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A REDESCRIPTION OF *PENAEUS (MELICERTUS)* *CANALICULATUS* (OLIVIER, 1811), A WIDE-RANGING INDO-WEST PACIFIC SHRIMP (CRUSTACEA, DECAPODA, PENAEIDAE)

by

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With five text-figures

In the original description of *Palaemon canaliculatus*, from "mer des Indes", Olivier (1811) presented the following observations among other more general ones: carapace with median sulcus extending from near posterior margin to base of rostrum, and two lateral ones beginning at same level as median sulcus and reaching tip of rostrum; ventral margin of rostrum bearing single tooth near apex, and lateral margins of telson setose and slightly spinous (un peu épineux). These features indicate that his species is closely related to, if not one of, the following Indo-West Pacific *Penaeus*: *P. japonicus* Bate, 1888, *P. latisulcatus latisulcatus* Kishinouye, 1900, *P. latisulcatus hathor* Burkenroad, 1959, *P. longistylus* Kubo, 1943, and *P. plebejus* Hess, 1865, the only *Penaeus* in the region that possess all of these characters; however, all five are armed with well-developed spines on the telson.

A few years later, Latreille (1818) published an illustration of *P. canaliculatus* in which telsonic spines are lacking. In 1837, H. Milne Edwards mentioned various differential characters of *P. canaliculatus* among which the lack of telsonic spines was included, and cited material from Celebes and l'Île-de-France (Mauritius Island). Later, De Haan (1849) identified material from Japanese waters — an area in which all species of *Penaeus* with long adrostral sulci possess spines on the telson — as *P. canaliculatus*. Nobili (1906) considered that De Haan's specimens were *P. japonicus*, but De Man (1911) indicated that they were probably members of *P. latisulcatus*.

Since those works appeared, the name *P. canaliculatus* has been applied to

Indo-West Pacific specimens with long adrostral sulci, which either lack or possess spines on the telson. For instance, Paulson (1875) applied the name *P. canaliculatus*, to specimens, which he also illustrated, that are now referred to *P. japonicus*, a species which, as stated above, exhibits telsonic spines. Bate (1881) identified specimens from the Fiji Islands (without spines on the telson) and from Port Jackson, Australia (with spines on the telson), as *P. canaliculatus*, at the same time quoting the differential characters of the species pointed out by Milne Edwards, among which was the absence of telsonic spines. He also suggested that material he had examined from Japan might belong to a different species for which he proposed the name *P. japonicus*. Seven years later, Bate (1888) confirmed his identification of the specimens from Fiji Islands, but considered the material from Port Jackson to belong to a different "variety", which he named *P. canaliculatus* var. *australiensis*; he also described in detail two females from Japan as *P. canaliculatus* var. *japonicus*.

Alcock (1906), in his widely read contribution, described and figured specimens of *P. japonicus* as *P. canaliculatus*, considering the two varieties proposed by Bate — "*P. canaliculatus* var. *australiensis*" and "*P. canaliculatus* var. *japonicus*" — synonyms of *P. canaliculatus*. Unfortunately, his interpretation had many followers through the years, particularly in regarding *P. japonicus* as a synonym of *P. canaliculatus*; this in spite of the fact that only five years after Alcock's work was published, De Man (1911) recognized *P. japonicus* as a species rather than a "variety", and demonstrated that Bate's "var. *australiensis*" is *P. plebejus* Hess.

The painstaking taxonomic investigations, and careful illustrations of De Man (1911) have done much to clarify the status of various Indo-West Pacific *Penaeus*. The observations he made on the morphological features of his specimens of *P. canaliculatus* together with the drawing of the thelycum, are extremely helpful, constituting a basis for the probable correct recognition of the species; however, to which species the name should be assigned must still be resolved.

Olivier's description of the telson of *P. canaliculatus*, although rather ambiguous (in members of the genus *Penaeus* the telson lacks spines entirely or possesses well-developed ones, thus "un peu épineux" does not seem to describe the latter) indicates, at least, that it is somewhat spinous. H. Milne Edwards, however, to whom Olivier's type-material might have been available at the Muséum National d'Histoire Naturelle, Paris, (MP), stated that the telson of this species lacks spines, but whether or not he examined Olivier's specimen/s (?) is not known. Jacques Forest (personal communication), after a thorough search of the penaeids collection in the MP, con-

cluded, that the type-material is no longer extant; consequently, it is not possible to ascertain with certainty the characteristics of the telson of *P. canaliculatus*.

The specimens mentioned by H. Milne Edwards from Celebes and Mauritius, which also were at the MP, have been lost also. In this Muséum there are two lots, which I have examined, one (MP 114) consisting of 1 ♂ (19.5 mm carapace length) and 1 ♀ (25 mm carapace length), the other (MP 115), of 1 ♂ (9.5 mm carapace length) and 4 ♀ (18-23 mm carapace length), each lot accompanied by a label that reads "*Penaeus canaliculatus* Milne Edwards, Ile Maurice. Type." All of these specimens exhibit three pairs of conspicuous spines on the telson, hardly agreeing with Olivier's "un peu épineux", and certainly cannot be those that H. Milne Edwards described as having the telson unarmed. They are actually *Penaeus latisulcatus hathor* Burkenroad, 1959 (Burkenroad himself left a label with this identification in his handwriting in the bottle that contains the second lot). More recently, Tirmizi (1965) described and illustrated the thelycum of the female in the first lot as "*P. canaliculatus*", and stated that the drawing was made from the "type-specimen — a female measuring 100 mm in length". Apparently, she did not question the authenticity of the label accompanying the specimen, which again is *P. latisulcatus hathor*.

The review above demonstrates the impossibility of recognizing with certainty which *Penaeus* was described by Olivier. It is my opinion that since each of the above mentioned Indo-West Pacific shrimps (all bearing spines on the telson) has a widely recognized name other than *P. canaliculatus*, and, whereas there is no name other than *P. canaliculatus* available for the only species in the region possessing long adrostral sulci and lacking telsonic spines, this name should be applied to the latter species. I have selected a specimen from Weh Island, North Sumatra, as the neotype of *Penaeus canaliculatus* Olivier, 1811, and I shall recommend to the International Commission on Zoological Nomenclature that it use its plenary powers to validate this action. The specimen is a male with a carapace length of 24.5 mm, total length 97 mm, rostral length 12.5 mm, and with a stylocerite length constituting 0.60 of the distance between its proximal end and the base of distolateral spine of the first antennular article; the petasma is illustrated in figure 3a, b. This specimen was collected by P. Buitendijk, and is deposited in the Rijksmuseum van Natuurlijke Historie, Leiden, number D 5829.

I have examined four adult specimens which are larger than the subadult neotype: two females (carapace lengths of 35 mm and 40 mm and total lengths of about 131 and 145 mm respectively); and two males, one with

carapace length of 31 mm and total length of 120, the other with carapace of 34 mm (rostrum broken). For the following reasons, none of the four was selected as the neotype: the females had been bought in markets on Lifu Island and in Bangladesh, thus the exact localities where they were caught are unknown; and the two males, from the Gulf of Oman, exhibit a stylocerite longer (its length 0.75 of the distance between its proximal end and the base of the lateral spine) than other specimens available, seemingly representing an extreme variation in the length of the structure.

Although there are numerous references to *P. canaliculatus* in the literature and a few general descriptions (some accompanied by illustrations), detailed observations on various morphological features are lacking. Therefore, I am including a redescription and several figures so as to provide a basis for future studies on variations within the extensive range of the species.

Presentation of data

Most of the terminology utilized in the description has been discussed and illustrated by Pérez Farfante (1969). The carapace length is the distance between the orbital margin and the midposterior margin of the carapace, and the total length is the distance from the apex of the rostrum to the apex of the telson. The scales accompanying the illustrations are in millimeters. The following abbreviations are used for repositories of the specimens: BM (NH) - British Museum (Natural History), London; MP - Muséum National d'Historie Naturelle, Paris; RM - Rijksmuseum van Natuurlijke Historie, Leiden; UK - Invertebrate Reference Museum, University of Karachi, Karachi; USNM - National Museum of Natural History, Washington; and YPM - Peabody Museum of Natural History, Yale University, New Haven, Connecticut.

Panaeus (Melicertus) canaliculatus (Olivier, 1811) (figs. 1-5)

Palaemon canaliculatus Olivier, 1811: 660. — Latreille, 1818: 65, pl. 318 fig. 3.

Panaeus canaliculatus. — Latreille, 1825: 51. — H. Milne Edwards, 1837: 414. — Heller, 1865: 121. — Bate, 1881 [part]: 174. — Stebbing, 1893 [part]: 215. — Bate, 1888: 243, pl. 32 figs. 1-2. — Borradaile, 1899: 404. — Nobili, 1901: 1. — Nobili, 1906: 9. — De Man, 1911: 106, (1913) pl. 9 fig. 34 a-b. — Lenz & Strunck, 1914: 298. — Stebbing, 1914 [part]: 13. — Pesta, 1915: 108. — De Man, 1924: 28. — Burkenroad, 1934: 75. — Blanco & Arriola, 1937: 221, pl. 1 figs. 1-3. — Villaluz & Arriola, 1938: 37, pl. 1 fig. 3. — Nataraj, 1942: 468. — Anderson & Lindner, 1945: 307. — Barnard, 1950: 13. — Domantay, 1956: 363. — Menon, 1956: 345. — Djajadiredja & Sachlan, 1956: 372. — Delmendo & Rabanal, 1956: 424. — Dall, 1957: 142. — Burkenroad, 1959: 82. — Eldred & Hutton, 1960: 92. — Ramamurthy, 1963: 147. — De Bruin, 1965: 75. — Joubert, 1965: 3. — Joubert & Davies, 1966: 10. — Jones, 1967: 1333. — Kunju, 1967: 1384. — Nair, Luther & Adolph, 1967: 425. — Day, 1969: 101, fig [unnumbered].

- George, 1969: 21. — Hughes, 1970: 79. — Burukovskii, 1972: 7. — Starobogatov, 1972: 388, pl. 4 fig. 30.
Peneus canaliculatus. — Hoffman, 1874: 43.
Penaeus latisulcatus. — Balss, 1914 [part]: 13.
Penaeus canaliculatus. — Qureshi, 1956: 362.

Material

- Fiji Islands: 1 ♂ 1 ♀, BM, Kandavu, "Challenger".
 Loyalty Islands: 1 ♀, BM, Lifou, S. J. Whitnee.
 Celebes, Indonesia: 1 ♂ 1 ♀, RM, Makassar, Celebes, 4 October 1914, Lab. Onderz. Zee, Djakarta.
 Sumatra, Indonesia: 5 ♀, RM, Weh Id, April 1911, P. Buitendijk. 1 ♀, RM, Weh Id, January 1913, P. Buitendijk. 2 ♂ 1 ♀, USNM, Weh Id, 1914, P. Buitendijk. 1 ♂ 1 ♀, RM, Weh Id, December 1919, P. Buitendijk. 1 ♂ neotype, RM, Weh Id, June 1921, P. Buitendijk. 4 ♀, RM, Weh Id, June 1921, P. Buitendijk. 1 ♀, RM, Weh Id, October 1923, P. Buitendijk. 1 ♀, RM, Weh Id, September 1924, P. Buitendijk. 2 ♀, RM, Weh Id, December 1924, P. Buitendijk. 1 ♂ 1 ♀, RM, Weh Id, April 1928, P. Buitendijk. 2 ♀, RM, Weh Id, January 1929, P. Buitendijk.
 Ceylon: 1 ♂ 2 ♀, RM, 1963, G. H. P. de Bruin.
 Bangladesh: 1 ♀, UK, Bay of Bengal, fishermen.
 Gulf of Oman: 2 ♂, BM, 33-46 m, 1971, A. W. White.
 Saudi Arabia: 1 ♀, RM, off Al Qunfudhah, 8 October 1957, A. Ben Tuvia.
 Republic of South Africa: 1 ♀, RM, Mac Arthur Bath, Humewood, Port Elizabeth, 2-4 October 1961, A. C. van Bruggen, "swimming prawn".

Description

Body glabrous (fig. 1). Rostrum slightly arched basally, almost straight anteriorly and extending to base or distal margin of third antennular article, highest portion of blade at level of first rostral tooth, from there decreasing gently toward apex; tip 0.25-0.30 length of rostrum; dorsal teeth 8-10 + epigastric, ventral tooth situated between level of penultimate tooth and slightly anterior to ultimate one; third rostral tooth at level of orbital margin. Postrostral carina long (fig. 2a), extending to 0.10-0.15 carapace length from posterior margin. Median sulcus deep throughout, narrowing towards both extremities, length 0.45-0.50 that of carapace and maximum width 0.30 that of postrostral carina. Adrostral sulcus long, accompanying postrostral carina along its entire length, broadest between epigastric and first rostral teeth, from there tapering to narrow posterior end, its width becoming only 0.15-0.25 that of postrostral carina, sulcus often turning rather abruptly mesially near posterior end. Gastrofrontal sulcus spanning slightly less than 0.20 of carapace length, bifurcate posteriorly; gastrofrontal carina strong, sharp, originating anteriorly in acute orbital angle, flanking sulcus and posteriorly turning abruptly toward orbital margin, forming narrow triangular wedge responsible for bifurcation of sulcus. Orbito-antennal sulcus broad anteriorly, narrowing posteriorly towards hepatic spine. Gastro-orbital carina

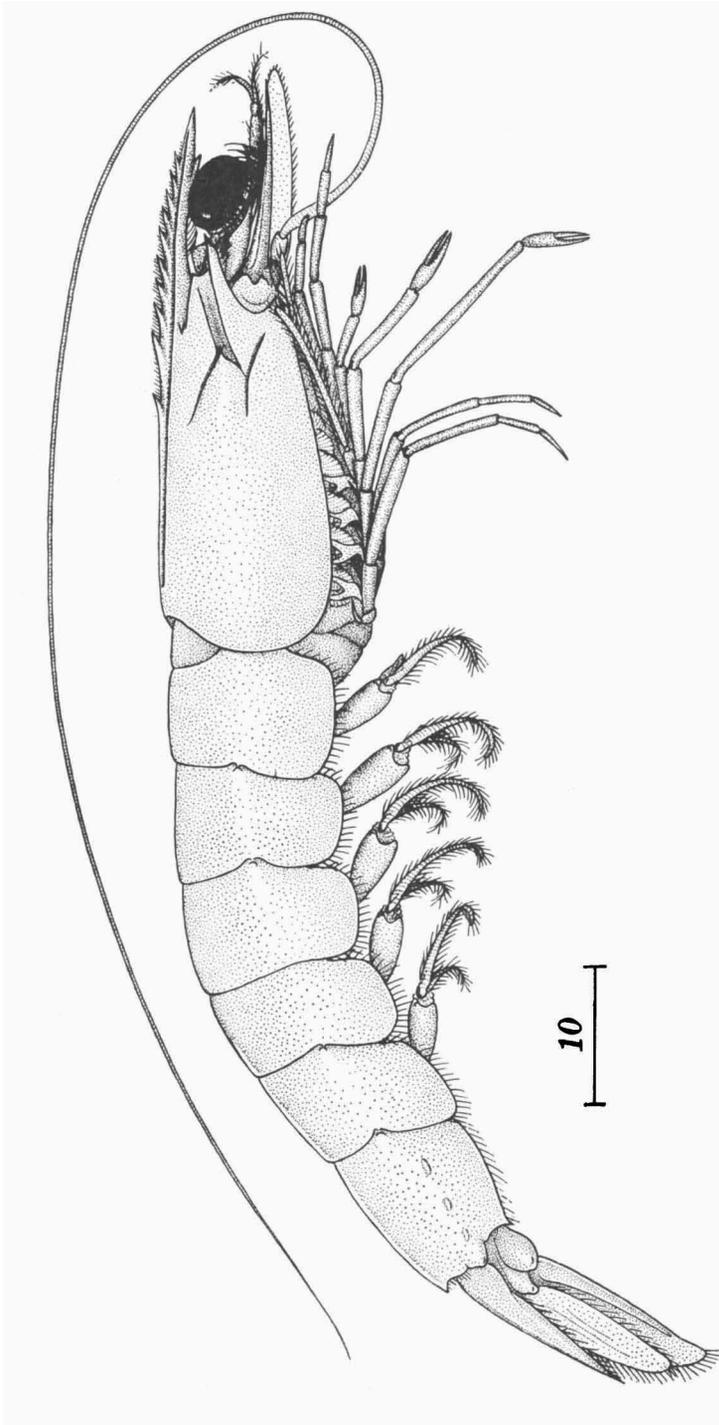


Fig. 1. - *Penaeus canaliculatus* (Olivier). Lateral view, ♂ neotype, 24.5 mm cl, Weh Island, North Sumatra.

sharp, occupying approximately 0.85 of distance between orbital margin and hepatic spine. Antennal carina very prominent. Cervical sulcus ending at anterior 0.40 of carapace length. Hepatic carina extending from just anterior

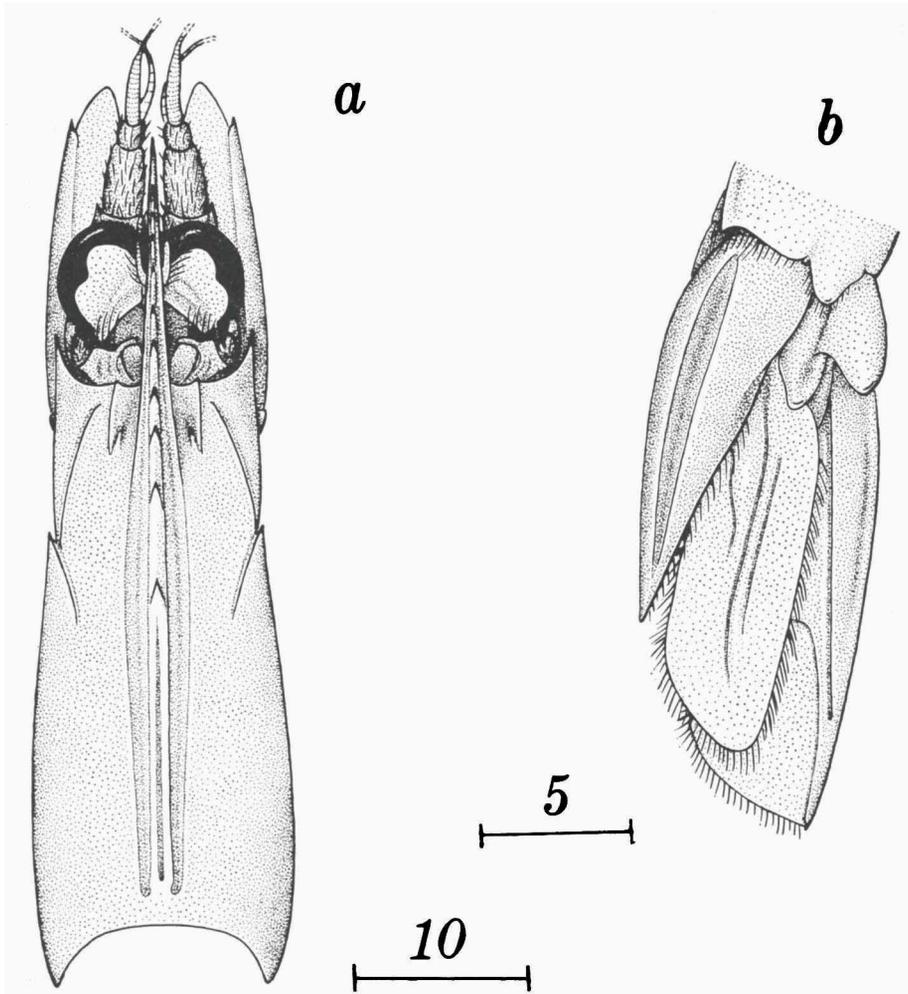


Fig. 2. - *P. canaliculatus* (Olivier). a, cephalothorax (dorsal view), ♂ 31 mm cl, Gulf of Oman; b, telson and uropod, ♂ neotype, 24.5 mm cl, Weh Island, North Sumatra.

to level of posterior end of cervical sulcus, almost horizontal to base of antennal carina, and from there sloping anteroventrally to about 0.10 carapace length from anterior margin. Antennal spine long, slightly overreaching distolateral margin of basal article of ocular peduncle.

Antennular peduncle about half as long as carapace; length of dorsal

flagellum no more than 0.50 that of peduncle, slightly longer than ventral; distolateral spine slender, long, reaching proximal 0.35 of second antennular article; prosartema relatively short, not quite reaching distal margin of first antennular article; stylocerite long, strongly acuminate, with spiculiform tip, its length equivalent to 0.60-0.75 of distance between its proximal end and base of distolateral spine, longer in adult.

Scaphocerite exceeding antennular peduncle by about 0.15 of its own length. Antennal flagellum short, 1.30 times total length of shrimp.

Third maxilliped in adult female extending to distal 0.20 of first antennular article, in juvenile and adult males reaching as far as proximal 0.40 of second antennular article; dactyl in females bearing small tuft of rigid setae, rather than elongate, brushlike tuft as in males. First pereopod reaching between base and distal margin of carpocerite. Second pereopod surpassing carpocerite by, at least, 0.30 length of dactyl or by as much as 0.90 that of propodus. Third pereopod reaching, at least, distal margin of first antennular article, sometimes exceeding peduncle by tip of dactyl. Fourth pereopod attaining level between base and distal 0.10 of carpocerite. Fifth pereopod only slightly overreaching fourth. First pereopod with long, slender spine on basis, lacking ischial spine; second pereopod with long spine on basis.

Abdomen with middorsal carina from about midlength of fourth somite through sixth; carina blunt on fourth, sharp posteriorly, ending in short spine on posterior margin of sixth; latter, lacking dorsolateral sulcus, bearing pair of posteroventral spines and three cicatrices (anteriormost longest) on each side, fifth abdominal somite lacking cicatrix. Telson (fig. 2b) lacking lateral spines, bearing deep median sulcus, and with sharp pointed tip; mesial ramus of uropod overreaching telson by 0.20-0.30 of its own length, and lateral ramus, surpassing mesial ramus by no more than 0.15 of its own length.

Petasma (fig. 3a-e) with ventral costa strongly curved distally, broadened apically into truncate prominence bearing minute spinules along proximal margin. Distomedian projection very short, reaching or only slightly overhanging (in adults only) distal margin of costa. Distal fold broad, hiding distalmost portion of prominence.

Appendix masculina (fig. 3f) with length about 1.5 times maximum width, roughly subelliptical, strongly convex dorsally, studded with conspicuous setae except proximally and proximolaterally; marginal setae longest apically.

Thelycum (fig. 4) with median protuberance largely exposed and slightly longer than lateral plates; anterior process subacuminate or subovate in out-

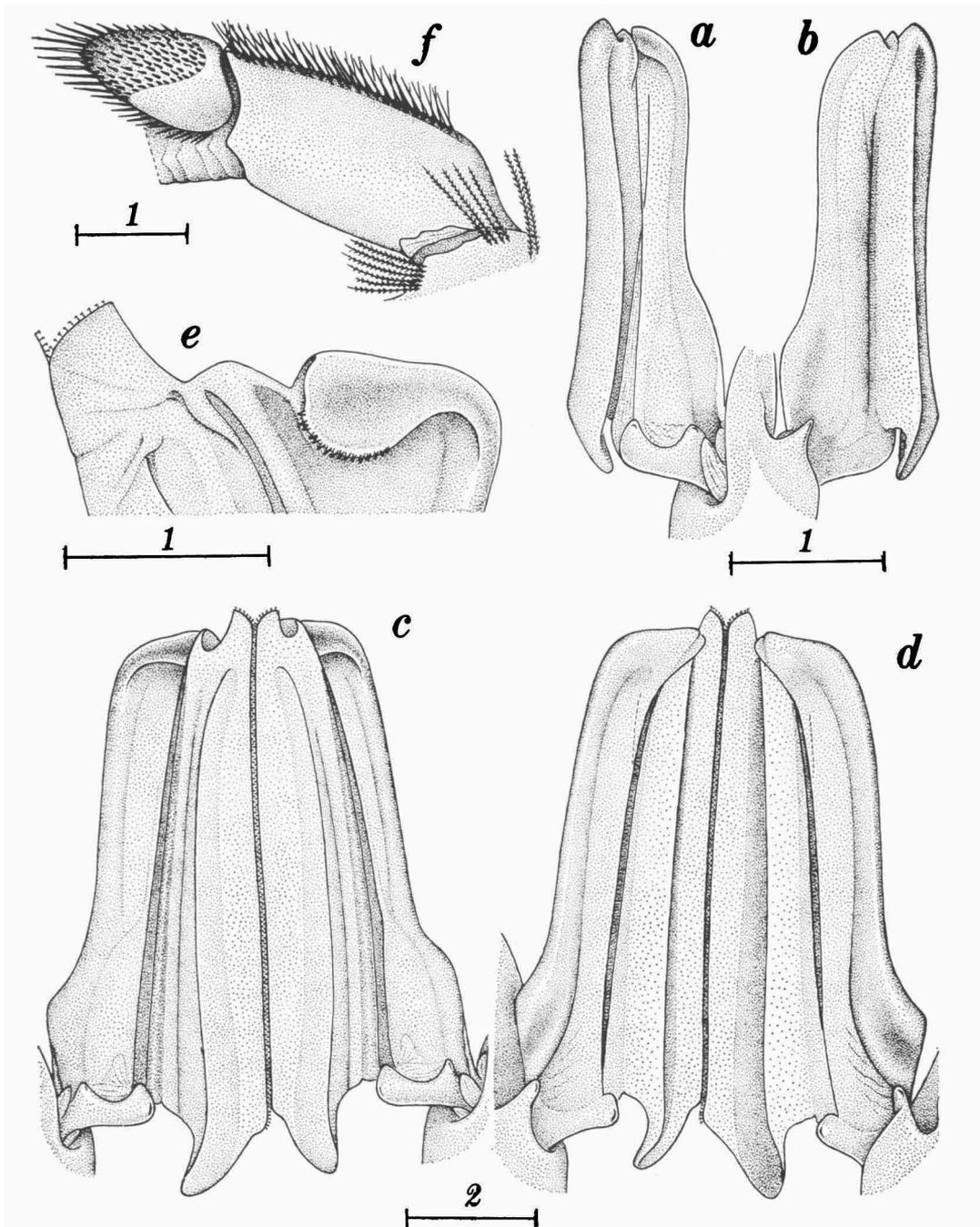


Fig. 3. - *P. canaliculatus* (Olivier). a, right half of petasma (dorsolateral view), ♂ neotype, 24.5 mm cl, Weh Island, North Sumatra; b, ventrolateral view of same specimen; c, petasma (extended), dorsal view, ♂ 34 mm cl, Gulf of Oman; d, ventral view of same specimen; e, distal portion of right half of same petasma extended; f, appendix masculina of same shrimp.

line, bearing apical tuft of setae, and in juveniles often with minute subapical tubercle. Posterior process narrow anteriorly, broadening considerably posteriorly, forming shelf with midposterior margin usually pointed, and overhanging sternite XIV; narrow anterior portion of process raised in lateral

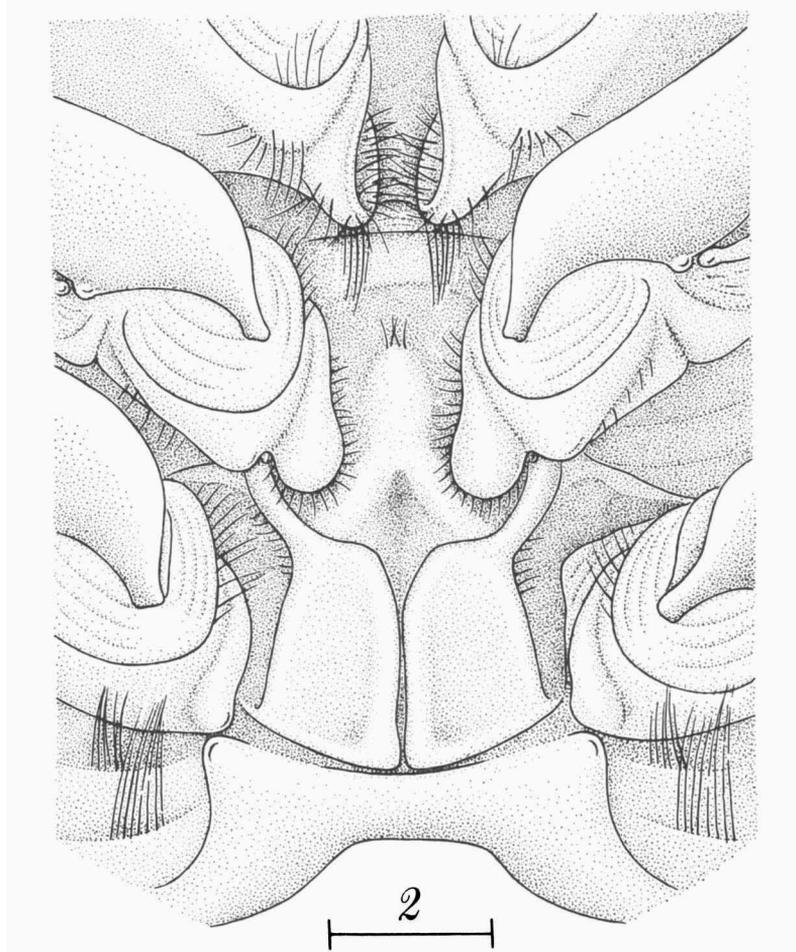


Fig. 4. - *P. canaliculatus* (Olivier), thelycum, ♀ 35 mm cl, Lifu, Loyalty Islands.

ridges delimiting median depressed area, and flanked by coxal plates of fourth pereopods. Lateral plates with mesial margins diverging anteriorly then turning in broad arc continuous with anterolateral margins.

Range. — Loyalty Islands to Taiwan, including the Philippines, Indonesia, through the Indian Ocean into the Red Sea, and south along the coast of Africa to Port Elizabeth, South Africa. This species has never been taken

in Australia, and although it has been recorded from Madagascar, it should be noted that Alain Crosnier (personal communication) did not find it in the collections he made there.

Burkenroad (1959) stated that *P. canaliculatus* is not uncommon in the Red Sea; otherwise, it has not been reported as abundant in any area throughout its range.

Remarks. — *Penaeus canaliculatus* shares more in common with *P. l. latisulcatus*, *P. l. hathor*, and *P. plebejus* than with the other two Indo-West

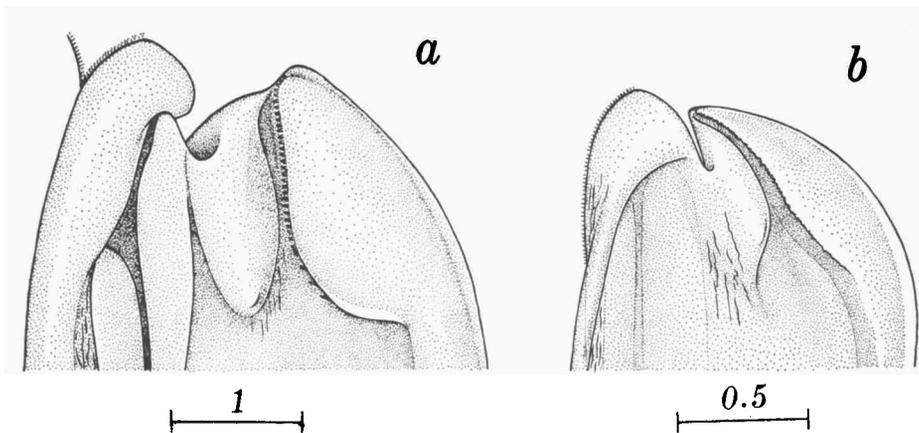


Fig. 5. - *Penaeus latisulcatus latisulcatus* Kishinouye. Distal portion of right half of petasma extended (dorsolateral view), ♂ (USNM), 35 mm cl, Japan. b, *Penaeus latisulcatus hathor* Burkenroad, same view of petasma, ♂ (YMP), 18.5 mm cl, Shab Mahmoud, Gulf of Suez.

Pacific members of the subgenus *Melicertus*; among other similar features the four lack ischial spines on the first pereopods. The other two species, *P. marginatus* and *P. longistylus*, bear such spines, and the former is unique within the subgenus in the possession of more than one tooth (usually two) on the ventral margin of the rostrum.

Penaeus canaliculatus may be readily distinguished from the other members of *Melicertus* lacking ischial spines on the first pereopods, by various characters other than the absence of spines on the telson. It differs from *P. l. latisulcatus* and *P. l. hathor* in the form of the ventral costa of the petasma, which in the latter two terminates distally in an acuminate prominence rather than in a truncate one (fig. 5a-b). The shape of the prominence of the ventral costa in these three shrimps has not been described or recognized as a differential feature between *P. latisulcatus* and *P. canaliculatus* previously. In female *P. l. latisulcatus* and *P. l. hathor* the anterior

process of the thelycum is armed with a pair of lateral or anterolateral projections respectively, whereas that of *P. canaliculatus* lacks projections. *Penaeus plebejus*, in turn, differs from *P. canaliculatus* in that the gastro-frontal sulcus is trifurcate posteriorly instead of bifurcate, the blade of the rostrum is accompanied by an accessory carina, the ventral costa of the petasma is subelliptical or almost rounded distally, and the anterior process of the thelycum is flanked by strong paired ridges.

Finally, *P. canaliculatus* differs strikingly from *P. (Marsupenaeus) japonicus* (the only species in the subgenus) in both the petasma and the thelycum. In the latter species, the petasma exhibits distomedian projections broadly overlapping the ventral costae. The thelycum of *P. japonicus* possesses a ventrally undivided plate, rather than paired lateral plates which are found in all other *Penaeus* except members of the American subgenus *Litopenaeus*, which lack such plates.

The study by Joubert (1965) indicates that males of *P. canaliculatus* from South African waters differ from those found along the eastern portion of the range of the species. Joubert described the general characters and presented clear outline drawings of specimens of *P. canaliculatus* from South Africa. The individuals I have examined agree with his observations except those regarding the male external genitalia. Joubert stated "Median lobes of petasma with well developed protuberances at apex similar to *Penaeus japonicus*". Although the distomedian projections of the petasma increase proportionately as well as actually with size, and the larger males in the collections I have studied are larger than those examined by Joubert, those larger individuals exhibit short projections as described above. These are quite different from those in *P. japonicus*, which exhibits the largest distomedian projections in any *Penaeus*. Furthermore, in the males of *P. canaliculatus* which I have examined, most of the dorsal surface of the appendix masculina bears setae, instead of being naked as it is in South African specimens. These striking differences in the external genitalia of males strongly suggest that the South African populations differ from those represented in the collections cited above. Unfortunately, the South African material available to me consists of a single juvenile female.

The references to *P. canaliculatus* given above are among approximately 175 occurring in the literature. Many of them have been found to be based on misidentifications (see Burkenroad, 1959; Dall, 1957; De Man, 1911); others are obviously erroneous (for example citations to the presence of the species in West African and Japanese waters), and yet others, for various reasons, are doubtful. I have selected only those references that are, or seem to be applicable to the species as recognized and depicted herein.

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