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Pontoniid shrimps from the Palau Islands (Crustacea, Decapoda, Palaemonidae)[1)]

Sadayoshi MIYAKE and Takahiro FUJINO

During the period from March to August, 1939 the senior author took the chance to stay at the Palao Tropical Biological Station in the Palau Islands for the collection and ecological study of decapod crustaceans in the coral reef. From the islands Kubo (1940) recorded only three species of pontoniid shrimps based on the late Professor Esaki's collection, since then additional records have been hardly known. The authors, therefore, try to reveal the pontoniid fauna of the Palau Islands and the commensal relationship of pontoniids and other marine invertebrates. In this paper are reported fifteen species of pontoniids collected there, with the description of one new species, ***Periclimenaeus palauensis*** and six species whose occurrences have never been known from Micronesia. There are some discussions regarding to the taxonomic interests in each species. In addition, the colour patterns of some species are here made clear, and also it is of interest to note that one specimen of ***Periclimenes*** (***Harpilius***) ***brevicarpalis*** infested by a bopyrid showed the intermediate colour pattern between male and female. Most of the species of five genera, ***Periclimenes***, ***Periclimenaeus***, ***Philarius***, ***Coralliocaris*** and ***Jocaste*** were taken among the branches of madreporarian corals, and those of the other genera, ***Anchistus***, ***Paranchistus*** and ***Conchodytes*** were found in commensal with large bivalves. Almost all the materials here dealt with were obtained by hands when coral reefs were exposed at low tide. All the materials are deposited in the collection of the Zoological Laboratory, Faculty of Agriculture, Kyushu University (ZLKU).

The collections were made from following six Palau localities (Fig. 1):

1) Ngáruangel Atoll (8° 10′ N, 134°39′E), the northern verge of the Palau Islands, separated from the main island by a long distance. The

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1) Contributions from the Zoological Laboratory, Faculty of Agriculture, Kyushu University, No. 373.

corals, *Montipora* sp. and *Acropora* sp., are most abundant.

2) S. W. Madalâi, Goréor Island (7°20′30″N, 134°28′E), facing the narrow reef flat between the northern part of Ulupságal Island and Goréor Island, with the narrow channel. The corals, *Pocillopora* sp. and *Montipora* sp., are common.

3) Ngarbagéd, Goréor Island (7°19′40″N, 134°28′40″E), south of Madalâi, near by the same reef as in Madalâi. Here was situated the Palao Tropical Biological Station. The coral, *Montipora* sp., flourishes.

4) Malagál Harbour, Ngurkdápel Island (7°18′N, 134°27′30″E), north of Urukutâburu Island.

5) Ngadarák Reef (7°17′30″N, 134°28′30″E), between Ulupságal Island and Urukutâburu Island, constituting wide reef flat. Most of the species were here taken. The coral, *Acropora* sp., prevails.

6) Ngaiánges Island (7°12′25″N, 134°23′E), a coral cay, south of Urukutâburu Island. The coral, *Acropora* sp., is the commonest.

Before proceeding any further, the authors wish to express their cordial thanks to Dr. Shiro Murakami of the Japan Sea Regional Fisheries Research Laboratory and Professor Seiji Wada of Kagoshima University for the interesting materials on which this paper is based. Thanks are also due to Dr. Tadashige Habe of the National Science Museum for his helpful suggestions on the study of the bivalves.

The following is the list of the species studied in this paper.

1. *Periclimenes* (*Periclimenes*) *ceratophthalmus* Borradaile
2. *Periclimenes* (*Periclimenes*) *commensalis* Borradaile
3. *Periclimenes* (*Harpilius*) *elegans* (Paulson)
4. *Periclimenes* (*Harpilius*) *platycheles* Holthuis
5. *Periclimenes* (*Harpilius*) *brevicarpalis* (Schenkel)
6. *Periclimenes* (*Harpilius*) *inornatus* Kemp
7. *Anchistus miersi* (de Man)
8. *Anchistus custos* (Forskål)
9. *Paranchistus biunguiculatus* (Borradaile)
10. *Periclimenaeus palauensis* sp. nov.
11. *Philarius imperialis* (Kubo)
12. *Coralliocaris graminea* (Dana)
13. *Coralliocaris superba* (Dana)
14. *Jocaste japonica* (Ortmann)
15. *Conchodytes tridacnae* Peters

Description of the species

Key to subgenera and species of the genus *Periclimenes*.

A. Dactili of last three pereiopods biunguiculate... Subgenus *Periclimenes*

B. Eye with terminal papilla; anterior border of dactylus without movable spine ..... *ceratophthalmus*

B′. Eye without terminal papilla; anterior border of dactylus with movable spine ..... *commensalis*

A′. Dactili of last three pereiopods simple ..... Subgenus *Harpilius*

B. Distal margin of carpus of second pereiopod with two strong teeth; rostrum and antennal scale elongated

C. Supraorbital spine present ..... *elegans*

C′. Supraorbital spine absent ..... *platycheles*

B′. Distal margin of carpus of second pereiopod without teeth; rostrum and antennal scale not elongated

C. Dorsal spines of telson minute and anterior pair placed behind middle of telson; movable finger is about as long

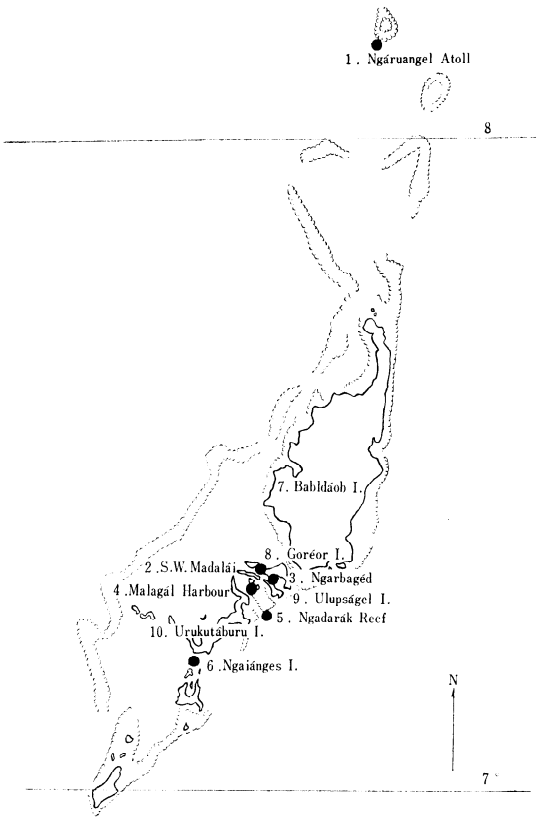

Fig. 1. Map of Palau Islands showing localities.

as palm; fused portion of outer antennular flagellum consists of more than three joints ..... *brevicarpalis*

C'. Dorsal spines of telson distinct and anterior pair placed before middle of telson; movable finger is about half as long as palm; fused portion of outer antennular flagellum usually consists of three joints ..... *inornatus*

1. *Periclimenes* (*Periclimenes*) *ceratophthalmus* Borradaile, 1915

(Fig. 2, a-d)

Periclimenes (*Corniger*) *ceratophthalmus* Borradaile, 1915, p. 211—Male Atoll, Maldive Arch. (on crinoids); Borradaile, 1917, p. 365, pl. 54—Male Atoll, Maldive Arch. (on crinoids).

Periclimenes (*Periclimenes*) *ceratophthalmus*: Kemp, 1925, p. 324, fig. 18—w. of Heratera I., Maldive Arch. (on crinoids); Holthuis, 1952, p. 56, fig. 20 — Obi latu, Molucca Is.

Meterial examined. Ngadarák Reef, on *Comanthus* sp., 2 ♂♂, 1 ovig. ♀, ZLKU No. 1957, Apr. 21, 1938, S. Murakami leg.

Description. Three specimens measure from 2.0 to 2.8 mm in the length of the carapace. The rostrum is lanceorate, outreaching the antennular peduncle. It bears five or six teeth on the upper border, the distal one or two of which are situated closely near the apex, while only one tooth on the lower border. The carapace is smooth and provided with supraorbital, antennal and hepatic spines; the supraorbital is strong and situated above the upper orbit, and the hepatic closely near the antennal.

The eye has a short terminal papilla on the cornea anteriorly.

The first segment of the antennular peduncle is broad, the lateral process being produced round. The terminal spine is small and exceeds the lateral process. The stylocerite is rather short and broad at the base, ending in a pointed tip. The fused portion of the outer flagellum consists of three joints.

The antennal scale is somewhat elongated with the narrow anterior margin, being far beyond the lateral spine.

The dactylus of the first pereiopod is as long as the palm. The carpus is equal to the merus in length (Fig. 2, a). The second pereiopods are symmetrical. Each of the fingers bears three illdefined teeth. The palm is rather cylindrical, being one and a half times as long as the movable finger. The carpus is short and semiconical. The merus is slightly longer than the movable finger and is provided with one stout tooth on the posterodistal margin (Fig. 2, b). The dactylus of the third pereiopod is short and recurved with a small proccess on the posterior border. The propodus is as long as the merus and provided with setae postero-

distally (Fig. 2, c).

Among the three specimens only one has a telson in complete form. It is elongated and bears two pairs of minute dorsal spines; the anterior is situated slightly before the middle and posterior at the position of posterior three-sevenths of the telson. At the terminal end five spines are present, the four on both sides except for the innermost one making two pairs, the outer of which is minute and the other strong (Fig. 2, d).

Remarks. The present specimens agree with Kemp's (1925) description and figure, excepting the characters as follows: The eye in Kemp's illustration has the terminal papilla which is longer than in the present specimens. The rostrum in the present specimens bears one spine on the lower borber but no spine in his description. Each dactylus of the last three pereiopods bears a large and sharp accessory claw in his figure, while the dactylus in the present specimens is provided with a small process in place of the claw.

This species is easily distinguished from all the others known in the subgenus *Periclimenes* by having the singular structure of the eye which bears the terminal papilla. Moreover, this species is characterized by having the supraorbital spine, like *Periclimenes* (*Periclimenes*) *commensalis.*

The one specimen, as already described, does not make three complete pairs of the terminal spines of the telson. Such a fact seems to be an unusual character.

Hosts. The present specimens were found in commensal with crinoid represented hereby a certain species of the genus *Comanthus.*

Distribution. This species was recorded from the Maldive Archipelago and the Malay Archipelago, and is newly collected from Micronesia.

2. *Periclimenes* (*Periclimenes*) *commensalis* Borradaile, 1915

(Fig. 2, e-g)

Periclimenes (*Cristiger*) *commensalis* Borradaile, 1915, p. 211 — Torres Straits (on crinoids); Borradaile, 1917, p. 364 — no new record.

Periclimenes commensalis: Potts, 1915, p. 82 — Murray I., Torres Straits (on crinoids).

Periclimenes (*Periclimenes*) *commensalis*: Holthuis, 1952, p. 53, figs. 18, 19 — w. coast of Flores.

Material examined. Ngadarák Reef, on crinoids, 1 ♂, 1 ovig. ♀, 1 ♀, ZIKU No. 1947, Apr. 21, 1938, S. Murakami leg.

Description. Three specimens measure from 1.8 to 2.2 mm in the length of the carapace. The rostrum, like *Periclimenes* (*Harpilius*) *brevicarpalis*, is lanceorate and directed slightly downwards. There are five teeth on the upper and one or two on the lower border. The carapace is smooth with supraorbital, antennal and hepatic spines; the supraorbital is strong, and the hepatic near the antennal and placed on a slightly lower

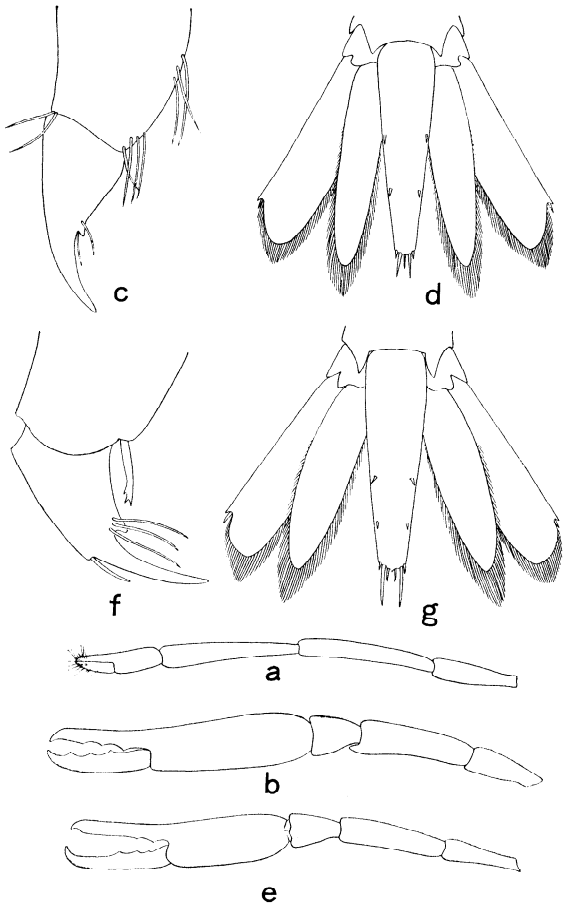

Fig. 2. *Periclimenes* (*Periclimenes*) *ceratophthalmus* Borradaile, a, first perereiopod, ×12; b, second pereiopod, ×8.4; c, dactylus of third pereiopod, ×60; d, telson and uropods, ×12.
Periclimenes (*Periclimenes*) *commensalis*, Borradaile, e, second pereiopod, ×12; f, dactylus of third pereiopod, ×120; g, telson and uropods, ×16.

level than the antennal. The orbital angle is narrowly produced.

The first segment of the antennular peduncle is broad. The lateral process is produced forwards with a pointed tooth distally which is longer than the terminal spine. The stylocerite is broad at the base and then becomes narrow distally, ending in a sharp point. The fused portion of the outer flagellum consists of three joints.

The antennal scale gradually becomes narrow anteriorly. The anterior margin of the lamella is convex and exceeds the lateral tooth.

The first pereiopod is rather stout. The movable finger is somewhat longer than the palm. The carpus is strong and as long as the merus. The second pereiopod is rather small. The chela is somewhat elongated. The fingers are slightly shorter than the palm, being provided with three, broad and obscure teeth in the proximal half of each cutting edge. The distal part of each finger is oppositely curved. The carpus is conical and swollen distally. The merus is twice as long as the ischium (Fig. 2, e). The dactylus of the third pereiopod is armed with distinctly biunguiculated claws; the proximal is a small accessory process and the distal a long claw. The anterior margin of the dactylus bears a fine movable spinule. The propodus bears a pair of distally serrated spines at the posterodistal margin, being twice as long as the carpus and slightly shorter than the merus than the merus (Fig. 2, f). The last two pereiopods resemble the third.

The telson is narrow and bears two pairs of the minute dorsal spines; the anterior is situated slightly behind the middle of the telson and the other at the midway between the anterior pair and the posterior margin of the telson. Of three pairs of terminal spines the outer is minute and the median more than twice the length of the inner (Fig. 2, g).

Remarks. This species is distinctly characterized by having the supraorbital spine as ***Periclimenes*** (***Periclimenes***) ***ceratophthalmus***, and also having a slender spinule on the anterior margin of each dectylus of the last three pereiopods. The present specimens are in accordance with Borradaile's (1915, 1917) descriptions. Kemp (1922) reported that the lateral process of the first segment of the antennular peduncle is round having no spine nor tooth. In all our specimes, however, the process is much produced forwards and forms a pointed tooth which is longer than the terminal spine as seen in Borradaile's descriptions.

Hosts. According to Borradaile (1915) and Potts (1915), the specimens they examined were found on a crinoid, ***Comanthus timorensis*** (J. Müller) (=***Comanthus annulatus*** (Bell)). The present specimens were also found clinging on to a certain species of crinoids.

Distribution. It was known from Torres Straits and Flores, and is for

the first time recorded from Micronesia.

3. *Periclimenes* (*Harpilius*) *elegans* (Paul'son, 1875)
(Fig. 3, a, b)

Anchistia elegans Paul'son, 1875, p. 113, pl. 17, fig. 1 [1961, p. 119, pl. 17, fig., 1-1h] — Red Sea.

Periclimenes (*Farciger*) *dubius* Borradaile, 1915, p. 211 — Minikoi, Maldive Arch.; Borradaile, 1917, p. 373, pl. 54, fig. 12 — Minikoi, Maldive Arch.

Periclimenes (*Ancylocaris*) *elegans*: Kemp, 1922, p. 215, figs. 60-62 — Sinai Peninsula, Persian Gulf and Andaman Is.

Periclimenes (*Ancylocaris*) *elegans* var. *dubius*: Kemp, 1922, p. 218, fig. 63 — Madras Harbour.

Periclimenes (*Harpilius*) *elegans*: Holthuis, 1952, p. 81, fig. 31 — Celebes, Amboina and some localities of Molucca Is.; Johnson, 1961, p. 59 — Singapore.

Material examined. Ngadarák Reef, on corals, 3 ovig. ♀♀, 1♀, ZLKU No. 1953, June 1, 1939, S. Miyake leg.

Description. The specimens range from 2.7 to 4.8 mm in the length of the carapace. The rostrum is elongated and rather deep in lateral view. It reaches to or slightly extends beyond the antennal scale, directing straight at the base and upwards in its distal half. The dorsal carina extends backwards to the anterior one-third point of the carapace. Seven or eight teeth are present on the upper border; the proximal two of them are placed on the carapace, and the distal one is placed near the apex of the rostrum. On the lower border there are four teeth; the proximal is placed at about the middle of the rostrum. The carapace has supraorbital, antennal and hepatic spines; the antennal is closely near the anterior margin of the carapace, and the hepatic located far behind the antennal and on a lower level.

The first segment of the antennular peduncle is broad. The outer margin is a little convex, ending in a sharply pointed terminal spine which scarcely reaches the distal end of the second segment. The stylocerite is short and fails to reach the middle of the first.

The antennal scale is very slender with the outer margin slightly concave and the inner one convex near the base. The lateral spine exceeds the end of the lamella.

The first pereiopod is slender with the movable finger somewhat shorter than the palm. The carpus and the merus are equal in length. The second pereiopods are symmetrical with the fingers slightly inturned and provided with fine setae sparsely at the end. The cutting

edge of the movable finger bears three indistinct teeth; the distal is located at about the middle, while that of the immovable finger two broad teeth in the proximal one-third point. The palm is rather cylindrical, being more than twice as long as the movable finger. The carpus is also cylindrical and longer than the movable finger, being equal to the merus. At the anterodistal margin there are two strong spines, of which the posterior is further divided into a large and a small spinules. The inner distal margin of the merus bears a strong acute spine (Fig. 3, a). The third pereiopod is considerably slender, especially in the dactylus and propodus. The dactylus is slightly curved with the sharply pointed tip, and at the posterior side there is no tooth nor spine. The propodus is much longer than the merus. One pair of spines is placed at the posterodistal margin, and several other teeth are also placed at the posterior border of this segment. The fourth and the fifth pereiopods are similar to the the third in shape and size.

The telson is a little longer than the sixth abdominal segment, and is broad at the middle and then tapers towards both the ends. There are two pairs of the dorsal spines which divide the telson into subequal length. Of three pairs of terminal spines the outer is the smallest, and the median is long which is more than twice the length of the inner (Fig. 3, b).

Remarks. The present specimens are generally identical with Paul'son's (1961)[1] original description, excepting both the merus and the ischium whose surfaces are not covered with squamate lines. The same account was also given by Nobili (1906) and Kemp (1922).

This species is closely related to *Periclimenes* (*Harpilius*) *grandis*, but the conclusive distinction between the two is presented by the fact that in *P.* (*H.*) *grandis* only one spine is placed at the distal margin of the carpus of the second pereiopod, whereas two strong spines in this species.

Kemp (1922) described the subspecies *dubius* Borradaile, 1915 only based upon the proportion of the carpus of the second pereiopod. Namely, the carpus is three times as long as the distal breadth in male and barely four times in female in *dubius*, while four to four and a half times in both sexes of the present species. In our materials, however, is found no individual having the pereiopod with same proportion as Kemp gave for the description of *dubius*. As pointed out by Holthuis (1952), this difference seems to be too small in a character to separate the present species into two distinct species.

Hosts. Johnson (1961) recorded a single specimen of this species from

1) We referred to the English translation (1961) of the original Russian publication for 1875.

Enhalus-beds in Singapore. But the present specimens were obtained in association with madreporarian corals.

Distribution. This species has been recorded from throughout the Indo-Westpacific region from the Red Sea, Persian Gulf, Bay of Bengal, the Malay Archipelago to Queensland. This species is newly recorded from Micronesia.

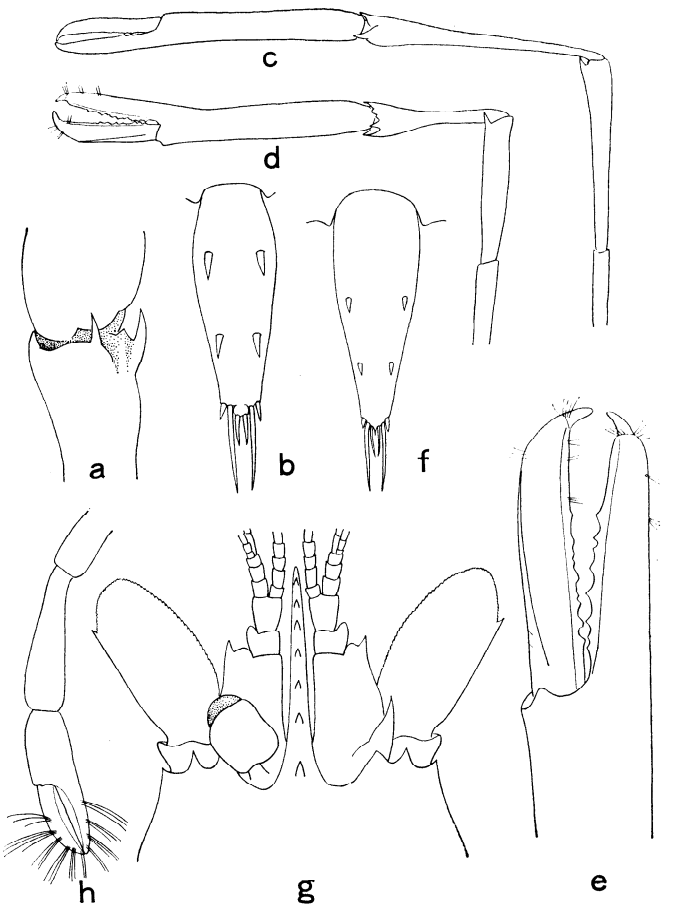

Fig. 3. *Periclimenes* (*Harpilius*) *elegans* (Paulson), a, distal part of carpus of second pereiopod, ×24; b, telson, ×12.
Periclimenes (*Harpilius*) *platycheles* Holthuis, c, second pereiopod, ×12; d, second pereiopod (No. 1387), ×8; e, fingers of second pereiopod, ×24; f, telson, ×16.
Periclimenes (*Harpilius*) *inornatus* Kemp, g, anterior part of body, ×13; h, first pereiopod, ×24.

4. *Periclimenes* (*Harpilius*) *platycheles* Holthuis, 1952
(Fig. 3, c–f)

Periclimenes (*Harpilius*) *platycheles* Holthuis, 1952, p. 85, fig. 33 — Fau I., w. coast of Gebe I. and Atiationin, w. coast of New Guinea.

Material examined. Ngadarák Reef, on corals, 1 ♂, ZLKU No. 1387, June 16, 1939, S. Miyake leg.

Ngadarák Reef, on *Acopora* sp., 3 ♂♂, ZLKU No. 8203, June 16, 1939, S. Miyake leg.

Description. Four male specimens measure from 2.0 to 2.5 mm in the length of the carapace. The rostrum is very slender, upturned near the distal half and reaches slightly beyond the antennal scale. One specimen has the rostrum with the concave apex which does not form any tooth nor point. There are six or seven teeth on the upper border; the proximal is placed on the carapace and the second just above the orbit. Five or six teeth stand on the lower border. The carapace is smooth and provided with antennal and hepatic spines, the former is situated slightly below the orbit and the latter near the former and placed on a lower level.

The first segment of the antennular peduncle is broad. The lateral process is not visible, and the terminal spine is short. The stylocerite is broad at the base and pointed at the tip, not reaching the middle of the first segment. The second and the third segments are equal in length. The fused portion of the outer flagellum is long and consists of thirteen to twenty joints.

The antennal scale is narrow. The outer margin is concave and ends in a strong lateral tooth which exceeds the end of the lamella. A strong spine is present on the basal portion of the antennal peduncle.

The movable finger of the first pereiopod is narrow and as long as the palm, having the thin cutting edges. Both the anterior and the inner sides of the chela are provided with tufts of setae. The carpus is slender and somewhat longer than the merus. The second left pereiopod is all lacking in our specimens. The right pereiopod is slender and long. The fingers are straight and armed with several obscure teeth on the cutting edges. The palm is rather cylindrical and as long as the movable finger. The carpus is slender except for the distal swollen part and somewhat longer than the palm, and two distinct spines are placed at the distal margin. The merus is slightly shorter than the carpus and equal to the ischium in length, its posterodistal tooth being strong (Fig. 3, c–e). The third pereiopod is slender. The dactylus is curved and has a sharply pointed tip. The propodus is thin and as

long as the merus, its posterior margin is provided with fine spines. The fourth and the fifth pereiopods rather resemble the third, excepting the propodus of the fifth, which is longer than that of the third.

The telson is rather narrow with two small dorsal teeth. Of three pairs of the terminal spines the median is long and about twice the inner, and the outer is very short. (Fig. 3, f).

Remarks. Of the three specimens examined only one is keeping the second right pereiopod but not the left, and the other two have only the left. According to Holthuis (1952), the right pereiopod is generally similar to the left in the shape, but the former is smaller than the latter, and the carpus in the former, which is as long as the chela, is relatively longer than that in the latter. On each of the cutting edges of the fingers several obscure teeth are placed in the present specimens, whereas two broad teeth are distinctly visible in his illustration. This account thus noted above is the only different point noticed between the present specimens and his description.

One male specimen (No. 1387) shows a variant form in the proportional length of the carpus of the second left pereiopod against the palm (Fig. 3, d). It has the exceptionally short carpus which is slightly longer than half the length of the palm and has three spines on the distal margin. While in the other specimens, as also described by Holthuis, the carpus is long and about as long as the palm, being armed with two teeth on the distal margin. The above-mentioned differences appear to fall within the range of the variation of this species.

Hosts. This species was originally recorded from the muddy bottom at a depth of about 30 to 60 m. The materials here examined, however, are picked up among the branches of the coral, *Acropora* sp. in the shallow reef.

Distribution. This species was only known from Gebe Island and New Guinea, and is newly obtained from Micronesia.

5. *Periclimenes* (*Harpilius*) *brevicarpalis* (Schenkel, 1902)

(Fig. 4)

Ancylocaris brevicarpalis Schenkel, 1902, p. 563, pl. 13, fig. 21 — Makassar.

Palaemonella aberrans Nobili, 1904, p. 234 — Jibuti.

Periclimenes potina Nobili, 1905, p. 159 — s. coast of Arabia.

Ancylocaris aberrans: Nobili, 1906, p. 64 — Jibuti (with anemones)

Periclimenes hermitensis Rathbun, 1914, p. 655, pl. 1, figs. 1-3 — Hermite, W. Australia.

Periclimenes (*Ancylocaris*) *brevicarpalis*: Kemp, 1922, p. 185, figs. 40-42, pl. 6, fig. 8 — Gulf of Manaar and some localities of Andaman Is. (with

anemone); McClloch & McNeill, 1923, p. 58, fig. 2 — some localities of Queensland (with anemones); Kubo, 1940a, p. 46, figs. 13, 14 — Ishigaki-jima I., Ryukyu Is. (with anemone); Barnard, 1950, p. 794, fig. 150, e - h - Delagoa Bay, S. Africa (with anemones).

Periclimenes brevicarpalis: Gravely, 1927, p. 137—Krusadai I., Gulf of Manaar (with anemone).

Periclimenes (*Harpilius*) *brevicarpalis*: Holthuis, 1952, p. 69, fig. 27 — Portu guese E. Africa, Red Sea (17°30′N, 40°30′E), Bay of Djakarta, Sulu Sea, Makassar Strait, Gebe I., Banda Sea and Sumbawa; Johnson, 1961, p. 59 — Singapore (with anemone).

Material examined. Ngadarák Reef, on *Acropora* sp., 1 ♂, ZLKU No. 2749; 1 ♂, ZLKU No. 2751, May 23, 1939, S. Miyake leg.

Ngadarák Reef, with *Stoichactis kenti*, 1 ovig. ♀, ZLKU No. 2774, June 18, 1939, S. Miyake leg.

Malagál Harbour, Ngurkdápel I., with *Stoichactis kenti*, ZLKU No. 2775, 11 ♂♂, 10 ovig. ♀♀, 2 ♀♀, May 6, 1939, S. Miyake leg.

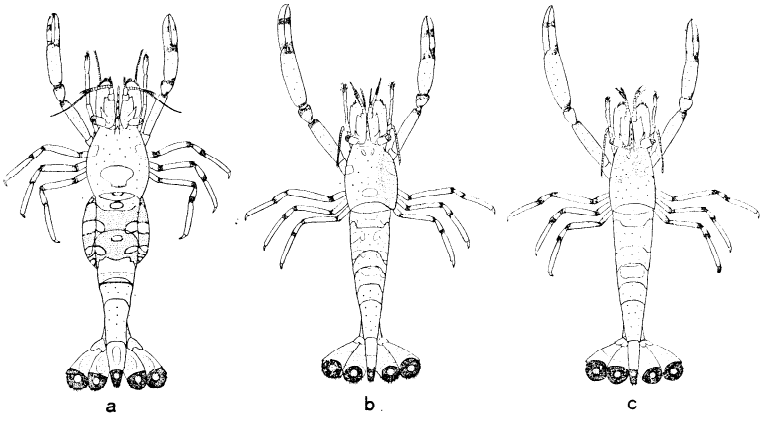

Fig. 4. Colour patterns of *Periclimenes* (*Harpilius*) *brevicarpalis* (Schenkel), a, ovigerous female; b, male infested by bopyrid; c, male.

Remarks. In the length of the carapace, the smallest male measures 2.7 mm and the largest ovigerous female 8.9 mm.

This species has hitherto been fully recorded from various seas. Between the present specimens and Kemp's (1922) description and figures none of the differences are noted. Of the materials one is occasionally found having the rostrum armed with eight teeth on the upper and four on the lower border, whereas the other specimens have five or six and one or two teeth, respectively.

This species is closely allied to *Periclimenes* (*Harpilius*) *inornatus*, but is distinctly separated from the latter, in regard to the size and position of the dorsal and terminal spines of the telson.

The colour in life is excellently described by Kemp (1922), and in the present specimens a close resemblance to his description is noticed. Ovigerous females in life are almost transparent except for such pigmented areas as followed next: Each articulated part of all the pereiopod is dark blue. The carapace has the pure white markings on either side and on the dorsal portion where the gonad is placed. In addition, the eyestalk and the part just behind the rostrum on the dorsal side of the carapace are also white. The abdomen in the dorsal and lateral sides is mainly covered with brown, excepting two pairs of the large, oval and white patches outlined by black bands laterally and the broad white patch situated on the posterodorsal side. These patterns are never seen in males. On the proximal half of the telson and each of the uropods there is a white, circular and broad ring followed by an orange eye-spot which is bordered by a dark, brown band as in the males. In the colouration, some noticeable differences are found between both sexes in our specimens. The males, as mentioned above, wholly lack the broad, white patch on the dorsal side of the carapace and the colour pattern of the abdomen, which are distinctly observed in the ovigerous females. Moreover, the bases of the telson and the uropods are white in the males. According to Kemp and others, considerable variations in the colour among the individuals are generally found.

In the next place, one living male infested by a bopyrid shows an interesting intermediate colour pattern between both sexes. On the carapace of this specimen there are small markings on either side, which are smaller than in the ovigerous females. In the abdomen are invisible oval patches, which are clearly observed in the ovigerous females, only leaving the white patches. The white patches on the bases of the telson and each of the uropods are common to the males. In this peculiar individual, the morphological changes, which may naturally be brought by the bopyrid's infestation, are examined carefully, especially in the apendix masculina which represents as usual a distinct external sexual organ. But any remarkable changes except for an unusual swell of the carapace where is infested by the bopyrid, are not morphologically recognizable. In this case, is expected the occurrence of the castration or the rudiment of the appendix masculina, because such fact may be likely observed in male crabs parasitized by rhizocephalids. Finally, we should not say without any doubt whether or not, the change of the colour is immediately caused by the infestation of the bopyrid. The fact, however, seems to be worthy of record (Fig. 4).

Hosts. The adults of the species have been reported as living with

the sea-anemones of the genera, *Thalassianthus* and *Stoichactis*. According to Holthuis (1952), the youngs of the present species are found among weeds on high sea. The present specimens were collected among the branches of *Acropora* sp. and in the oral cavity of the giant anemone, *Stoichactis kenti* (Haddon et Shackleton). This anemone commonly inhabits the coral reefs around the Palau Islands. It usually measures 15 to 40 centimeters in diameter, with countless tentacles. The senior author already reported (1943) as to the habits of this anemone in some details. "The tentacles are tinged with brown, blue and purple, and they look so charming that one feels a temptation to touch them. These feelers have a peculiar nature of getting easily stuck to other objects, and once they get so clung, they will get detached from the body. If one thrusts one's bare hand into the tentacle-crown, the tentacles will stick to the hand firmly and the skin of the hand so touched will later become swollen up and a little pain is felt. The injuly will last for a few days." Furthermore, he noticed the fact of the association of this anemone with the hippolytid shrimp, *Thor amboinensis*, some pretty fishes, *Actinicola percula*, *Amphiprion polymus* and *Amphiprion frenatus* and the porcellanid crab, *Neopetrolisthes ohshimai*, besides the present shrimps.

Distribution. This species has been recorded throughout the Indo-Westpacific region, from E. Africa and the Red Sea to the Ryukyu Islands, the Malay Archipelago and Oceania.

6. *Periclimenes* (*Harpilius*) *inornatus* Kemp, 1922

(Fig. 3, g, h)

Periclimenes (*Ancylocaris*) *inornatus* Kemp 1922, p. 191, figs. 43-46 — Andaman Is. (with anemones).

Periclimenes (*Harpilius*) *inoratus*: Patton, 1966, p. 274, fig. 2 — several localities of Queensland (on corals).

Material examined. Ngadarák Reef, on corals, 3 ♂♂, 1 ovig. ♀, ZLKU No. 1949, June 1, 1939, S. Miyake leg.

Description. In the length of the carapace, the smallest male measures 2.0 mm and the ovigerous female 3.0 mm. The rostrum is bent downwards and exceeds the end of the antennular peduncle. It bears seven teeth on the upper, the proximal of them is located just above the orbit, the distal one being small which placed closely near the apex. One tooth is situated on the lower border beneath the fifth on the upper (Fig. 3, g).

The first segment of the antennular peduncle is broad, and the outer margin is slightly convex. The stylocerite is slender in contact with

the outer margin of the first segment, projecting forwards beyond the middle of the first segment. The third and the second segments are subequal in length. The outer flagellum is bifurcated at the third joint.

The antennal scale is broad, measuring twice as long as broad. The outer margin is slightly convex, ending in the lateral tooth which does not reach the end of the lamella. The anterior margin is strongly convex.

The first pereiopod reaches beyond the antennal scale by the chela. The movable finger is slightly longer than the palm and provided with many setae distally. The cutting edges are thin and a little gapped when closed. The carpus is somewhat longer than the chela (Fig. 3, h).

Remarks. This species is closely related to *Periclimenes* (*Harpilius*) *brevicarpalis*. The specimens examined agree well with Kemp's (1922) original description and figures except for only the proportional length of the first pereiopod against the palm. According to him, the palm is one and a half the length of the movable finger, whereas the palm is as long as or slightly shorter than the movable finger in the present specimens.

Hosts. Kemp (1922) noted that a series of the specimens in his collection from the Andaman Islands were found on anemones of the genus *Stoichactis* (=*Discosoma*) in company with *P.* (*H.*) *brevicarpalis*, while the present materials were all living touched with madreporarian corals in shallow waters as well as in Patton's (1966) publication.

Distribution. This species has been known from the Andaman Islands and Queensland. The present specimens extend the known range of this species further to Micronesia.

7. *Anchistus miersi* (de Man, 1888)

Harpilius miersi de Man, 1888, p. 274, pl. 17, figs. 6-10 — Mergui Arch.

Anchistus miersi: Borradaile, 1898, p. 387 — New Guinea; Nobili, 1906, p. 63 — Red Sea (in bivalve); Borradaile, 1917, p. 388, pl. 56, fig. 25 — Male Atoll and Seychelles; Tattersall, 1921, p. 391 — Suakin Harbour, Red Sea; Kemp, 1922, p. 255, fig. 85 — Mergui Arch. and Andaman Is. (in bivalves); Ramadan, 1936, p. 23 — Ghardaqa, Red Sea; Kubo, 1940a, p. 51, figs. 18-20 — Palau Is. (in bivalves); Holthuis, 1952, p. 110, fig. 45 — Borneo Bank (in bivalve); Johnson, 1961, p. 59 — Singapore (in bivalves).

Material examined. Ngáruangel Atoll, in *Hippopus hippopus*, 1 ♂, 1 ovig. ♀, ZLKU No. 1945, Mar. 25, 1938, S. Murakami leg.

S. W. Madalâi, Goréor I., in *Tridacna squamosa*, 1 ovig. ♀, ZLKU No. 1937, May 11, 1938, S. Murakami leg.

Ngadarák Reef, in *Tridacna crocea*, 1 ♀, ZLKU No. 2675, May 28, 1938, S. Wada leg.

Ngadarák Reef, in *Tridacna squamosa*, 5 ♂♂, 5 ovig. ♀♀, ZLKU No. 2689, May 30, 1938, S. Wada leg.

Ngadarák Reef, in *Hippopus hippopus*, 1 ♂, ZLKU No. 2678, May 31, 1938, S. Wada leg.

S. W. Madalâi, Goréor I., in *Tridacna squamosa*, 1 ovig. ♀, ZLKU No. 1938, June 5, 1938, S. Murakami leg.

Ngadarák Reef, in *Hippopus hippopus*, 1 ♂, 1 ovig. ♀, ZLKU No. 2676, June 5, 1938, S. Wada leg.

Malagál Harbour, Ngurkdápel I., in *Pinctada maxima*, 1 ♀, ZLKU No. 2699, Apr. 20, 1939, R. Wada leg.

Ngadarák Reef, in *Tridacna squamosa*, 1 ovig. ♀, ZLKU No. 2767, May 22, 1939, S. Miyake leg.

Ngadarák Reef, 1 ♂, ZLKU No. 2766, May 22, 1939, S. Miyake leg.

Ngadarák Reef, in *Tridacna squamosa*, 1 ♂, 1 ovig. ♀, ZLKU No. 2762, May 31, 1939, S. Miyake leg.

Ngadarák Reef, in *Tridacna squamosa*, 1 ovig. ♀, ZLKU No. 2764, May 31, 1939, S. Miyake leg.

Ngadarák Reef, 3 ovig. ♀♀, ZLKU No. 2769, June 17, 1939, S. Miyake leg.

Remarks. The present specimens measure 2.3 to 7.0 mm in the length of the carapace.

According to Kubo (1940a), the outermost terminal spines of the telson are placed just at the terminal margin of the telson, though in the present specimens they being situated on the dorsal side in front of the terminal margin. In this account the present specimens are agreeable to Holthuis' (1952) figure.

Hosts. This species has been taken from bivalves, *Tridacna* (*Flodacna*) *squamosa* Lamarck, *Pinctada maxima* Jameson, *Pteria* sp. and *Pinna* sp. While, the present specimens were all commensal with *Tridacna* (*Flodacna*) *squamosa* Lamarck, *T.* (*Chametrachea*) *crocea* Lamarck, *Hippopus hippopus* (Linné) and *Pinctada maxima* Jameson.

Distribution. This species has been known throughout the Indo-West-pacific region, the Seychelles and the Red Sea to New Guinea and the Palau Islands.

8. *Anchistus custos* (Forskål, 1775)

Anchistia aurantiaca: Dana, 1852, p. 581 — Fiji Is. (on corals).

Harpilius inermis Miers, 1884, p. 291, pl. 32, fig. B — Port Molle, N. E. Aus-

tralia (in bivalves) and Shark Bay, W. Australia (in bivalves).

Pontonia pinnae: Nobili, 1906, p. 65 — Red Sea (in bivalves) and Jibuti.

Anchistus inermis: Lanchester, 1901, p. 565 — Pulau Bidan, Penang (in gastropod); Rathbun, 1914, p. 656 — Hermite I., N. W. Australia (in bivalve); Tattersall, 1921, p. 391, pl. 27, fig. 4 — Suakin Harbour, Red Sea; Kemp, 1922, p. 249, fig. 81 — Gulf of Manaar, Ceylon, Mergui Arch., and Port Brair, Andaman Is. (in bivalves); Kemp, 1925, p. 322 — Octavia Bay, Nicobar Is. (in bivalves); Barnard, 1950, p. 792—Delagoa Bay (in bivalves).

Anchistus custos: Holthuis, 1952, p. 105, figs. 43, 44—Takao, S. Formosa (in bivalve), Siau I., Sangihe Group, Bay of Djakarta, Kera near Timor, Kai Is. and Lesser Sunda Is.; Johnson, 1961, p. 59 — some localities of Singapore (in bivalves); Johnson & Liang, 1966, p. 433, figs. 1-10—Singapore (in bivalves).

Material examined. Ngadarák Reef, in *Atrina vexillum*, 1 ♂, 2 ♀♀, ZLKU No. 2679, June 18, 1938, S. Wada leg.

Ngadarák Reef, in *Atrina vexillum*, 1 ovig. ♀, ZLKU No. 2768, May 22, 1939, S. Miyake leg.

Ngadarák Reef, in *Atrina vexillum*, 1 ovig. ♀, ZLKU No. 2765, June 18, 1939, S. Miyake leg.

Remarks. The specimens measure from 3.6 to 7.4 mm in the length of the carapace.

They agree precisely with Miers' (1884) description but the only different point between them is found in the second pereiopod. Namely, each cutting edge of fhe fingers of the second pereiopod bears one strong, broad tooth near the base in his description, whereas one or two on the movable and five or six teeth on the immovable finger in the present specimens. On the other hand, Kemp (1922) described that each cutting edge on the inner margin bears in the proximal half a very large triangular tooth and a round knob close to the articulation, and when the claw is closed both the tooth and the knob are received into a large socket of the immovable finger.

Colour. In the ovigerous female the entire body is pale brown, and the similar colour becomes much deeper from the third to the sixth abdominal segments. In the first two abdominal segments, carapace and rostrum the brown colour is darkish, dotted with whitish blue. The base of the eyestalk is light blue.

Hosts. In the present specimens, *Atrina vexillum* (Born) is found to be commensal with this species. Johnson and Liang (1966) recorded this species from in *Pinna atropurpurea* (Sowerby).

Distribution. This species has hitherto been recorded throughout the

Indo-Westpacific region from the Red Sea and the East African coast to the Malay Archipelago, South Formosa, the Palau Islands, South Australia and Oceania.

9. *Paranchistus biunguiculatus* (Borradaile, 1898)

Anchistus biunguiculatus Borradaile, 1898, p. 387 — New Guinea.

Anchistus oshimai Kubo, 1949, p. 26, figs. 1, 2 — Helen Atoll, Palau Is. (in bivalve).

Paranchistus biunguiculatus: Holthuis, 1952, p. 93, figs. 36-38 — Obi latu, Molucca Is.

Material examined. Ngadarák Reef, in *Tridacna gigas*, 1 ovig. ♀, ZLKU No. 1939, June 8, 1939, S. Miyake leg.

Ngaiánges I., in *Tridacna gigas*, 1 ♂, 1 ovig. ♀, ZLKU No. 1940, June, 1940, S. Wada leg.

Remarks. The present specimens agree with Kubo's (1949) description based on a couple of specimens from the Palau Islands.

Colour. The ovigerous female in life is transparent or light blue with dark blue spots except for the carapace, in which they are enclosed with white rings. The cornea is bitter-orange, and the stalk is light blue. The antennal flagellum is reddish-purple. The colour in the male is unknown.

Hosts. The specimens examined were collected in *Tridacna* (*Tridacna*) *gigas* (Linné) as in Kubo's (1949) description.

Distributiion. This species has hitherto been reported from New Guinea, the Palau Islands and Molucca Islands.

10. *Periclimenaeus palauensis* sp. nov.

(Fig. 5)

Type. Holotype, ovig. ♀. ZLKU No. 2773, Ngadarák Reef, June 16, 1939, S. Miyake leg.

Description of holotype. The description is based on an ovigerous female measuring 10.2 mm long with the carapace 3.4 mm long. The body is round and slightly compressed. The rostrum is somewhat directed downwards, the pointed apex reaching the end of the first segment of the antennular peduncle. It bears seven teeth arranged equidistantly on the upper convex border, the proximal of which is situated a little in advance of the orbit. There is no tooth on the lower border. The carapace is smooth, and the anterolateral margin is straight. Only the strong antennal spine is present.

The oval eye is well developed, the peduncle being swollen (Fig. 5, a). The first segment of the antennular peduncle is broad, and the outer margin is triangularly produced near the base. The lateral process is broadly projected, exceeding the middle of the second segment. The stylocerite is broad and foliaceous, being directed obliquely outwards. The second and the third segments are subequal in both length and breadth. The outer flagellum is biramous at the fourth fused joint (Fig. 5, b).

The antennal scale is rather small and somewhat narrow, exceeding

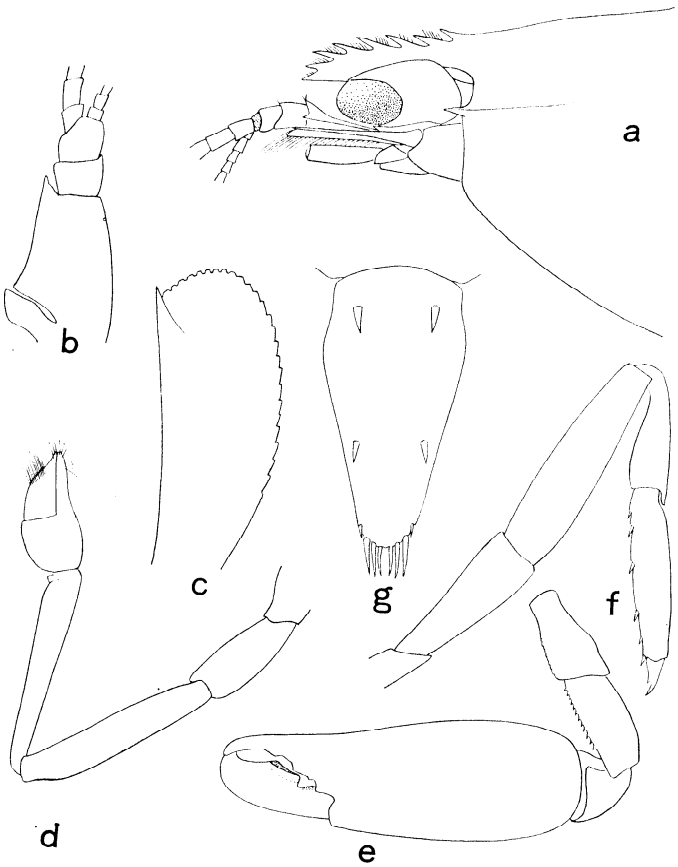

Fig. 5. *Periclimenaeus palauensis* sp. nov., holotype, ovig. ♀, a, anterior part of body, ×16; b, antennular peduncle, ×25; c, antennal scale, ×50; d, first pereiopod, ×19, e, second left pereiopod, ×8.4; f, third pereiopod, ×19; g, telson, ×19.

the rostrum. The outer margin is almost straight and ends in a small lateral tooth which fails to reach the end of the lamella. The inner margin is convex and the anterior is round. The antennal peduncle is not armed with a spine at the basal portion. The distal segment does not reach the end of the antennal scale (Fig. 5, c).

The third maxilliped is pediform. The ultimate segment is half the length of the penultimate. The antepenultimate segment is straight and somewhat broad, being two and a half as long as the ultimate. The exopod slightly overreaches the end of the antepenultimate segment.

The movable finger of the first pereiopod is very broad, and slighty less than twice as long as the palm. The anterior margin is round with a tuft of long hairs in the distal half. The immovable finger is narrow, less than half the breadth of the movable. The cutting edges of both the fingers are straight without pectination and tooth. The carpus is cylindrical, becoming somewhat thicker distally. It is shorter than twice the length of the chela, and as long as the merus which is five and a half the breadth (Fig. 5, d). The second left pereiopod is lacking. The fingers of the right pereiopod are considerably turned inwards near the tips which are crossed when they are closed. The movable finger is rather broad and bears a flat and truncated tooth on the cutting edge, which fits in the shallow hollow at the middle of the immovable finger. The immovable fingr is narrow and becomes still slenderer towards the end, the cutting edge bearing a strong tooth near the base. The palm is compressed and heavy, being twice as long as broad. The carpus is short and triangular. The merus is slightly shorter than the ischium. On the posterior margins of the merus and the ischium many spinules are present (Fig. 5, e). The third pereiopod is stout. The dactylus is biunguiculated into the large anterior claw and the small posterior one. The propodus is armed with six spines on the posterior border, being six times as long as broad, and about one and a half times as long as the carpus. The merus is broad and slightly longer than the propodus, being more than four times as long as broad (Fig. 5, f). The fourth and the fifth pereiopods are rather similar to the third. In the fourth the propodus is longer than the merus and not armed with spines on the posterior border.

The abdomen is smooth, the pleura of the first three segments being round at the ventral margins, while those of the fourth and the fifth are bluntly pointed. The eggs are oval and rather large, measuring approximately 0.5×0.3 mm in diameter.

The telson is rather broad and much longer than the sixth abdominal segment, tapering gradually to the posterior end, and is measured twice as long as broad at the base. Two pairs of the dorsal spines are small;

the anterior is situated near the anterior margin and the posterior at the posterior third point of the telson, the former being situated much more inwards than the posterior. The terminal spines consist of four pairs, of which the outermost is minute and the other three are subequal in length. The uropods are longer than the telson. The outer margin of the exopod is convex and ends in two spines (Fig. 5, g).

Remarks. This species resembles *Pericimenaeus minutus* Holthuis in the shape of the rostrum and each dactylus of the last three pereiopods. Some remarkable differences betwen these two species, however, are immediately marked in the following regards:

1) In this species the first pereiopod is long and very slender, and the chela is half as long as the carpus and also as the merus, whereas in *Periclimenaeus minutus* it is short and stout, and the chela is as long as the carpus and slightly shorter than the merus.

2) In the last three pereiopods *P. minutus* has the much shorter and stouter propodus and merus than those in the present species; in the former the propodus and the merus are three times and a little more than twice as long as broad, respectively, while in the latter they are six and four times as long as broad, respectively.

3) The dorsal spines of the telson in this species are much shorter than those in *P. minutus.*

4) The distal segment of the antennal peduncle in *P. minutus* is long and reaches distinctly beyond the antennal scale, whereas in this species it fails to reach the end of the antennal scale.

Hosts. This specimen was found living in the small pit at the base of a negro head on the coral reef. It is uncertain whether this species is in the habit of commensalism with corals and also other animals.

11. *Philarius imperialis* (Kubo, 1940)

(Fig. 6)

Harpilius imperialis Kubo, 1940, p. 1, figs. 1-3 — Haha-jima I., Bonin Is.

?Pilarius gerlachei: Holthuis, 1952, p. 152, fig. 69 — Borneo Bank, e. coast of Borneo and Sissie near Misool I.

Phlirius imperialis: Holthuis, 1958, p. 9 —Eylath, Islael; Johnson, 1961, p. 59 — Singapore (on corals); Patton, 1966, p. 276 —Queensland (on corals).

Material examined. Ngadarák Reef, on corals, 1 ♀, ZLKU No. 2761, May 23, 1939, S. Miyake leg.

Description. The following description is based on a single female specimen measuring 15.2 mm long. The rostrum is compressed and rather shallow, exceeding the end of the antennular peduncle. The apex

is somewhat directed upwards. The upper border is armed with nine strong teeth; the distal is short and closely near the apex, and the proximal three on the carapace. On the lower border one tooth is situated beneath the distal third tooth on the upper border (Fig. 6, a).

The antennal scale is rather broad, reaching far beyond the rostrum. The outer margin is considerably concave and terminates in a strong lateral tooth which exceeds the end of the lamella. The inner margin is strongly convex. One strong spine is situated at the antennal peduncle (Fig. 6, b).

The second right pereiopod is lacking. The movable and immovable fingers of the left pereiopod are slender and both bear many fine setae entirely. The movable finger has fine small teeth equidistantly situated on the cutting edge, while the immovable bears four small teeth, the distal of which is placed at the middle of the cutting edge. The palm is subcylindrical and one and a half times as long as the movable finger. The carpus is also cylindrical and armed with two strong spines at the distal margin. On the outer side of the carpus and ischium and the inner side of the merus there are shallow gooves running in the longitudinal direction (Fi. 6, c). The third pereiopod is stout. The dactylus is curved backwards, forming a strong sharp claw, whose base is considerably broad. The propodus is as long as the merus and the distal margin bears long and thickly growing setae (Fig. 6, d).

The telson is rather broad and twice as long as broad at the base. On the dorsal surface there are two pairs of spines, with many fine hairs; the anterior is situated at the anterior three-fifths point of the telson and the posterior at the posterior one-fifth point (Fig. 6, e).

Remarks. Kubo (1940) originally described this species under the name of *Harpilius imperialis.* The present specimen falls in with his description and figure, excepting only the presence of the shallow grooves running on both the outer and the inner borders of the carpus and ischium in the second pereiopod.

The distinction between this species and ***Philarius gerlachei*** (Nobili), the latter has a close relation to the former, is pointed out by Kubo regarding to the total number of the rostral teeth and of the teeth on the dorsal carina of the carapace; seven and three, respectively, in ***P. imperialis***, while three to five and one teeth in ***P. gerlachei.*** In the present specimen, as descrided above, nine teeth are present on the dorsal side of the rostrum, of which the proximal three are placed on the dorsal carina of the carapace. In this regard the present specimen is within the possible limits of the variation of this species.

Holthuis (1952) reported this species under the name of ***Philarius gerlachei*** (Nobili), based upon one damaged and two other specimens. In

consideration of all his specimens having dorsal teeth on the carapace and of the two specimens except for the damaged one bearing larger number of the rostral teeth, it seems probable that they are referred not to *P. gerlachei* but to *P. imperialis*, as Johnson (1961) already reported it.

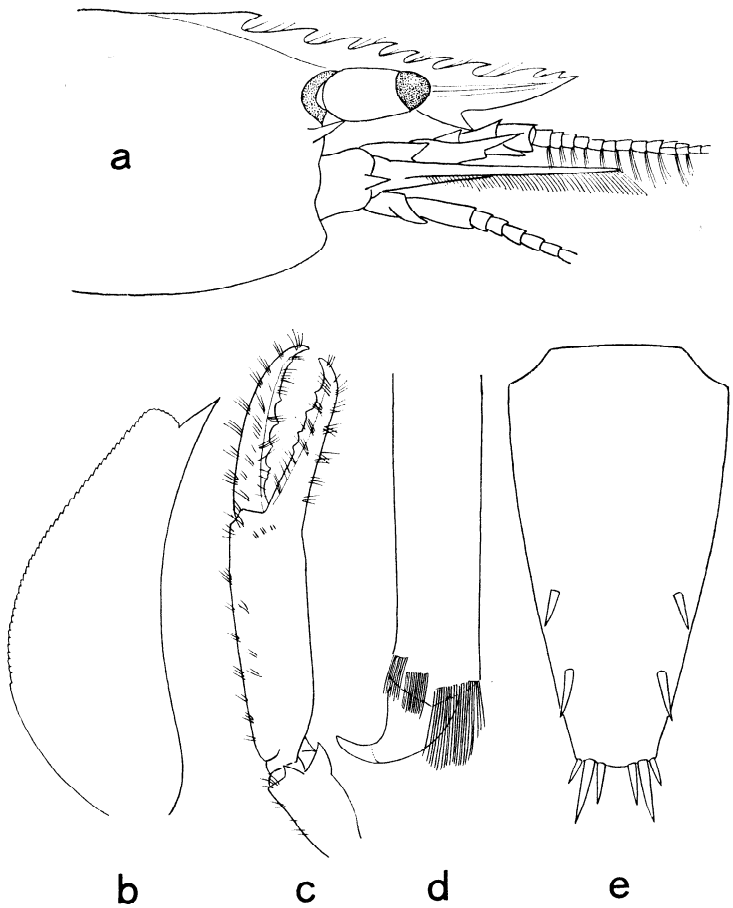

Fig. 6. *Philarius imperialis* (Kubo), a, anterior part of body, ×11; b, antennal scale, ×21; c, chela of second pereiopod, ×7.4; d, dactylus of third pereiopod, ×21; e, telson, ×21.

Hosts. According to Patton (1966), the branching corals of certain species of the genus *Acropora* were in most cases recognized as the host of the shrimps in the region of Queensland. Likewise the present

single specimen was obtained from an uncertain species of madreporarian corals.

Distribution. This species was originally taken from the Bonin Islands and since then it has hitherto been recorded from the Red Sea, the Malay Archipelago, the Marshal Islands and Queensland. It is newly recorded here from Micronesia.

12. *Coralliocaris graminea* (Dana, 1852)
(Fig. 7, a, c)

Oedipus gramineus: Dana, 1852, p. 574 — Rewa, Fiji Is. (on corals).

Coralliocaris inaequalis Ortmann, 1890, p. 510 — Kagoshima, Japan and Samoa; Borradaile, 1898, p. 386 — Loyalty Is.; Urita, 1921, p. 217 — Kagoshima, Japan.

Coralliocaris graminea: Stimpson, 1860, p. 107 — Hong Kong (on corals); Miers, 1884, p. 563 — Seychelles; Borradaile, 1898, p. 385 — no new record; Balss, 1915, p. 26 — Suez, Red Sea and Ryukyu Is.; Kemp, 1922, p. 269, figs. 96, 97 — Seychelles, Gulf of Manaar, Andaman Is. and South Sea; Balss, 1925, p. 294 — Seychelles; Edmondson, 1925. p. 7 — Johnston I. and Wake I.; Ramadan, 1936, p. 23 — Ghardaqa, Red Sea; Kubo, 1940a, p. 70, figs. 33-35 — Amami-oshima I., Ryukyu Is.; Barnard, 1950, p. 800, Mozambique Channel; Holthuis, 1952, p. 186, fig. 91 — many localities of Malay Arch.; Johnson, 1961, p. 60 — Singapore; Patton, 1966, p. 277 — some localities of Queensland (on corals).

Material examined. Ngadarák Reef, on *Acropora* sp., 2 ♂♂, 2 ovig. ♀♀, ZLKU No. 2752, May 23, 1939, S. Wada leg.

Remarks. Four specimens measure about 14.5 mm long.

This species is characterized by the swollen and heavy second pereiopod with the round outer margin of the movable finger and the broad and hummer-shaped tooth placed on the cutting edge of the immovable finger. The present specimens agree with Kudo's (1940a) description with the exception of the lateral tooth of the antennal scale not reaching beyond the end of the lamella (Fig. 6, a).

Hosts. The present specimens were obtained from the madreporarian coral, *Acropora* sp., as in the case of Kemp's (1922) record.

Distribution. This species has hitherto been recorded throughout the Indo-Westpacific region from the Red Sea ana the East African coast to China, Japan, Australia and Oceania.

13. *Coralliocaris superba* (Dana, 1852)
(Fig. 7, b, d)

Oedipus superba: Dana, 1852, p. 573 — Tongatabu I., Tonga Is. (on corals).

Oedipus dentirostris Paulson, 1875, p. 112, pl. 14, fig. 7 [1961, p. 118, pl. 14, fig., 7-7d] — Red Sea.

Coralliocaris superba: Stimpson, 1860, p. 107 — Tahiti I. (on corals) ; Nobili, 1906, p. 55 — Jibuti ; Balss, 1914, p. 53 — Bonin Is.; Balss, 1915, p. 26 — Red Sea and Sherm Sheik, Africa ; Tattersall, 1921, p. 390 — Khor Dongonab, Red Sea ; Kemp, 1922, p. 272, figs. 98, 99 — Port Blair, Andaman Is. ; Kemp, 1925, p. 322 — Camorta I., Nicobar Is. ; Kubo, 1940a, p. 67, figs. 30-32 — Haha-jima I., Bonin Is.; Holthuis, 1952, p. 189, fig. 92 — e. coast of Borneo (on corals), Misool I., near Timor I., Halmahera, Obi latu, w. coast of Sumatra, Djakarta and Samoa Is.; Patton, 1966, p. 277 — some localities of Queensland (on corals).

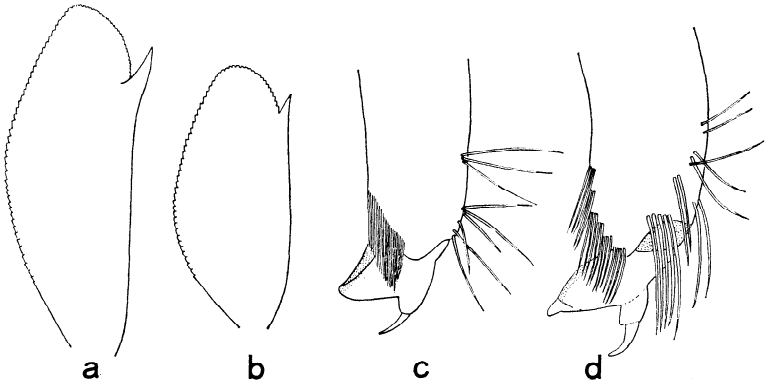

Fig. 7. *Coralliocaris graminea* (Dana), a, antennal scale, ×21 ; c, dactylus of third pereiopod, ×24.
Coralliocaris superba (Dana), b, antennal scale, ×8 ; d, dactylus of third pereiopod, ×24.

Material examined. Ngadarák Reef, on corals, 1 ♂, 1 ovig. ♀, ZLKU No. 2749 ; 1 ♂, 1 ovig. ♀, ZLKU No. 2756, May 23, 1939, S. Miyake leg.

Ngadarál Reef, on corals, 1 ovig. ♀, ZLKU No. 2823, May 31, 1939, S. Miyake leg.

Remarks. Nine specimens examined vary from 22 to 9.4 mm in the body length.

This species is related to *Coralliocaris graminea* in the stout form of the third maxilliped, in the possession of a series of small teeth at the distal end of the carpus of the second pereiopod, and in the shape of

the dactyli of last three pereiopods. Kemp (1922) described the principal differences between the two species, in regard to the shape of the third maxilliped, the ratio of the carpus of the first pereiopod against the merus, the shape of the chela and movable finger of the second pereiopod, and the teeth on the upper part of each distal border of both the carpus and the merus of the second pereiopod. These differences mentioned above are also true in the present specimens, and a detailed examination of the present specimens shows further additional differences between these species as follows: in *C. superba* a small terminal tubercle is present on each dactylus of the last three pereiopods, but absent in *C. graminea* (Fig. 7, c, d). The antennal scale, in *C. graminea* is comparatively narrower than that in *C. superba*, and the lateral tooth is stronger and much directed outwards than that in the former (Fig. 7, a, b).

Hosts. According to Kemp (1922), the species is always found together with madreporarian corals. Also all the present specimens were collected among the branches of the same corals.

Distribution. This species has been recorded throughout the Indo-Westpacific region from Africa, the Red Sea, the Andaman Islands and the Nicobar Islands to the Bonin Islands, the Malay Archipelago, Oceania and Australia. This species is newly recorded from the Palau Islands.

14. *Jocaste japonica* (Ortmann, 1890)

Coralliocaris superba var. *japonica* Ortmann, 1890, p. 509, pl. 36, fig. 22 — Kagoshima, Japan.

Coralliocaris japonica: Borradaile, 1917, p. 384, pl. 56, fig. 23 — Seychelles, Maldive Arch. and Chagos Arch.

Jocaste japonica: Patton, 1966, p. 279, fig. 3b — some localities of Queensland (on corals).

Material examined. Ngadarák Reef, on *Acropora* sp., 3 ovig. ♀♀, ZLKU No. 2758, May 23, 1939, S. Miyake leg.

Ngadarák Reef, on *Acropora* sp., 1 ovig. ♀, ZLKU No. 2772, June 16, 1939, S. Miyake leg.

Remarks. Of four ovigerous females two measure 3.3 mm in the length of the carapace and the other two 3.1 mm.

Holthuis (1952) regarded *Coralliocaris superba* var. *japonica* as a synonym of *Jocaste lucina*. Patton (1966), however, mentioned that Ortmann's species seems referable not to *J. lucina* but to *J. japonica*, on the basis of the number of the teeth on the rostrum and of the tooth on the movable finger of the larger second pereiopod. The specimens at hand are in

exact accordance with Patton's description and his opinion. While Patton (1966) noted that this species usually has only one tooth on the lower border of the rostrum, yet one specimen has two teeth on the same border.

Hosts. The specimens examined were found living with *Coralliocaris superba* among the branches of the coral, *Acropora* sp., as also described by Patton (1966).

Distribution. This species has been known from the Maldive Islands, the Chagos Archipelago, Japan and Queensland, and is the first record from Micronesia.

15. *Conchodytes tridacnae* (Peters, 1852)
(Fig. 8)

Pontonia Tridacnae: Dana, 1852, p. 571 — Samoa Is. (in bivalves); Ortmann, 1890, p. 509, pl. 37, fig. 10, d-i — Samoa Is.

Pontonia (*Conchodytes*) *tridacnae*: Miers, 1884, p. 290 — Warrier Reef, Torres Straits.

Pontonia meleagrinae: Bate, 1888, p. 707, pl. 124, figs. 1, 2 — Torres Straits.

Conchodytes meleagrinae: Borradaile, 1898a, p, 1007 — Rotuma I.; Borradaile, 1898, p. 390 — New Guinea, Conflict Group, Loyalty Is. and Rotuma I.; Balss, 1915, p. 31 — Tor (in bivalves), Ras Abu Somer and Hasani I., Red Sea (in bivalves); Borradaile, 1917, p. 393, pl. 57, fig. 26 — Salomon I., Chagos Arch.; Nobili, 1906, p. 66, pl. 3, fig. 5 — Massawa, Jibuti and Red Sea (in bivalves); Balss, 1921, p. 15 — Cape Jaubert, N. W. Australia (in bivalves); Tattersall, 1921, p. 392 — Red Sea; Kemp, 1922, p. 285 — Andaman Is. and Samoa Is. (in bivalves); Edmondson, 1925, p. 8 — French Frigate Shoals, Hawaii Arch. (in bivalves); Ramadan, 1936, p. 23 — Ghardaqa, Red Sea; Kubo, 1940a, p. 58, figs. 24, 25 — Ishigaki-jima I. (in bivalves) and Palau Is. (in bivalves); Edmondson, 1946, p. 250, fig. 151 — Hawaii (in bivalves); Barnard, 1950, p. 801, fig. 151, n, o — no new record.

Conchodytes tridacnae: Borradaile, 1917, p. 324 — Hulule, Male Atoll and Mini koi; Kemp, 1922, p. 283, fig. 105 — Laccadive Is., Andaman Is. and Torres Straits (in bivalves); McNeill, 1926, p. 300 — Northwest Islet, Queensland; Chopra, 1931, p. 306 — S. Andaman Is. (in sea-cucumber); Kubo, 1940a, p. 62, fis. 26, 27 — Haha-jima I., Bonin Is. (in bivalves) and Palau Is. (in bivalves); Barnard, 1950, p. 801 — no new record; Holthuis, 1952, p. 195, fig. 95 — e. coast of Aru Is. (in bivalves) and Obi latu.

Material examined. Ngarbagéd, Goréor I., in *Pinctada margaritifera*, 2 ♂♂,

1 ovig. ♀, ZLKU No. 1942, Mar. 31, 1938, J. Ogushi leg.

Ngadarák Reef, 4 ♂♂, 4 ovig. ♀♀, 1 ♀, ZLKU No. 2680, June 10, 1938, S. Wada leg.

Malagál Harbour, Ngurukdápel I., in *Pinctada maxima*, 7 ♂♂, 6 ovig. ♀♀, 1 ♀, ZLKU No. 2700, Apr. 20, 1939, R. Wada leg.

Malagál Harbour, Ngurkdápel I., in *Pinctada maxima*, 6 ♂♂, 4 ovig. ♀♀, 1 ♀, ZLKU No. 2735 ; 35 ♂♂, 30 ovig. ♀♀, 7 ♀♀, ZLKU No. 8205, May 7, 1939, R. Wada leg.

Malagál Harbour, Ngurukdápel I., 1 ovig. ♀, ZLKU No. 1936, July 1939, R. Wada leg.

Ngáruangel Atoll, in *Pinctada maxima*, 2 ovig. ♀♀, ZLKU No. 1934, Mar. 27, 1940, S. Wada leg.

Remarks. The specimens vary from 5.7 to 10.4 mm in the length of the carapace.

This species had been for a long time separated from *Conchodytes meleagrinae* Peters until Holthuis (1952) regarded both as the same. The most distinctive character to separate them into two different species was based upon the fact that the outer distal angle of the first segment of the antennular peduncle is round in *C. tridacnae*, while acute in *C. meleagrinae*. As he pointed out it may be too indistinct in the morphological feature to consider this as one of the characters to distinguish these two close species, for some specimens of the present material represent the intermediate type between these two species in this regard.

Colour. When alive, the body of the female is entirely pink, with many red spots all over the body (Fig. 8). According to Kemp (1922), the specimens obtained at Port Blair are thinly sprinkled with small white chromatophores, with similar red ones on the rostrum and anterior parts of the carapace. The eggs and ovary are orange or orange-red. In the male the white chromatophores are usually absent and the red less

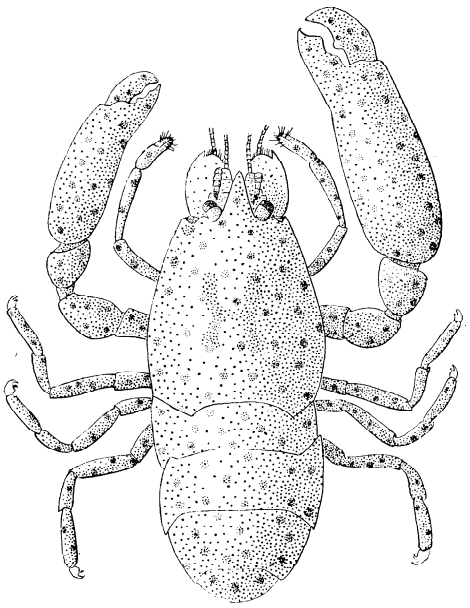

Fig. 8. *Conchodytes tridacnae* Peters, ×2.7.

numerous.

Hosts. This species has hitherto been reported living in company with bivalves, "pearloyster," *Pinctada* sp., *Pinctada margaritifera* (Linné), *Tridacna* (*Flodaona*) *squamosa* Lamarck and *Pinna* sp. Chopra (1931) happened to find this species in the cloaca of holothurians. The present specimens were also taken from in the mantle cavities of *Pinctada margaritifera* (Linné), *Pinctada maxima* (Jameson) and *Tridacna* (*Chametrachea*) *crocea* Lamarck.

Distribution. This species has been recorded throughout the Indo-Westpacific region from E. Africa and the Red Sea to the Malay Archipelago, the Palau Islands, Australia and the Ryukyu Islands, and further extends to the Hawaii Archipelago.

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Table 1. List of pontoniid shrimps from Palau Islands and their commensal hosts.

Species from Palau Is.	Their hosts	Hosts in records
Periclimenes ceratophthalmus	*Comanthus* sp.	crinoids
Periclimenes commensalis	crinoids	*Comanthus timorensis*; crinoids
Periclimenes elegans	madreporarian corals	unknown
Periclimenes platycheles	*Acropora* sp.	unknown
Periclimenes brevicarpalis	*Stoichactis kenti*; *Acropora* sp.	*Stoichactis giganteum*; *Stoichactis haddoni*; *Stoichactis kenti*; *Thalassianthus hypnoides*
Periclimenes inornatus	madreporarian corals	*Stoichactis* sp.; *Pocillopola verrucosa*; *Pocillopora damicornis*; *Acropora* sp.; *Stylophora hystrix*; *Stylophora pistillata*
Anchistus miersi	*Tridacna squamosa*; *Tridacna crocea*; *Hippopus hippopus*; *Pinctada maxima*	*Tridacna squamosa*; *Tridacna* sp.; *Pinna* sp.; *Pictada* sp.
Anchistus custos	*Atrina vexillum*	*Atrina vexillum*; *Pinna bicolor*; *Pinna dolabrata*; *Pinna madida*; *Pinna nigra*; *Pinna saccata*
Paranchistus biunguiculatus	*Tridacna gigas*	*Tridacna gigas*; *Tridacna* sp.
Periclimenaeus palauensis sp. nov.	madreporarian corals	
Philarius imperialis	madreporarian corals	*Acropora* sp.
Coralliocaris graminea	*Acropora* sp.	*Acropora* sp.; *Seriatopora hystrix*
Coralliocaris superba	madreporarian corals	*Acropora* sp.
Jocaste japonica	*Acropora* sp.	*Acropora* sp.
Conchodytes tridacnae	*Pinctada margaritifera*; *Pinctada maxima*; *Tridacna crocea*;	*Pinctada margaritifera*; *Pinctada* sp. *Tridacna squamosa*; *Tridacna* sp.; *Pinna* sp.; pearl oyster