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The Indo-West Pacific Processidae

(Crustacea, Decapoda, Caridea)*

By

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CONTENTS

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Introduction

In 1957 NOUVEL and HOLTHUIS gave a complete revision of the genus *Processa* from the European waters of the Atlantic Ocean. MANNING and CHACE (1971) reviewed extensively the northwestern Atlantic species of the family Processidae. However, many species of the Indo-West Pacific processids have not been adequately treated, though some revisional works were present (DE MAN, 1920 and GURNEY, 1937).

At first I examined the Japanese species of this family at the Zoological Laboratory, Kyushu University under the guidance of Prof. Emer. S. MIYAKE and fully realized the necessity of the revision of the Processidae from the Indo-West Pacific region. Consulting with Dr. L. B. HOLTHUIS, I received his unpublished manuscript on the Siboga material in which he reviewed DE MAN's (1920) *Processa* sp. and other processids, including those of the Snellius Expedition, in the collections of the Rijksmuseum van

Natuurlijke Historie and the Amsterdam Museum. Meanwhile I also received EDMONDSON's (1930 and 1935) species of Hawaiian and Polynesian waters, and South African species described by BARNARD (1947, 1950 and 1955) and KENSLEY (1969). Then I thought the framewark of the review of the Indo-West Pacific Processidae was completed and sent my draft to Dr. HOLTHUIS. Reviewing my draft, however, he pointed out some questions about a few species and recommended the reexamination of the Siboga material and other species deposited at the Rijksmuseum van Natuurlijke Historie and the Amsterdam Museum, which were once examined by him. During the reexamination of these specimens, Dr. A. J. BRUCE courteously placed at my disposal a considerable number of the processids collected chiefly from Kenya and its neighbourhood. Thus five species of *Nikoides* including one new species and twenty species of *Processa* with seven new species are revealed from the Indo-West Pacific region.

All the species examined are described with a brief diagnosis and illustration. An ecological account is given for three species of *Processa*, which form some of the most important components of littoral weed belts in Japan and a note of abnormalities is given for three species of *Processa*, of which a few aberrant specimens were examined.

The material examined is derived from the following many institutions: Amsterdam Museum (AM), Bernice P. Bishop Museum (BPBM), East African Marine Fisheries Research Organization (EAMFRO), Muséum National d'Histoire Naturelle (MNHN), Rijksmuseum van Natuurlijke Historie (RMNH), South African Museum (SAM), U. S. National Museum (USNM), and Zoological Laboratory, Kyushu University (ZLKU). The initials given in the parentheses after the name of the institutions are used in the material source of this paper to indicate these institutions.

Acknowledgements

I started to study at the Zoological Laboratory, Kyushu University and later at the Sabiura Marine Park Research Station and the Shimonoseki University of Fisheries under the guidance of Prof. Emer. Sadayoshi MIYAKE, for whose valuable suggestions and encouragement, I wish to express here my sincere gratitude. At the same time I am much indebted to Prof. Dr. Lipke B. HOLTHUIS of the Rijksmuseum van Natuurlijke Historie, Leiden, for placing his unpublished manuscript and many specimens including the Siboga material at my disposal and reading my first and final manuscripts. I am also indebted to the following carcinologists: Dr. Fenner A. CHACE, JR. of the U. S. National Museum for the loan of the paratype of *Processa molaris* and a specimen of *P. hawaiensis*, Dr. Brian F. KENSLEY of the South African Museum for sending many interesting specimens of that museum, Dr. Dennis M. DEVANEY of the Bernice P. Bishop Museum for the loan of the holotypes of *Processa paucirostris* and *P. steinii*, Dr. Alexander J. BRUCE of the East African Marine Fisheries Research Organization for the loan of many specimens of very interesting species, Dr. Ch. LEWINSOHN of the Tel Aviv University for sending ten specimens of *P. canaliculata* for comparison

and Dr. Jacques FOREST of the Muséum National d'Histoire Naturelle for kind information about the type of *P. coutierei* and for the loan of an additional specimen of this species, Dr. H. NOUVEL of the Laboratoire de Biologie générale, Faculté des Sciences de Toulouse for information about the type of *P. coutierei* and Dr. R. W. INGLE of the British Museum, Natural History, London for kind information about the type of *Nika processa* BATE.

Many specimens of the family Processidae from various localities of Japan were kindly donated to the Zoological Laboratory, Kyushu University by the following gentlemen to whom I extend my best thanks: Dr. Taiji KIKUCHI of the Amakusa Marine Biological Laboratory, Kyushu University, Mr. Hitoshi SANDO of the Yamagata Prefectural Fisheries Research Station, Mr. Hideo YAMASHITA of the Seikai Regional Fisheries Research Laboratory, Dr. Shûhei MATSUURA of the Fisheries Laboratory, Kyushu University and Dr. Takahiro FUJINO and other members of the Zoological Laboratory, Kyushu University.

Systematics

Family Processidae ORTMANN, 1896

Processidae ORTMANN, 1896, pp. 415, 424.
Processidae HOLTHUIS, 1955, p. 116 (synonymy).
Processidae MANNING and CHACE, 1971, p. 2 (definition and key to genera).

Remarks Before MANNING and CHACE's (1971) publication the family Processidae contained only two genera, *Processa* and *Nikoides*, in which all the species have the first pereiopods asymmetrical, the right chelate and the left simple. The genus *Processa* differs from *Nikoides* in having no exopod on the first pair of pereiopods. The third genus *Ambidexter* MANNING and CHACE contains three species with both first pereiopods chelate and lacking exopods. The type species, *A. symmetricus* MANNING and CHACE, was described from western Atlantic region (MANNING and CHACE, 1971). Two additional species, *A. panamensis* ABEL and *A. swifti* ABEL, were reported from the Pacific coast of Panama (ABEL, 1972).

The family is very small containing three genera and some 50 species, in which the external characters are generally very similar to one another. The mouth parts of the Indo-West Pacific species agree with those of the Atlantic species described by MANNING and CHACE (1971). The branchial formulae are also similar to those of the Atlantic species. Therefore the mouth parts and the branchial formulae are not described nor figured in each species. The following interesting point is observed in the present material. Two species of the Indo-West Pacific *Processa* have no exopod on the third maxilliped while the other species of *Processa* and *Nikoides* do bear exopods on the third maxilliped.

Genus *Nikoides* PAULSON, 1875

Nikoides PAULSON, 1875, p. 98.
Nikoides DE MAN, 1920, p. 192.
Nikoides HOLTHUIS, 1955, p. 117 (synonymy).
Nikoides MANNING and CHACE, 1971, p. 7 (key to species).

Definition Rostrum as long as or much shorter than eye; apex bifid or simple. Antennal spine present; supraorbital and branchiostegal spine absent; pterygostomial angle finely pectinated or smooth. Postorbital groove absent. First four abdominal somites smooth dorsally and posteriorly. Pleuron of fifth somite posteriorly pointed or rounded. Pleuron and lateral plate of sixth somite pointed. Telson with two pairs of spines on dorsal surface and with three pairs of spines on posterior margin. Eye developed, without distinct ocellus. Antennular peduncle slender; stylocerite pointed; flagella simple, outer flagellum thicker and stouter than inner flagellum; distal half of outer flagellum bearing short hairs. Antennal scale well developed, extending to end of antennular peduncle. Mandible simple, without incisor process or palp. Maxillule rounded, without proximal endite. Endopod of maxilla reduced; palp distinct, scaphognathite well developed. First maxilliped with exopod and epipod; caridean lobe well developed. Second maxilliped with exopod and epipod. Third maxilliped with exopod. Pleurobranchs present on all pereiopods. Arthrobranch and exopod present on first pereiopod. Podobranchs and epipods absent from all pereiopods. First pereiopod asymmetrical, right bearing well developed chela and left ending in simple dactylus. Second pereiopods chelate, more slender and longer than first pereiopod, unequal in length, right longer than left; carpus, merus and sometimes ischium subdivided; ischium with a small process proximally. Following three pereiopods long and slender ending in simple dactylus. Outer surface of ischium and merus of third and fourth pereiopods usually with some spines. Ischium and merus of fifth pereiopods unarmed; propodus with some spines on posterior margin. Endopod of first male pleopod foliaceous. Endopod of second pleopod with small appendix interna and long appendix masculina. Uropod as long as telson, outer margin of exopod ending in two spines.

Type species *Nikoides danae* PAULSON, 1875, by monotypy.

Remarks The genus *Nikoides* agrees well with the genus *Processa*, with the first pair of pereiopods asymmetrical; the right being chelate and the left ending in a simple dactylus. A rather well developed arthrobranch is usually present on the first pair of pereiopods. Only difference is the presence of the exopod on the first pair of pereiopods in *Nikoides*. The ocellus is absent in any species of the family Processidae, but an ocellus-like process is observed in *N. danae* and *N. sibogae*.

Six specific names have been employed in the genus *Nikoides*; *N. danae* PAULSON, 1875, *N. pontica* SOWINSKY, 1882, *N. maldivensis* BORRADAILE, 1915, *N. sibogae* DE MAN, 1918, *N. nanus* CHACE, 1955 and *N. schmitti* MANNING and CHACE, 1971.

In 1921 TATTERSALL reported a single specimen from the Red Sea under the name *Nikoides* sp.?

Nikoides pontica does not belong to the present genus but to *Processa* (BACESCU, 1967). Although GURNEY (1937) pointed out *N. sibogae* is identical with *N. danae*, CHACE (1955) and MANNING and CHACE (1971) treated them as the different species. *Processa jacobsoni* DE MAN, 1921 and *P. steinii* EDMONDSON, 1935 prove not to belong to that genus but to *Nikoides*, because of a distinct exopod on the base of the first pair of pereiopods. The former is identical with *Nikoides maldivensis*. The latter is a distinct species and seems to be identical with *Nikoides nanus* CHACE. *N. schmitti* is the only representative of the genus from the Atlantic Ocean.

TATTERSALL's (1921) specimen of *Nikoides* sp. (?) is very unique, and is readily distinguished from all the known species of the genus, such as from *N. steinii* (EDMONDSON) and *N. maldivensis* BORRADAILE by the shape of the rostrum. It also differs from *N. danae* PAULSON, *N. sibogae* DE MAN and *N. schmitti* MANNING and CHACE in having no spine on outer surface of the merus and the ischium of the third and fourth pereiopods. The specimen, however, is very small, being only 8 mm in length. These differences may result from the degree of growth and the specimen can not be identified with certainty.

In addition to all the members of the Indo-West Pacific species, during the present study a new one, *Nikoides gurneyi* sp. nov., is discovered, which is very closely related to *N. danae* and has been confused with that species.

The species of the genus *Nikoides* of the Indo-West Pacific region described so far are revised as follows:

Nikoides danae PAULSON, 1875	=	*Nikoides danae* PAULSON
Nikoides maldivensis BORRADAILE, 1915	=	*Nikoides maldivensis* BORRADAILE
Nikoides nanus CHACE, 1955	=	*Nikoides steinii* (EDMONDSON)
Nikoides sibogae DE MAN, 1918	=	*Nikoides sibogae* DE MAN
Processa jacobsoni DE MAN, 1918	=	*Nikoides maldivensis* BORRADAILE
Processa steinii EDMONDSON, 1935	=	*Nikoides steinii* (EDMONDSON)

Key to the species of the genus *Nikoides*

1 Rostrum short, not reaching end of eyestalk, apex simple or indistinctly bifid. Ischium of third and fourth pereiopods with a single spine. Right second pereiopod with 15-19 meral and 39-52 carpal joints, left second pereiopod with 6-8 meral and 19-22 carpal joints... ***Nikoides steinii*** (EDMONDSON, 1935)

– Rostrum long and slender, reaching beyond eyestalk, with dorsal rostral tooth. Ischium of third and fourth pereiopods with usually two spines..... 2

2 Dorsal rostral tooth large and placed near middle of rostrum. Stylocerite and antennal scale with long and stout outer distal spine, respectively. Right second pereiopod with 26 meral and 55 or 56 carpal joints, left second pereiopod with 7-10 meral and 19-25 carpal joints. ***Nikoides maldivensis*** BORRADAILE, 1915

– Dorsal rostral tooth small and placed near apex. Stylocerite unarmed or pointed; if pointed, distal spine not so stout. Outer spine of antennal scale not so long.... 3

3 Stylocerite unarmed. Basicerite without any pointed process. Apex of telson

unarmed. Propodus of last three pereiopods without series of hairs on anterior margin in males 4

– Stylocerite pointed. Basicerite with pointed process. Apex of telson ending in stout median spine. Propodus of last three pereiopods with series of hairs on anterior margin in males 5

4 Pleuron of fifth abdominal somite acutely pointed. Stylocerite truncated. Outer terminal spine of antennal scale shorter than lamella. Pereiopods slender and long. Propodus of fifth pereiopod with small terminal spine. Up to 12.0 mm in carapace length. Right second pereiopod with 33-43 meral and 74-89 carpal joints, left second pereiopod with 8-10 meral and 22-28 carpal joints ..... ***Nikoides sibogae*** DE MAN, 1918

– Pleuron of fifth abdominal somite rounded. Stylocerite rounded. Outer terminal spine of antennal scale overreaching lamella. Pereiopods not so long. Propodus of fifth pereiopod with three spines on posterior margin. Up to 8.0 mm in carapace length. Right second pereiopod with 23-24 meral and 43-49 carpal joints, left second pereiopod with 5 meral and 17-18 carpal joints .... *Nikoides schmitti* MANNING and CHACE, 1971 (Western Atlantic)

5 Pleuron of fifth abdominal somite pointed posteriorly but not acute. Stylocerite sharply pointed at outer distal corner and bluntly pointed at inner distal corner. Basicerite with both sharply-pointed and bluntly-pointed processes. Merus of third pereiopod with usually five spines. Right second pereiopod with 21-30 meral and 51-66 carpal joints, left second pereiopod with 8-12 meral and 21-32 carpal joints ..... ***Nikoides danae*** PAULSON, 1875

– Pleuron of fifth abdominal somite acutely pointed. Stylocerite sharply pointed at both outer and inner distal corners. Basicerite with bluntly-pointed process only. Merus of third pereiopod with usually four spines. Right second pereiopod with 18-32 meral and 47-72 carpal joints and left second pereiopod with 6-9 meral and 22-28 carpal joints ..... ***Nikoides gurneyi*** sp. nov.

Nikoides danae PAULSON, 1875

(Figs. 1 and 2 *a-t*)

Nikoides Danae PAULSON, 1875, p. 98, pl. 14 fig. 5-5d.
Nikoides Danae NOBILI, 1906, p. 79, pl. 5 fig. 1-1f.
?*Processa processa* RATHBUN, 1906, p. 912, pl. 22 fig. 6 (not *Nika processa* BATE).
Nikoides danae BALSS, 1915, p. 32.
Nikoides danae DE MAN, 1920, p. 193 (list).
Nikoides sibogae p.p. DE MAN, 1920, p. 193, pl. 16 fig. 50i-50j (not *Nikoides sibogae* DE MAN)
not *Nikoides danae* GURNEY, 1937, p. 89, pl. 1 figs. 20-25, pl. 2 figs. 26-29, pl. 3 figs. 38, 39 (= *Nikoides gurneyi* sp. nov.)
Processa processa EDMONDSON, 1946, p. 247 (not *Nika processa* BATE).
not *Nikoides danae* BARNARD, 1955, p. 44 (= *Nikoides gurneyi* sp. nov.).
Nikoides danae MCNEILL, 1968, p. 23.
Nikoides danae MANNING and CHACE, 1971, p. 8 (key).

Japan

Kabira Bay, Ishigaki Island, Yaeyama Group, depth 1 m, July 27, 1967, T. FUJINO leg. – 1 ovig. ♀ (ZLKU)

East Africa

Bamburi Beach, 7 miles north of Mombasa, Kenya, seagrass belt, depth 0.1-1.0 m, November 19-26, 1969, L. B. HOLTHUIS leg. – 11 ♂♂, 1 ovig. ♀, 3 ♀♀, 4 juv. (RMNH)

Mazizini, Zanzibar, posioned weedy pool at LWS, June 5, 1970, A. J. BRUCE leg. – 1 ovig. ♀ (EAMFRO)

Leven reef, Mombasa, Kenya, weedy pools at reef flats, November 29, 1970, A. J. BRUCE leg. – 1 ♂, 5 ♀♀ (EAMFRO)

Station 163, Ras Iwatine, Mombasa, reef crest and pools at LWS, February 24, 1973, A. J. BRUCE leg. – 1 ♂ (EAMFRO)

Kikambala, Kenya, weedy pools, inner reef flat at LWS, February 25, 1973, A. J. BRUCE leg. – 1 ♂, 1 ovig. ♀, 1 ♀, 1 juv. (EAMFRO)

Jadini, Kenya, lagoon pools at LWS, bottom sand and weed, September 14, 1973 – 1 ♀ (EAMFRO)

Definition Rostrum long, apex bifid. Pleuron of fifth abdominal somite pointed but not acute. Apex of telson with median spine. Stylocerite acutely pointed on outer distal end. Outer spine of antennal scale overreaching lamella. Basicerite with two processes, upper sharply pointed and lower bluntly pointed. First pair of pereiopods with long exopods and small arthrobranchs. Right second pereiopods with 21-30 meral and 51-66 carpal joints, left second pereiopod with 8-12 meral and 21-32 carpal joints. Ischium and merus of third and fourth pereiopods with two spines. Merus of third pereiopod with usually five spines. Propodus of fifth pereiopod with five or six spines.

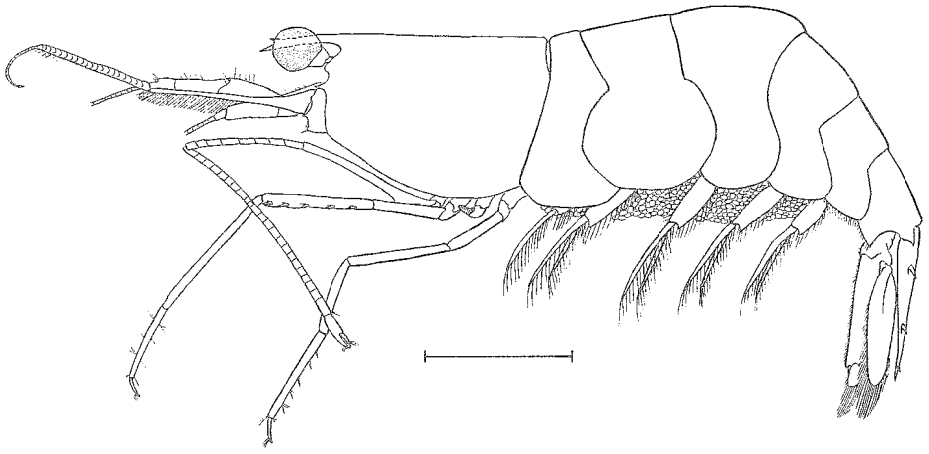

Fig. 1. *Nikoides danae* PAULSON, ovigerous female from Ishigaki-jima Island. Scale represents 5.0 mm.

Description Body robust (Fig. 1). Rostrum long, as long as or slightly shorter than eye; apex bifid, upper tooth much shorter than lower tooth and curved upward (Fig. 2 *a-c*). Carapace smooth, 2.3-3.0 times as long as rostrum; antennal spine well de-

veloped, separated from suborbital angle by notch. Pterygostomial angle finely undulated (Fig. 2 *d*). Bifid process present below middle of rostrum (Fig. 2 *a*).

First five abdominal pleura not acutely pointed. Pleuron and lateral plate of sixth abdominal somite acutely pointed (Fig. 2 *e*, *f*). Telson with two pairs of spines; anterior pair placed on anterior third and posterior pair on posterior third of telson; posterior margin pointed at middle, flanked by three pairs of spines (Fig. 2 *g*).

Antennular peduncle long; basal segment as long as or slightly longer than distal two segments combined; third segment short, less than half length of second (Fig. 2 *h*); stylocerite with a large spine at outer distal and with a small blunt spine at inner distal end (Fig. 2 *i*). Antennal scale as long as antennular peduncle, outer margin nearly straight, ending in a spine, which extends beyond lamella of scale (Fig. 2 *j*); basicerite with a small but acutely pointed process at middle and with a small blunt process just below (Fig. 2 *d*); carpocerite reaching basal segment of antennular peduncle.

Third maxilliped reaching with ultimate and a part of penultimate segment beyond antennal scale; with long exopod (Fig. 2 *k*). Right first pereiopod chelate, reaching just end of antennal scale; left first pereiopod not chelate, reaching with dactylus beyond antennal scale; exopod developed as long as that of third maxilliped (Fig. 2 *l*). Second pereiopods strongly unequal. Right pereiopod reaching with chela, carpus and distal third of merus beyond antennal scale; carpus with (42) 51-66 joints, merus with 21-30 joints and ischium with three or four joints (Fig. 2 *m*). Merocarpal articulation of left second pereiopod reaching end of second segment of antennular peduncle; carpus with 21-32 joints, merus with 8-12 joints and ischium undivided (Fig. 2 *n*). Third pereiopod reaching with distal two segments beyond antennal scale; ischium with two spines on outer posterior margin; merus with four or five, usually five, spines on outer surface; propodus with about 15 tufts of hairs on anterior margin in males, while without these hairs in females (Fig. 2 *o*). Fourth pereiopod longer than third and fifth pereiopods, reaching with dactylus, propodus and a part of carpus beyond antennal scale; ischium with two spines as in third pereiopod; merus with usually four spines; propodus with about 20 tufts of hairs in males only (Fig. 2 *p*, *q*). Fifth pereiopod reaching just to or slightly beyond antennal scale; ischium and merus unarmed (Fig. 2 *r*); propodus with five or six spines on posterior margin in both sexes and about 20 tufts of hairs on anterior margin in males only; dactylus as long as that of fourth pereiopod and a little broadened at posterior margin in mature female (Fig. 2 *s*, *t*).

Endopod of first male pleopod deeply notched at apex. First four abdominal sternites with a small posteriorly curved median spine; fifth sternite with a large, anteriorly curved median spine; sixth sternite with a small preanal spine. Uropod slightly longer than telson; outer margin of exopod nearly straight, ending in two large spines. Eggs small and numerous.

Remarks DE MAN (1920) described in detail his new species, *N. sibogae* and compared it with *N. danae* PAULSON. As mentioned by DE MAN, a specimen from Siboga station 71 differs from the other members of the type series in having a pointed apex

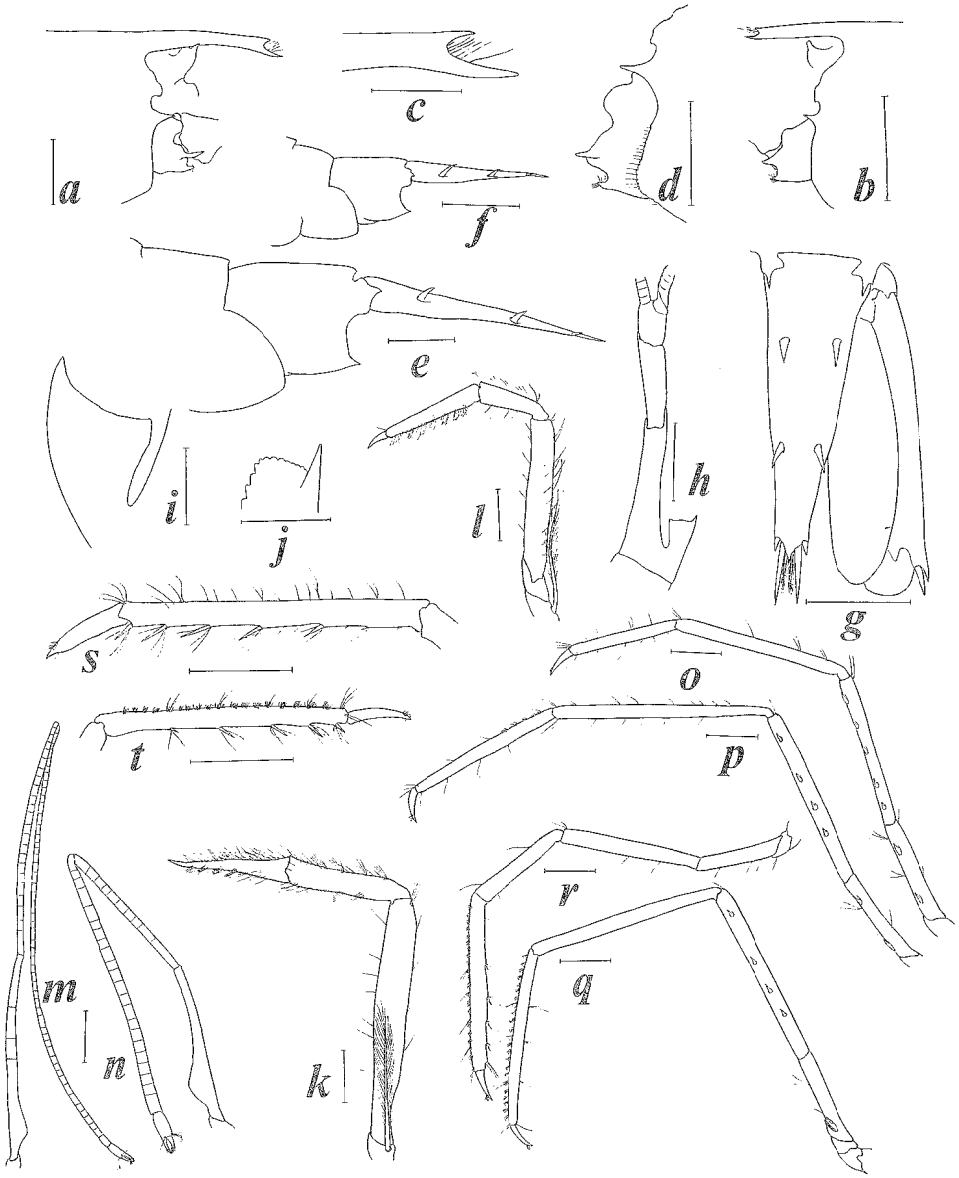

Fig. 2. *Nikoides danae* PAULSON, *a, c, q, r,* male (5.2 mm in carapace length), *b, f,* juvenile (2.4 mm), *d, e, s,* ovigerous female (5.6 mm), *h, j-n, t,* male (3.9 mm), *g,* broken male, *o, p,* female (3.5 mm), all from N. of Mombasa; *i,* ovigerous female (6.9 mm) from Ishigaki-jima Island.

a, b, anterior part of carapace, *c,* apex of rostrum, *d,* anterior margin of carapace and basicerite, *e, f,* posterior part of body, *g,* telson, *h,* antennular peduncle, *i,* stylocerite, *j,* apex of antennal scale, *k,* third maxilliped, *l,* left first pereiopod, *m,* right second pereiopod, *n,* left second pereiopod, *o,* third pereiopod, *p, q,* fourth pereiopod, *r,* fifth pereiopod, *s, t,* dactylus and propodus of fifth pereiopod. Scales for *a, b, d-h, k-t* represent 1.0 mm and scales for *c, i, j* represent 0.5 mm.

of the telson, a long outer spine at the antennal scale, short second pereiopods and a shorter dactylus of the fifth pereiopod. It is evident that this specimen does not belong to *N. sibogae* but to *N. danae*. These two species are distinguished from each other by the following characters.

(1) *N. sibogae* is much larger than *N. danae*. The former is up to 13.6 mm in carapace length but the latter is up to only 7.4 mm in carapace length. (2) The third maxilliped and the pereiopods are more slender and longer in *N. sibogae* than in *N. danae*. In *N. sibogae* the right second pereiopod reaches with the chela, the carpus and almost entire merus beyond the antennal scale; the carpus is subdivided into 74-89 joints, the merus into 33-43 joints and the ischium into 9-13 joints. The left second pereiopod reaches with the chela and the entire carpus beyond the antennal scale. The last three pereiopods reach with the dactylus, the propodus and more than half of carpus beyond the antennal scale, respectively. In *N. danae*, on the other hand, the right second pereiopod reaches with the chela, the carpus and a part of the merus beyond the antennal scale; the carpus is composed of 51-66 joints, the merus of 21-30 joints and the ischium of 3 or 4 joints. The merocarpal articulation of the left second pereiopod falls short of the end of the antennal scale. The fourth pereiopod is longer than the third and the fifth pereiopods and reaches with the dactylus, the propodus and a part of the carpus beyond the antennal scale.(3) The apex of the telson is truncated in *N. sibogae* but sharply pointed in *N. danae*. (4) The series of tufts of hairs on the propodus of the last three pereiopods is present in males of *N. danae* but entirely absent in *N. sibogae*. (5) The propodus of the fifth pereiopod is armed with a single, small subterminal spine in *N. sibogae* and with principally five or six spines in *N. danae*. (6) The outer spine of the antennal scale extends beyond the lamella in *N. danae* but fails to do so in *N. sibogae*. (7) *N. danae* is a littoral species and mostly collected from coral reefs, while *N. sibogae* is obtained from a considerable depths by Danish seine, trawl net and so on.

Neverthless GURNEY (1937) considered *N. sibogae* a synonym of *N. danae*, but he gave some differences between his specimens and DE MAN's description of *N. sibogae*, such as the long outer spine of the antennal scale, the short pereiopods and tufts of hairs on the propodus of the fifth pereiopods, which characters clearly distinguished his specimens from *N. sibogae* as mentioned above. Moreover, the pointed pleura of the fifth abdominal somite and the slender dactylus of the fifth pereiopod in females show that GURNEY's specimen can not be referred to the true *N. danae*, but belongs to another species. The latter has not been adequately treated so far, and therefore, is described herewith as *N. gurneyi* sp. nov., which is more closely related to *N. danae* than to *N. sibogae*. The above mentioned characters separating *N. danae* from *N. sibogae* are all found also in *N. gurneyi*, and thus, *N. gurneyi* differs readily from *N. sibogae*. The more detailed distinctions between *N. danae* and *N. gurneyi* are mentioned in the account for *N. gurneyi*.

The specimens from stations 3872 and 3874 described and figured by RATHBUN (1906) as *Processa processa* undobtedly belong either to *N. danae* or *N. gurneyi*. In

the photograph (pl. 22, fig. 6) an ovigerous female is figured, in which the exopod on the first pereiopod is clearly visible, thus indication that the species belongs to the genus *Nikoides* and not to *Processa*; all characters mentioned in description and visible in the figure are in accordance with those of *N. danae* or *N. gurneyi*, so far instance the right second pereiopod has the carpus divided into 65 joints, a number of which is much larger than in the Indo-West Pacific species of *Processa*, and in turn, is much fewer than in *N. sibogae*. Its description, however, is too short to determine the species as either of them. The specimen from station 3876 mentioned by RATHBUN (1906) as an aberrant form of *Processa processa* probably belongs to *Nikoides maldivensis* BORRADAILE. EDMONDSON's (1946) *Processa processa* may be a only quotation of RATHBUN's (1906) species and probably belongs to *N. danae* or *N. gurneyi* as in the case of RATHBUN's species.

Size PAULSON's type is 34 mm in entire length. Ovigerous females of the present material are 5.6-6.9 mm in carapace length and 25-30 mm in body length. The largest specimen is a non-ovigerous female, being 7.4 mm in carapace length and 33 mm in body length. The largest male is 5.2 mm in carapace length and 23 mm in body length.

Distribution This is a littoral species and collected usually from coral reefs. Honolulu, reef ? (RATHBUN, 1906; EDMONDSON, 1946), Makassar and surroundings, up to 32 m (DE MAN, 1920), Kabira Bay, Ishigaki Is., Japan, 1 m (present publication), Great Barrier Reef, 20 fms (MCNEILL, 1968), Red Sea (PAULSON, 1875), Perim (NOBILI, 1906), Jibuti (NOBILI, 1906), Kamaran (BALSS, 1915), Mombasa, Kikambala, Jadini, 0.1-1.0 m (present publication) and Mazizini, Zanzibar, LWS (present publication).

Nikoides gurneyi sp. nov.

(Figs. 3 and 4 *a-t*)

Nikoides danae GURNEY, 1937, p. 89, pl. 1 figs. 20-25, pl. 2 figs. 26-29 (not *Nikoides danae* PAULSON, 1875).

Nikoides danae BARNARD, 1955, p. 44 (not *Nikoides danae* PAULSON, 1875).

Snellius Expedition

Off Bongao, Tawitai, Sulu Islands, dredge, depth 27 m, September 9, 1929 – 1 ovig. ♀ (paratype, RMNH No. D 21286)

Malay Archipelago

Poeloe Weh, N. Sumatra, May 1922, P. BUITENDIJK leg. – 3 ovig. ♀♀, 1 ♀ (paratypes, RMNH No. D 3734)

Africa

Ras Kidomoni, Mombasa, shore pools at LWS, February 19, 1972, A. J. BRUCE – 3 juv. (EAMFRO)

Kikambala, Kenya, weedy pools inner reef flat at LWS, February 25, 1973, A. J. BRUCE – 1 ♀ (holotype), 5 ♂♂, 2 ♀♀, 2 juv. (paratypes, EAMFRO)

North of Bawi, Zanzibar, depth 16 m, September 29, 1970, B. BENBOW leg. – 1 juv. (EAMFRO)

Delagoa Bay, Moçambique, 1955, University of Witwatersrand – 1 ♂ (SAM)

Definition Rostrum long, apex bifid. Pleuron of fifth abdominal somite pointed posteriorly. Apex of telson with median spine. Stylocerite with spine on both inner and outer distal ends. Basicerite with bluntly pointed process on lower margin. First pair of pereiopods with long exopods. Right second pereiopod with 18-32 meral and 47-72 carpal joints, left second pereiopod with 6-9 meral and 22-28 carpal joints. Ischium of third and fourth pereiopods with two spines. Merus of third pereiopod with usually four spines. Propodus of fifth pereiopod with four to six spines.

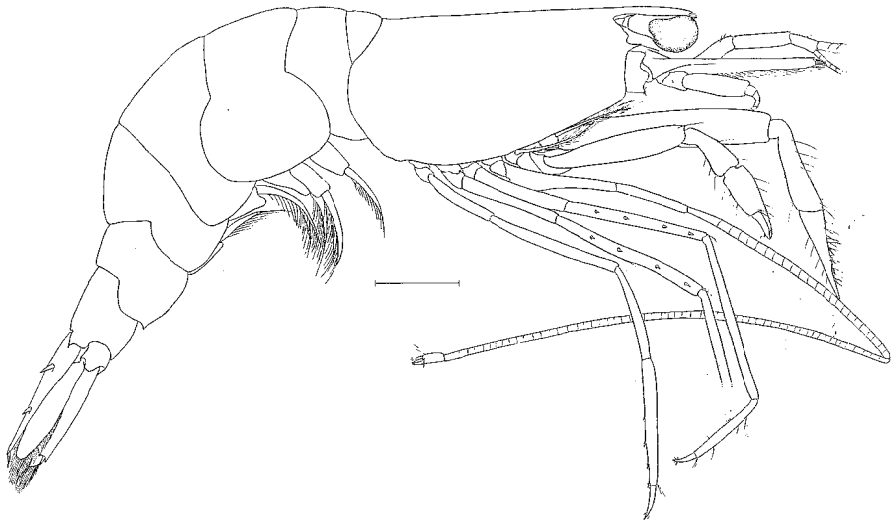

Fig. 3. *Nikoides gurneyi* sp. nov., holotype, female from Kikambala. Scale represents 3.0 mm.

Description Body slender and robust (Fig. 3). Rostrum long, as long as or sometimes longer than eye; apex bifid, upper tooth shorter than lower and straight or slightly downcurved (Fig. 4 *a*, *b*). Carapace smooth, 2.6-3.0 times as long as rostrum; antennal spine well developed, separated from suborbital angle by notch. Pterygostomial angle finely undulated (Fig. 4 *c*, *d*). A process present below base of rostrum, but not developed and apex not distinctly bifid (Fig. 4 *a*).

First four abdominal pleura rounded posteriorly. Pleuron of fifth somite ending in a small acute point. Pleuron and lateral plate of sixth somite acutely pointed (Fig. 4 *e*). Telson with two pairs of spines; position of the dorsal spines similar to that of *N. danae* (Fig. 4 *f*); posterior margin pointed at middle, flanked by three pairs of spines (Fig. 4 *g*).

Antennular peduncle long; basal segment as long as distal two segments combined; third segment short, about half as long as second (Fig. 4 *h*); stylocerite pointed at inner and outer distal ends, inner spine longer than outer (Fig. 4 *i*). Antennal scale

as long as antennular peduncle, outer margin straight, ending in a long spine (Fig. 4 *j*); basicerite with a blunt process on lower distal end (Fig. 4 *d*); carpocerite reaching end of basal antennular segment.

Third maxilliped reaching with ultimate and half penultimate segment, with long exopod (Fig. 4 *k*). Right first pereiopod chelate, falling short of end of antennal scale (Fig. 4 *l*); left first pereiopod not chelate, reaching with entire dactylus or dactylus and a part of propodus beyond antennal scale (Fig. 4 *m*). Right second pereiopod reaching with chela, carpus and half merus beyond antennal scale; carpus with 47-72 joints, merus with 18-32 joints and ischium with two joints (Fig. 4 *n*). Merocarpal articulation of left second pereiopod reaching end of second antennular segment; carpus with (17) 22-32 joints, merus with 6-11 joints and ischium undivided (Fig. 4 *o*). Third pereiopod reaching with dactylus, propodus and a part of carpus beyond antennal scale (Fig. 4 *p*). Fourth pereiopod reaching with distal two segments and 2/5-3/5 length of carpus beyond antennal scale. Ischium of these two pereiopods with two spines as in *N. danae* and merus with three to six, usually four, spines. Propodus of these two pereiopods, as in the fifth pereiopod, provided with two series of tufts of hairs on anterior margin in males (Fig. 4 *q*). Fifth pereiopod reaching with dactylus beyond antennal scale; ischium and merus unarmed; propodus with four to six spines on posterior margin (Fig. 4 *r*, *s*); dactylus longer than that of fourth pereiopod and not specialized even in mature female (Fig. 4 *t*).

Endopod of first male pleopod deeply notched at apex. First four abdominal sternites without spine or process, fifth sternite with an anteriorly curved median spine; sixth sternite with a preanal spine. Uropod slightly longer than telson; outer margin of exopod straight, ending in two large spines. Eggs small and numerous, 0.35 x 0.45 mm in diameter.

Remarks *Nikoides gurneyi* sp. nov. is very closely related to *N. danae* PAULSON. The differences between them are as follows.

(1) The basicerite bears two pointed processes in *N. danae* but only one process in *N. gurneyi*. (2) The stylocerite is pointed in both of the outer and inner distal ends in both species, but in *N. danae* the outer spine is more sharply pointed and longer than the inner spine, while in *N. gurneyi* the inner is larger and longer than the outer spine. (3) The merus of the third pereiopod is armed with usually five spines in *N. danae* and four spines in *N. gurneyi*. (4) In *N. danae* the dactylus of the fifth pereiopod is as long as or slightly shorter than that of the fourth pereiopod and it is modified, being broad, thin and knife-like, especially in mature females. In *N. gurneyi* the dactylus of the fifth pereiopod is longer than those of the preceding two pereiopods and it is not modified, even in mature females. (5) The pleuron of the fifth abdominal somite ends in an acutely pointed spine in *N. gurneyi*, whereas it is pointed but not acute in *N. danae*.

GURNEY's (1937) figure of the distal half of the telson resembles neither that of *N. danae* nor of *N. gurneyi*, but is somewhat like that of *N. sibogae*.

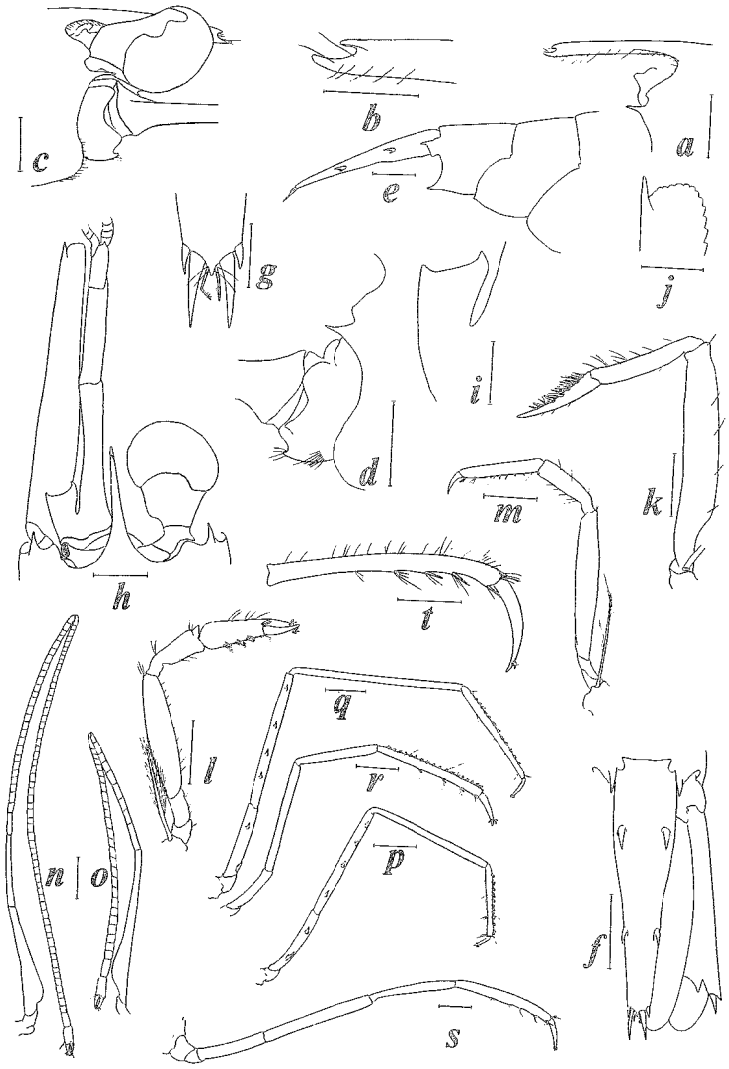

Fig. 4. *Nikoides gurneyi* sp. nov., paratypes; *a, d, g-i, l, m, s, t,* ovigerous female (6.7 mm in carapace length), *b, j, k,* female (5.9 mm), *e,* broken female from Sumatra; *c,* ovigerous female (7.0 mm) from Sulu Islands; *f,* male (5.0 mm), *n, o,* female (5.1 mm), *p-r,* male (4.6 mm) from Kikambala.

a, anterior part of carapace, *b,* apex of rostrum, *c, h,* anterior part of body, *d,* anterior margin of carapace and basicerite, *e,* posterior part of body, *f,* tail fan, *g,* apex of telson, *i,* stylocerite, *j,* apex of antennal scale, *k,* third maxilliped, *l,* right first pereiopod, *m,* left first pereiopod, *n,* right second pereiopod, *o,* left second pereiopod, *p,* third pereiopod, *q,* fourth pereiopod, *r, s,* fifth pereiopod, *t,* dactylus and propodus of fifth pereiopod. Scales for *a, c-f, h, n-t* represent 1.0 mm, scales for *b, g, i, j* represent 0.5 mm and scales for *k-m* represent 2.0 mm.

BARNARD (1955) described a single male from Delagoa Bay under the name *N. danae*. Fortunately this specimen could be examined and proves not to belong to *N. danae* but to the present species.

Of the specimens that were treated in the literature as *N. danae* without detailed descriptions, some may refer to *N. gurneyi*, as these two species are superficially alike and have a similar habitat and the same distributional range.

Size The holotype is a female, 5.3 mm in carapace length. The ovigerous females vary from 5.9-7.0 mm in carapace length and more than 20 mm in body length.

Distribution Off Bongao, Sulu Islands, 27 m, Poeloe Weh, N Sumatra (present publication), Ghardaqa (GURNEY, 1937), Ras Kidomoni and Kikambala, Kenya, LWS (present publication), N of Bawi, Zanzibar, 16 m (present publication) and Delagoa Bay, Moçambique (BARNARD, 1955; present publication)

Nikoides maldivensis BORRADAILE, 1915

(Fig. 5 *a-j*)

Processa processa p.p. RATHBUN, 1906, p. 912 (not *Nika processa* BATE).
Nikoides maldivensis BORRADAILE, 1915, p. 209.
Nikoides maldivensis BORRADAILE, 1917, p. 411, pl. 58, fig. 11.
Nikoides maldivensis DE MAN, 1920, p. 193 (list).
Processa Jacobsoni DE MAN, 1921, p. 95.
Processa Jacobsoni DE MAN, 1924, p. 32, fig. 11-11f.
Processa jacobsoni GURNEY, 1937, p. 87 (list) and p. 91 (key).
Nikoides maldivensis GURNEY, 1937, p. 91, pl. 2 figs. 30-32.
Processa jacobsoni ARMSTRONG, 1941, p. 13.
? *Processa* sp. EDMONDSON, 1946, p. 248.
Nikoides maldivensis HOLTHUIS, 1955, fig. 82 on p. 117.
Nikoides maldivensis MANNING and CHACE, 1971, p. 8 (key).
Processa jacobsoni MANNING and CHACE, 1971, p. 13 (list).

Central Pacific

GUF Station 77, 1°4'29"N, 154°44'05"E, Topot Tokoeluailala, coral mesa in middle of lagoon, Kapingamarangi Atoll, July 26, 1954 – 1 ♂ (RMNH No. D 16285)

East Africa

Station 60/55.6, 10°08.1'S, 51°09.6'E, Farquhar Is., shore collection, time 07:30-10:45, central lagoon, February 26, 1972, A. J. BRUCE leg. – 1 juv. (EAMFRO)

Ras Iwatine, Mombasa, Kenya, weedy pool at LWS, April 30, 1972, A. J. BRUCE leg. – 1 juv. (EAMFRO)

Definition Rostrum long, overreaching end of eye, dorsal rostral tooth placed near midlength of rostrum. Pleuron of fifth abdominal somite pointed posteriorly. Apex of telson with median spine. Stylocerite with stout tooth on distal corner. Outer spine of antennal scale stout and much longer than lamella. Basicerite with two

processes, upper acutely pointed and lower bluntly pointed. First pair of pereiopods with long exopods. Right second pereiopod with 26 meral and 55 or 56 carpal joints, left second pereiopod with 7-10 meral and 19-25 carpal joints. Ischium of third and fourth pereiopods with two spines. Merus of third pereiopod usually with four spines. Propodus of fifth pereiopod with four spines.

Description Rostrum long, usually overreaching end of eye; dorsal tooth placed near middle of rostrum; apex sharply pointed. Carapace smooth, 2.2-2.4 times as long as rostrum, with well developed antennal spine, which is separated from suborbital angle by notch (Fig. 5 *a*, *b*); pterygostomial angle finely undulated.

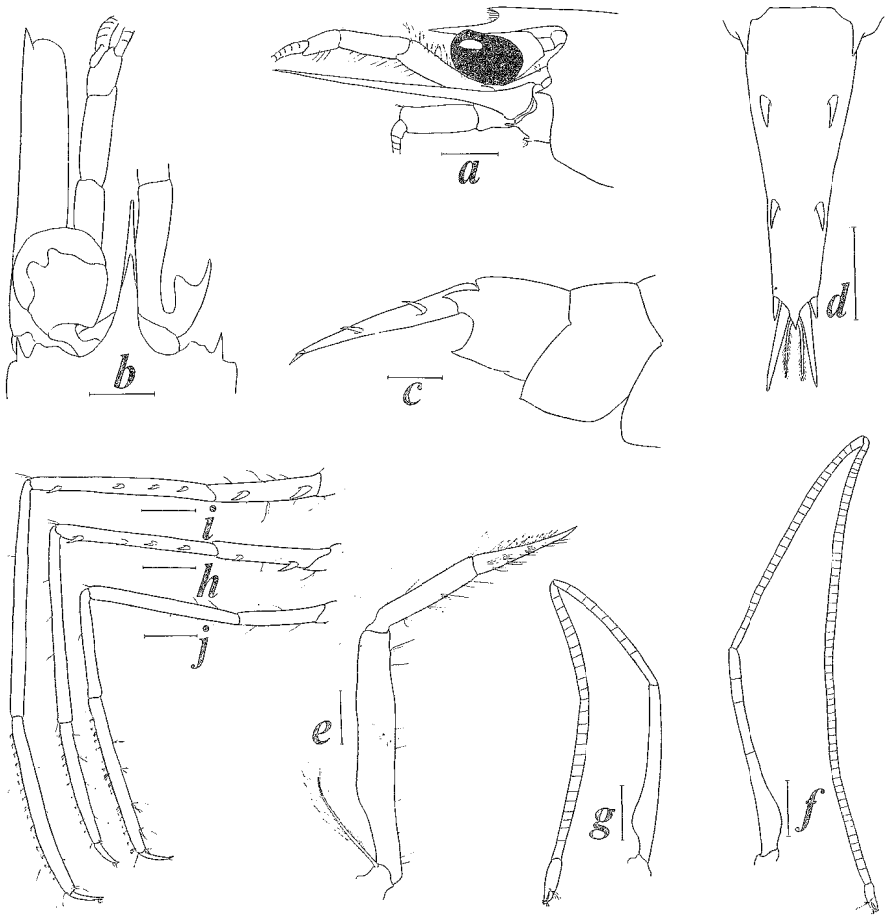

Fig. 5. *Nikoides maldivensis* BORRADAILE, male (5.2 mm in carapace length) from Kapingamarangi Atoll.

a, anterior part of body, *b*, same in dorsal view, *c*, posterior part of body, *d*, telson, *e*, third maxilliped, *f*, right second pereiopod, *g*, left second pereiopod, *h*, third pereiopod, *i*, fourth pereiopod. *j*, fifth pereiopod. Scales represent 1.0 mm.

First four abdominal pleura rounded posteriorly; pleuron of fifth somite ending in a small but acute point; pleuron and lateral plate of sixth somite with large spine (Fig. 5 *c*). Telson with two pairs of spines; posterior margin pointed at middle, flanked by three pairs of unequal spines (Fig. 5 *d*).

Antennular peduncle long, basal segment as long as distal two segments combined; third segment short, about half as long as second; stylocerite with a well developed spine at outer distal end; inner distal end rounded (Fig. 5 *b*). Antennal scale as long as or slightly beyond antennular peduncle, outer terminal spine much longer than lamella (Fig. 5 *b*); basicerite with two developed processes; upper sharply and lower bluntly pointed; carpocerite reaching basal segment of antennular peduncle (Fig. 5 *a*).

Third maxilliped reaching with ultimate and half penultimate segment beyond antennal scale; with long exopod (Fig. 5 *e*). Right first pereiopod chelate, reaching just end of antennal scale; left first pereiopod simple, reaching with dactylus and a part of propodus beyond antennal scale; exopod as long as that of third maxilliped. Second pereiopod strongly unequal; right pereiopod reaching with chela, carpus and about one-fourth length of merus beyond antennal scale; carpus with 55 or 56 joints, merus with 26 joints, ischium with 4 joints (Fig. 5 *f*). Left second pereiopod reaching with chela and large part of carpus beyond antennal scale; carpus with 19-25 joints, merus with 7-10 joints, ischium undivided (Fig. 5 *g*). Third pereiopod reaching with dactylus, propodus and one-fourth length of carpus beyond antennal scale; ischium with two spines; merus with four spines on outer surface; propodus with two series of about 10 tufts of hairs on anterior margin in male (Fig. 5 *h*). Fourth pereiopod longer than third and fifth pereiopods, reaching with dactylus, propodus and half carpus beyond antennal scale; ischium with two spines and merus with four spines as in third pereiopod; propodus with two series of about 20 tufts of hairs on anterior margin as in third pereiopod (Fig. 5 *i*). Fifth pereiopod reaching with dactylus beyond antennal scale; ischium and merus unarmed; propodus with two series of about 20 tufts of hairs on anterior margin and with four spines on posterior margin; dactylus longer than those of preceding two pereiopods (Fig. 5 *j*).

Endopod of first male pleopod deeply notched at apex. First three abdominal sternites with a small posteriorly curved spine; fourth sternite with a slender, long, posteriorly curved spine; fifth sternite with low keel; sixth sternite with a preanal spine.

Remarks The present species is distinguished from the other members of the genus *Nikoides* by having a rather large dorsal tooth separated considerably from the rostral apex.

Dr. HOLTHUIS kindly examined the type of *Processa jacobsoni* DE MAN, which has been preserved in the Rijksmuseum van Natuurlijke Historie, Leiden and informed as follows. "The type of *P. jacobsoni* bears a distinct exopod at the base of the first pereiopod and is identical with *N. maldivensis*. Only difference between *P. jacobsoni* and *N. maldivensis* is the length of the rostrum; in the former the rostrum reaches distinctly beyond the eyes while in the latter it just fails to reach the end of the

cornea. This difference is too slight to be of value for specific distinction." MANNING and CHACE (1971) were already suggested this fact.

RATHBUN's (1906) aberrant specimen of *Processa processa* collected from station 3876, which appears the same form of the rostrum as the present species, seems to be identical with *N. maldivensis*, though no other details of the structure of the body are given. Likewise EDMONDSON's (1946) *Processa* sp. collected at Pearl and Hermes Reef is probably identical with the present species. *N. maldivensis* is the only species in the family Processidae with the rostrum bearing a dorsal tooth separated considerably from the apex.

Size The type of *Nikoides maldivensis* is a female, 24 mm (BORRADAILE, 1917) or 26 mm in length (GURNEY, 1937). The type of *P. jacobsoni* is a male, 20 mm in entire length and 6 mm in carapace length including the rostrum (DE MAN, 1921 and 1924). Of the specimens examined, the male is 5.2 mm in carapace length and about 20 mm in body length and two youngs are both 2.1 mm in carapace length.

Distribution This is a littoral species and found mostly on coral reefs, but it thought to be rather rare and only four specimens have been discovered.

Hawaii (RATHBUN, 1906; EDMONDSON, 1946), Mataatu Harbor, Savaii, shallow water (ARMSTRONG, 1941), Simalur Is., Sumatra (DE MAN, 1921; 1924), Topot Tokoeluailala, Kapingamarangi Atoll, lagoon (present publication), Maldive Is., (BORRADAILE, 1915; 1917 and GURNEY, 1937), Farquhar Is., lagoon (present publication) and Ras Iwatine, Mombasa, LWS (present publication).

Nikoides sibogae DE MAN, 1918

(Figs. 6 and 7 *a-r*)

Nikoides Sibogae DE MAN, 1918, p. 160.

Nikoides Sibogae p.p. DE MAN, 1920, p. 193, pl. 16 fig. 50-50h (not 150i-50j = *Nikoides danae* PAULSON).

Processa sp. p.p. DE MAN, 1920, p. 203, fig. 52j-52n (not 52-52i = *Processa affinis* sp. nov., 52o = *Processa neglecta* sp. nov. and 52p = *Processa demani* sp. nov.).

Nikoides sibogae DE MAN, 1922, p. 46.

Nika edulis YOKOYA, 1933, p. 31.

Nikoides sibogae HOLTHUIS, 1953, p. 52 (list).

Nikoides sibogae CHACE, 1955, p. 8.

Nikoides sibogae JOHNSON, 1961, p. 54.

Nikoides sibogae MANNING and CHACE, 1971, p. 8 (key).

Japan

East China Sea, 23°32.0'N, 125°34.0'E, depth 101 m, June 13, 1962, time 20:00, H. YAMASHITA leg. – 2 ♂♂ (ZLKU No. 13905).

Kii Strait, Wakayama-ken, Danish seine, June 1973, T. SAKAMOTO leg. – 2 ovig. ♀♀ (ZLKU)

Siboga Expedition

Station 154, NW of Waigeo Island, 0°07.2'N, 130°25.5'E, depth 83 m, bottom gray muddy sand,

shell sand, shells and lithothamnion, August 14, 1899 – 1 juv. (AM)

South Viet Nam

Station 270b, Bay of Nha Trang, depth 22 m, bottom sandy mud, March 21, 1960, V. A. GALLARDO leg. – 1 ♀ (RMNH No. D 16286)

East Africa

Station 37/AT-8, Curieuse Bay, 4°18.2'S, 55°44.0'E, Seychelles, depth 15 fms, February 19, 1972 – 5 ovig. ♀♀, 1 ♀ (EAMFRO)

Station 79/AT-9, Zanzibar Channel, 6°32'S, 39°16'E, depth 29 fms, March 3, 1972 – 2 ♂♂, 1 ♀ (EAMFRO)

Definition Rostrum long, apex bifid. Pleuron of fifth abdominal somite pointed posteriorly. Apex of telson truncated. Stylocerite truncated. Outer spine of antennal scale small, not reaching lamella. Basicerite without any spiniform process. First pair of pereiopods with long exopods. Right second pereiopod with 33-43 meral and 74-89 carpal joints, left second pereiopod with 8-10 meral and 22-28 carpal joints. Ischium of third and fourth pereiopods with two spines. Merus of third pereiopod with four spines. Propodus of fifth pereiopod with a subterminal spine.

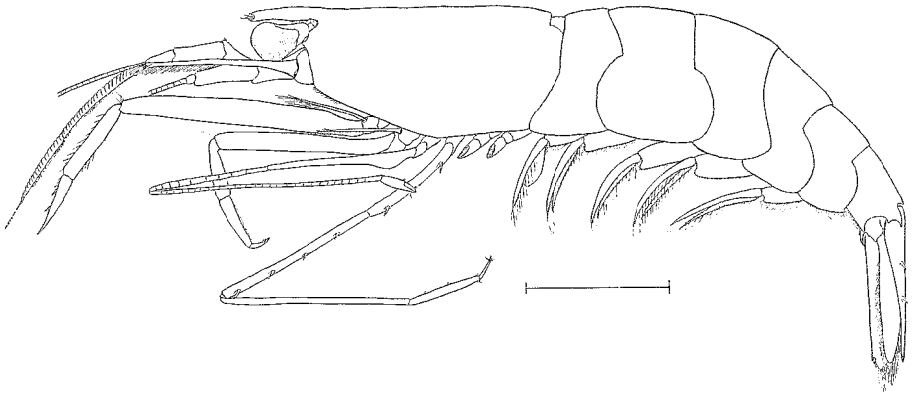

Fig. 6. *Nikoides sibogae* DE MAN, male from East China Sea. Scale represents 7.0 mm.

Description Body large and stout (Fig. 6). Rostrum long, usually overreaching or as long as eye; apex bifid, upper tooth shorter than lower (Fig. 7 *a*, *b*). Carapace smooth, 3.0-3.5 times as long as rostrum; antennal spine well developed, not separated by notch from suborbital angle, which is indistinctly produced. Pterygostomial angle not undulated; blunt process present below base of rostrum (Fig. 7 *a*).

First four abdominal pleura rounded posteriorly. Pleuron of fifth somite acutely pointed posteriorly. Pleuron and lateral plate of sixth somite acutely pointed (Fig. 7 *d*). Telson with two pairs of spines, anterior pair placed on anterior fourth and posterior pair on posterior third of telson (Fig. 7 *e*); posterior margin truncated with three pairs

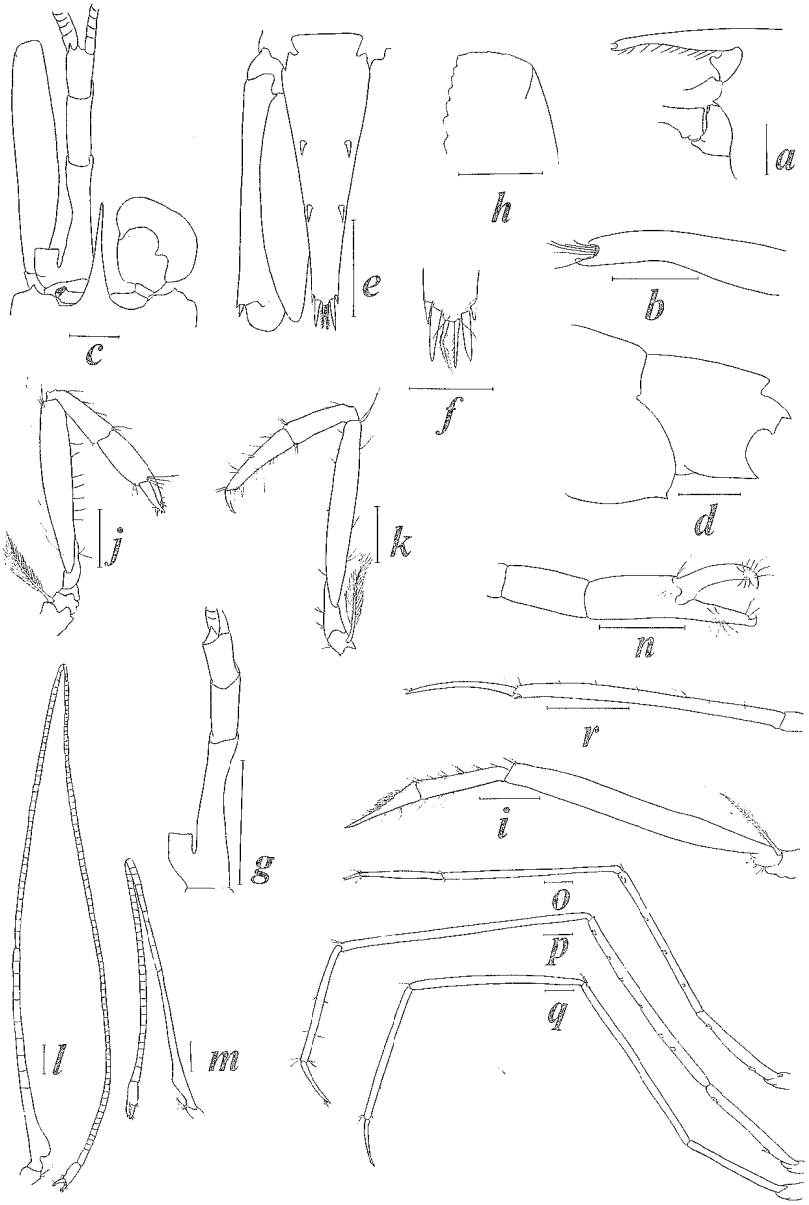

Fig. 7. *Nikoides sibogae* DE MAN , *a-c, h,* male (5.7 mm in carapace length), *d, l-q,* male (7.0 mm), *f, r,* female (7.5 mm) from Zanzibar Channel; *e, i-k,* female (4.5 mm) from Bay of Nha Trang; *g,* juvenile (3.0 mm) from NW. of Waigeo.

a, anterior part of carapace, *b,* apex of rostrum, *c,* anterior part of body, *d,* fifth and sixth abdominal somites, *e,* teil fan, *f,* apex of telson, *g,* antennular peduncle, *h,* apex of antennal scale, *i,* third maxilliped, *j,* right first pereiopod, *k,* left first pereiopod, *l,* right second pereiopod, *m,* left second pereiopod, *n,* chela of right second pereiopod, *o,* third pereiopod, *p,* fourth pereiopod, *q,* fifth pereiopod, *r,* dactylus and propodus of fifth pereiopod. Scales for *a, c-e, g, i-m, o-r* represent 1.0 mm and scales for *b, f, h, n* represent 0.5 mm.

of spines (Fig. 7 *f*).

Basal segment of antennular peduncle as long as or slightly longer than distal two segments combined; third segment short, more than half of second segment. Stylocerite short and truncated (Fig. 7 *g*). Antennal scale reaching slightly beyond antennular peduncle; outer margin straight, ending in a small spine, which fails to reach end of lamella (Fig. 7 *h*); basicerite without distinct marginal process; carpocerite reaching slightly beyond first segment of antennular peduncle.

Third maxilliped reaching with entire distal two segments or distal two segments and a part of antepenultimate segment beyond antennal scale (Fig. 7 *i*). Right first pereiopod chelate, reaching with fingers (Fig. 7 *j*), and left first pereiopod reaching with dactylus and propodus beyond antennal scale; exopod well developed (Fig. 7 *k*). Second pair of pereiopods strongly unequal; right pereiopod reaching with entire length of chela, carpus and large part of merus beyond antennal scale; carpus with 74-89 joints, merus with 33-43 joints, ischium with 9-13 joints (Fig. 7 *l*). Left second pereiopod reaching with chela and carpus beyond antennal scale; carpus with 22-28 joints, merus with 8-10 joints and ischium undivided or indistinctly divided into 2 or 3 joints (Fig. 7 *m*). Last three pereiopods (Fig. 7 *o-q*) long and slender, all reaching with distal three segments beyond antennal scale; propodus of these pereiopods without tufts of hairs on anterior margin in both sexes. Ischium of third and fourth pereiopods with two spines and merus of these two pereiopods with four to six spines. Propodus of fifth pereiopod with a single, very small subterminal spine; dactylus of fifth pereiopod twice as long as that of fourth pereiopod (Fig. 7 *r*).

First four abdominal sternites without any spine or process; fifth sternite with a low keel, sixth sternite with a preanal process. Uropod longer than telson; outer margin of exopod nearly straight, ending in two spines. Eggs small and numerous, 0.3-0.45 x 0.4-0.6 mm in diameter.

Remarks The species has been considered to be a synonymy of *N. danae* PAULSON but rather readily distinguished from the latter as mentioned above. The type series of *N. sibogae* DE MAN (1920) contains a single specimen of *N. danae* as mentioned in the account for the latter species. Moreover, a single small specimen of the Siboga material, which was described by DE MAN (1920) under the name *Processa* sp., has the distinct, but not so long, exopod on the first pereiopod, and therefore it does not belong to the genus *Processa* but to *Nikoides*. This is a juvenile, because of the small size and of the rudimental exopods present on the second to the fourth pereiopods, and very probably belongs to the present species.

YOKOYA (1933) examined many processids collected from various localities of the continental shelf of Japan and identified them without any description as the European species, *Nika edulis*. I had the opportunity to reexamine a part of the Sôyô Maru collection but no specimen of *Nika edulis* identified by YOKOYA could be found. Recently an unpublished manuscript concerning Japanese Macrura written by YOKOYA was received. In this manuscript YOKOYA described four species of the genus *Nika*

in the family Nikiidae, in which the genus *Glyphocrangon* was included. According to his description, two species of *Nika* prove to belong to the genus *Nikoides* and the other two to the genus *Processa*. One of *Nikoides* is *N. danae* or *N. maldivensis* BORRADAILE which has given the name *Nika processa* by him and the other is given the name *Nika edulis* and probably identical with *Nikoides sibogae*.

Size The species is much larger than the other species of the genus. The type is 42 mm in entire length. Japanese specimens are as large as the type, such as 45 and 50 mm in body length and 12.5 and 13.6 mm in carapace length in ovigerous females and 37 and 38 mm in body length and 11.4 and 12.0 mm in carapace length in males. The specimens from East Africa are rather small, 28-30 mm in body length and 7.5-8.1 mm in carapace length in ovigerous females. CHACE's (1955) ovigerous female is much smaller, only 4.2 mm in carapace length.

Distribution This species has been collected from considerable depths. Bikini Atoll (CHACE, 1955), Japan, continental shelf (YOKOYA, 1933), East China Sea, 101 m (present publication), Kii Strait (present publication), Saipan, reef flat (HOLTHUIS, 1953), Bay of Nha Trang, South Viet Nam, 22 m (present publication), Singapore, sandy and muddy beaches (JOHNSON, 1961), Nuhu Jaan, Kei Is., 90 m (DE MAN, 1918; 1920), Aru Is., 57 m (DE MAN, 1918; 1920), between Nusa Besi and NE point of Timor, 27-54 m (DE MAN, 1918; 1920), Waigeo Is., 83 m (DE MAN, 1920; present publication), Ambon, 54 m (DE MAN, 1922), Curieuse Bay, Seychelles, 15 fms (present publication) and Zanzibar Channel, 29 fms (present publication).

Nikoides steinii (EDMONDSON, 1935)

(Figs. 8 *a-c* and 9 *a-l*)

Processa steinii EDMONDSON, 1935, p. 3, fig. 1 a-i.
Processa steinii GURNEY, 1937, p. 87 (list) and p. 91 (key).
Nikoides nanus HOLTHUIS, 1953, p. 52 (nomen nudum).
Nikoides nanus CHACE, 1955, p. 8, fig. 4 a-u.
Nikoides nanus MANNING and CHACE, 1971, p. 7 (key).
Processa steinii MANNING and CHACE, 1971, p. 13 (list).

Pacific Ocean

Maui, Hawaiian Archipelago, in coral head, October 8, 1934, H. STEIN leg. – 1 ♀ (holotype of *Processa steinii* BPBM No. S 3918)

aUgulpelú Reef, aUgulpelú Island (134°32'E, 7°17'20"E), Palau Islands, May 5, 1939, S. MIYAKE leg. – 1 ♀ (ZLKU No. 2545)

Malay Archipelago

Beach near Base G, shore N. of Hollandia, New Guinea, November 12, 1954, L. B. HOLTHUIS leg. – 1 ♂ (RMNH)

East Africa

Station 91, Mwemba Island, 5°46.6'S, 39°23.5'E, Zanzibar, depth 0.5 m September 17, 1970, A. J. BRUCE leg – 2 ♂♂ (EAMFRO)

Leven Reef, Mombasa, Kenya, weedy pools, reef flats at LWS, November 29, 1970, A. J. BRUCE leg – 1 ♂ (EAMFRO)

Definition Rostrum extremely short, not reaching base of eyestalk, apex simple or indistinctly bifid. Pleuron of fifth abdominal somite rounded posteriorly. Apex of telson with median spine. Stylocerite unarmed. Outer spine of antennal scale falling short of lamella. Basicerite without any spiniform process. First pair of pereiopods with short exopods. Right second pereiopods with 15-19 meral and 39-52 carpal joints, left second pereiopod with 6-8 meral and 19-22 carpal joints. Ischium of third and fourth pereiopod with a single spine. Merus of third pereiopod with two to four spines. Propodus of fifth pereiopod with five spines.

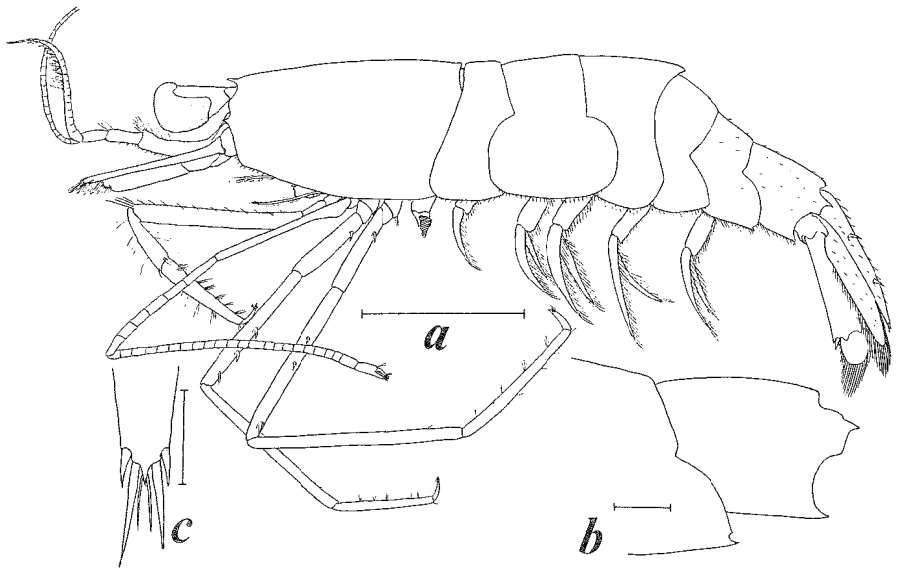

Fig. 8. *Nikoides steinii* (EDMONDSON), holotype from Hawaiian Archipelago.

a, animal in lateral view, *b*, fifth and sixth abdominal somites, *c*, apex of telson. Scale for *a* represents 3.0 mm and scales for *b*, *c* represent 0.5 mm.

Description Body small and slender (Fig. 8 *a*). Rostrum extremely short, not reaching base of eyestalk; apex simple or indistinctly bifid (Fig. 9 *a*, *b*). Carapace with a sharp antennal spine, pterygostomial angle largely rounded.

Abdomen smooth dorsally, with short hairs implanted on surface of fifth and sixth somites, telson and inner uropod (Fig. 9 *d*). Pleuron of fifth and sixth somites acutely pointed posteriorly. Lateral plate of sixth somite also acutely pointed (Figs. 8 *b*, 9 *d*). Telson with two pairs of dorsal spines; posterior margin pointed at middle, flanked by

three pairs of unequal spines (Figs. 8 *c*, 9 *e*).

Eye large. Basal segment of antennular peduncle longer than distal two segments combined; second segment slightly longer than distal segment; stylocerite short, bluntly pointed at inner distal end (Fig. 9 *c*). Antennal scale not extending beyond antennular peduncle; outer distal spine falling short of lamella (Fig. 9 *c*); basicerite without spine; carpocerite long, reaching as far as distal end of second segment of antennular peduncle.

Third maxilliped long, reaching with distal two segments beyond antennal scale; exopod short, reaching basal fourth of antepenultimate segment (Fig. 9 *f*). First pair of pereiopods asymmetrical, right chelate and left simple; exopod short, as long as or shorter than that of third maxilliped (Fig. 9 *g*). Second pereiopods strongly unequal, right pereiopod reaching slightly beyond end of antennal scale; carpus with 39-52 joints, merus with 15-19 joints and ischium with two joints (Fig. 9 *h*). Merocarpal articulation of left second pereiopod reaching second segment of antennular peduncle; carpus with 19-22 joints, merus with 5-8 indistinct joints and ischium undivided (Fig. 9 *i*). Third pereiopod reaching with dactylus, propodus and one-third length of carpus beyond antennal scale (Fig. 9 *j*). Fourth pereiopod reaching with dactylus, propodus and three-fourths length of carpus beyond antennal scale (Fig. 9 *k*). Fifth pereiopod reaching with dactylus, propodus and one-third length of carpus beyond antennal scale (Fig. 9 *l*). Ischium of third and fourth pereiopods with a single spine on posterior margin near base. Merus of third pereiopod armed with two to four spines on outer surface, merus of fourth pereiopod with two or three spines on outer surface. Propodus of third pereiopod without tufts of hairs on anterior margin and that of fourth pereiopod with about 15 tufts of hairs on anterior margin. Propodus of fifth pereiopod with five spines on posterior margin and about 20 tufts of hairs on anterior margin; merus and ischium unarmed.

Remarks EDMONDSON (1935) gave the description and figures of a new species under the name *Processa steinii* from the Maui, Hawaiian Archipelago. Through the courtesy of Dr. DEVANEY, the holotype of EDMONDSON's species deposited at the Bernice P. Bishop Museum, Hawaii was examined. It becomes clear that the species does not belong to the genus *Processa* but to *Nikoides*, for a distinct exopod is present at the base of the first pair of pereiopods. Two other important characters, which were overlooked and mistaken in the original description, are revealed.

(1) The holotype is a female, not a male as described by EDMONDSON, because there is no appendix masculina on the endopod of the second pleopod, and (2) the entire animal from the apex of the rostrum to the posterior extremity of the telson is about 15 mm long, not 17 mm as stated in the original description.

Nikoides steinii is distinguished from the other four species of the Indo-West Pacific region treated herewith by the short rostrum and the small size, which characters are in accordance with CHACE's *Nikoides nanus* based upon two males from Eniwetok Atoll and Bikini Atoll. Indeed all of the characters of the type of *P. steinii* agree well with description and figures of *N. nanus*. The following minor differences between

them are noted.

(1) The lateral plate of the sixth abdominal somite ends in an acutely pointed spine in the type of *Processa steinii*, while it was not described by CHACE (1955), but his figure shows that this plate is rounded at tip. (2) The posterior margin of the

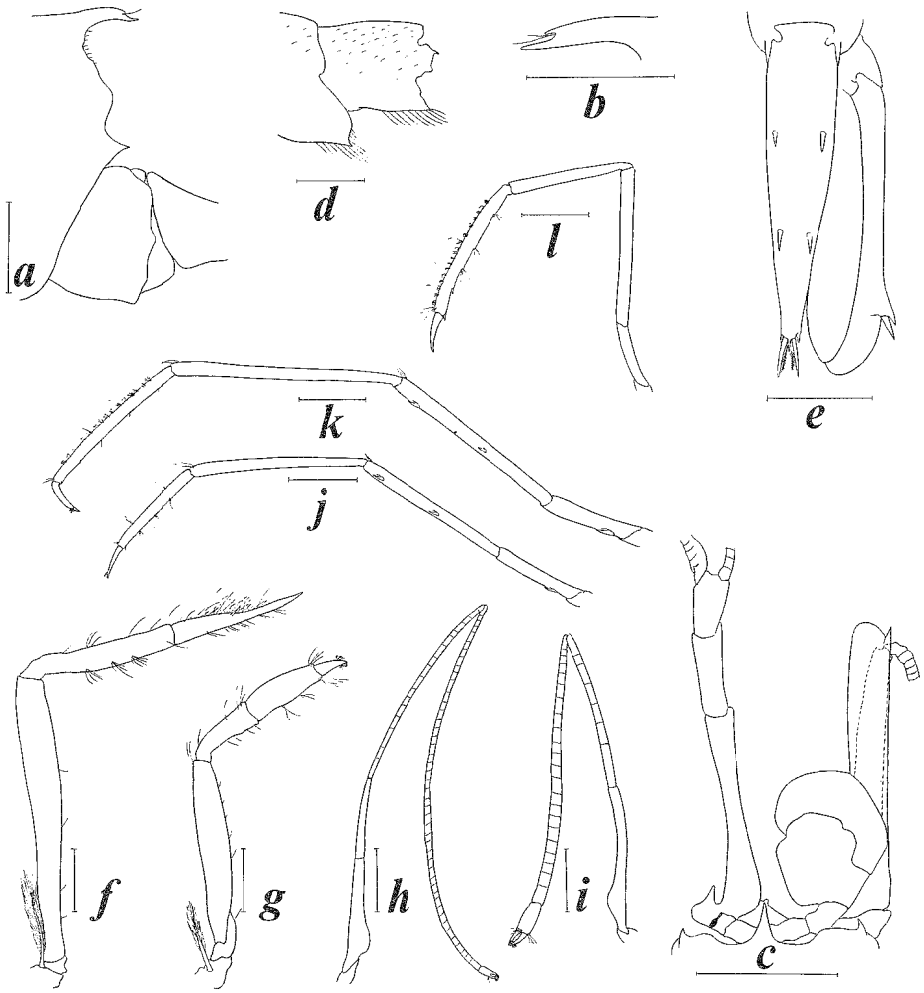

Fig. 9. *Nikoides steinii* (EDMONDSON), *a*, male (3.3 mm in carapace length) from New Guinea; *b*, *c*, *j-l*, male (3.4 mm), *e*, male (3.7 mm) from Zanzibar; *d*, *f-i*, male (3.7 mm) from Mombasa.

a, anterior part of carapace and basicerite, *b*, rostrum, *c*, anterior part of body in dorsal view, *d*, fifth and sixth abdominal somites, *e*, tail fan, *f*, third maxilliped, *g*, right first pereiopod, *h*, right second pereiopod, *i*, left second pereiopod, *j*, third pereiopod, *k*, fourth pereiopod, *l*, fifth pereiopod. Scales for *a*, *b* represent 0.5 mm and scales for *c-l* represent 1.0 mm.

telson bears a short median spine in the type of *P. steinii*, while it is bluntly pointed in CHACE's figure. (3) In *P. steinii*, the carpus of right second pereiopod is subdivided into about 50 (52 in EDMONDSON's description) joints and the merus into 19 joints. In *N. nanus* the carpus is composed of 43 joints and the merus of 15 joints. (4) The carpus of the left second pereiopod has 22 joints in EDMONDSON's type, but 19 joints in CHACE's specimens. (5) In the type of *P. steinii* the merus of both of the third and fourth pereiopods is provided with three or four spines on the outer surface, respectively. A single spine is present on outer surface near the base of the ischium of these two pereiopods. According to the figures of CHACE's *N. nanus*, two outer spines are present on the merus of the third and fourth pereiopods and there is no outer spine on the ischium of these two pereiopods.

Recently three males of *N. steinii* were received from East Africa and a single male from New Guinea through the courtesy of Dr. BRUCE and Dr. HOLTHUIS, respectively. They, as well as the female from the Palau Is., are slightly smaller than the holotype of *P. steinii* but agree well with it. In these specimens the lateral plate of the sixth abdominal somite is pointed and the posterior margin of the telson bears a short median spine. The right second pereiopod has the carpus with 39-45 joints and merus with 16-18 joints. The left second pereiopod has the carpus with 21-22 joints and merus with 7-8 joints. There are two or three, usually two, spines on the merus of the third pereiopod and two spines on the merus of the fourth pereiopod. Each ischium of the third and fourth pereiopods is provided with a single spine. Therefore, the differences between EDMONDSON's type and CHACE's type may be attributed to the differences in size or sex.

Size The holotype of *Processa steinii* is 4.2 mm in carapace length and 14.7 mm in entire length. CHACE's (1955) holotype of *Nikoides nanus* is 2.5 mm in carapace length and about 10 mm in entire length. The largest male examined is 3.7 mm in carapace length.

Distribution A littoral species, usually found on coral reefs. Maui, Hawaiian Archipelago, a shoal water reef (EDMONDSON, 1935; present publication), Runit Island, Eniwetok Atoll, intertidal (CHACE, 1955), Namu Island, Bikini Atoll, reef at shore inside lagoon (CHACE, 1955), aUgulpelú Reef, Palau Islands (present publication), Base G, N of Hollandia, New Guinea (present publication), Leven Reef, Kenya, reef flat (present publication) and Mwemba Island, Zanzibar, 0.5 m (present publication).

Genus *Processa* LEACH, 1915

Processa LEACH, 1815, pl. 41.
Processa HOLTHUIS, 1955, p. 166 (synonymy).
Processa NOUVEL and HOLTHUIS, 1957, p. 7 (synonymy and definition).
Processa MANNING and CHACE, 1971, p. 12

Definition See NOUVEL and HOLTHUIS, 1957.

Type species *Processa canaliculata* Leach, 1815, by monotypy.

Remarks The third maxilliped is provided with an exopod in all the species but two, *Processa japonica* (DE HAAN) and *P. molaris* CHACE, in which the exopod is entirely absent from the third maxilliped. In *P. hawaiensis* (DANA) only a rudimental exopod is present on the base of the third maxilliped.

MANNING and CHACE (1971) listed 14 nominal species of the genus *Processa* from the Indo-West Pacific region. Of these *P. jacobsoni* DE MAN and *P. steinii* EDMONDSON do not belong to the present genus but to *Nikoides* as mentioned above.

DE MAN (1920) treated six lots of the processids of the Siboga Expedition as *Processa* sp. After reexamination, they prove to be five different species, of which three are new to science, *P. affinis* sp. nov., *P. demani* sp. nov. and *P. neglecta* sp. nov. At the same time DE MAN (1920) identified 12 lots of the Siboga material as *P. australiensis*. Five different species excluding *P. australiensis* prove to be included in this material, two of which are new species, *P. neglecta* sp. nov. and *P. sulcata* sp. nov. EDMONDSON (1930) reported a new species, *P. paucirostris*, from Oahu, Hawaiian Islands. The direct examination of the type specimen proves that this species is a synonym of *Processa hawaiensis* (DANA), as already pointed out by CHACE (1962).

The description of *Nika kotiensis* YOKOYA (1933) is short and incomplete, although provided with a figure, and the type is not extant. Recently YOKOYA's unpublished manuscript on Japanese Macrura written in Japanese was received. This manuscript is also rather incomplete but includes descriptions of some Japanese processids. According to it, *Nika kotiensis* proves to be a distinct species, and to have been misidentified with *Processa processa* (BATE).

BARNARD (1947) gave a short description of two South African processids, *P. austroafricana* BARNARD and *P.* cf. *edulis* (RISSO). The examination of those specimens proves both to be valid species. The latter is now adequately treated as *P. barnardi* sp. nov.

In 1958 RICHARDSON and YALDWYN reported an unnamed processid from New Zealand and recently YALDWYN (1971) gave a full description of it under the name *P. moana*. KENSLEY (1969) described and figured a single ovigerous female from the South West Indian Ocean as an undetermined species and showed a great affinity to *P. australiensis*. After the reexamination, the specimen proves to be a new species, *P. sulcata* sp. nov.

In addition, three new species, *P. dimorpha* sp. nov., *P. longirostris* sp. nov. and *P. zostericola* sp. nov. are found from Japan and South Viet Nam.

The specimens from the Indo-West Pacific region referred without any description to the European species, such as *Processa* (*Nica* or *Nika*) *canaliculata* or *edulis* by ORTMANN (1890), PEARSON (1905), BALSS (1914), URITA (1921), MIYAKE (1961) and MIYAKE, SAKAI and NISHIKAWA (1962) could not be assigned with certainty to

any species.

The Indo-West Pacific species of the genus *Processa* are summarized as follows:

Nika aequimana PAULSON, 1875	=	*Processa aequimana* (PAULSON)
Processa australiensis BAKER, 1907	=	*Processa australiensis* BAKER
Processa austroafricana BARNARD, 1947	=	*Processa austroafricana* BARNARD
Processa Coutierei NOBILI, 1904	=	*Processa coutierei* NOBILI
Processa cf. *edulis* BARNARD, 1947	=	*Processa barnardi* sp. nov.
Processa gracilis BAKER, 1907	=	*Processa gracilis* BAKER
Nika Hawaiensis DANA, 1852	=	*Processa hawaiensis* (DANA)
Processa Jacobsoni DE MAN, 1921	=	*Nikoides maldivensis* BORRADAILE
Nika japonica DE HAAN, 1844	=	*Processa japonica* (DE HAAN)
Nika kotiensis YOKOYA, 1933	=	*Processa kotiensis* (YOKOYA)
Nica macrognatha STIMPSON, 1860	=	*Processa macrognatha* (STIMPSON)
Processa moana YALDWYN, 1971	=	*Processa moana* YALDWYN
Processa molaris CHACE, 1955	=	*Processa molaris* CHACE
Processa paucirostris EDMONDSON, 1930	=	*Processa hawaiensis* (DANA)
Nika Processa BATE, 1888	=	*Processa processa* (BATE)
Processa steinii EDMONDSON, 1935	=	*Nikoides steinii* (EDMONDSON)
Processa sp. DE MAN, 1920	=	p.p. *Nikoides sibogae* DE MAN
	=	p.p. *Processa affinis* sp. nov.
	=	p.p. *Processa demani* sp. nov.
	=	p.p. *Processa neglecta* sp. nov.
Processa sp. nov. RICHARDSON and YALDWYN, 1958	=	*Processa moana* YALDWYN
Processa sp. KENSLEY, 1969	=	*Processa sulcata* sp. nov.

The Indo-West Pacific species are readily distinguished from the Atlantic species treated by NOUVEL and HOLTHUIS (1957) and MANNING and CHACE (1971) by the following key. *Processa aequimana* PAULSON reported from the Mediterranean and North Sea by CAROLI (1947), REES and CATLLEY (1949) and others were referred to *Processa parva* HOLTHUIS (NOUVEL and HOLTHUIS, 1957). This key to all the known species of *Processa* is based on the key given by MANNING and CHACE (1971), which has been enlarged and slightly modified.

Key to the species of the genus ***Processa***

1 Third maxilliped without exopod 2
– Third maxilliped with exopod 3
2 Large size, up to 30-40 mm in body length. Rostrum short, triangular in dorsal view. Antennal spine present. Right second pereiopod with 13-22 meral and 41-50 carpal joints. Left second pereiopod with 3-8 meral and 15-19 carpal joints. ..... ***Processa japonica*** (DE HAAN, 1844)
– Small size, 8.5 mm in body length. Rostrum slender. Antennal spine absent, but suborbital angle produced. Second pereiopods subequal in length, with 1 or 2 meral and 6 carpal joints ..... ***Processa molaris*** CHACE, 1955

3 Third maxilliped with rudimental exopod. Rostrum short, not reaching end of eye. Pleuron of fifth abdominal somite pointed posteriorly. Right second pereiopod with 7-9 meral and 15-18 carpal joints. Left second pereiopod with 4-7 meral and 10-14 carpal joints .... ***Processa hawaiensis*** (DANA, 1852)

– Third maxilliped with normal exopod 4

4 Pleuron of fifth abdominal somite with posterolateral spine. Second pereiopod unequal 5

– Pleuron of fifth abdominal somite without distinct posterolateral spine 17

5 Apex of rostrum simple, not bifid. Right second pereiopod with 18-31 meral and 47-65 carpal joints. Left second pereiopod with 6-7 (13) meral and 23-28 carpal joints .... *Processa acutirostris* NOUVEL and HOLTHUIS, 1957 (Eastern Atlantic)

– Apex of rostrum bifid 6

6 Antennal spine usually absent. Rostrum short. Right second pereiopod with 6-9 meral and 14-20 carpal joints. Left second pereiopod with 5-6 meral and 11-13 carpal joints ..... ***Processa australiensis*** BAKER, 1907

– Antennal spine present 7

7 Lateral plate of sixth abdominal somite truncated or blunt triangular process (in *P. macrodactyla* sometimes with spine on upper and lower angles) 8

– Lateral plate of sixth abdominal somite ending in spine or spiniform process .. 12

8. Basicerite without any spine or process 9

– Basicerite with blunt process or spine 10

9 Dactylus of last three pereiopods long, nearly half as long as propodus. Stylocerite pointed. Right second pereiopod with 12-18 meral and 36-43 carpal joints. Left second pereiopod with 1 meral and 16-19 carpal joints .... *Processa macrodactyla* HOLTHUIS, 1952 (West Africa)

– Dactylus of last three pereiopods short, about one-third to one-fourth length of propodus. Stylocerite without outer spine. Right second pereiopod with 10-14 meral and 21-30 carpal joints. Left second pereiopod with 5-7 meral and 10-14 carpal joints..... ***Processa sulcata*** sp. nov.

10 Stylocerite with small spine at outer distal angle. In males carpus and propodus of fourth and fifth pereiopods with a dense coat of short hairs. Right second pereiopod with 13-16 meral and 31-40 carpal joints. Left second pereiopod with 4-6 meral and 15-18 carpal joints .... *Processa fimbriata* MANNING and CHACE, 1971 (Western Atlantic)

– Stylocerite usually without outer spine. In males carpus and propodus of fourth and fifth pereiopods without a dense coat of hairs 11

11 Second pereiopods slightly unequal; merocarpal articulation of right pereiopod reaching, at most, end of antennal scale, with 7-11 meral and 19-25 carpal joints. Left second pereiopod with 5-6 meral and 13-15 carpal joints .... ***Processa zostericola*** sp. nov.

– Second pereiopods strongly unequal; merocarpal articulation of right pereiopod, at least, beyond antennal scale, with 14-20 (22) meral and 38-49 carpal joints. Left second pereiopod with 5-6 (8) meral and 17-18 (20) carpal joints .... *Processa macrophthalma* NOUVEL and HOLTHUIS, 1957 (Western Mediterranean and Gulf of Guinea)

12 Stylocerite unarmed 13

– Stylocerite with spine or spines on anterior margin 15

13 Merocarpal articulation of right second pereiopod not extending beyond antennal

scale. Second pereiopods slightly unequal, right second pereiopod with 6-9 (11) meral and 18-24 carpal joints. Left second pereiopod with 5 meral and 14-15 (17) carpal joints. ..... *Processa robusta* NOUVEL and HOLTHUIS, 1957 (Eastern Atlantic)

– Merocarpal articulation of right second pereiopod extending beyond antennal scale. Second pereiopod strongly unequal 14

14 Antennular peduncle thick and robust. Right second pereiopod with 12-18 (21) meral and 31-45 (49) carpal joints. Left second pereiopod with 5-7 meral and 17-24 carpal joints ..... *Processa edulis* (RISSO, 1816) (Eastern Atlantic)

– Antennular peduncle slender. Right second pereiopod with 10-12 meral and 25-31 carpal joints. Left second pereiopod with 5-6 meral and 15-17 carpal joints ..... ***Processa barnardi*** sp. nov.

15 Stylocerite with row of spinules across anterior margin. Pleuron of fifth abdominal somite with spinule above posterolateral spine. Right second pereiopod with 15-18 meral and 28-40 carpal joints. Left second pereiopod with 5 meral and 20-24 carpal joints ..... *Processa pontica* (SOWINSKY, 1882) (Black Sea)

– Stylocerite with spinule at inner or outer angle but not across anterior margin. Pleuron of fifth abdominal somite lacking supplementary spinule above posterolateral spine. 16

16 Basicerite with process. First pereiopod with arthrobranch. Sternal spines absent. Right second pereiopod with 10-20 meral and 28-65 carpal joints. Left second pereiopod with 5-7 meral and 14-20 carpal joints ..... *Processa intermedia* HOLTHUIS, 1951 (West Africa)

– Basicerite with spine. No arthrobranch on first pereiopods. Spines present on sternum of anterior five abdominal somites. Right second pereiopod with 17 meral and 39-43 carpal joints. Left second pereiopod with 5-6 meral and 16-20 carpal joints ..... *Processa riveroi* MANNING and CHACE, 1971 (Puerto Rico)

17 Second pereiopod equal or subequal in length; carpus less than 15 joints on right side 18

– Second pereiopod unequal in length; carpus more than 17 joints on right side 28

18 Rostrum simple, not bifid at apex 19

– Rostrum bifid at apex 20

19 Rostrum extremely short. Anterior margin of carapace without any spine. Stylocerite without spine. Second pereiopods with 4 or 5 meral and 11 carpal joints. ..... ***Processa macrognatha*** (STIMPSON, 1860)

– Rostrum long, triangular in dorsal view. Suborbital angle pointed. Stylocerite pointed. Second pereiopods equal, with 1 meral and 6 carpal joints ..... ***Processa coutierei*** NOBILI, 1904

20 Lateral plate of sixth abdominal somite without spine (uncertain in *P. moana*) 21

– Lateral plate of sixth abdominal somite with spine 26

21 Rostrum extending slightly beyond eye. Propodus of fifth pereiopod without any spine on posterior margin. Second pereiopods equal, with 1 meral and 13 carpal joints ..... ***Processa moana*** YALDWYN, 1971

– Rostrum long, but not extending beyond eye. Propodus of fifth pereiopod with a few spines on posterior margin 22

22 Antennal spine always absent. Stylocerite obliquely truncated. Rostrum deflexed anteriorly. Second pereiopods with 5 meral and 10-14 carpal joints .....

..... *Processa vicina* MANNING and CHACE, 1971 (Western Atlantic)

– Antennal spine present 23

23 Antennal spine small, sometimes absent. Stylocerite usually without spine, but in some specimens bearing a small spine. Second pereiopods with 3-5 meral and 12-13 carpal joints ..... ***Processa neglecta*** sp. nov.

– Antennal spine always developed. Stylocerite with a spine on outer distal angle 24

24 Propodus of fifth pereiopod with three spines. Rostrum anteriorly deflexed. Apex of telson acute but not produced into a sharp point. Second pereiopods with 4-6, usually 6, meral and 10-15, usually 11, carpal joints .... *Processa parva* HOLTHUIS, 1951 (Eastern Atlantic)

– Propodus of fifth pereiopod with two spines. Rostrum not markedly deflexed. Apex of telson produced into a sharp point 25

25 Second pereiopods with 2-4 meral and 11-13, usually 11, carpal joints .... ***Processa dimorpha*** sp. nov.

– Second pereiopods with 4 meral and 10 carpal joints .... *Processa hemphilli* MANNING and CHACE, 1971 (Florida)

26 Rostrum exceeding beyond end of eye. Basicerite with well developed spine. Second pereiopods equal, with 5-6 meral and 11-12 carpal joints .... ***Processa longirostris*** sp. nov.

– Rostrum as long as or shorter than eye. Basicerite with small spiniform process 27

27 Rostrum normally bifid at apex. Dactylus of fifth pereiopod longer than those of third and fourth pereiopods. Second pereiopods equal, with 1 meral and 9-11 carpal joints ..... ***Processa aequimana*** (PAULSON, 1875)

– Rostral apex unusually bifid; lower tooth much longer than and separated from upper tooth. Dactylus of fourth pereiopod longer than those of third and fifth pereiopods. Right second pereiopod with 3 meral and 14-16 carpal joints. Left second pereiopod with 3 meral and 10-12 carpal joints .... ***Processa demani*** sp. nov.

28 Antennal spine absent 29

– Antennal spine present 30

29 Right second pereiopod with 10-15 meral and 19-29 carpal joints. Left second pereiopod with 3-4 meral and 13-15 carpal joints .... *Processa bermudensis* (RANKIN, 1900) (Western Atlantic)

– Right second pereiopod with about 20 indistinct carpal joints. Left second pereiopod with about 10 indistinct carpal joints .... ***Processa processa*** (BATE, 1888)

30 Second pereiopods slightly unequal, merocarpal articulation of right pereiopod not extending beyond antennal scale 31

– Second pereiopods strongly unequal, merocarpal articulation of right pereiopod overreaching antennal scale 33

31 Stylocerite obliquely truncated. Right second pereiopod with 6 meral and 19 carpal joints. Left second pereiopod with 5 meral and 15 carpal joints .... ***Processa affinis*** sp. nov.

– Stylocerite pointed at outer distal angle 32

32 Rostrum extending beyond eye. Endopod of first male pleopod with angular apex. Right second pereiopod with 6-8 (11) meral and 17-21 (30) carpal joints. Left second pereiopod with 5-6 meral and 14-17 carpal joints .....

..... *Processa elegantula* NOUVEL and HOLTHUIS, 1957 (Eastern Atlantic)

– Rostrum not extending beyond eye. Endopod of first male pleopod broadly rounded apically. Right second pereiopod with 7 meral and 23 carpal joints. Left second pereiopod with 5 meral and 15 carpal joints .... *Processa wheeleri* LEBOUR, 1941 (Western Atlantic)

33 Lateral plate of sixth abdominal somite pointed (uncertain in *P. gracilis*) ... 34

– Lateral plate of sixth abdominal somite not pointed 36

34 Antennular peduncle with distal two segments subequal in length. Right second pereiopod with about 40 carpal joints. Left second pereiopod with about 20 carpal joints, merus of these pereiopods with several joints .... ***Processa gracilis*** BAKER, 1907

– Third segment of antennular peduncle less than three-fifths length of second segment 35

35 Anterior margin of stylocerite evenly concave from inner angle to lateral spine. Antennal scale scarcely overreaching antennular peduncle. Right second pereiopod with 21-22 meral and 45-46 carpal joints. Left second pereiopod with 5 meral and 18-21 carpal joints .... *Processa profunda* MANNING and CHACE, 1971 (Gulf of Mexico)

– Anterior margin of stylocerite straight or slightly sinuous, not curving from inner angle to lateral spine. Antennal scale overreaching antennular peduncle by length of distal segment. Right second pereiopod with 16-24 (27) meral and 40-62 carpal joints. Left second pereiopod with 4-8 (11) meral and 18-22 (28) carpal joints .... *Processa mediterranea* (PARISI, 1915) (Eastern Atlantic)

36 Right second pereiopod with 9-12 meral and 21-27 carpal joints. Left second pereiopod with 5-7 meral and 16-17 carpal joints .... ***Processa kotiensis*** (YOKOYA, 1933)

– Carpus of right second pereiopod subdivided into more than 30 joints 37

37 Basicerite of antenna without lateral spine. Anterior margin of stylocerite strongly sloping laterally. First pereiopod with arthrobranch. Right second pereiopod with 9 meral and (20) 33-36 carpal joints. Left second pereiopod with 4 meral and 17 carpal joints .... *Processa borboronica* HOLTHUIS, 1952 (Gulf of Guinea)

– Basicerite of antenna with lateral spine. Anterior margin of stylocerite straight or sinuous, not markedly sloping laterally. First pereiopod without arthrobranch 38

38 Stylocerite with strong lateral spine. Carpus of right second pereiopod with fewer than 40 joints 39

– Stylocerite with lateral tubercles. Carpus of right second pereiopod more than 40 joints 40

39 Antennal scale slightly overreaching antennular peduncle. Right second pereiopod with 2 or more ischio, 14-21 meral and 33-37 carpal joints. Left second pereiopod with 1 or 2 ischio, 5-8 meral and 14-21 carpal joints .... ***Processa austroafricana*** BARNARD, 1947

– Antennal scale scarcely overreaching antennular peduncle. Right second pereiopod with 1 ischio, 14-18 meral and 30-35 carpal joints. Left second pereiopod with 1 ischio, 5 meral and 15-19 carpal joints .... *Processa canaliculata* LEACH, 1815 (Eastern Atlantic)

40 Fifth pereiopod with propodus four times as long as dactylus and merus longer

than carpus. Rostrum straight dorsally. Right second pereiopod with 18-20 meral and 44-47 carpal joints. Left second pereiopod with 3-5 meral and 17-18 carpal joints ..... *Processa guyanae* HOLTHUIS, 1959 (Western Atlantic)

– Fifth pereiopod with propodus 6-7 times as long as dactylus and merus shorter than carpus. Rostrum convex dorsally. Right second pereiopod with 18-28 meral and 48-69 carpal joints. Left second pereiopod with 5-9 meral and 17-26 carpal joints .... *Processa tenuipes* MANNING and CHACE, 1971 (Western Atlantic)

Processa aequimana (PAULSON, 1875)

(Figs. 10 *a-j* and 11 *a-g*)

Nika aequimana PAULSON, 1875, p. 97, pl. 14 fig. 6, 6a.
Processa aequimana NOBILI, 1906, p. 79.
Processa aequimana DE MAN, 1920, p. 198 (list).
Processa sp. p.p. DE MAN, 1920, p. 203.
not *Processa aequimana* DE MAN, 1922, p. 44, pl. 4 fig. 19-19f (= *Processa demani* sp. nov.).
Processa aequimana GURNEY, 1937, p. 87, pl. 1 figs. 1-10, pl. 2 figs. 33-35, pl. 3 figs. 36-37.
Processa aequimana BARNARD, 1955, p. 44.
Processa aequimana HOLTHUIS, 1958, p. 34.
Processa aequimana MANNING and CHACE, 1971, p. 13 (list).

Japan

Hishio, Mukaishima Island, Sea of Setonaikai, August 24, 1961 – 1 ovig. ♀ (ZLKU No. 13907)

Siboga Expedition

Station 4, Anchorage off Djangkar, Java, 7°42'S, 114°12.6'E, depth 9 m, bottom coarse sand, March 9, 1899 – 1 ovig. ♀ (AM)

South Viet Nam

Station 21, Bay of Nha Trang, depth 2m, bottom sand, January, 8, 1960, V. A. GALLARDO leg.- 1 ♀ (RMNH No. D 17049)

Station 23p, Bay of Nha Trang, depth 7 m, bottom muddy sand, January, 8, 1960, V. A. GALLARDO leg. - 1 ♂ (RMNH No. D 17050)

Station 24, Bay of Nha Trang, depth 8 m, bottom muddy sand, January, 8, 1960, V. A. GALLARDO leg. - 1 ♂ (RMNH)

Station 94 II, Bay of Nha Trang, depth 10 m, bottom muddy sand, February 5, 1960, V. A. GALLARDO leg. - 1 ovig. ♀, 1 ♀ (RMNH No. D17051)

South Africa

Near Morumbene estuary, *Zostera* at Linga Linga, Moçambique, 1954, University of Cape Town - 1 ovig. ♀ (SAM No. MDR 41 H).

Definition Rostrum narrow, slender, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite rounded. Lateral plate of sixth somite with spine. Stylocerite truncated. Basicerite with small spiniform process. Third maxilliped with exopod. Second pereiopod equal, with 1 meral and 9-11 carpal joints. Propodus of fifth pereiopod without any spine on posterior margin.

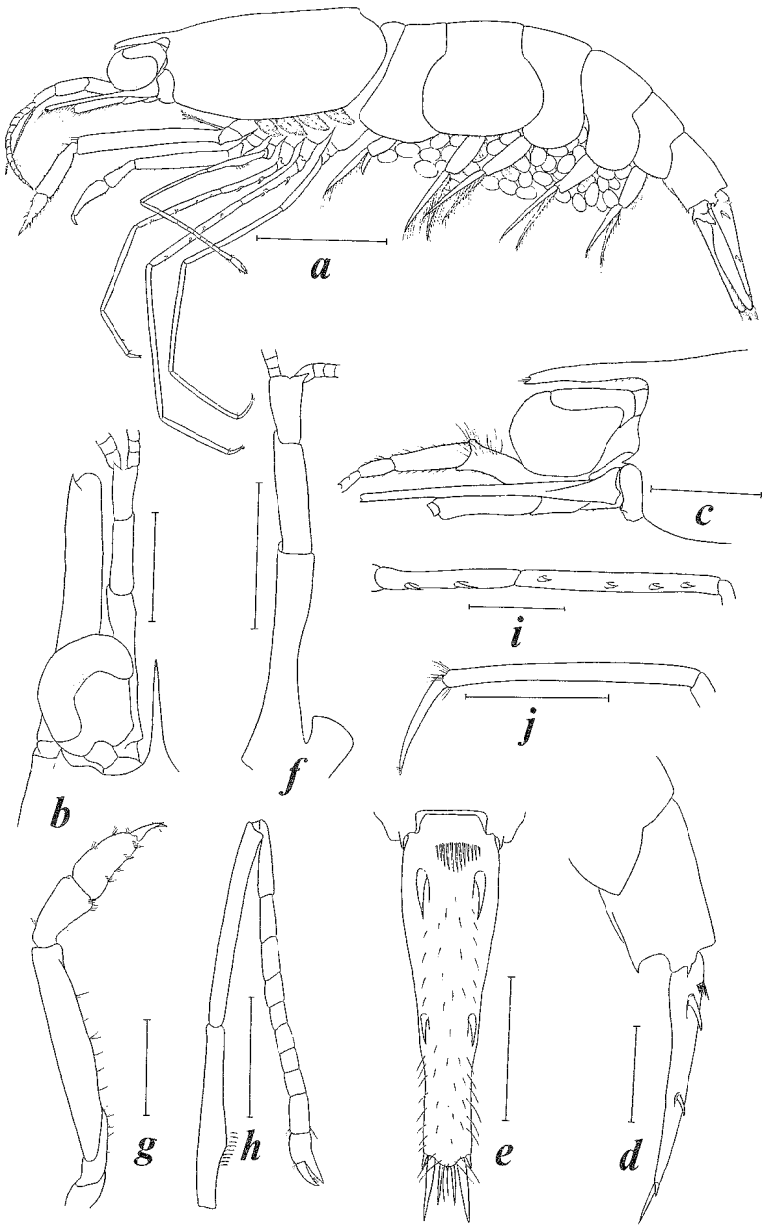

Fig. 10. *Processa aequimana* PAULSON, ovigerous female from Sea of Setonaikai.
a, animal in lateral view, *b*, anterior part of body, *c*, same in lateral view, *d*, posterior part of abdomen, *e*, telson, *f*, antennular peduncle, *g*, right first pereiopod, *h*, right second pereiopod, *i*, merus and ischium of third pereiopod, *j*, dactylus and propodus of fifth pereiopod. Scale for *a* represents 3.0 mm and scales for *b-j* represent 1.0 mm.

Description Body slender (Fig. 10 *a*). Rostrum slender, falling short of or as long as end of eye; apex bifid, lower tooth rather longer than upper tooth (Figs. 10 *c*, 11 *b*). Carapace smooth, 3.4-3.8 times as long as rostrum; small but acute antennal spine present; suborbital angle hardly pointed; postorbital groove absent (Figs. 10 *b*, 11 *a*).

First five abdominal pleura rounded posteriorly; pleuron of sixth somite sharply pointed; lateral plate of sixth somite bearing a spine (Figs. 10 *d*, 11 *c*, *d*). Telson about 1.5 times as long as sixth somite, with two pairs of dorsal spines; anterior pair placed near base of sixth somite, posterior pair situated in middle of telson; posterior margin with a tiny median spine, flanked by three pairs of spines (Fig. 10 *e*).

Eye large, depressed. Antennular peduncle longer than antennal scale; basal segment longer than distal two segments combined; stylocerite obliquely truncated; inner distal corner quadrate, outer rounded; third segment about half as long as second (Figs. 10 *f*, 11 *a*); outer flagellum small and feebly thickened in basal 7-10 joints, of these distal few joints bearing fine setae on ventral surface in female and all thickened joints setose in male. Antennal scale about 6 times as long as broad; outer spine falling short of lamellar part; basicerite with a small spiniform process on outer inferior corner; carpocerite reaching distal third of antennal scale (Figs. 10 *c*, 11 *b*).

Third maxilliped reaching with entire distal segment beyond antennal scale; antepenultimate segment slightly longer than distal two segments combined, with short exopod. First pair of pereiopods rather slender, just reaching to or slightly shorter than end of antennal scale. Right first pereiopod chelate (Fig. 10 *g*), slightly stouter than left pereiopod (Fig. 11 *e*). Second pair of pereiopods equal in length, merocarpal articulation reaching rostral apex; merus and ischium subequal in length, and neither clearly subdivided; carpus with 9-11 joints; chela very small, palm as long as fingers (Fig. 10 *h*). Third pereiopod reaching with dactylus and propodus or these two segments and one-fourth length of carpus beyond antennal scale; ischium with two spines on outer posterior surface; merus with four or five spines on outer surface (Fig. 10 *i*). Fourth pereiopod reaching with dactylus, propodus and half carpus beyond antennal scale; ischium with two spines, merus with usually four outer spines, dactylus variable in length, but not so long, two-fifths to one-fourth length of propodus (Fig. 11 *f*). Fifth pereiopod reaching with dactylus and half propodus to entire propodus beyond antennal scale; ischium, merus and propodus without any spine; dactylus longer than those of third and fourth pereiopods, about half as long as propodus (Figs. 10 *j*, 11 *g*).

Endopod of first male pleopod deeply notched at apex, inner lobe with some retinacula. Abdominal sternites without any spine or process. Uropod longer than telson; outer margin of exopod straight, ending in two spines; diaeresis well developed. Eggs small and numerous, 0.35 x 0.45 mm in diameter.

Remarks The following eight species of the Indo-West Pacific region are characterized by the presence of an exopod on the third maxilliped, the rounded pleuron of the fifth abdominal somite and the equal or subequal second pair of pereiopods; *Processa aequimana* (PAULSON), *P. coutierei* NOBILI, *P. demani* sp. nov., *P. dimorpha* sp. nov., *P. longirostris*

sp. nov., *P. macrognatha* (STIMPSON), *P. moana* YALDWYN and *P. neglecta* sp. nov.

Of these *P. coutierei* is separated from *P. aequimana* by having the triangular rostrum and six carpal joints of the second pair of pereiopods, and *P. macrognatha* is distinguished by the short and simple rostrum and no spine on the anterior margin of the carapace. *P. moana*, known only from New Zealand waters, has a long rostrum, which extends slightly beyond the eye and 13 carpal joints of the second pereiopods. The remaining five species are very closely related to one another.

PAULSON's (1875) original description of *Nika aequimana* from the Red Sea is short, but some important characters were mentioned or figured, such as the long rostrum, the short and broad stylocerite, the presence of an antennal spine and 11 carpal joints of the second pair of pereiopods. GURNEY (1937) examined several specimens of *P. aequimana* from the Red Sea and mentioned the following features; the rounded lateral process of the sixth abdominal somite, the pointed pleuron of the sixth somite, the short outer spine of the antennal scale, 4 or 5 spines on the merus of the third and fourth pereiopods, no spine on the propodus of the fifth pereiopod and so on. There seem to be no distinct discrepancy between PAULSON's and GURNEY's descriptions. The features of the present material of *P. aequimana* agree well with those of PAULSON's (1875) and GURNEY's (1937) descriptions of that species, except for the presence of a small spine of the lateral plate of the sixth somite, which is obscure even under a binocular microscope, though constantly present.

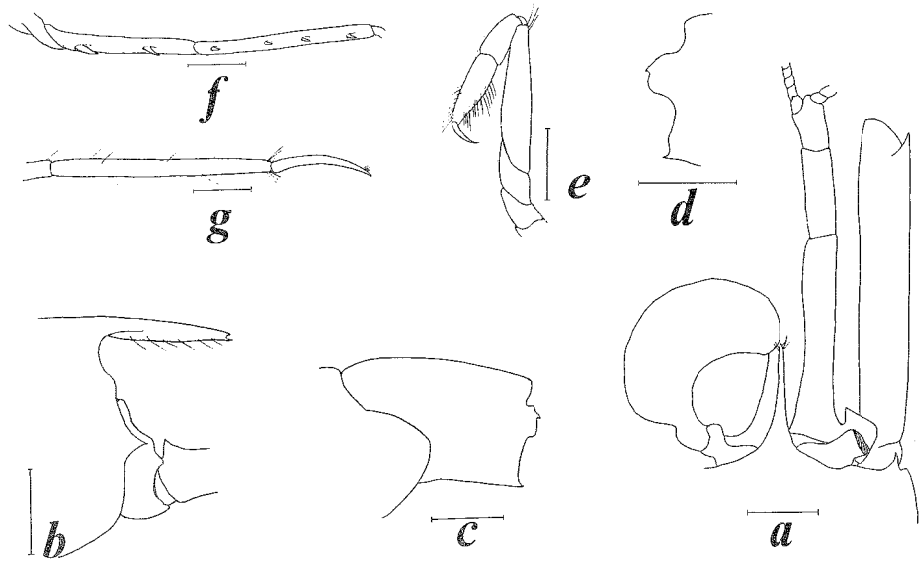

Fig. 11. *Processa aequimana* PAULSON, *a, b, d, f, g,* female (3.4 mm in carapace length), *c, e,* female (2.4 mm) from Bay of Nha Trang.

a, anterior part of body, *b,* same in lateral view, *c,* fifth and sixth abdominal somites, *d,* posterior margin of sixth abdominal somite, *e,* left first pereiopod, *f,* merus and ischium of third pereiopod, *g,* dactylus and propodus of fifth pereiopod. Scales represent 0.5 mm.

Meanwhile DE MAN (1920) described several specimens of the Siboga Expedition belonging to some species under the name *Processa* sp. and later DE MAN (1922) identified two of them as *P. aequimana*, furthermore including in this species six specimens from station 181. Fortunately these Siboga specimens could be examined; only a single ovigerous female from station 4 proves to belong to the true *P. aequimana* and the rest, viz., specimens from stations 104 and 181, differ from that species. These specimens and a single ovigerous female from station 96 referred by DE MAN (1920) to *Processa* sp., have not been treated adequately so far, and therefore are described herewith as a new species, *P. neglecta* sp. nov.

P. aequimana can be separated from *P. neglecta* by having an acute point on the sixth abdominal pleuron, a small spine on the lateral plate of the sixth abdominal somite, a short outer spine on the antennal scale, 9-11 carpal joints in the second pereiopods and no spine on the posterior margin of the propodus of the fifth pereiopod.

The remaining three species, *P. demani, P. dimorpha* and *P. longirostris* differ from *P. aequimana* in having two spines on the propodus of the fifth pereiopod and the pointed stylocerite. Moreover *P. demani* possesses an unusually bifid rostrum and a slightly unequal subdivision of the carpus of the second pereiopods. *P. dimorpha* has no spine on the lateral plate of the sixth abdominal somite and the second and third segments of the antennular peduncle are subequal, and finally *P. longirostris* bears a long rostrum, which exceeds slightly the eye, and a well developed spine on the basicerite of the antennal peduncle.

Three Atlantic species also have an equal second pair of pereiopods; *P. hemphilli* MANNING and CHACE, *P. parva* HOLTHUIS and *P. vicina* MANNING and CHACE. *P. aequimana* is distinguished from *P. hemphilli* and *P. parva* by the presence of a spine on the lateral plate of the sixth abdominal somite and in having no spine on the posterior margin of the propodus of the fifth pereiopod. *P. vicina* differs from *P. aequimana* in lacking an antennal spine.

CAROLI (1947), REES and CATLLEY (1949) and others have reported *P. aequimana* from the Mediterranean Sea and North Sea, but their material was referred to *P. parva* HOLTHUIS by NOUVEL and HOLTHUIS (1957).

Size The type specimen is an ovigerous female, 4.5 mm in carapace length and 1.5 mm in rostrum length (PAULSON, 1875). GURNEY's (1937) specimens are about 18 mm in length. A single specimen from Eylath, Israel is much larger, about 30 mm in length (HOLTHUIS, 1958). The ovigerous females examined are 4.3 and 4.6 mm in carapace length, and 15 and 16 mm in entire length.

Distribution This is a littoral species: Mukaishima Is., Sea of Setonaikai, Japan (present publication), Bay of Nha Trang, South Viet Nam, 2-10 m (present publication), Anchorage off Djangkar, Java, 9 m (DE MAN, 1920; present publication), Red Sea (PAULSON, 1875; NOBILI, 1906), Ghardaqa, Red Sea, shallow reef-flat (GURNEY, 1937), Eylath, Israel (HOLTHUIS, 1958), Mormbene estuary, Moçambique, *Zostera* (BARNARD, 1955; present publication).

Processa affinis sp. nov.

(Fig. 12 *a, b*)

Processa sp. p.p. DE MAN, 1920, p. 203, pl. 17 figs. 52, 52 a-i.
Processa processa DE MAN, 1922, p. 44.

Siboga Expedition

Station 193, Sanana Bay, east coast of Sanana, Soela Islands, depth 22 m, bottom mud, September 13-14, 1899 – 1 ♀ (holotype, AM)

Definition Rostrum narrow, slender, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite rounded posteriorly. Lateral plate of sixth somite truncated. Stylocerite obliquely truncated. Basicerite without spine. Third maxilliped with exopod. Right second pereiopod with 6 meral and 19 carpal joints, left second pereiopod with 5 meral and 15 carpal joints.

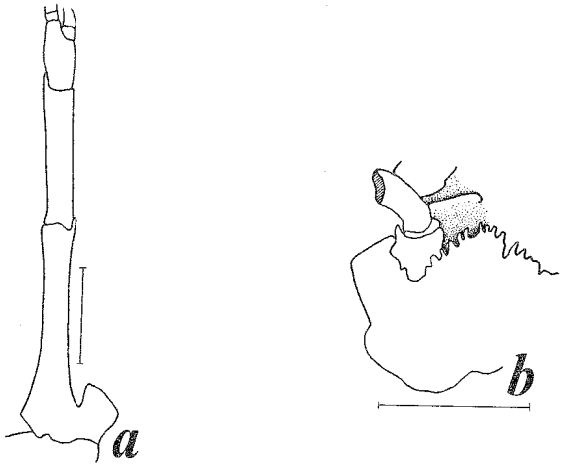

Fig. 12. *Processa affinis* sp. nov., holotype, female (5.0 mm in carapace length) from Soela Islands.

a, antennular peduncle, *b*, fifth thoracic sternite. Scales represent 1.0 mm.

Remarks The present specimen was well described and excellently figured by DE MAN (1920), who did not identify it with certainty, but considered it belonging to *Processa processa* (BATE). Two years later, DE MAN (1922) confirmed his earlier statement by considering the specimen belonging to *P. processa*. However, *P. processa* was not adequately known at that time. Recently the type of *Nika processa* BATE reexamined by Dr. INGLE of the British Museum (Natural History) and some discrepancies between BATE's figure of *Nika processa* and its type specimen were revealed. The specific status of the true *P. processa* is mentioned in account for that species. The most remarkable characters of the present specimen distinguishing it from *P. processa* to which it is very closely related, are the presence of the antennal spine, the slightly unequal second

pair of pereiopods and the unusual shape of the fifth thoracic sternum (Fig. 12 *b*). Although two Atlantic species, *P. elegantula* NOUVEL and HOLTHUIS and *P. wheeleri* LEBOUR bear an antennal spine and slightly unequal second pereiopods, the present specimen differs from these two species in having an obliquely truncated stylocerite (Fig. 12 *a*), which is pointed at outer distal angle in the latter two species. Thus it can not be referred to any described species of this genus and is treated herewith a new species *Processa affinis* sp. nov.

Size The holotype is 5.0 mm in carapace length and 1.9 mm in rostrum length.

Distribution The species is only recorded from the type locality, Soela Islands, 22 m (DE MAN, 1920; present publication).

Processa australiensis BAKER, 1907

(Fig. 13 *a-m*)

Processa australiensis BAKER, 1907, p. 185, pl. 25 fig. 2-2e.
Processa australiensis p.p. DE MAN, 1920, p. 199, pl. 17 fig. 51-51j (not 51k-51m=*Processa sulcata* sp. nov.)
Processa australiensis HALE, 1927, p. 61, fig. 57.
Processa australiense MCNEILL and WARD, 1930, p. 359.
Processa australiensis ESTAMPADOR, 1937, p. 479.
not *Processa australiensis* GURNEY, 1937, p. 88, pl. 1 figs. 11-15.
Processa australiensis JOHNSON, 1961, p. 54.
Processa australiensis MANNING and CHACE, 1971, p. 13 (list).

Siboga Expedition

Station 71, Makassar, up to 32 m, bottom mud, sand with mud, coral, May 10–June 7, 1899 – 2 ovig. ♀♀ (AM)
Station 89, Pulu Kaniungan Ketjil, reef, June 21, 1899 – 1 ovig. ♀ (AM)
Station 96, South-east side of Pearl Bank, Sulu Archipelago, depth 15 m, lithothamnion, June 27, 1899 – 1 ovig. ♀ (AM)
Station 99, 6°07.5'N, 120°26.0'E, Anchorage of North Ubian, depth 16-23 m, lithothamnion, June 28-30, 1899 – 2 spp. (AM)
Station 109, Anchorage off Pulu Tongkil, Sulu Archipelago, depth 13 m, lithothamnion, July 5-6, 1899 – 1 ovig. ♀, 1 ♀ (AM)
Station 258, Tual-anchorage, Kei Islands, depth 22 m, bottom lithothamnion, sand and coral, December 12-16, 1899 – 1 ♂, 1 ♀ (AM)
Station 273, Anchorage off Pulu Djedan, east coast of Aroe Islands, depth 13 m, bottom sand and shells, December 23-26, 1899 – 1 ovig. ♀ (AM)
Station 315, Anchorage east of Sailus Besar, Paternoster Islands, up to 36 m, bottom coral and lithothamnion, February 17-18, 1900 – 1 ovig. ♀ (AM)

East Africa

Baie Ternay, Mahe, Seychelles, coral rocks, depth 70 feet, August 29, 1891, NVC POLUNIN leg. – 1 ♀ (RMNH)

Definition Rostrum narrow, short, apex bifid. Antennal angle more or less produced but usually not spiniform. Pleuron of fifth abdominal somite pointed posteriorly. Lateral plate of sixth abdominal somite not pointed. Stylocerite truncated. Basicerite with blunt process on lower distal angle. Third maxilliped with well developed exopod. Right second pereiopod with 6-9 meral and 14-20 carpal joints, left second pereiopod with 5-6 meral and 11-13 carpal joints. Propodus of fifth pereiopod with 7-8 spines on posterior margin.

Remarks The species described and figured by BAKER (1907) and DE MAN (1920) and characterized by the absence of the antennal spine, the pointed pleuron of the fifth abdominal somite and the subequal second pair of pereiopods. There are two allied species, both new to science, *P. sulcata* sp. nov. and *P. zostericola* sp. nov., which have been confused with or misidentified as *P. australiensis.* These three species are separated from one another by the following characters.

(1) The rostrum is short, not reaching the base of the cornea in *P. australiensis*, but it is moderate in length, extending to the base of the cornea in the other two species. (2) In *P. australiensis* the postorbital groove is absent, and sometimes the suborbital angle is slightly elevated in large specimens, while in the other two species a distinct postorbital groove is present. (3) The antennal spine is usually absent in *P. australiensis,* while a developed antennal spine is present in the other two species. (4) The merus of the third and fourth pereiopods is armed with two or three, mostly two, outer spines in *P. australiensis* and three or four spines in the other two species. (5) The right second pereiopod bears 6-9 meral joints and 14-20 carpal joints in *P. australiensis*, but 7-11 meral and 19-25 carpal joints in *P. zostericola* and 10-14 meral and 24-30 carpal joints in *P. sulcata*. (6) The basicerite of the antennal peduncle is armed with a blunt process on the lower distal angle in *P. australiensis* and *P. zostericola* but is entirely smooth in *P. sulcata.*

After reexamining the Siboga material, which was referred to *P. australiensis* by DE MAN (1920), some specimens prove not to belong to that species. As mentioned by DE MAN (1920) two specimens from station 7 have a developed antennal spine, a distinct postorbital groove, an obliquely truncated stylocerite and a smooth basicerite of the antennal peduncle. They prove to be identical with *P. sulcata* sp. nov. described later. The other four specimens from stations 40, 66 and 258 are readily separated from both *P. australiensis* and *P. sulcata* by the rounded pleuron of the fifth abdominal somite. Of these, two specimens from station 40 are very small and immature and be distinguished from each other by the length of the second pereiopods. The smaller specimen belongs to *P. molaris* CHACE, as it shows the peculiar rostrum, and the other specimen is too small to be identified certainly. A single ovigerous female from station 66 is very probably *P. macrognatha,* because of a very short rostrum and absence of the antennal spine. A male specimen from station 258 is rather damaged, but probably belongs to *P. neglecta* sp. nov.

GURNEY (1937) gave brief notes on differences between his specimens from the

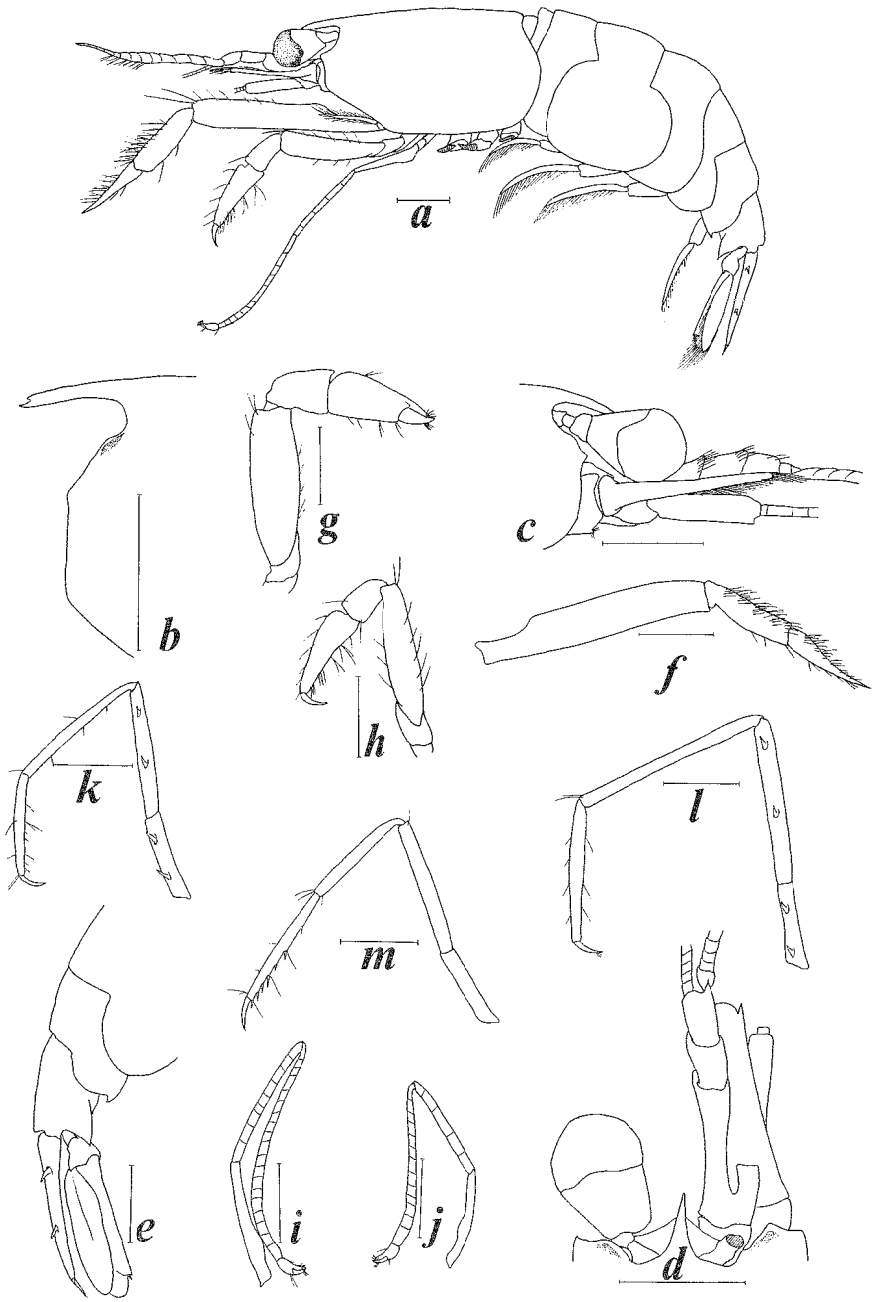

Fig. 13. *Processa australiensis* BAKER, *a-c, e,* ovigerous female (3.3 mm in carapace length), *d, f-m,* ovigerous female (3.0 mm) from Makassar.

a, animal in lateral view, *b,* anterior part of carapace, *c,* anterior part of body, *d,* same in dorsal view, *e,* posterior part of abdomen, *f,* third maxilliped, *g,* right first pereiopod, *h,* left first pereiopod, *i,* right second pereiopod, *j,* left second pereiopod, *k,* third pereiopod, *l,* fourth pereiopod, *m,* fifth pereiopod, Scales represent 1.0 mm.

Arabia Sea and DE MAN's (1920) description, such as the longer and more subdivided second pereiopods and the greater number of spines on the merus of the third and fourth pereiopods. As mentioned above, his specimens may be referred to *P. sulcata* rather than to *P. australiensis.*

On the contrary, *P. australiensis* shows some morphological variations. For example, in an ovigerous female from station 275 (see DE MAN, 1920, pl. 17 fig. 51 and 51a*) the antennal angle is produced into an acute spine and moreover a shallow indistinct postorbital groove is observed, though the latter is not indicated in his figure, and the carpal subdivision of the right second pereiopod is rather numerous. A male from station 258 bears also a small antennal spine. However, they are apparently distinguished from the specimens from station 7, which is referred to *P. sulcata,* by the short rostrum, the smooth basicerite of the antennal peduncle and the carpal subdivision of the right second pereiopod. These variations seem to be caused by the growth rate, as these two specimens are the largest individuals of both sexes examined.

A single specimen from the Seychelles is a small female, which though entirely mutilated, represents its specific characters well, such as the short rostrum, no antennal spine, the pointed pleuron of the fifth abdominal somite and so on.

Size The carapace length is 2.9-3.9 mm in ovigerous females and 2.1-2.5 mm in males. The present material is much smaller than BAKER's type which was 6 mm in carapace length.

Distribution South Australia (BAKER, 1907; HALE, 1927), Kurnell, Botany Bay, New S. Wales, between tide marks (MCNEILL and WARD, 1930), Philippines (ESTAMPADOR, 1937), Singapore (JOHNSON, 1961), Pulu Tongkil, Sulu Archipelago, 13 m (DE MAN, 1920; present publication), North Ubian, Sulu Archipelago, 16-32 m (DE MAN, 1920; present publication), Pearl Bank, Sulu Archipelago, 15 m (DE MAN, 1920; present publication), Pulu Kaniungan Ketjill, off E. Boreno, reef (DE MAN, 1920; present publication), Makassar, up to 32 m (DE MAN, 1920; present publication), E. of Sailus Besar, Paternoster Is., up to 36 m (DE MAN, 1920; present publication), Tual, Kei Islands, 22 m (DE MAN, 1920; present publication), off Pulu Djedan, Aroe Is., 13 m (DE MAN, 1920; present publication), Mahe, Seychelle Is., 70 ft (present publication).

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* There are two figures 52a, and no 51a in DE MAN's plate 17, one being in the upper right and the other being in the bottom center. Both figure the rostrum and the anterior part of the carapace. The upper right figure shows a long rostrum and a well developed antennal spine, which is very probably the true 52a. The figure of the bottom center, on the other hand, shows a short rostrum and a small antennal spine, which characters agree very well with the ovigerous female from station 275. The number 52a of the latter figure, therefore, seems to be a typographical error for 51a.

Processa austroafricana BARNARD, 1947

(Fig. 14 *a-g*)

Processa canaliculata p.p. BALSS, 1925, p. 294.
Processa austroafricana BARNARD, 1947, p. 386.
Processa austroafricana BARNARD, 1950, p. 715, fig. 133 a-d (synonymy).
Processa austroafricana BARNARD, 1955, p. 43 (key).
Processa austroafricana MANNING and CHACE, 1971, p. 13 (list).

South Africa

Off Great Fish Point Lighthouse, South Africa, depth 30 fms.-16 spp. (SAM No. A 3272)

Definition Rostrum narrow, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite pointed but not spiniform. Lateral plate of sixth abdominal somite without spiniform process. Stylocerite pointed. Basicerite with a spine on anterior margin. Third maxilliped with well developed exopod. Right second pereiopod with 14-21 meral and 33-37 carpal joints, left second pereiopod with 5-8 meral and 14-21 carpal joints. Propodus of fifth pereiopod with two spines on posterior margin.

Remarks The species is described and figured in detail by BARNARD (1947 and 1950). It is related to *P. gracilis* BAKER from South Australia and *P. canaliculata* LEACH from the Eastern Atlantic. It differs from *P. gracilis* in having the third segment of the antennular peduncle short, being half as long as the second (Fig. 14 *b*).

BARNARD (1950) compared *P. austroafricana* to the description and figure of *P. canaliculata* given by LEBOUR (1936). According to NOUVEL and HOLTHUIS (1957), LEBOUR's specimens were referred to *P. mediterranea* (PARISI), though ALLEN (1961) treated *P. mediterranea* as a synonymy of *P. canaliculata* based upon the material from Northumberland, England. The South African species is more closely related to *P. canaliculata* than *P. mediterranea,* because *P. canaliculata* is distinguished from *P. mediterranea* by the absence of the spine on the lateral plate on the sixth abdominal somite which is entirely absent in *P. austroafricana,* too (Fig. 14 *c*). Through the courtesy of Dr. LEVINSOHN of the Tel Aviv University, ten specimens of *P. canaliculata* collected from off Cham Junis, South of Gaza at a depth of 48 fms could be examined. The specific status of *P. canaliculata* is decided by these specimens and the description given by NOUVEL and HOLTHUIS (1957).

The following differences between them are revealed.

(1) The body and appendages of *P. austroafricana* are stouter than those of *P. canaliculata.* (2) In *P. austroafricana* the antennal scale extends just to or a little beyond the end of the antennular peduncle (Fig. 14 *b*), while in *P. canaliculata* it is slightly shorter than the antennular peduncle. (3) The propodus of the fifth pereiopod is about 2.5 times as long as the dactylus in *P. austroafricana* (Fig. 14 *g*) but more than 3 times in *P. canaliculata.* (4) The subdivision of the segments of the second pereiopods is rather different in these species. In *P. austroafricana* the ischium

of the right pereiopod is composed of two or more, the merus is composed of 14-21 and the carpus is composed of 33-37 joints (Fig. 14 *e*); the ischium of the left pereiopod is composed of 1 or 2, the merus of 5-8 and the carpus of 14-21 joints (Fig. 14 *f*). In *P. canaliculata* the ischium of the right pereiopod is undivided, the merus is subdivid-

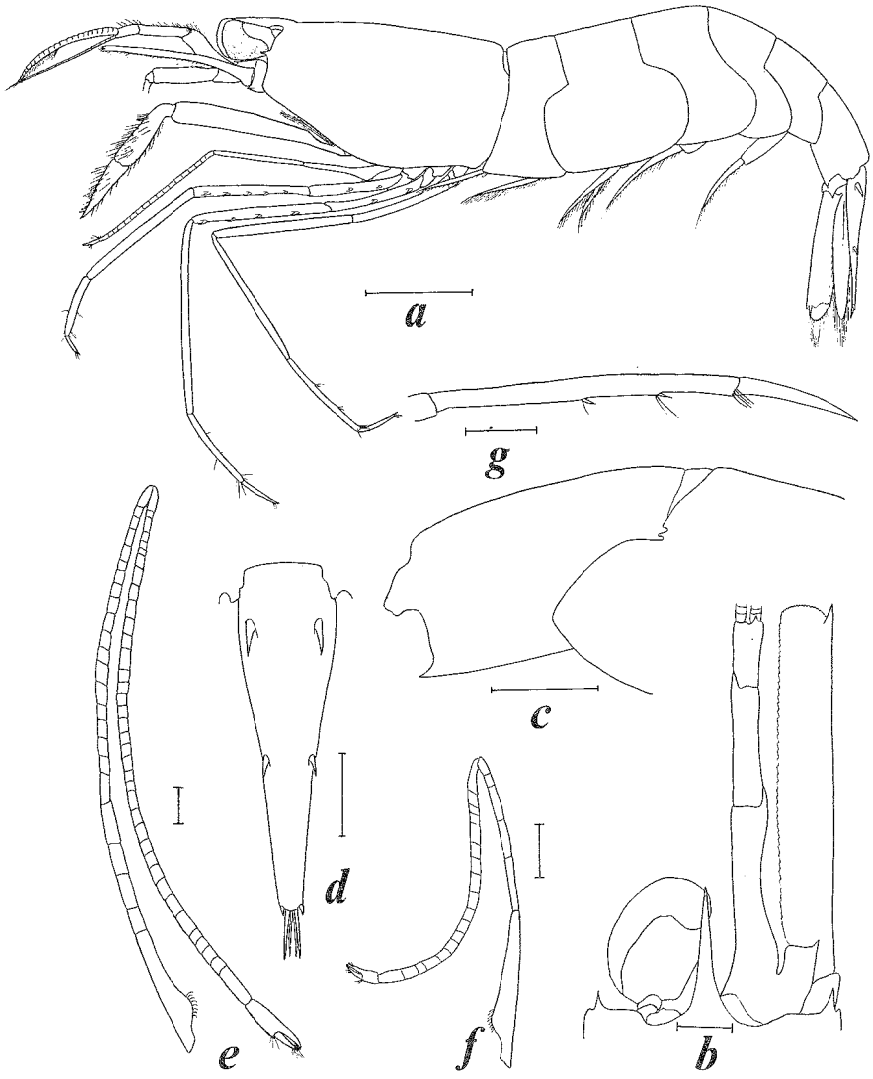

Fig. 14. *Processa austroafricana* BARNARD, ovigerous females (7.0-8.7 mm in carapace length) from South Africa.

a, animal in lateral view, *b*, anterior part of body, *c*, fifth and sixth abdominal somites, *d*, telson, *e*, right second pereiopod, *f*, left second pereiopod, *g*, dactylus and propodus of fifth pereiopod. Scale for *a* represents 4.0 mm and scales for *b-g* represent 1.0 mm.

ed into 14-18 and the carpus into 30-35 joints; the ischium of the left pereiopod is undivided, the merus is subdivided into 5 and the carpus into 15-19 joints.

Size The carapace length of ovigerous females varies from 7.0 to 8.7 mm. Length up to 38 mm (BARNARD, 1947 and 1950).

Distribution After BARNARD (1950), off Cape St. Blaize, 40 fms, off Knysna, 30 fms, Algoa Bay, 10-16 fms (STEBBING, 1905 and 1910); Cape Infanta and St. Sebastian Bay, 61 and 72 m (ODHNER, 1923); off Cape Agulhas, 120-126 m (BALSS, 1925); Agulhas Bank from Cape Agulhas to Algoa Bay and Great Fish Point, 20-26 fms (BARNARD, 1947 and 1950; present publication)

Processa barnardi sp. nov.

(Figs. 15 *a-m* and 16 *a-d*)

Processa cf. *edulis* BARNARD, 1947, p. 386.
Processa cf. *edulis* BARNARD, 1950, p. 178, fig. 133 e-g.
Processa cf. *edulis* BARNARD, 1955, p. 43 (key).

South Australia

St. Vincent Gulf, South Australia, H. M. HALE leg. – 1 ♂ (paratype, RMNH No. D 7244).

Arabian Sea

Monora Island, Coastal area of Northern Arabian Sea, West Pakistan, May, 1964 – 1 ovig. ♀; December 1, 1969 – 1 sp. (University of Karachi)

South Africa

33°50'S, 25°46'E, depth 20 fms. – 1 ovig. ♀ (holotype, SAM No. A 1114)

Definition Rostrum narrow, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite with spine. Lateral plate of sixth abdominal somite with long spine. Stylocerite unarmed. Basicerite of antennal peduncle with rounded process on inferior margin. Third maxilliped with well developed exopod. Right second pereiopod with 10-12 meral and 25-31 carpal joints, left second pereiopod with 5-6 meral and 15-17 carpal joints. Propodus of fifth pereiopod with 7-8 spines on posterior margin.

Description Body robust (Fig. 15 *a*). Rostrum rather shorter than eye; apex bifid. Carapace smooth, with a shallow postorbital groove; antennal spine acutely pointed and separated from the suborbital angle (Fig. 16 *a*).

First four abdominal somite rounded both dorsally and posteriorly. Pleura of fifth and sixth abdominal somites acutely pointed posteriorly. Lateral plate of sixth somite with a long spine (Figs. 15 *b*, 16 *c*). Telson 1.6 times as long as sixth somite; dorsal surface rather strongly sulcate, with two pairs of spines; posterior margin with a median point, flanked by three pairs of spines (Fig. 15 *c*).

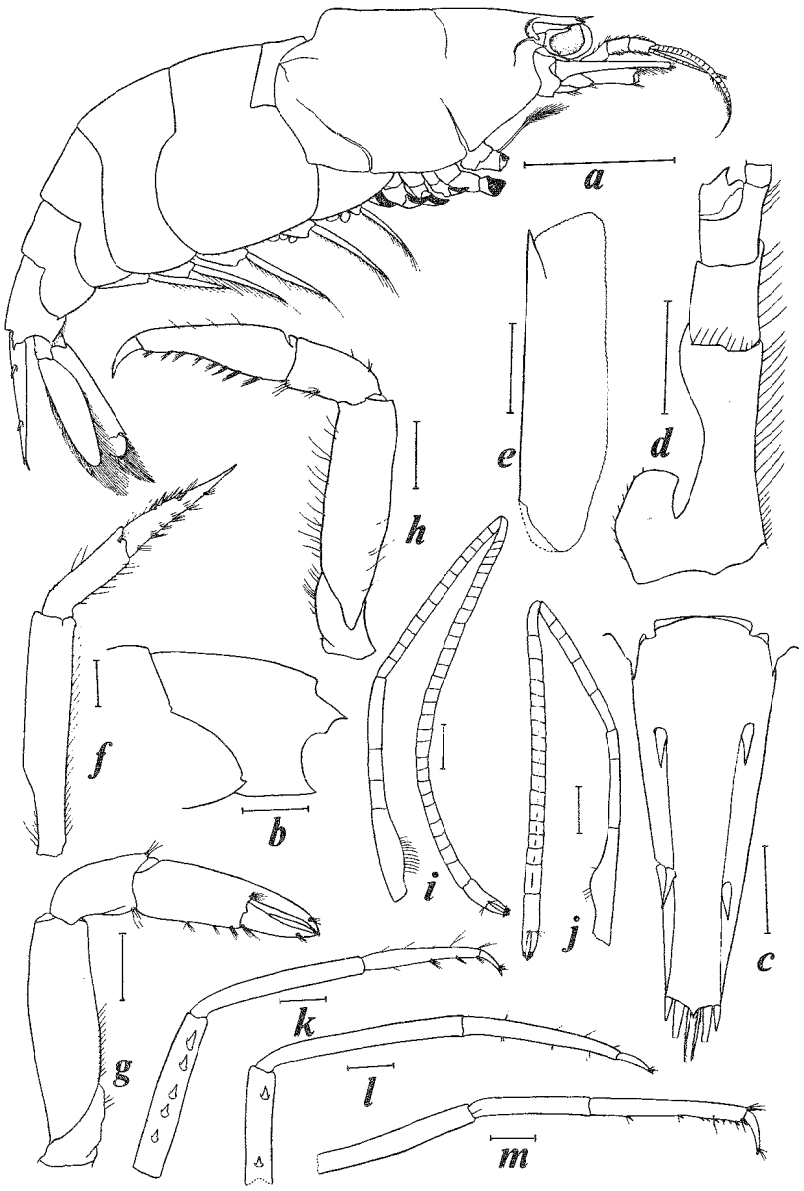

Fig. 15. *Processa barnardi* sp. nov., holotype, ovigerous female (7.0 mm in carapace length) from South Africa.

a, body in lateral view, *b*, fifth and sixth abdominal somites, *c*, telson, *d*, antennular peduncle, *e*, antennal scale, *f*, third maxilliped, *g*, right first pereiopod, *h*, left first pereiopod, *i*, right second pereiopod, *j*, left second pereiopod, *k*, third pereiopod, *l*, fourth pereiopod, *m*, fifth pereiopod. Scale for *a* represents 5.0 mm and scales for *b-m* represent 1.0 mm.

Eye moderately large. Antennular peduncle thick; basal segment slightly longer than distal two segments combined; stylocerite anteriorly rounded (Fig. 15 *d*). Antennal scale as long as antennular peduncle; outer terminal spine falling short of lamella (Fig. 15 *e*); basicerite with a process on inferior margin (Fig. 16 *a*); carpocerite extending to distal third of antennal scale.

Third maxilliped extending beyond antennal scale by distal two segments; antepenultimate segment as long as distal two segments combined. First pereiopods chelate on right side and simple on left side. Palm of right first pereiopod more than 1.5 times as long as fingers; carpus slightly shorter than palm; merus twice as long as carpus (Fig. 15 *g*). Left first pereiopod as long as right; propodus less than three times as long as dactylus (Fig. 15 *h*). Second pereiopods unequal, right longer. Merocarpal articulation of right second pereiopod reaching beyond antennal scale; ischium slightly longer than merus; merus a little more than half as long as carpus; ischium with 3-4 joints, merus with 10-12 joints and carpus with 25-31 joints (Fig. 15 *i*). Merocarpal articulation of left second pereiopod reaching basal segment of antennular peduncle; ischium about 1.4 times as long as merus; merus just half as long as carpus; ischium with 1 or 3 joints, merus with 5-6 joints and carpus with 15-17 joints. Chela of left second pereiopod longer and larger than that of right second pereiopod (Fig. 15 *j*). Third pereiopod reaching with dactylus, propodus and a part of carpus beyond antennal scale; ischium with two spines on outer surface; merus 1.7 times as long as ischium, with 4-5 outer spines; carpus slightly longer than merus; propodus three times as long as dactylus (Fig. 15 *k*). Fourth pereiopod longer than third or fifth pereiopods and reaching with dactylus, propodus and one-third length of carpus beyond antennal scale; merus with 3-5 outer spines; carpus 1.2 times as long as merus; propodus more than three times as long as dactylus (Fig. 15 *l*). Fifth pereiopod reaching with dactylus and propodus beyond antennal scale; ischium and merus without any outer spine; merus 1.2 times as long as carpus; propodus slightly longer than carpus, with a series of 7 or 8 spines on posterior margin (Fig. 15 *m*). Fifth abdominal sternite with a tiny median tubercle in male from St. Vincent Gulf; first four and sixth sternites without any spines or tubercles. Endopod of male first pleopod slightly notched at apex, inner lobe with a few retinacula, outer lobe bare and rounded (Fig. 16 *d*).

Eggs small and numerous, but shriveled in the holotype.

Remarks The holotype was already described and figured by BARNARD (1947 and 1950) under the name *Processa* cf. *edulis* (RISSO).

The present species belongs to the group which possesses the pointed pleuron of the fifth abdominal somite, the slender spine on the lateral plate of the sixth abdominal somite and the strongly unequal second pereiopods, and therefore, closely related to the European *Processa edulis* (RISSO) as already pointed out by BARNARD (1947 and 1950). It is, however, distinguished from this European species, which was first adequately described by NOUVEL and HOLTHUIS (1957) by the thick and short segment of the antennular peduncle and a smaller number of carpal joints in the right second pereiopod.

The Australian male specimen examined was collected from St. Vincent Gulf, which is near the type locality of *P. australiensis* BAKER and it was labeled as *P. australiensis*. The specimen, however, has the well developed antennal spine (Fig. 16 *a*), the slender spine on the lateral plate of the sixth abdominal somite (Fig. 16 *c*) and the rather long rostrum (Fig. 16 *b*). These features are not found in the original description of *P. australiensis*, but coincide with those of a single ovigerous female described as *Processa* cf. *edulis by* BARNARD (1947 and 1950). Reexamining of BARNARD's specimen, proves it to be a valid species and to have never been described adequately so far. Two additional specimens from the Arabian Sea were received, which agree well with BARNARD's type. Inclusive these specimens, they are described herewith as *P. barnardi* sp. nov., dedicated for the late Dr. K. H. BARNARD.

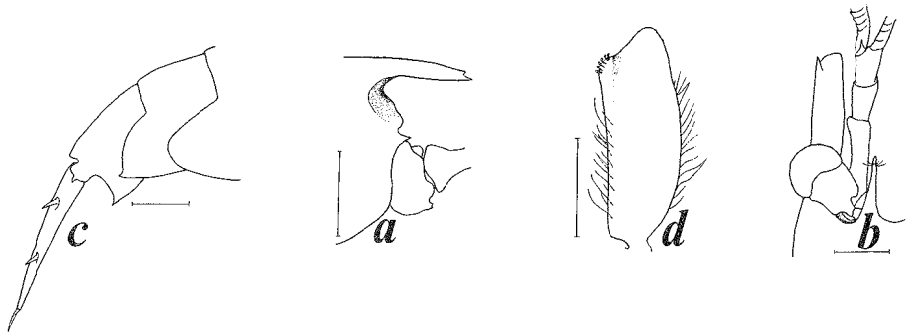

Fig. 16. *Processa barnardi* sp. nov., paratype, male (4.2 mm in carapace length) from St. Vincent Gulf.

a, anterior part of carapace and basicerite, *b*, anterior part of body, *c*, posterior part of body, *d*, endopod of first pleopod. Scales for *a-c* represent 1.0 mm and scale for *d* represent 0.5 mm.

Size The holotype is 7.0 mm in carapace length and about 25 mm in entire length. The other specimens are smaller than the holotype, 4.3 mm in carapace length in the ovigerous female from the Arabian Sea and 4.1 mm in the male paratype from South Australia.

Distribution South Africa (BARNARD, 1947 and 1950; present publication), Morora Is., West Pakistan (present publication) and St. Vincent Gulf, S. Australia (present publication).

Processa coutierei NOBILI, 1904

(Figs. 17 and 18 *a-h*)

Processa Coutierei NOBILI, 1904, p. 234.
Processa Coutierei NOBILI, 1906, p. 78, pl. 4 fig. 3, 3a
Processa Coutierei DE MAN, 1920, p. 199 (list).
Processa coutierei GURNEY, 1937, p. 87 (list) and p. 91 (key).
Processa coutierei NOUVEL, 1945, p. 395, figs. 1-8.

not *Processa coutierei* HOLTHUIS, 1958, p. 33, fig. 13 (= *Processa molaris* CHACE, 1955).
Processa coutiere MANNING and CHACE, 1971, p. 13 (list).

East Africa

Fort Jesus, Mombasa, October 24, 1973, depth 50 ft, J. WOOD and P. HUTCHENS leg. – 1 ovig. ♀ (MNHN)

Definition Rostrum long, simple, triangular in dorsal view. Antennal spine absent, but suborbital angle pointed. Pleuron of fifth abdominal somite rounded posteriorly. Lateral plate of sixth abdominal somite not pointed. Stylocerite pointed. Third maxilliped with well developed exopod. Second pereiopods equal, with 1 meral and 6 carpal joints. Propodus of fifth pereiopod with three spines on posterior margin.

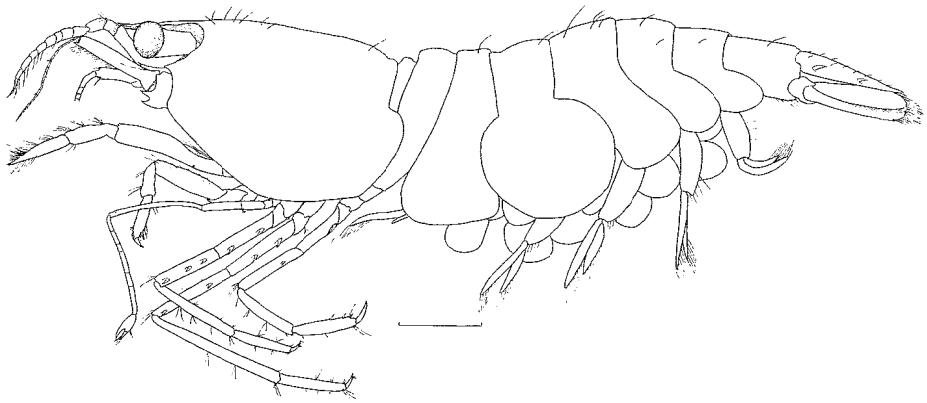

Fig. 17. *Processa coutierei* NOBILI, ovigerous female from Mombasa. Scale represents 1.0 mm.

Description Very recently a single ovigerous female obtained from Mombasa was received from the Muséum National d'Histoire Naturelle. It is probably the second specimen of this species and agrees very well with the holotype, which was redescribed by NOUVEL (1945) and was kindly reexamined by Dr. FOREST. The following short description of the present specimen may be given.

Body small, only 8.3 mm in body length, with long simple setae sparsely (Fig. 17). Rostrum long, exceeding end of eye; tip upturned and without any tooth; triangular in dorsal view; lateral margin carinate sharply. Carapace twice as long as rostrum; antennal spine absent, but suborbital angle sharply pointed; pterygostomial angle rounded. Post-orbital region deeply grooved (Fig. 18 *a*).

Abdomen smooth; pleura of all abdominal somites rounded posteriorly. Lateral plate of sixth somite not pointed. Telson about 1.4 times as long as sixth somite, with two pairs of dorsal spines; posterior margin pointed in the middle with three pairs of spines (Fig. 18 *b*).

Eye, antennular peduncle and antennal scale are very similar to those of NOUVEL's redescription of the holotype. Basicerite of antenna with two spines on outer distal end; carpocerite long, exceeding middle of scale.

Third maxilliped stout, reaching with ultimate segment beyond antennal scale; basal segment as long as distal two segments combined, provided with well developed exopod; distal segment slightly longer than second segment, ending in stout spine (Fig. 18 *c*).

First pair of pereiopods short, reaching only to rostral apex. Right first pereiopod with large chela (Fig. 18 *e*). Left first pereiopod ending in a slender dactylus, which is half as long as propodus (Fig. 18 *d*). Left second pereiopod attached to the body, reaching with chela and distal joint of carpus beyond antennal scale; ischium obscurely subdivided, without distinct basal expansion, though with a few curved setae; merus longer than ischium, obscurely subdivided into two or three joints; carpus longer than merus, subdivided into six joints (Fig. 18 *f*). Chela large; movable finger robust with dense terminal setae; immovable finger slender, with an acute end (Fig. 18 *g*). Right

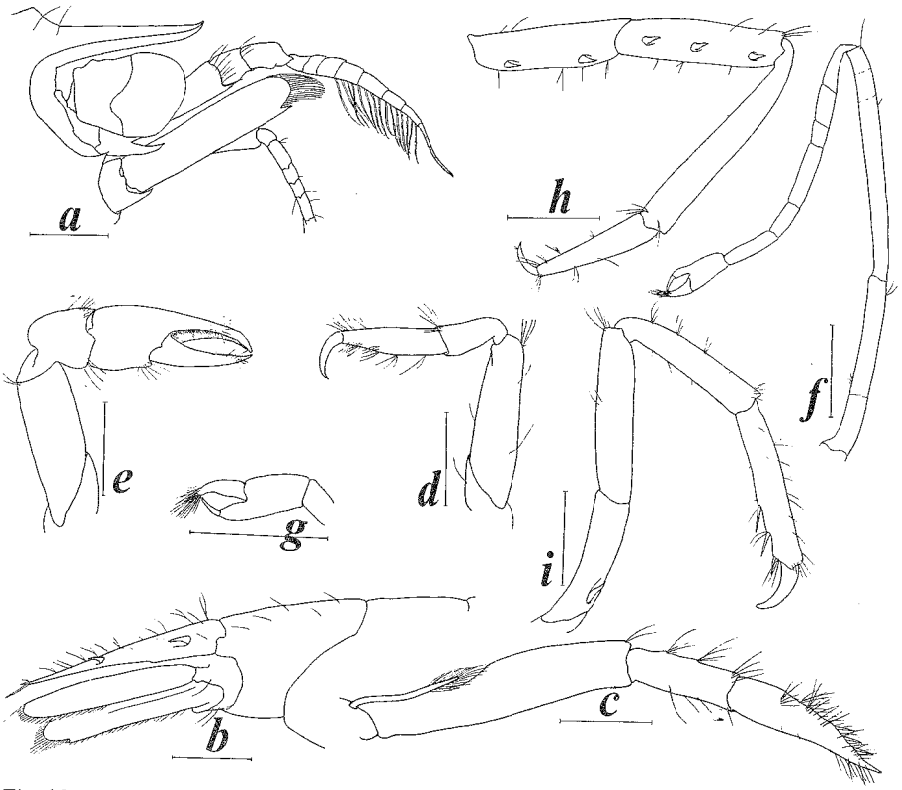

Fig. 18. *Processa coutierei* NOBILI, ovigerous female from Mombasa.

a, anterior part of body, *b*, posterior part of body, *c*, third maxilliped, *d*, left first pereiopod, *e*, right first pereiopod, *f*, second pereiopod, *g*, chela of second pereiopod, *h*, third pereiopod, *i*, fifth pereiopod. Scales represent 0.5 mm.

second pereiopod missing. Left third pereiopod reaching with dactylus and propodus beyond antennal scale; ischium with two spines on outer surface; merus longer than ischium, with three spines; carpus 1.3 times as long as merus; distal three segments without any spine (Fig. 18 *h*). Left fourth pereiopod reaching with distal two segments and one-third length of carpus beyond antennal scale; ischium and merus with two spines respectively; carpus 1.6 times as long as merus, without any spine as in propodus and dactylus. Fifth pair of pereiopods attached to the body, reaching end of rostrum; ischium with a single outer spine near base on both sides; merus with a single small spine at proximal third on left side, but unarmed on right side; carpus as long as merus without spine; propodus as long as carpus with three spines on distal half of posterior margin on both sides (Fig. 18 *i*).

Remarks The present specimen agrees well with the holotype in all respects except for the spination of the merus and ischium of the third and fourth pereiopods.

1) The left third and fourth pereiopods are attached to the body in the present specimen. Each ischium of these two pereiopods is armed with two spines. In the holotype the ischium of the third and fourth pereiopods is armed with four and five small spines, respectively.

2) The left fifth pereiopod is armed with a spine on proximal third of the merus. The merus of the right fifth pereiopod is unarmed as in the holotype.

The distinctional characters of this species from *P. molaris* CHACE to which *P. coutierei* is most closely related are mentioned in the remarks of *P. molaris*.

Size The holotype is 15 mm in length. The present specimen is smaller than the holotype, only 8.3 mm in body length, 2.2 mm in carapace length and 1.1 mm in rostrum length. Eggs comparatively large and not so numerous, 0.5 × 0.6 mm in diameter.

Distribution This species is very rare. Dijbuti (NOBILI, 1904 and 1906; NOUVEL 1945), Fort Jesus, Mombasa, 50 ft (present publication).

Processa demani sp. nov.

(Figs. 19 and 20 *a-o*)

Processa sp. p.p. DE MAN, 1920, p. 203, pl. 17 fig. 52 p (not 52-52i = *Processa affinis* sp. nov; 52j-n = *Nikoides sibogae* DE MAN; 52o = *Processa neglecta* sp. nov.)

Siboga Expedition

Station 4, 7°42'S, 114°12.6'E, anchorage off Djangkar, Java, depth 9 m, bottom coarse sand, March 9, 1899 – 1 ♀ (paratype, AM).

Station 261, Elat, west coast of Great Kei Islands, depth 27 m, bottom mud, December 16-18, 1899 – 1 ♀ (holotype, AM), 1 ♂ (paratype, AM)

South Viet Nam

Station 317, Bay of Nha Trang, bottom mud, April 1, 1960, V. A. GALLARDO leg. – 1 ovig.♀

(paratype, RMNH)
Station 331, Bay of Nha Trang, bottom mud, April 4, 1960, V. A. GALLARDO leg. – 1 ♀ (paratype, RMNH No. D 17057)
Station 334, Bay of Nha Trang, bottom mud, depth 4 m, April 7, 1960, V. A. GALLARDO leg. – 1 ♂ (paratype, RMNH No. D 17058)

Definition Rostrum narrow, slender, as long as eye; apex unusually bifid. Antennal spine present. Pleuron of fifth abdominal somite not pointed. Lateral plate of sixth somite with small spine. Stylocerite with small outer distal spine. Basicerite with small spiniform process. Third maxilliped with short exopod. Second pereiopods subequal in length, right pereiopod with 3 meral and 14-16 carpal joints, left pereiopod with 3 meral and 10-12 carpal joints. Propodus of fifth pereiopod with two or three spines on posterior margin.

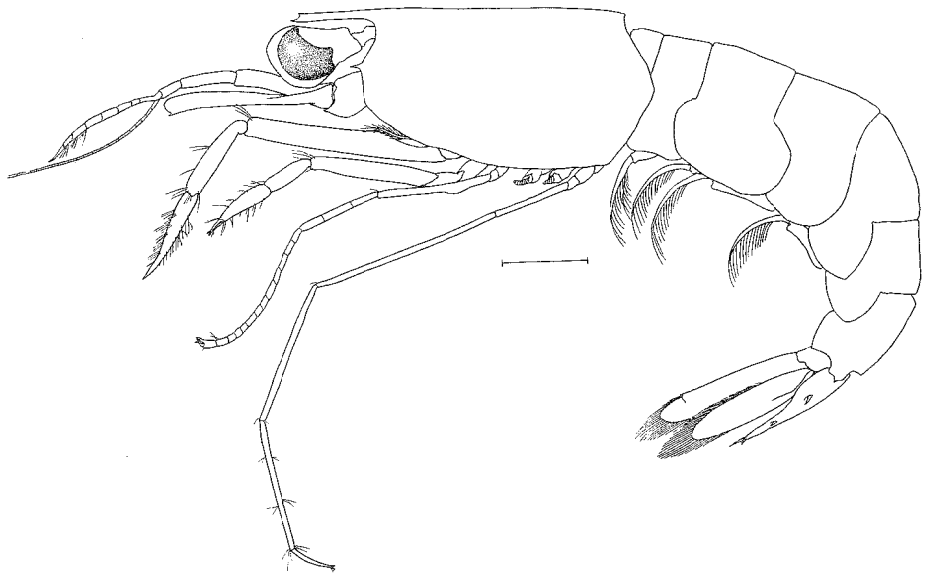

Fig. 19. *Processa demani* sp. nov., holotype, female from Great Kei Islands. Scale represents 1.0 mm.

Description Body slender (Fig. 19). Rostrum long, slender, as long as or overreaching eye; apex unusually bifid, upper tooth short, somewhat erect and separated from lower tooth, which is much longer than upper tooth and curved upward at tip (Fig. 20 *a-c*). Carapace smooth, 2.8-3.2 times as long as rostrum; antennal spine rather well developed; suborbital angle slightly pointed; postorbital groove absent (Fig. 20 *d*).

First five abdominal somites rounded dorsally and posteriorly; pleuron of sixth somite sharply pointed; lateral plate of sixth somite with an acute spine (Fig. 20 *e-g*). Telson short, much shorter than uropod, with two pairs of dorsal spines, anterior pair placed on

anterior third or fourth length of telson and posterior pair on three-fourths length of telson; outer lower margin notched at basal third; posterior margin with three pairs of spines, but without median spine.

Eye large, flattened dorsally and rounded ventrally. Antennular peduncle as long as or slightly shorter than antennal scale; basal segment apparently longer than distal two segments combined; stylocerite truncated obliquely with small outer distal spine; second segment more than twice as long as third. Antennal scale about six times as long as broad; outer spine shorter than lamellar part; basicerite with a small spiniform process on outer inferior corner (Fig. 20 *h*); carpocerite reaching distal third of antennal scale.

Third maxilliped much slender, reaching with ultimate segment beyond antennal scale; antepenultimate segment with short exopod (Fig. 20 *i*). First pair of pereiopods slender, just reaching end of antennal scale; right chelate and left simple. Second pair of pereiopods subequal in length, merocarpal articulation reaching rostral apex; ischium undivided, merus with 3 joints on both sides and carpus with 14-16 joints in right pereiopod (Fig. 20 *j*) and 10-12 joints in left pereiopod (Fig. 20 *k*); chela very small, curved inward, immovable finger shorter than movable finger on right side and normal chela but with rather wide gap between fingers on left side (Fig. 20 *l, m*). Third pereiopod reaching with dactylus and propodus beyond antennal scale; ischium with two spines on outer inferior margin; merus with four to six spines on outer surface. Fourth pereiopod reaching with dactylus, propodus and half carpus beyond antennal scale; ischium with two spines; merus with five or six spines; dactylus long, more than half as long as propodus and longer than those of third and fifth pereiopods (Fig. 20 *n*). Fifth pereiopod reaching with dactylus and propodus beyond antennal scale; ischium, merus and carpus without any spines; propodus with two or three spines on posterior margin; dactylus less than half as long as propodus and slightly shorter than that of fourth pereiopod (Fig. 20 *o*).

Endopod of male first pleopod more or less notched at apex, inner lobe with some retinacula. First four abdominal sternites without any spine; fifth sternite with a median low keel; sixth sternite with or without a very low preanal process. Eggs small but attached not numerous.

Remarks The present species, *P. demani* sp. nov., is related to *P. aequimana* (PAULSON) and its allied species, including three Atlantic species, in having the rounded pleuron of the fifth abdominal somite and the subequal second pereiopods, but it is distinguished from these species, except for *P. aequimana* and *P. longirostris* sp. nov., by the spine on the lateral plate of the sixth abdominal somite. In the characters of the rostrum and armature of the basicerite, *P. demani* is more closely related to *P. aequimana* than to *P. longirostris*, and is separated from the former species by the following characters.

(1) The rostrum is normally bifid at the apex in *P. aequimana* and it is unusually bifid in the present species; the lower tooth being much longer than and separated from

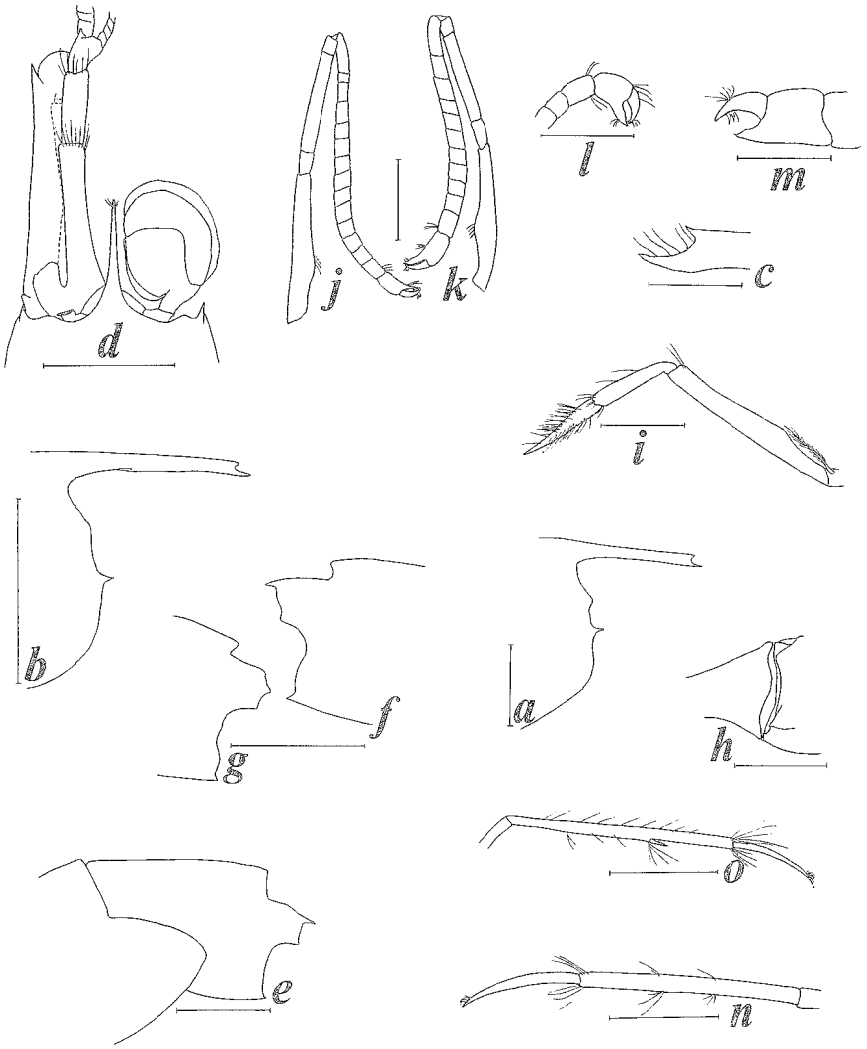

Fig. 20. *Processa demani* sp. nov., *a, f-h, j, k, n, o,* paratype, ovigerous female (3.0 mm in carapace length) from Bay of Nha Trang; *b, d, e, l,* paratype, male (2.8 mm) from Great Kei Islands; *c, i,* holotype, *m,* paratype, male (3.0 mm) from Bay of Nha Trang.

a, b, anterior part of carapace, *c,* apex of rostrum, *d,* anterior part of body, *e,* fifth and sixth abdominal somites, *f, g,* posterior margin of sixth abdominal somite, *h,* basicerite, *i,* third maxilliped, *j,* right second pereiopod, *k,* left second pereiopod, *l,* chela of left second pereiopod, *m,* chela of right second pereiopod, *n,* dactylus and propodus of fourth pereiopod, *o,* dactylus and propodus of fifth pereiopod. Scales for *a, b, d, f, g, i-k, n, o* represent 1.0 mm, scales for *c, m* represent 0.25 mm and scales for *e, h, l* represent 0.5 mm

the upper tooth, which is somewhat erect in some specimens in *P. demani.* (2) The dactylus of the fifth pereiopod is longer than those of the third and fourth pereiopods in *P. aequimana.* The dactylus of the fifth pereiopod is a little shorter than or as long as that of the fourth pereiopod in *P. demani.* (3) The propodus of the fifth pereiopod is armed with two spines in *P. demani* whereas it is unarmed in *P. aequimana.* (4) The anterior pair of the dorsal spines on the telson is placed much more anteriorly in *P. aequimana* than in *P. demani.* (5) The telson is shorter in *P. demani* than in *P. aequimana* and moreover the inferior margin is notched at anterior third in *P. demani.* (6) The second pair of pereiopods has 1 meral and 9-11 carpal joints in *P. aequimana,* while in *P. demani* the carpus of the second pereiopods is asymmetrically subdivided into 14-16 joints on the right side and 10-12 joints on the left side, though the merus is subdivided into three joints on both sides. The chela is larger in *P. aequimana* than in *P. demani.* In the latter the immovable finger is sometimes shorter than the movable finger somewhat like a subchela in appearance.

The present three specimens of the Siboga material were treated as *Processa* sp. by DE MAN (1920). Later DE MAN (1922) separated these specimens from others but did not give a name of them. They are treated herewith as a new species, *Processa demani* sp. nov., to which also belong the other material from the Bay of Nha Trang, South Viet Nam. The species is dedicated to the late Dr. J. G. DE MAN, who discovered them at first as a species distinct from *P. aequimana.* A single specimen from Siboga station 4 is a female, not a male as described by DE MAN (1920 and 1922) and two specimens from station 261 are one male and one female, not two young males as mentioned by DE MAN (1920 and 1922).

Size The holotype is a female, 3.1 mm in carapace length and 1.0 mm in rostrum length. Ovigerous female is 5.0 mm in carapace length. Males vary from 2.8 to 3.0 mm in carapace length.

Distribution Djangkar, Java, 9 m (DE MAN, 1920; present publication), Great Kei Is., 27 m (DE MAN, 1920; present publication), Bay of Nha Trang, South Viet Nam, 4 m (present publication).

Processa dimorpha sp. nov.

(Fig. 21 *a-l*)

Japan

Off Asamushi, Aomori Bay, Aomori Prefecture, *Sargassum* and *Zostera* belts, small Danish seine, September 2-3, 1960, H. SANDO leg. – 1 ♂ (paratype, ZLKU)

Sea of Genkai, off Shingu, Fukuoka Prefecture, weed belts, December 20, 1966, night, Danish seine, S. MATSUURA leg.– 1 ♂ (paratype, ZLKU No. 13699); June 23, 1967, night, S. MATSUURA leg.– 1 ♂ (paratype, ZLKU No. 13700); off Tsuyazaki, May 23, 1967, night, S. MATSUURA leg. – 1 ♂ (paratype, ZLKU No. 9426); Ainoshima Island, July 18, 1967, night, S. MATSUURA leg. - 1 ♀ (holotype, ZLKU No. 13771), 6 ♂♂, 12 ovig. ♀♀, 1 ♀ (paratypes, ZLKU No. 13772)

Tomioka Bay, Amakusa Islands, Kumamoto Prefecture, *Zostera* belt, small Danish seine, April 24, 1959, night T. KIKUCHI leg. – 1 ovig. ♀ (paratype, ZLKU)

South Viet Nam

Station 266, Bay of Nha Trang, depth 14 m, bottom sand, March 21, 1960, V. A. GALLARDO leg. – 1 ♂, 1 ovig. ♀ (paratypes, RMNH No. D 17054).

Definition Rostrum narrow, slender; apex bifid. Antennal spine present. Pleuron of fifth abdominal somite rounded posteriorly. Lateral plate of sixth abdominal somite without spiniform process. Stylocerite with outer distal spine. Basicerite with well developed spine. Third maxilliped with small exopod. Second pereiopod subequal in length, with 2-4 meral and 11-13, mostly 11, carpal joints. Propodus of fifth pereiopod with two spines on posterior margin.

Description Body slender (Fig. 21 *a*). Rostrum slender, falling far or slightly short of distal end of eye; apex distinctly bifid, lower tooth slightly longer than upper tooth; upper margin straight, lower margin a little concave at middle. Carapace about 3.8-4.0 times as long as rostrum; suborbital angle not distinctly pointed; antennal spine acutely pointed; postorbital region smooth (Fig. 21 *c*).

Pleuron of fifth abdominal somite rounded. Pleuron of sixth somite pointed posteriorly, more acute in males than in females; lateral plate truncated (Fig. 21 *d*). Telson 1.3-1.5 times as long as sixth somite, bearing two pairs of dorsal spines, anterior pair placed on much near base, posterior pair placed just behind middle; posterior margin acutely pointed, with three pairs of unequal spines (Fig. 21 *e*).

Eye moderate in size and depressed. Basal segment of antennular peduncle as long as distal two segments combined; stylocerite pointed at outer distal end, rounded at inner distal corner; second segment slightly longer than third (Fig. 21 *b*). Outer flagellum thickened in basal 10 or more joints, of which a distal few joints bear fine setae on ventral surface in females and all are setose in males; inner flagellum very slender, about twice as long as carapace. Antennal scale about 5 times as long as broad, reaching just beyond second segment of antennular peduncle; outer spine falling short of lamellar part; basicerite bearing a well-developed spine at outer inferior end (Fig. 21 *c*); carpocerite cylindrical, reaching distal third of scale; flagellum more than twice as long as body.

Third maxilliped extending beyond distal extremity of antennular peduncle by entire ultimate and half penultimate segment; antepenultimate segment longer than distal two segments combined; ultimate segment shorter than penultimate segment. First pair of pereiopods more slender than third maxilliped; right pereiopod chelate (Fig. 21 *g*), slightly stouter than left pereiopod which has a simple dactylus (Fig. 21 *h*); merus 2.5 times as long as carpus on both sides; palm of right pereiopod twice as long as fingers; dactylus of left pereiopod one-third length of propodus. Second pair of pereiopods subequal in length (Fig. 21 *i*); merocarpal articulation reaching beyond eye; ischium not subdivided; merus obscurely subdivided into 2-4 joints, carpus into 11-13, usually 11,

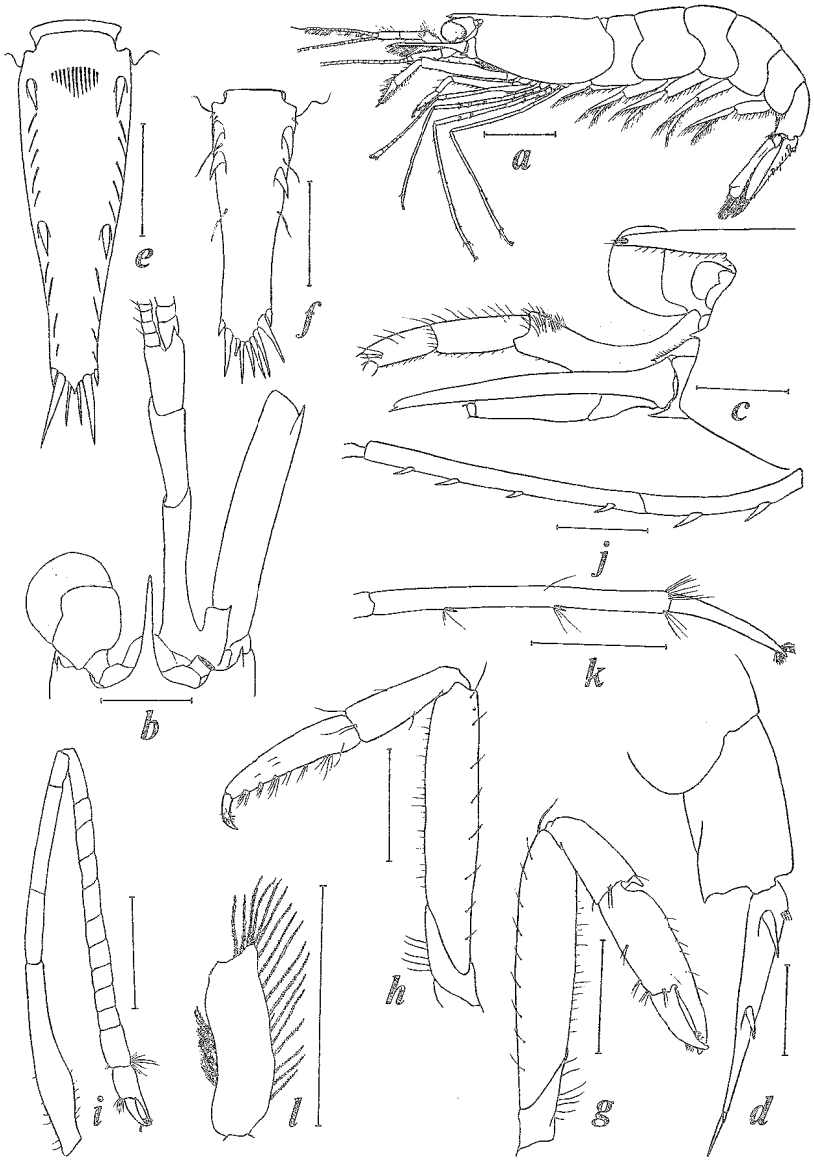

Fig. 21. *Processa dimorpha* sp. nov., *a*, holotype, female (4.8 mm in carapace length), *b*, *l*, paratype, male (4.2 mm), *c*, *g*, *h*, *j*, paratype, ovigerous female (5.5 mm), *d*, paratype, male (4.3 mm), *e*, paratype, ovigerous female (5.9 mm), *f*, paratype, male (4.3 mm), *i*, paratype, ovigerous female, *k*, paratype, ovigerous female (6.1 mm), all from Sea of Genkai.

a, animal in lateral view, *b*, anterior part of body, *c*, same in lateral view, *d*, posterior part of body, *e*, telson, *f*, abnormal telson, *g*, right first pereiopod, *h*, left first pereiopod, *i*, right second pereiopod, *j*, merus and ischium of third pereiopod, *k*, dactylus and propodus of fifth pereiopod, *l*, endopod of first pleopod. Scale for *a* represents 3.0 mm and scales for *b-l* represent 1.0 mm.

joints; palm as long as fingers. Third pereiopod reaching with dactylus and propodus beyond distal end of antennular peduncle; ischium always with two spines; merus with three to five, usually four, outer spines (Fig. 21 *j*). Fourth pereiopod reaching with entire dactylus and propodus beyond tip of third pereiopod; ischium with also two outer spines; merus with two to five outer spines. Fifth pereiopod reaching with dactylus and propodus beyond distal end of antennular peduncle; ischium and merus unarmed and propodus with two spines on posterior margin, one placed at the proximal fourth, the other half way between proximal spine and end of segment, a tuft of hairs but no spine, present on extremity of propodus (Fig. 21 *k*).

Endopod of first male pleopod slightly notched at end, outer lobe bluntly pointed with a long plumose setae, inner lobe not markedly defined with some retinacula only (Fig. 21 *l*). Fifth abdominal sternite bearing a small rounded median process. Uropod slightly longer than telson; outer margin of exopod nearly straight, ending in two spines, outer small and fixed, inner large and movable; diaeresis well marked.

Eggs small and numerous, 0.35 × 0.46 mm in diameter.

Abnormality Two males collected off Shingu, Fukuoka Prefecture, show unusual features. One (ZLKU No. 13700) has an abnormal telson; the two pairs of dorsal spines on the telson are placed closely together on the base of the telson and posterior margin bears 5 (right) and 4 (left) irregular spines (Fig. 21 *f*). The other male (ZLKU No. 13699) has the first pair of pereiopods symmetrically simple, not chelate on the right side. The other characters of these two specimens are very similar to those of the normal specimens.

Remarks The new species, *P. dimorpha,* belongs to the *P. aequimana* group, which possesses a slender, bifid rostrum, a developed antennal spine, a rounded pleuron of the fifth abdominal somite and equal or subequal second pereiopods, and is most closely related to *P. neglecta* sp. nov., in having no spine on the lateral plate of the sixth abdominal somite. It, however, is distinguished from that species by the following characters.

(1) The antennal spine is constantly present in *P. dimorpha,* while it is usually present but sometimes absent in *P. neglecta.* (2) The anterior pair of dorsal spines of the telson is placed more anteriorly in *P. dimorpha* than in *P. neglecta.* (3) The stylocerite is constantly pointed in *P. dimorpha,* while it is usually pointed but sometimes rectangular in *P. neglecta.* (4) The second segment of the antennular peduncle is as long as or slightly longer than the third segment in *P. dimorpha,* while it is about 1.5 times as long as the third segment in P. *neglecta.* (5) The outer spine of the antennal scale is shorter than the lamellar part in *P. dimorpha,* but it exceeds slightly the lamellar part in *P. neglecta.* (6) The propodus of the fifth pereiopods has two spines in *P. dimorpha* and four spines in *P. neglecta.* (7) The pleuron of the sixth abdominal somite is not acutely pointed in both sexes of *P. neglecta,* while it is acutely pointed in males and not acutely pointed in females of *P. dimorpha.*

The present species is also allied to two Atlantic species, *P. hemphilli* MANNING

and CHACE and *P. parva* HOLTHIUS. It is more closely related to the former than the latter in having two spines on the propodus of the fifth pereiopod and the apex of the telson pointed. In *P. parva* the propodus of the fifth pereiopod has three spines and the apex of the telson is acute but not produced into a sharp point. *P. dimorpha* differs from *P. hemphilli* in having a spine on the basicerite of the antennal peduncle and in the propodal spination of the fifth pereiopod.

Size The holotype is about 17 mm in body length. The carapace is 4.8 mm and the rostrum is 1.25 mm. Ovigerous females vary from 3.6-6.1 mm and males from 3.3 to 4.3 mm in carapace length.

Distribution This is a littoral species; Sea of Genkai, off Fukuoka Prefecture (present publication); Bay of Nha Trang, South Viet Nam, 14 m (present publication).

Processa gracilis BAKER, 1907

Processa gracilis BAKER, 1907, p. 187, pl. 25 fig. 3-3c.
Processa gracilis DE MAN, 1920, p. 199 (list).
Processa gracilis GURNEY, 1937, p 87 (list) and 92 (key).
Processa gracilis MANNING, and CHACE, 1971, p. 13 (list).

Definition Rostrum narrow, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite rounded posteriorly. Stylocerite pointed. Right second pereiopod with several (7 ?) meral and about 40 carpal joints, left second pereiopod with several (4 ?) meral and about 20 carpal joints.

Size The holotype is 18 mm in length, excluding rostrum and telson, and 6 mm in carapace length (BAKER, 1907).

Distribution The species has been reported from the type locality only; South Australian coast (BAKER, 1907).

Processa hawaiensis (DANA, 1852)

(Figs. 22 and 23 *a-j*)

Nika hawaiensis DANA, 1852, p. 20.
Nika hawaiensis DANA, 1852a, p. 538.
Nika hawaiensis WEITENWEBER, 1854, p. 10.
Nika hawaiensis DANA, 1855, pl. 33 fig. 7a-7h.
Processa hawaiiensis RATHBUN, 1906, p. 912.
Processa hawaiensis DE MAN, 1920, p. 199 (list).
Processa paucirostris EDMONDSON, 1930, p. 3, fig. 1.
Processa paucirostris GURNEY, 1937, p. 87 (list).

Processa hawaiensis EDMONDSON, 1946, p. 247, fig. 148b.
Processa hawaiensis CHACE, 1962, p. 616.
Processa hawaiiensis MANNING and CHACE, 1971, p. 13 (list).
Processa paucirostris MANNING and CHACE, 1971, p. 13 (list).

Pacific Ocean

Station W58-289, Clipperton Island, east end, coral reef, August 15, 1958, REESE, BALDWIN and WINTERSTEEN leg. – 1 ovig. ♀ (USNM No. 110977)

Kahana Bay, Oahu, Hawaiian Archipelago, in shallow water, September 1, 1921, EDMONDSON leg. – 1 ovig. ♀ (BPBM No. S 1533, holotype of *Processa paucirostris* EDMONDSON).

East Africa

Station 91, Mwemba Island, Zanzibar, 5°46.6'S, 39°23.5'E, LWS, depth 0.5 m, September 17, 1970, A. J. BRUCE leg. – 3 ♂♂, 5 ovig. ♀♀ (EAMFRO)

Station 100, Ras Iwatine, Mombasa, Kenya, 4°00'38"N, 39°44'23"E, depth 0.5 m, seaward edge of lagoon, LWS, January 3, 1971, A. J. BRUCE leg. – 2 ♂♂, 2 ♀♀ (EAMFRO)

Station 115, Andromache R., Mombasa, Kenya, 4°04.9'S, 39°40.5'E, reefs, mainly under stones, few corals, LWS, April 26, 1971, A. J. BRUCE leg. – 3 ovig. ♀♀ (EAMFRO)

Station 163, Ras Iwatine, Mombasa, Kenya, reef crest pools, February 24, 1973, A. J. BRUCE leg. – 5 ♂♂, 1 ovig. ♀, 1 ♀, 5 juv. (EAMFRO)

Watamu, Natinoal Marine Park, Malindi, Kenya, sand pools in reef crest at LWS, March 9, 1973, A. J. BRUCE leg. – 2 ♂♂, 1 ovig. ♀, 5 ♀♀ (EAMFRO)

Definition Rostrum short, triangular in dorsal view; apex simple. Antennal spine present. Pleuron of fifth abdominal somite pointed posteriorly. Lateral plate of sixth abdominal somite triangular. Stylocerite unarmed. Basicerite without outer spine. Third maxilliped with rudimental exopod. Right second pereiopod with 7-9

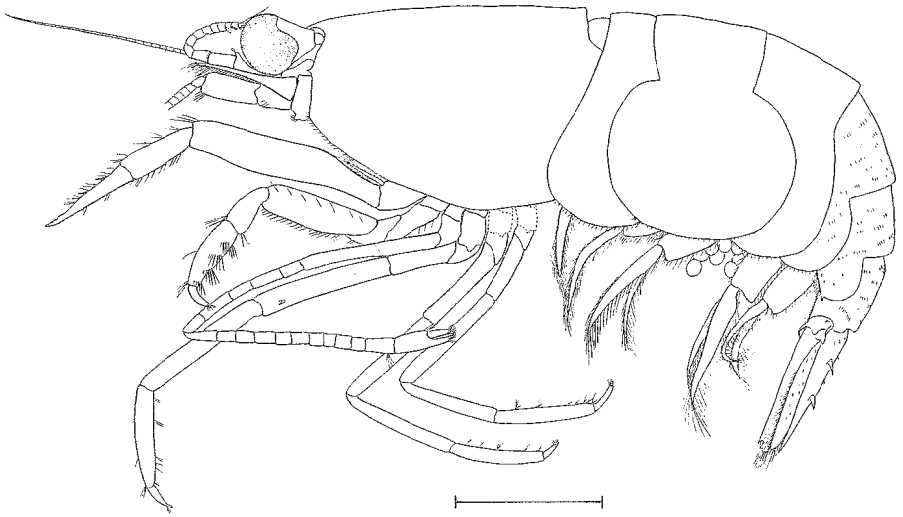

Fig. 22. *Processa hawaiensis* (DANA), ovigerous female from Clipperton Island. Scale represents 6.0 mm.

meral and 15-18 carpal joints, left second pereiopod with 4-7 meral and 10-14 carpal joints. Propodus of fifth pereiopod with 6-8 spines on posterior margin.

Description The species was described and figured in detail by DANA (1852 and 1852a; 1855) and EDMONDSON (1930). Now the following important characters may be added.

Carapace with a postorbital groove (Fig. 23 *a*). Gastric region swollen in ovigerous female. Fourth to sixth abdominal somites as well as telson bearing short setae; pleura of fifth and sixth abdominal somites pointed posteriorly (Fig. 23 *c*); lateral plate of sixth somite triangular, but not pointed (Fig. 23 *c*). Posterior margin of telson terminating in a very small spine, with three pairs of spines.

Eye well developed. Second and third segments of antennular peduncle subequal in length; stylocerite obliquely truncated (Fig. 23 *b*). Basicerite of antennal peduncle without outer spine; carpocerite long, reaching as far forward as outer spine of antennal scale (Fig. 23 *a*). Third maxilliped with a rudimental exopod (Fig. 23 *d*).

Merus of third pereiopod usually with a single subterminal spine on outer surface; ischium usually with a single spine on proximal third of posterior margin (Fig. 23 *g*). Merus and ischium of fourth and fifth pereiopods usually without any spine (Fig. 23 *h*). Propodus of fifth pereiopod provided with 6-8 spines on posterior margin (Fig. 23 *i*). Endopod of first pleopod in males broadened at apex, inner distal angle with several small retinacula and outer margin with long plumose setae (Fig. 23 *j*). Fifth abdominal sternite with a posteriorly curved spine; first four and sixth sternites without spine. Eggs small and numerous, 0.30 × 0.35 mm in diameter.

Remarks Through the courtesy of Dr. DEVANEY of the Bishop Museum and Dr. CHACE, of the U. S. National Museum, the type of *Processa paucirostris* EDMONDSON and the ovigerous female of *Processa hawaiensis* identified by CHACE could be actually examined. *P. paucirostris* proves to be a synonymy of *Nika hawaiensis* as already pointed out by CHACE (1962).

The species has been known from the East Pacific only and thought to be rare, but recently a considerable collection of specimens from East Africa was received from Dr. BRUCE. The East African specimens agree with the East Pacific specimens in every respect. The species is characterized by the rudimental exopod of the third maxilliped, and the short and simple rostrum, which are unique characters in the family Processidae.

The right second pereiopod has not been known in detail and all East Pacific specimens examined lack the right second pereiopod. But the East African specimens show that the merus of the right second pereiopod is subdivided into 7-9, usually 8, and the carpus is subdivided into 15-18 joints. The ischium is subdivided into two joints as in the left side. The spination of the merus and ischium of the third and fourth pereiopod is slightly variable. Of 35 specimens examined most specimens are armed with a single subterminal spine on both sides of the merus of the third pereiopod, but only

three individuals bear no outer spine on both sides, and four specimens without spine on one side. The ischium of the third pereiopod is armed usually with a single spine on posterior margin, but without any spine on one side in three specimens, two spines on one side in two specimens and without any spine on both sides in four specimens. The merus of the fourth pereiopod bears no spine in any specimen examined and the ischium of that leg is usually unarmed, but only four specimens have a single spine on

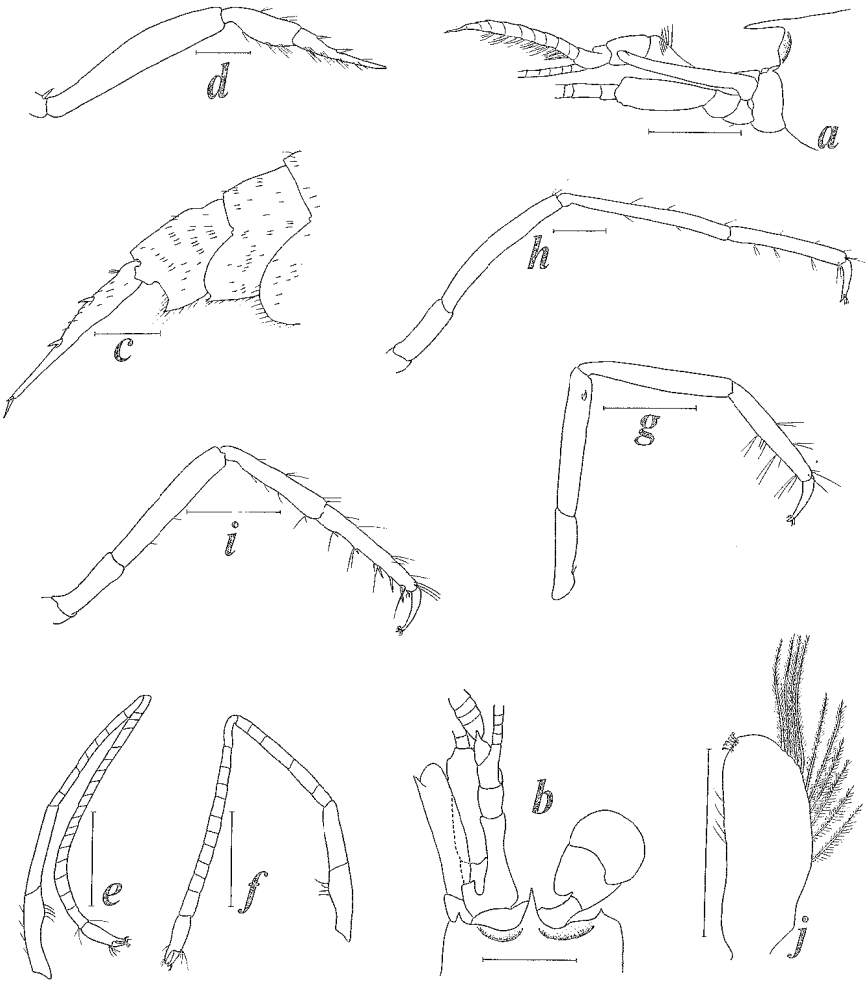

Fig. 23. *Processa hawaiensis* (DANA), *a, b, e, f,* male (2.8 mm in carapace length), *c, h, i,* ovigerous female (4.5 mm), *d,* ovigerous female (3.6 mm) from Mombasa; *g, j,* male (2.9 mm) from Malindi.

a, anterior part of body, *b,* same in dorsal view, *c,* posterior part of body, *d,* third maxilliped, *e,* right second pereiopod, *f,* left second pereiopod, *g,* third pereiopod, *h,* fourth pereiopod, *i,* fifth pereiopod, *j,* endopod of first pleopod. Scales for *a-i* represent 1.0 mm and scale for *j* represents 0.5 mm.

one side.

The juveniles less than 1.5 mm in carapace length agree with the above specific characters in almost all respects, but some differences from the adults are present. A rudimental exopod is present on the basis of the first four pereiopods, though that of the third maxilliped is still rudimental. The number of spines on the posterior margin of the fifth pereiopod and the number of segments of the second pereiopod are slightly smaller.

Size The type of *P. paucirostris* is 4.0 mm in carapace length and 17 mm in entire length. According to CHACE (1955), the carapace lengths of males are 1.7-2.3 mm, 1.7 mm in non-ovigerous female and 3.1-4.7 mm in ovigerous females in Clipperton Island specimens. The East African specimens are similar in size to those of the Pacific Ocean. Ovigerous females are 3.5-5.0 mm and males are 2.1-3.1 mm in carapace length.

Distribution The species is a littoral species and usually found on coral reefs. It has been known only from the East Pacific Ocean, but the present record extends its distribution to East Africa, though with a wide distributional gap. Lahaina, Maui, Hawaiian Archipelago (DANA, 1852, 1852a and 1855; RATHBUN, 1906), Kahana Bay, Oahu, in shallow water (EDMONDSON, 1930 and 1946; present publication), Clipperton Is., coral reef (CHACE, 1962; present publication), Mwemba Is., Zanzibar, 0.5 m (present publication), Ras Iwatine, 0.5 m and Andromache R., Mombasa, Kenya (present publication) and Watamu, Malindi, Kenya (present publication).

Processa japonica (DE HAAN, 1844)

(Fig. 24 *a-e*)

Nika japonica DE HAAN, 1844, pl. 46. fig. 6.
Nika japonica DE HAAN, 1849, p. 184, pl. N.
Nika Japonica HERKLOTS, 1861, p. 147.
Nika japonica ORTMANN, 1890, p. 529.
Nika japonica p.p. DOFLEIN, 1902, p. 641.
Nica japonica BALSS, 1914, p. 61.
Processa japonica PARISI, 1919, p. 88, fig. 8a.
Processa japonica DE MAN, 1920, p. 208, pl. 18 figs. 53.
Processa japonica GURNEY, 1937, p. 88, pl. 1 figs. 16-19.
Nica japonica MIYADI, 1940, p. 7.
Processa japonica NAKAZAWA and KUBO, 1947, p. 764, fig. 2204.
Processa japonica BARNARD, 1955, p. 44.
Processa japonica MIYAKE, 1961, p. 9.
Processa japonica p.p. MIYAKE, SAKAI and NISHIKAWA, 1962, p. 123 (list).
Processa japonica IKEMATSU, 1963, p. 79.
Processa japonica KUBO, 1965, p. 622, fig. 1002.
Processa japonica MANNING and CHACE, 1971, p. 13 (list).
Processa japonica MOTOH, 1972, p. 44, pl. 11, figs. 1,2.

Japan

Tomioka Bay, Amakusa Islands, Kumamoto Prefecture, *Zostera* belt, May 28, 1951, Y. SUMI leg. – 1 ovig. ♀ (ZLKU No. 780); small Danish seine, April 24, 1959, night, T. KIKUCHI leg. – 9 ♂♂, 7 ♀♀ (ZLKU No. 13908); July 19-20, 1959, night, T. KIKUCHI leg. – 9 ♂♂, 10 ovig. ♀♀, 4 ♀♀ (ZLKU No. 13924).

Munakata-oshima Island, Sea of Genkai, Fukuoka Prefecture, September 18, 1957, Y. MOTOMATSU leg. – 1 ♂, 3 ovig. ♀♀, 1 ♀ (ZLKU No. 1466).

Snellius Expedition

Basilan Strait, Sulu Archipelago, 6°58'N, 121°32.5'E, dredge, depth 72-80 m, September 5, 1929 – 1 ♂ (RMNH No. 21318)

Siboga Expedition

Station 71, Makassar and surroundings, depth up to 32 m, bottom mud, sand with mud, coral, May 10-June 7, 1899 – 1 ♂ (AM)

Station 164, 1°42.5'S, 130°47.5'E, between Misool and New Guinea, depth 32 m, bottom sand, small stones and shells, August 20, 1899 – 1 sp. (AM)

Station 313, anchorage east of Danger Besar, Saleh Bay, depth up to 36 m, bottom sand, coral and mud, February 14-16, 1900 – 1 ♀ (AM)

Africa

Station 37/AT-8, Curieuse Bay, Praslin, 4°18.2'S, 55°44.0'E, depth 15 fms, February 19, 1972 – 2 ♂♂, 2 ovig, ♀♀ (EAMFRO)

Station 79/AT-9, Zanzibar Channel, 6°32'S, 39°16'E, depth 29 fms, March 3, 1972 – 1 ♂ (EAMFRO)

Delagoa Bay, Moçambique, University of Witwatersrand, 1955-1 ovig. ♀ (SAM No. 10608)

Definition Rostrum short, simple and triangular in dorsal view. Antennal spine present. Pleuron of fifth abdominal somite rounded posteriorly. Lateral plate of sixth abdominal somite triangular. Telson with two pairs of very obscure spines on dorsal surface. Stylocerite unarmed. Basicerite without spiniform process. Third maxilliped without exopod. Right second pereiopod with 13-22 meral and 41-50 carpal joints, left second pereiopod with 3-8 meral and 15-19 carpal joints. Propodus of fifth pereiopod with more than 25 spinules on posterior margin.

Description Body large, almost cylindrical. Rostrum short, triangular in dorsal view; lateral margin rather strongly carinate. Carapace smooth, glabrous; postorbital region slightly grooved (Fig. 24 *a*); antennal spine small but acute; pterygostomial angle rounded.

Abdomen smooth and rounded; pleura of all abdominal somites not acutely pointed. Lateral plate of sixth somite triangular but not spiniform. Telson pubescent, more than twice as long as sixth somite; dorsal surface shallowly grooved, with two pairs of very small spines; posterior margin ending in a very small median spine, with two pairs of spines and a tuft of rather long hairs present between inner pair of spines (Fig. 24 *b*).

Eye comparatively small, pyriform; cornea wider than stalk. Antennular peduncle long, slender; basal segment as long as distal two segments combined; stylocerite trun-

cated, reaching distal third of basal segment of antennular peduncle; second segment longer than third. Antennal scale exceeding distal extremity of antennular peduncle; outer terminal spine falling short of lamella; basicerite short, without any distinct spine on distal margin; carpocerite long, reaching distal third of antennal scale.

Third maxilliped stout, reaching with distal two segments beyond antennal scale; ultimate segment directed outward and tapering to a strong terminal spine. Exopod absent from third pair of maxillipeds (Fig. 24 *c*). First pair of pereiopods large and stout; right pereiopod chelate and stouter than left pereiopod which has a simple dactylus. Second pair of pereiopods slender and strongly unequal in length, right longer than left. Ischium of right second pereiopod with 2, merus with 13-22 and carpus with 41-50 joints. Ischium of left second pereiopod with 1, merus with 3-8 and carpus with 15-19 joints. Ischium of third and fourth pereiopods with two spines on outer surface; merus of third pereiopod with two to four, mostly three, spines on outer surface. Fourth-pereiopod with one to three, mostly two, spines on outer surface of merus. More than 25 small spines on posterior margin of propodus of fifth pereiopod (Fig. 24 *d*).

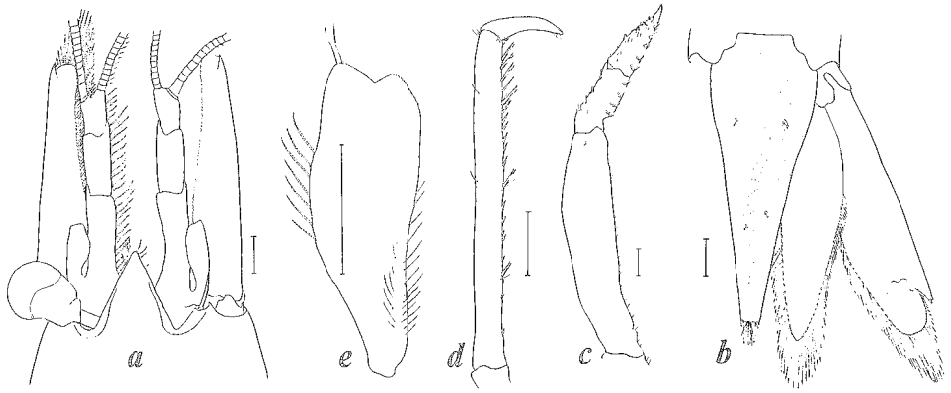

Fig. 24. *Processa japonica* (DE HAAN), *a-d*, ovigerous female (12.4 mm in carapace length) from Munakata-oshima I.; *e*, male (8.4 mm) from Amakusa Is.

a, anterior part of body, *b*, tail fan, *c*, third maxilliped, *d*, dactylus and propodus of fifth pereiopod, *e*, endopod of first pleopod. Scales represent 1.0 mm.

First abdominal sternite with a small median spine curved anteriorly; second sternite with a small median tubercle; third and fourth sternites unarmed; fifth sternite with a distinct median hook curved posteriorly; sixth sternite with a preanal spine. Endopod of first male pleopod more or less notched at end; inner lobe bearing some retinacula (Fig. 24 *e*). Slender appendix masculina on second male pleopod bearing some stiff marginal setae and long apical setae. Uropod longer than telson, outer margin of exopod straight ending in a small spine with a small movable spine immediately inside; diaeresis clearly marked (Fig. 24 *b*).

Ecology KIKUCHI (1962 and 1966) mentioned partly the life history of *Processa*

japonica in *Zostera* belt of Amakusa Islands, Japan as follows: "The species appears principally in *Zostera* belt from April to October (1966, p. 29), where is the ovigerous season of the species. Even in this season it is hardly found the specimens from the day time hauls, but rather abundant in night hauls" (1962, Tab. 1). This apparent nocturnal habit is confirmed in some specimens reared in an aquarium.

Remarks Dr. HOLTHUIS examined the syntypes of *Nika japonica* DE HAAN and described in his unpublished manuscript as follows. "In the Leiden Museum the syntypes of *Nika japonica* DE HAAN are still present. One of them is preserved in spirit, the other two are dry. When examining the specimens it becomes clear that the spirit specimen does not belong to the same species as the dry ones. The dry specimens must be considered to be the real *Processa japonica* as the figure and description of DE HAAN are made after one of them. DE MAN (1920) already stated that the spirit specimen of the syntypes of *P. japonica* had two distinct spinules at each half of the telson; a feature which was not observed in *P. japonica*, where these spines were extremely small." The spirit specimen is fortunately reexamined and it proves to belong to *P. sulcata* sp. nov.

For the same reason an ovigerous female from Itulup reported by DOFLEIN (1902) under the name *P. japonica* does not belong to that species. Three specimens of *P. japonica* reported by MIYAKE, SAKAI and NISHIKAWA (1962) from Yamagata Prefecture, Japan are examined and prove not to belong to that species but to *P. kotiensis*. DOFLEIN's specimen seems also to be *P. kotiensis*, because it has been recorded from northern Japan and is as large as *P. japonica* in northern waters.

There are small morphological variations among the specimens examined or between those and the characters described in the literature. In the types, as well in all the specimens examined, the posterior margin of the sixth abdominal somite is rounded and not acute as in the specimen from the John Murray Expedition (GURNEY, 1937). GURNEY (1937) also described and figured the rounded endopod of the first pleopod in the male as one of the specific characters of the species. All the large males, however, have a rather notched endopod, but in the young specimens it is more or less rounded. In the Siboga and African specimens the telson is dorsally rounded somewhat glabrous, while in the Japanese specimens it is grooved longitudinally and pubescent. The spines of the first and second abdominal sternites are indistinct in young specimens, but those of the fifth and sixth sternites are usually apparent even in young specimens. Eggs numerous and small, 0.43 × 0.51 mm in diameter.

Size Ovigerous females 35-43 mm, male 30 mm in entire length.

Distribution The species is distributed from the east coast of Africa through the Malay Archipelago to Japan, and sometimes collected from considerable depths. Itulup, Kurile Is., fresh water ?(DOFLEIN, 1902). Japan (DE HAAN, 1844 and 1849; HERKLOTS, 1861; NAKAZAWA and KUBO, 1947; KUBO, 1965), Toyama (MIYAKE et al., 1962),

Kadsiyama [Katsuyama], Chiba Pref. (ORTMANN, 1890), Tokio Bay (ORTMANN, 1890), Yenoshima, Kanagawa Pref. (PARISI, 1919), Sagami Bay (PARISI, 1919), Osaka (MIYADI, 1940), Munakata-oshima I., Fukuoka Pref. (MIYAKE et al., 1962; present publication), Amakusa Is., Kumamoto Pref. (MIYAKE, 1961; present publication), Nagasaki (BALSS, 1914), Sea of Ariake (IKEMATSU, 1963), Makassar, up to 32 m (DE MAN, 1920; present publication); Saleh Bay, Soembawa, up to 36 m (DE MAN, 1920; present publication); Between Misool and New Guinea, 32 m (DE MAN, 1920; present publication); Basilan Strait, 72-80 m (present publication), Zanzibar Channel, 29 fms (present publication), Curieuse Bay, Praslin, 15 fms (present publication), Arabian Sea (GURNEY, 1937) and Delagoa Bay (BARNARD, 1955; present publication).

Processa kotiensis (YOKOYA, 1933)

(Fig. 25 *a-m*)

Nika japonica p.p. DOFLEIN, 1902, p. 641.
?*Nica processa* BALSS, 1914, p. 61.
Nika kotiensis YOKOYA, 1933, p. 30, fig. 11.
Processa kotiensis GURNEY, 1937, p. 87 (list) and p. 91 (key).
Processa japonica p.p. MIYAKE, SAKAI and NISHIKAWA, 1962, p. 123 (list).
Processa processa FUJINO and MIYAKE, 1970, p. 257 (not *Nika processa* BATE).
Processa kotiensis MANNING and CHACE, 1971, p. 13 (list).

Japan

Off Atsumi, Yamagata Prefecture, Sea of Japan, depth 80 m, July 14, 1958, Japan Sea Regional Fisheries Research Laboratory – 1 ♂, 2 ovig. ♀♀ (ZLKU No. 1312).

Sea of Genkai, off Tsuyazaki, Fukuoka Prefecture, Danish seine, May 9, 1967, S. MATSUURA and T. FUJINO leg. – 1 ♂, 1 ovig. ♀, 3 ♀♀ (ZLKU No. 13757), 1 ovig. ♀, 1 ♂ (SAM); June 23, 1967, night, *Sargassum*, S. MATSUURA and T. FUJINO leg. – 2 ovig. ♀♀ (ZLKU No. 9592); between Ainoshima Island and Tsuyazaki, June 23, 1967, night, S. MATSUURA and T. FUJINO leg. – 1 ovig. ♀ (ZLKU No. 13764); Ainoshima Island, July 18, 1967, night, S. MATSUURA leg. – 1 ♂, 1 ovig. ♀, 1 ♀ (ZLKU No. 13767).

Tomioka Bay, Amakusa Islands, Kumamoto Prefecture, *Zostera* belt, small Danish seine, April 24, 1959, T. KIKUCHI leg. – 1 ♂, 1 ♀ (ZLKU No. 13755).

East China Sea

33°34.9'N, 128°25.2'E, depth 120 m, June 18, 1964, time 19:18, H. YAMASHITA leg. – 1 ♀ (ZLKU No. 16462).

Definition Rostrum narrow, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite rounded posteriorly. Lateral plate of sixth somite truncated. Stylocerite with spine at outer distal end. Basicerite with small spine. Third maxilliped with exopod. Right second pereiopod with 9-12 meral and 21-27 carpal joints, left second pereiopod with 5-7 meral and 16-17 carpal joints. Propodus of fifth pereiopod with three groups of spines.

Description Body robust (Fig. 25 *a*). Rostrum directly downward, reaching almost

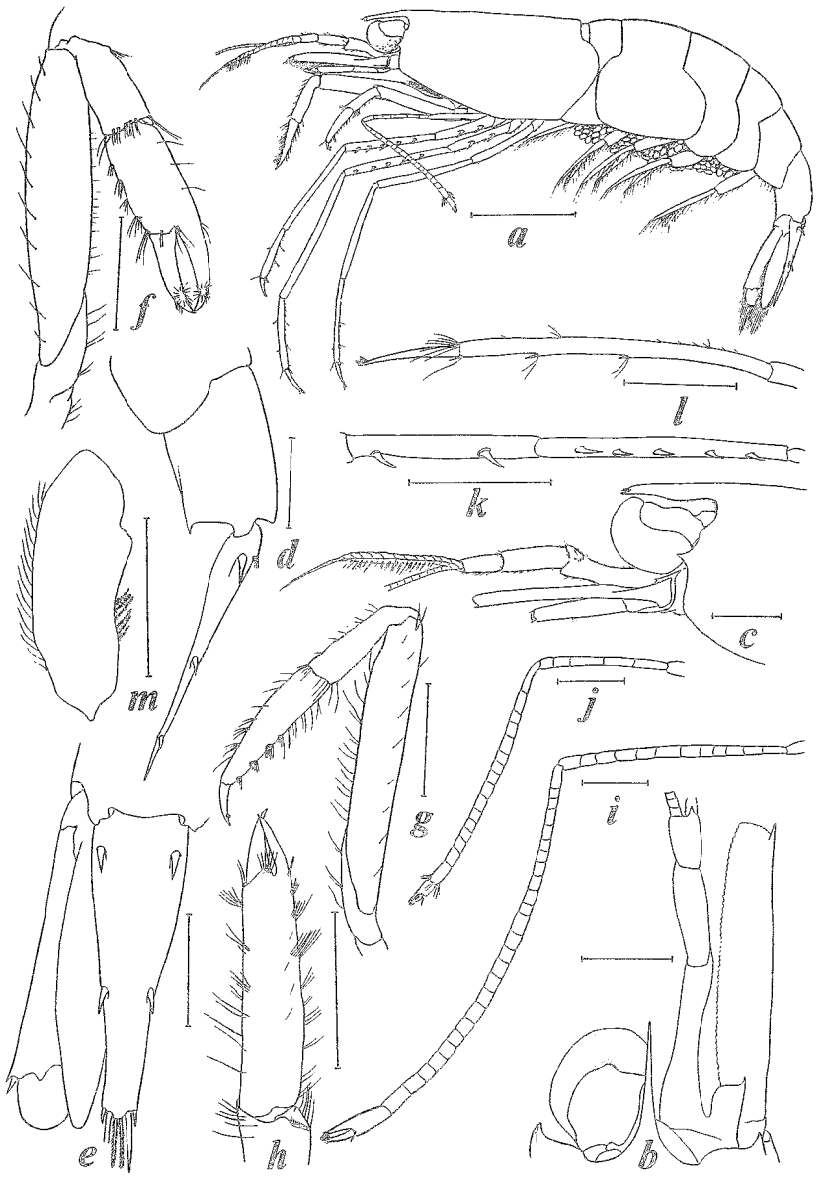

Fig. 25. *Processa kotiensis* (YOKOYA), *a, f, g,* ovigerous female (4.8 mm in carapace length), *b,* ovigerous female (4.5 mm), *c-e, i, j, l,* ovigerous female (5.0 mm), *k,* male (4.4 mm), *m,* male (4.0 mm) from Sea of Genkai; *h,* male from Yamagata Pref.

a, animal in lateral view, *b,* anterior part of body, *c,* same in lateral view, *d,* posterior part of body, *e,* tail fan, *f,* right first pereiopod, *g,* left first pereiopod, *h,* abnormal chela of left first pereiopod, *i,* right second pereiopod, *j,* left second pereiopod, *k,* merus and ischium of third pereiopod, *l,* dactylus and propodus of fifth pereiopod, *m,* endopod of first pleopod. Scale for *a* represents 4.0 mm and scales for *b-m* represent 1.0 mm.

end of eye; lower border slightly concave; apex apparently bifid; upper tooth half as long as lower tooth (Fig. 25 *c*). Carapace smooth, about 3.0-4.0 times as long as rostrum; no postorbital groove. Suborbital angle not distinctly pointed, continuous with an acute antennal spine.

Pleuron of fifth abdominal somite rounded. Sixth somite about 1.3 times as long as fifth; pleuron acutely pointed, lateral plate truncated (Fig. 25 *d*). Telson about 1.6 times as long as sixth somite; dorsal surface with two pairs of spines, first pair situated very close to base and second pair in middle; posterior margin truncated, with three pairs of irregular spines (Fig. 25 *e*).

Eye large and compressed; cornea much wider than stalk. Basal segment of antennular peduncle longer than distal two segments combined; stylocerite ending in a stout spine at outer distal angle; second segment 1.5 times as long as third (Fig. 25 *b*); outer antennular flagellum thickened and setose at basal 13-15 joints in males, while in females basal 4-6 joints naked; inner flagellum very slender, about twice as long as carapace. Antennal scale as long as antennular peduncle, about 5.5 times as long as broad; outer margin almost straight, ending in a stout spine; lamellar part truncated, as long as outer spine (Fig. 25 *b*); basicerite with spine on outer distal end; carpocerite extending to three-fifths of scale (Fig. 25 *c*); flagellum about 1.5 times as long as body.

Third maxilliped reaching with ultimate segment or distal two segments beyond antennal scale. Exopod slender, reaching one-third length of antepenultimate segment. First pair of pereiopods stout; right pereiopod chelate (Fig. 25 *f*) and stouter than left pereiopod which has a simple dactylus (Fig. 25 *g*). Second pair of pereiopods strongly unequal; merocarpal articulation of right pereiopod reaching beyond, at least, antennal scale; ischium with 2, merus with 9-12 and carpus with 21-27 joints (Fig. 25 *i*). Merocarpal articulation of left second pereiopod reaching beyond eye; ischium undivided, merus with 5-7 and carpus with 16-17 joints (Fig. 25 *j*). Third pereiopod reaching with dactylus, propodus and half or more than half of carpus beyond antennal scale; ischium with two spines on outer surface; merus with a row of four to six, mostly five, large spines on outer surface (Fig. 25 *k*). Fourth pereiopod reaching with dactylus, propodus and more than half to entire carpus beyond antennal scale; ischium with two outer spines as in third pereiopod; merus with four or five outer spines. Fifth pereiopod with dactylus, propodus and less than half of carpus beyond antennal scale. Ischium and merus unarmed; propodus with three groups of spines on posterior margin, each group consisting of one to three spines (Fig. 25 *l*).

Endopod of first pleopod in male about half as long as exopod, not distinctly notched at tip (Fig. 25 *m*). Uropod longer than telson, outer margin of exopod straight, ending in two spines, outer small and fixed, inner long and movable. Abdominal sternites without any spine.

Abnormality Three specimens (1 ♂, 2 ovig. ♀♀, ZLKU No. 1312) collected from the northern Sea of Japan, off Atsumi, Yamagata Prefecture are larger than the other specimens examined. Of these the male has the chelate first pereiopods on both

sides. The right pereiopod shows the normal chela but the left chela is rather abnormal; the fingers are curved and much shorter than those of the normal chela and the palm is more than twice as long as fingers (Fig. 25 *h*). One ovigerous female has the usual first pereiopods and the other female is devoid of the left first pereiopod.

Remarks Although YOKOYA (1933) described a new species, *Nika kotiensis* from Murotozaki, Kochi Prefecture, Japan, his description is short and many important characters were not mentioned. Recently his unpublished manuscript on Japanese Macrura written in Japanese was received. The description of *Nika kotiensis* is also very brief in this manuscript, but a few important characters are mentioned. According to these YOKOYA's description of *N. kotiensis,* it proves to be a distinct species and seems to be confused with another species, which has been erroneously named *P. processa* (BATE). YOKOYA (1933) compared his new species with *Nika processa* sensu RATHBUN (1906), which is either *Nikoides danae* or *N. maldivensis.* The true *P. processa,* however, is a very rare and unique species, and its allied form, which was referred to *P. processa* by DE MAN (1922) and is now created as a new species, *P. affinis* sp. nov., is also a rare species. *P. kotiensis* differs from the true *P. processa* in having an antennal spine and from *P. affinis* in having more numerous carpal joints of the right second pereiopod and a spine on the outer distal angle of the stylocerite. Some specimens reported under the name *P. processa* (BATE) from Japan, such as by BALSS (1914) and FUJINO and MIYAKE (1970), may probably be referred to *P. kotiensis.* With regard to the latter authors' specimens, a part of them are reexamined and they prove to belong to the present species.

After a reexamination the three specimens from Yamagata Prefecture identified with *P. japonica* by MIYAKE, SAKAI and NISHIKAWA (1962) proves to be *P. kotiensis.* DOFLEIN's (1902) ovigerous female from Itulup referred to *P. japonica* also may belong to the present species.

P. kotiensis is more closely related to *P. austroafricana* BARNARD, *P. canaliculata* LEACH and *P. gracilis* BAKER than to *P. affinis* and *P. processa* in having strongly unequal second pereiopods and a pointed stylocerite but it is distinguished from these three species by the numerous segmentations of the right second pereiopod; 14-20 meral and 33-37 carpal joints in *P. austroafricana,* 14-18 meral and 30-35 carpal joints in *P. canaliculate* and about 40 carpal joints in *P. gracilis.*

Size The type is less than 30 mm in body length. In southern Japan ovigerous females are 4.7-5.0 mm and males 3.5-4.4 mm in carapace length, while the specimens collected from the Sea of Japan, off Atsumi, Yamagata Prefecture are larger than the southern Japanese specimens, e.g., the male is 6.8 mm and the ovigerous females are 8.0 or 8.2 mm in carapace length.

Distribution This species is more common in deep waters than in the littoral. Itulup, Kurile Is. (DOFLEIN, 1902); Japan, off Atsumi, Yamagata Prefecture, 86 m (MIYAKE,

SAKAI, NISHIKAWA, 1962; present publication), ? Dzushi, Sagami Bay, 130 m (BALSS, 1914), Kochi Prefecture, 110 m (YOKOYA, 1933), Fukuoka Pref. (present publication), Amakusa Islands, Kumamoto Pref. (present publication), East China Sea, 55-126 m (FUJINO and MIYAKE, 1970 and present publication).

Processa longirostris sp. nov.

(Figs. 26 and 27 *a-o*)

South Viet Nam

Station 336b, Bay of Nha Trang, depth 5 m, bottom sandy mud, V. A. GALLARDO leg. – 1 ovig. ♀ (holotype, RMNH No. D 17059), 1 ♂, 1 ♀ (paratypes, RMNH)

Definition Rostrum narrow, slender, crested dorsally, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite rounded. Lateral plate of sixth somite with small spine. Stylocerite pointed. Basicerite with well developed outer spine. Third maxilliped with developed exopod. Second pereiopod equal, with 5-6 meral and 11-12 carpal joints. Propodus of fifth pereiopod with two spines on posterior margin.

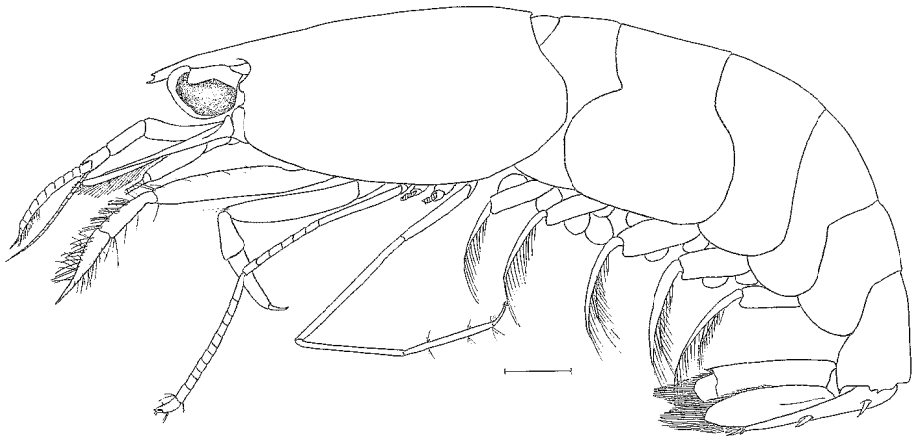

Fig. 26. *Processa longirostris* sp. nov., holotype, ovigerous female from Bay of Nha Trang. Scale represents 1.0 mm.

Description Body robust (Fig. 26). Rostrum long and descendant, extending beyond end of eye; dorsally carinate; apex bifid, lower tooth distinctly longer than upper tooth (Fig. 27 *a*). Carapace with short postrostral carina; suborbital angle produced and separated from antennal spine (Fig. 27 *a, g*); postorbital region without groove.

First five abdominal pleura smooth posteriorly; pleuron of sixth somite pointed (Fig. 27 *c*); lateral plate of sixth somite with small spine (Fig. 27 *d*). Telson about

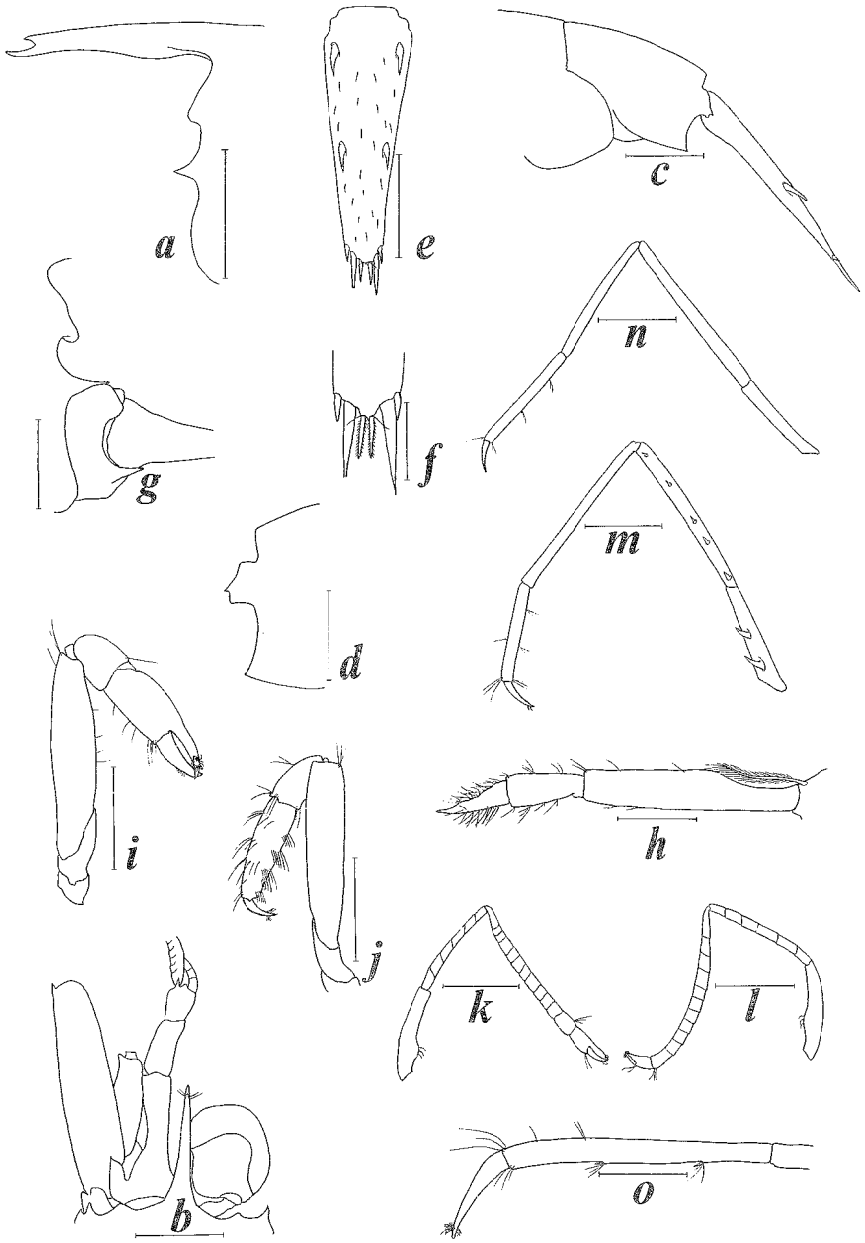

Fig. 27. *Processa longirostris* sp. nov., *a, c,* paratype, male (4.4 mm in carapace length), *b, d, g-l, n, o,* paratype, female (4.2 mm), *e, f, m,* holotype from Bay of Nha Trang.

a, anterior part of carapace, *b,* anterior part of body, *c,* posterior part of body, *d,* posterior margin of sixth abdominal somite, *e,* telson, *f,* apex of telson, *g,* anterior margin of carapace and basicerite, *h,* third maxilliped, *i,* right first pereiopod, *j,* left first pereiopod, *k,* right second pereiopod, *l,* left second pereiopod, *m,* fourth pereiopod, *n,* fifth pereiopod, *o,* dactylus and propodus of fifth pereiopod. Scales for *a-c, e, h-n* represent 1.0 mm and scales for *d, f, g, o* represent 0.5 mm.

1.5 times as long as sixth somite; two pairs of spines present, anterior pair placed near end of sixth somite, posterior pair situated just behind half of telson (Fig. 27 *e*); posterior margin ending in a median spine, flanked by three pairs of spines (Fig. 27 *f*).

Eye large, dorsally flattened and ventrally rounded. Antennular peduncle long; basal segment longer than distal two segments combined; stylocerite short, with a sharply pointed spine on outer distal end; second segment about 1.5 times as long as third (Fig. 27 *b*). Antennal scale as long as antennular peduncle, 4 times as long as broad; outer spine longer than lamellar part; basicerite with a strong spine on outer posterior end (Fig. 27 *g*); carpocerite rather short, reaching end of basal segment of antennular peduncle.

Third maxilliped slender and short, reaching with ultimate segment beyond antennal scale; antepenultimate segment longer than distal two segments combined, with a well developed exopod (Fig. 27 *h*). First pair of pereiopods short, not reaching end of antennal scale; right chelate (Fig. 27 *i*) and left simple (Fig. 27 *j*). Second pereiopods equal in length, reaching beyond antennal scale by chela; ischium not subdivided, merus with 5 or 6 obscure joints and carpus with 11-12 joints (Fig. 27 *k, l*). Third and fourth pereiopods reaching with distal two segments beyond antennal scale; ischium of these pereiopods with two spines and merus of these pereiopods with five spines on outer surface; merus of third pereiopod slightly longer than carpus; merus of fourth pereiopod as long as carpus (Fig. 27 *m*). Fifth pereiopod reaching beyond antennal scale by dactylus and half propodus; ischium and merus without outer spine (Fig. 27 *n*); propodus with two short spines on posterior margin, distal end without spine though with a tuft of hairs (Fig. 27 *o*).

First three abdominal sternites with a posteriorly curved hook; fourth and sixth sternites without any hook or spine; fifth sternite with a low keel. Endopod of first male pleopod broadened at apex, with several retinacula. Uropod longer than telson. Eggs small and numerous, 0.24 × 0.30 mm in diameter.

Remarks The present new species belongs to a group characterized by the rounded pleuron of the fifth abdominal somite and the equal second pair of pereiopods and is apparently distinguished from all the species of this group, except for *P. moana* YALDWYN from New Zealand, by having a long rostrum, which extends beyond end of eye. In *P. moana* the second pair of pereiopods has 1 meral and 13 carpal joints, while in *P. longirostris* it bears 5-6 meral and 11-12 carpal joints.

The European *P. elegantula* NOUVEL and HOLTHUIS, *P. macrophthalma* NOUVEL and HOLTHUIS and *P. mediterranea* (PARISI) have also a long rostrum but they differ principaily from *P. longirostris* by the long and unequal second pair of pereiopods.

Size The holotype is the ovigerous female, 4.4 mm in carapace length and 1.6 mm in rostrum length. The male paratype is 4.8 mm and the female paratype is 4.2 mm in carapace length.

Distribution This species has been only known from the type locality, Bay of Nha Trang, 5 m (present publication).

Processa macrognatha (STIMPSON, 1860)

(Fig. 28 *a-k*)

Nica macrognatha STIMPSON, 1860, p. 26.
not *Nica macrognatha* DE MAN, 1888, p. 274.
Processa macrognatha DE MAN, 1920, p. 199 (list).
Processa australiensis p.p. DE MAN, 1920, p. 199 (not *Processa australiensis* BAKER).
Processa macrognatha MANNING and CHACE, 1971, p. 13 (list).

Siboga Expedition

Station 66, Bank between island of Buhuluwang and Tambolungan, South of Saleyer, depth 8 m bottom dead coral, Halimeda, lithothamnion, May 7-8, 1899 – 1 ovig. ♀ (AM)

Definition Rostrum extremely short, simple. Antennal spine absent. Pleura of fifth abdominal somite rounded posteriorly. Lateral plate of sixth abdominal somite not pointed. Stylocerite obliquely truncated. Basicerite without process. Third maxilliped with well developed exopod. Second pereiopods subequal, 4 or 5 meral and 11 carpal joints. Propodus of fifth pereiopod without any spine.

Description Body small and robust (Fig. 28 *a*). Rostrum short, not reaching end of eyestalk; apex simple (Fig. 28 *b, c*). Carapace 6 times as long as rostrum; anterior margin without any process; postorbital groove shallow (Fig. 28 *b*).

Abdomen smooth; pleura of first five somites rounded, that of sixth somite pointed but not acute. Lateral plate of sixth somite truncated (Fig. 28 *d*). Telson long, 1.7 times as long as sixth somite; dorsal surface with two pairs of spines, anterior pair situated near end of sixth somite and posterior pair situated at half length of telson; posterior margin ending in a very small median point, flanked by three pairs of spines (Fig. 28 *e*).

Eye rather large. Antennular peduncle long, slender; basal segment 1.5 times as long as distal two segments combined; stylocerite short and obliquely truncated; second segment as long as third. Antennal scale as long as antennular peduncle; outer terminal spine slightly shorter than lamella (Fig. 28 *c*); basicerite without any distinct spine or process; carpocerite reaching distal fourth of antennal scale.

Third maxilliped stout, reaching with distal two segments beyond antennal scale; well developed exopod present. First pair of pereiopods stout; right pereiopod chelate (Fig. 28 *f*), stouter than left pereiopod, which has a simple dactylus (Fig. 28 *g*). Second pair of pereiopods slender and subequal in length. Merocarpal articulation reaching last segment of antennular peduncle on both sides; ischium with 2, merus with 4 or 5 and carpus with 11 joints (Fig. 28 *h, i*). The ischium of third and fourth pereiopods with two spines on outer posterior margin; merus of third pereiopod with three spines and

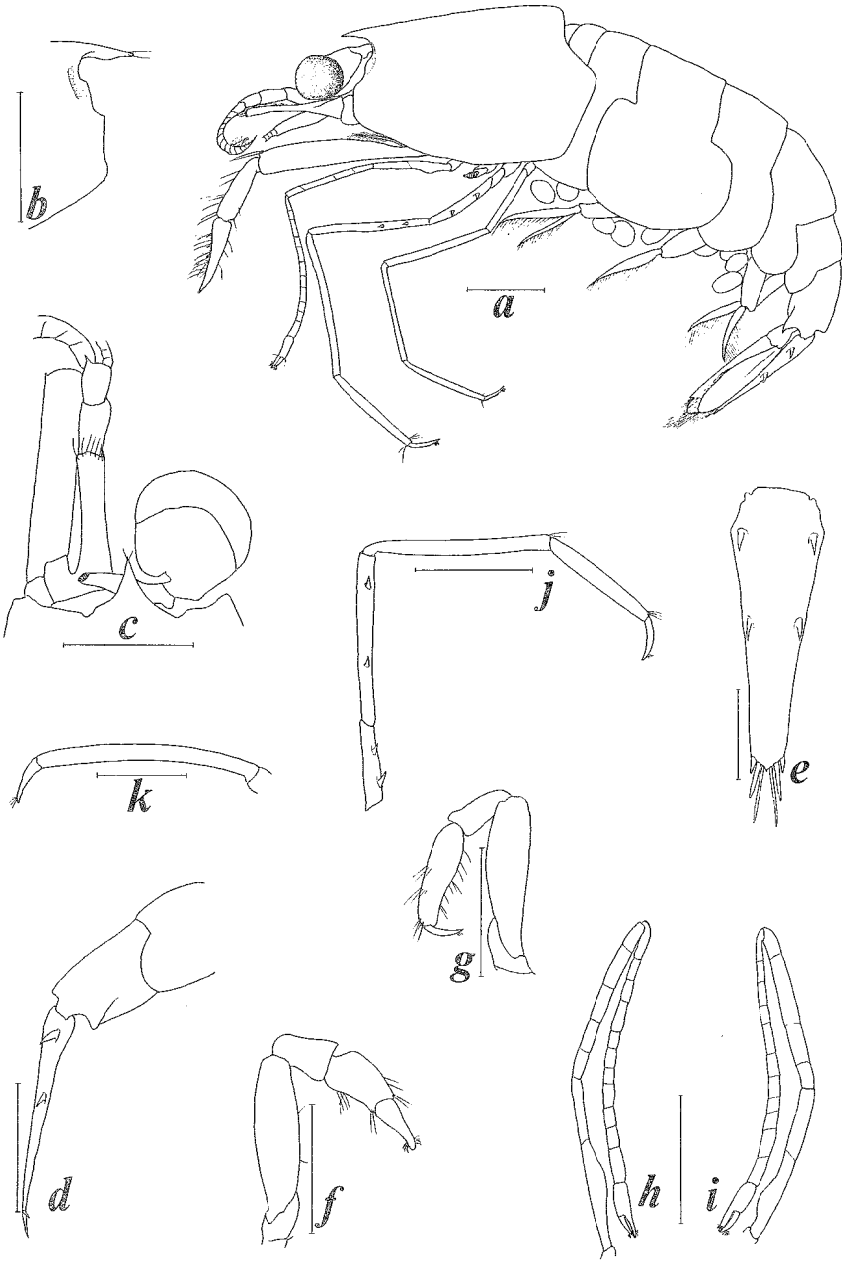

Fig. 28. *Processa macrognatha* (STIMPSON), ovigerous female (2.5 mm in carapace length) from S. of Saleyer.

a, animal in lateral view, *b*, anterior margin of carapace, *c*, anterior part of body, *d*, posterior part of body, *e*, telson, *f*, right first pereiopod, *g*, left first pereiopod, *h*, right second pereiopod, *i*, left second pereiopod, *j*, third pereiopod, *k*, dactylus and propodus of fifth pereiopod. Scales for *a-d*, *f-j* represent 1.0 mm and scales for *e*, *k* represent 0.5 mm.

that of fourth pereiopod with one or two spines (Fig. 28 *j*). Fourth pereiopod reaching with dactylus, propodus and one-fifth of carpus beyond antennal scale. Fifth pereiopod reaching with distal two segments beyond antennal scale; no spine on outer surface of ischium and merus or even on posterior margin of propodus (Fig. 28 *k*).

Remarks The present specimen was dealt with under the name *Processa australiensis* BAKER by DE MAN (1920). It, however, differs readily from that species by the rounded pleuron of the fifth abdominal somite and the equal second pereiopods. Some important characters are mentioned in DE MAN's description, such as the short and simple rostrum, the absence of a spine on the anterior margin of the carapace. DE MAN (1920) considered the apex of rostrum missing, but it seems to be intact, because a few hairs are implanted near the apex, which is naturally tapered. In addition to these features, this specimen possesses a long third maxilliped with a developed exopod, an unarmed propodus of the fifth pereiopods, three spines on the merus of the third pereiopod and one or two spines on the merus of the fourth pereiopod.

STIMPSON (1860) described *Nica macrognatha* from Hong Kong, which description is short and the type is not extant. DE MAN (1920) referred STIMPSON's species to *Processa australiensis* BAKER with a slight hesitation and GURNEY (1937) thought the description of STIMPSON inadequate. But the present specimen may be referred to *N. macrognatha*. STIMPSON (1860) mentioned that *N. macrognatha* possesses a very short and sharply pointed rostrum and a well developed third maxilliped. These characters agree well with those of the present material. Furthermore there is no distinct discrepancy between the other characters given by STIMPSON (1860) and those of the present material. The short and pointed rostrum excludes all the known species except for *P. hawaiensis* (DANA), *P. japonica* (DE HAAN) and *P. molaris* CHACE. STIMPSON's (1860) description distinguishes his species from the first two species by the differences of the eye, of the first pair of pereiopods and the armature of the telson. From *P. molaris*, *N. macrognatha* differs in the well developed third maxilliped and the large size.

DE MAN (1888) reported two very young specimens from Owen Island under the name *Nica macrognatha*, but these specimens are distinguished from that species by the length of the rostrum, which is a little shorter than eye in DE MAN's specimens. The other important characters were not mentioned, so that the specific status can not be determined certainly.

In *P. hawaiensis* the rudimental exopod is present on the third maxilliped and in *P. japonica* and *P. molaris* no exopod is present on the third maxilliped. The absence of a spine on the anterior margin of carapace is another important character of *Processa macrognatha*. The following five species are not provided with a spine on the anterior margin of the carapace; *P. australiensis*, *P. bermudensis* (RANKIN), *P. coutierei* NOBILI, *P. processa* (BATE) and *P. vicina* MANNING and CHACE. *P. australiensis* has a short rostrum but with a bifid apex and has no spine on the pleuron of the fifth abdominal somite as mentioned above. In the other four species the rostrum is not short, as long

as or slightly shorter than eye. Except for *P. coutierei,* moreover, their apex is always bifid. In *P. coutierei* the rostrum is triangular in dorsal view.

From *P. aequimana* (PAULSON) and its allied species, which have no spine on the fifth abdominal somite and subequal or equal second pair of pereiopods, *P. macrognatha* differs in having a small and simple rostrum and no antennal spine.

Size STIMPSON's type is 25.1 mm in length. The present material is 2.5 mm in carapace length and 0.4 mm in rostrum length.

Distribution Hong Kong, 8 fms (STIMPSON, 1860), S. of Saleyer, 8 m (DE MAN, 1920; present publication).

Processa moana YALDWYN, 1971

Processa ? n. sp. RICHARDSON and YALDWYN, 1958, p. 34, fig. 32.
Processa moana YALDWYN, 1971, p. 91.

Definition Rostrum narrow, slender, apex bifid, exceeding slightly beyond eye. Antennal spine present. Pleuron of fifth abdominal somite rounded posteriorly. Second pereiopods equal, 1 meral and 13 carpal joints. Propodus of fifth pereiopod without any spine on posterior margin.

Size Length up to 1 inch (RICHARDSON and YALDWYN, 1958) and the male holotype is 6 mm in carapace length (YALDWYN, 1971).

Distribution The species has been recorded only from Bay of Plenty (RICHARDSON and YALDWYN, 1971).

Processa molaris CHACE, 1955

(Figs. 29 and 30 *a-d*)

Processa molaris CHACE, 1955, p. 11, fig. 5 a-t.
Processa coutierei HOLTHUIS, 1958, p. 33, fig. 13 (not *Processa coutierei* NOBILI).
Processa molaris MANNING and CHACE, 1971, p. 13 (list).

Central Pacific

Namu Island, Bikini Atoll, reef at shore inside lagoon, April 3, 1946, M. JOHNSON leg. – 1 ovig. ♀ (one of the paratypes of *P. molaris,* USNM)

Siboga Expedition

Station 40, Anchorage off Pulu Kawassang, Paternoster Islands, depth 12 m, bottom coral reef, April 2, 1899 – 1 juv. (RMNH)

Red Sea

Golf van Akaba, Eylath, Israel, No. E 5517a, May 2, 1955, H. STEINITZE leg. – 1 ovig. ♀ (RMNH

No. D 14287)

East Africa

Jadini, Kenya, lagoon pools at LWS, bottom sand and weed, September 14, 1973, A. J. BRUCE leg. – 1 ovig. ♀ (EAMFRO)

Definition Rostrum narrow, simple. Antennal spine absent, but suborbital angle pointed. Pleuron of fifth abdominal somite rounded posteriorly. Lateral plate of sixth abdominal somite obtusely pointed. Stylocerite pointed. Basicerite of antennal peduncle without distinct spine. Third maxilliped without exopod. Second pereiopods subequal, with 1 or 2 meral and 6 carpal joints. Propodus of fifth pereiopod with four pairs of spines on posterior margin.

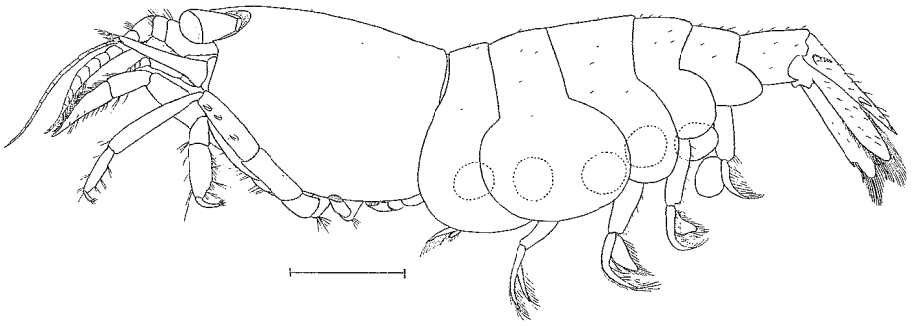

Fig. 29. *Processa molaris* CHACE, paratype, ovigerous female from Bikini Atoll. Scale represents 1.0 mm.

Remarks The species is closely related to *P. coutierei* NOBILI in having the carpus of the second pereiopod subdivided into 6 joints (Figs. 18 *f* and 30 *c*), in the unusually large mandible and in having a single outer spine on the ischium of the fifth pereiopod (Figs. 18 *i* and 30 *d*), which characters are unique in the family Processidae. The specific status of *P. coutierei* depends upon the present material from Mombasa, NOUVEL's redescription of the holotype and Dr. FOREST's kind reexamination of the mouthparts and branchial formula of the holotype. *P. molaris* and *P. coutierei* differ from each other by the following characters.

(1) *P. molaris* bears no exopod on the third maxilliped, while in *P. coutierei* the third maxilliped is provided with a distinct exopod, which is well developed, being as long as that of the second maxilliped. (2) The rostrum of *P. molaris* is shorter than the eye, *P. coutierei* has a long rostrum, extending beyond the distal end of eye. (3) The apex of the telson is pointed in the middle and flanked by three pairs of spines in *P. coutierei*, while in addition to three pairs of spines, each outer distal corner of the telson in *P. molaris* ends in a small sharply pointed spine, but is without the median spine.

P. molaris is comprehensively described and excellently figured by CHACE (1955). Through the courtesy of Dr. CHACE, one of the paratypes of that species could be re-examined. Three other specimens of the species are examined; the first was collected from East Africa, and kindly donated by Dr. BRUCE. The second was obtained from the Red Sea and forms part of the collection of the Rijksmuseum van Natuurlijke Historie. It was received through the courtesy of Dr. HOLTHUIS, and was referred to *P. coutierei* by HOLTHUIS (1958). The last is a very small specimen of the Siboga collection which was referred to *P. australiensis* by DE MAN (1920).

The Siboga material is rather different from the first three specimens but apparently differs from *P. australiensis* in the rounded pleuron of the fifth abdominal somite and the short and equal second pair of pereiopods, in which the merocarpal articulation does not reach the anterior margin of the carapace. It is too small to confirm some specific characters, such as the segmentation of the carpus of the second pereiopods and the spination of the basicerite. Moreover it has a rather long rostrum, reaching beyond the eyestalk and shows remains of a rudimental exopod on the third maxilliped and the first four pereiopods. However, it probably belongs to *P. molaris*, in having the unique shape of the rostrum, as in the adult females, and the pointed stylocerite.

The remaining three specimens agree well with one another in every respect but some minor variations are observed. They are all ovigerous females, and the paratype is 1.9 mm in carapace length but the other two specimens are rather larger, 2.7 and 3.1 mm. The eggs are comparatively large, measuring about 0.35 mm in the paratype, 0.49 × 0.24 mm in the Red Sea specimen and 0.71 x 0.63 mm in the East African specimen, while the number of eggs are comparatively few in the latter two specimens and in the former specimen only a few eggs are observed attached on the pleopods.

The rostrum is short, extending as far forward as the end of the eyestalk and each lateral margin of the rostrum is elevated as low and thin keel in all specimens (Fig. 30 *a*). The postorbital carina is well developed in all specimens and the suborbital angle is sharply pointed in the East African specimen and not sharply pointed in the type and the Red Sea specimen (Fig. 30 *b*). The lateral plate of the sixth abdominal somite is triangular, the tip being rounded. The basicerite of the antennal peduncle bears two blunt processes on the outer distal margin with a thin projection below the lower process just inside, and one small process on the inferior margin in all specimens. The merus of the second pereiopod is indistinctly subdivided into two joints in the specimen from East Africa, but not subdivided in the two other specimens. The merus of the fifth pereiopod is armed with one or two outer spines on the East African and the Red Sea specimens (Fig. 30 *d*), while it is unarmed in the type series (CHACE, 1955, fig. 5 t). The fourth pereiopod is longer than the third and fifth pereiopods. CHACE's figures of the third (Fig. 5 *r*) and the fourth (Fig. 5 *s*) pereiopods seem to be interchanged.

Size According to CHACE (1955), the carapace length varies from 1.7 to 2.0 mm in the types and the entire animal in the holotype is 8.5 mm long. The Red Sea and the East African specimens are rather larger, 2.7 and 3.1 mm in carapace length, re-

spectively, The Siboga specimen is much smaller, 0.9 mm in carapace length.

Distribution. This is a littoral species, found mostly on coral reefs. Burok I., Rongelap Atoll, intertidal coral (CHACE, 1955), Namu I., Bikini Atoll, reef at inside lagoon (CHACE, 1955 ; present publication), Paternoster Is., 12 m (DE MAN, 1920; present publication), Eylath, Israel (HOLTHUIS, 1958; present publication), and Jadini, Kenya, lagoon pools at LWS (present publication).

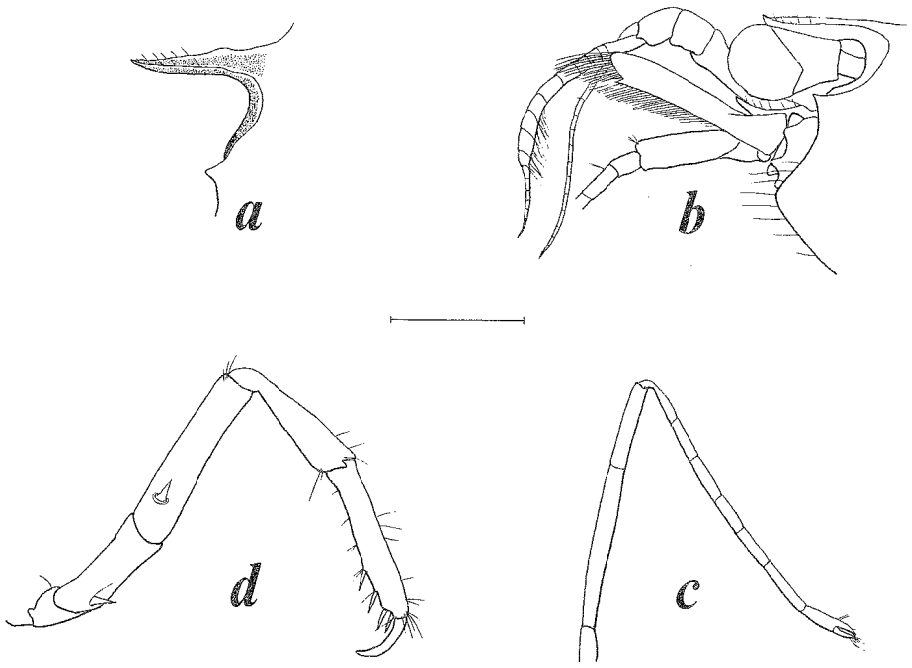

Fig. 30. *Processa molaris* CHACE, *a*, ovigerous female (2.7 mm in carapace length) from Eylath; *b-d* ovigerous female (3.1 mm) from Jadini.

a, rostrum, *b*, anterior part of body, *c*, right second pereiopod, *d*, fifth pereiopod. Scale represents 1.0 mm.

Processa neglecta sp. nov.

(Figs. 31 and 32 *a-l*)

Processa sp. p.p. DE MAN, 1920, p. 203 pl. 17 fig. 52 o (not 52-52i=*Processa affinis* sp. nov.; 52 j -n = *Nikoides sibogae* DE MAN; 52p = *Processa demani* sp. nov.).

Processa aequimana DE MAN, 1922, p. 44, pl. 4 fig. 19-19f (not *Nika aequimana* PAULSON).

Siboga Expedition

Station 96, SE side of Pearl-bank, Sulu Archipelago, depth 15 m, bottom lithothamnion, June 27, 1899 – 1 ovig. ♀ (paratype, AM)

Station 104, Sulu harbour, Sulu Island, depth 14 m, bottom sand, July 2-3, 1899 – 1 ♀ (paratype, AM)
Station 181, Ambon-Anchorage, depth 54 m, bottom mud, sand and coral, September 5-11, 1899 – 3 ovig. ♀♀, 1 ♀, 2 spp. (paratype, AM)
Station 258, Tual-anchorage, Kei Islands, depth 22 m, bottom lithothamnion, sand and coral, December 12-16, 1899 – 1 ♂ (paratype, AM)
Ambon – 1 sp. (paratype, AM)

South Viet Nam

Station 77, Bay of Nha Trang, depth 11 m, bottom mud, January 20, 1960, V. A. GALLARDO leg. – 1 ♀ (paratype, RMNH)
Station 221, Bay of Nha Trang, depth 17 m, bottom sand, March 7, 1960, V. A. GALLARDO leg. – 1sp.(paratype, RMNH)
Station 232 II, Bay of Nha Trang, depth 12 m, bottom sand, March 8, 1960, V. A. GALLARDO leg. – 1 sp. (paratype, RMNH)
Station 250, Bay of Nha Trang, depth 19 m, bottom sand, March 18, 1960, V. A. GALLARDO leg. – 1 ♀ (paratype, RMNH)
Station 251s, Bay of Nha Trang, depth 20 m, bottom sand, March 18, 1960, V. A. GALLARDO leg. – 1 ♂, 1 oivg. ♀ (paratypes, RMNH No. D 17053)
Station 260, Bay of Nha Trang, depth 17 m, bottom sand, March 18, 1960, V. A. GALLARDO leg. – 1 ♀ (paratype, RMNH No. D 17055)
Station 264, Bay of Nha Trang, depth 9 m, bottom sand, March 21, 1960, V. A. GALLARDO leg. – 1 ♂ (paratype, RMNH)
Station 265, Bay of Nha Trang, depth 11 m, bottom sand, March 21, 1960, V. A. GALLARDO leg. – 1 ovig. ♀ (holotype, RMNH)
Station 292, Bay of Nha Trang, depth 25 m, bottom sand, March 25, 1960, V. A. GALLARDO leg. – 1 ovig. ♀ (paratype, RMNH)
Station 297, Bay of Nha Trang, depth 20 m, bottom muddy sand, March 25, 1960, V. A. GALLARDO leg. – 1 ovig. ♀ (paratype, RMNH No. D 17056)
Station 303, Bay of Nha Trang, depth 15 m, bottom sand, March 30, 1960, V. A. GALLARDO leg. – 1 ♂ (paratype, RMNH)

Definition Rostrum narrow, slender; apex bifid. Antennal spine usually small. Pleuron of fifth abdominal somite rounded posteriorly. Lateral plate of sixth abdominal somite without spiniform process. Stylocerite usually without outer distal spine. Basicerite with developed spine. Third maxilliped with short exopod. Second pereiopods subequal in length, with 3-5 meral and 12-13 carpal joints. Propodus of fifth pereiopod with four spines on posterior margin.

Description Body slender (Fig. 31). Rostrum slender, falling far or slightly short of end of eye; apex distinctly bifid, lower tooth longer than upper tooth; upper margin straight; lower margin convex posteriorly and a little concave at middle, curved upward at tip in adults (Fig. 32 *a*) and upper and lower margins straight in some young specimens (Fig. 32 *b*). Carapace 2.5-3.5 times as long as rostrum; suborbital angle slightly pointed; antennal spine small and in some specimens absent; postorbital region feebly concave (Fig. 32 *a, b, h*).

Pleura of first five abdominal somite rounded. Pleuron of sixth somite pointed but

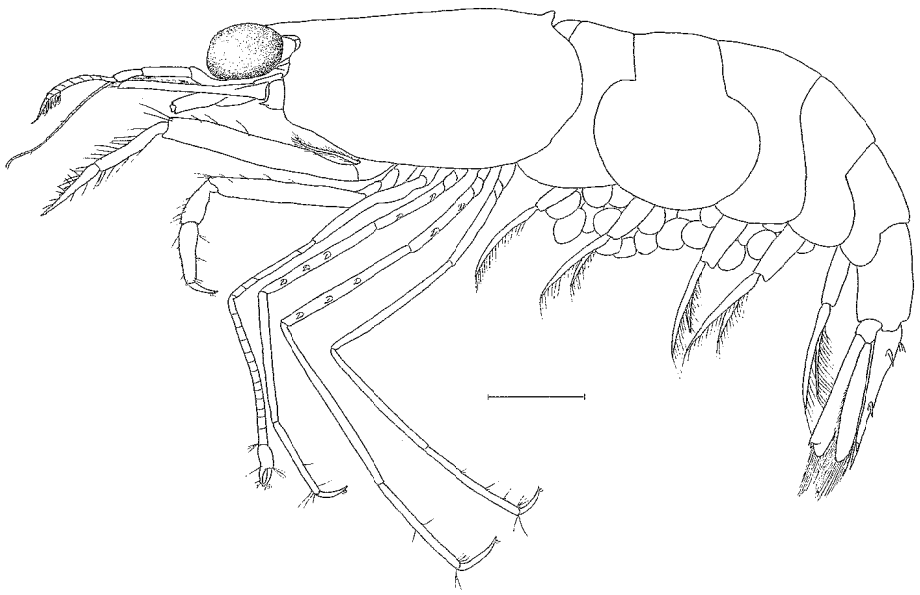

Fig. 31. *Processa neglecta* sp. nov., holotype, ovigerous female from Bay of Nha Trang. Scale represents 1.0 mm.

not acute; lateral plate not pointed (Fig. 32 *d, e*). Telson 1.3-1.6 times as long as sixth somite, with two pairs of dorsal spines, anterior pair placed on anterior fifth of telson, posterior pair on three-fifths of telson; posterior margin with a very small spine at middle, flanked by three pairs of spines (Fig. 32 *f*).

Eye moderate in size and slightly depressed. Antennular peduncle as long as antennal scale; basal segment longer than distal two segments combined; stylocerite obliquely truncated and with a very small spine on outer distal angle in most specimens (Fig. 32 *c*) but entirely quadrate on outer distal angle in a few specimens (Fig. 32 *g*); second segment about 1.5 times as long as third segment; outer flagellum thickened in basal 7-10 joints in females and 10-12 joints in males, of which the distal 2 or 4 joints in females and about all in males with setae; inner flagellum slender. Antennal scale 5.6-6.5 times as long as broad; outer spine exceeding slightly beyond lamellar part; basicerite with a well developed spine (Fig. 32 *a, h*); carpocerite reaching distal third of scale; flagellum more than twice as long as body.

Third maxilliped extending beyond antennal scale by ultimate segment or ultimate and distal half of penultimate segment; antepenultimate segment longer than distal two segments combined, which are equal in length (Fig. 32 *i*). First pair of pereiopods more slender in males than in females, reaching just end of scale. Second pair of pereiopods equal in length (Fig. 32 *j, k*); merocarpal articulation reaching beyond eye; merus obscurely subdivided into 3-5 joints; carpus into 12-13 joints; palm slightly longer than

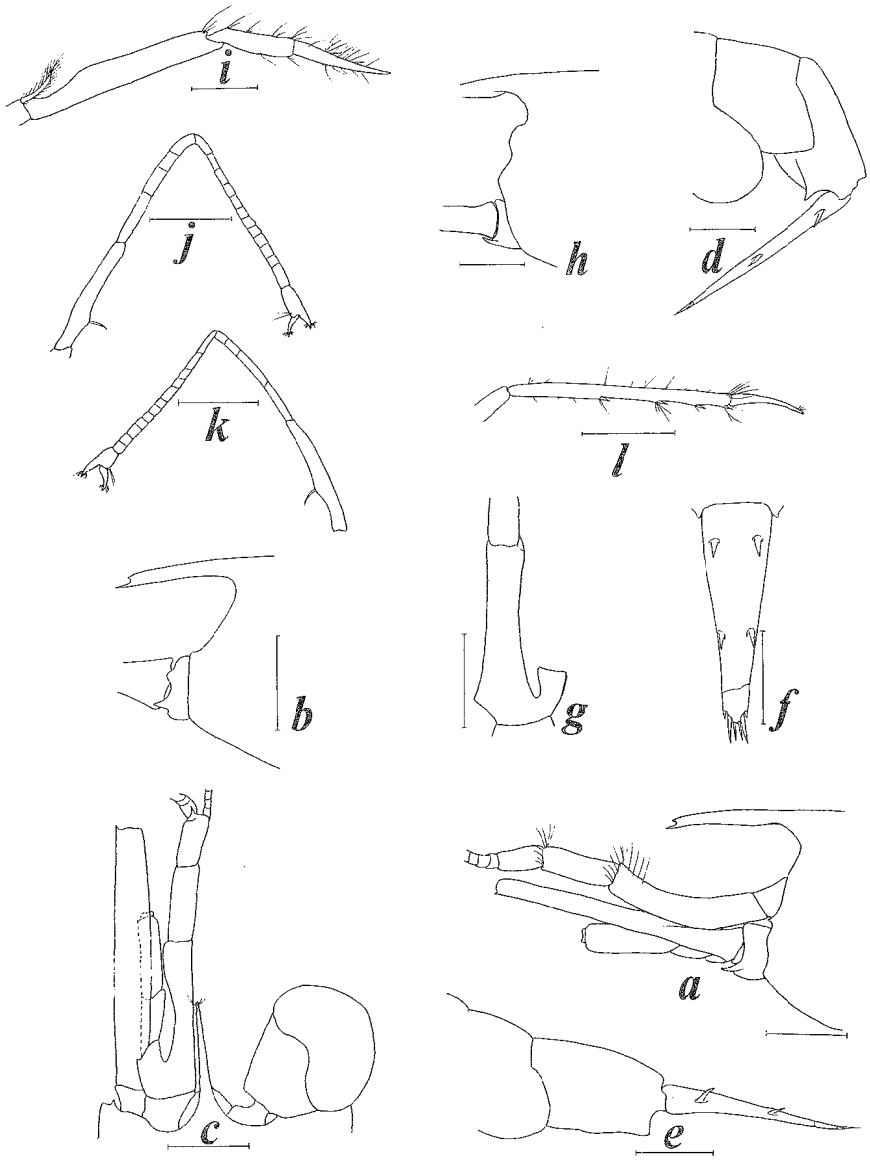

Fig. 32. *Processa neglecta* sp. nov., paratypes, *a*, female (2.4 mm in carapace length), *b*, *c*, *i*-*l*, female (2.0 mm), *e*, *f*, male (1.9 mm) from Bay of Nha Trang; *d*, *g*, *h*, ovigerous female (2.8 mm) from Sulu Archipelago.

a, *b*, anterior part of body, *c*, same in dorsal view, *d*, *e*, posterior part of body, *f*, telson, *g*, basal segment of antennular peduncle, *h*, anterior margin of carapace and basicerite, *i*, third maxilliped, *j*, right second pereiopod, *k*, left second pereiopod, *l*, dactylus and propodus of fifth pereiopod. Scales represent 0.5 mm.

fingers. Third pereiopod reaching with dactylus and propodus or these two segments and half carpus beyond antennal scale; ischium always with two spines; merus with three or four spines. Fourth pereiopod reaching with dactylus, propodus and half or two-thirds length of carpus beyond antennal scale; spinations of ischium and merus similar to those of the third pereiopod. Fifth pereiopod reaching with distal two segments beyond antennal scale; propodus with four spines on posterior margin (Fig. 32 *l*).

Endopod of first male pleopod slightly notched at end, inner lobe with some retinacula. Fifth abdominal sternite with a median keel; sixth sternite with a preanal spine. Eggs comparatively large and rather numerous, 0.35 × 0.44 mm in diameter.

Remarks The present new species, *P. neglecta*, was considered to be identical with *P. aequimana* PAULSON, and described fully under that name by DE MAN (1922). It is distinguished from *P. aequimana* by having four spines on the propodus of the fifth pereiopod, 3-5 meral and 12-13 carpal joints of the second pair of pereiopods and the unarmed lateral plate of the sixth somite, as already mentioned in the remarks of *P. aequimana*. On the other hand, *P. neglecta* is most closely allied to *P. dimorpha* sp. nov. and the distinctions between them are mentioned in the account for the latter species.

While *P. neglecta* somewhat resembles to two Atlantic species, *P. hemphilli* MANNING and CHACE and *P. parva* HOLTHUIS in having the antennal spine, the rounded pleuron of the fifth abdominal somite and equal second pereiopods. They, however, are more closely related to *P. dimorpha* than *P. neglecta* and therefore, separated apparently from *P. neglecta* by such characters distinguishing *P. dimorpha* from *P. neglecta* as the developed antennal spine, the pointed stylocerite and two or three spines on the posterior margin of the propodus of fifth pereiopod.

A single male from Siboga station 258, which was treated as *P. australiensis* by DE MAN (1920), was small (2.1 mm in carapace length) and rather broken and mutilated. It, however, does not belong to *P. australiensis*, because of the rounded pleuron of the fifth abdominal somite. Judging from the shape of the styloceite, of the basicerite and of the pleuron of the sixth abdominal somite and the comparative length of the second and third antennular segments, it probably identical with the present new species.

P. neglecta represents some morphological variations in the important specific characters. The antennal spine is generally small, but a single ovigerous female from Siboga station 96 and four small specimens from Ambon (Siboga material) and the Bay of Nha Trang, South Viet Nam, bear no spine on the anterior margin of the carapace. Even in this case the antennal angle is more or less produced. In addition, the outer distal angle of the stylocerite is armed with a small but distinct spine in some specimens from the Bay of Nha Trang, for example, a female from station 221. It is pointed but very indistinct in one specimen from station 260 and is entirely quadrate in an ovigerous female from station 292. These variations seem not to be correlated with growth rate or sex.

Size The holotype is about 10 mm in body length, the carapace is 2.65 mm and the rostrum is 0.95 mm in length. Ovigerous females are 2.4-2.7 mm and males are 1.9 -2.8 mm in carapace length. The largest specimen is a non-ovigerous female, 3.1 mm in carapace length.

Distribution Kei Island, 22 m (DE MAN, 1920; present publication), Sulu Is., 14-15 m (DE MAN, 1920; present publication), Ambon, 54 m (DE MAN, 1920 and 1922; present publication), Bay of Nha Trang, 9-25 m (present publication).

Processa processa (BATE, 1888)

(Fig. 33 *a-b*)

Nika processa BATE, 1888, p. 527 (not pl. 95 fig. 1).
Nika processa HENDERSON, 1893, p. 445.
? *Processa processa* NOBILI, 1903, p. 8.
not *Processa processa* RATHBUN, 1906, p. 912, pl. 22 fig. 6 (= p.p. *Nikoides maldivensis* BORRADAILE and *Nikoides danae* PAULSON or *N. gurneyi* sp. nov.).
Processa processa DE MAN, 1920, p. 199 (list).
not *Processa processa* EDMONDSON, 1946, p. 247, (= ? *Nikoides danae* PAULSON).
? *Processa processa* JOHNSON, 1961, p. 54.
not *Processa processa* FUJINO and MIYAKE, 1970, p. 257 (= *Nika kotiensis* YOKOYA).
Processa processa MANNING and CHACE, 1971, p. 13 (list).

Definition Rostrum narrow, slender, bifid at apex. Antennal spine absent. Pleuron. of fifth abdominal somite rounded posteriorly. Lateral plate of sixth somite truncated, Stylocerite obliquely truncated. Basicerite without spine. Third maxilliped with exopod. Right second pereiopod with 20 or more carpal joints, left second pereiopod with about 10 or more joints. Ischium of these second pereiopods not subdivided and subdivision of merus of these pereiopods obscure.

Remarks The specific status of *Processa processa* (BATE) has been very obscure. GURNEY (1937), for instance, considered this species to be a species incerta, as it was never adequately described and as the figures of the species in BATE's report were made after a specimen of the European *Nika edulis*. Recently Dr. INGLE of the British Museum (Natural History) kindly reexamined the type of *Nika processa*, and informed several important characters of it as follows: "Antennal spine absent. Pleuron of fifth abdominal somite rounded. Lateral plate of sixth somite truncate. Stylocerite truncate. Basicerite of antennal peduncle without a spine. Third maxilliped with an exopod. Segmentation of right second peraeopod – the peraeopods 1-2 detached, the longest (2nd) is shown in the figure (Fig. 33 *a*), the segmentation of the carpus is indistinct but seems to have 20-21 segments. This peraeopod seems to reach to about 1/2 way along antennal scale. The segmentation of 2nd left peraeopod is shown in figure (Fig. 33 *b*), the carpus is indistinctly segmented. The 3rd and 4th peraeopods are detached and are not readily identifiable, but none of the detached peraeopods have

spines on their segments; a bunch of setae is present of the distal propodal margin of each peraeopod. The 5th peraeopods are detached and not easily identifiable, the segments are without spines, but the distal propodal margines are setosed."

Judging from this repley, BATE's figures of *Nika processa* were not made after its type specimen as mentioned by GURNEY (1937). The most remarkable difference between the type specimen and BATE's figures is the absence of the antennal spine. Although some authors were referred their specimens to *Processa processa* (BATE), thus, all of them seem to be misidentified, beside RATHBUN (1906) whose *P. processa* is partly *Nikoides maldivensis* BORRADAILE and partly *N. danae* PAULSON or *N. gurneyi* sp. nov. as mentioned above. DE MAN (1920) thought the specimen from Sanana Bay of Siboga station 193, belonging to *P. processa.* In his publication of 1922 he confirmed his earlier statement by considering the specimen belonging to *P. processa* indeed. After the direct examination of this specimen, however, it proves not to belong to the true *P. processa,* but to the new species, *P. affinis* described herewith. FUJINO and MIYAKE (1970) recently reported *P. processa* from East China Sea, but their species is referred to *P. kotiensis* (YOKOYA).

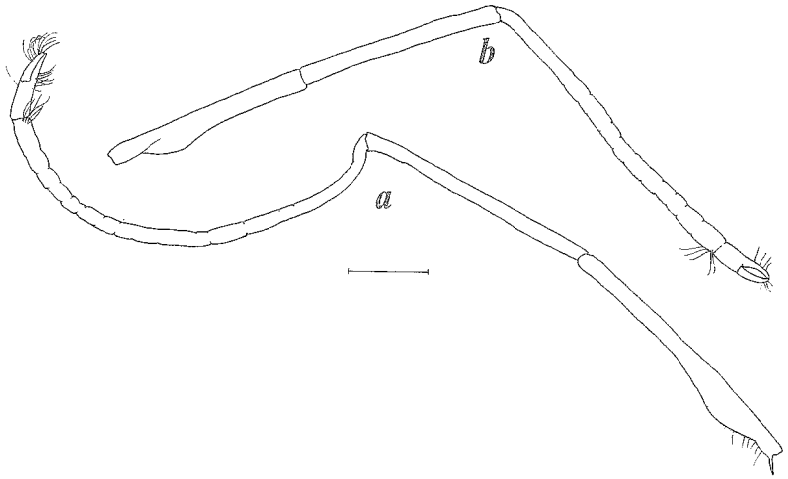

Fig. 33. *Processa processa* (BATE), holotype, female from Amboina.

a, right second pereiopod, *b,* left second pereiopod; after camera lucida skeches by Dr. INGLE. Scale represents 1.0 mm.

Considering the absence of the antennal spine, the unequal second pair of pereiopods and the rounded pleuron of the fifth abdominal somite, *P. processa* is easily distinguished from the other Indo-West Pacific species of this genus and closely related to the Atlantic species, *Processa bermudensis* (RANKIN), Distinctions between these two species are only the segmentations of the second pair of pereiopods and the armature of the third and fifth pereiopods.

Size The holotype is a female, 26 mm in length (BATE, 1888).

Distribution The species is very rare and no additional material is found. Ambon, 15 fms (BATE, 1888).

Processa sulcata sp. nov.

(Fig. 34 *a-o*)

Processa australiensis p.p. DE MAN, 1920, p. 199, pl. 17 fig. 51k-m (not *Processa australiensis* BAKER, 1907).

Processa australiensis GURNEY, 1937, p. 88, pl. 1 figs. 11-15 (not *Processa australiensis* BAKER, 1907).

Processa sp. KENSLEY, 1969, p. 172, fig. 14 a-g

Japan

Japan, P. F. von SIEBOLD leg. – 1 sp. (syntype of *Nika japonica*, RMNH No. D 991).

Off Asamushi, Aomori Bay, Aomori Prefecture, *Sargassum* and *Zostera* belts, small Danish seine, September 2-3, 1960, H. SANDO leg. – 2 ♂♂, 1 ovig. ♀, 1 ♀ (paratypes, ZLKU No. 13890)

Off Akashi, Sea of Setonaikai, March 15, 1958, J. YASUDA leg. – 1 ♂, 1 ovig. ♀, 1 ♀ (paratypes, ZLKU); Kurushima Strait, depth 52 m, bottom sand, gravel, December 10, 1967 – 1 ♀ (paratype ZLKU)

Sea of Genkai, Ainoshima Island, Fukuoka Prefecture, Danish seine, July 18, 1967, night, S. MATSUURA leg. – 1 ovig. ♀ (holotype, ZLKU No. 13900), 2 ♂♂, 1 ovig. ♀ (paratypes, ZLKU No. 13901)

Off Yoshimi, Yamaguchi Prefecture, depth 13-23 fms, November 11, 1966, night I. MURATA and H. KISHIMOTO leg. – 1 ovig. ♀ (paratype, ZLKU No. 13899)

Tomioka Bay, Amakusa Islands, Kumamoto Prefecture, *Zostera* belt, small Danish seine, April 24, 1959, night, T. KIKUCHI leg. – 16 ♂♂, 14 ovig. ♀♀ (paratypes, ZLKU No. 13860); June 21, 1959, night, T. KIKUCHI leg. – 7 ♂♂, 4 ovig. ♀♀, 6 ♀♀ (paratypes, ZLKU No. 13843)

Tomioka, Amakusa Islands, gill net, depth 35 fms, October 6, 1966, A TAKI leg. – 1 ♂, 1 ovig. ♀, 1 ♀ (paratypes, ZLKU No. 13896)

Station 4, Chijiwa Bay, Nagasaki Prefecture, dredge, 1961, T. KIKUCHI leg. – 1 ♂, 1 ovig. ♀, (paratypes, ZLKU No. 13894)

Siboga Expedition

Station 7, east reef of Batjulmati, Java, 7°55.5'S, 114°26'E, March 11, 1899 – 1 ♂, 1 ♀ (paratypes, AM).

South Viet Nam

Station 303, Bay of Nha Trang, depth 15 m, bottom sand, March 30, 1960, V. A. GALLARDO leg. – 1 ♀ (paratype, RMNH).

South Africa

24°53'S, 34°56'E, depth 55 m, 1964, Anton Brunn – 1 ovig. ♀ (SAM Cat. No. PED 16 x-y).

Definition Rostrum narrow, bifid apex. Antennal spine present. Pleuron of fifth abdominal somite pointed. Lateral plate of sixth abdominal somite truncated or triangular. Stylocerite rounded. Basicerite without any spine or process. Third maxilliped with well developed exopod. Right second pereiopod with 10-14 meral and 21-

30 carpal joints, left second pereiopod with (3) 5-7 meral and 10-14 carpal joints. Propodus of fifth pereiopod with 10-13 spines on posterior margin.

Description Body rather robust (Fig. 34 *a*). Rostrum reaching scarcely beyond end of eyestalk; apex distinctly bifid (Fig. 34 *b, c*). Carapace 4.5-5.1 times as long as rostrum; suborbital angle not produced, continuous with a pointed antennal spine; postorbital region distinctly hollowed (Fig. 34 *c*).

First four abdominal pleura smooth; fifth and sixth somites with sharply pointed pleura; lateral plate of sixth somite truncated or rectangular at tip (Fig. 34 *d*). Telson 1.7-1.9 times as long as sixth somite, sulcated dorsally; dorsal surface with two pairs of spines; posterior margin ending in a median spine, flanked by three pairs of unequal spines (Fig. 34 *e*).

Eye as long as broad, dorsally flattened and ventrally rounded. Antennular peduncle and flagellum similar to those of *P. zostericola* sp. nov. Antennal scale 4.5 times as long as broad, reaching nearly end of antennular peduncle; lamellar part obliquely truncated at tip, slightly overreaching outer terminal spine; basicerite bearing smooth outer margin without any process; carpocerite reaching distal extremity of second segment of antennular peduncle.

Third maxilliped extending beyond antennal scale by distal two segments. Right first pereiopod with well-developed chela; propodus about 1.4 times as long as dactylus (Fig. 34 *f*). Left first pereiopod simple; propodus 2.5 times as long as dactylus; merus 2.8 times as long as carpus as in right pereiopod (Fig. 34 *g*). Right second pereiopod long, reaching with merocarpal articulation beyond end of swollen part of antennular flagellum; ischium as long as merus, carpus 1.7 times as long as merus; palm about twice as long as broad; ischium with 2 or 3 joints, merus with 10-14 joints and carpus with 21-30 joints (Fig. 34 *h*). Left second pereiopod usually reaching with merocarpal articulation beyond eye; ischium as long as merus; carpus 1.5 times as long as merus; ischium undivided, merus with (3) 5-7 joints and carpus with 10-14 joints (Fig. 34 *i*). Third pereiopod reaching with dactylus, propodus and half carpus beyond antennal scale; merus with four or five, mostly four, outer spines (Fig. 34 *k*). Fourth pereiopod much longer than third pereiopod, reaching with dactylus, propodus and more than half carpus beyond antennal scale; merus bearing 3 or 4 outer spines (Fig. 34 *l*). Fifth pereiopod reaching with dactylus and propodus beyond antennal scale; propodus with 10-13 spines on posterior margin (Fig. 34 *m*).

Endopod of first pleopod in male bluntly pointed, bearing some retinacula on inner distal margin (Fig. 34 *o*). Fifth abdominal sternite with a median spine. Uropod similar to those of *P. zostericola.* Eggs small and numerous.

Ecology The present species is common in *Zostera* belt of Tomioka Bay, Amakusa Islands and collected together with *P. zostericola.* In the Aomori Bay, northern extremity of the Main Island of Japan, *P. sulcata* is collected from *Sargassum* and *Zostera* belts. While outside the Tomioka Bay, this species is collected from sea weeds or sessile

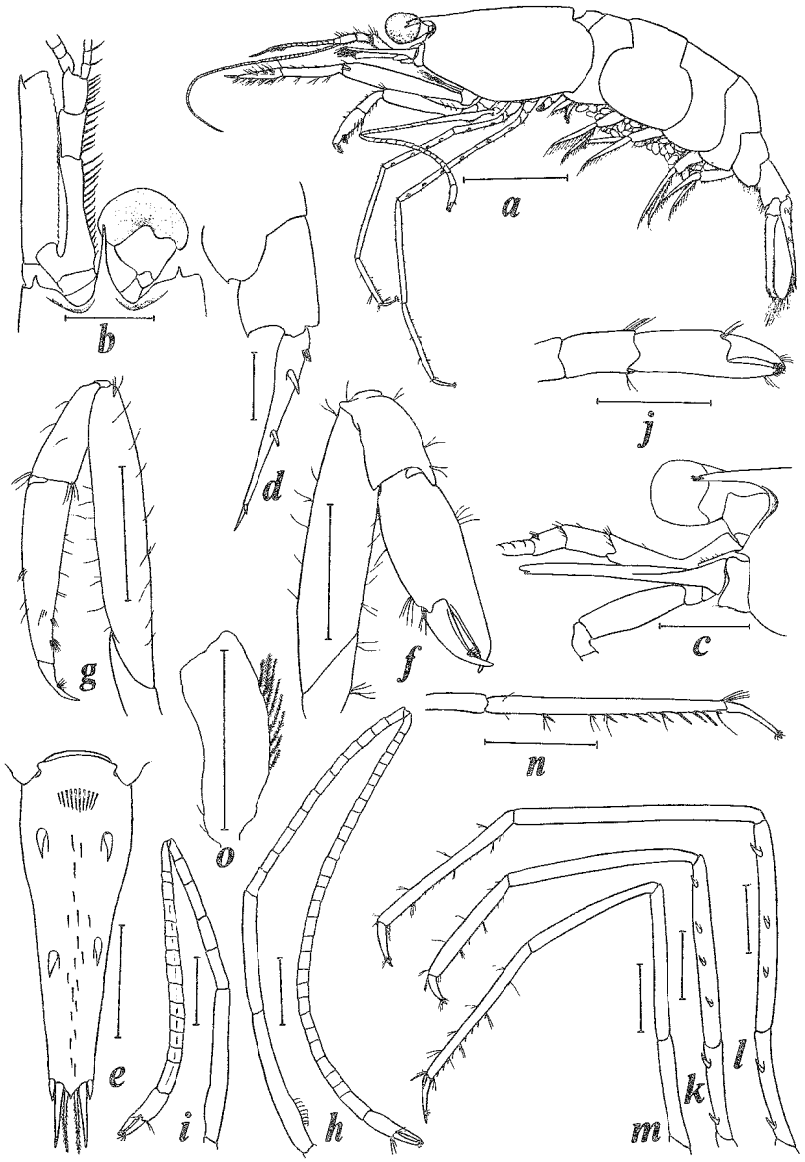

Fig. 34. *Processa sulcata* sp. nov., paratypes; *a*, *e*, ovigerous female (4.6 mm in carapace length) from Yamaguchi Pref.; *b-d*, *f*, *g*, *n*, ovigerous female (3.7 mm) from Ainoshima Is.; *h-j* ovigerous female (4.5 mm), *k-m* female (4.2 mm), *o*, male (3.7 mm) from Amakusa Is.

a, animal in lateral view, *b*, anterior part of body, *c*, same in lateral view, *d*, posterior part of body, *e*, telson, *f*, right first pereiopod, *g*, left first pereiopod, *h*, right second pereiopod, *i*, left second pereiopod, *j*, chela of left second pereiopod, *k*, third pereiopod, *l*, fourth pereiopod, *m*, fifth pereiopod, *n*, dactylus and propodus of fifth pereiopod, *o*, endopod of first pleopod. Scale for *a* represents 4.0 mm and scales for *b-o* represent 1.0 mm.

marine invertebrates that get entangled in gill nets for spiny lobster, and from dredge samples.

Remarks The present species is closely related to *P. zostericola* sp. nov., and differences between them are explained in the remarks of that species.

The Atlantic species, *Processa macrophthalma* NOUVEL and HOLTHUIS, somewhat resembles the present species. The two species are readily distinguished from each other by the length of the second pair of pereiopods. The merus of the right pereiopod is subdivided into 14-20 joints in *P. macrophthalma* and 10-14 joints in *P. sulcata.* The carpus of the right pereiopod is subdivided into 38-49 joints in *P. macrophthalma* and 21-30 joints in *P. sulcata.*

The syntype of *Nika japonica* DE HAAN is well preserved in spirit at the Rijksmuseum van Natuurlijke Historie. It belongs to *P. sulcata,* as shown by the presence of a well developed exopod on the third maxilliped, two pairs of distinct spines on the telson, the slender and bifid rostrum and the unarmed basicerite of the antennal peduncle. Two specimens of the Siboga material reported as *P. australiensis* by DE MAN (1920), and GURNEY's (1937) specimens of *P. australiensis* from the Red Sea are also identical with the present new species, as already mentioned in the remarks of that species. KENSLEY (1969) reported a single specimen from South East Africa, under the name *Processa* sp. and gave a short description and remarks. Fortunately this specimen could be examined, and proves to belong to the present species.

Size The holotype is 4.4 mm in carapace length and 16 mm in entire length. The carapace length of ovigerous females varies from 3.4-6.3 mm. The largest specimen is a non-ovigerous female measuring 7.6 mm in carapace length and 26 mm in entire length. The largest male is 4.7 mm in carapace length.

Distribution Japan, 0-35 fms: off Asamushi, Aomori Prefecture; off Yoshimi, Yamaguchi Pref.; off Akashi and Kurushima Strait, Sea of Setonaikai; Ainoshima I., Fukuoka Pref.; Chijiwa Bay, Nagasaki Pref.; Tomioka Bay, Amakusa Is., Kumamoto Pref. (present publication), Bay of Nha Trang, South Viet Nam, 15 m (present publication), Butjulmati, Java (DE MAN, 1920; present publication), South Arabian coast (GURNEY, 1937) and South East Africa, 55 m (KENSLEY, 1969; present publication).

Processa zostericola sp. nov.

(Fig. 35 *a-l*)

Japan

Off Asamushi, Aomori Bay, Aomori Prefecture, *Sargassum* and *Zostera* belts, small Danish seine, September 2-3, 1960, H. SANDO leg. – 4 ♂♂, 15 ♀♀ (paratypes, ZLKU No. 13824).

Tomioka Bay, Amakusa Islands, Kumamoto Prefecture, *Zostera* belt; small Danish seine, April 24, 1959, night, T. KIKUCHI leg. – 1 ovig. ♀ (holotype, ZLKU No. 13791), 12 ♂♂, 4 ovig. ♀♀, 3 ♀♀

(paratypes, ZLKU No. 13792); June 21, 1959, night, T. KIKUCHI leg. – 9 ♂♂, 3 ovig. ♀♀, 2 ♀♀ (paratypes, ZLKU No. 13810).

Definition Rostrum narrow, bifid at apex. Antennal spine present. Pleuron of fifth abdominal somite pointed. Lateral plate of sixth abdominal somite truncated or triangular. Stylocerite usually unarmed. Basicerite of antennal peduncle with rounded process on lower distal angle. Third maxilliped with well developed exopod. Right second pereiopod with 7-11 meral and 19-25 carpal joints, left second pereiopod with 5-6 meral and 13-15 carpal joints. Propodus of fifth pereiopod with 10-12 spines on posterior margin.

Description Body rather robust (Fig. 35 *a*). Rostrum directed slightly downward, extending only to line between eyestalk and cornea; apex bifid, upper tooth much shorter than lower tooth (Fig. 35 *c*). Carapace smooth, about 3.7-4.6 times as long as rostrum. Suborbital angle not pointed, continuous with a small antennal spine; distinct suborbital groove present (Fig. 35 *b, c*).

Pleura of fifth and sixth abdominal somite posteriorly pointed. Lateral plate of sixth abdominal somite truncated or triangular (Fig. 35 *d*). Telson about 1.7 times as long as sixth somite; dorsal surface shallowly grooved, with two pairs of dorsal spines; posterior margin ending in a very small median spine and with three pairs of spines (Fig. 35 *e*).

Eye moderate, rather longer than wide. Antennular peduncle long and rather robust; basal segment slightly longer than distal two segments combined, which are subequal in length; stylocerite truncated at tip in most specimens (Fig. 35 *b*), but in a few specimens its outer margin ending in a small spine (Fig. 35 *f*). Outer flagellum thickened in basal 16-20 joints; in males all thickened joints setose, but in females basal 6-7 joints bearing no setae; distal part of outer flagellum also slender. Antennal scale about 4.8 times as long as broad, reaching nearly end of antennular peduncle; lamellar part truncated at tip and as long as stout outer spine. Outer lower part of basicerite produced to a small obtuse, not spiniform, process; carpocerite reaching to or beyond distal end of second segment of antennular peduncle; flagellum about twice as long as body.

Third maxilliped exceeding antennal scale by distal two segments. First pereiopods chelate on right and simple on left side. Second pair of pereiopods unequal, right longer than left. Merocarpal articulation of right second pereiopod reaching, at most, end of antennular peduncle; merus with 7-11 joints and carpus with 19-25 joints (Fig. 35 *h*). Merocarpal articulation of left second pereiopod reaching distal end of eye; merus with 5 or 6 and carpus with 13-15 joints (Fig. 35 *h*). Palm of both right and left second pereiopods about 1.5 times as long as broad (Fig. 35 *i*). Ischium of third and fourth pereiopods with two spines on outer surface; merus of these pereiopods with usually three outer spines (Fig. 35 *j*). Fifth pereiopod with no outer spines but 10-12 small spines on posterior margin of propodus (Fig. 35 *k*).

Endopod of first pleopod in large male deeply notched at end, outer lobe rounded,

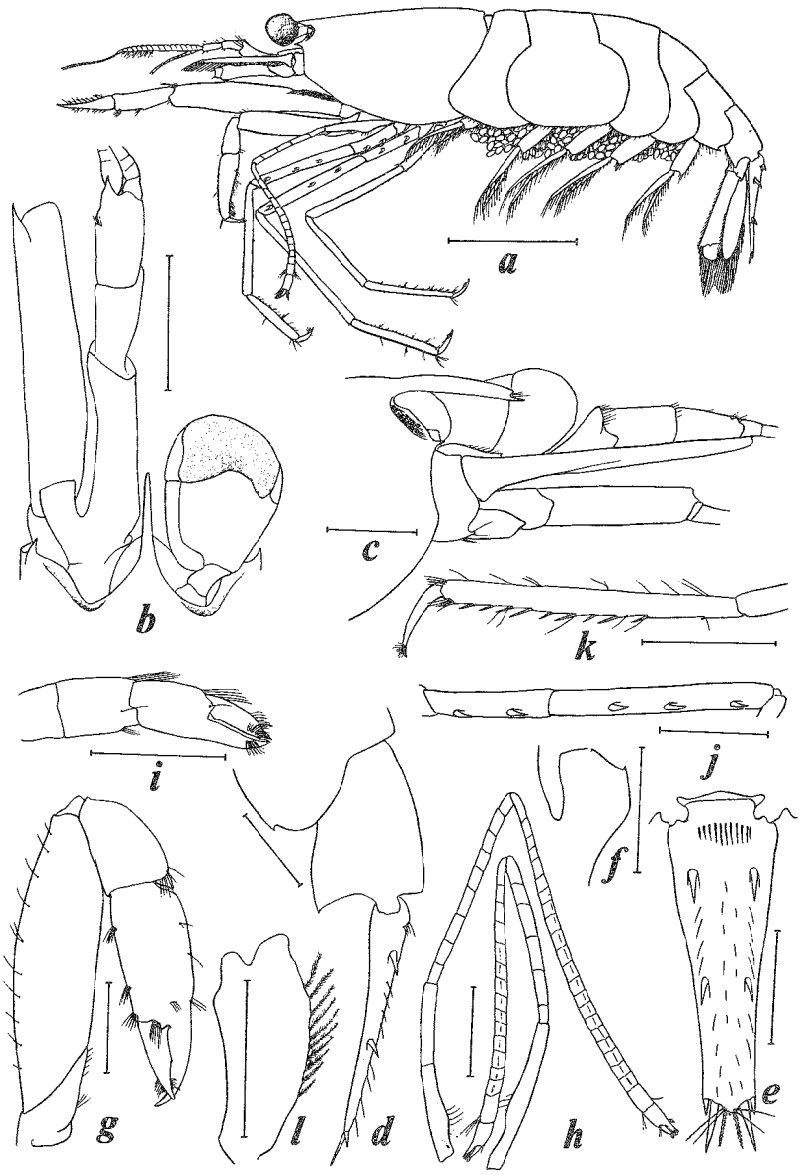

Fig. 35. *Processa zostericola* sp. nov., *a*, holotype, ovigerous female (5.9 mm in carapace length), *b, d, e, j, k*, paratype, male (3.4 mm), *c, g, i*, paratype, ovigerous female (5.5 mm), *f*, paratype, male (3.6 mm), *h*, paratype, male (4.3 mm), all from Amakusa Is.

a, animal in lateral view, *b*, anterior part of body, *c*, same in lateral view, *d*, posterior part of body, *e*, telson, *f*, stylocerite, *g*, right first pereiopod, *h*, second pair of pereiopods, *i*, chela of left second pereiopod, *j*, merus and ischium of third pereiopod, *k*, dactylus and propodus of fifth pereiopod, *l*, endopod of first pleopod. Scale for *a* represents 4.0 mm, scales for *b-e, g-l* represent 1.0 mm and scale for *f* represents 0.5 mm.

inner lobe bearing some retinacula (Fig. 35 *l*). First abdominal sternite with a median spine. Uropod longer than telson; outer margin of exopod straight, ending in two spines, outer small and fixed, inner longer and movable. Diaeresis distinct, bearing two broad triangular teeth.

Abnormality A single ovigerous female (ZLKU No. 13804) collected from *Zostera* belt of the Tomioka Bay, Amakusa Islands, Japan is highly remarkable. Although the specimen is 5.5 mm in carapace length and its general shape is very similar to the other specimens collected together with it, in its first and second pereiopods the right and left are entirely reversed. The proportional length of each segment of these two pereiopods and the segmentation of the merus and carpus of the second pereiopod agree well with those of the opposite side of the normal specimens. The left first pereiopod is a normal chela and stouter than the right, which ends in a simple claw. The left second pereiopod is longer than the right, and reaches with the merocarpal articulation beyond the second segment of the antennular peduncle; the merus is subdivided into 7 joints and the carpus into 22 joints. The right second pereiopod reaches with its merocarpal articulation beyond the end of the eye; the merus is subdivided into 5 joints and the carpus into 14 joints.

Ecology In Japan the present species is abundant in littoral weed belts. KIKUCHI (1962 and 1966) reported that the species under the name *Processa* sp. was one of "year round residents" in *Zostera* belts of Tomioka Bay, Amakusa Islands and it had two generations in those belts. After the reexamination of a small part of his material, his *Processa* sp. proves to contain, at least, three species, *P. kotiensis* (YOKOYA), *P. sulcata* sp. nov and *P. zostericola* sp. nov. Of these *P. kotiensis* is not so common as the other two species. *P. sulcata* is collected from sea weed and sessile marine invertebrates, which get entangled in the gill nets used for fishing spiny lobsters outside the Tomioka Bay; no specimens of *P. zostericola* are known to be obtained in this way. Thus *P. zostericola* probably corresponds to the true "year round resident" of KIKUCHI's *Processa* sp. and consequently it is thought to show two generations in *Zostera* belts. However, in the present small samples collected in April and June, *P. zostericola* appears in about the same quantity as *P. sulcata* and both have a few ovigerous females of about equal size, so that it is impossible to draw any conclusion here.

Remarks The present new species is very closely related to *Processa sulcata* sp. nov. as well as to *P. australiensis* BAKER. As the distinctive characters from *P. australiensis* are mentioned in the account for that species, only the differences between *P. zostericola* and *P. sulcata* are mentioned here.

(1) The rostrum is shorter in *P. sulcata* than in *P. zostericola* and the apex is more distinctly bifid in the former than in the latter. (2) The telson is longer in *P. sulcata* than in *P. zostericola*; namely it is 1.7-2.0 times as long as the sixth abdominal somite in the former and 1.6-1.8 times in the latter. (3) In *P. zostericola* the lamellar part

of the antennal scale is straightly truncated and is as long as the outer terminal spine, while in *P. sulcata* it is obliquely truncated and reaches with its inner tip beyond the outer distal spine. Furthermore in the former species the basicerite is provided with a small obtuse process which is entirely absent in the latter. (4) In *P. sulcata* the second pereiopods are strongly unequal. The right is much longer and reaches with the merocarpal articulation, at least, beyond the antennal scale. The palm of the chela of the second pereiopods is slender and twice as long as broad. In *P. zostericola* the second pereiopods are slightly unequal; the merocarpal articulation of the right pereiopod reaches, at most, the end of the antennal scale. The palm of both sides of the second pereiopod is about 1.5 times as long as broad.

From the Atlantic species, *P. macrophthalma* NOUVEL and HOLTHUIS, to which *P. zostericola* is related, it is distinguished by the length of the second pair of pereiopods, a character which also distinguishes *P. sulcata* from *P. macrophthalma.*

Size The holotype is 5.8 mm in carapace length. The ovigerous females vary from 5.3-7.5 mm and the largest male is 4.5 mm in carapace length.

Distribution The species is known from the littoral weed belts in Japanese waters. Aomori Bay and Tomioka Bay (present publication).

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