
| — Telson broad with large dorsal spines; distolateral margin of exopod of uropod with fixed tooth only | <i>Pontonia</i> |

VI. THE GENUS *TULEARIOCARIS* HIPEAU-JACOTTE WITH THE DESCRIPTION OF A NEW SPECIES, *TULEARIOCARIS ZANZIBARICA* SP. NOV., FROM EAST AFRICA AND NEW CALEDONIA

In Zanzibar, between 1959 and 1962, three specimens of a small pontoniid shrimp were found living in association with some intertidal echinoids. These shrimps proved to belong to the recently described genus *Tuleariocaris* Hipeau-Jacotte, 1965. On examination they were found to be distinct from the type species of the genus, *T. holthuisi* Hipeau-Jacotte, and are now described as new. Further specimens of *T. holthuisi* have become available for study and can be compared with the new species.

Tuleariocaris Hipeau-Jacotte, 1965

Diagnosis. — Commensal pontoniid shrimps associated with echinoids. Body elongated and compressed. Well developed toothed rostrum with conspicuous supra-ocular midrib. Antennal and hepatic spines present. Supra-orbital spines lacking. Carapace smooth. Abdomen elongated, smooth, with rounded pleura. Telson elongated, with three pairs of terminal spines and two pairs of dorsal spines. Eyes well developed with large globular cornea. Basal segment of antennular peduncle long and narrow with short stylocerite: antero-lateral angle armed; intermediate and distal segments short; rami short. Scaphocerite long and slender with lamella exceeding strong antero-

lateral spine. Antennal flagellum long. Mandible without palp; molar processes with cutting edges and bristles; incisor process reduced and edentate. Maxillula with short palp, laciniae broad. Maxilla with simple setose endite, well developed palp and narrow scaphognathite. First maxilliped with long palp, small caridean lobe on exopod, and bilobed epipod. Second maxilliped with well developed exopod and a simple epipod. Third maxilliped with short exopod and epipod but lacking arthrobranch. First pereopods robust with well developed chelae. Second pereopods symmetrical and very slender in male, the chelae having minute fingers. In the female, the second pereopods are very asymmetrical. The smaller is similar to those of the male but the larger is robust and elongate with well developed fingers on the chela. The pereopods are short and stout. The dactyli have hoof-shaped protuberances on the third and fifth but that of the third is biunguiculate. The thoracic sternites are unarmed. The endopod of first male pleopod is elongate and rounded with a setose medial border. Appendix masculina with three long terminal setae and two short subterminal setae. Uropods slender.

Type species: *Tuleariocaris holthuisi* Hipeau-Jacotte, 1965.

***Tuleariocaris zanzibarica* sp. nov.** (fig. 13-18)

Material examined. — Mtoni, Zanzibar, 24 September 1961, from an echinoid collected at L.W.S. (= low water spring tide level) on a muddy sand beach. — one male with bopyrid and one ovigerous female.

Prison Island, Zanzibar, 8 February 1962, on an echinoid collected on reef at L.W.S. — one ovigerous female.

Kieta, Bougainville Island, New Caledonia, 10 March 1965, on echinoid, coll. J. S. Pearse. — one male.

Description. — The rostrum is almost straight in the male but is slightly depressed in the females. In the former it extends only to the level of the distal border of the middle segment of the antennular peduncle or slightly beyond, and in the latter, to or slightly beyond the distal border of the terminal antennular peduncular segment. The upper border is dentate and bears nine and ten teeth in the males and eight and nine teeth in the females. The first tooth is situated immediately behind the posterior orbital margin. The teeth are small and regularly spaced and, in the male, extend anterior to the level of the distal border of the first antennular segment, leaving a short unarmed tip, while in the females they extend to the middle of the second antennular segment in the smaller, leaving a long acute bare and slightly up-curved tip, and to the distal end of the second antennular segment in the larger, which has a deeper and straighter tip. The ventral margin is armed with a single minute tooth in Mtoni male at a level of two thirds of the first antennular

segment. In the Kieta male there are four ventral teeth. The females have five ventral teeth in the larger and two in the smaller specimen. The ventral teeth are larger than in the males but smaller than the dorsal series. They are situated on the third quarter of the ventral margin in the larger specimen and opposite the middle antennular segment in the smaller. The rostrum is deepest basally and tapers uniformly to a slender point. A broad laminar

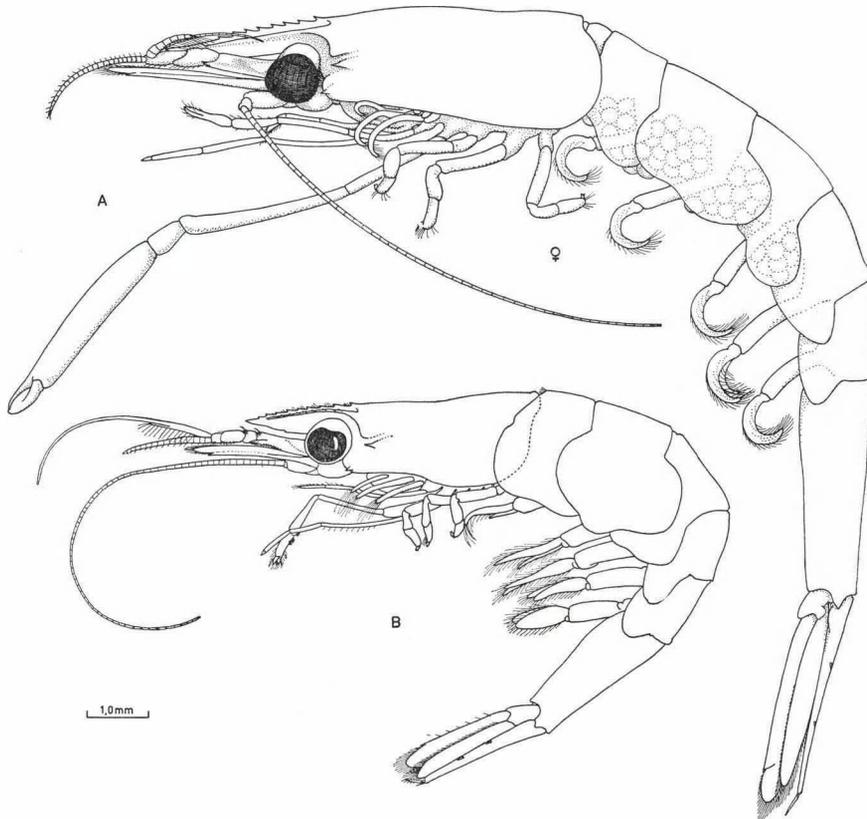


Fig. 13. *Tuleariocaris zanzibarica* sp. nov. A, female holotype; B, male allotype.

midrib is present that extends forwards from the posterior orbital margin in the form of a broad shelf as far as the dorsal series of rostral teeth. It is slightly broader anteriorly than at its base, and lies nearer to the dorsal margin of the rostrum than to the ventral. Its lateral margin is thickened and setose. The carapace is smooth and lacks a supra-orbital spine. A well developed hepatic spine is present. Above the hepatic spine is a horizontal groove that extends anteriorly below the lower end of the well marked posterior orbital margin, into the orbit. A smaller antennal spine is present,

close to the antero-lateral angle of the carapace which is broadly rounded. The antennal spine is at a much lower level than the hepatic spine. The inferior lateral margin of the carapace is sinuous, being concave at the level of the buccal region and the exopods of the maxillipeds are conspicuously exposed in lateral view.

The abdomen has the pleura of all somites rounded, those of the fourth and fifth segments being slightly produced posteriorly. The ventral margins of the second and third segments are sinuous, being produced as rounded lobes in their central portions, while that of the first segment is produced at the anterior ventral angle. These lobes are less conspicuous in the males than in the females. The third abdominal segment is not conspicuously produced posteriorly in the dorsal midline. The sixth segment is long and slender and its length is more than three times its maximum width in the females but only a little over two and a half times in the males. It is about two and a half times the length of the fifth segment in the females, and twice in the males. The telson is long and narrow, being 6.5 times as long as its basal width in the female, and tapers uniformly throughout its length (fig. 15B). It is slightly shorter than the sixth abdominal segment. It terminates distally in a blunt point which bears three pairs of spines: a pair of short lateral spines, a pair of long strong intermediate spines and a pair of stout submedian plumose spines, the ratio of their lengths being 9 : 30 : 14. There are two pairs of dorsal spines, which are of similar size to the lateral terminal spines, situated on the lateral margins of the carapace at 39% and 63% of the telson length from the anterior margin. The dorsal aspect of the telson is flattened anteriorly.

The eyes are large and short. The cornea is hemispherical and its diameter is about twice the length of the peduncle. No ocellus is visible.

The antennular peduncle (fig. 15A), is slightly shorter than the level of the spine of the scaphocerite. The stylocerite is short, reaching only about one third of the length of the basal segment. The antero-lateral angle is produced and bears three acute subequal spines in the females and four in the male. A ventral medial spine is present at the level of the tip of the stylocerite. The basal segment is about three times longer than wide. The second segment is very obliquely joined to the third segment and extends antero-ventrally to it. The second segment is slightly longer than the third and the two together are equal to about two thirds of the length of the basal segment. In the dissected specimen the ventral flagellum is short and stout and subequal in length to the peduncle. It has about fourteen segments. The upper flagellum has two rami, which are fused basally for four segments. The free portion is short and equal in length to about half the length of the fused

part and consists of only 2 or 3 segments. The longer ramus is three to four times the length of the fused portion and slightly longer than the ventral flagellum.

The scaphocerite extends far beyond the antennular peduncle (fig. 15C). It is 5.5 times longer than its maximum width which lies at about one fourth of its length. Its lateral border is slightly convex and has a strong distal tooth at 88% of its length. The carpoцерite is a quarter of the length of the scaphocerite. The basicerite is elongated and unarmed.

The mandibles lack palps. The molar processes are well developed and asymmetrical, with well defined cutting edges and groups of bristles, the arrangement of which is shown in fig. 16 C, D. The incisor processes are reduced and toothless. They are symmetrical and of similar form in both sexes but in the male a small subterminal seta is present that is lacking

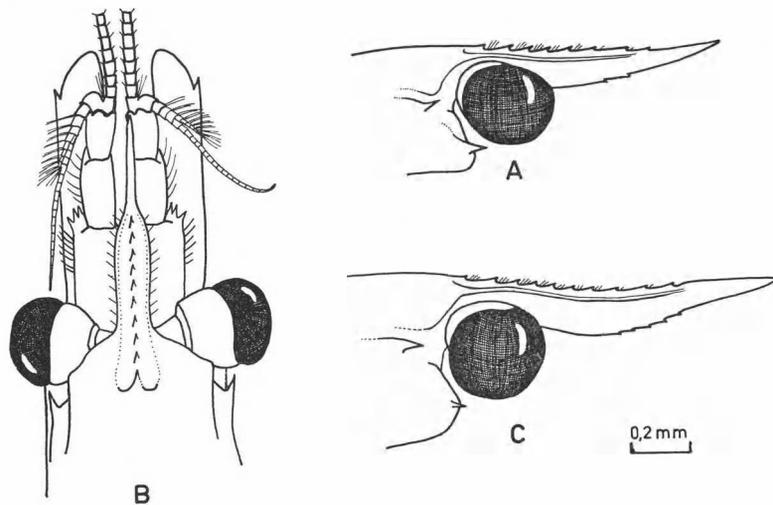


Fig. 14. *Tuleariocaris zanzibarica* sp. nov., anterior part of body. A, B, female holotype; C, female paratype. A, C, lateral view; B, dorsal view.

in the female. The maxillula has a reduced palp of unusual form (fig. 16F). The upper lacinia is well developed and very broad. The lower lacinia is short and broad with a generally rounded border. The upper lacinia is provided with long and short spines distally and long setae ventrally and the borders of the lower lacinia are setose. The endite of the maxilla is broad and unclft. The palp is large and broad and with a setose medial border. The scaphognathite is narrow. The first maxilliped has a well developed exopod with a small caridean lobe. The coxal endite is well developed and exceeds the distal border of the caridean lobe. The palp is elongated and pointed. It exceeds the

anterior border of the coxal endite and is non-setose. The endites of the coxa and basis are not separated. A bilobed epipod is present. The second maxilliped has the dactylar segment reduced and its maximum length is less than half that of the propodus. The carpus is normal but the merus is broadened and its maximum width is about 0.6 times its length. A well developed exopod is present and a simple epipod but no podobranch. The third maxilliped is slender and it extends anteriorly to the middle of the carpoperite. A broad well developed exopod is present that reaches in level to a little beyond half the length of the ischium. The terminal and penultimate segments are subequal and equal in length to 0.3 times the length of the ischium. An epipod is present but there is no arthrobranch.

The first pereopods are similar in male and female and reach to the level of the anterior border of the intermediate segment of the antennular peduncle in the female and to the anterior border of the distal segment in the male. The fingers, which have entire cutting edges and small hooked tips, are 0.4 times the length of the palm. They are provided with tufts of long setae. The palm is subcylindrical and has a conspicuous patch of short cleaning bristles along its ventral aspect. The carpus is 0.86 times the length of the chela and is curved. Its distal width is double that of its proximal end. A small tuft of cleaning bristles is present at its distal ventral end. The merus is cylindrical and 1.6 times the length of the carpus. The ischium is compressed and bears a row of long fine setae along its posterior ventral margin. It is 0.5 times the length of the merus. All segments are unarmed. The second pereopods are symmetrical in the male and asymmetrical in the female. In the former they are slender and feeble and exceed the antennular peduncle by the length of the dactylus. The chela is subcylindrical and is wider basally than distally. The fingers are very small and unequal, the free finger being twice the length of the fixed finger. Both fingers have entire cutting edges and acutely hooked tips. The dactylus is 0.2 times the length of the propodus. The carpus is subcylindrical and wider distally than proximally. It is equal to the palm in length. The merus is cylindrical and curved. It is provided with long setae along its ventral margin. It is 1.6 times the length of the carpus. The ischium is subcylindrical distally and broadened and compressed basally and is 1.1 times the length of the merus. The basis is less than a third of the length of the ischium and its disto-ventral border is provided with a single strong curved seta. All segments of the second pereopod are unarmed. In both females, the smaller second pereopod, which is in both cases on the right side, is very similar to that of the male, and it exceeds the end of the antennular peduncle by about one third of the length of the chela. The larger second pereopod is elongate and robust. It exceeds the end of the antennal

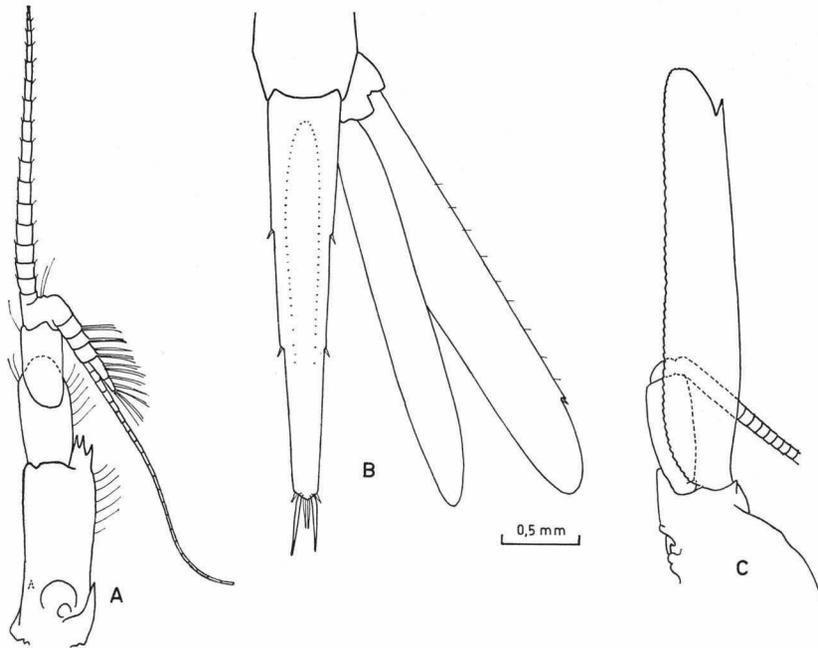


Fig. 15. *Tuleariocaris zanzibarica* sp. nov., female holotype. A, antennule; B, telson and right uropod; C, antenna.

peduncle by the whole of the chela and carpus. The free finger is 0.34 times the length of the palm and it slightly exceeds the tip of the fixed finger. The free finger is lingulate and twisted laterally. It is ventrally situated and its outer margin is thickened. The cutting edge is concave and entire. It overlaps the cutting edge of the fixed finger and closes with a scissor-like action. The fixed finger is pointed, with a small hooked process and a straight entire cutting edge. The palm is subcylindrical and tapers slightly distally. The carpus is short, 1.5 times as wide distally as proximally, and 0.2 times the length of the palm. The merus is subequal in length to the palm and 1.8 times the length of ischium. All segments are unarmed. The third to fifth pereopods are short and stout and articulated so that the ventral surfaces of the dactyli are directed towards the midline. The third pereopod extends anteriorly only to the level of the antero-lateral angle of the carapace. The dactyli are short and similar on the third and fifth pereopods. There is a well developed but small ventral hoof-shaped process distally, surrounded by robust and flattened setae with blunt ends on both sides but not terminally. Dorsally there is a distinct curved unguis directed disto-laterally. The fourth

pereiopod is biunguiculate with four small denticles on the ventral border immediately posterior to the accessory spine. The propodi are stout and taper distally. They increase slightly in length posteriorly in the ratio of 34 : 37 : 40. A single stout spine is present at each distal ventro-lateral angle. The propodus of the fourth pereiopod also bears conspicuous brushes of long flattened setae on its distal dorso-lateral aspect. The carpus is stout and shorter than the propodus. The merus is robust and about twice the length of the carpus. The ischium is very short. All segments are unarmed except for a few stout setae along the distal dorsal margin of the carpus. The thoracic sternites are unarmed.

The pleopods in the male are well developed and biramous. The endopod of the first pleopod is reduced and bluntly pointed. It bears two long setae and a small spine on its lateral border and a single small spine at the middle of its medial border with three long basal setae. On the second pleopod, which has both rami well developed, there is an appendix interna and an appendix masculina. The appendix interna is two thirds of the length of the appendix masculina. It bears 3 or 4 cincinnuli only on its terminal end. The appendix masculina bears three strong terminal setae. The two shorter setae are spinulate and the longest is smooth. The lateral border bears two small spines distally. The endopod of the female first pleopod is reduced and bluntly rounded distally. It bears numerous long setae along the medial border, two small setae distally and a single small seta on the lateral border. The uropods are long and slender and slightly exceed the length of the telson. The lateral border of the exopod bears a small tooth and a movable spinule.

Size. — The measurements of the four specimens are as follows: ♀ holotype cl. 3.5 mm, tl. 17 mm; ♂ allotype cl. 2.7 mm; ♀ paratype cl. 4.5 mm, tl. 22 mm; ♂ paratype cl. 2.7 mm. The ova are numerous and have a diameter of 0.35×0.25 mm.

Types. — The intact female from Mtoni, Zanzibar, is selected as holotype and has been deposited in the British Museum (Natural History) (Reg. No. 1965. 12. 29. 5). The male allotype, dissected, has been deposited in the Rijksmuseum van Natuurlijke Historie (Reg. No. Crust. D. 21742). The Prison Island specimen is retained in the author's collection.

Colour. — The Mtoni specimens were a dark purplish red colour over the whole body and appendages except for the exopod of the uropod and the first and third to fifth pairs of pereiopods, which were pale translucent blue. The Prison Island specimen was a similar dark purplish red but also showed a narrow cream lateral line extending from along the lateral border of the scaphocerite to the posterior ventral angle of the sixth abdominal segment. This line is broadest over the second and third abdominal segments and very

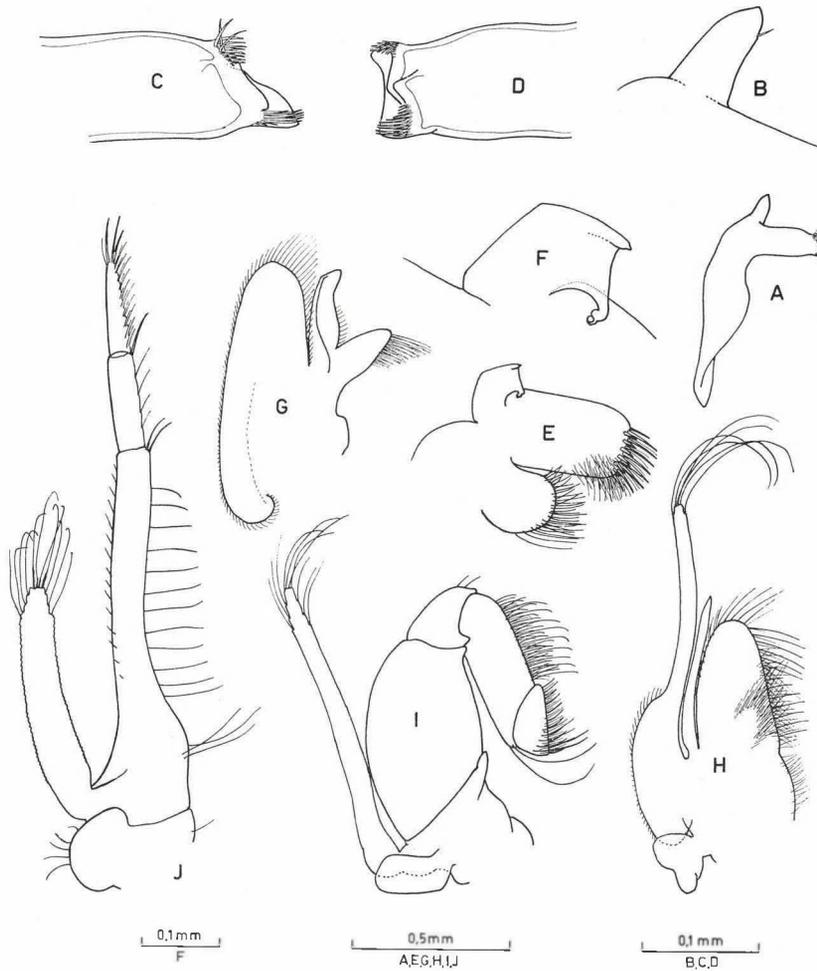


Fig. 16. *Tuleariocaris zanzibarica* sp. nov., male allotype. A, mandible; B, incisor process; C, left molar process; D, right molar process; E, maxillula; F, maxillular palp; G, maxilla; H, first maxilliped; I, second maxilliped; J, third maxilliped.

narrow over the sixth. A similar pattern was noted for the Kieta specimen.

Hosts. — The Mtoni specimens were obtained from the echinoid *Astropyge radiata* (Leske), exposed on muddy sand flats at L.W.S. tide level. The shrimps were on the ventral aspect of the echinoid which was still immersed in water. The Prison Island and Kieta specimens were found on another echinoid, *Diadema setosum* (Leske), obtained from a coral reef at L.W.S.

Discussion. — The genus *Tuleariocaris* shows many similarities to the

genus *Stegopontonia* Nobili, which includes only a single species, *S. commensalis* Nobili, an obligate commensal of sea urchins. *S. commensalis* has been reported from the genus *Diadema* (cf. Holthuis, 1952) on which specimens of *Tuleariocaris zanzibarica* have also been found. Although presenting many similarities the two genera may be easily separated by the following features: —

<i>Stegopontonia</i> Nobili	<i>Tuleariocaris</i> Hipeau-Jacotte
Broad toothless rostrum	Narrow toothed rostrum
Small eyes	Large eyes
Normal incisor process of mandible	Reduced incisor process
Normal maxillular palp	Reduced maxillular palp
Scaphognathite broad	Scaphognathite narrow
Endite of maxilla lacking setae	Endite of maxilla setose
Caridean lobe normal in size	Caridean lobe reduced
Palp of first maxilliped shorter than endite	Palp of first maxilliped exceeds endite
Terminal segment of third maxilliped longer than penultimate	Terminal segment of third maxilliped less than half length of penultimate
Merus of second maxilliped shorter than ischium	Merus of second maxilliped very large and broad, much longer than ischium
Dactyli of third to fifth pereopods lacking hoof-shaped ventral process.	Dactyli of third and fifth pereopods with hoof-shaped ventral process.

The form of the dactyli of third to fifth pereopods in the genera *Tuleariocaris* and *Stegopontonia* are generally similar, each having a basal process provided with a dense fringe of setae on each side (Holthuis, personal communication) but that of *Stegopontonia* appears to be bilaterally compressed and not distally dilated.

The presence of hoof-shaped dactylar processes distinguishes this genus from all other members of the Pontoniinae except the coral-inhabiting species of the genera *Coralliocaris* Stimpson and *Jocaste* Holthuis. In these two genera the dactyls are similar on the three posterior pereopods and the fourth does not differ from the others as is found in *Tuleariocaris*. The resemblance is closest to *Jocaste*, with which *Tuleariocaris* shares the following features: a well developed toothed rostrum with a strong supra-ocular midrib; the presence of hepatic and antennal spines, and of asymmetrical second pereopods. In contrast, *Coralliocaris* has symmetrical second pereopods and lacks a hepatic spine.

The three genera may be conveniently separated by the following key:

1. Hepatic spine absent. Second pereopods similar in shape and size, arthrobranch present on third maxilliped. Body squat and depressed *Coralliocaris*
— Hepatic spine present 2
2. Body squat and depressed, arthrobranch present on third maxilliped *Jocaste*
— Body compressed and elongated, arthrobranch absent from third maxilliped *Tuleariocaris*

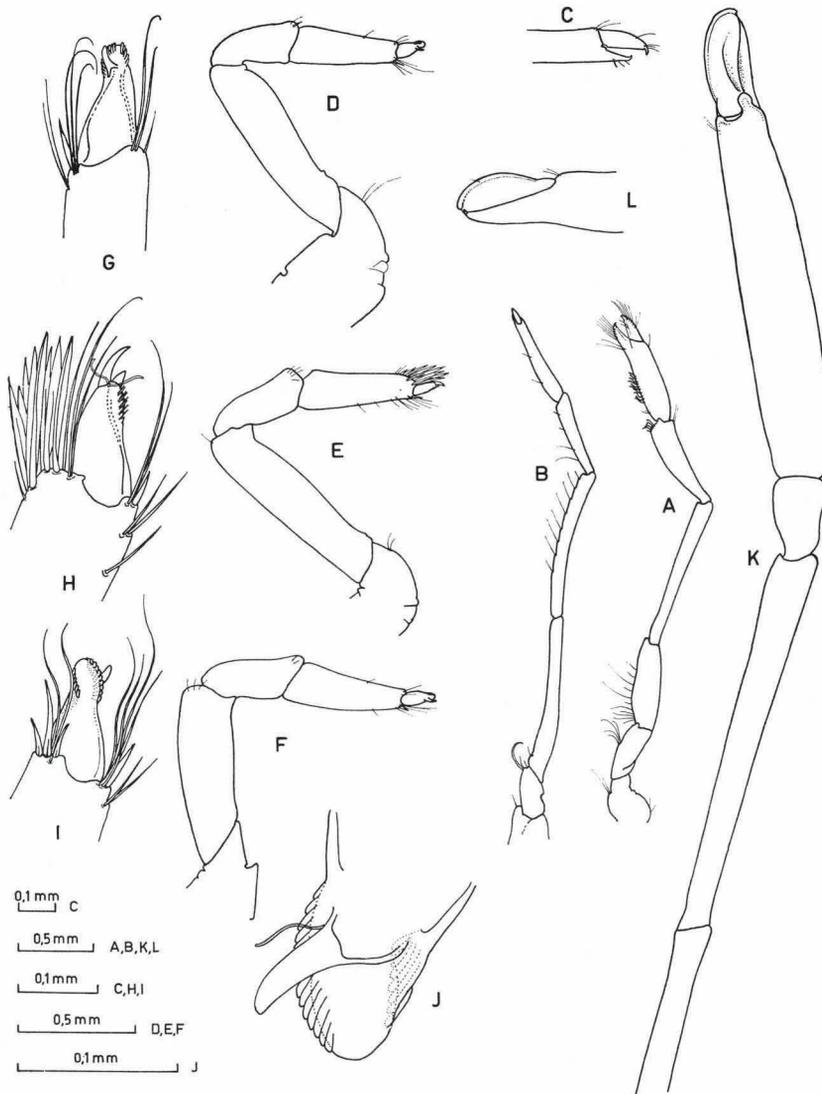


Fig. 17. *Tuleariocaris zanzibarica* sp. nov. A-J, male allotype; K, L, female holotype. A, first pereopod; B, second pereopod; C, fingers of chela of second pereopod; D, third pereopod; E, fourth pereopod; F, fifth pereopod; G, dactylus of third pereopod, dorsal view; H, dactylus of fourth pereopod; I, dactylus of fifth pereopod, ventral view; J, tip of dactylus of fifth pereopod, dorsal view; K, larger second pereopod; L, fingers of chela of second pereopod.

The form of the incisor process of the mandible in *Tuleariocaris* is unusual in the Pontoniinae. In *T. zanzibarica* both mandibles of the allotype were examined and one mandible of the holotype; in each case, the form was found to be similar, so that it is unlikely to be due to abnormal variation. Although not known in any Indo-Pacific species the reduction of the incisor process is reported in several Pontoniinae occurring outside that region and in some, e.g., *Typton gnathophylloides* Holthuis, the process may be absent. As the process is normally present in the genus *Typton* (Holthuis, 1951), it cannot be used as a generic character. For those species for which information is available, the presence of an arthrobranch on the third maxilliped appears to be a more consistent generic character (Holthuis, 1951, 1952).

Another feature that is found in *Tuleariocaris zanzibarica* and is unusual in the Pontoniinae, is the degree of development of the second pereopods. These are relatively large and robust in the female and feeble and slender in the male. In most pontoniid shrimps where sexual dimorphism has been reported, the male second pereopods are larger and more robust than those of the female.

Since the original discovery of the type specimens of *Tuleariocaris holthuisi* in Madagascar, further specimens have become available for study. The details are:

Tuleariocaris holthuisi Hipeau-Jacotte

Material examined. — Hanauma Bay, Oahu, Hawaii. On *Astropyge radiata* (Leske), depth 15 m, coll. D. M. Devaney. — 1 ♂ cl. 1.65 mm, 1 ovigerous ♀ cl. 1.90 mm.

These two specimens agree well with Hipeau-Jacotte's description and indicate a wide geographical range for that species. It is interesting to note that, in this part of their range, they occur on the same host as the type specimens of *T. zanzibarica*. Comparison of the two species shows that *T. zanzibarica* is a larger and more elongated species, a feature particularly noticeable in the females, which are distinctly larger than the males. The rostrum bears 8 to 10 dorsal teeth and 1 to 5 ventral teeth in contrast to *T. holthuisi* which has 6 to 8 dorsal teeth and no ventral teeth. In *T. zanzibarica* most of the appendages are longer and more slender than in *T. holthuisi* and this is particularly noticeable in the antennules, scaphocerites, sixth abdominal segments, telson and uropods. Comparison between the sexes shows that in the males, in *T. zanzibarica* the length of the sixth abdominal segment is 2.70 times the maximum depth but only 2.39 times in *T. holthuisi*. In the females, the same proportions are 3.02 in *T. zanzibarica* and 2.78 in *T. holthuisi*. In *T. zanzibarica* the ovigerous female bears about 50 small ova and in *T. holthuisi* the ovigerous female bears 10 relatively large eggs

the maximum diameter being about 0.45 mm. These differences are also found in the specimens described by Hipeau-Jacotte, where the male figured can be seen to have a post-orbital carapace length of less than 2 mm and the length of the sixth abdominal segment equal to 1.86. In the females of *T. zanzibarica* the merus of the larger second pereiopod exceeds the carapocerate by more than one third of its length. In *T. holthuisi* the merus of the larger second pereiopod only slightly exceeds the carapocerate.

Numerous specimens of several species of echinoids were examined for the presence of commensal shrimps in East African waters from 1959 to 1962 but only three specimens of *Tuleariocaris zanzibarica* were obtained, so that it would appear to be naturally uncommon. No specimens of *Stegopontonia commensalis* Nobili were obtained. The single specimen of *T. zanzibarica* from Bougainville Island, was obtained from 25 specimens of *Diadema*.

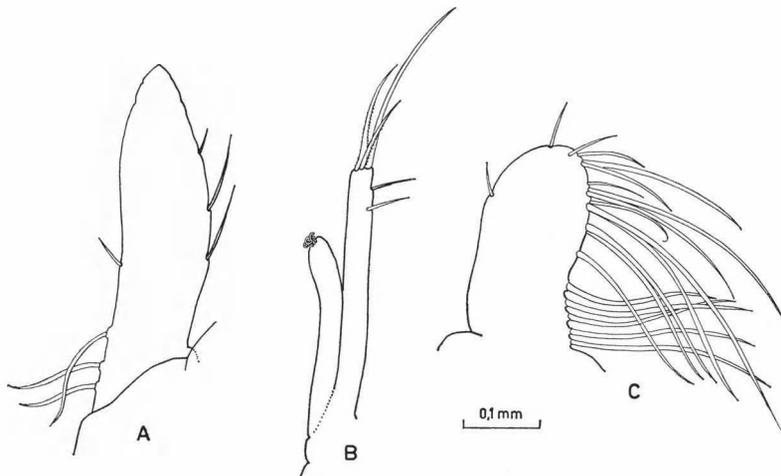


Fig. 18. *Tuleariocaris zanzibarica* sp. nov. A, B, male allotype; C, female holotype. A, C, endopod of first pleopod; B, appendix interna and appendix masculina of second pereiopod.

Acknowledgements. — I am grateful to Dr. L. B. Holthuis for providing original drawings of *Stegopontonia commensalis* Nobili for comparison with the new species and for the loan of the specimens of *Tuleariocaris holthuisi* Hipeau-Jacotte, and to Dr. J. S. Pearse for the specimen of *T. zanzibarica* from Bougainville Island.

VII. PERICLIMENES ANTONBRUUNII SP. NOV., FROM THE COMORES

During the ninth cruise of the R.V. "Anton Bruun" in the western Indian

Ocean, as part of the U.S. contribution to the biological programme of the International Indian Ocean Expedition, collections of littoral Pontoniinae were made at several stations in the Archipel des Comores. In the material obtained was a single example of a species of the genus *Periclimenes* Costa, 1844, which on subsequent examination was found to represent a new species, belonging to the subgenus *Periclimenes*.

Periclimenes antonbruunii sp. nov. (fig. 19-22)

Material examined. — Pamanzi Island reef, Dzaoudzi, Ile Mayotte, Archipel des Comores, R.V. "Anton Bruun" Cruise 9, 24 November 1964. — 1 ♀, holotype.

Description. — The rostrum is long and slender and greatly exceeds the length of the antennular peduncle, reaching anteriorly to the level of the end of the shorter ramus of the upper flagellum. The rostrum is uniformly up-curved and tapering and its dorsal margin bears five teeth with a single epigastric tooth present on the carapace. The largest tooth is situated over the eyestalks and is separated by a small interval from the next anterior tooth. A larger interval separates the third and fourth teeth and the interval between fourth and fifth is slightly less than that between third and fourth. The fifth tooth is situated more than halfway along the rostral lamina and the sixth is close to the tip. The first to fourth teeth bear a series of small serrations on their distal anterior ventral aspects, six being present on the first and second tooth and five on the third and fourth. The tips of the four posterior teeth are angled anteriorly but the two distal teeth are not. Plumose setae are present between the dorsal teeth except distal to the fifth tooth, the dorsal margin being glabrous anteriorly. The ventral margin is provided with six small, simple, unserrated teeth. The proximal part is unarmed and setose and the first ventral tooth is situated slightly anteriorly to the fourth dorsal tooth. The intervals between the ventral teeth decrease slightly anteriorly and the terminal portion is unarmed. There is no distinct midrib. The carapace is smooth and the inferior orbital margin is produced as a rounded lobe, slightly pointed anteriorly. The antennal spine is well developed, situated on the anterior margin of the carapace, and directed slightly upwards. The hepatic spine is of similar size to the antennal spine but although close to the anterior margin of the carapace, lies at a distinctly lower level. Supra-orbital spines are absent. The antero-lateral angle of the carapace is broadly rounded and not produced.

The pleura of the abdominal segments are all smoothly rounded and the postero-lateral angle of the sixth segment is acute. The postero-dorsal part of the third abdominal segment is produced in the form of a triangular,

laterally compressed hump. The fifth segment is slightly less than half the length of the sixth. The length of the sixth segment is slightly more than twice its maximum depth. The telson is three quarters of the length of the sixth abdominal segment. The anterior two fifths of the lateral margins are parallel and the posterior three fifths taper uniformly to an angular tip, the median part being produced as a slender pointed process. The upper surface is provided with two pairs of small dorsal spines which are all situated close to the lateral margins on the posterior half of the telson. The posterior pair of dorsal spines is slightly closer to the anterior pair than to the posterior margin. The posterior margin of the telson bears three pairs of spines. The lateral pair are short and stout, about one third of the length of the intermediate spines. They are situated slightly dorsally and are a little larger than

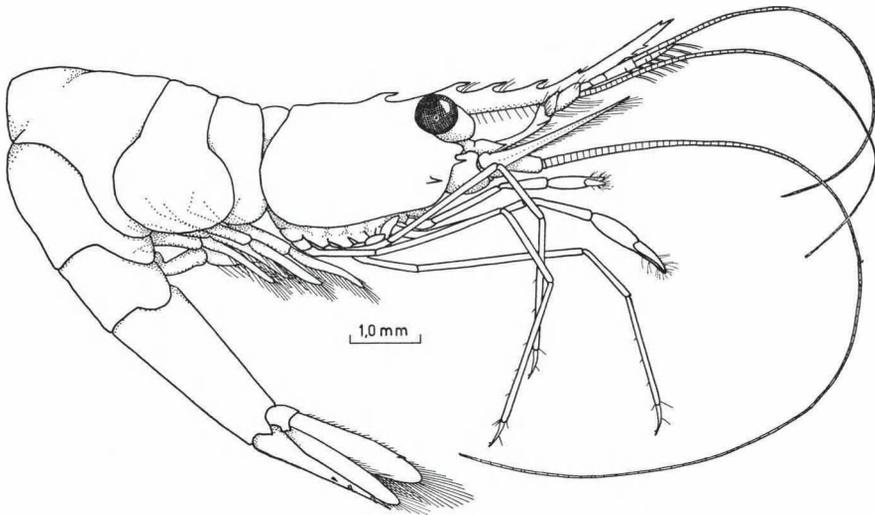


Fig. 19. *Periclimenes antonbruunii* sp. nov., holotype.

the dorsal telson spines. The intermediate spines are robust and are one eighth of the length of the telson. The submedian spines are setose and slender and about one half of the length of the intermediate spines.

The cornea is globular and its diameter about two thirds of the length of the stalk. A well marked groove separates the cornea from the stalk. No ocellus can be discerned.

The basal segment of the antennular peduncle exceeds the level of the anterior margin of the cornea by about one third of its length. It reaches the level of the proximal ventral rostral tooth. The stylocerite is acutely pointed and reaches almost to the middle of the segment. The lateral margin bears

a single slender tooth distally and the medial margin bears a small ventral spine near its midpoint. The lateral anterior margin is convex and produced, and exceeds the tip of the disto-lateral spine. The statolith is composed of a cluster of small granules. The second peduncular segment is two thirds of the length of the third, the two together being equal to about half the length of the basal segment. The two rami of the upper flagellum are fused basally for two fifths of the length of the shorter ramus. The fused portion consists of three segments and the free part of four segments. The tip of the shorter ramus is slightly exceeded by the tip of the rostrum. The longer ramus is slender and equal to three times the post-orbital carapace length. The lower flagellum is also slender and subequal to the longer ramus of the upper flagellum in length.

The scaphocerite exceeds the end of the antennular peduncle by one quarter of its length. Its lateral margin is feebly concave and provided distally with a strong spine. The anterior margin of the lamella is narrowly rounded and exceeds the tip of the disto-lateral spine. The maximum width is situated proximally and is slightly less than one quarter of the maximum length. The anterior margin of the carapocerite reaches the level of the end of the basal third of the scaphocerite. The basicerite is unarmed laterally.

The mouthparts are typical of the genus. The mandible lacks a palp. The incisor process is well developed and bears three small teeth distally, of which the central is smaller than the other two. The molar process of the right mandible bears five processes with a tuft of setae posteriorly. The maxillula has a distinctly bilobed palp. The upper lacinia is short and broad and bears seven strong spines distally. The lower lacinia is longer and narrower than the upper and bears numerous long smooth slender setae, those which are ventrally situated being plumose. The maxilla has the endite distinctly cleft for half its length, each process being provided with several long smooth setae. The palp is well developed and non-setose. The scaphognathite is well developed and broad, its margins bearing plumose setae. In addition, the tip of the scaphognathite bears a submarginal row of seven short simple setae. All maxillipeds have well developed exopods. A small notch separates the small basal endite of the first maxilliped from the coxal endite. The palp is robust and tapering and bears a single long plumose seta at the middle of its medial border. The caridean lobe of the exopod is small and a well developed bilobed epipod is present, the distal lobe being much larger than the proximal lobe. The second maxilliped is of normal shape; the epipod is well developed and a small podobranch is present. The third maxilliped exceeds the carapocerite by half the length of the terminal segment. The two distal segments are subequal to the length of the ischium, the terminal segment

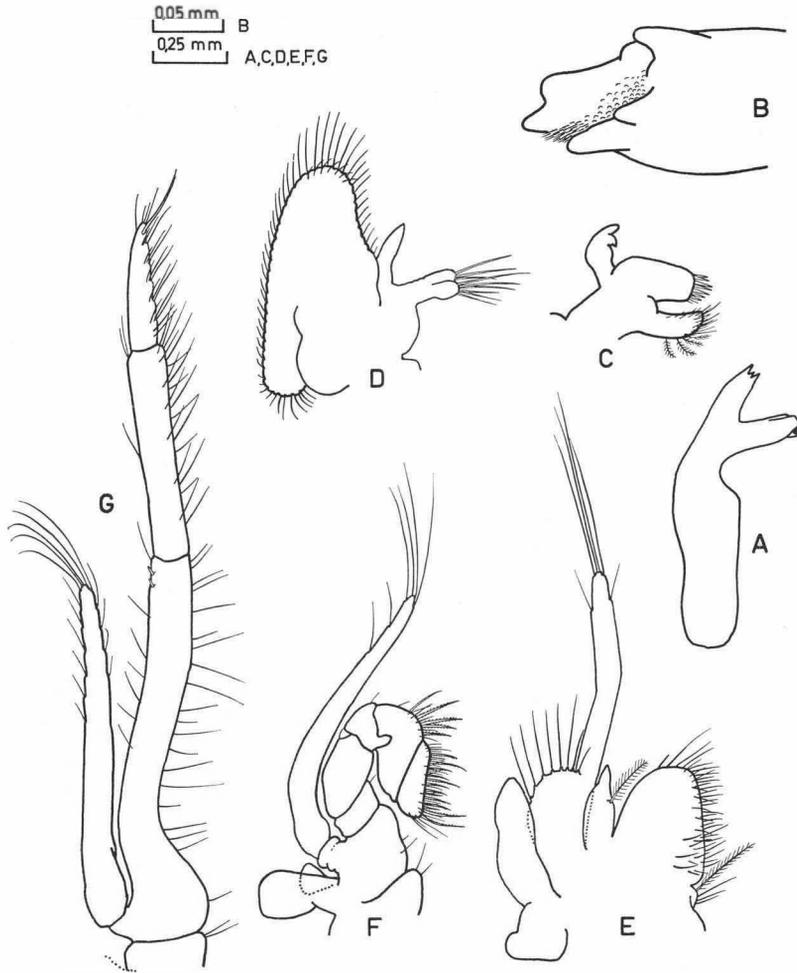


Fig. 20. *Periclimenes antonbruunii* sp. nov., holotype. A, mandible; B, molar process of mandible; C, maxillula; D, maxilla; E, first maxilliped; F, second maxilliped; G, third maxilliped.

being slightly more than twice the length of the penultimate. The distolateral end of the ischium is provided with two small spines in addition to the usual setae. The exopod reaches almost to the level of the distal end of the ischium. A small epipod and a rudimentary arthrobranch are present, but there is no pleurobranch.

The first pereopod exceeds the carpoperite by the length of the chela and half the carpus. The fingers are subequal to the palm and provided with entire cutting edges, and strongly hooked tips. Numerous setae are present

on the fingers and three groups of cleaning setae at the proximal ventral aspect of the palm. The carpus is robust and slightly shorter than the chela; its length is about three times its maximum width, which lies at the distal end. The merus is more slender than the carpus and one and one third times its length. The second pereopods are equal, short and slender, extending anteriorly to exceed the tip of the scaphocerite by half the length of the dactylus. The fingers are slightly longer than the cylindrical palm and have strongly hooked tips and entire cutting edges. The carpus is two thirds of the length of the chela and four times longer than its maximum width which lies at its distal end. The merus is one and one fifth times the length of the carpus and one and two sevenths times the length of the ischium. All segments of the second pereopods are unarmed. Rudimentary exopods, which decrease in size posteriorly, are present on the first three pereopods. The third to fifth pereopods are similar. The third pereopod reaches to the tip of the rostrum and exceeds the scaphocerite by the dactylus and one third of the propodus. The fifth pereopod exceeds the third by half the length of the dactylus. The dactylus is slightly curved and slender, being about five times longer than its maximum width, and bears a small accessory spine at the end of its proximal two thirds. The propodus is slender, fifteen times longer than wide, and four and one half times the length of the dactylus. A pair of distal spines and four single spines, with setae, decreasing in size proximally, are present on the posterior margin. The carpus is one and two thirds and the merus ten elevenths of the length of the propodus. The ischium is half the length of the merus. All segments are unarmed. The third and fourth pereopods have shorter propodi than the fifth in the ratio of 66 : 76 : 86 and the third propodus has only three spines along the posterior margin. There is no median sternal process between the first pereopods.

The pleopods are normal in shape. The endopod of the first pleopod bears a medial, two terminal and three lateral plumose setae on its distal third and two short non-plumose setae on the medial aspect of the basal third. The appendix interna of the second pleopod reaches to the level of three-quarters of the length of the endopod. The uropods are typical. The outer edge of the exopod is straight and feebly setose and terminates distally in a small acute tooth with a small mobile spinule medially. The endopod distinctly exceeds the tips of the terminal spines of the telson and is considerably exceeded by the exopod.

Measurements in mm. — Post-orbital carapace length, 2.20; total length of carapace and rostrum, 5.60; length of fifth abdominal segment, 1.15; length of six abdominal segment, 2.60; maximum telson length, 3.10; maximum

telson width, 0.55. First pereiopod: chela, 0.88; carpus, 0.75; merus, 1.02; ischium, 0.37. Second pereiopod: chela, 1.54; carpus, 1.00; merus, 1.24; ischium, 0.89. Fifth pereiopod: dactylus, 0.46; propodus, 2.14; carpus, 1.30; merus, 1.93; ischium, 0.98.

Type. — The holotype and only specimen, partly dissected, has been deposited in the U.S. National Museum, Smithsonian Institution, Washington, D.C.

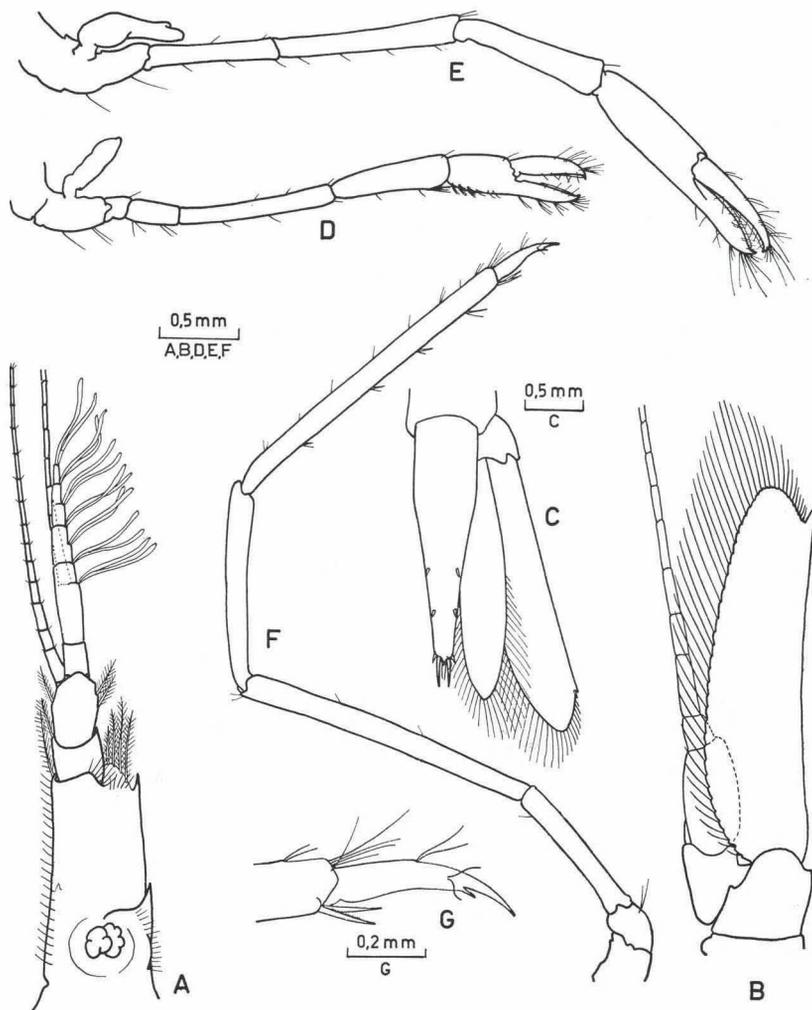


Fig. 21. *Periclimenes antonbruunii* sp. nov., holotype. A, antennule; B, antenna; C, telson and right uropod; D, first pereiopod; E, second pereiopod; F, fifth pereiopod; G, dactylus of fifth pereiopod.

Colour. — The specimen was mainly transparent when caught, with small red dots scattered over the carapace and the first to fifth abdominal segments and a red bar across the hump of the third abdominal segment, parallel to its anterior margin. Extensive tracts of red extend along the mid-ventral line of the abdomen with red patches also at the bases of the pleopods. Red patches are also present at the bases of third and fourth pereopods but the carpus and chela of the second pereopod are covered with scattered white dots and only a few red spots are present on the palm. Numerous red dots are present on the eyestalks, and the antennular peduncles are also red. Red subterminal spots are present on exopod and endopod of the uropods.

Ecological data. — The single example was obtained by poisoning a shallow pool, some four inches deep on non-calcareous rock flats at low water spring tide level. The specimen emerged from a small cavity in the side of the pool. No weeds, coral, fish or other invertebrates were obtained from the pool.

Discussion. — The new species is shown by the distinctly biunguiculate dactyli of the last three pereopods to belong to the typical subgenus of the genus *Periclimenes*. In this subgenus the only other species so far to be described with a hump on the third abdominal segment is *P. aesopius* (Bate, 1863). This species has been since redescribed (Holthuis, 1952) and shows numerous differences from *P. antonbruunii*. The following differences between the two species may be noted.

1. In *P. aesopius* the rostrum does not exceed the antennular peduncle. In *P. antonbruunii* the rostrum greatly exceeds the antennular peduncle.

2. In *P. aesopius* the ventral margin of the rostrum is concave; in *P. antonbruunii* the ventral margin is strongly convex.

3. In *P. aesopius* there are 8 to 11 dorsal teeth and 1 or 2 subapical ventral teeth. In *P. antonbruunii*, there are six dorsal teeth and six ventral teeth, the latter being remote from the tip of the rostrum.

4. In *P. aesopius* the teeth situated on the carapace are close to the post-orbital margin. In *P. antonbruunii* the single tooth is remote from the post-orbital margin.

5. The disto-ventral aspects of the posterior rostral teeth are serrated in *P. antonbruunii*. This feature is absent in *P. aesopius*.

6. In *P. aesopius* the inferior orbital angle is long and acutely pointed. In *P. antonbruunii* the inferior orbital angle is shorter and more rounded.

7. In *P. aesopius* the hepatic spine is situated more remotely from the anterior margin of the carapace than in *P. antonbruunii*.

8. The hump on the third abdominal segment is larger and more triangularly produced in *P. antonbruunii* than in *P. aesopius*.

9. The pleura of the fifth abdominal segment is more pointed in *P. aesopius* than in *P. antonbruunii*.

10. In *P. aesopius* the disto-lateral tooth of the basal antennular segment is small and the anterior margin strongly produced. In *P. antonbruunii* the disto-lateral spine is large and the anterior margin only slightly produced.

11. In *P. aesopius* the shorter ramus of the upper flagellum has the fused portion twice the length of the free portion. In *P. antonbruunii* the free portion is about twice the length of the fused portion.

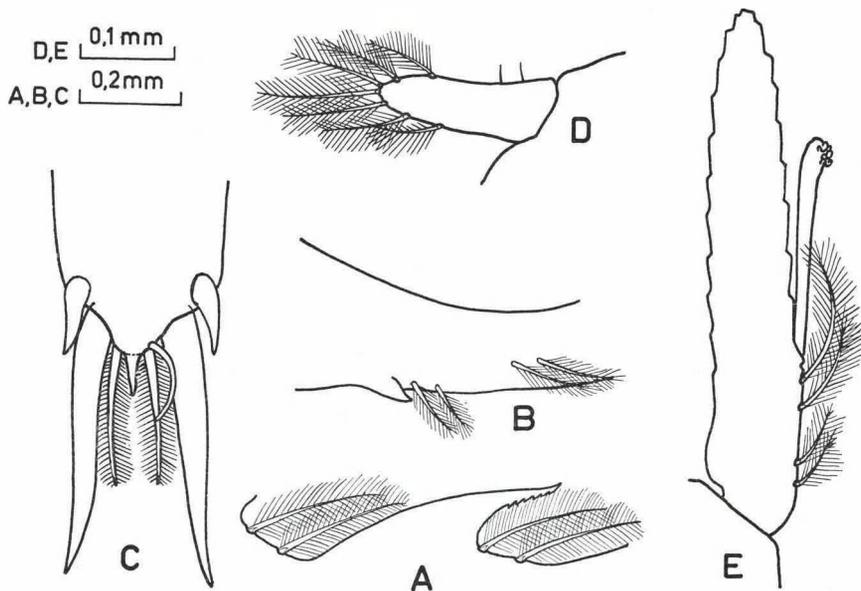


Fig. 22. *Periclimenes antonbruunii* sp. nov., holotype. A, third dorsal rostral tooth; B, central region of basal segment of left antennular peduncle, medial view; C, terminal telson spines; D, endopod of first pleopod; E, endopod of second pleopod.

12. The colour pattern in *P. aesopius* is distinct from that of *P. antonbruunii* (personal observation) and consists of few large spots of red on the carapace, two bands of orange-red across the hump of the third abdominal segment, purple rings around the bases of the fingers of the chelae, the distal end of the carpus of the second pereopod, and an oval purple spot distally on the exopod of the uropod.

Periclimenes aesopius (Bate) has not been reported from the western Indian Ocean, its nearest recorded occurrence being in Ceylon (Pearson,

1905). It was originally reported from Australia, where there are numerous records and also from the Malay Archipelago (Holthuis, 1952; Johnson, 1961). It has also recently been found to occur in Hong Kong (personal observation).

The characteristic serrations present on the distal ventral aspects of the four posterior rostral teeth are not known to occur in any other Indo-Pacific species of the subgenus *Periclimenes*. They are very similar to those illustrated for *Periclimenes (Harpilius) psamathe* (De Man) by Holthuis (1952). The species also shows considerable resemblance to the palaemonid shrimp *Leander urocaridella* Holthuis, which also bears serrations on some of the dorsal rostral teeth. *P. antonbruunii* may be readily distinguished from this species by the absence of a mandibular palp, the lack of a pleurobranch on the third thoracic segment and the hepatic spine being situated well behind the antero-lateral margin of the carapace so that the tip of the spine is remote from the border.

VIII. *PERICLIMENES IMPERATOR* SP. NOV., FROM THE RED SEA,
THE WESTERN INDIAN OCEAN, AND HAWAII

The examination of several specimens of a large pontoniid shrimp belonging to the genus *Periclimenes* Costa, 1844, from widely separated localities in the Indo-West Pacific region, has shown that they cannot be referred to any known species of that genus. The morphological characteristics are constant in each locality and the species is therefore described as new.

Periclimenes imperator sp. nov. (fig. 23-25)

Periclimenes rex Barnard, 1955, Ann. S. Afr. Mus. 43: 47.

Material examined. — Chumbe Island, west coast of Zanzibar Island, on nudibranch from low water spring tide level, 10 December 1961, Mrs. E. Barton. — 1 ♂ cl. 6.0 mm, 1 ovigerous ♀ cl. 7.1 mm.

Tumbatu Island, west coast of Zanzibar Island, on nudibranch, 3 ft. below low water spring tide level, 7 May 1964, Mrs. L. Cameron. — 1 ♂ cl. 5.5 mm.

Mitsio, Madagascar, June 1959, A. Crosnier. — 1 ♂ cl. 7.6 mm.

Delagoa Bay, Moçambique, South African Museum Cat. No. A 10642. — 1 ovigerous ♀ cl. 5.4 mm.

Inhaca, Moçambique, 6 July 1958, obtained from nudibranch, South African Museum Cat. No. In. 58.1. — 1 ♀ cl. 7.0 mm.

Eilath, Gulf of Aqaba, Red Sea, from nudibranch, 12 April 1961, Ch. Lewinsohn and L. Fishelson. — 1 ♂ cl. 4.5 mm.

Barber's Point, Oahu, Hawaii, from a dorida nudibranch at 80 ft., April 1965, R. Ridgeway No. 2050. — 1 specimen cl. 4.0 mm.

Description. — A large and robust pontoniid shrimp. The rostrum is

deep and strongly depressed. The dorsal margin is convex and bears from 23 to 30 small acute, anteriorly directed teeth throughout the length. The teeth decrease regularly in size anteriorly and the two most posterior teeth are situated behind the posterior level of the orbital margin. There are 23 to 30 dorsal teeth in the males and 26 to 28 in the females. The largest male has the fewest teeth and the smallest female the most. The tip of the rostrum may be slightly upturned. The ventral margin is strongly convex and without teeth in all specimens. The midrib is well developed and extends from the orbital margin almost to the tip of the rostrum and lies close to the ventral border of the rostrum. There are no epigastric or supra-orbital spines. The carapace is smooth. The inferior orbital angle is acute and produced. The antennal spine is acute and slender and placed on the anterior margin of the carapace below the inferior orbital angle. The hepatic spine is robust, markedly larger than the antennal spine and lying posteriorly at a similar level. The antero-lateral angle of the carapace is bluntly obtuse and the posterior margin of the branchiostegite broadly rounded.

The pleuron of the first abdominal segment is bluntly angled anteriorly. The margins of the second and third pleura are broadly rounded, the fourth narrowly rounded and the fifth bluntly pointed. The third abdominal segment is slightly produced posteriorly in the dorsal midline but there is no dorsal hump. The fifth segment is two thirds of the length of the sixth, which is one and a half times longer than its depth. The telson is one and two thirds times the length of the sixth abdominal segment. Its length is two and three fifths times the maximum width. Its lateral margins are feebly convex and converge uniformly posteriorly to a bluntly triangular tip. There are two pairs of dorsal spines situated close to the lateral margins. The anterior pair of spines arise a little anteriorly to the middle of the telson and the posterior pair, which are subequal to the anterior pair, are situated slightly closer to the posterior margin of the telson than to the anterior pair. The posterior margin of the telson bears three pairs of spines. The lateral pair are short and robust and shorter than the dorsal telson spines. The intermediate pair are short and stout and twice the length of the lateral pair. The submedian spines are half the length of the intermediate spines and subequal to the length of the lateral spines but are more slender and densely setose.

The cornea is globular and obliquely situated on the eyestalk which is broadened and dorso-ventrally compressed proximally. The maximum length of the stalk is 1.4 times the maximum diameter of the cornea. A furrow separates the cornea from the stalk except postero-dorsally where a well marked ocellus is present.

The basal segment of the antennular peduncle exceeds the anterior margin of the cornea by one third of its length, but falls far short of the tip of the rostrum. The stylocerite is broad and acutely pointed and reaches to a level of two thirds of the length of the medial border of the segment. The lateral part of the anterior margin is produced in a large lobe that extends anteriorly to the level of the proximal end of the terminal segment of the peduncle. The margins of the lobe are broadly rounded and generally armed with two or three acute teeth, the lateral tooth arising at a distinctly more posterior level than the anterior teeth. A fringe of long densely plumose setae arises from the ventral aspects of the margins of the antero-lateral lobe and a fringe of similar but shorter setae arises from the medial border of the basal antennular segment. A ventral spine is present at a position two fifths of the length of the medial border. The statolith is smoothly circular. The second segment of the antennular peduncle dorsally is four and a half times the length of the basal segment and it is produced antero-laterally as a rounded lobe, fringed with long densely plumose setae, that slightly exceeds the antero-lateral lobe of the basal segment and extends along two thirds of the length of the lateral border of the distal segment. The two distal peduncular segments are slightly more than half the length of the medial border of the basal segment. The distal end of the peduncle falls short of the tip of the rostrum. The two rami of the upper flagellum are fused for the six proximal segments. The free part of the shorter ramus consists of four segments and is two fifths of the length of the fused part. The free part of the longer ramus is filiform and is two and half times the length of the fused part. The lower ramus is also filiform and slightly shorter than the longer ramus of the upper flagellum.

The scaphocerite exceeds the tip of the rostrum by one third of its length. The lateral margin is convex and terminates distally in a strong spine which is greatly exceeded anteriorly by the lamella. The anterior margin of the lamella is concave and forms a blunt angle with the medial border. The scaphocerite is broad and the maximum width, which lies in the proximal half, is almost half the maximum length. The carpocerite is slender and one third of the length of the lateral border of the scaphocerite. The basicerite is armed disto-laterally with a small tooth. The antennal flagellum is slender and more than three times the post-orbital carapace length.

The mouthparts are typical of the genus. The mandible lacks a palp. The molar process is armed with five robust processes and lacks groups of setae. The incisor process on the right side bears three irregular teeth and on the left four regular teeth. The maxillula has a feebly bilobed palp. The upper lacinia is short and broad and bears numerous robust teeth distally. The

lower lacinia is longer and more slender than the upper lacinia and bears numerous long slender setae distally and ventrally. The maxilla has the endite deeply cleft, each process bearing numerous long slender setae. The palp is well developed and tapering, bearing a single non-plumose terminal seta, and having several short plumose setae along the proximal half of its lateral border. The scaphognathite is well developed and broad. All maxillipeds have well developed exopods. A small notch separates the small coxal endite from the well developed basal endite of the first maxilliped. The palp is long and slender with a single short subterminal plumose seta. The caridean lobe is well developed and broad and a distinctly bilobed epipod is present. The second maxilliped is of normal shape with a subrectangular

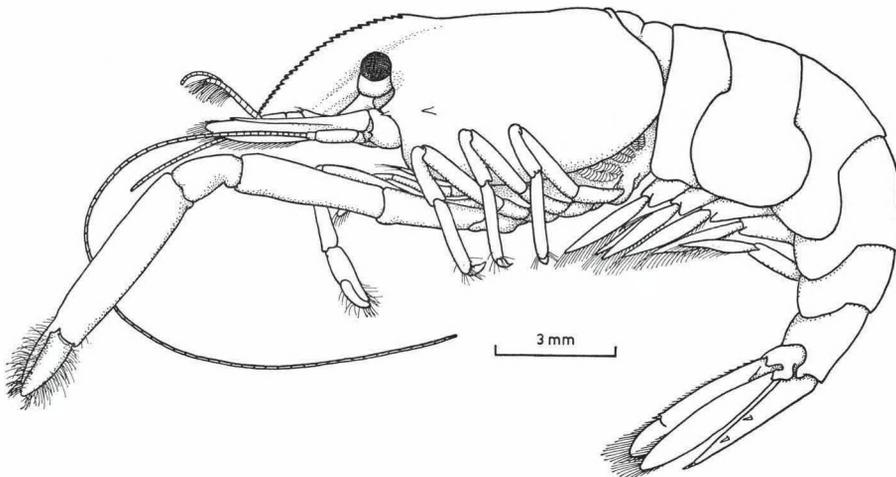


Fig. 23. *Periclimenes imperator* sp. nov., holotype.

epipod that lacks a podobranch. The third maxilliped is short, not reaching to the distal end of the carpocerite. The terminal segment is twice the length of the penultimate and both are provided with numerous groups of setae. The antepenultimate segment is curved laterally and ventrally convex. The maximum length is one and one-fifth times the length of the penultimate segment. Its medial border is densely setose. The basis bears an exopod which is the same length as the lateral border of the antepenultimate segment. The coxa bears a well developed rounded epipod with a feebly setose margin. The medial border of the coxa is produced as a small setose knob. A well developed arthrobranch is present.

The first pereiopod exceeds the carpocerite by the length of the carpus and chela, and it exceeds the tip of the scaphocerite by the length of the

dactylus. The fingers are three quarters of the length of the palm and are spatulate with cutting edges entire for the proximal two-thirds and finely pectinate for the distal third and bear numerous setae. The palm is subcylindrical with a group of short serrate cleaning setae at its proximal ventral end. The carpus is 1.1 times the length of the chela and twice as wide distally as near its proximal end. The merus is 1.1 times the length of the carpus and both segments are unarmed. The ischium is 0.4 times the length of the merus and its medial border bears numerous long slender setae. The basis is shorter than the ischium and its medial border is carinated with numerous setae. The coxa has a short setose carina disto-medially, similar to that of the basis, and a large distally directed process with numerous long slender setae arises from the proximal end of the medial border. In the three intact specimens the second pereopods are equal and symmetrical. The chela exceeds the antennular peduncle by one fifth to one third of the length of the merus. The chelae are longer and more robust in the males than in the females, ranging from 116 to 147% of the post-orbital carapace length in the former and from 104 to 108% in the latter. The fingers are slightly more than one third of the length of the palm, which is subcylindrical. The fingers are densely covered with long setae and the tips are strongly hooked. The proximal third of the free finger bears two small teeth separated by a notch, the distal tooth being acute and the proximal one being blunt. The acute tooth is opposed to a notch between the teeth of the fixed finger. The distal tooth of the fixed finger is small and acute and the proximal tooth is in the form of a low ridge bearing several small denticulations. The cutting edges distal to the teeth are entire on both fingers. The carpus is a little less than a quarter of the length of the chela. It is one and one half times wider distally than at its proximal end and with a sharp unarmed distal margin, interrupted by a notch on its medial side. The merus is nine sixteenths of the length of the chela and armed with a very small disto-ventral process. The ischium is three quarters of the length of the merus. The third to fifth pereopods are similar. The third pereopod, extended anteriorly, reaches to the tip of the scaphocerite and the fifth to exceed the carpocerite by one fifth of the propodus. In the third pereopod the dactylus is stout and curved with a distinct slender unguis. There is no accessory spine. The propodus is robust, six times longer than wide, with the posterior margin armed with a subterminal and terminal spine only. The distal end of the propodus bears numerous groups of long slender simple setae. The carpus is unarmed and two thirds of the length of the propodus and a little longer than half the length of the merus, the disto-ventral angle of which is feebly produced. The ischium is two thirds of the length of the merus. The dactylus

of the fourth pereopod bears a minute protuberance in the position of the accessory spine in other species of the subgenus *Periclimenes* and the propodus bears only a single terminal spine on the posterior border. On the fifth pereopod a minute tubercle is present on the posterior border of the dactylus but there are no spines present on the posterior margin of the propodus, a long spinose seta only being situated terminally with numerous groups of slender non-spinose setae. The ratios of the lengths of the propodi of the third to fifth pereopods in the dissected specimen are 43 : 41 : 46 and the meri 48 : 47 : 46. There is no medial sternal process between the first pereopods.

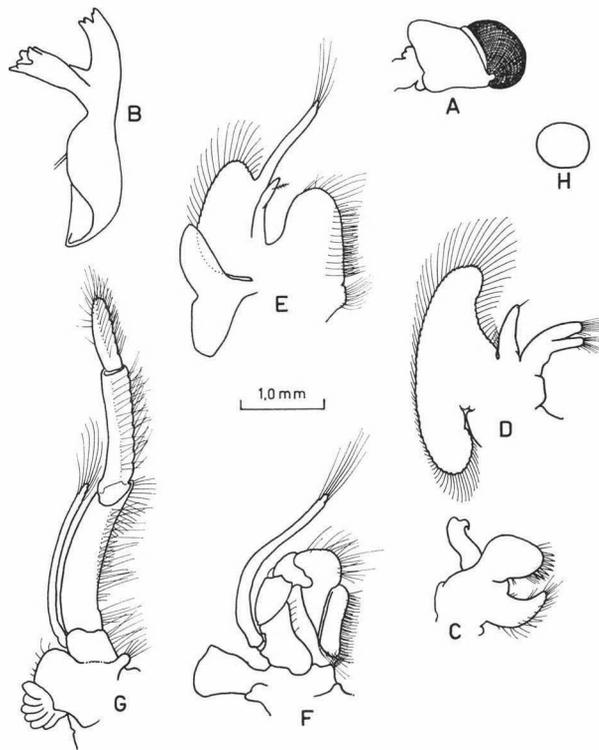


Fig. 24. *Periclimenes imperator* sp. nov., allotype. A, eye; B, mandible; C, maxillula; D, maxilla; E, first maxilliped; F, second maxilliped; G, third maxilliped; H, egg.

The pleopods are normal in shape. In the male the endopod of the first pleopod, which reaches to the level of the middle of the exopod, bears a subterminal triangular lobe on the distal half of its medial border. The proximal half of the medial border bears a row of ten short distally curved, hook-like setae, with a few longer simple setae. The middle third of the

lateral border bears eight short plumose setae. The appendix masculina and appendix interna of the second pereopod are subequal in length and reach to the middle of the length of the endopod. The appendix masculina bears four long terminal setae, the inner and outermost being serrated and the central pair simple. The middle part of the lateral border bears four short setae. The uropods are typical, and exopod and endopod are subequal and exceed the tip of the telson by one quarter of their length. The exopod is broad, the width being five twelfths of the length and the lateral border is concave, terminating at the level of the tip of the telson, in a small acute process laterally with a mobile spinule medially. The tip of the exopod exceeds the disto-lateral spine by one quarter of the total length and a well marked diaeresis is present.

The ova are small and very numerous.

Types. — The male from Zanzibar has been selected as holotype and is deposited in the British Museum (Natural History) (Reg. No. 1965.12.29.1), and the allotype, dissected, has been deposited in the Rijksmuseum van Natuurlijke Historie, Leiden.

Measurements (in mm). — Post-orbital carapace length, holotype 6.0, allotype 7.1; total length of carapace and rostrum, holotype 9.6, allotype 11.5; length of fifth abdominal segment, holotype 1.4, allotype 1.7; length of sixth abdominal segment, holotype 2.1, allotype 2.4; maximum telson length, holotype 3.4, allotype 3.6; length of chela of second pereopod, holotype 8.5, allotype 7.5; maximum width of chela of second pereopod, holotype 1.6, allotype 0.9; diameter of ova, 0.6.

Colour. — The following colours were noted for the Zanzibar specimens.

Male. The general colour is bright red. The rostrum, the carapace above the pterygostomial and branchiostegal regions, and the abdomen above the pleura, all have a deep red colour, fading out posteriorly on the sixth abdominal segment to blend with the white caudal fan. This region is composed of a dense red reticulum, each lacuna enclosing a small yellowish white dot. The red is most intense on the rostrum. The eyestalk and cornea are of a similar red. The whole of this upper region is outlined by a longitudinal line of white dots. The pterygostomial, branchiostegal and pleural regions are of a uniform red of similar shade to the dorsal areas. The antennal peduncles are transparent with red and white spots, the tip of the scaphocerite has a transverse purple band distally and the flagella are colourless. The first and second pereopods are red with purple fingers. The carpus and merus of the second pereopod have a few yellow spots and are purple distally. The ischium is red. The third to fifth pereopods have the dactyli transparent except for a small red subterminal spot. The propodus,

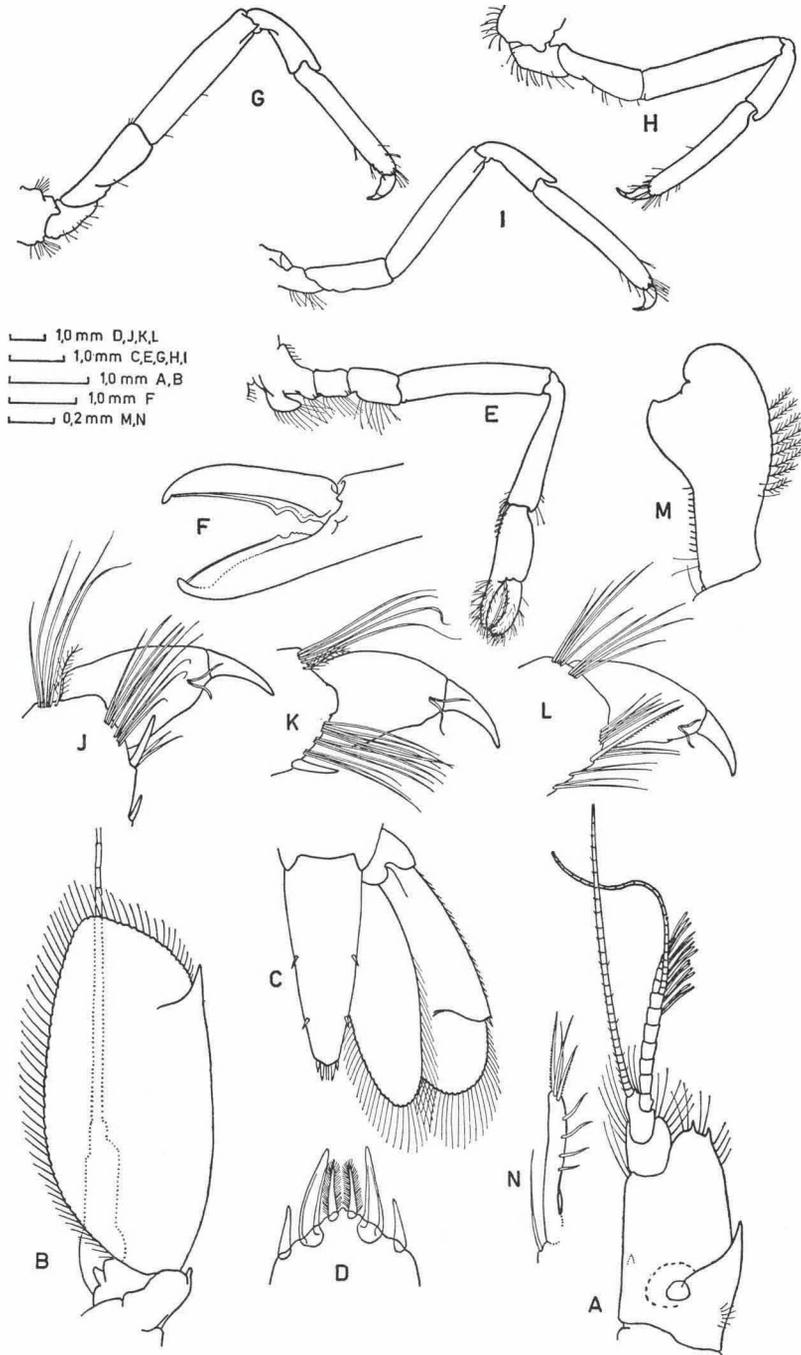


Fig. 25. *Periclimenes imperator* sp. nov., allotype. A, antennule; B, antenna; C, telson and right uropod; D, posterior end of telson; E, first pereiopod; F, fingers of chela of second pereiopod; G, third pereiopod; H, fourth pereiopod; I, fifth pereiopod; J, dactylus of fourth pereiopod; K, dactylus of fifth pereiopod; L, dactylus of fifth pereiopod; M, endopod of male first pleopod; N, appendix masculina of male pleopod.

carpus, merus and ischium are purple and the basis and coxa red. The pleopods are pale red proximally and transparent distally.

Female. Generally the colour is similar to that of the male but paler and more diffuse. The reticular pattern is more extensive and not divided into upper and lower regions. Dorsally the white spots are only present over the gastric region. The proximal end of the carpus and the distal end of the merus of the first pereopod are purple. The chela of the second pereopod is without yellow spots. The purple of the pereopods is paler than in the male.

The purple of the chelae of the first and second pereopods is persistent in alcohol and still intense in specimens more than three years old.

Host. — The Zanzibar and Inhaca specimens were obtained from the large orange red littoral nudibranch *Hexabranhus marginatus* Quoy & Gaimard. The host of the Madagascar specimen was not recorded, but the Hawaiian and Red Sea specimens were also obtained from nudibranchs.

Discussion. — The genus *Periclimenes* Costa, 1844 is divided into two subgenera, *Periclimenes* s. str. and *Harpilius* Dana, 1852 according to the presence or absence of an accessory spine on the dactyli of the third to fifth pereopods. Accepting this criterion *Periclimenes imperator* should be placed in the subgenus *Harpilius* but it shows little resemblance to any species of that genus. It does bear a close resemblance to *P. rex* Kemp, 1922, and also to *P. soror* Nobili, 1904, both of which are placed in the subgenus *Periclimenes* s. str. It is therefore considered as belonging to that subgenus.

In its general morphology *P. imperator* is very similar to *P. rex* but may be separated by the following characteristics:

1. The absence of an epigastric spine in *P. imperator*. Kemp illustrated an epigastric spine and described it in his text for *P. rex*.
2. The presence of two or more disto-lateral spines on the basal segment of the antennular peduncle. Kemp described and illustrated only a single spine in this position in *P. rex*.
3. The pectinate distal ends of the cutting edges of the fingers of the first pereopods in *P. imperator*. Kemp did not specifically describe the cutting edges of the first pereopods in *P. rex* but as he observed a similar pectination in other species of *Periclimenes* it is unlikely that he overlooked its presence in the single specimen of *P. rex* that was available to him.
4. The obsolescent accessory spines of the dactylus of the third to fifth pereopods in *P. imperator*. These are distinct although small in the only known specimen of *P. rex*.

Other less important differences between *P. imperator* and *P. rex* are that in the former the rostrum is more strongly depressed and bears more

numerous teeth on the dorsal margin; the lateral aspect of the basicerite bears a small spine that is not present in *P. rex*; the positions of the dorsal spines of the telson are less regularly placed; the scaphocerite is distinctly broader with a more strongly convex inner margin and the dactyls of the third to fifth pereopods are more robust.

Periclimenes rex has only been reported from the Andaman Islands. Other reports from the western Indian Ocean (e.g., Macnae & Kalk, 1962) probably all refer to *P. imperator* and the Moçambique specimen had actually also been previously identified by Barnard as *P. rex*.

The number of teeth on the disto-lateral margin of the basicerite is subject to variation. Out of the eight specimens available only the specimen from Madagascar had less than two teeth present in this situation and then on one side only. Four of the remaining specimens had two teeth on each side, one had two on one side and three on the other (Barnard, 1955) and two had three teeth on each side. Kemp clearly indicated that his specimen of *P. rex* had only a single tooth present on the lateral aspect of each basicerite.

Whereas *P. imperator* appears to be a mainly littoral species, *P. rex* was obtained from a depth of 7 fms and its host has not been definitely identified. *P. imperator* is the only pontoniid occurring on a nudibranch and although many pontoniid shrimps are known to be associated with sessile or sedentary hosts, this is the only one known to occur on an actively mobile host.

Acknowledgements. — It is a pleasure to thank Professor W. Macnae, Dr. L. B. Holthuis, Dr. R. Grindley and Dr. A. Crosnier for providing the specimens of *P. imperator* on which this report is based.

IX. PERICLIMENES ZANZIBARICUS SP. NOV., FROM THE WESTERN INDIAN OCEAN

During the period 1959 to 1962 numerous echinoderms were examined in East African waters and the pontoniid fauna collected. In the material obtained were some small shrimps of the genus *Periclimenes* Costa. Further collections made in 1964, during the ninth cruise of the R.V. "Anton Bruun", as part of the United States contribution to the International Indian Ocean Expedition, revealed that the same species is also present in the Seychelles. The specimens, which belong to the typical subgenus of *Periclimenes* could not be referred to known species of *Periclimenes* and do not seem closely related to any of the previously described species.

***Periclimenes zanzibarcus* sp. nov. (fig. 26-29)**

Material examined. — Mtoni, west coast of Zanzibar Island, on echinoids at low water spring tide level on muddy sand beach; 24 September 1961. — 19 specimens including 3 ovigerous females.

Fawatu Reef, off west coast of Zanzibar Island, on echinoid at low water spring tide level on sand flats, September 1961. — 3 specimens including 1 ovigerous female.

Pange Reef, off west coast of Zanzibar Island, on echinoid collected from 1 fm. below low water spring tide level, 23 March 1962. — 3 specimens including 1 ovigerous female.

Victoria Harbour, Mahé, Seychelles, from echinoids collected from 3 ft. below low water on grassy flats; R.V. "Anton Bruun", Cruise 9, 9 December 1964. — 2 specimens including 1 ovigerous female.

Anse Royale, Mahé, Seychelles, from echinoids collected from 1 ft. below low water on weedy flats; R.V. "Anton Bruun", Cruise 9, 10 December 1964. — 2 specimens.

Description. — General body form slender. Rostrum depressed, extending anteriorly to the level of the distal end of the middle antennular segment or even to the distal end of the distal antennular segment. The dorsal margin is straight or very feebly convex and bears 3 or 4 small acute teeth, all situated on the distal half. The ventral margin is strongly convex and deepest in its distal half. There are no ventral rostral teeth. The midrib of the rostrum is very well developed and extends the whole length of the rostrum. It forms a broad laterally projecting lamina which increases in width posteriorly, becoming continuous with the upper orbital margin. The midrib is close to the upper margin of the rostrum in its posterior part but anteriorly runs along the middle of the lamina. At the level of the ophthalmic somite the lateral lamina is slightly constricted. A pair of well developed triangular supra-ocular spines is situated on the orbital margin immediately above the ophthalmic somite. The dorsal margin of the rostrum extends posteriorly to the supra-ocular spines from which it is separated by small depressions. The dorsal orbital margin extends posteriorly and laterally to demarcate a large orbital fossa. The ventral margin is formed by a ridge extending dorso-posteriorly from the hepatic spine which is robust and situated close to the anterior margin at a lower level than the antennal spine. The antennal spine is situated on the anterior margin of the carapace and is weak and slender. It lies distinctly below the inferior orbital angle which is small, acute and slightly produced. The antero-lateral angle of the carapace is not produced and is bluntly angled. There are no supra-orbital spines.

The abdomen has the pleura of the first to fourth segments rounded, that of the fifth being slightly produced and bluntly angled posteriorly. The third abdominal segment is not dorsally produced. The fifth abdominal segment is half the length of the sixth. The depth of the sixth segment is a little more than half its length which is equal to three quarters of the length of the telson. The length of the telson is two and two thirds times its maximum width and its straight sides taper distally. There are two pairs of small dorsal spinules situated close to the lateral margins on the posterior half of the telson. The posterior pair is slightly closer to the anterior pair than to the tip of the

telson. There are three pairs of terminal spines, the outer pair being less than a quarter of the length of the intermediate pair which are long and robust and slightly less than a quarter of the telson length. The submedian spines are robust and setose and three fifths of the length of the intermediate spines. The tip of the telson is truncated, the central third being slightly produced and a minute acute median process is present.

The eyes are short, the maximum length being a little more than one and a half times the maximum width. The cornea is globular and lies obliquely to the long axis of the stalk. There is no ocellus.

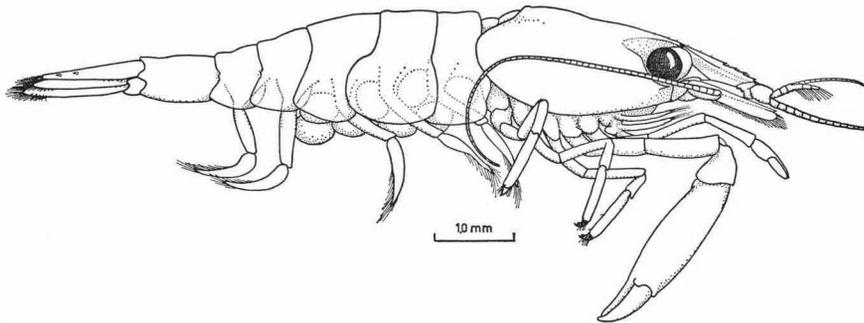


Fig. 26. *Periclimenes zanzibaricus* sp. nov., holotype, female, from Fawatu Reef, Zanzibar.

The basal segment of the antennular peduncle is broad, and its maximum width anterior to the stylocerite is more than half its length. The stylocerite is broad and acutely pointed and exceeds the middle of the segment. The statolith is a subcircular mass. The lateral margin converges distally and is armed anteriorly with a strong acute tooth. The antero-lateral margin is produced beyond the disto-lateral tooth and consists of a small short acute process medially and a slender acute tooth laterally. A short stout ventral spine is present at two fifths of the length of the medial border. The dorsal length of the second segment is half that of the third and the two together are two thirds of the length of the basal segment. The two rami of the upper flagellum are fused for three segments in adult specimens. The free part of the shorter ramus is subequal to the fused part and consists of three segments. The longer ramus consists of about 14 segments. The lower flagellum is subequal to the free part of the longer ramus of the upper flagellum and consists of 13 segments.

The scaphocerite exceeds the length of the antennular peduncle. The lateral border is feebly convex and terminates anteriorly in a strong tooth. The lamella exceeds the disto-lateral tooth and is medially angulated. The

maximum length is two and two thirds times the maximum width, which lies in the proximal half. The antennal peduncle fails to reach the middle of the scaphocerite and the basicerite is unarmed laterally.

The mouthparts are similar to those of other species of the genus. The mandible lacks a palp. The incisor processes are well developed and bear, in the dissected specimen, four small teeth on the right and five on the left. The outer teeth are slightly larger than the intermediate teeth. The molar processes are asymmetrical and consist of processes and groups of setae as illustrated in fig. 28B, C. The maxillula has a well developed palp which is not bilobed. The upper lacinia is short and broad and armed with short stout spines distally and plumose setae disto-ventrally. The lower lacinia is longer and more slender and armed with three slender spines and numerous setae distally. The maxilla has a well developed scaphognathite, broad in its anterior portion and narrower in its posterior part. The endite is distinctly cleft for about one third of its length, the proximal process bearing 8 long setae and the distal process bearing 10. The palp is well developed and a single plumose seta arises from the middle of its medial border. All maxillipeds have well developed exopods. A very small notch separates the small basal endite of the first maxilliped from the coxal endite. The palp is well developed and bears a single plumose subterminal seta and two plumose setae also arise from the middle of its medial border. The caridean lobe of the exopod is large and well developed and a small bi-lobed epipod, without a podobranch, is also present. The second maxilliped is of normal shape, with a well developed subrectangular epipod. The third maxilliped extends anteriorly to the level of the anterior margin of the merocerite. The antepenultimate segment is broad and its length is slightly more than three times its width. Its medial border has numerous long slender setae and its proximal third is provided with a row of dense, short, hooked setae. The penultimate segment is also robust and armed with three stout setae on its outer margins. The terminal segment is three quarters of the length of the penultimate and bears a few robust setae along its outer margin. The exopod is subequal in length to the antepenultimate segment. A large rounded epipod is present, with a few small setae on its margin, and a small arthrobranch.

The first pereopod exceeds the antennular peduncle by the length of the dactylus. The fingers are one and a half times the length of the palm, which is subcylindrical. The cutting edges of the fingers are straight and situated laterally on the fingers, which are slightly spatulate. The cutting edge of the dactylus is finely serrated with small acute, recurved teeth; that of the fixed finger is entire. The carpus is slightly longer than the chela and subequal to the merus. Both are subcylindrical and unarmed. The ischium and basis

are also subequal and slightly less than half the length of the merus. The second pereiopods are short, robust and equal. They exceed the carpuerite by the length of carpus and chela. The chela is robust, with a subcylindrical

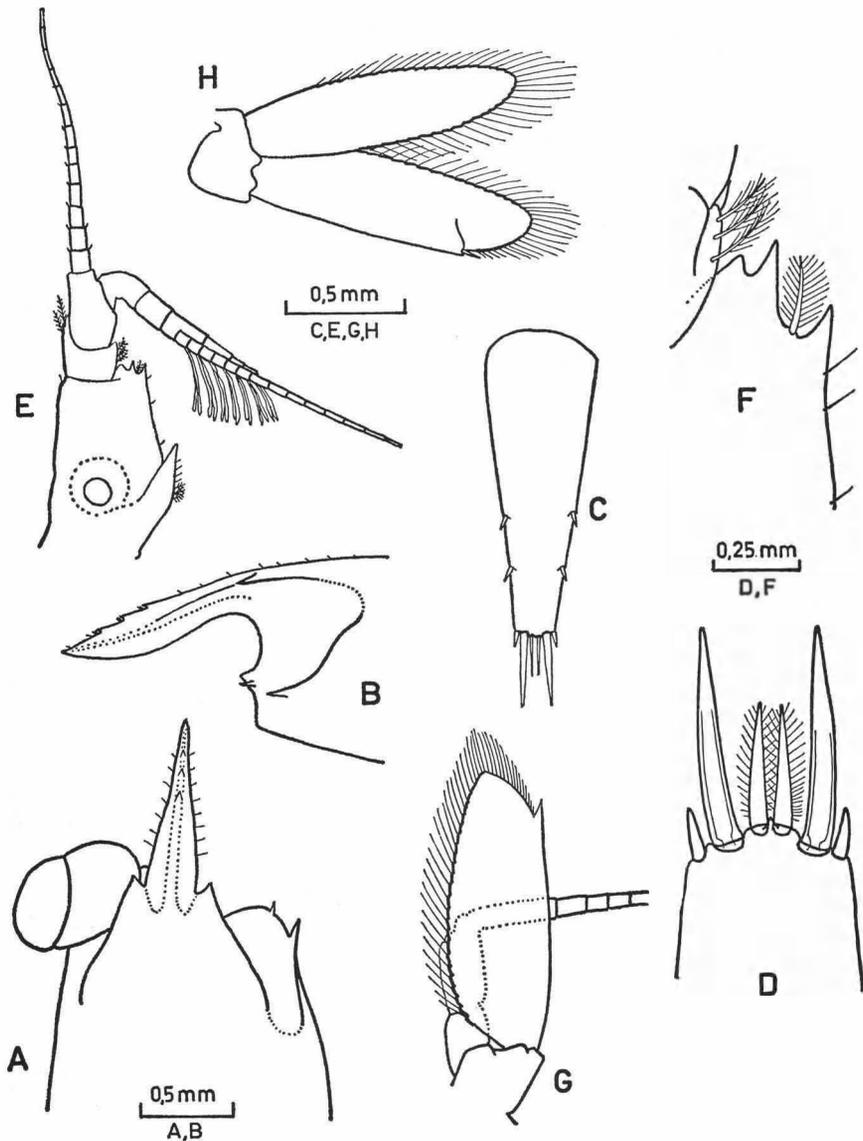


Fig. 27. *Periclimenes zanzibaricus* sp. nov., paratype, female, Mtoni, Zanzibar. A, anterior carapace, dorsal view; B, anterior carapace, lateral view; C, telson; D, posterior end of telson; E, antennule; F, disto-lateral angle of basal segment of antennular peduncle; G, antenna.

palm, slightly swollen in its middle. The fingers are a little less than half the length of the palm. The cutting edges are situated slightly externally, that of the dactylus having a single small tooth at its middle, which opposes two similar teeth on the fixed finger. The cutting edges distal to these teeth bear numerous small close-set square topped teeth. The tips of the fingers are strongly hooked. The carpus is a quarter of the maximum length of the chela. It is unarmed and greatly expanded distally, its maximum width being about three times the proximal width. The merus and ischium are subequal and unarmed. The third to fifth pereopods are similar, short and robust. The third pereopod reaches to the distal end of the carapocerate. The fifth pereopod reaches to the antero-lateral angle of the carapace. In the third pereopod the dactylus is short and stout, twice as long as the basal width, with a well developed accessory spine and a slender acute terminal portion. The dactylus is one sixth of the length of the propodus. The propodus is stout, five and a half times longer than its maximum width and armed, with five groups of spines on the distal half of its posterior border. The spines are single, except for the second which is paired, and increase in size and proximity distally. The distal end of the propodus is obscured by tufts of long slender setae. The outer border bears a few slender setae only. The carpus is a little less than two thirds of the length of the propodus and the merus is subequal to the propodus. The ischium is a little longer than the carpus and about three quarters of the length of the merus. Propodus, carpus, merus and ischium are all unarmed. The fourth pereopod is similar to the third except that the distal half of the posterior border bears six spines, proximally smaller than those of the third pereopod but increasing in size distally, the largest spine of all being close to the posterior border of the dactylus. The propodus of the fifth pereopod lacks spines and bears only long setae. The ratios of the lengths of the segments of the third pereopod from propodus to ischium are 15 : 9 : 15 : 10. The ratios of the lengths of the propodi of the third to fifth pereopods are 15 : 14 : 16 and the meri 14 : 13 : 12. There is no median sternal process between the first pereopods.

The pleopods are normal in shape. The endopod of the first pleopod in the female is narrow, five times longer than wide with a single plumose seta at three quarters of the length of the lateral border and a second terminally. The distal end of the medial border bears four slender non-plumose setae, proximally to which arise a pair of long slender sparsely plumose setae and a single slender seta. Four simple setae are present along the basal third of the medial border. The endopod of the first pleopod of the male is broader than in the female, about three and a half times longer than wide. The distal third of the medial margin bears three short slender plumose setae. A pair

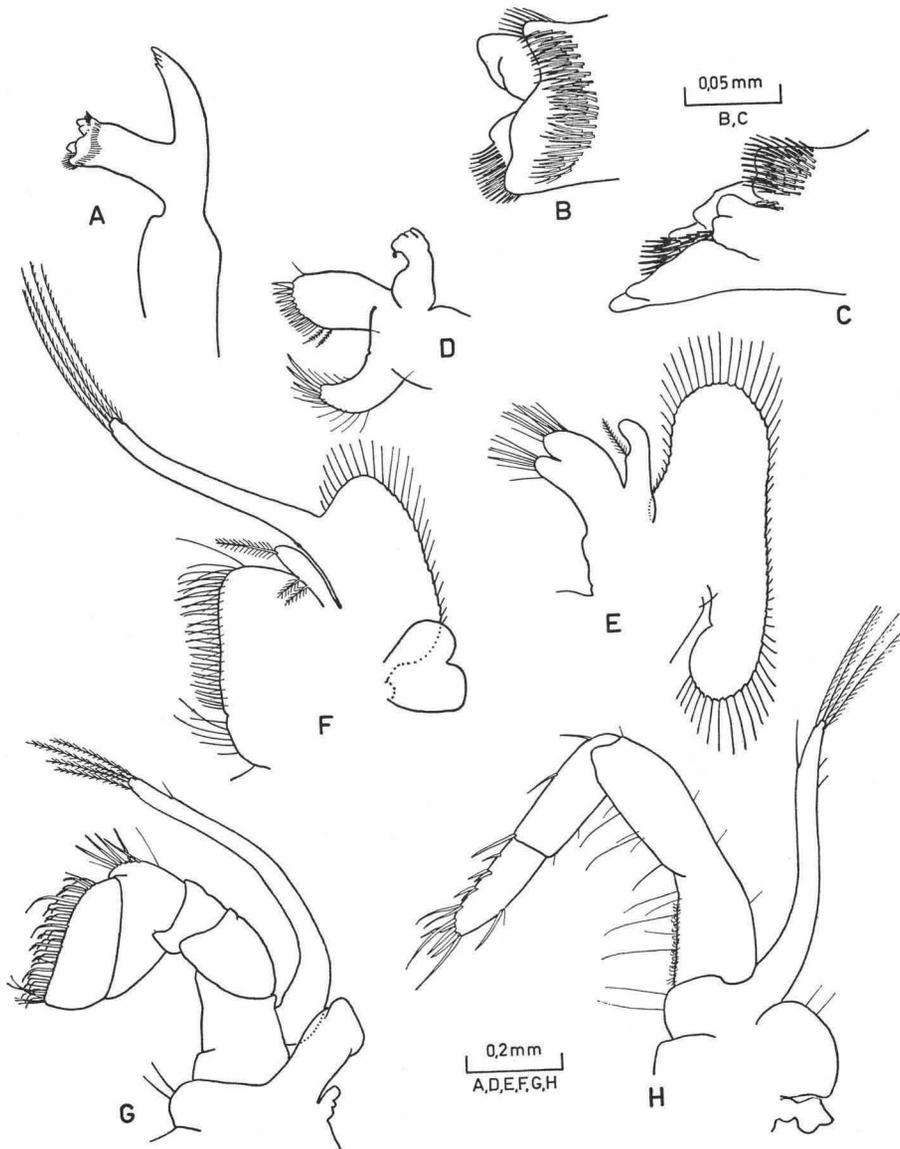


Fig. 28. *Periclimenes zanzibaricus* sp. nov., paratype, female, Mtoni, Zanzibar. A, mandible; B, C, molar processes; D, maxillula; E, maxilla; F, first maxilliped; G, second maxilliped; H, third maxilliped.

of short robust plumose setae are present close to the base of the medial side and distally to these are three short hook-like setae. In the male second pleopod the appendix masculina is two thirds of the length of the appendix interna and is armed distally with three strong slender setae, the central one being finely serrated. The appendix interna bears only three sub-terminal cincinnuli. The uropods are typical. The exopod exceeds the tips of the terminal telson spines. Its lateral border is feebly convex and terminates distally in a small acute tooth with a long slender mobile spinule immediately proximally. The lamella exceeds the disto-lateral spine by one third of the length of the lateral border. The endopod exceeds the tip of the telson but not the telson spines and is slightly shorter than the exopod.

Types. — The ovigerous female from Fawatu Reef, Zanzibar, has been selected as the holotype. It and the allotype and a juvenile have been deposited in the British Museum (Natural History) (Reg. No. 1965.8.17.16, 17, and 18). Paratypes from Mtoni, Zanzibar, have been deposited in the Rijksmuseum van Natuurlijke Historie, Leiden, and paratypes from Mahé, Seychelles, have been deposited in the U.S. National Museum, Smithsonian Institution, Washington.

Measurements (in mm). — The holotype female has a total body length of 9.2. A dissected ovigerous female from Mtoni gave the following measurements: total body length, 7.8; post-rostral carapace length, 1.75; total length of carapace and rostrum, 2.75; length of fifth abdominal segment, 0.50; length of sixth abdominal segment, 0.95; maximum telson length, 1.27; maximum telson width, 0.45; chela of first pereopod, 0.65; chela of second pereopod, 1.80; propodus of third pereopod, 0.70; maximum length of ova, 0.50.

Colour. — The Fawatu Reef specimens were noted in the field as being of a dark purple red colour. The largest specimen from Pange Reef was recorded as being entirely dark purple except for the sixth abdominal segment and caudal fan, which were orange red. The ova were pale translucent brown. The smaller specimens were orange coloured. The colour pattern of the Seychelles specimens was slightly different, the general colour still being purple red, consisting of fine dots on a transparent ground covering the whole animal except for the antennal flagella and the merus and ischium of the third to fifth pereopods. In addition a median line of fine white dots, double over the gastric region, extends from the tip of the rostrum to the posterior margin of the carapace. A similar line extends along the sides of the body from the hepatic spine to the posterior ventral angle of the sixth abdominal segment. The setae of the scaphocerite, uropods and the telson spines are dark purple.

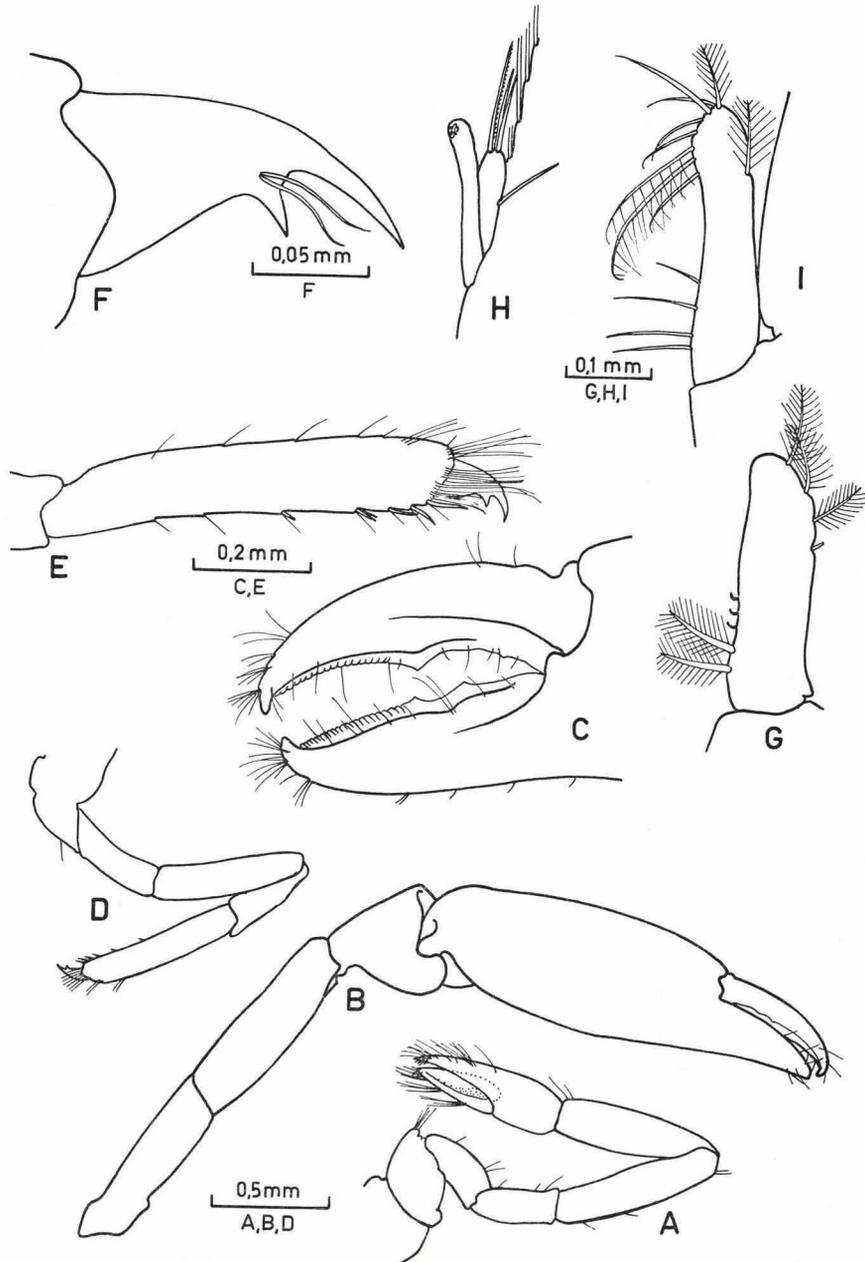


Fig. 29. *Periclimenes zanzibaricus* sp. nov., paratypes, Mtoni, Zanzibar. A-F, I, female; G, H, male. A, first pereiopod; B, second pereiopod; C, fingers of second pereiopod, medial aspect; D, fifth pereiopod; E, propodus and dactylus of third pereiopod; F, dactylus of fourth pereiopod; G, I, endopod of first pleopod; H, appendix masculina and appendix interna of second pleopod.

Hosts. — All specimens were found on echinoids. The type specimen was found on *Echinothrix calamaris* (Pallas). The specimens from Mtoni were on *Astropyga radiata* (Leske). The host for the Pange Reef specimens was a third species of echinoid as yet unidentified. The Seychelles specimens were also found on *Astropyga radiata* and on *Diadema setosum* (Leske). All hosts were obtained from at or near low water spring tide level. The specimens from Mtoni were obtained at the same time as some specimens of *Tuleariocaris zanzibarica* sp. nov.

Discussion. — The presence of distinct accessory spines on the dactyli of the third to fifth pereopods places the species under discussion in the typical subgenus of *Periclimenes* Costa, 1844, where it occupies an isolated systematic position. The presence of supra-orbital spines is well known in many species of the subgenus *Harpilius* Dana (1852) but has been reported in only two species of the subgenus *Periclimenes*. These are *P. commensalis* Borradaile, 1915, and *P. ceratophthalmus* Borradaile, 1915. In *P. commensalis* the spines are true supra-orbital spines as they are slender and remote from the orbital margin. In *P. ceratophthalmus* the spines are similar to those of *P. zanzibaricus* as they are broad triangular spines situated on the orbital margin, level with the ophthalmic somite, and should therefore be described as supra-ocular rather than supra-orbital.

Periclimenes zanzibaricus is therefore most closely related to *P. ceratophthalmus* which has been recorded in association with crinoids in the Maldives (Borradaile, 1915; Kemp, 1925) and from the Malay Archipelago (Holtuis, 1952). *P. zanzibaricus* may be readily separated from *P. ceratophthalmus* by the following points:

1. The cornea in *P. zanzibaricus* is globular. In *P. ceratophthalmus* it is conically produced.

2. In *P. ceratophthalmus* the rostrum is horizontal, in *P. zanzibaricus* it is markedly depressed.

3. In *P. zanzibaricus* there are 3 or 4 dorsal teeth and 4 or 5 in *P. ceratophthalmus*.

4. The rostral midrib is a broad lamina, constricted in front of the supra-ocular spines in *P. zanzibaricus* but not broadened in *P. ceratophthalmus*.

5. Basal segment of antennular peduncle with only a single disto-lateral spine in *P. ceratophthalmus* but with two distinct spines and an acute medial lobe in *P. zanzibaricus*.

6. Incisor process of mandible with 4 or 5 small teeth in *P. zanzibaricus* but with about 9 in *P. ceratophthalmus*.

As far as can be ascertained from the description of *P. ceratophthalmus*

at present available, the two species appear to be similar in their other morphological features.

Although many species of *Periclimenes* are associated with echinoderms *P. zanzibaricus* is only the second species to be found in association with an echinoid, the other species being *P. hertwigi* Balss, 1913, a deep water species.

A number of small morphological features of the present species are note-worthy as they have not usually been reported in the descriptions of the species of this genus. The palp of the maxilla has a single plumose seta half way along its medial border, while that of the first maxilliped has a subterminal plumose seta, with two more half way along its medial border. The basal third of the medial border of the antepenultimate segment of the third maxilliped has a characteristic row of short hook-like setae which have not been reported in other species. The cutting edge of the dactylus of the first pereopod is also characteristic with its row of minute acute recurved teeth and the serrations on the distal halves of the cutting edges of the second pereopods also appear to be distinct from all other species of *Periclimenes*.

The species appears to be naturally uncommon as it was only rarely found although numerous echinoids were examined. At Anse Royale on Mahé a group of 20 specimens of *Diadema* were examined but only two examples of *P. zanzibaricus* were obtained, each from a different host.

Acknowledgements. — I wish to thank Miss A. M. Clark and Dr. G. Cherbonnier for the identification of the echinoid hosts.

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