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**OBSERVATIONS ON THE INDO-WEST-PACIFIC PALICIDAE
(CRUSTACEA : DECAPODA) WITH DESCRIPTIONS OF TWO
NEW SUBFAMILIES, FOUR NEW GENERA AND SIX NEW SPECIES**

by

M. KASIM MOOSA¹⁾ and RAOUL SERENE²⁾

ABSTRAK

Duabelas jenis Crustacea yang tergolong dalam suku Palicidae berasal dari perairan Indonesia berhasil dikumpulkan. Bersama dengan dua jenis lagi berasal dari perairan Philippina dan spesimen tipe *Crossotonotus compressipes* A. Milne Edwards, 1873, dipelajari dan *Manella spinipes* digunakan sebagai pembanding. Dua anak suku baru, empat marga baru, dan enam jenis baru dipertelakan. Tipe *Crossotonotus compressipes* dipilih dan dikukuhkan.

ABSTRACT

Twelve species of Crustacea of the family Palicidae were collected from Indonesian waters. Together with two species from the Philippines and type specimens of *Crossotonotus compressipes* A. Milne Edwards, 1873, are studied and *Manella spinipes* is used for comparison. Two new subfamilies, four new genera, and six new species are described and the type of *Crossotonotus compressipes* has been designated.

INTRODUCTION

Twelve species of Palicidae (Crustacea : Decapoda) were collected from the Indonesian waters mostly by the Mariel King Memorial Expedition, 1970, conducted in the Moluccan region under the leadership of Dr. Barry R. Wilson of the Western Australian Museum and attended by one of us (M.K. Moosa) assuming the participation of the National Institute of Oceanology to the expedition. Two species added to the collection here studied were collected in the Philippines by the Musorstom expedition during 1976 under the leadership of Prof. J. Forest of the Museum National d'Histoire Naturelle de Paris.

The Palicidae of the Indo-West-Pacific region is known to be represented by five genera : *Palicus* Philippi, 1838; *Crossotonotus* A. Milne Edwards, 1973; *Pleurophricus* A. Milne Edwards, 1873; *Parapleurophrycoides* Nobili, 1906; and *Manella* Rathbun, 1906. *Palicus* Philippi, 1838 is herewith regarded as strictly Atlanto — Mediterranean and East American form, the

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first male pleopod type of its type species (*Palicus granulatus* Philippi, 1838 = ? *Cymopolia caroni* Roux, 1830) is very different as figured by Monod (1956, figs. 549—551, for *Cymopolia caroni*). *Manella* Rathbun, 1906 is regarded by Sakai (1965, 1976) as synonym of *Crossotonotus* A. Milne regards. 1973. Examination of the type specimens of the latter genus showed that the two genera are clearly different. *Pleurophricus* A. Milne Edwards, 1873 is not known, as far the genus is known only by its type specimen and in the present study the genus is kept distinct. *Parapleurophrycoides* Nobili, 1906 is discarded since the remark of Forest and Guinot (1961), after examining the type specimen, stating that the genus was based on juvenile specimens and therefore can not be used for generic definition.

The authors would like to express their gratitude to the institutions in charge which have entrusted them for the study of the materials.

PALICIDAE RATHBUN, 1898

Palicidae, Rathbun, 1898, p. 200.— 1900, p. 12.— Alcock, 1900, p. 285, 450.— Borradaile, 1907, p. 482.— Holthuis and Gottlieb, 1958, p. 104.— Sakai, 1965, p. 110,— 1976, p. 592.— Serene, 1968, p. 96.— Zarenkov, 1968, p. 761.— Kensley, 1969, p. 156.— Cymopoliidae, Faxon, 1895, p. 38.— Rathbun, 1918, p. 182.— Sakai, 1934, p. 319.— 1939, p. 607.— Balss, 1957, p. 1661.— Edmondson, 1962, p. 7.
Type genus : *Palicus* Philippi, 1838.

Systematic position

The Palicidae is generally classified in the Brachyryncha. The name is listed under No. 376 of the Official List of the Family (Bull. Zool. Nomencl. 1964). This family is situated by Alcock (1900) between Hymenosomidae and Ptenoplacidae (Retroplumidae), by Rathbun (1918, under Cymopoliidae) between Pinnotheridae and Grapsidae, by Sakai (1939, under Cymopoliidae) between Retroplumidae and Ocypodidae, by Balss (1958, under Cymopoliidae) between Retroplumidae and Grapsidae, and by Guinot (1977) between Dorippidae and Retroplumidae. Guinot (1977) places the Dorippidae, Palicidae, and with reserve the Retroplumidae, in the superfamily Dorippoidea. Our comments will be focused on some relationship between Palicidae and Dorippidae with reference to the observation of the hooking adaptation of the fifth pereopod, the male external sexual apparatus, and the morphology of the conducting system of the respiratory water circulation. Unfortunately, until more is revealed about the ecology and ethology of Palicidae, the assimilation of the dorsal position of the fifth pereopod as a hooking system can not be supported by any observation. However, the morphological modifications of structure resembling those of the Dromiacea which are peditremen (classified as Peditremata by Guinot

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[1977]) and the Dorippidae which are sternotremen (classified as Heterotremata by Guinot, which also consists some member with male genital orifice pedotremen) and this would suggest some possible relationship among them. Palicidae is typical sternotremen Brachyura : the male opening is completely sternal, the male conducts are running under the sternal plates, the penis are free far away from the coxae; such a condition is similar to that existing on Dorippidae.

The respiratory water circulation of the Palicidae is closely resembling that of the Dorippidae but differs by the absence of modification of the second maxilliped which does not serve as a wall of the efferent channel. On the Palicidae each efferent channel opens separately on the anterior border of the buccal frame, while on the Dorippidae the two channels run parallelly to form a tube-like opening distally between the bases of the antennulae.

Since 1964, *Palicus* Philippi, 1838 with *Palicus granulatus* Philippi, 1838 as type species and is a subjective synonym of *Cymopolia caroni* Roux, 1830 is the official valid name, similarly Palicidae Rathbun, 1898. The use of *Cymopolia* Roux, 1830 and Cymopoliidae Faxon, 1895 is rejected.

Presently the Palicidae comprises of three genera : *Palicus* Philippi, 1838; *Crossotonotus* A. Milne Edwards, 1873; and *Pleurophricus* A. Milne Edwards, 1873. *Palicus* is clearly different from the two other genera and could be separated from them in the subfamily level as follow :

1. Last pair of ambulatory legs (pereiopod fifth) abnormally reduced in size, slender, filiform, and dorsally positioned.
Palicinae nov. subfam.
2. Last pair of ambulatory legs (pereiopod fifth) slightly reduced in size but similar in shape and in position with the preceding three legs. Crossotonotinae nov. subfam.

PALIGINAE new subfamily

Type genus : *Palicus* Philippi, 1838

The Palicinae covers the genus *Palicus* as it is presently accepted. It includes about 25 species from the Mediterranean, the Atlantic and the American coast of the Pacific Ocean and 26 species from the Indo-West-Pacific region.

Rathbun (1918) suggested a grouping of the American species by separating one group of species characterized by the slender pereiopod-2 from the second group of species characterized by having pereiopod-2 of normal size. A similar grouping for the Indo-West-Pacific species was indicated by Zarenkov (1968). *Parapalicus* nov. gen. is herewith established for the Indo-West-Pacific species having slender, filiform pereiopod-2, and the

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- segments distinct and segments 3 — 5 not remarkably broader than segment-6 and telson 2
- 2.(1). — Frontal border cut into four teeth or lobes
Pseudopalicus nov. gen.
 type species : *Cymopolia serripes* Alcock and Anderson, 1894
- Frontal border cut into two lobes divided by a deep fissure 3
- 3.(2). — Frontal border laterally separated from supra orbital border by a distinct notch. Eye-peduncle with some (2-3) smooth tubercles or small lobes, but without acicular process ...*Neopalicus* nov. gen.
 type species : *Cymopolia jukesi* White, 1847
- Frontal bodrer laterally sinuous and in continuation with the supra orbital border. Eye-peduncle with an acicular process like a sickle-shaped blade *Palicoides* nov. gen.
 type species : *Cymopolia whitei* Miers, 1879

The Palicinae in the present study are :

1. *Parapalicus marielae* new species
2. *Parapalicus unidentatus* (Zarenkov, 1968)
3. *Parapalicus piruensis* new species
4. *Parapalicus ambonensis* new species
5. *Pseudopalicus serripes* (Alcock and Anderson, 1894)
6. *Pseudopalicus amadaibai* (Sakai, 1963)
7. *Neopalicus jukesi* (White, 1847)
8. *Neopalicus contractus* (Rathbun, 1902)
9. *Palicoides longimanus* (Miyake, 1936)
10. *Palicoides ternatensis* new species
11. *Palicoides whitei* (Miers, 1879)
12. *Manella brevimana* Ward, 1933
13. *Manella ceramensis* new species
14. *Manella longirostris* new species
15. *Crossototnotus compressipes* A. Milne Edwards, 1873

Parapalicus new genus

Diagnosis : Carapace depressed, broader than long, granular, outline sub-circular. Frontal border lobated. Cornea globular, reniform, much wider than eyepeduncle. Orbit deep, infra orbital border with a deep open sinus. Antennulae elongate and fold transversely beneath the front, interantennular septum very narrow (linear). Antennal peduncle fitted in the orbital hiatus and with long flagellum. Merus of maxilliped smaller and narrower than ischium. Anterolateral angle of buccal frame with a long process, visible in dorsal view as a little more protuberant lobe nearly at the inner side of the infra-inner orbital angle. Cheliped small. First pair of ambulatory

legs (pereopod-2) much slenderer than the second and third pairs (pereopods-3 and 4). Male abdomen with segments 3-5 generally soldered into one piece and remarkably broader than segment-6 and telson.

Type species : Parapalicus marielae new species

The species of the genus : Parapalicus is established for *Parapalicus marielae*, *P. unidentatus*, *P. piruensis*, *P. ambonensis*, and *P. elaniticus*; species which are separated by characters given in our key. In spite of the different type of first male pleopod, male abdomen, and aspect of the carapace, several characters like the small size of adult specimens, the slenderness of the first pair of the ambulatory legs and particularly the filiform aspect of their carpus, propodus, and dactylus, like also the general slenderness of the other ambulatory legs (pereopods-3 and 4). The flat and reniform cornea of the eyes indicate a close relationship between *Palicus vietnamensis* to *Parapalicus*, the similar case is also for *Palicus hatusimaensis*, both species are provisionally include in *Parapalicus* since no material is available for this study.

In the order of the key, the species of the genus are : *marielae* new species, *ambonensis* new species, *unidentatus* (Zarenkov, 1968), *elaniticus* (Holthuis, 1977), *piruensis* new species, *vietnamensis* (Zarenkov, 1968), and *hatusimaensis* (Sakai, 1963). The last two species are provisionally included in *Parapalicus*, which further would probably be restricted to species with broad abdomen only. *P. vietnamensis* was collected in the South China Sea at the depth of 300-350 m.; *P. hatusimaensis* was first described from Japan collected at the depth of 25-85 m., then were further recorded from; outside Japan at the depth of 196 m. and from South China Sea at the depth of 30-150 m. All the species of the genus have sizes smaller than 10 mm. It would be interesting to compare with *Parapalicus*, the American species of *Palicus* classified in the Group I by Rathbun (1918).

Key to the species of *Parapalicus*

1. — Anterolateral border of the subcircular carapace with only one or two teeth or lobes behind the extra-orbital angle. (Male abdomen broadly trapezoidal). 2.
- Anterolateral border of the carapace with more than four teeth or lobes behind the extra-orbital angle. (Male abdomen elongate). 6.
2. (1). — Anterolateral border of carapace with a triangular granular tooth at the level of the hepatic region and a salient granular tubercle as a second tooth nearby middle of the lateral border (on epibranchial region). Supra-orbital border with two shallow excavations, extra-orbital angle blunt. Eye-peduncle is much smaller than

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- cornea. Merus of pereopod-2 a little shorter than the carapace length. First male pleopod short and stout (fig. 1) *marielae* new species.
- Anterolateral border of carapace with only one tooth or lobe at the level of the hepatic region3.
3. (2). — Anterolateral border of carapace with a triangular lobe behind the extra-orbital angle. Merus of third maxilliped broad and denticulate in its cutting edge. Supra-orbital border with only one shallow excavation. Extra-orbital angle blunt, large and low. First male pleopod unknown *ambonensis* new species
- Anterolateral border of carapace with a single subacute tooth at the level of the hepatic region. 4.
4. (3). — Supra-orbital border with a shallow excavation only. Second pair of ambulatory legs with merus 0.85 as long as carapace and a little longer than merus of the third pair. First male pleopod short and stout (fig. 4). *unidentatus* (Zarenkov, 1968)
- Supra-orbital border with two narrow and shallow excavations. Second pair of ambulatory legs with merus between 0.6-0.7 as long as carapace 5.
5. (4). — Abdomen with segments 3-5 fused, segments-3-4 with transverse carina. First male pleopod unknown. *piruensis* new species
- Abdomen with segments 3-5 distinct, segments 3-4 with tubercle. First male pleopod in Holthuis (1977, fig. 3g) *elaniticus* (Holthuis, 1977).
6. (1). — Anterolateral border of carapace with six small rounded teeth, lobe-like, behind the extra-orbital angle which is salient and blunt. Male abdomen relatively narrow and elongated with segments 5-6 distinct and segments 3-4 soldered; segments 3-5 not remarkably broader than segment-6; telson as long as broad at base. First male pleopod in Zarenkov (1968, fig. 2) *vietnamensis* (Zarenkov, 1968)
- Extra-orbital angle salient, acute, followed by two large acute teeth and some 3-4 small ones. Posterior border of carapace with four equidistant tubercle. First male pleopod in Takeda and Miyake (1969, fig. 11 b.c.). *hatusimaensis* (Sakai, 1963)

Parapallicus marielae new species
(fig. 1 a,b; pl. I A)

Material.— *Holotype* : 1 ♂ 4.6 x 6.6 mm.; off west coast of Wasir Island, Wokam, Aru Islands, 5°30'S., 134°12'E.; dredged, 40-50 fms., muddy sand and shell rubble; coll. M.K.M.E., Sta. AW I/11-12, 15/6/1970; cat. no. CB 2710.— *Paratype* : 1 ♀ 6.7 x 9.0; data as in holotype; cat. no. CB 2711.

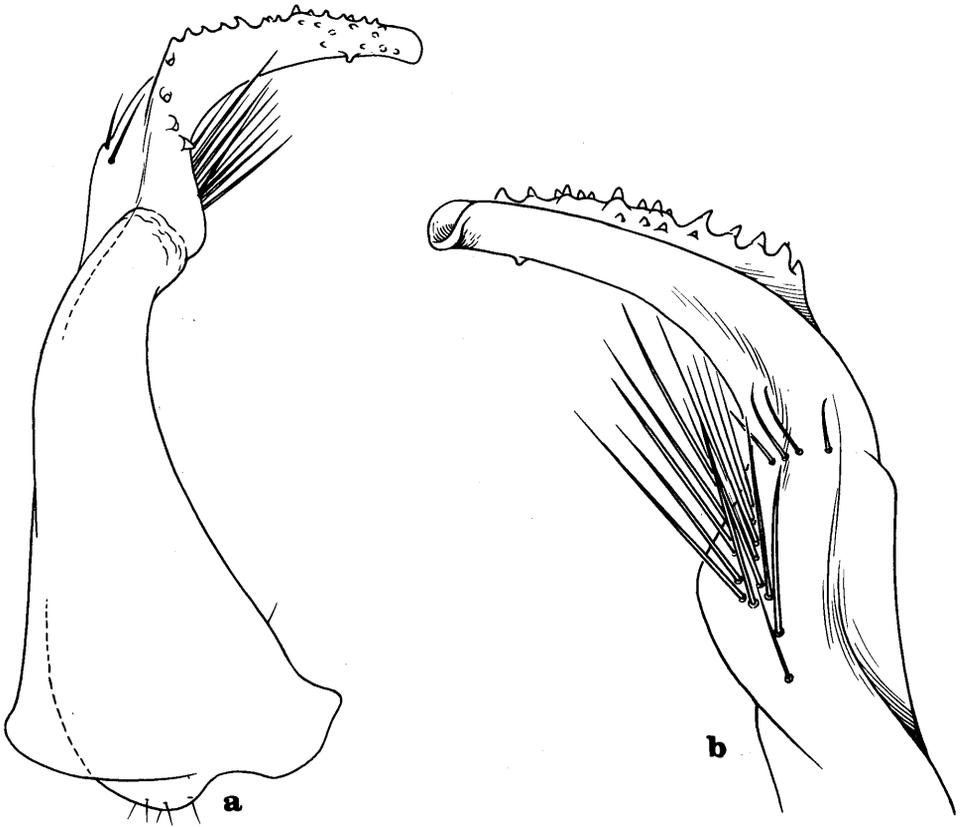


Figure 1. *Parapalicus marielae* new species : a. first male pleopod, ventral view ; b. tip of the first male pleopod, enlarged, dorsal view.

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Description.— Carapace covered with granules which form bosses. Lateral border with one large tooth behind the extra-orbital angle and one tooth situated interiorly in the epibranchial region which give impression as if the lateral border armed with two teeth. Posterior border of carapace granulated with 4-5 small granular bosses overhang on it at each lateral side. Cornea of the eyes reniform, eye-peduncle is smaller than cornea. Orbit with two broad and shallow excavations. Male cheliped missing. Female chelipeds small and slender. First legs (pereiopod-2) smaller than the second and third legs (pereiopods-3 and 4), second leg is the largest. First leg with merus width less than one-third of its length, armed distally with a blunt tooth; carpus short; propodus slender, and shorter than the lanceolate dactylus. Second and third legs with merus width more than one-third of its length; propodus as long as the lanceolate dactylus. Male abdomen with segments 3-5 fused, segment-6 less wider than segments 3-5; triangular tooth present on each submedian part of segment 3 and a triangular tooth present on central part of segment-4.

Measurements of the holotype: Carapace : length = 4.6, width = 6.6. Merus of first leg : length = 2.4, width = 0.7. Merus of third leg : length = 4.0, width = 1.2.

Remarks.— *Parapalicus marielae* has very close resemblances with *Parapalicus unidentatus* but they differ in the following characters : 1. the form of the first male pleopod (fig. 1 a,b for *marielae*; fig. 4 a,b for *unidentatus*); 2. the orbital border of *marielae* with two broad while in *unidentatus* with only one excavation; 3. the eye-peduncle of *marielae* is slightly longer and thinner than *unidentatus* (pls. I A, I B).

Parapalicus ambonensis new species (fig. 2a, 3a; pl. I D)

Material.— *Holotype* : 1♀ 5.2 x 7.4 mm; north of Tg. Batang Kapał, Haruku Island (East of Ambon), 3°36'S., 128°24'E., dredged, 60-63 fms., shell sand and rubble; coll. M.K.M.E., Sta. AH I/4, 31/5/1970; cat. no. CB 2733.

Description.— Carapace evenly granular with coarse and fine granules which in some part of the carapace clustered from 2 to 30 to form small to large bosses; clusters of granules can be seen on the following regions : cardiac, mesobranchial, epibranchial, mesogastric, protogastric, frontal, and also at the posterior part of the carapace. Front with two lobes; no clear separation between front and inner supra-orbital angle. Lateral border of carapace with one large, blunt tooth. Posterior border of carapace finely granular. cornea of the eyes reniform, eye-peduncle granular and smaller than cornea. Orbit with a small, very narrow and shallow excavation, extra-orbital angle blunt. Only one small, detached female cheliped exists which is short



Figure 2. a. *Parapalicus ambonensis* new species; b. *Parapalicus piruensis* new species.

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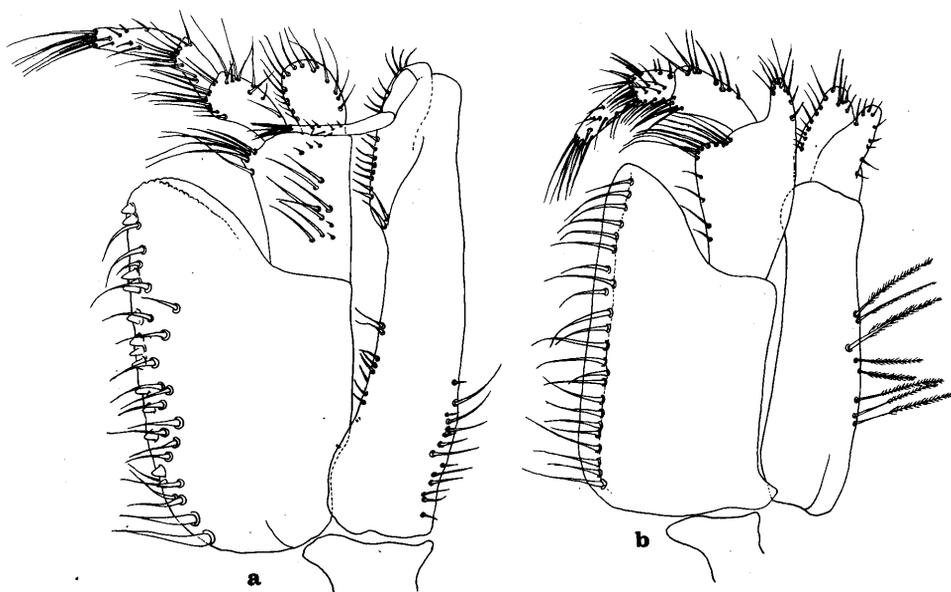


Figure 3. Third maxilliped of : a. *Parapalicus ambonensis* new species; b. *Parapalicus piruensis* new species.

and slender, First to third legs (pereiopods-2-4) massings, only last leg present which is small and positioned dorsally with hook-like dactylus. Female abdomen with segments 3-5 soldered, segment-3 with transverse entire carina which curved medially, segment-4 with small transverse carina on laterals part only.

Remarks.— This species is very close to *Parapalicus piruensis* but differs in the following characters : 1. the form of the carapace granulation (pl. I D); 2. the form of the extra-orbital angle of carapace (fig. 2a); 3. the form of the ischium of third maxilliped (fig. 3a): the ischium of the third maxilliped is inflated in *ambonensis* (length 1.5 mm., width 0.4 mm) and with cutting edge serated in *ambonensis* but entire in *piruensis* (fig. 3b); 4. the carination of the female abdomen : *ambonensis* with entire carina on the third segment and lateral carina only on the 4th segment, *piruensis* with transverse and interrupted carina on segments 3-4.

Parapalicus unidentatus (Zarenkov, 1968)
(fig. 4 a,b; pl. I B)

Palicus unidentatus, Zarenkov, 1968, p. 763, fig. 3 A-L.

Material.— 1 ♂ 7.3 x 10.2 mm., 8 ♀♀ 5.2 x 7.1 — 9.7 x 12.0 mm.; the Philippines, 14°09,3'N., 120°26,2'E.— 14°10,0'N., 120°26,8'E.; 174 — 204m; coll. Musorstom, Sta. 71,28/3/1976 (1 ♂ and 1 ♀ cat. no. CB 2723).— 2 ♀♀ 8.7 x 10.7 — 9.0 x 11.7 mm.; the Philippines, 13°53,1'N., 120°18,7'E.— 13°59,7'N, 120°16,7'E.; 186 — 177 m.; coll. Mosurstom, Sta. 56, 22/3/1976.— 1 ♂ 5.3 x 7.3 mm., 6 ♀♀ 5.7 x 9.1 — 7.5 x 10.0 mm.; the Philippines 14°00,9'N., 120°16,8'E.— 13°59,5'N., 120°18,2'E.; 189 m.; coll. Musorstom, Sta 26,22/3/1976.

Diagnosis.— Carapace covered with coarse granules which form granular bosses or clusters. Bosses can be seen on : one big boss on each side of cardiac region with one smaller boss situated laterally; two bosses on the intestinal region; several bosses on the metabranchial, epibranchial, and mesobranchial regions. Front with two small lobes. Lateral border of carapace armed with one tooth only. Posterior border with irregularly arranged bosses, in some specimens these bosses are as if symmetrically arranged while in most specimens they are not regularly arranged. Cornea of the eyes reniform, eye-peduncle smaller than cornea. Orbit with a shallow excavation only. Male and female chelipeds small and slender, dactylus curved. First leg (pereiopod -2) is smaller than the second and third (pereiopods-3-4); fourth leg situates dorsally. First leg with merus width less than one-third of its length, tuberculated and armed anterodistally with a large tubercle; carpus smooth; propodus smooth and slender; dactylus long and slender. Second and third legs with merus width less than one-third of its length; merus and carpus

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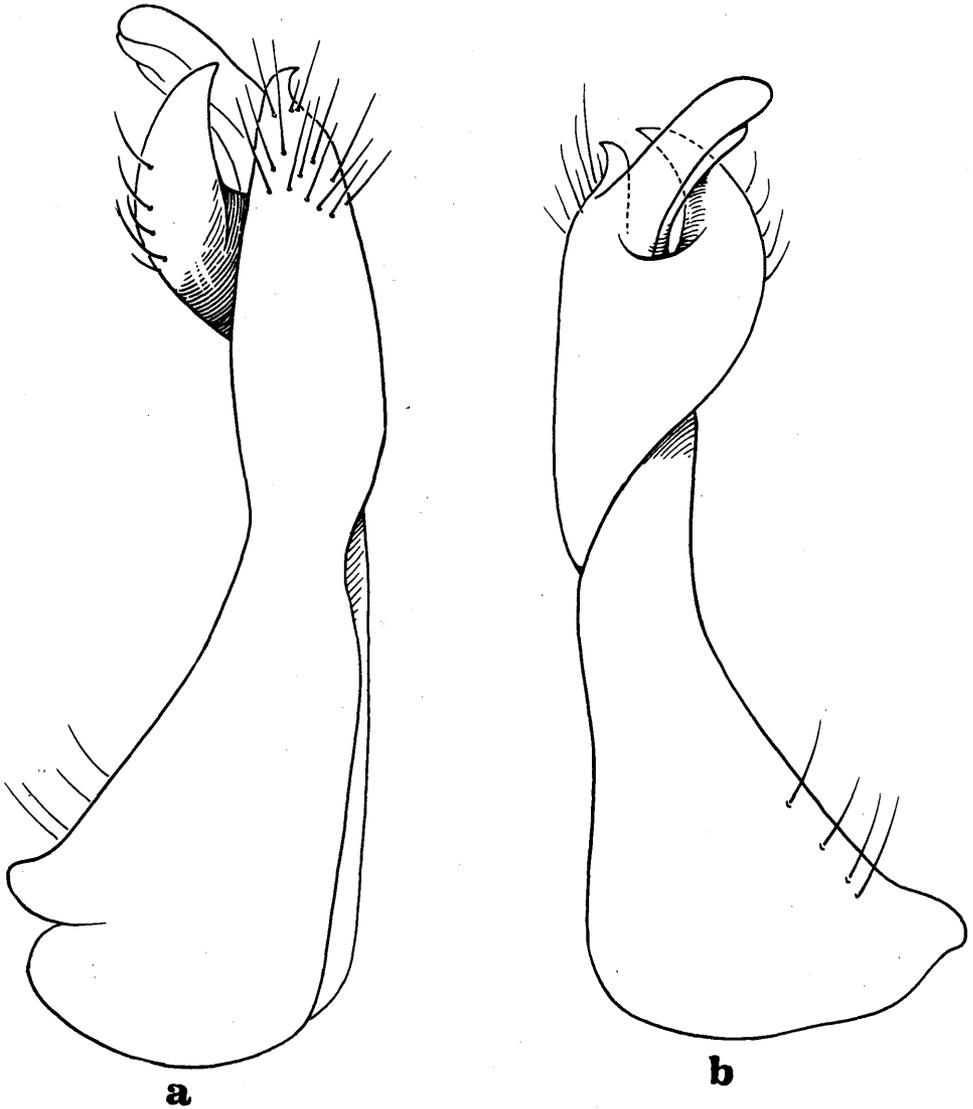


Figure 4. *Parapallicus unidentatus* (Zarenkov, 1968) : a. first male pleopod, dorsal view; b. first male pleopod, ventral view.

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resembling that of the first leg; dactylus a little more inflated than the preceding leg. Male abdomen of moderate width, segments 3-5 soldered together but borders observable; segment-3 with two lobes, each lobe situated laterally; segments-4 with a triangular lobe situated at the central part; distal part of telson with thick setae. Female abdomen with segments 3-5 soldered; segments 3-4 with transverse carina; distal part of telson with setae.

Measurements.— 1 ♀. Carapace : length = 9.7, width = 12.0; Merus of first leg : length = 4.5, width = 1.2. Merus of second leg : length = 6.6, width = 2.1.

Remarks.— The specimens agree with the description and figures of Zarenkov (1968). Zarenkov described *unidentatus* for three ovigerous females with carapace breadth of 7.8, 7.1, and 7.5 mm. and one male specimen of 6.0 mm. collected in the South China Sea at 60-180 m depth.

Parapalicus piruensis new species
(figs. 2b, 3b; pl. I C)

Material.— *Holotype* : 1 ♀ 4.4 x 5.8 mm.; off Tg. Tutuhuhur, Piru Bay, Ceram, 3° 15'S., 128° 08'E.; dredged, 32-35 fms., coarse foraminiferal and shell sand; coll. M.K.ME., Sta. CP I/1, 1/6/1970; cat no. CB 2730.— *Paratype* 1 ♀ 3.2 x 4.2 mm.; all legs missing; Coronado Bay, Mindanao, Sulu Sea, the Philippines; dredged, 25-70 fms., sand and mud; coll. Pele, 10/11/1964; cat. no. CB 2728.

Description.— Carapace evenly granular, granules not forming granular bosses; cardiac, mesobranchial, epibranchial, gastric, and hepatic regions swollen. Front with two lobes and separated from the inner supra-orbital angle with a marked ridge. Lateral border of carapace with one well developed, acute tooth. Posterior border of carapace finely granular. Cornea of the eye with reniform character; eye-peduncle smaller than cornea. Orbit with two narrow and shallow excavations. Only female chelipeds exist which are small, short and slender. First leg is smaller than the second and third but markedly much larger than the fourth. Third leg bears resemblances of the second but smaller. First leg with merus width about one-fourth of its length, slightly inflated proximally, granulated and covered with plumose setae, anterodistal border with a low blunt tooth; carpus short, very finely granular; propodus long and slender very finely granular; dactylus nearly as long as propodus. Second leg with merus about one-third of its length, clearly more robust than the other segments, granular and covered with plumose setae, anterodistal border with developed blunt tooth; carpus very finely granular; propodus long and slender; dactylus lanceolate, more expanded than that of the first leg and shorter than the propodus. Third leg has the characters of the second but less robust. Fourth leg very small and

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slender. Female abdomen with segments 3-5 fused, segments 3-4 with transverse carina interrupted submedially which give the impression of a raised, inflated median part.

Remaks.— *Parapalicus piruensis* has close resemblances with *Parapalicus ambonensis* and *Parapalicus elaniticus*, they can be recognized by several characters (see remarks on *Parapalicus ambonensis* and key for species of the genus).

Pseudopalicus new genus

Diagnosis.— Front cut into four lobes or teeth. Anterolateral border of carapace with two to five teeth behind the extra-orbital angle. Eye-peduncle granular without acicular process. The first three pairs of ambulatory legs with foliaceous and flattened propodus and dactylus. Male cheliped slightly unequal and relatively small; dorsal surface of carapace granular, with generally granular tubercles in symmetrical arrangement. Abdomen smooth with transverse carina at least on segment-1.

Type species : *Cymopolia serripes* Alcock and Anderson, 1894

The species of the genus : The genus includes in the order of the key the following former species of *Palicus* : *Palicus woodmasoni* Alcock, 1900; *Palicus serripes* (Alcock and Anderson, 1894), *Palicus fisheri* (Rathbun, 1906), *Palicus cyrenae* Ward, 1942; *Palicus investigatoris* Alcock, 1900; *Palicus amadaibai* Sakai, 1963; *Palicus oahuensis* (Rathbun, 1906), and *Palicus sexlobatus* Kensley, 1969.

In the present study only specimens of two species : *serripes* and *amadaibai* have been examined. The characters of other species in the key are taken from the descriptions and figures of the authors. The first male pleopod is known only from three of the eight species of the genus. Some species are particularly close to one another and their separation is not very satisfying yet in the present condition of our knowledges. The comparison between type specimens of these species could demonstrate their identity; it could be the case for *fisheri* and *cyrenae*, for *investigatoris* and *amadaibai*, and for *oahuensis* and *sexlobatus*.

Key to the species of *Pseudopalicus*

1. — Lateral border of carapace with only two teeth behind the acute extra-orbital angle; supra-orbital border with three deep excavations. Male chelipeds unequal with tuberculate palm. Carpus of third leg (pereopod-4) with bilobed crest on anterior margin. Male pleopod unknown *woodmasoni* (Alcock, 1900)
- Lateral border of carapace with three or more teeth behind the extra-orbital angle 2.

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2. (1). — First to third legs (pereopods-2-4) with posterior border of propodus and dactylus serrated with some spines or spinules3.
 — First to third legs (pereopods-2-4) with posterior border of propodus and dactylus entire. 7.
3. (2). — Propodus and dactylus of second and third legs (pereopods-3-4) remarkably broad and foliaceous; propodus of third leg (pereopod-4) approximately twice as long as broad with its posterior border armed with 5-6 spines; posterior margin of dactylus armed with 4 spines. Four anterolateral teeth behind extra-orbital angle. Dorsal surface of carapace entirely ornamented with coarse granules. Frontal lobes blunt. Twelve small lobes on posterior border of carapace. First male pleopod long with blunt tip (fig. 5 a,b,c) *serripes* (Alcock and Anderson, 1894).
 — Propodus and dactylus of second and third legs (pereopod-3-4) slimmer, propodus of third leg (pereopod-4) at least thrice as long as broad. Three or four anterolateral teeth behind extra-orbital angle. 4.
4. (3). — Frontal lobes mainly median ones remarkably long and acute. Anterolateral teeth of carapace long and acute. Dorsal surface of carapace with acute or spiny tubercles. 5.
 — Frontal lobes subtriangular and median ones only a little longer than laterals. Anterolateral teeth of carapace more triangular in form 6.
5. (4). — Lateral border of carapace with four long, acute teeth behind the extra-orbital angle. Posterior border of carapace with eleven small lobes. Second to third legs (pereopods-3-4) with 4-5 denticulations on the posterior border of propodus and 2-3 on posterior border of dactylus. First male pleopod unknown *fisheri* (Rathbun, 1906)
 — Lateral border of carapace with three broad, acuminate teeth behind the extra-orbital angle. Eye-peduncle with spines. Posterior border of carapace with 10-11 dentiform spines. Second and third legs (pereopods-3-4) with two spines on the posterior border of dactylus. First male pleopod unknown. *cyrenae* (Ward, 1942)
6. (4). — Dorsal surface of carapace with areolar capped by a sharp little tubercle between which the surface is smooth except on the granular lateral regions of the carapace. Four anterolateral teeth which are sharp and smooth. Posterior border of carapace with 8-10 separated lobes. First male pleopod unknown. *investigatoris* (Alcock, 1900)

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- Regions fairly well defined, each beset with tubercles of various sizes, the largest ones covered with tiny granules. Supra-orbital border with two teeth, of which the inner one is broad and subtruncate, the outer one narrower and with pointed tip. Posterior border of carapace with 6 feeble lobes. First male pleopod with trifid and broadened apex (fig. 6 a,b,c).....
..... *amadaibai* (Sakai, 1963)
- 7. (3). — Front with small median rounded lobes at a lower level than the broad and shallower lateral ones. First anterolateral tooth of carapace located at a distant from the extra-orbital angle; second and third teeth much larger, subequal, and last tooth dentiform very small and acute. Posterolateral and posterior border of carapace with some spaced tubercles. First four abdominal segments carinate. First male pleopod unknown
..... *oahuensis* (Rathbun, 1906)
- Front with more acute lobes, the medians slimmer, a little longer and subequal with the laterals. First anterolateral tooth of carapace located at a distance from the extra-orbital angle followed by two smaller ones. Posterior border of carapace with six separated, flat lobes. Gastric region with six tubercles arranged into two transverse rows; cardiac region with transverse row of four tubercles. Anterior edge of carpus of first leg (pereopod-2) with a proximal rounded lobe and an acute flattened spine. First male pleopod in Kensley (1969, fig. 2 d) *sexlobatus* (Kensley, 1969)

Pseudopalicus serripes (Alcock and Anderson, 1894)

(fig. 5 a,b,c; pl. II A)

Cymopolia serripes, Alcock and Anderson, 1894, p. 208, pl. 24, fig. 7.— Sakai, 1935, p. 86, fig. 17.— 1936, p. 208, fig. 111, pl. 58, fig. 1.— 1939, p. 608, pl. 71, fig. 1.

Palicus serripes, Bouvier, 1898, p. 12.— Alcock, 1900, p. 454.— Calman, 1900, p. 32, pl. 2, figs. 20-22.— Illus. Invest., 1903 pl. 7, fig. 1.— Laurie, 1906, p. 431.— Sakai, 1976, p. 594, pl. 205, fig. 2.

Material.— 1 ♀ ovigerous 7.5 x 8.5 mm.; 8 miles southwest of Tg. Ratoe, Maikoor, Aru Islands, 6° 7'S., 133° 57'E.; dredged, 35-30 fms., sand and rubble; coll. M.K.M.E., Sta. AM II/3, 18/6/1970; cat. no. CB 2716.— 1 ♂ 7.0 x 7.8 mm.; 1 mile south of Tg. Tutuhuhur, Piru Bay, Ceram, 3° 15'S., 128° 8'E.; dredged, 14-30 fms., coarse sand, lithothamnion and rubble; coll. M.K.M.E., Sta. CP I/8-14, 2/6/1970; cat. no. CB 2715.— 1 ♂ 6.2 x 7.5 mm.; north of Du Rowa Island, north of Nuhu Rowa, Kai Islands, 5° 32'S.,

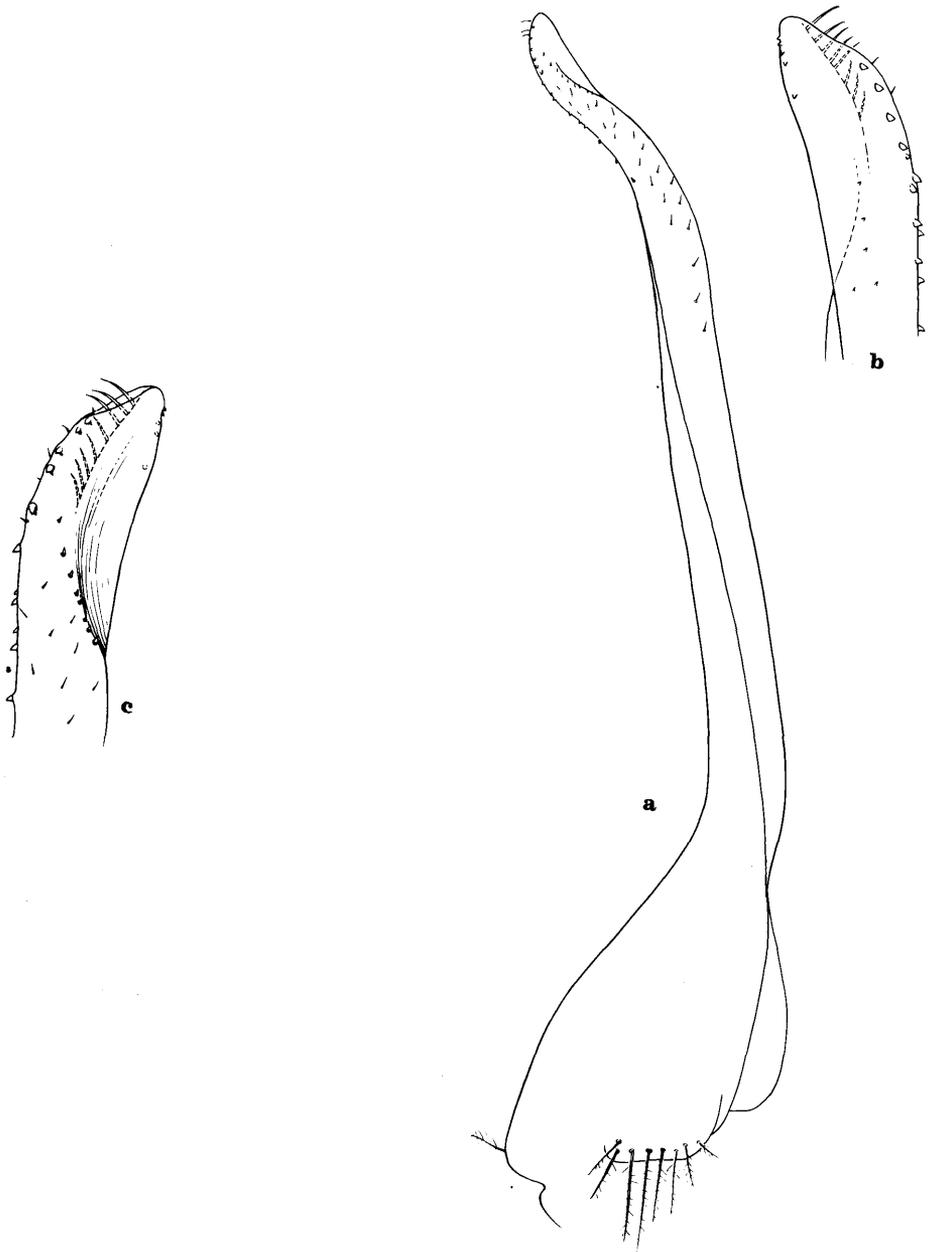


Figure 5. *Pseudopalicus serripes* (Alcock and Anderson, 1894) : a. first male pleopod, ventral view ; b. tip of the first male pleopod, enlarged, ventral view ; c. as b, dorsal view.

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132° 41'E., dredged, 20 fms., sand and rubble; coll. M.K.M.E., Sta. KR VI/3-10, 11/6/1970; cat. no. CB 2725.

Observation.— The outer half of the supra-orbital border is divided into two elongate lobes distally rounded. The chelipeds are unequal and the inner surface of the palm setose. The dorsal surface of the carapace is coarsely granular. The broad and relatively short propodus and dactylus of the second and third legs (pereopods-3-4) separate the species from the other species of the *Pseudopalicus*. The carina of the first male abdominal segment granular and is as long as the width of the segment. The first male pleopod is illustrated for the first time herewith. The species is scarcely recorded and known by less than 20 specimens.

Pseudopalicus amadaibai (Sakai, 1963)
(fig. 6,a,b,c; pl. II B)

Palicus oahuensis, Balss, 1922, p. 120, fig. 6.— Yokoya, 1933, p. 206.— nec Rathbun, 1906, p. 836.

Cymopolia oahuensis, Sakai, 1939, p. 609, fig. 90a.

Palicus amadaibai, Sakai, 1963, p. 227, fig. 7a.— 1965, p. 183, pl. 89, fig. 1 1976, p. 593, pl. 205, fig. 1.

Material.— 1 ♂ 11.7 x 14.8 mm.; the Philippines, 14°01,3'N., 120° 16, 8'E.— 13° 59,5'N., 120° 18,2'E.— 186-177 m.; coll. Musorstom. Sta. 30, 22/3/1976.

Observation.— The present specimen agrees in most detail with the description of Sakai (1963, 1965). Information of the first male pleopod of the type specimen would provide the necessary security. Sakai (1963, 1965) mentioned that the posterior border of the second to fourth pereopods is entire while in his figures (1963, fig. 7a; 1965, pl. 89, fig. 1) show the presence of spinules which in the Philippines specimen is the moveable ones.

Remarks.— *Pseudopalicus amadaibai* (Sakai, 1963) is close to *Pseudopalicus investigatoris* (Alcock, 1900). The comparison of the material of *amadaibai* from Japan or at least the comparison of their first male pleopod with the type of *investigatoris* would probably leads to the validity of the name of Alcock's. Referring to the descriptions and figures of the two species their separation is difficult, many characters are similar. Besides, Alcock (1900) and Sakai (1963, 1965) are sometimes using the different characters. For example, in the description of *amadaibai*, Sakai indicates that on the propodus of the pereopods-2-4 is entire and sparingly furnished with short feathered hairs, a condition which seems to be similar at least to the figure of *investigatoris* published in III. Invest. (1903, pl. 67, fig. 2). Moreover, the figure of Sakai (1963, fig. 71; 1965, pl. 89, fig. 1) shows the presence of the spinules on the posterior border of the propodus of the second to

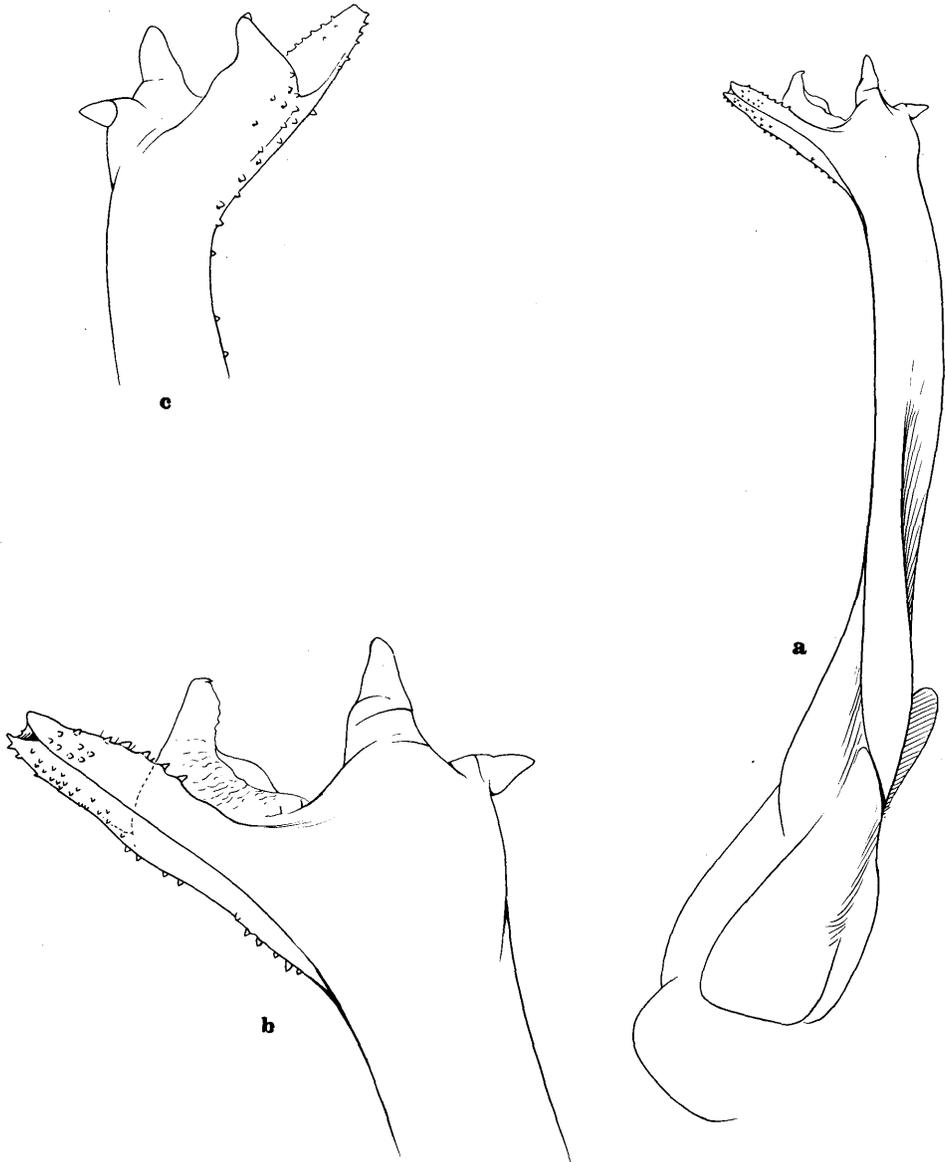


Figure 6. *Pseudopalicus amadaibai* (Sakai, 1963) : a. first male pleopod, ventral view; b. tip of the first male pleopod, enlarged, ventral view; c. as b, dorsal view.

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fourth pereopods which is also demonstrated in the Ill. Invest. (1903). *Pseudopalicus investigatoris* is as far only known by the type specimen, a non adult male of 7 x 8 mm. collected in the Andamans, and second specimen, male 9 x 11 mm. collected in the Persian Gulf described by Mac-Gilchrist (1905) as a variety which is slightly different from the type material.

Neopalicus new genus

Diagnosis.— Frontal border cut into two lobes defined on either side from the upper orbital margin by a distinct notch. Dorsal surface of carapace covered with scabrous large granules, without elevated granular tubercle symmetrically arranged at the summit of regions but 4-5 transverse, slightly swollen wrinkles can be distinguished. Eye-peduncle with 2-3 smooth tubercles, the largest is closest to cornea, without acicular process. Anterior border of propodus of the second and third ambulatory legs with a marked distal convexity; posterior border of propodus and dactylus of the ambulatory legs entire. Abdominal segments transversely carinate.

Type species : *Cymopolia jukesi* White, 1847

The species of the genus.— *Neopalicus* is established for two closely related species: *N. jukesi* (White, 1847) and *N. contractus* (Rathbun, 1902). These species are represented in this study and they can be separated by the following characters :

- Carapace widening anteriorly, its largest breadth lies at the level of the second anterolateral tooth behind the extra-orbital angle which is short and blunt. Frontal lobes rounded. Supra-orbital border with two fissures, the inner widely open and the outer nearly close and inconspicuous. Basal antennal article with anterolateral angle subacutely carinate. On the third pair of ambulatory legs (pereopod-4) the dactylus is slightly longer than half of the propodus length. First male pleopod in Calman (1900, pl. I, fig. 13) *jukesi* (White, 1847)
- Carapace widening posteriorly, its largest breadth lies at the level of the first anterolateral tooth behind the extra-orbital angle which is markedly acuminate and salient. Frontal lobes subangular being more protruding in the middle. Supra-orbital border with two fissures, the inner wide and deep, the outer about half as deep and wide as the inner. Basal antennal article with anterolateral angle expanded as a bilobed process. On the third pair of ambulatory legs (pereopod-4) the dactylus is less than half the length of propodus. First male pleopod in Zarenkov (1968, fig. 3E)..... *contractus* (Rathbun, 1902)

Neopalicus jukesi (White, 1847)

(fig. 7 a,b; pl. II C)

Cymopolia jukesi, White, 1847, p. 358, pl. 2, fig. 1.— Miers, 1874, p. 4, pl. 3, fig. 4.— 1886, p. 325.— Haswell, 1881, p. 138.— Henderson, 1893, p. 405.

Cymopolia carinipes, Paulson, 1875, p. 73, pl. 9, figs. 4-4c.

Palicus jukesi, Bouvier, 1898, p. 12.— Alcock, 1900, pl. 451.— Calman, 1900, p. 29, pl. I, figs. 9-13.— Rathbun, 1902, p. 126.— 1911, p. 240, pl. 19, fig. 9. Borradaile, 1903, p. 433.— Laurie, 1906, p. 430, pl. I, fig. 12.— Nobili, 1906, p. 433.

nec *Palicus jukesi* Zarenkov, 1968, p. 765, fig. 3D., E.

Palicus carinipes, Holthuis, 1977, p. 181, fig. 2.

Material.— 1 ♀ 7.4 x 8.6 mm.; off Tg. Tutuhuhur, Piru Bay, Ceram, 3° 15'S., 128° 8'E.; dredged, 25-35 fms., coarse foraminiferal and shell sand; coll. M.K.M.E., Sta. CP I/1-6, 1/6/1970; cat. no. CB 2713.— 1 ♂ 6.8 x 7.9 mm., 1 ♀ 6.9 x 7.8 mm.; off Tg. Tutuhuhur, Piru Bay, Ceram, 3° 15'S., 128° 8'E.; dredged, 14-30 fms., coarse sand, lithothamion and rubble; coll. M.K.M.E., Sta. CP I/8-14, 12/6/1970; cat. no. CB 2719.— 1 ♂ 5.9 x 7.1 mm., 2 ♀♀ 6.0 x 7.1—7.5 x 8.7 mm.; off Tg. Tutuhuhur, Piru Bay, Ceram, 3° 15'S., 128° 8'E.; dredged, 30 fms., grey sand, fine with shelly grit; coll. M.K.M.E., Sta. CP I/15, 2/6/1970; cat. no. CB 2722.— 2 ♂♂ 5.5 x 6.1—5.6 x 6.5 mm.; north of Du Rowa Island, north of Nuhu Rowa, Kai Islands, 5° 32'S., 132° 41'E.— dredged, 18-20 fms., sand; coll. M.K.M.E., Sta. KR VI/1, 10/6/1970 cat. no. CB 2714.— 2 ♂♂ 4.9 x 5.7—6.0 x 7.1 mm., 3 ♀♀ 6.2 x 7.3—6.4 x 7.4 mm.; north of Du Rowa Island, north of Nuhu Rowa, Kai Islands, 5° 32'S., 132° 41'E.; dredged, 15-20 fms., sand and rubble; coll. M.K.M.E., Sta. KR VI/3-10, 11/6/1970; cat. no. CB 2721.— 1 ♂ 5.8 x 7.0 mm.; off Elat Bay, west coast of Nuhu Tjut, Kai Islands, 5° 40'S., 132° 59'E.; dredged, 38 fms., mud; coll. M.K.M.E., Sta. KN II/1-2, 13/6/1970; cat. no. CB 2727.— 1 ♀ 3.8 x 4.4 mm.; east side of Mitduan reef, west coast of Nuhu Tjut, Kai Islands, 5° 32'S., 133° E.; dredged 30-31 fms., sand, coral, rubble and sponge; coll. M.K.M.E., Sta. KN IV/1-2, 13/6/1970; cat. no. CB 2717.— 2 ♂♂ 6.0 x 7.1—6.7 x 8.1 mm.; approx. 13 miles west-southwest of Tg. Lelar, Trangan Island, Aru Islands, 6° 49'S., 133° 50'E.; dredged, 21-22 fms., sand; coll. M.K.M.E., Sta. A V /1-2, 21/6/1970; cat. no. CB 2720.— 1 ♂ 6.3 x 7.4 mm., 1 ♀ 6.8 x 8.1 mm.; approx. 8 miles southwest of Tg. Ratoe Maikoor, Aru Islands, 6° 7'S., 133° 57'E.; dredged, 25 fms., sand and rubble; coll. M.K.M.E. Sta. AM II/4-5, 18/6/1970; cat. no. CB 2718.

Observation.— The present specimens generally agree with the descriptions and figures of authors. Calman (1900, pl. I, fig. 13) illustrated the first male pleopod and described it as 'stout' precisising that "the two lobes of

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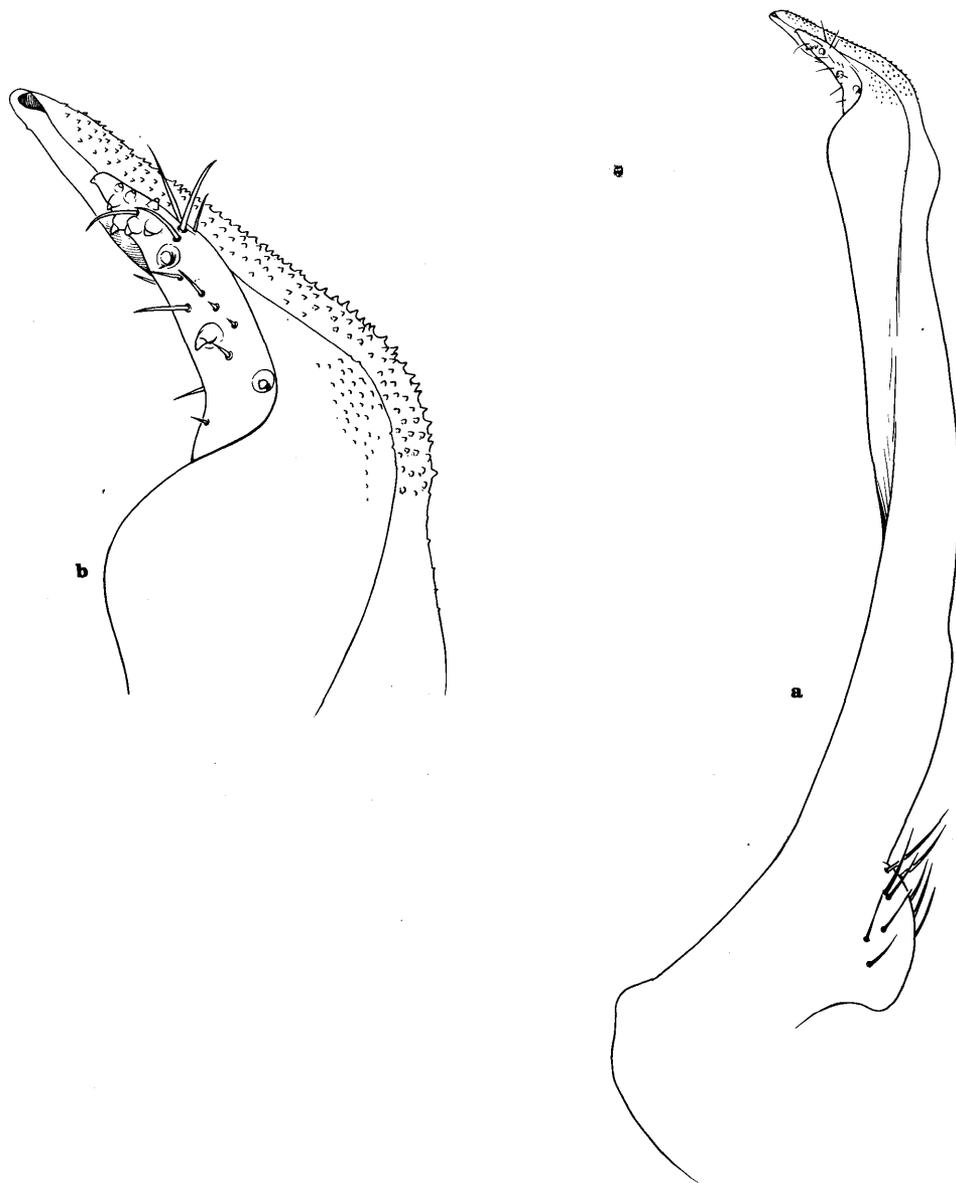


Figure 7. *Neopalicus jukesii* (White, 1847) : a first male pleopod, ventral view ; b. tip of the first male pleopod, enlarged ventral view.

the tip are closely approximated, the outer extending a little beyond the inner". The first male pleopod of the present specimens has the same type with spiraled shaft; the two distal lobes of the apex are hardly distinguished one from another.

Neopalicus jukesii was originally described for specimens from the Torres Strait, which are deposited in the British Museum. The species was recorded from several localities in the Indian Ocean and the distribution is from Red Sea to Australia. It is the most recorded of all the Indo-West-Pacific species of Palicinae. Alcock (1900) identified 32 specimens in the collection of the Indian Museum. Zarenkov (1968) identified as *jukesii* one male and four females indicating in his text their figures under figure 3D,E. However, these figures (3D, E) are given under the name of *contractus* and in any way the first male pleopod is not that of *jukesii*, a comment on this will be further detailed when studying the *contractus*.

Neopalicus contractus (Rathbun, 1902)

(pl. II D)

Palicus contractus, Rathbun, 1902, p. 126, figs. 7,8.

? *Palicus contractus*, Zarenkov, 1968, p. 766, fig. 3D,E.

Cymopolia robusta, Ward, 1942, p. 46, pl. 4, figs. 3,4.

? *Palicus jukesii*, Zarenkov, 1968, p. 765.

Material.—1 ♀ 10.7 x 11.0 mm.; off Tg. Tutuhuhur, Piru Bay, Ceram, 3°15'S., 128°8'E.; dredged, 30 fms. grey sand, fine with shelly grit; coll. M.K.M.E., Sta. CP I/15, 1/6/1970; Cat. no. CB 2734.—1 ♀ 12.8 x 15.0 mm.; off Elat Bay, west coast of Nuhu Tjut, Kai Islands, 5°40'S., 132°59'E.; dredged, 27-30 fms., rubble, algae, and sand; coll. M.K.M.E., Sta. KN II/6, 13/6/1970; cat. no. CB 2726.

Observation.— The present specimens agree with the description and illustrations of the species by Rathbun (1902). In connection with the anteriorly narrowing carapace of *contractus*, Rathbun (1902) indicated on the type material: "width between outer orbital angle 6.9 mm., width between the tips of the next lateral teeth 7.7 mm." The comparison of the specimen of *jukesii* and *contractus* allow to precise that *jukesii* has several (3-4) lateral teeth behind the extra-orbital angle ornamenting the divergent lateral border, instead on *contractus* only two teeth continued by a smooth (entire) converging lateral border. Rathbun (1906) in her description of the genus *Manella* and referring generally to the species of *Palicus* wrote that "*spinipes* most resembles in shape to *contractus* in which the side margins converge from front to back". Some characters mentioned in the separation between *contractus* and *jukesii* were already used by Ward (1942) for the separation

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of his new species *robustus* Ward, 1942 from *jukesi*, but *robustus* is herewith considered as identical with *contractus*. The two species — *jukesi* and *contractus* — are so close that they could rise confusion. Zarenkov (1968) probably had faced that difficulty. Zarenkov (1968, fig. 3 E) gave the figure of the first male pleopod of a male of 7 mm. breadth. In the text he quoted specimens of *jukesi* but not of *contractus* but in his summary (in English) he mentioned *contractus* not *jukesi*. The first male pleopod of *contractus* figured by Zarenkov (1968) is very different from that of *jukesi* figured by Calman (1900) and it could be supposed that Zarenkov corrected the identification of his specimens of *jukesi* to that of *contractus* which is the closest species. Rathbun (1902) described *contractus* for two immature males (the largest was 6.4 x 6.9 mm.) collected from Nallandu at about 30 meters deep. Ward (1942) described *robustus* for a single female of 16 mm. carapace width collected from Mauritius.

Palicoides new genus

Diagnosis.— Frontal border cut into two lobes and laterally continuous (without marked notch) with supra-orbital border. Eye-peduncle with an acicular process, crescent-like or sickle-shaped blade. Ambulatory legs less granulated with fine, not coarse, granules. Male abdomen narrow with distinct segments.

Type species.— *Cymopolia whitei* Miers, 1884

The species of the genus.— The genus includes with *whitei* two other species : *ternatensis* new species and *longimanus* (Miyake, 1936). The genus is heterogeneous if full consideration is given to the type of the first male pleopod of the species. The type species, *whitei*, has pleopod with elongate, straight shaft continued distally by a large furca, that part of appendage is dorso-ventrally flattened having some aspect of a paper sheet or a tape. The first male pleopod of *ternatensis* has a similar type but not that of *longimanus*, which has a spiraled shaft and a broadened apex. The three species of this new genus is represented in the present study and are in the order of the key : *Palicoides longimanus* (Miyake, 1936), *P. whitei* (Miers, 1884), and *P. ternatensis* new species.

Key to the species of *Palicoides*

1. — Chelipeds of the two sexes remarkably elongate; merus of the male cheliped longer than carapace length. Surface of carapace entirely but irregularly granular, some granule on the branchial regions being much larger. First male pleopod with spiraled shaft (fig. 8 a,b.) *longimanus* (Miyake, 1936).

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- Chelipeds of the two sexes of normal size or small; merus of male cheliped always shorter than carapace length. Surface of carapace entirely and finely granular; all granules of about the same sizes. First male pleopod with a flattened shaft 2.
2. (1). — Merus of the male cheliped is less than half of the carapace length. Male abdomen with segments 3-5 soldered. First male pleopod figured herewith (fig. 9 a,b). *whitei* (Miers, 1884)
- Merus of male cheliped is about 0.63-0.75 as long as carapace length. Male abdomen with segments 3-5 distinct. First male pleopod (fig. 11 a,b,c). *ternatensis* new species

Palicoides longimanus (Miyake, 1936)

(fig. 8 a,b; pl. III A)

Cymopolia longimana, Miyake, 1936, p. 495, fig. 1, pl. 35, figs. 3-4.— Sakai 1939, p. 609, fig. 90 c.

Palicus longimanus, Sakai, 1976, p. 595, fig. 325 c.

Material.— 1 ♀ 14.5 x 17.5 mm.; east side of Mitduan reef, west coast of Nuhu Tjut, Kai Islands, 5°32'S., 133°E.; dredged, 30-31 fms., sand, coral, rubble and sponge; coll. M.K.M.E., Sta. KN IV/3-4. 13/6/1970; cat. no. CB 2732.— 1 ♂ 8.1 x 10.2 mm., 1 ♀ 9.6 x 10.6 mm.; north side of Labuan Olendir, Selaru Island, Tanimbar Islands, 8°7'S., 130°59'E.; dredged; coll. M.K.M.E., Sta. TS IV, 26/6/1970; cat. no. CB 2731.

Observation.— The present specimens agree with the description and illustrations of the species by Miyake (1936). They have the chelipeds and ambulatory legs comparatively a little broader and shorter respectively than the type specimen. The first anterolateral tooth is separated from the extra-orbital angle by a well marked but close incision. On the dactylus of the cheliped, the proximal large tooth of the cutting edge is strongly marked. Finally the first male pleopod is identical to that figured by Miyake (1936), secure the identity of the present specimens with *longimanus*. The species was described from a single male of 9 x 12 mm. collected in Japan and since then was never been recorded again. Sakai (1939, 1976) was only referring to Miyake's record. The present specimens extend the geographical distribution of the species.

Palicoides whitei (Miers, 1884)

(figs. 9 a,b; 10)

Cymopolia whitei, Miers, 1884, p. 551, pl. 49, fig. C.

Palicus whitei, Bouvier, 1898, p. 12.— Alcock, 1900, p. 453.— Calman,

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Figure 8. *Palicoides longimanus* (Miyake, 1936) : a. first male pleopod, ventral view; b. tip of the first male pleopod, enlarged, ventral view.

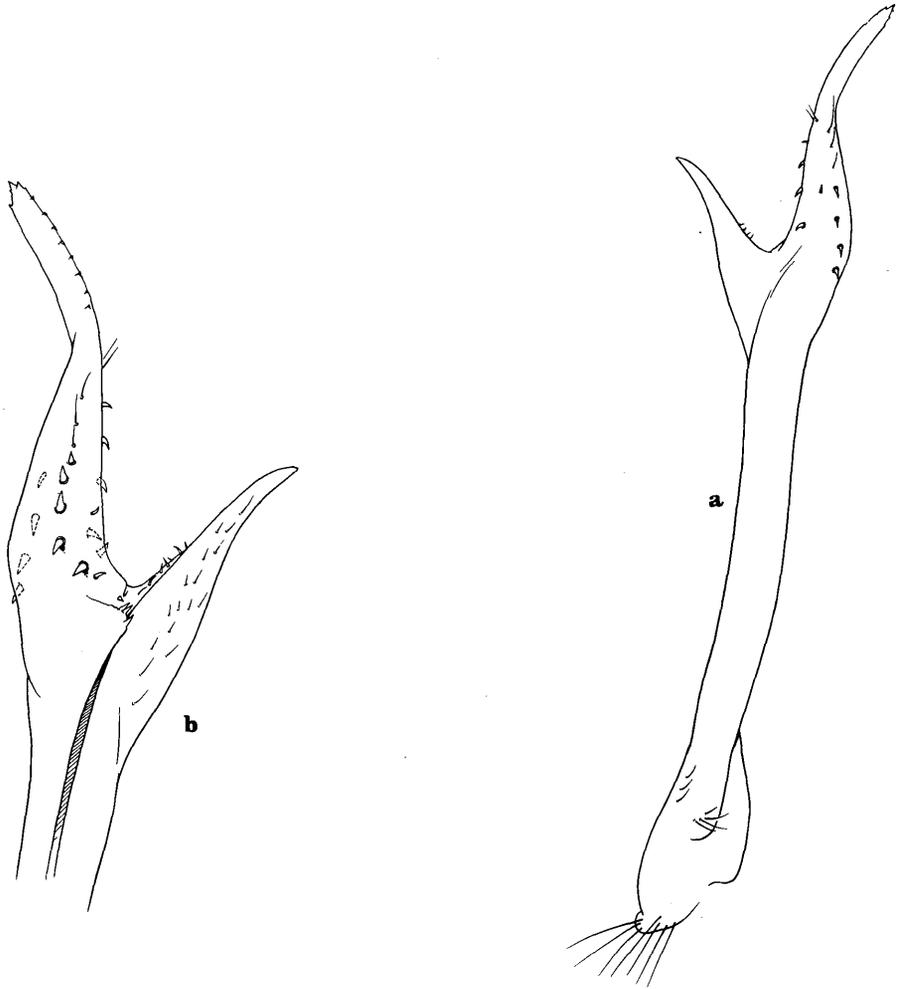


Figure 9. *Palicoides whitei* (Miers, 1879) : a. first male pleopod, ventral view ; b. tip of the first male pleopod, enlarged, dorsal view.

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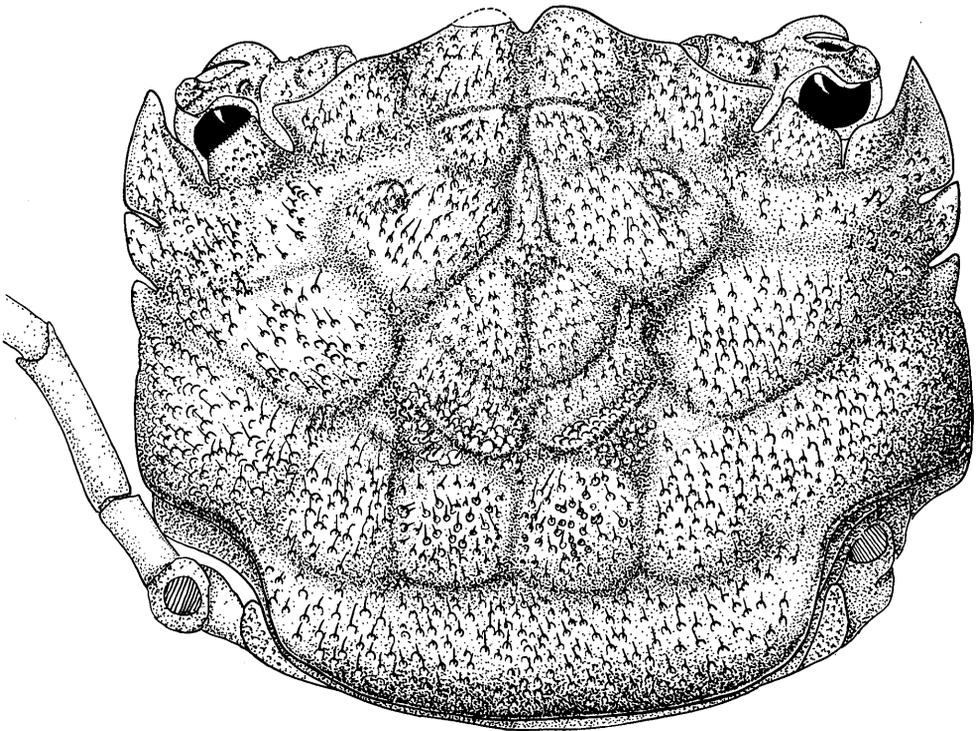


Figure 10. *Palicoides whitei* (Miers, 1879)

1900, p. 31, pl. 2, figs. 14-19.— Rathbun, 1911, p. 240, pl. 19, fig. 10.— McNeill, 1968, p. 82.— Holthuis, 1977, p. 186.

Material.— 1 ♂ 9.2 x 10.6 mm.; off Elat Bay, west coast of Nuhu Tjut, Kai Islands, 5°40'S., 132°59'E.; dredged, 27-30 fms., rubble, algae and sand; coll. M.K.M.E., Sta. KN II/6, 13/6/1970; cat. no. CB 2729.

Observation.— The similarity of the first male pleopod of the present specimen with the figure given by Calman (1900) insure the identity of it. Miers (1884) described the species from material collected in the Seychelles; the larger syntype was a female of 9 mm. carapace breadth, the other syntypes were a female and two males. Alcock (1900) recorded two females from Andamans. Calman (1900) recorded several specimens from Torres Straits. Rathbun (1911) recorded an ovigerous female of 14.9 x 15.5 mm. from Seychelles which is slightly different from the description and figures of Miers (1884) and Calman (1900). McNeill (1968) recorded five specimens from the N.E. Australia, the largest being a female of 22 mm. of carapace breadth. The species is known by less than 15 specimens only.

Palicoides ternatensis new species

(fig. 11 a,b,c,d; pl. III B)

Material.— *Holotype* : 1 ♂ 10.0 x 10.5 mm.; Teluk Dodinga, north of Ternate Island, Halmahera, 0°49'N., 127°33'E.; dredged, 17-23 fms., coral (*Acropora* sp.) and mud; coll. M.K.M.E., Sta. HD I/1, 20/5/1970; cat. no. CB 2729.—

Description.— Carapace evenly granular with regions well defined. Front with two broad lobes and without any indication separating it from the inner supra-orbital angle, Anterolateral border armed with two closely placed teeth behind the extra-orbital angle; first tooth is much larger than the second which then followed posteriorly by granulated border. Posterior border of carapace smooth. Cornea of the eyes globular, larger than eye-peduncle; eye-peduncle granulated dorsally with a cornulation distally and a sickle-shaped acicular process. Orbit with two excavations, the inner wide and deep, outer deeper than inner but very narrow; extra-orbital angle acuminate. Male chelipeds subequal, elongate and setose; merus about 0.63 — 0.75 as long as the carapace length; propodus as long as merus; dactylus curved. First ambulatory leg (second pereopod) is smaller than second and third legs (pereopods-3-4), the fourth which is the smallest situated somewhat dorsally. width of the merus of the first to third ambulatory legs is less than half of its length; posterior border of carpus and propodus of the first to third legs with slender moveable spinules in between the setae. Male abdomen elongate, segments distinct; segments 5 and 6 is about as long

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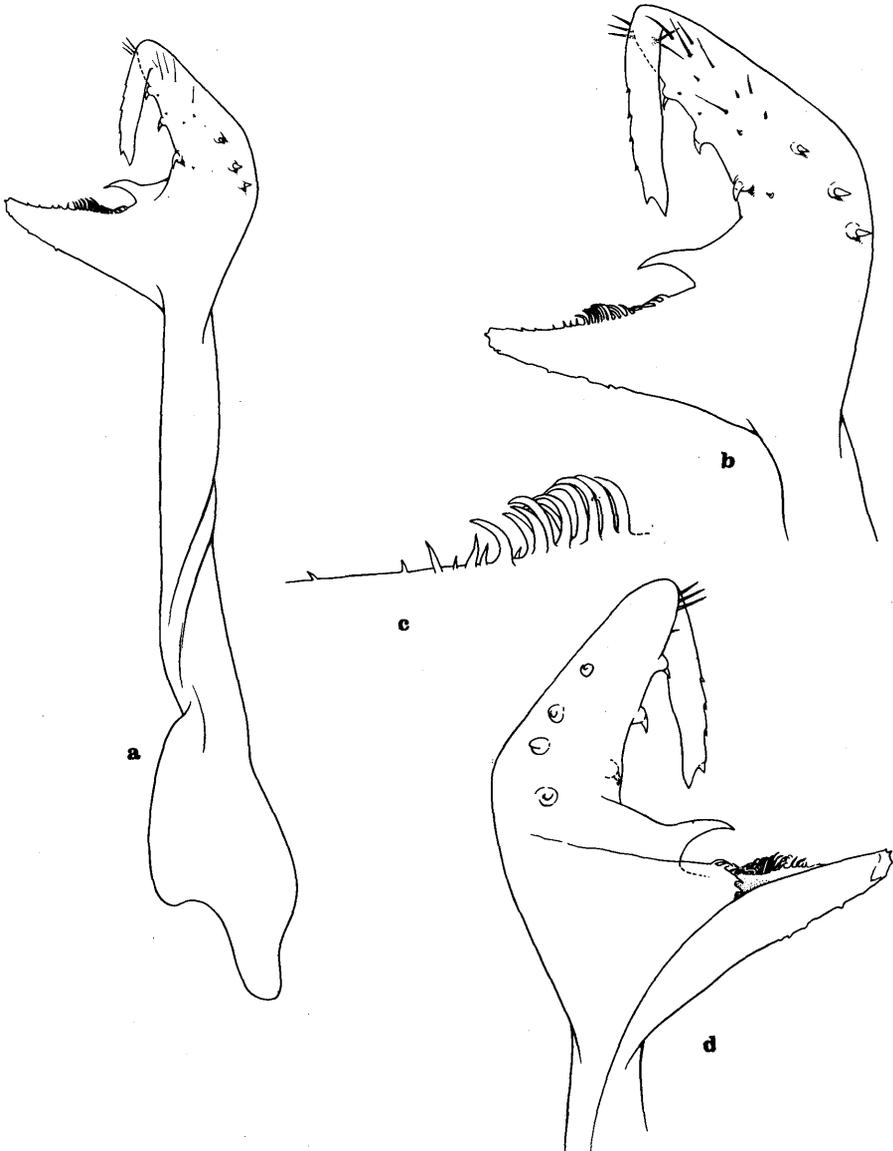


Figure 11. *Palicouaes ternatensis* new species : a. first male pleopod, ventral view; b. tip, enlarged, of the first male pleopod, ventral view; c. lateral bifurcation of the first male pleopod, enlarged; d. tip of the first male pleopod, enlarged, dorsal view.

as broad; segments-3-4 with transverse carina. First male pleopod elongated and distally enlarged with folded tip (fig. 11).

Remarks.— The general pattern of the carapace is very close to the other two species. *Palicoides ternatensis* is hardly distinguished from *whitei*. The characters which are easily observable to separate them are : the form of the male cheliped which is very long in *longimanus* (merus longer than carapace length), less longer in *ternatensis* (merus about 0.63 — 0.75 as long as carapace length) and short in *whitei* (merus less than half of the carapace length); the form of the male abdomen which segments are distinct is *ternatensis*, segments-3-6, soldered in *whitei* and in *longimanus* only segments 5-6 soldered; the form of the first male pleopod.

Crossotonotinae new subfamily

Diagnosis.— The fourth pair of ambulatory legs are reduced in size but similar in shape and position with the three anterior pairs. All margins of carapace, including the frontal border, are ornamented with numerous lobes or teeth (sometimes very acute). Dorsal surface of carapace convex or a little flattened, regions often elevated mainly the gastric, cardiac, intestinal, branchial which are separated by broad and shallow depressions; pairs of large tubercles generally occupying these elevated regions. Ventral surface of carapace of the male flattened, smooth; male abdomen with distinct, and relatively narrow segments.

Type genus : *Crossotonotus* A. Milne Edwards, 1873

The genera of Crossotonotinae.— The four following genera belong to the subfamily : *Crossotonotus* A. Milne Edwards, 1873, *Pleurophricus* A. Milne-Edwards, 1873, *Parapleurophricoides* Nobili, 1906, and *Manella* Rathbun, 1906. The genus of Nobili must be discarded, since the remark of Forest and Guinot (1961) who, after examining the type specimen of the type species of the genus stated that it was a juvenile which can not be used for the definition of the genus. However, the separation or identity of the other three genera is controversial. Ward (1933), after comparing the material of three species of *Manella* with the original material (deposited in the Paris Museum which is available during this study) of *Crossotonotus* suggested to keep the two genera distinct. Sakai (1965, 1976) synonymized *Manella* with *Crossotonotus*. Until more information being available on the species of these genera, we prefer to separate them as distinct; they are in order of the postulated key : *Manella*, *Crossotonotus*, and *Pleurophricus*.

Key to the genera of Crossotonotinae

1. — Carapace subquadrate in outline with subangular junction of the

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- nearly straight (slightly convex) posterior border with the nearly straight (feebly concave) posterolateral border. Male cheliped unequal *Manella* Rathbun, 1906
type species : *Pleurophricus spinipes* de Man, 1887
- Carapace subcircular in outline without marked junction of the convex posterior border with the posterolateral border 2.
2. (1). — Frontal border with four subequal rounded lobes, laterals a little less advance than medians. Posterior and lateral margins of carapace ornamented with more than 20 small rounded lobes. Merus of third maxilliped with feeble anterolateral angle. Male chelipeds unequal *Crossotonotus* A. Milne Edwards, 1873
type species : *Crossotonotus compressipes* A. Milne Edwards 1873.
- Frontal border with four angular lobes, submedians much more in advance than the laterals. Posterior and lateral margins of carapace ornamented with less than 15 acute, large teeth. Merus of third maxilliped with strongly extended (auriculate) anterolateral angle. Cheliped equal *Pleurophricus* A. Milne Edwards, 1873
type species : *Pleurophricus cristatus* A. Milne Edwards, 1873

Manella Rathbun, 1906

Manella, Rathbun, 1906, p. 837.— 1911, p. 240.— Ward, 1933, p. 387.— Sakai, 1939, p. 610.

Crossotonotus (pars), Sakai, 1965, p. 186.— 1976, p. 595.

nec *Crossotonotus*, A. Milne Edwards, 1873, p. 259.

Pleurophricus, de Man, 1887, p. 344.

nec *Pleurophricus*, A. Milne Edwards, 1873, p. 260.

Observation.— The genus was established by Rathbun (1906) with *Pleurophricus spinipes* de Man, 1887 as type species. Two other species are included in the genus : *Manella gardineri* Rathbun, 1911 and *Manella brevimana* Ward, 1933. *Manella spinipes* is the better known species than the other two and is represented by dozen specimens with wide geographical distribution and was recorded from Red Sea (Monod, 1938), Japan (Sakai, 1939, 1965, 1976), Amboina, Indonesia (de Man, 1887), China Sea (Zarekov, 1968) and Hawaii (Rathbun, 1906; Edmondson, 1946, 1962). *Manella gardineri* Rathbun, 1911 is only known by the type material collected from Australia. The collection contains four specimens of *Manella* one of

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which is identified as *Manella brevimana* and the others belong to two different species which can not be identified with the present known species. Two specimens are herewith described as *Manella ceramensis* new species and one small specimen which is an ovigerous female is described as *Manella longirostris* new species.

Manella brevimana Ward, 1933

(figs. 12 a,b; 13 a)

Manella brevimana, Ward, 1933, p. 387, pl. 21, figs. 7,8.

Material.— 1 ♂ 5.6 x 6.3 mm.; off Tg. Tutuhuhur, Piru Bay, Ceram, 3°15'S., 128°8'E.; dredged, 14-26 fms., coarse sand, lithothamnion, and rubble; coll. M.K.M.E., Sta. CP I/8-14, 2/6/1970; cat. CB 2736.

Observation.— The specimen agrees in most characters with the description of Ward (1933). Carapace subquadrate with areolated surface; front four lobes, median notch wide and deep; median lobes broad, protruding, and nearly as wide as the submedians. Anterolateral border of carapace short, armed with three teeth behind the extra-orbital angle, second tooth with bifurcated tip. Posterolateral border with 7-8 acute teeth and the concave proximal part with or without teeth. Posterior border denticulate and armed with 23 alternating teeth. Cornea globular; eye-peduncle smaller than cornea with distal elevated triangular ridge. Supra-orbital border with wide, V-shaped inner fissure which is deeper and wider than the outer one. Only one cheliped present which is stout and massive. Ambulatory legs with segments denticulated dorsally; dactylus foliated and denticulated at both sides, inner side with three teeth. Male abdomen narrow, segments 3-6 soldered with observable sutures. First male pleopod long and slender.

Remarks.— The present specimen has close characters with Ward's specimen and differs in the following characters : posterolateral border of carapace is armed with lesser teeth (7-8 in the present specimen, 10 in Ward's); posterior border is armed with 23 teeth instead of 22 as mentioned by Ward; median lobes of front not bifid but denticulated.

Manella ceramensis new species

(figs. 12 c,d; 13 b; pl. III C)

Material.— *Holotype* 1 ♂ 5.6 x 6.1 mm.; off Tg. Tutuhuhur, Piru Bay, Ceram, 3°15'S. 128°8'E.; dredged, 14-26 fms., coarse sand, lithothamnion and rubble; coll. M.K.M.E., Sta. CP I/8-14, 2/6/1970; cat. no. CB 2735.— *Paratype* : 1 ♀ 7.7 x 8.5 mm.; data as in holotype; cat. no. CB 2737.

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Figure 12. a. First male pleopod of *Manella brevimana* Ward, 1933, ventral view ; b. tip of the first male pleopod of *Manella brevimana* Ward, 1933, enlarged, dorsal view ; c. first male pleopod of *Manella ceramensis* new species, ventral view ; d. tip of the first male pleopod of *Manella ceramensis* new species, enlarged, dorsal view .



Figure 13. a. *Manella brevimana* Ward, 1933 b. *Manella ceramensis* new species.

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Description.— Carapace subquadrate, dorsal surface granulated and setose, tubercles seen at epibranchial, metagastric, protogastric, cardiac, intestinal, postcardiac, and in the paratype also seen at one part of the cardiac groove. Front four lobes, margin entire; median lobes more in advance than the submedians and both are of the same width; median notch obscure in the holotype and very shallow in the paratype. Anterolateral border of carapace with three denticulated teeth behind extra-orbital angle, second tooth is the largest cuts into three smaller teeth; posterolateral border with six to eight teeth, three to five anterior ones denticulated; distal part of the posterolateral border concave and joins the lobulated posterior border; posterior border with 15-17 alternating lobes. Cornea globular, eye-peduncle as large as cornea with dorsal cornulation; supra-orbital border with two fissures, inner fissure deeper but less wider than the outer; infra-orbital border with two fissures, inner fissure deeper and wider than outer, inner plate with three acute teeth, outer plate with two sharp teeth. Cheliped robust, subequal, left cheliped in both sexes less massive than the right. Ambulatory legs denticulated on both sides; dactylus of the first three legs armed with four to five spines on its inner margin and are inflated, outer margin serrated; dactylus of the last leg lanceolated and armed with two to three spines on its inner margin. Male abdomen elongate, segments 3-6 distinct, carina not seen; female abdomen with segments 3-6 distinct. First male pleopod elongate with spinule distally.

Remarks.— *Manella ceramensis* can be easily distinguished from *Manella brevimana* and *spinipes* in the following characters: 1. the form of the rostrum (herewith figured for *brevimana* and for *spinipes* see de Man 1887, pl. 9, fig. 1); 2. the form of the anterolateral border; 3. the form of the posterior border; 4. the form of the male abdomen; and 5. the form of the first male pleopod (figured herewith for *brevimana* and for *spinipes* see Edmondson, 1962, fig. 2e). *Manella ceramensis* has closer resemblances with *Manella gardineri* as described by Rathbun (1911, pl. 20, fig. 19) but differs in the following characters: 1. the form of the rostrum which is entire and with obscure or very shallow median notch in *ceramensis* but in *gardineri* is "quadridentate, the median pair of teeth bilobate, the inner lobes smaller; median sinus broadly triangular, rounded at base, other sinus acute at base;" 2. the form of the anterolateral teeth; 3. the number and form of the teeth or lobes on the posterior border. The specimen of *Manella spinipes* identified and figured by Monod (1938, figs. 26 D.E; 29) which exists in Paris Museum (under the label of *Manella gardineri* Rathbun) is observed for comparison.

Manella longirostris new species

(fig. 14)

Material.— *Holotype* : 1♀ ovigerous 4.2 x 4.3 mm; Sunda Strait, close to Panjang Island; coll. 16/3/1963; cat. no. CB 2712

Description.— Carapace nearly as long as broad, dorsal surface finely granular; cardiac, epibranchial and gastric regions raised to form swollen area or bosses; intestinal region form a tube-like boss which continue to join the central posterior lobe. Front with two well pronounced lobes, median notch wide and deep, lateral margin of front is in continuation with the supra-orbital border; on the submedian part of the front overhang one anteriorly directed tooth on each side. Supra-orbital border with two fissures, outer fissure is less marked than the inner. Cornea of the eyes globular, distinctly smaller than the base of eye-peduncle; dorsal surface of eye-peduncle finely granulated with distal cornulation. Infra-orbital border with two fissures, triangular in form; outer plate with one tooth, inner plate with two teeth, both with denticulate margin. Anterolateral border of carapace of moderate length armed with six to seven teeth behind the extra-orbital angle, second tooth is the largest; posterolateral border with two lobes or one lobe with additional lobulation on its edge; posterior border of carapace with three wide lobes at each side of the median posterior lobe. Cheliped robust, only left cheliped present. Ambulatory legs are of the same form, first leg more or less of the same size with the second, fourth leg is the smallest; merus very inflated which give impression of a tree leaf, carpus very short, propodus long and finely granulated; dactylus hook-like, not inflated, inner side with only one spinule, outer side smooth and without setae. Female abdomen with segments 2-6 distinct, carina absent.

Remarks.— *Manella longirostris* is different from the known species of *Manella*. The form of the posterior border and its small size will lead the impression of a juvenile specimen. The condition of the dorsal surface of the carapace is not very good but the form of the abdominal segments proved that the specimen is a mature female which carries the mature eggs. The rostrum as well as the form of the posterior border of carapace can be easily seen that the specimen is not belong to any of the known species of *Manella*. The form of the hook-like dactylus further confirm its position.

Crossotonotus A. Milne Edwards, 1873

Crossotonotus, A. Milne Edwards, 1873, p. 259.— 1873a, p. 282.— Ward, 1933, p. 387. (in the description of *Manella brevimana*).— McNeill, 1968, p. 81.

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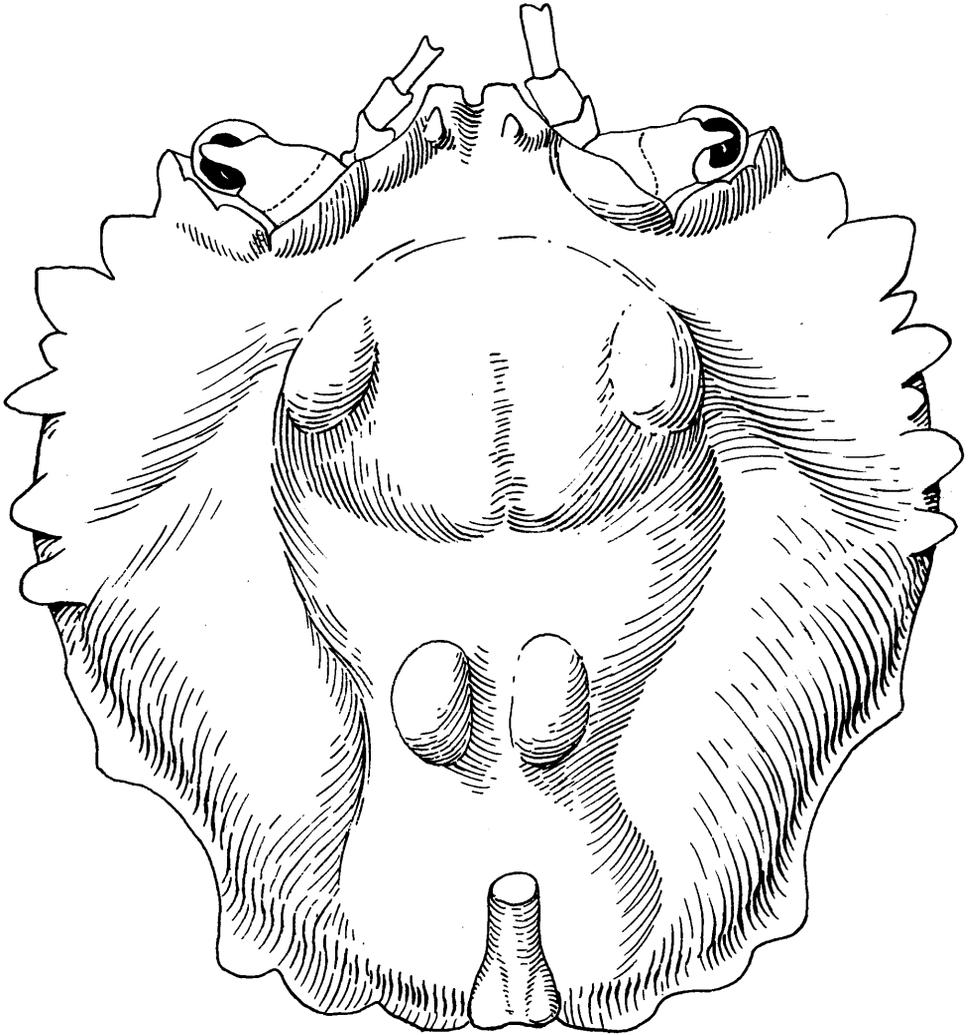


Figure 14. *Manella longirostris* new species.

Crossotonotus ? (pars), Sakai, 1965, p. 186.— 1976, p. 595.

Crossonotus (sic), Haswell, 1882, p. 96.

Remarks.— The genus includes the type species *Crossotonotus compressipes* A. Milne Edwards, 1873 and *C. taketomiensis* Sakai, 1974. The first male pleopod of these species is not known.

Crossotonotus compressipes A. Milne Edwards, 1873

(pl. III D)

Crossotonotus compressipes, A. Milne Edwards, 1873, p. 259.— 1873a, p. 283, pl. 13, fig. 1. — Ward, 1933, p. 389.— McNeill, 1968, p. 81.

Crossonotus compressipes, Haswell, 1882, p. 96.

Material.— *Holotype*: ♀ 8.4 x 9.5 mm. (dry specimen); Upolu, Samoa. *Paratype* : 1 ♀ 6.4 x 7.4 (juvenile); data as holotype. Both are registered under No. 3078 for dry collection in the Museum National d'Histoire Naturelle, Paris.— 1 ♀ 6,3 x 6.5 (juvenile); New Caledonia; det. by Bouvier.

Observation.— A. Milne Edwards (1873, 1873a) did not designate holotype neither paratype. Ward (1933) in his description of *Manella brevimana*, commenting about the separation of *Manella* from *Crossotonotus*, mentioned his examination of *Crossotonotus compressipes* identified by A. Milne-Edwards and maintained in the collection of the Paris Museum. The two specimens were reexamined by us and designated the largest as holotype the other as paratype. They are original specimens described and illustrated by A. Milne Edwards (1873, 1873a). The cheliped and part of the ambulatory legs are separated and kept in a small tube. The two specimens are female; the larger one is mature with broad abdomen covering entirely the sternal plate; the other is a juvenile female with abdomen still narrow and all pleopods elongated below; the two abdomen were figured by A. Milne-Edwards (1873a, pl. 13, figs. 1e, 1f). Apart from that type material, *C. compressipes* is only known for one specimen (sex and size unknown) from Rabaul (New Britain) mentioned by Ward (1933), one female from Low Isles (Australia) and one male from Hope Island (reg. No. P. 3740 in the Australian Museum, Sydney). It would be of great interest to have the first male pleopod of the specimen deposited in the Australian Museum. If *Manella* was originally differentiated and separated from *Pleurophricus* and must be considered as different from *Crossotonotus*, the two genera of A. Milne Edwards, 1873 are close one from another and perhaps identical. Since its description, no one had the opportunity to record or examine specimens of *Pleurophricus cristatipes* A. Milne Edwards, 1873, the type species of the genus, a species which was established for a single specimen of 9 x 9 mm. from the "Nouvelle Hollande" (Australia). Rathbun

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(1906) noted about this specimen that its abdomen (in fig. 6e) was that of a young female. The type specimen was deposited in the Godeffroy Museum, Strassbourg.

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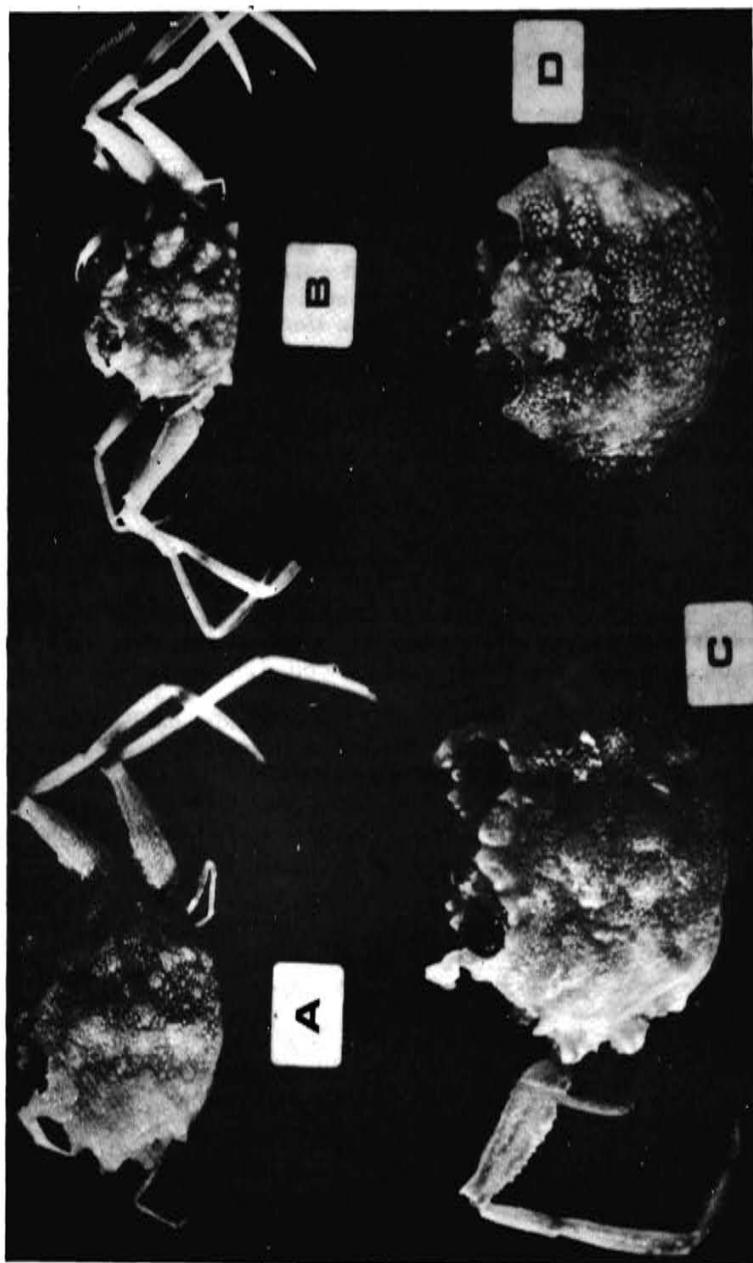


Plate I A. *Parapallicus mariclae* new species female paratype B. *Parapallicus unidentatus* (Zarenkov, 1968)
C. *Parapallicus piruensis* new species D. *Parapallicus ambonensis* new species

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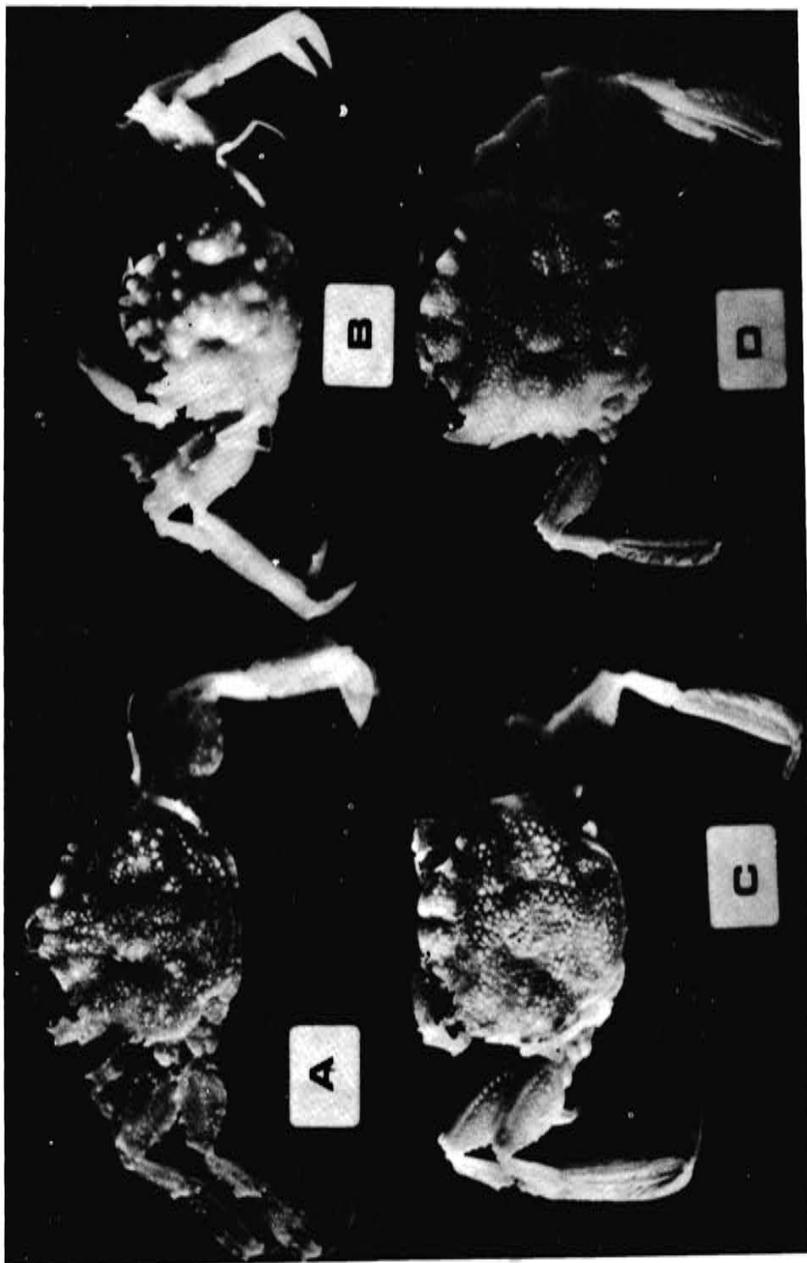


Plate II A. *Pseudopalicus serripes* (Alcock and Anderson, 1894) B. *Pseudopalicus amadaibai* (Sakai, 1963)
C. *Neopalicus jukesi* (White, 1847) D. *Neopalicus contractus* (Rathbun, 1902)

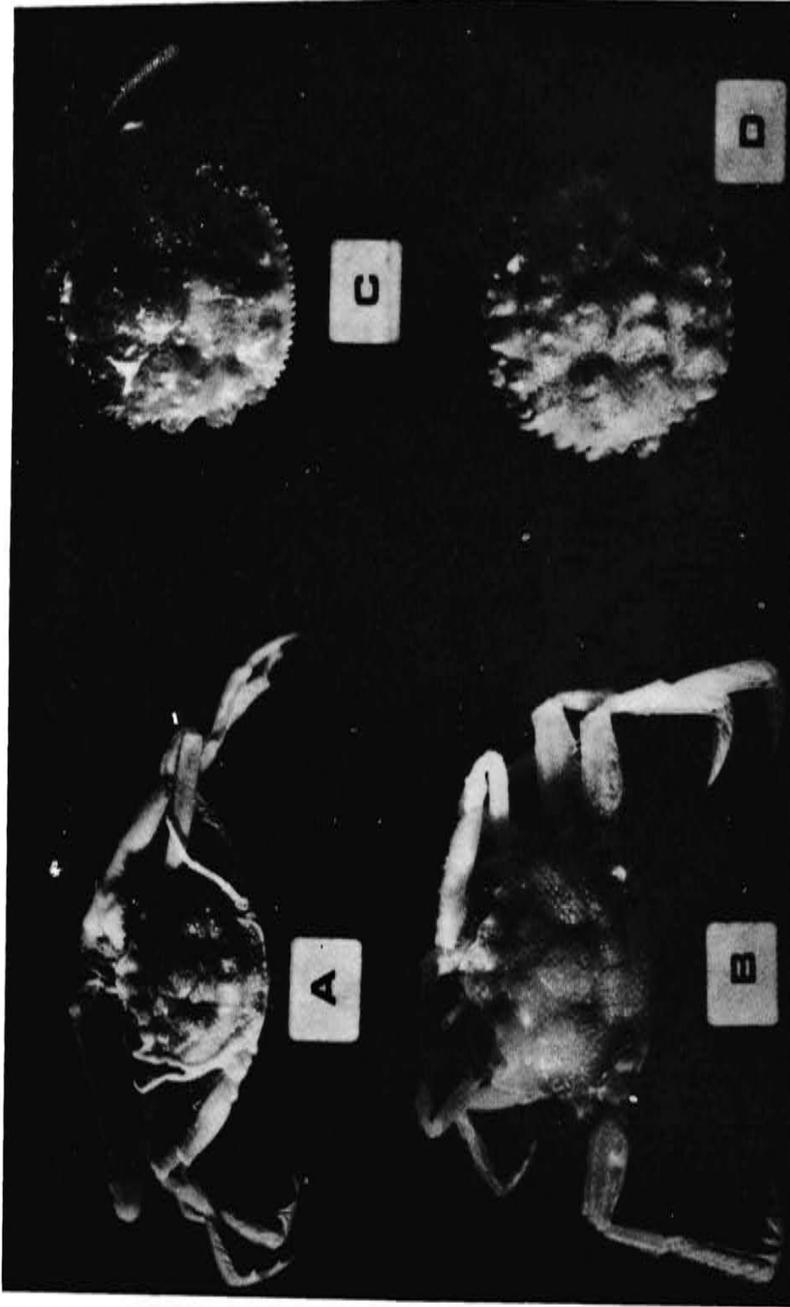


Plate III. A. *Palicoides longimanus* (Miyake, 1936) B. *Palicoides ternatensis* new species
C. *Manella ceramensis* new species D. *Crossotonotus compressipes* A. Milne Edwards, 1873