

Crustacea Decapoda: Revision of *Pasiphaea sivado* (Risso, 1816) and related species, with descriptions of one new genus and five new species (Pasiphaeidae)

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ABSTRACT

The study of many samples collected by MUSORSTOM cruises, deposited in the Muséum national d'Histoire naturelle, as well as the reexamination of types and published specimens reveal that *Pasiphaea sivado* (Risso, 1816) and the related species, *P. propinqua* de Man, 1916, *P. japonica* Omori, 1976, *P. marisrubri* Iwasaki, 1989 and *P. nudipeda* Burukovsky, 1993, belong to one group. All are characterized by a terminal spine on the sixth abdominal somite and a branchial reduction. However, *P. nudipeda* is entirely devoid of arthrobranchia, has unarmed first pereopods and three pairs of spines on the posterior margin of telson and has to be separated; a new genus *Alainopasiphaea* is proposed for it. The other species mentioned above, except *P. marisrubri*, bear three arthrobranchiae from the fourth to sixth thoracic somites. *P. marisrubri* and five new species found in the MUSORSTOM material and belonging in this group have four pleurobranchiae from the fourth to seventh thoracic somites. On the other hand, *P. propinqua*, *P. japonica* and *P. sivado* have one more, but rudimentary, pleurobranchia on the eighth somite. A key for all these species is provided.

RÉSUMÉ

Crustacea Decapoda: Révision de *Pasiphaea sivado* (Risso, 1816) et des espèces qui lui sont proches. Description d'un genre et cinq espèces nouveaux (Pasiphaeidae).

L'étude de nombreuses récoltes, rassemblées lors des campagnes MUSORSTOM et déposées au Muséum national d'Histoire naturelle, et le réexamen de types ou de spécimens publiés montrent que *Pasiphaea sivado* (Risso, 1816) et les espèces proches, *P. propinqua* de Man, 1916, *P. japonica* Omori, 1976, *P. marisrubri* Iwasaki, 1989 et *P. nudipeda* Burukovsky, 1993, appartiennent à un même groupe qui se caractérise par la présence d'une épine distale sur le sixième segment abdominal et une réduction des branchies. Toutefois *P. nudipedia* est totalement dépourvue d'arthrobranchies et a des premiers péreiopodes sans épine et trois paires d'épines sur le bord postérieur du telson; il convient de la séparer; pour elle, un nouveau genre *Alainopasiphaea* est proposé. Les autres espèces mentionnées ci-dessus, à l'exception de *P. marisrubri*, possèdent trois arthrobranchies réparties sur les segments thoraciques 4-6. *P. marisrubri* et cinq espèces nouvelles, trouvées dans le matériel MUSORSTOM et appartenant au groupe considéré ici, possèdent quatre pleurobranchies réparties sur les segments thoraciques 4-7. Enfin, *P. propinqua*, *P. japonica* et *P. sivado* ont une pleurobranchie supplémentaire, mais rudimentaire, sur le segment thoracique 8. Une clé d'identification pour toutes ces espèces est proposée.

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INTRODUCTION

The genus *Pasiphaea* is a large group, containing nearly 60 species (BURUKOVSKY & ROMENSKY, 1987; BURUKOVSKY, 1996). A world wide review of the genus has not been completed, and several species have been left unclear as to their specific status. Amongst them are the type species of the genus, *P. sivado* (Risso, 1816) and related species.

P. sivado was reported from both the Atlantic Ocean and the Indo-West Pacific region. However, specimens from Japanese waters were shown to be a different species, *P. japonica* Omori, 1976, and Red Sea specimens were referred to another different species, *P. marisrubri* Iwasaki, 1989. Some specimens from other localities described under that name have not been reexamined in detail, such as those recorded in WOOD MASON & ALCOCK (1893) and in KENSLEY (1977), both from the Indian Ocean.

All these species are easily distinguished by having a terminal spine on the sixth abdominal somite. Two other species, *P. propinqua* de Man, 1916, and *P. nudipeda* Burukovsky, 1993, have such a spine. All these species share some other important characters with one another and therefore, probably constitute a natural group: the *P. sivado* species group. One of the important characters of this group is the branchial reduction, which has not been drawn attention to as a means of distinguishing between species in the genus *Pasiphaea*.

Many pasiphaeids collected from various areas by several MUSORSTOM cruises are referred to seven species belonging to the *P. sivado* species group and including five new species. An another species, close to this group but entirely devoid of arthrobranchiae, seems to have to be separated from it; for this species I propose a new genus *Alainopasiphaea*.

The specimen size is indicated by the carapace length (CL), not including the rostrum. The specimens examined are preserved at the following institutions: Muséum national d'Histoire naturelle, Paris (MNHN), Forschungsinstitut Senckenberg, Frankfurt (SMF), National Fisheries University, Shimonoseki (NFU), South African Museum (SAM), Zoologisch Museum, Amsterdam (ZMA) and Zoological Museum of the Moscow State University (MMSU).

SYSTEMATIC ACCOUNT

Genus *ALAINOPASIPHAEA* nov.

DEFINITION. — Small pasiphaeids. Rostrum short, triangular with pointed apex, arising behind anterior margin of carapace. Carapace not carinated and smooth dorsally, with branchiostegal spine only. Abdomen not carinated dorsally. Posterior margin of telson truncated with three pairs of spines. Mandible without palp. Fourth pereopod shorter than third and fifth. No arthrobranchia on third maxilliped. No arthrobranchiae but four pleurobranchiae present on fourth to seventh thoracic somites.

ETYMOLOGY. — The genus name *Pasiphaea* with the prefix Alain, the first name of a French carcinologist, Alain CROSNIER of the ORSTOM who is much involved in editing the results of the MUSORSTOM cruises.

REMARKS. — The new genus is related to the genus *Pasiphaea*, from which it is distinguished by such characters as the simple branchial formula, having four pleurobranchiae only and no arthrobranchiae at all, the unarmed first pereopod and three pairs of spines on the posterior margin of the telson.

A full set of the branchial components of the genus *Pasiphaea* is five pleurobranchiae from the fourth to the eighth thoracic somites and three arthrobranchiae from the fourth to sixth thoracic somites. The reduction of the branchial formulae is shown in some species, especially in *P. sivado* and related species, but then three arthrobranchiae are always present, without exception. The posterior margin of the telson is usually armed with eight or more spines in *Pasiphaea*, and is very variable in shape and armature. The completely unarmed first pereopod, with even no posterodistal spine on the basis, is also shown in a few species of the genus *Pasiphaea*.

The present genus contains a single species, *Alainopasiphaea nudipeda* (Burukovsky, 1993) described in detail below.

Alainopasiphaea nudipeda (Burukovsky, 1993) new comb.

Figs 1-3

Pasiphaea sp. α - DE MAN, 1920: 9, pl. 1, fig. 3-30.*Pasiphaea nudipeda* Burukovsky, 1993: 35, fig. 1, 8-13; 1996, 843 (list).

MATERIAL EXAMINED. — **Mozambique.** "Vitiáz": stn 2631, 25°28.0'S, 35°08'E, 535-490 m, 23.11.1988: 1 ♀ holotype (MMSU 1/84269).

Madagascar. "Vauban": Trawl 89, 21°18'S, 43°17.4'E, 620 m, 26.11.1973: 1 ♂ 11.5 mm (MNHN-Na 13370). — Trawl 90, 21°24.5'S, 43°13.5'E, 640-720 m, 26.11.1973: 1 ovig. ♀ 10.9 mm (MNHN-Na 13371).

Indonesia. *Mollucas*: "Siboga": stn 148, 0°17.6'S, 129°14.5'E, 10.08.1899: 1 juv. 4.6 mm (ZMA).

DIAGNOSIS. — Shell not fragile. Rostrum small, apex not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus developed. Abdominal somites dorsally rounded. First pereiopod unarmed on merus, ischium and basis, posterodistal angle of basis not spiniform. Merus of second pereiopod with single spine, ischium unarmed, basis unarmed, posterodistal spine small. Ischium of third pereiopod without spinules. Arthrobranchiae absent. Pleurobranchiae on fourth to seventh thoracic somites. Ovigerous female about 10 mm.

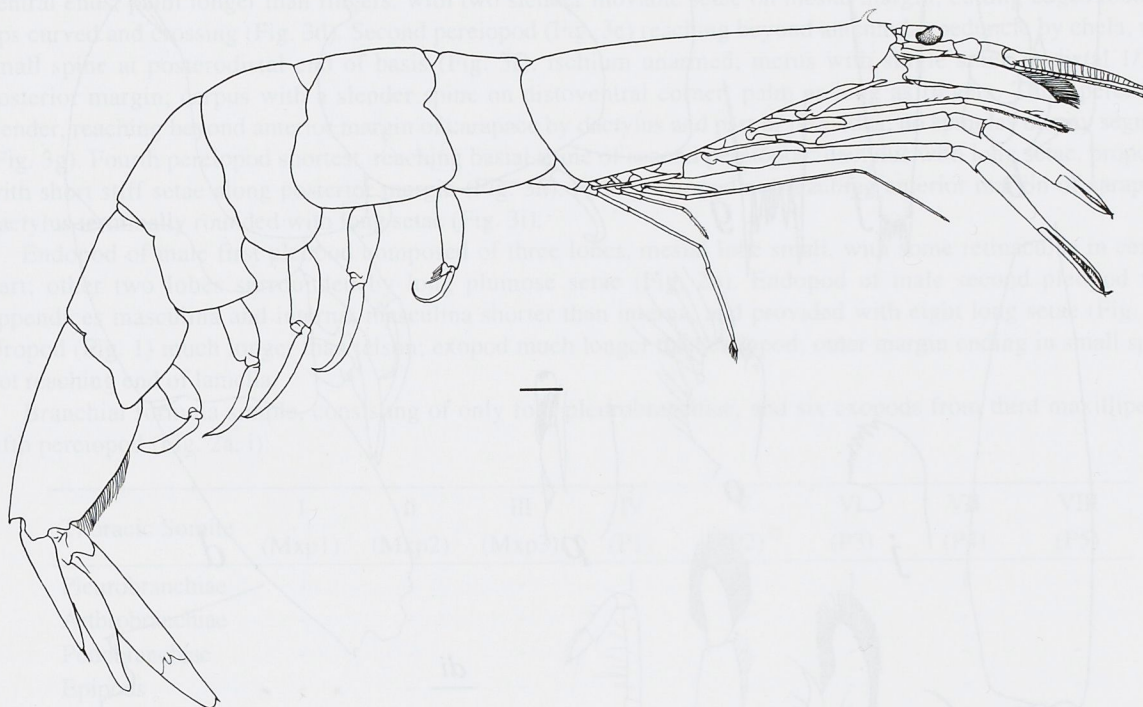


FIG. 1. — *Alainopasiphaea nudipeda* (Burukovsky, 1993), ♂ 11.5 mm (MNHN-Na 13370), Madagascar. Scale = 1 mm.

DESCRIPTION. — Rostrum small and short, hardly reaching halfway between base of rostrum and anterior margin of carapace, though apex missing in male (Figs. 1, 2c) and entirely broken in female. Branchiostegal spine small situated just inside anterior margin of carapace. No middorsal carina on carapace. Branchiostegal sinus distinct (Fig. 2c).

All abdominal somites dorsally smooth, without carinae and spines (Fig. 2d). Sixth abdominal somite 1.8 times as long as fifth somite and 1.9 times as long as deep; terminal spine extending straight backward; posterolateral margin with small convexity just below spine; ventrodistal corner with small concavity near distal end (Fig. 2e). Telson 0.6 times as long as sixth somite, dorsally with shallow groove, but almost flat near

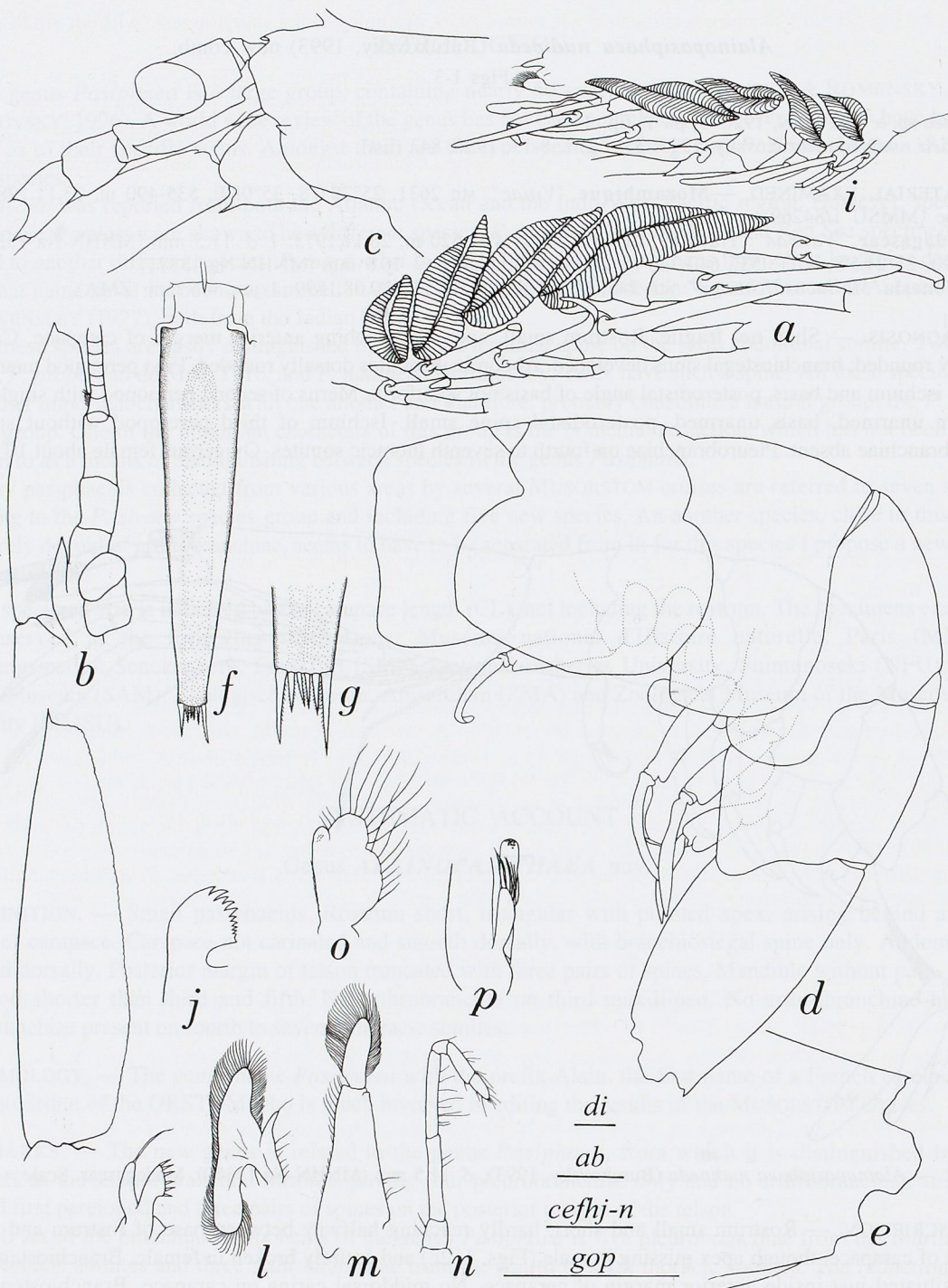


FIG. 2. — *Alainopasiphaea nudipeda* (Burukovsky, 1993), **a-b**, holotype, ♀ 12 mm (MMSU, 1/84269), Mozambique; **c e, i-n**, ovig. ♀ 10.9 mm (MNHN-Na 13371); **f-h, o-p**, ♂ 11.5 mm (MNHN-Na 13370), both from Madagascar.

a, i, branchial chamber; **b**, eye, antennule and antennal scale, dorsal view; **c**, anterior part of body; **d**, abdomen; **e**, distal end of sixth somite; **f**, telson; **g**, distal end of telson; **h**, antennal scale; **j**, mandible; **k**, maxillula; **l**, maxilla; **m**, first maxilliped; **n**, second maxilliped; **o**, first pleopod; **p**, second pleopod. Scales = 1 mm.

midlength (Fig. 2f); distal margin truncated with three pairs of spines, outer pair longest, without small seta on base; inner two pairs nearly equal in length (Fig. 2g).

Eyes well developed; cornea spherical in lateral view and well pigmented (Fig. 2b-c). Stylocerite slightly shorter than first segment of antennular peduncle (Fig. 2b). Antennal scale reaching midpoint of enlarged part of antennular flagellum (Fig. 1), 3.8 times as long as wide, and shorter (0.88-0.92) than chela of first pereopod; outer margin evenly convex, and ending in small tooth; lamellar part truncated at distal end, entirely overreached by distolateral tooth (Fig. 2b, h). Basicerite with slender spine on lower distal corner (Fig. 2c).

Mouth-parts illustrated, not apparently different from those of the genus *Pasiphaea*, but slightly more simple in structure. Mandible provided with about 10 strong teeth along mesial margin of incisor process; palp absent (Fig. 2j). Proximal endite of maxillula small, triangular, with short simple seta; distal endite armed with six acute teeth; endopod oblong, with stout simple seta on distal end (Fig. 2k). Maxilla composed of well developed endopod and large scaphognathite (Fig. 2l). First maxilliped provided with elongated lamellar part, articulated distally; no incision present on the outer margin of basal part (Fig. 2m). Second maxilliped simple pediform; epipod and exopod absent (Fig. 2n). Third maxilliped long, reaching slightly beyond antennal scale (Fig. 1); distal segment about twice as long as penultimate segment; exopod well developed (Fig. 3a).

First pereopod (Fig. 3b) reaching beyond antennular peduncle by chelae (Fig. 1); basis not ending in spiniform process (Fig. 3c); ischium and merus unarmed on posterior margin; carpus short, with spine on distodorsal and ventral ends; palm longer than fingers, with two slender movable setae on mesial margin; cutting edges toothed, tips curved and crossing (Fig. 3d). Second pereopod (Fig. 3e) reaching beyond antennular peduncle by chela, with small spine at posterodistal end of basis (Fig. 3f); ischium unarmed; merus with single spine at distal 1/3 of posterior margin; carpus with a slender spine on distoventral corner; palm as long as fingers. Third pereopod slender, reaching beyond anterior margin of carapace by dactylus and part of propodus; no spinules on any segment (Fig. 3g). Fourth pereopod shortest, reaching basal spine of second pereopod; dactylus with long setae, propodus with short stiff setae along posterior margin (Fig. 3h). Fifth pereopod not reaching anterior margin of carapace; dactylus terminally rounded with long setae (Fig. 3i).

Endopod of male first pleopod composed of three lobes, mesial lobe small, with some retinaculæ in central part; other two lobes surrounded by long plumose setae (Fig. 2o). Endopod of male second pleopod with appendices masculina and interna; masculina shorter than interna, and provided with eight long setae (Fig. 2p). Uropod (Fig. 1) much longer than telson; exopod much longer than endopod; outer margin ending in small spine, not reaching end of lamella.

Branchial formula simple, consisting of only four pleurobranchiae, and six exopods from third maxilliped to fifth pereopod (Fig. 2a, i):

Thoracic Somite	I (Mxp1)	II (Mxp2)	III (Mxp3)	IV (P1)	V (P2)	VI (P3)	VII (P4)	VIII (P5)
Pleurobranchiae	-	-	-	1	1	1	1	-
Arthrobranchiae	-	-	-	-	-	-	-	-
Podobranchiae	-	-	-	-	-	-	-	-
Epipods	-	-	-	-	-	-	-	-
Exopods	-	-	1	1	1	1	1	1

SIZE. — The holotype is 12 mm CL (BURUKOVSKY, 1993). The MUSORSTOM material are slightly smaller than the holotype. The carapace length is 11.5 mm CL in male and 10.9 mm in ovigerous female. Eggs are large and relatively few in number, 1.47 x 0.95 mm. The "*Siboga*" specimen is immature, its carapace length is only 4.6 mm.

REMARKS. — The present species was recently described by BURUKOVSKY (1993), based on a single female collected from the western Indian Ocean. Although six spines on the posterior margin of the telson and the unarmed first pereopod were shown in the original description, the simple branchial formula was neither mentioned nor figured by BURUKOVSKY (1993). Very recently I could examine the holotype, in which

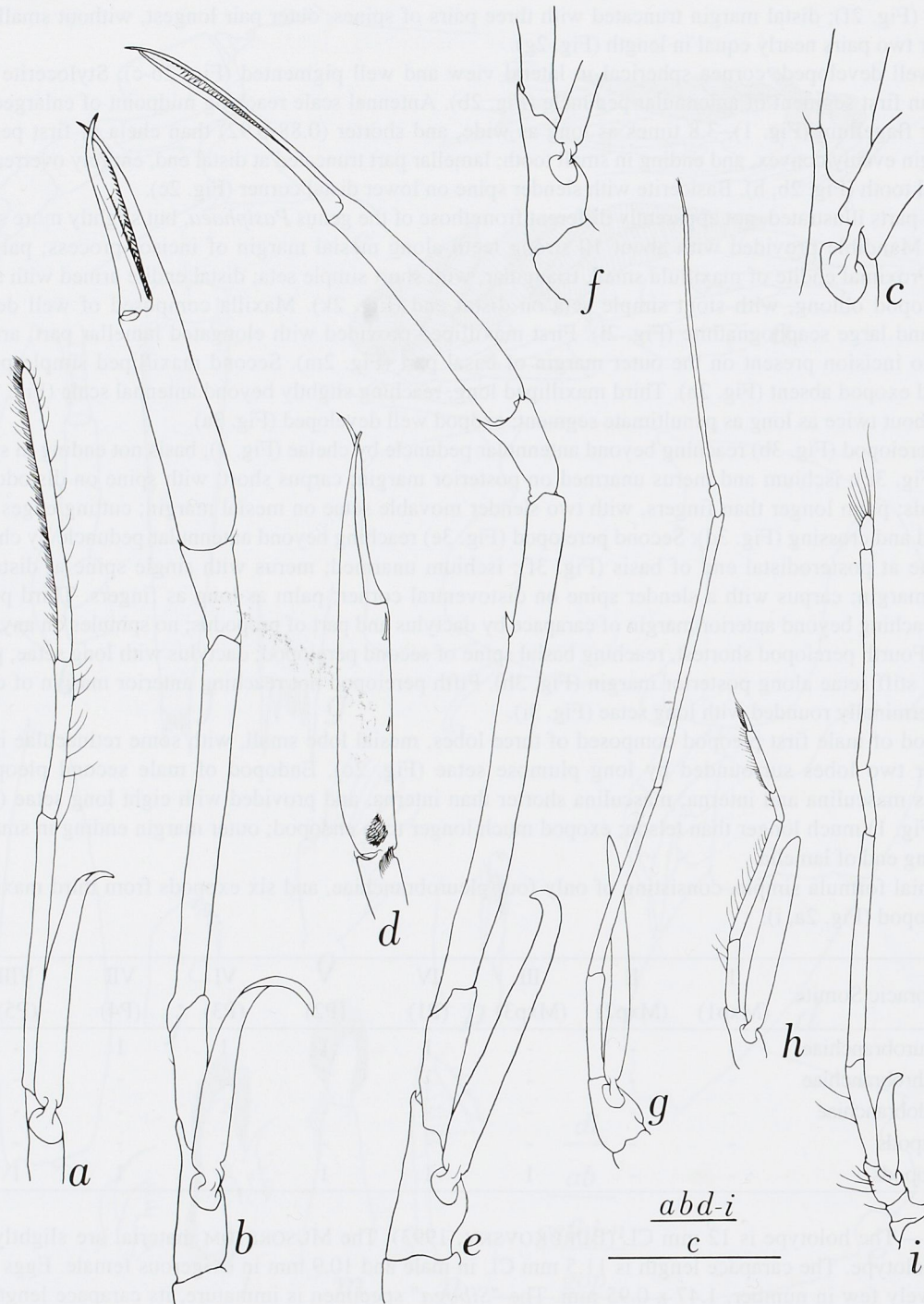


FIG. 3. — *Alaiopasiphaea nudipeda* (Burukovsky, 1993), **a-b, e, g-i**, ♂ 11.5 mm (MNHN-Na 13370) ; **c-d, f**, ovig. ♀ 10.9 mm (MNHN-Na 13371), both from Madagascar.

a, third maxilliped; **b**, first pereopod; **c**, basal part of first pereopod; **d**, chela of first pereopod in inner view; **e**, second pereopod; **f**, basal part of second pereopod; **g**, third pereopod; **h**, fourth pereopod; **i**, fifth pereopod. Scales = 1 mm.

unfortunately the carapace was entirely missing, but confirmed these characters (Fig. 2a-b). The MUSORSTOM specimens agree well with the holotype and show no apparent sexual dimorphism.

I could also examine the small specimen that DE MAN (1920) named *Pasiphaea* sp. α . This is a juvenile, only 4.6 mm in carapace length, and probably identical with the present species in having the following characters: The branchial formula is the same as in the present species, only four pleurobranchiae are recognized in the branchial chamber. The first pereopod is entirely unarmed on the posterior margin of merus, ischium and basis. The distal end of basis bears no spine. The merus of the second pereopod is armed with one spine at distal third of the posterior margin; the distal end of the basis bears a small spine.

Some minor discrepancies between the MUSORSTOM and "*Siboga*" specimens are present. The branchiostegal sinus is ill defined and the spine on the basicerite is small in the "*Siboga*" specimen, and the ventral surface of palm of the first pereopod is provided with a single seta near the finger articulation, while two setae, one near the finger articulation and the other on the midlength of palm, are observed in the MUSORSTOM specimens. Obviously these differences depend largely on the immaturity of the "*Siboga*" specimen.

DISTRIBUTION. — The present specimens were collected from two localities near Madagascar at depths of 620-720 m. The holotype was obtained from off Mozambique at depths of 535-490 m. The "*Siboga*" specimen was obtained from Indonesia.

Genus *PASIPHAEA* Savigny, 1816

Pasiphaea sivado species group

DEFINITION. — Small and moderately sized pasiphaeids. Rostrum short, triangular with pointed apex, arising behind anterior margin of carapace. Dorsal margin of carapace smooth in most species but carinate anteriorly in some species. Branchiostegal spine present. Posterior margin of telson truncate, slightly convex or slightly concave, with four pairs of spines. Mandible without palp. Fourth pereopod shorter than third and fifth pereopods. No arthrobranchia on third maxilliped. Three arthrobranchiae from fourth to sixth thoracic somites and four or five pleurobranchiae present on fourth to seventh or eighth thoracic somites, pleurobranchia on eighth somite, if present, always rudimentary.

Pasiphaea sivado and related species have the following characters: 1) size small to moderate, 2) carapace usually not carinate dorsally, 3) first to fifth abdominal somites not carinated dorsally, 4) a terminal spine present on sixth abdominal somite only, 5) distal margin of telson not forked, with four pairs of spines, 6) pleurobranchia on eighth thoracic somite absent or rudimentary, and 7) three arthrobranchiae present on fourth to sixth thoracic somites.

The general morphology of the species of this group resembles each other, as set out below.

Rostrum small, triangular process situated at middorsal line slightly inside carapace. Small branchiostegal spine situated on or just inside anterior margin of carapace.

First to fifth somites smooth dorsally, unarmed. Sixth somite less than twice as long as fifth and less than twice as long as deep. Telson shorter than sixth somite, usually with longitudinal groove dorsally. Distal margin of telson truncate or convex, with four pairs of spines; outer pair longest, usually with small accessory seta on their base; inner pairs shorter than outer, gradually decreasing in size.

Eye well developed; cornea spherical or semispherical in lateral view, well-pigmented. Stylocerite not reaching or just reaching distal margin of first segment of antennular peduncle; dorsal margin ending in small point in lateral view. Antennal scale overreaching enlarged part of antennular flagellum, about four times as long as wide; outer margin more or less convex; outerdistal tooth projecting beyond lamella. Basicerite armed with slender spine on lower distal corner.

Mouth-parts of typical shape. Mandible with several strong teeth along mesial margin of incisor process. Maxillula comparatively large; proximal endite small, obliquely truncate distally with one or few short simple setae; distal endite with several acute teeth; endopod oblong, with stout simple seta on mesial margin near distal end.

Maxilla with well developed endopod and large scaphognathite. First maxilliped with elongated lamellar part, articulated distally. Second maxilliped simple, pediform; epipod and exopod absent. Third maxilliped long, reaching slightly beyond antennal scale; distal segment about twice as long as penultimate segment; exopod well developed.

All pereopods with well developed exopods, but no epipods. First pereopod usually reaching beyond distal end of antennular peduncle by entire chela; carpus short, sharply pointed on dorsal and ventral ends; palm slightly longer than fingers, usually with two slender movable setae on mesial margin; fingers slender, their cutting edges toothed; tips curved, crossing one another. Second pereopod similar to first pereopod in shape and length; carpus with slender distoventral spine only; finger nearly as long as palm, strongly curved at distal part. Third pereopod slender, reaching beyond anterior margin of carapace by dactylus and a part of propodus; all segments usually unarmed. Fourth pereopod shortest, reaching basal spine of second pereopod only; dactylus provided with rather long setae on posterior margin; propodus with short stiff setae along posterior margin. Fifth pereopod reaching distal margin of carpus of third pereopod; dactylus broad and rounded distally, with several long setae.

Endopod of male first pleopod with two or three lobes, mesial lobe small, with some retinaculæ in central part; outer lobe surrounded by long plumose setae. Endopod of male second pleopod with appendices masculina and interna; masculina usually shorter than interna, with many long setae. Uropod elongate; exopod much longer than endopod, outer margin with small distal spine, as long as or overreaching lamella.

REMARKS. — The genus *Pasiphaea* contains many species which together show a wide range of morphological variation. Of these the type species of the genus, *P. sivado*, and other related species, such as *P. propinqua* de Man, 1916, *P. japonica* Omori, 1976, and *P. marisrubri* Iwasaki, 1989, were reported to be very similar in shape and size. They differ from the other members of *Pasiphaea* in having a terminal spine on the dorsal margin of the sixth abdominal somite. Five other new species related to *P. sivado* were found in the MUSORSTOM material. They prove to share some important characters with the above mentioned species, in addition to the terminal spine on the sixth abdominal somite. They constitute a single natural group, the *P. sivado* species group, which maybe in the future will be recognized as a distinct subgenus of the genus *Pasiphaea*.

The terminal spine on the sixth abdominal somite is the most apparent and useful character, by which this species group is readily distinguished from the other species groups. This character does not easily change in shape and size, and is less likely to be damaged than the tips of rostrum, telson and uropodal exopods, when specimens suffer damage. In some species such as *P. truncata* Rathbun, 1906 and *P. longitaenia* Kensley, Tranter & Griffin, 1987, the dorsal margin of the sixth abdominal somite is produced as a "pointed end", not as a true spine. The lateral aspect of the pointed end somewhat resembles that of a true spine, but spine and pointed end are easily recognized from each other in dorsal view. The true spine is slender and needle-like, especially not broadened at base, but the pointed end is triangular in shape with a broad base.

There are some species provided with a posterodorsal spine on other abdominal somites as well as on the sixth somite, for example *P. orientalis* Schmitt, 1931, *P. hoplocerca* Chace, 1940 and *P. semispinosa* Holthuis, 1951. They are excluded from this species group, because they do not share the above mentioned characters.

It has been emphasized that main specific characters of the genus *Pasiphaea* were the spination of the first and second pereopods and the shape of the telson end (BURUKOVSKY & ROMENSKY, 1987; BURUKOVSKY, 1996). They are indeed important, but the branchial differences seem to be almost neglected in this genus. The species of this species group, such as *P. sivado*, *P. japonica*, and *P. propinqua*, have the same branchial formula, three arthrobranchiae from the fourth to sixth thoracic somites and four normal and one rudimentary pleurobranchiae from the fourth to eighth thoracic somites. This formula, however, differs from those of other remaining species, in which the last pleurobranchia is normal, not reduced. Among the MUSORSTOM materials are five new species, which bear different and more reduced branchial formulae.

Branchial reduction, therefore, occurs in every species of the *P. sivado* species group. The condition is not uniform, though there are always three arthrobranchiae, and the species are roughly divided into two groupings: five species bear only four pleurobranchiae and three have five pleurobranchiae, of which the last one is always rudimentary, bearing only a few gill lamellae. It differs in form from the miniature or undeveloped gill, often seen in the immature specimens of other large-sized species of the genus.

On the other hand, *Pasiphaea* species without the terminal spine on the sixth somite have three well-developed arthrobranchiae from the fourth to sixth thoracic somites and five normal pleurobranchiae are also present on all

thoracic somites. The last pleurobranch is never reduced, having usually the same shape as those of preceding somites. *Pasiphaea* species with terminal spines on two or three abdominal somites, even if a spine is present on the sixth somite, never show branchial reduction, and have a complete set of gills.

These two groupings within the *Pasiphaea* species group based on branchial differences coincide rather well with a pattern of spination of the first and second pereopods. Each basis of the first and second pereopods always ends in a well-developed posterodistal spine in both groupings. The meri are armed with a series of spines, but their arrangements are rather different from each other. There are less than ten spines on the first pereopod and less than 17 spines on the second pereopod in the first grouping, while in the second grouping usually more than ten spines on the first pereopod and usually more than 15 spines on the second pereopod. *P. sivado* is an exception, though it has the branchial formula of the second grouping, the spination is less than ten on the first pereopod, and less than 15 spines on the second pereopod.

The basis and ischium does not show such pattern of the spination, and the presence or absence of the spine(s) seem to be constant, though numbers are always variable. There is an exception with the ischium of *P. gracilis* sp. nov., in which one female from the northern South Pacific is armed with one spine on the left side but unarmed on the right side.

The rostrum is shown to be rather variable in shape depending on growth, or presence or absence of ellobiopsis parasites, but its general morphology is still useful for almost all species. As pointed out by BURUKOVSKY & ROMENSKY (1987) and BURUKOVSKY (1996), the form of the branchial sinus is important and may be constant, though it is rather difficult to observe, because the ventral margin of carapace is often softened and folded inwards.

Pasiphaea sivado has been reported several times from various seas. Records from other areas than the Atlantic Ocean, were partly checked and proved to be different species (OMORI, 1976 and IWASAKI, 1989) and the remaining records are now reexamined from the specimens concerned or from the published references. Now, *P. sivado* s.s. is restricted in its distribution to the northeastern Atlantic Ocean and Mediterranean Sea. Including the five new species described here, the *Pasiphaea sivado* species group includes the following nine members:

- P. debitusae* sp. nov. (? = *Pasiphaea sivado* Wood Mason, 1892 and *Pasiphaea sivado* Wood Mason & Alcock, 1893),
- P. fragilis* sp. nov.,
- P. gracilis* sp. nov. (? = *Pasiphaea* sp. β de Man, 1920),
- P. japonica* Omori, 1976 (= *Pasiphaea* aff. *sivado* Crosnier, 1976 and *Pasiphaea sivado* Kensley, 1977),
- P. laevis* sp. nov.,
- P. marisrubri* Iwasaki, 1989,
- P. philippinensis* sp. nov.,
- P. propinqua* de Man, 1916,
- P. sivado* (Risso, 1816).

These species are distinguished from each other in the key presented below.

Key to the *Pasiphaea sivado* species group

1. Four pleurobranchiae present 2
- Five pleurobranchiae present, though that on last thoracic somite rudimentary 7
2. Basis of second pereopod with 2-7 spines, excluding terminal spine 3
- Basis of second pereopod without spines 4
3. Rostrum slender and short, not reaching halfway between base of rostrum and anterior margin of carapace. Ischium of third pereopod with 1-4 spinules *P. marisrubri* Iwasaki, 1989
- Rostrum short, but reaching beyond halfway between base of rostrum and anterior margin of carapace. Ischium of third pereopod unarmed . *P. philippinensis* sp. nov.

4. Rostrum short and small. Ischium of second pereopod with spine *P. debitusae* sp. nov.
 — Rostrum medium or long. Ischium of second pereopod usually unarmed 5
5. Shell fragile. Terminal spine of sixth abdominal somite extending slightly upwards *P. fragilis* sp. nov.
 — Shell not fragile. Terminal spine of sixth abdominal somite extending straight backwards 6
6. Branchiostegal sinus absent or obscure. Rostrum long with wide base *P. laevis* sp. nov.
 — Branchial sinus present. Rostrum medium with narrow base *P. gracilis* sp. nov.
7. Sixth abdominal somite sharply carinate dorsally. Posterior margin of telson slightly convex *P. propinqua* De Man, 1916
 — Sixth abdominal somite not carinate dorsally. Posterior margin of telson truncate 8
8. Merus of first pereopod with 1-8 spines, merus of second pereopod with 5-15 spines ... *P. sivado* (Risso, 1816)
 — Merus of first pereopod with 5-12 spines, merus of second pereopod with 14-23 spines *P. japonica* Omori, 1976

Pasiphaea marisrubri Iwasaki, 1989

Fig. 4

Pasiphaea marisrubri Iwasaki, 1989: 178, figs 1-2.

Pasiphaea marisrubrae - BURUKOVSKY, 1996: 843 (list).

? *Pasiphaea sivado* - BALSS, 1915: 17. Not Risso, 1816.

Pasiphaea sivado - CALMAN, 1939: 185. Not Risso, 1816.

MATERIAL EXAMINED. — **Central Red Sea.** "Sonne": stn So-02/43-TAP, 21°14.80'N, 37°15.40'E, 0-220 m, 18.10.1977: 7 ♂ 7.1-10.0 mm, 1 ovig. ♀ 10.8 mm, 6 ♀ 6.6-11.4 mm (paratypes, SMF 17545).

"Meteor": stn M5/193-Ku, 19°24.3'N, 38°31.2'E, 696-705 m, 28.02.1987: 4 ♀ 9.1-12.7 mm (SMF 17999).

DIAGNOSIS. — Shell moderately firm. Rostrum small, spine-like, not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus developed. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereopod with 5-12 spines on merus and unarmed on basis except for a posterodistal spine. Second pereopod with 14-23 spines on merus, and unarmed on ischium; unarmed on basis except for a posterodistal spine. Ischium of third pereopod with two or three spinules on posterior margin. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae from fourth to seventh thoracic somites.

SIZE. — The holotype is a male, 10.0 mm in CL and the allotype an ovigerous female, 11.2 mm. The smallest ovigerous female is 9.4 mm in CL. The egg size is 1.2 x 0.8 mm (IWASAKI, 1989).

REMARKS. — The species is well described by IWASAKI (1989). The branchial formula of this species was confirmed by the examination of paratypes and other materials deposited at the Forschungsinstitut Senckenberg, Frankfurt. No trace of a pleurobranch is present on the eighth thoracic somite (Fig. 4b).

The distinctions between the present species and *P. philippinensis* sp. nov. are mentioned under the account of the latter species. As shown by IWASAKI (1989), the rostrum is small and short, and the distal spine on the basicerite is more slender (Fig. 4a). Moreover *P. marisrubri* always bears two or three spinules on the posterior margin of the ischium of the third pereopod, which is a unique character of this species (Fig. 4c-d).

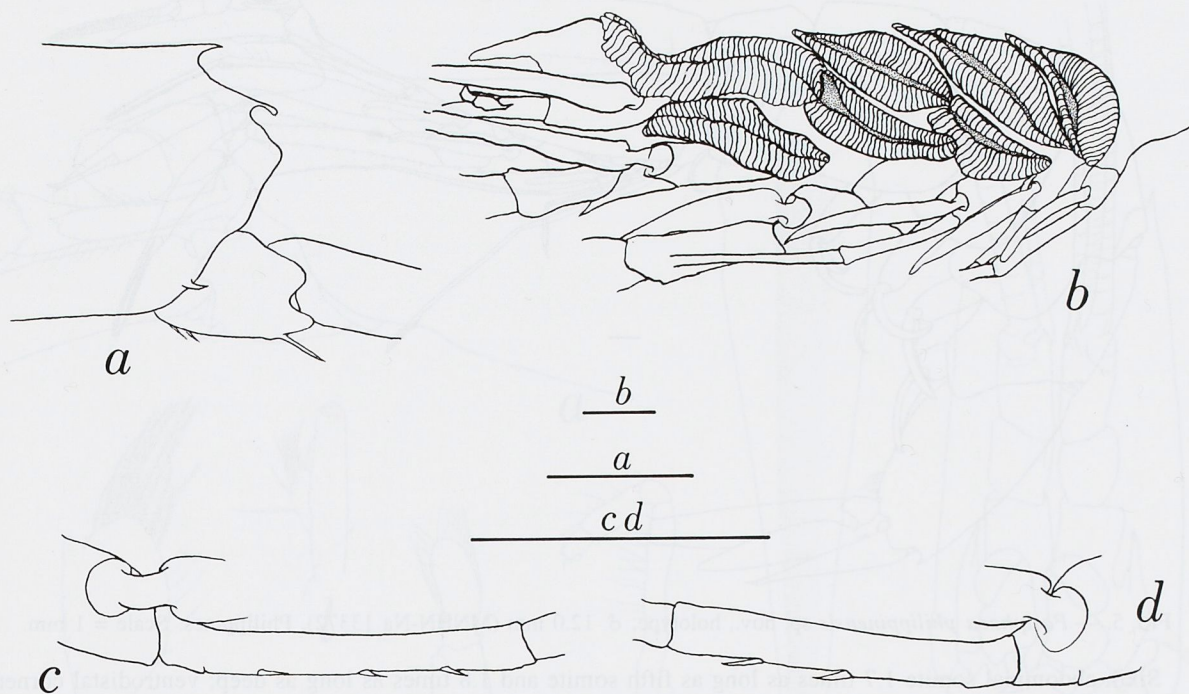


FIG. 4. — *Pasiphaea marisrubri* Iwasaki, 1989, paratypes: **a**, ♀ 9.7 mm ; **b-d**, ♀ 11.4 mm, both from Red Sea (SMF 17545, part).

a, anterior part of body; **b**, branchial chamber; **c**, basal part of right third pereiopod; **d**, basal part of left third pereiopod. Scales = 1 mm.

References to *P. sivado* based on Red Sea specimens (BALSS, 1915 and CALMAN, 1939) have already been reviewed by IWASAKI (1989).

DISTRIBUTION. — Only known from the Red Sea (IWASAKI, 1989).

Pasiphaea philippinensis sp. nov.

Figs 5-7

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn CP 25, 13°39'N, 120°43'E, 520-550 m, 23.11.1980: 1 ♂ 12.0 mm (MNHN-Na 13372).

TYPE MATERIAL. — The unique specimen, a male 12.0 mm CL (MNHN-Na 13372), is the holotype.

DIAGNOSIS. — Shell not fragile. Rostrum moderate, not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus obscure. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereiopod with 9 spines on merus and 1 spine on basis excluding posterodistal spine. Second pereiopod with 16-17 spines on merus, 1 spine on ischium and 4-5 spines on basis excluding posterodistal spine. Ischium of third pereiopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae on fourth to seventh thoracic somites.

DESCRIPTION. — Rostrum short, directed obliquely forwards, reaching halfway between base of rostrum and anterior margin of carapace. Carapace with branchiostegal sinus hardly developed (Figs 5, 6a).

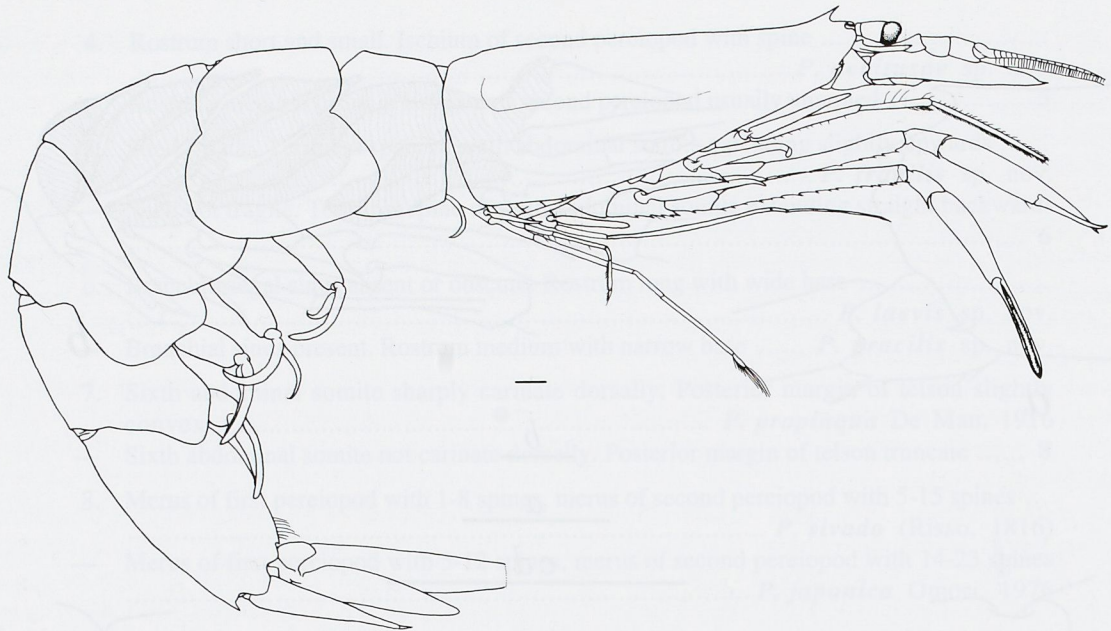


FIG. 5. — *Pasiphaea philippinensis* sp. nov., holotype, ♂ 12.0 mm (MNHN-Na 13372), Philippines. Scale = 1 mm.

Sixth abdominal somite 1.7 times as long as fifth somite and 1.8 times as long as deep; ventrodistal corner with small convexity with minute spine (Fig. 6c). Telson 0.7 times as long as sixth somite, dorsally with shallow groove extending for almost entire length (Fig. 6d); distal margin slightly convex with probably four pairs of spines, outer pair longest, without small seta on base; inner two pairs nearly equal in length (Fig. 6e).

Stylocerite shorter than first segment of antennular peduncle (Fig. 6b). Antennal scale 4.0 times as long as wide, and shorter (0.93) than chela of first pereopod; basicerite articulated with slender spine on lower distal corner (Fig. 6a). Mouth-parts showing typical shape of genus (Figs 6f-j, 7a).

First pereopod with spine at posterodistal end of basis (Fig. 7b, c); ischium unarmed and merus with nine spines on posterior margin; chela typical shape, with two movable setae on mesial margin (Fig. 7d). Basis of second pereopod with large spine at posterodistal end and four or five spines on posterior margin (Fig. 7e-f); ischium with one spine on midlength of posterior margin; merus with 16 or 17 spines on posterior margin. No spinules on ischium of third pereopod (Fig. 7g). Fourth and fifth pereopods typical shape for genus (Fig. 7h, i).

Endopod of male first pleopod composed of two lobes, mesial lobe small, with some retinaculæ in central part; other lobe large, surrounded by long plumose setae (Fig. 6k). Endopod of male second pleopod of typical shape for the group; appendix masculina with ten long setae (Fig. 6l).

Branchial formula as follows:

Thoracic Somite	I (Mxp1)	II (Mxp2)	III (Mxp3)	IV (P1)	V (P2)	VI (P3)	VII (P4)	VIII (P5)
Pleurobranchiae	-	-	-	1	1	1	1	-
Arthrobranchiae	-	-	-	1	1	1	-	-
Podobranchiae	-	-	-	-	-	-	-	-
Epipods	-	-	-	-	-	-	-	-
Exopods	-	-	1	1	1	1	1	1

Pleurobranchiae present on fourth to seventh thoracic somites, eighth somite with no pleurobranch. Arthrobranchiae present on fourth to sixth thoracic somites. All pereopods with well developed exopods, but without epipods or podobranchiae.

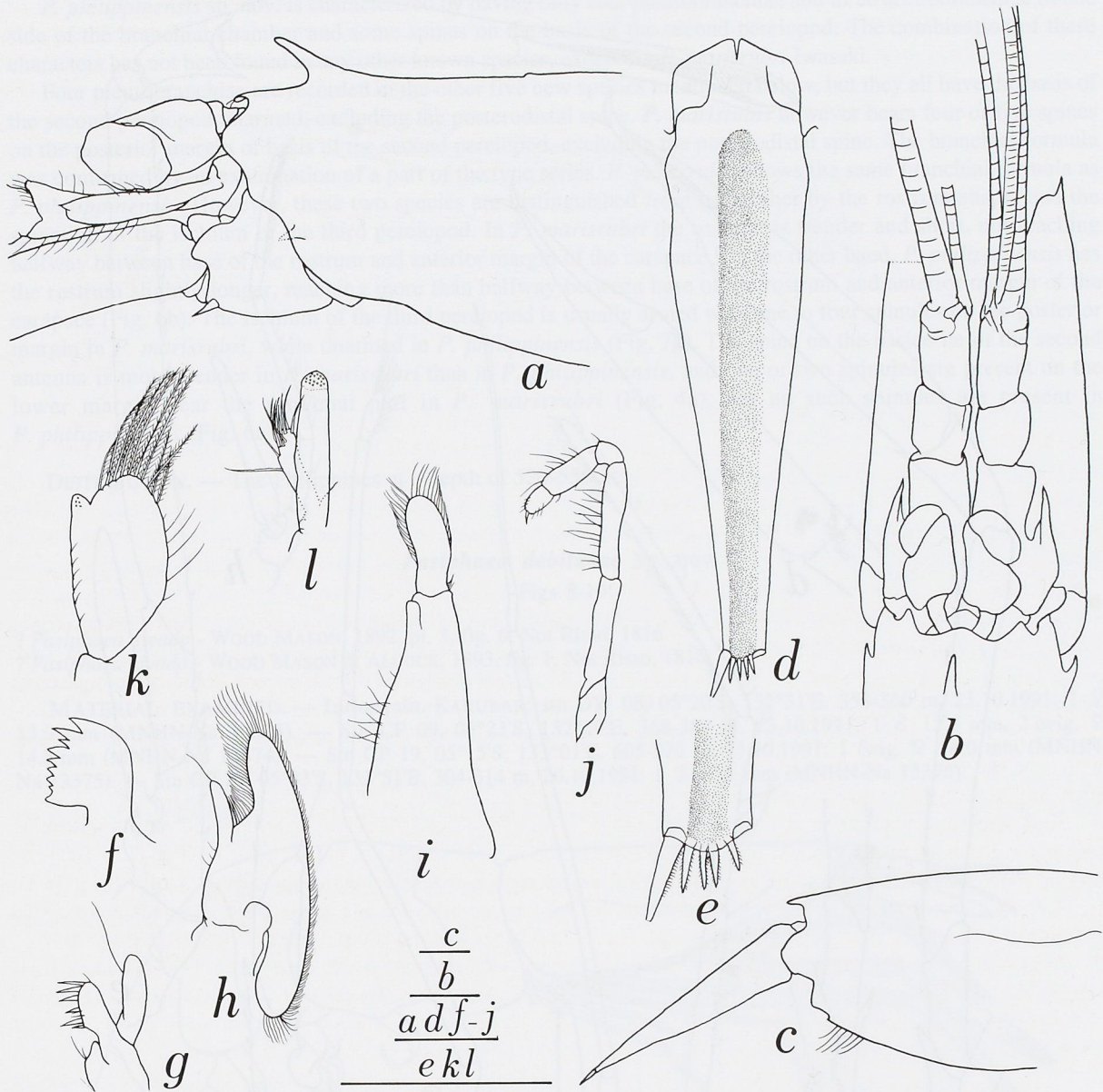


FIG. 6. — *Pasiphaea philippinensis* sp. nov., holotype, ♂ 12.0 mm (MNHN-Na 13372), from the Philippines.

a, anterior part of body in lateral view; **b**, same in dorsal view; **c**, distal end of sixth abdominal somite and telson in lateral view; **d**, telson in dorsal view; **e**, distal end of telson; **f**, mandible; **g**, maxillula; **h**, maxilla; **i**, first maxilliped; **j**, second maxilliped; **k**, first pleopod; **l**, appendices masculina and interna. Scales = 1 mm.

ETYMOLOGY. — The specific name, *philippinensis*, refers to the type locality, Philippine waters.

SIZE. — The unique specimen, the holotype male, is 12.0 mm CL.

REMARKS. — The holotype is slightly damaged, distal three segments and the distal part of merus of the left first pereiopod, distal three segments of the right second pereiopod, and outer distal spine of the uropodal exopod are missing. However, this species is very clear in its specific status and readily distinguished from other species.



FIG. 7. — *Pasiphaea philippinensis* sp. nov., holotype, ♂ 12.0 mm (MNHN-Na 13372), Philippines.

a, third maxilliped; **b**, first pereiopod; **c**, basal part of first pereiopod; **d**, chela of first pereiopod in inner view; **e**, second pereiopod; **f**, basal part of second pereiopod; **g**, third pereiopod; **h**, fourth pereiopod; **i**, fifth pereiopod. Scale = 1 mm.

P. philippinensis sp. nov. is characterized by having only four pleurobranchiae and three arthrobranchiae in one side of the branchial chamber and some spines on the basis of the second pereiopod. The combination of these characters has not been found in any other known species, except for *P. marisrubri* Iwasaki.

Four pleurobranchiae are recorded in the other five new species mentioned below, but they all have the basis of the second pereiopod unarmed, excluding the posterodistal spine. *P. marisrubri* however bears four or five spines on the posterior margin of basis of the second pereiopod, excluding the posterodistal spine. The branchial formula was confirmed by an examination of a part of the type series. *P. marisrubri* shows the same branchial formula as *P. philippinensis*. However, these two species are distinguished from each other by the rostrum shape, and the spination of the ischium of the third pereiopod. In *P. marisrubri* the rostrum is slender and short, not reaching halfway between base of the rostrum and anterior margin of the carapace. On the other hand, *P. philippinensis* has the rostrum slightly longer, reaching more than halfway between base of the rostrum and anterior margin of the carapace (Fig. 6b). The ischium of the third pereiopod is usually armed with one to four spinules on the posterior margin in *P. marisrubri*, while unarmed in *P. philippinensis* (Fig. 7g). The spine on the basicerite of the second antenna is more slender in *P. marisrubri* than in *P. philippinensis*, and one or two spinules are present on the lower margin near the proximal part in *P. marisrubri* (Fig. 4a), but no such spinules are present in *P. philippinensis* (Fig. 6a).

DISTRIBUTION. — The Philippines at a depth of 520-550 m.

Pasiphaea debitusae sp. nov.

Figs 8-10

? *Pasiphaea sivado* - WOOD MASON, 1892, pl. 3, fig. 6. Not Risso, 1816.

? *Pasiphaea sivado* - WOOD MASON & ALCOCK, 1893, fig. 1. Not Risso, 1816.

MATERIAL EXAMINED. — **Indonesia.** KARUBAR: stn DW 08, 05°20'S, 132°31'E, 358-360 m, 23.10.1991: 1 ♀ 13.9 mm (MNHN-Na 13373). — Stn CP 09, 05°23'S, 132°29'E, 368-389 m, 23.10.1991: 1 ♂ 13.8 mm, 2 ovig. ♀ 14.8 mm (MNHN-Na 13374). — Stn CP 19, 05°15'S, 133°01'E, 605-576 m, 25.10.1991: 1 ovig. ♀ 14.0 mm (MNHN-Na 13375). — Stn CP 27, 05°33'S, 132°51'E, 304-314 m, 26.10.1991: 1 ♀ 10.1 mm (MNHN-Na 13376).

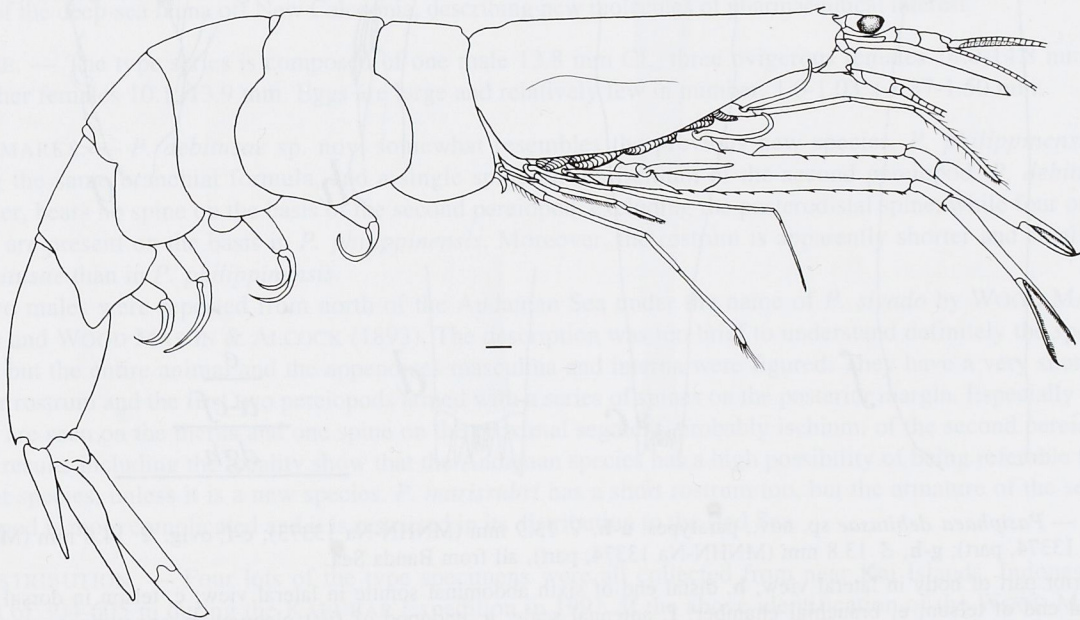


FIG. 8. — *Pasiphaea debitusae* sp. nov., holotype, ovig. ♀ 14.0 mm (MNHN-Na 13375), Banda Sea. Scale = 1 mm.

TYPE MATERIAL. — The ovigerous female (14.0 mm, MNHN-Na 13375) collected at the station CP 19 of KARUBAR cruise is the holotype. All the other specimens are paratypes.

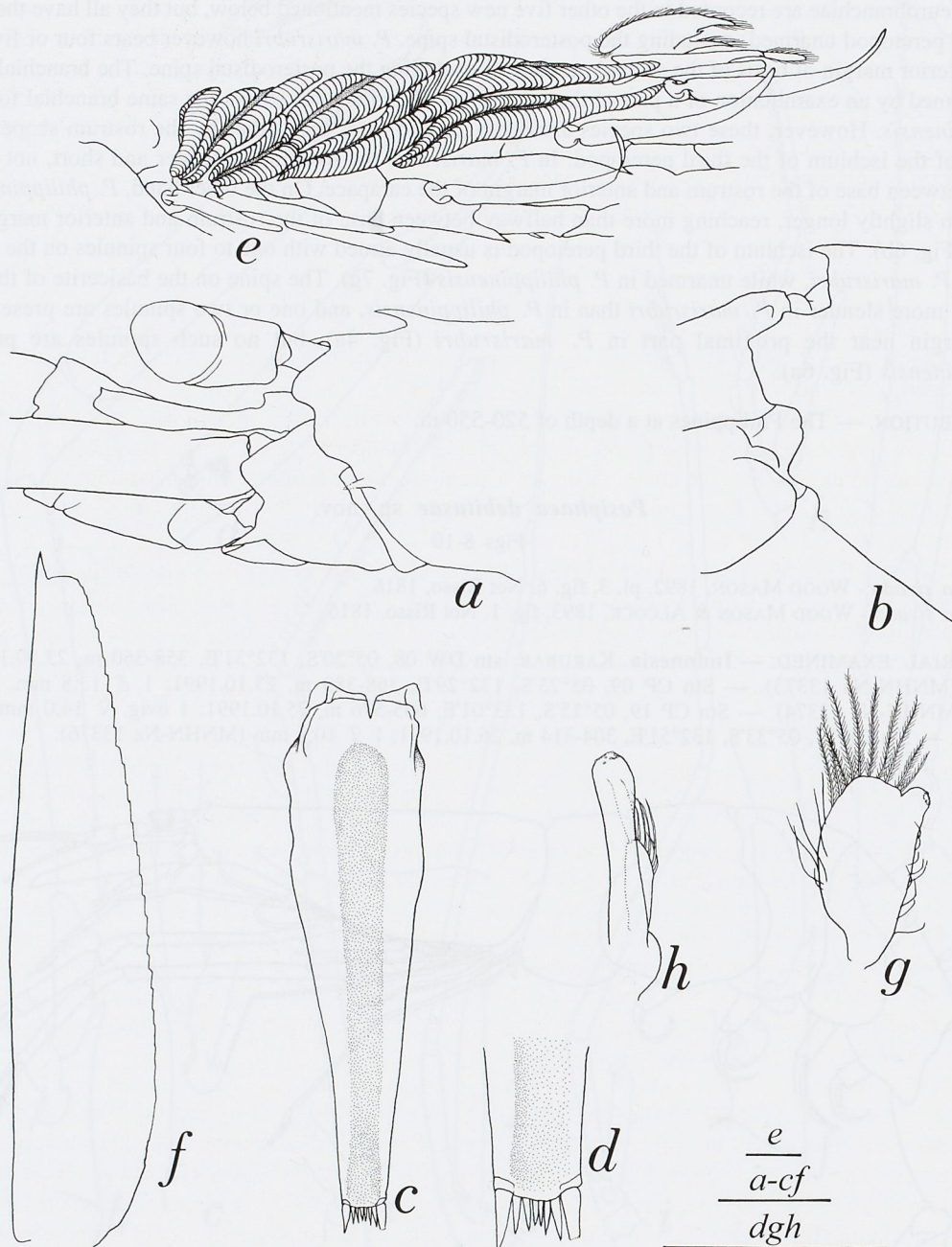


FIG. 9. — *Pasiphaea debitusae* sp. nov., paratypes: **a-b**, ♀ 13.9 mm (MNHN-Na 13373); **c-f**, ovig. ♀ 14.8 mm (MNHN-Na 13374, part); **g-h**, ♂ 13.8 mm (MNHN-Na 13374, part), all from Banda Sea.

a, anterior part of body in lateral view; **b**, distal end of sixth abdominal somite in lateral view; **c**, telson in dorsal view; **d**, distal end of telson; **e**, branchial chamber; **f**, antennal scale; **g**, endopod of first pleopod; **h**, appendices masculina and interna. Scales = 1 mm.

DIAGNOSIS. — Shell not fragile but not hard. Rostrum small spine-like, not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus obscure. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereopod with 4-8 spines on merus and unarmed on basis excluding posterodistal spine. Second pereopod with 9-12 spines on merus, a single spine on ischium and unarmed on basis excluding posterodistal spine. Ischium of third pereopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae from fourth to seventh thoracic somites. Ovigerous females 14-15 mm.

DESCRIPTION. — Rostrum small, like short spine, hardly reaching halfway between base of rostrum and anterior margin of carapace (Figs 8, 9a). Branchiostegal sinus hardly developed (Fig. 9a).

Sixth abdominal somite 1.7-2.0 times as long as fifth somite and 1.9-2.0 times as long as deep; ventrodistal corner shallowly convex distally (Fig. 9b). Telson 0.6-0.7 times as long as sixth somite, dorsally grooved without interruption (Fig. 9c); distal margin truncate with four pairs of spines, outer pair longest, without small seta on base; innermost pair shortest, two intermediate pairs nearly of equal length (Fig. 9d).

Stylocerite shorter than first segment of antennular peduncle (Fig. 9a). Antennal scale 4.1-4.8 times as long as wide, and shorter (0.91-0.95) than chela of first pereopod; basicerite with slender spine on lower distal corner (Fig. 9a). Mouth-parts showing typical shape of genus (Fig. 10a-f).

First pereopod with spine at posterodistal end of basis; ischium unarmed; merus with four to eight spines on posterior margin (Fig. 10g); palm longer than fingers, with two slender setae on mesial margin (Fig. 10h). Basis of second pereopod ending in large spine, posterior margin unarmed; ischium with or without single spine on posterior margin (Figs 8, 10i); merus with 9 to 14 spines on posterior margin (Fig. 10i). No spinules on ischium of third pereopod (Fig. 10j). Fourth and fifth pereopods typical shape for genus (Fig. 10k-l).

Endopod of male first pleopod composed of two lobes, mesial lobe small, with some retinaculæ in central part; outer lobe surrounded by long plumose setae (Fig. 8g). Endopod of male second pleopod similar to preceding species; appendix masculina with seven long setae (Fig. 8h).

Branchial formula same as preceding species. Pleurobranchiae present on fourth to seventh thoracic somites, no pleurobranchia on eighth thoracic somite. Arthrobranchiae on fourth to sixth somites (Fig. 9e).

ETYMOLOGY. — From the family name of Cécile DEBITUS, biochemist at ORSTOM, who was in charge of the programm SMIB (Substances Marines d'Intérêt Biologique) from 1986 to 1996 and busily took part in the study of the deep-sea fauna off New Caledonia, describing new molecules of pharmaceutical interest.

SIZE. — The type series is composed of one male 13.8 mm CL, three ovigerous females 14.0-14.8 mm and two other females 10.1, 13.9 mm. Eggs are large and relatively few in number, 1.0-1.03 x 1.37-1.50 mm.

REMARKS. — *P. debitusae* sp. nov. somewhat resembles the previous new species, *P. philippinensis*, in having the same branchial formula, and a single spine on the ischium of the second pereopod. *P. debitusae*, however, bears no spine on the basis of the second pereopod, excluding the posterodistal spine, while four or five spines are present on the basis in *P. philippinensis*. Moreover, the rostrum is apparently shorter and smaller in *P. debitusae* than in *P. philippinensis*.

Two males were reported from north of the Andaman Sea under the name of *P. sivado* by WOOD MASON (1892) and WOOD MASON & ALCOCK (1893). The description was too brief to understand definitely the specific status, but the entire animal and the appendices masculina and interna were figured. They have a very short and slender rostrum and the first two pereopods armed with a series of spines on the posterior margin. Especially some spines are seen on the merus and one spine on the proximal segment, probably ischium, of the second pereopod. These results including the locality show that the Andaman species has a high possibility of being referable to the present species, unless it is a new species. *P. marisrubri* has a short rostrum too, but the armature of the second pereopod is more complicated and it is restricted in its distribution to the Red Sea.

DISTRIBUTION. — Four lots of the type specimens were all collected from near Kai Islands, Indonesia, at depths of 304-605 m during the KARUBAR Expedition in 1991. If the above identification of the WOOD MASON specimens is correct, the distribution range of the species can be extended to the Andaman Sea.

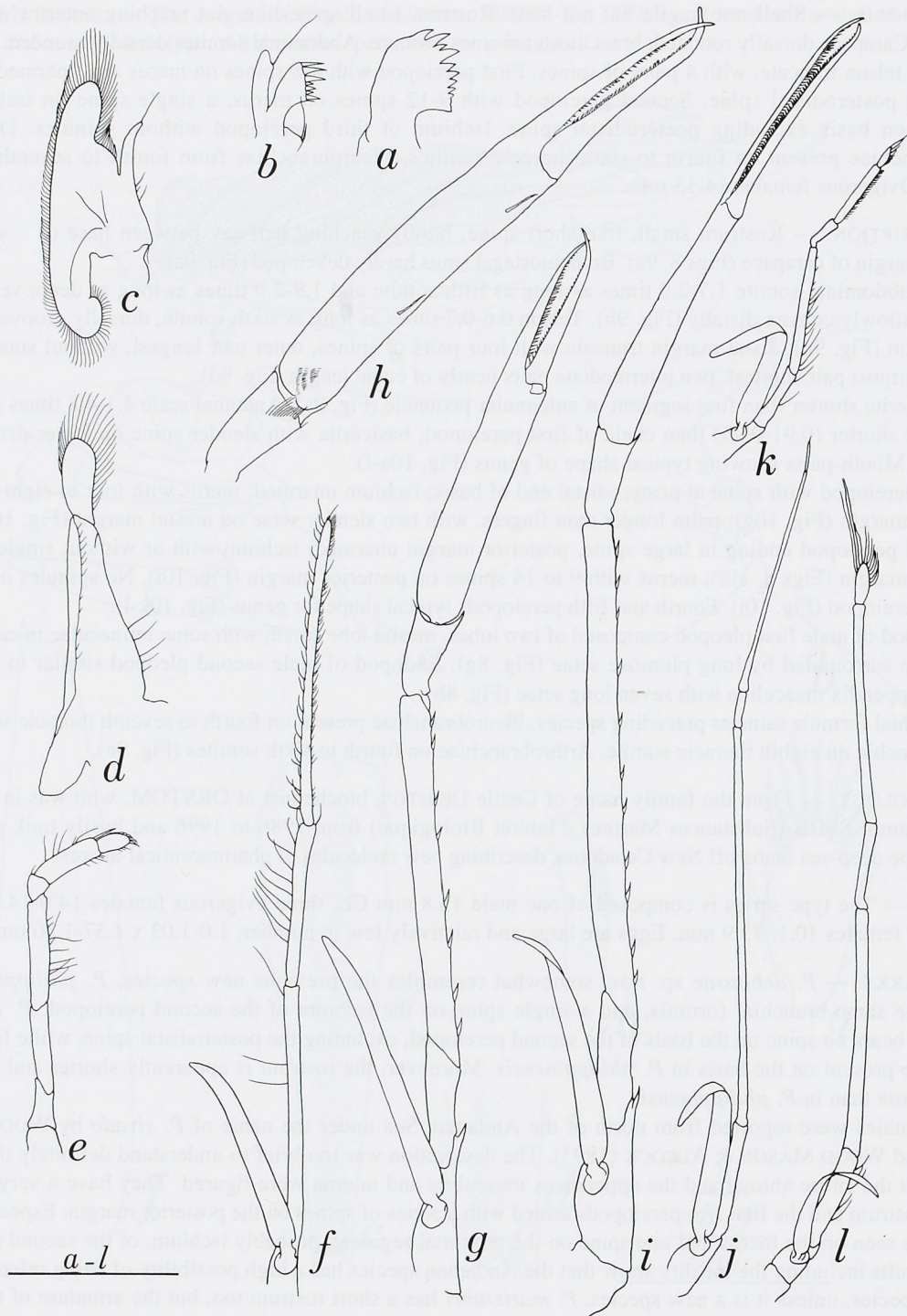


FIG. 10. — *Pasiphaea debitusae* sp. nov., paratype, ♂ 13.8 mm (MNHN-Na 13374, part), from Banda Sea.

a, mandible; **b**, maxillula; **c**, maxilla; **d**, first maxilliped; **e**, second maxilliped; **f**, third maxilliped; **g**, first pereiopod; **h**, chela of first pereiopod in inner view; **i**, second pereiopod; **j**, third pereiopod; **k**, fourth pereiopod; **l**, fifth pereiopod. Scale = 1 mm.

Pasiphaea fragilis sp. nov.

Fig. 11

MATERIAL EXAMINED. — **Loyalty Islands.** MUSORSTOM 6: stn CP 438, 20°23.0'N, 166°20.1'E, 780 m, 18.02.1989: 1 ♂ 10.8 mm (MNHN-Na 13377), 1 ♀ 10.9 mm (MNHN-Na 13378).

TYPE MATERIAL. — The male (10.8 mm, MNHN-Na 13377) collected at the station CP 438 of MUSORSTOM 6 cruise is the holotype. The female collected at the same station is a paratype.

DIAGNOSIS. — Shell fragile. Rostrum small, not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus developed. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereopod with 6-9 spines on merus and unarmed on basis excluding posterodistal spine. Second pereopod with 9-12 spines on merus, unarmed on ischium, and unarmed on basis excluding posterodistal spine. Ischium of third pereopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae on fourth to seventh thoracic somites. Specimens about 11 mm.

DESCRIPTION. — Rostrum short, not reaching halfway between base of rostrum and anterior margin of carapace. Branchiostegal sinus shallow, but distinct (Fig. 11a).

Sixth abdominal somite 1.7 times as long as fifth somite and 1.8 times as long as deep; ventrodistal corner with shallow convexity and with small pointed process; terminal spine angled slightly upwards (Fig. 11b). Telson 0.7 times as long as sixth somite, with shallow groove extending dorsally without interruption (Fig. 11c); distal margin slightly convex, probably with four pairs of spines (Fig. 11d).

Stylocerite shorter than first segment of antennular peduncle. Antennal scale 3.8-4.2 times as long as wide, and shorter (0.89) than chela of first pereopod; outerdistal spine overreaching lamella (Fig. 11e); basicerite with slender spine on lower distal corner. Mouth-parts not apparently different from those of other species (Fig. 11f).

First pereopod with spine at posterodistal end of basis; ischium unarmed; merus with six to nine spines on posterior margin (Fig. 11g). Basis of second pereopod ending in spine, posterior margin unarmed; ischium unarmed; merus with 9 to 12 spines on posterior margin (Fig. 11h). No spinules on ischium of third pereopod (Fig. 11i).

Endopods of male first and second pleopods similar to those of preceding species (Fig. 11 l-m).

Branchial formula same as preceding species, pleurobranchiae from fourth to seventh thoracic somites and arthrobranchiae on fourth to sixth thoracic somites.

ETYMOLOGY. — The specific name, *fragilis*, is based on the very fragile condition of the shell.

SIZE. — The male, holotype, is 10.8 mm CL; the female, paratype, 10.9 mm.

REMARKS. — *P. fragilis* sp. nov. belongs to the subgroup having four pleurobranchiae and three arthrobranchiae, and is morphologically related to *P. gracilis* sp. nov. in the shape of rostrum and branchiostegal sinus. The shell is fragile and the terminal spine of the sixth abdominal somite is angled slightly upwards in *P. fragilis*. Moreover, the meral spination of the first two pereopods is slightly less in *P. fragilis*. Six spines in *P. fragilis* and seven to nine spines in *P. gracilis* on the first pereopod and 9 to 12 spines in *P. fragilis* and 13 or 14 spines on the second pereopod in *P. gracilis*.

The spination of the distal margin of the telson is probably four pairs in the present species; in the holotype only seven spines remains, but the left half bears four spines, their arrangement is similar to those of other species. On the other hand, there are nine spines in the paratype, four regular spines present on the right half, five spines on left half, in which the inner two are more slender than others.

DISTRIBUTION. — The two type specimens were collected from one station in New Caledonian waters at a depth of 780 m.

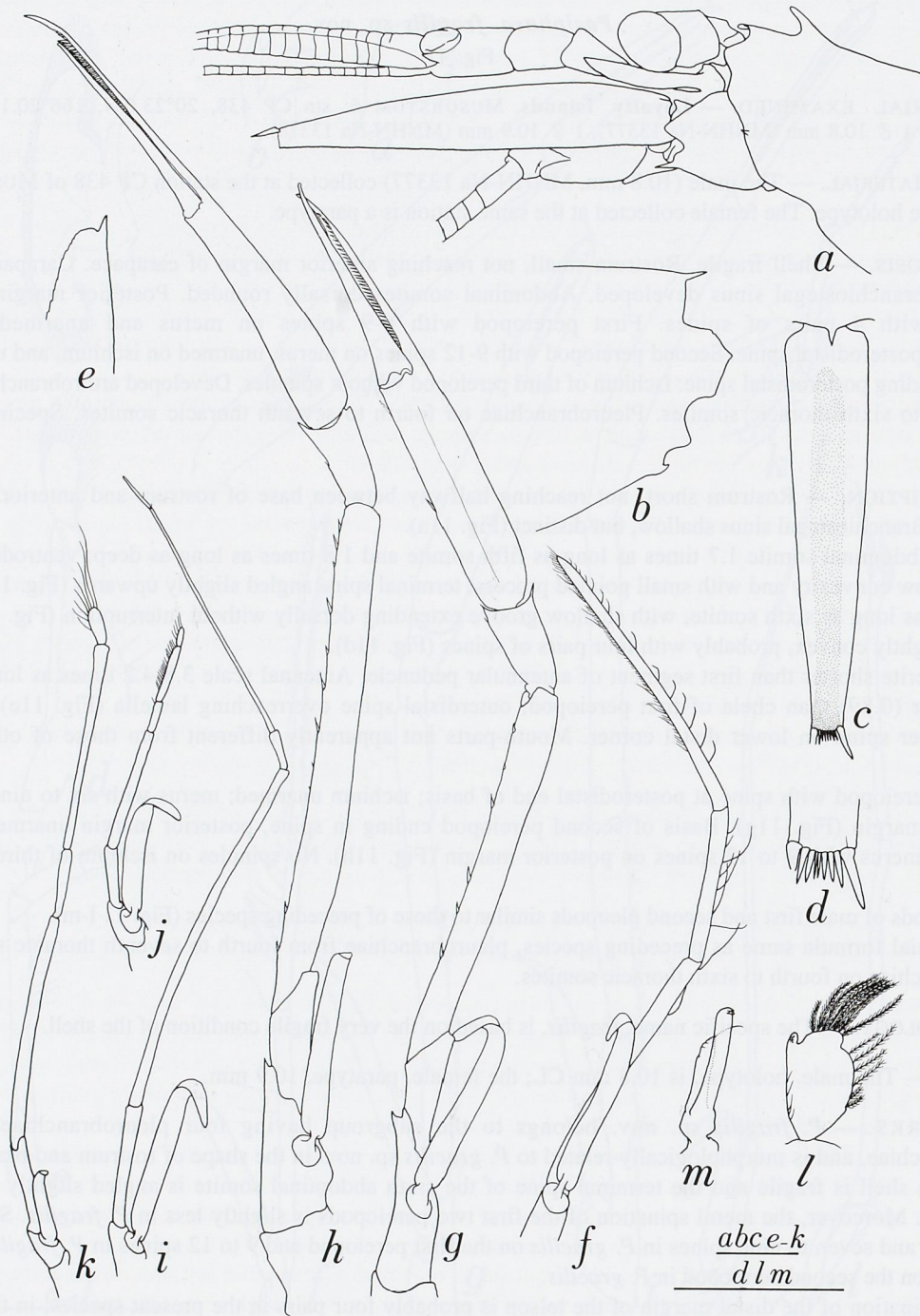


FIG. 11. — *Pasiphaea fragilis* sp. nov.: **a-b, e-m**, holotype, ♂ 10.8 mm (MNHN-Na 13377); **c-d**, paratype, ♀ 10.9 mm (MNHN-Na 13378), both from Central Pacific Ocean.

a, anterior part of body in lateral view; **b**, distal end of sixth abdominal somite in lateral view; **c**, telson in dorsal view; **d**, distal end of telson; **e**, apex of antennal scale; **f**, third maxilliped; **g**, first pereiopod; **h**, second pereiopod; **i**, third pereiopod; **j**, fourth pereiopod; **k**, fifth pereiopod; **l**, endopod of first pleopod; **m**, appendices masculina and interna. Scales = 1 mm.

Pasiphaea laevis sp. nov.

Figs 12-14

MATERIAL EXAMINED. — **Indonesia**. *Makassar Strait*. CORINDON 2: stn CH 214, 00°31'N, 117°50'E, 595 m: 1 ♀ 11.9 mm (MNHN-Na 13379).

Moluccas. KARUBAR: stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ovig. ♀ 12.3 mm (MNHN-Na 13380).

TYPE MATERIAL. — The ovigerous female (12.3 mm, MNHN-Na 13380) collected at the station CP 35 of KARUBAR cruise is the holotype. The other female (11.9 mm, MNHN-Na 13379) is a paratype.

DIAGNOSIS. — Shell not fragile. Rostrum long and broad based, nearly overreaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus very indistinct. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereiopod with 7-9 spines on merus and unarmed on basis excluding posterodistal spine. Second pereiopod with 12-13 spines on merus, unarmed on ischium and unarmed on basis excluding posterodistal spine. Ischium of third pereiopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae from fourth to seventh thoracic somites. Ovigerous female with carapace length of 12 mm.

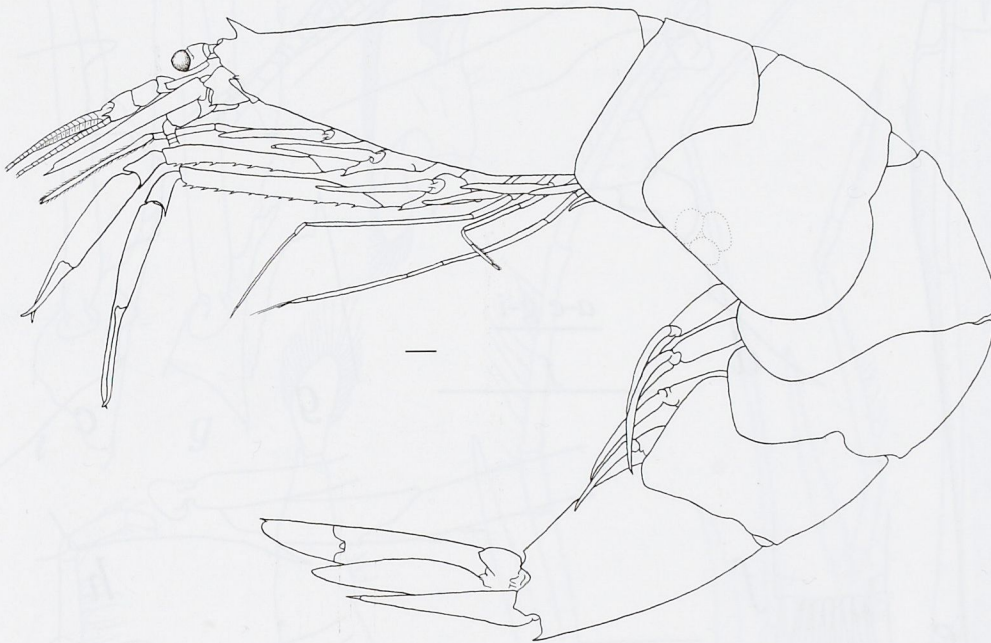


FIG. 12. — *Pasiphaea laevis* sp. nov., holotype, ovig. ♀ 12.3 mm (MNHN-Na 13380), Banda Sea. Scale = 1.0 mm.

DESCRIPTION. — Rostrum long, with broad base, reaching or overreaching anterior margin of carapace (Figs. 12, 13a-b). Branchiostegal sinus indistinct, without apparent excavation (Fig. 13a, b).

Sixth abdominal somite 1.8 times as long as fifth somite and 1.8 times as long as deep; ventrodistal corner shallowly convex, with minute spine (Fig. 13c-d). Telson 0.7 times as long as sixth somite, with groove dorsally, but with groove almost disappearing around midlength (Fig. 13e); distal margin truncate, with four pairs of spines, outer pair longest, with small seta on base (Fig. 13f).

Stylocerite slightly shorter than first segment of antennular peduncle (Fig. 13a-b). Antennal scale 3.8-4.0 times as long as wide, and as long as chela of first pereiopod; outerdistal spine rather long, entirely

overreaching lamella (Fig. 13g); basicerite with slender spine on lower distal corner. Mouth-parts showing no apparent difference from other species (Fig. 14a-f).

First pereiopod with extremely large spine on posterodistal end of basis; ischium unarmed; merus with 7 to 9 spines on posterior margin (Figs 13h, 14g); palm of typical shape with two movable setae on mesial margin (Fig. 14h). Basis of second pereiopod ending in spine, posterior margin unarmed; ischium unarmed; merus with

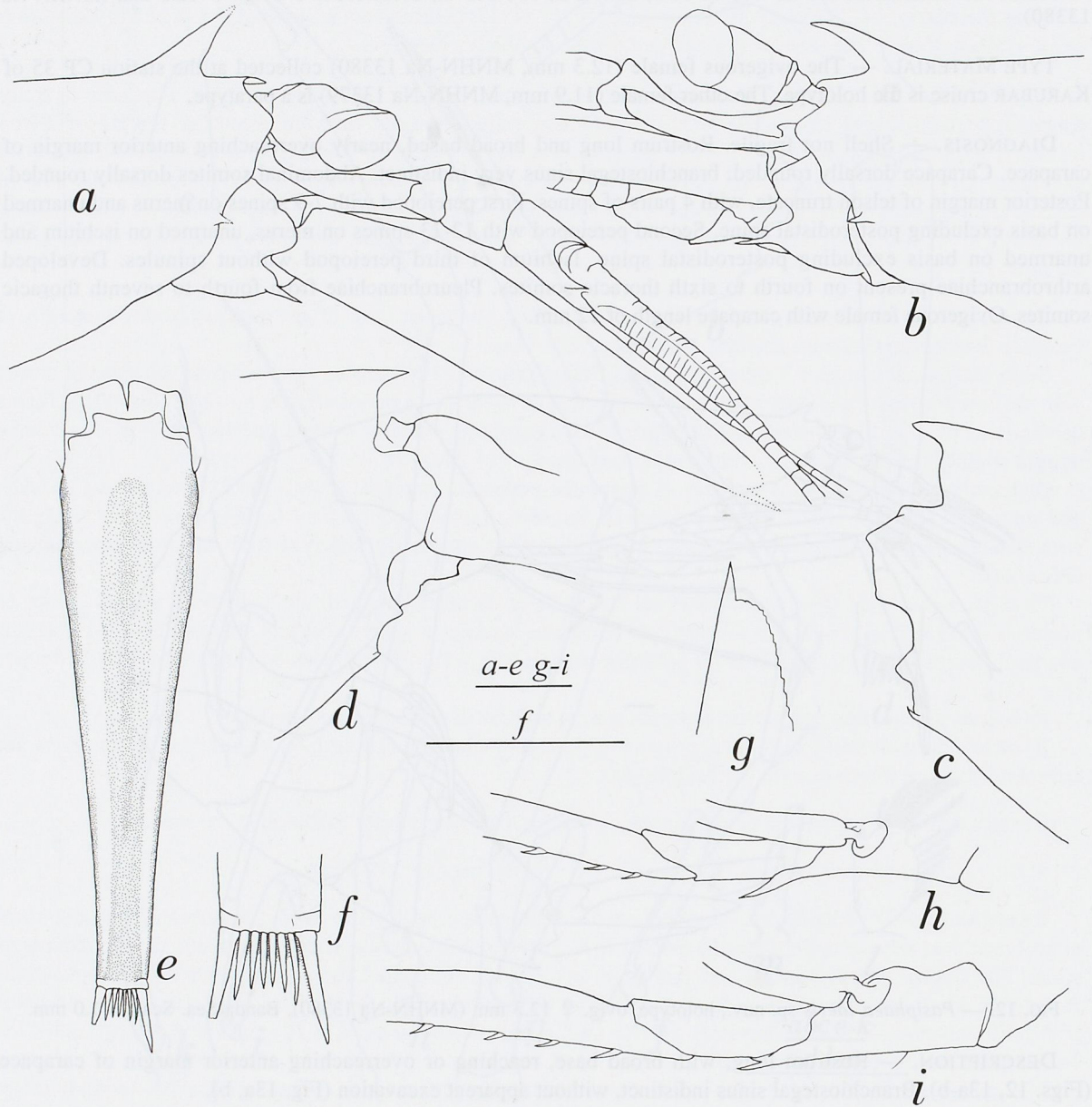


FIG. 13. — *Pasiphaea laevis* sp. nov.: a, c, e-f, holotype, ovig. ♀ 12.3 mm (MNHN-Na 13380), Banda Sea; b, d, g-i, paratype, ♀ 11.9 mm (MNHN-Na 13379), Indonesia.

a-b, anterior part of body in lateral view; c-d, distal end of sixth abdominal somite in lateral view; e, telson in dorsal view; f, distal end of telson; g, distal apex of antennal scale; h, basal part of first pereiopod; i, basal part of second pereiopod. Scales = 1 mm.



FIG. 14. — *Pasiphaea laevis* sp. nov., paratype, ♀ 11.9 mm (MNHN-Na 13379), Indonesia.

a, mandible; **b**, maxillula; **c**, maxilla; **d**, first maxilliped; **e**, second maxilliped; **f**, third maxilliped; **g**, first pereiopod; **h**, chela of first pereiopod in inner view; **i**, second pereiopod; **j**, third pereiopod; **k**, fourth pereiopod; **l**, fifth pereiopod. Scale = 1 mm.

12 or 13 spines on posterior margin (Figs 13i, 14i). No spinules on ischium of third pereiopod (Fig. 14j). Fourth and fifth pereiopods same as other member of the *P. sivado* species group (Fig. 14k, l).

Four pleurobranchiae and three arthrobranchiae on one side of the branchial chamber. Branchial formula same as *P. marisrubri* and *P. fragilis* sp. nov. described above.

ETYMOLOGY. — The specific name, *laevis*, refers to the smooth ventral margin of carapace.

SIZE. — The ovigerous female, holotype, is 12.3 mm CL, the non-ovigerous female, 11.9 mm. Eggs are numerous in number, 0.8-0.9 x 1.2-1.3 mm in size.

REMARKS. — *P. laevis* sp. nov. has the same branchial formula as *P. marisrubri* and the preceding new species *P. fragilis*, but is distinguished from those species by the long rostrum and no branchiostegal sinus on the carapace.

The present new species shows the same meristic value of the spination of the first two pereiopods as *P. fragilis* sp. nov. and *P. gracilis* sp. nov. However, in latter two new species the branchiostegal sinus is more or less defined. Moreover, the shell is distinctly fragile in *P. fragilis* and the rostrum and antennal scale is comparatively shorter in *P. gracilis*.

DISTRIBUTION. — The holotype was collected near Kai Islands, Indonesia, at a depth of 390-502 m, and the paratype was from Makassar Strait, at a depth of 595 m.

Pasiphaea gracilis sp. nov.

Figs 15-17

? *Pasiphaea* sp. β - DE MAN, 1920: 11, pl. 1, fig. 4-4g, pl. 2, fig. 4h-4p.

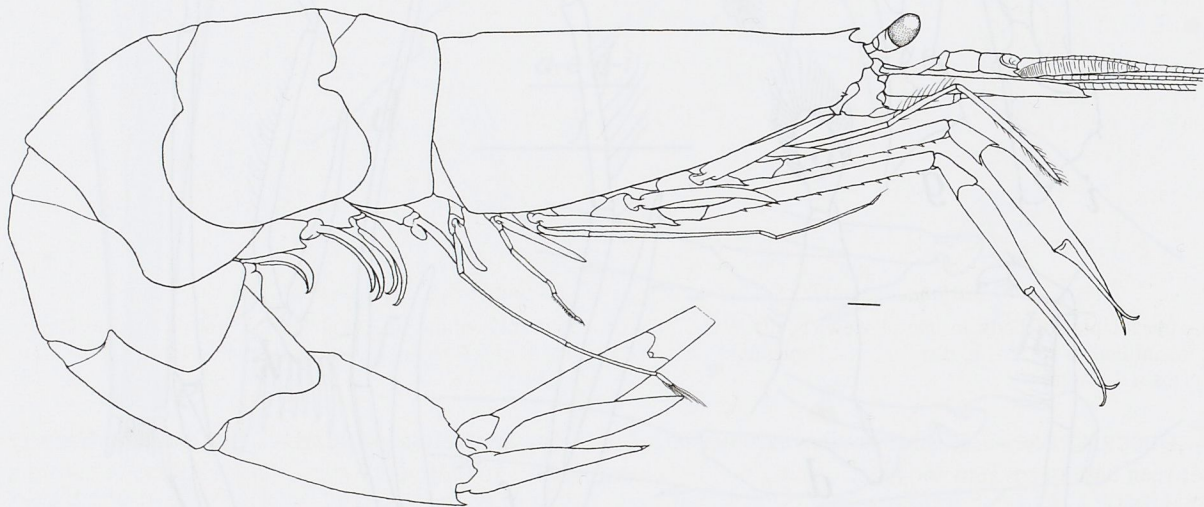


FIG. 15. — *Pasiphaea gracilis* sp. nov., holotype, ♂ 12.3 mm (MNHN-Na 13382), New Caledonia. Scale = 1 mm.

MATERIAL EXAMINED. — **Chesterfield Islands.** MUSORSTOM 5: stn DW 313, 22°24.31'S, 159°32.53'E, 780-930 m, 13.10.1986: 1 ♀ 12.0 mm (MNHN-Na 13381).

New Caledonia. BIOCAL: stn CP 31, 23°08'S, 166°51'E, 850 m, 29.08.1985: 1 ♂ 12.3 mm (MNHN-Na 13382), 1 ♀ 14.0 mm (MNHN-Na 13383).

Wallis and Futuna Islands. MUSORSTOM 7: stn DW 620, 12°34'S, 178°11'W, 1280 m, 28.05.1992: 1 ♂ 6.3 mm (MNHN-Na 13384). — Stn CP 627, 11°54'S, 179°31'W, 597-600 m, 29.05.1992: 3 ♂ 8.6-10.0 mm, 1 ♀ 9.1 mm (MNHN-Na 13385). — Stn CP 628, 11°53'S, 179°32'W, 625-650 m, 29.05.1992: 4 ♂ 9.6-11.8 mm, 5 ♀ 10.0-11.1 mm (MNHN-Na 13386).

Indonesia. "Siboga": stn 105, off Sulu Islands, 6°8'N, 121°19'E, 275 m, 4.07.1899: 1 juv. 5.8 mm (ZMA).

TYPE MATERIAL. — The male (12.3 mm, MNHN-Na 13382) collected at the station CP 31 of BIOCAL cruise is the holotype. All the other specimens, except the "Siboga" one, are paratypes.

DIAGNOSIS. — Shell not fragile. Rostrum small, not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus developed. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereiopod with 7-9 spines on merus, unarmed on basis excluding posterodistal spine. Second pereiopod with 11-13 spines on merus, usually unarmed on ischium and unarmed on basis excluding posterodistal spine. Ischium of third pereiopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae on fourth to seventh thoracic somites. Females 12-14 mm.

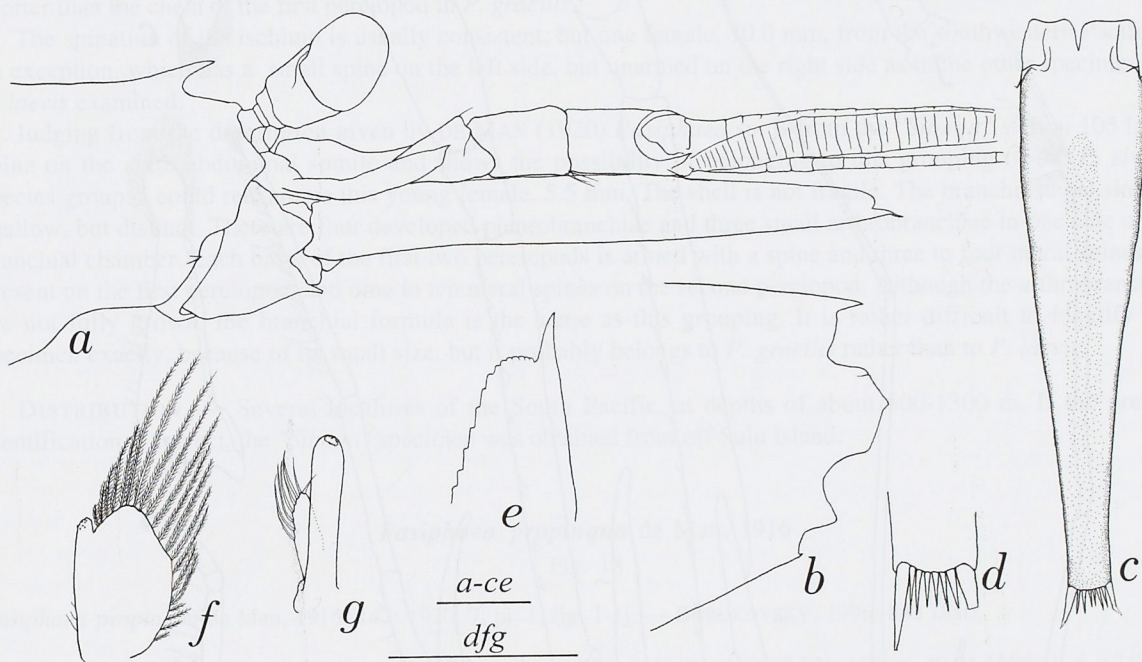


FIG. 16. — *Pasiphaea gracilis* sp. nov., holotype, ♂ 12.3 mm (MNHN-Na 13382), New Caledonia.

a, anterior part of body in lateral view; **b**, distal end of sixth abdominal somite in lateral view; **c**, telson in dorsal view; **d**, distal end of telson; **e**, distal apex of antennal scale; **f**, endopod of first pleopod; **g**, appendices interna and masculina. Scales = 1.0 mm.

DESCRIPTION. — Rostrum rather variable in length, comparatively short, usually just reaching halfway between base of rostrum and anterior margin of carapace (Figs 15, 16a). Branchiostegal sinus shallow, but distinct (Fig. 16a).

Sixth abdominal somite 1.7 times as long as fifth somite and 1.8 times as long as deep; ventrodistal corner with shallow convexity, with small pointed process (Fig. 16b). Telson 0.7 times as long as sixth somite, with shallow groove dorsally without interruption; distal margin truncate with probably four pairs of spines (Fig. 16c); outer pair longest, without small seta on base (Fig. 16d).

Stylocerite shorter than first segment of antennular peduncle. Antennal scale 3.8-4.2 times as long as wide, and shorter (0.85-0.95) than chela of first pereiopod; outerdistal spine slightly curved outward, overreaching lamella (Fig. 16e). Mouth-parts not apparently different from those of other species (Fig. 17a-f).

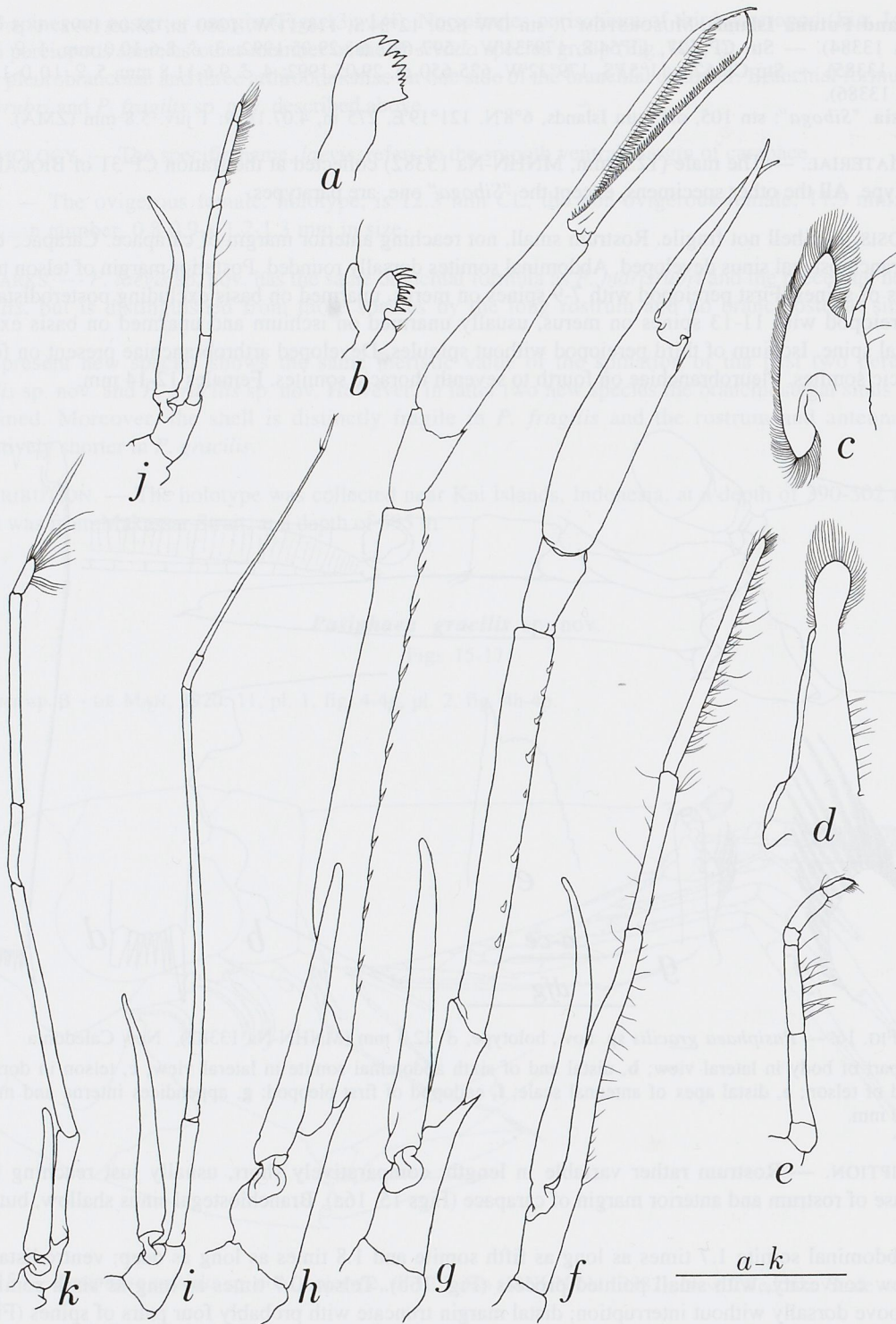


FIG. 17. — *Pasiphaea gracilis* sp. nov., paratype, ♂ 11.3 mm (MNHN-Na 13386), South Pacific Ocean near Wallis Island. **a**, mandible; **b**, maxillula; **c**, maxilla; **d**, first maxilliped; **e**, second maxilliped; **f**, third maxilliped; **g**, first pereiopod; **h**, second pereiopod; **i**, third pereiopod; **j**, fourth pereiopod; **k**, fifth pereiopod. Scale = 1 mm.

First pereopod with spine at posterodistal end of basis; ischium unarmed; merus with four to ten spines on posterior margin (Fig. 17g). Basis of second pereopod ending in spine, posterior margin unarmed; ischium usually unarmed; merus with 9 to 14 spines on posterior margin (Fig. 17h). No spinules on ischium of third pereopod (Fig. 17i). Fourth and fifth pereopods of typical shape for the genus (Fig. 17j-k).

Endopods of male first and second pleopods similar to those of preceding species (Fig. 16f, g).

Branchial formula same as preceding species. Arthrobranchiae present on fourth to sixth somites, no pleurobranchia on eighth thoracic somite (Fig. 9e).

ETYMOLOGY. — The specific name, *gracilis*, refers to the slender shape of the species.

SIZE. — The type series is composed of nine males, 8.6-13.6 mm and eight non-ovigerous females, 9.1-14.0 mm.

REMARKS. — *P. gracilis* sp. nov. resembles the preceding new species, *P. laevis*, in having the same spination of the first two pereopods, and the shell not fragile but the branchial sinus is distinct and the antennal scale is shorter than the chela of the first pereopod in *P. gracilis*.

The spination of the ischium is usually consistent, but one female, 10.0 mm, from the southwestern Pacific is an exception, which has a small spine on the left side, but unarmed on the right side as in the other specimens of *P. laevis* examined.

Judging from the description given by DE MAN (1920) *Pasiphaea* sp. β from the "Siboga" station 105 has a spine on the sixth abdominal somite and shows the possibility of belonging to this grouping of the *P. sivado* species group. I could reexamine this young female, 5.5 mm. The shell is not fragile. The branchiostegal sinus is shallow, but distinct. There are four developed pleurobranchiae and three small arthrobranchiae in one side of the branchial chamber. Each basis of the first two pereopods is armed with a spine and three to four meral spines are present on the first pereopod, and nine to ten meral spines on the second pereopod. Although the arthrobranchiae are not fully grown, the branchial formula is the same as this grouping. It is rather difficult to identify this specimen exactly, because of its small size, but it probably belongs to *P. gracilis* rather than to *P. laevis*.

DISTRIBUTION. — Several localities of the South Pacific, at depths of about 600-1300 m. If the present identification is correct, the "Siboga" specimen was obtained from off Sulu Island.

Pasiphaea propinqua de Man, 1916

Fig. 18

Pasiphaea propinqua de Man, 1916: 147; 1920: 7, pl. 1, fig. 1-1j. — BURUKOVSKY, 1996: 843 (list).

MATERIAL EXAMINED. — **Indonesia.** "Siboga": stn 100, 06°11'N, 120°37.5'E, 450 m, 29.06.1899: 1 ♂ 17.0 mm (holotype, ZMA 102505).

Philippines. MUSORSTOM 2: stn CP 38, 12°53.5'N, 122°26.6'E, 1650 m, 25.11.1980: 1 ♀ 12.8 mm (MNHN-Na 13387).

TYPE-MATERIAL. — The male (17.0 mm, ZMA 102505) collected at the station 100 of the "Siboga" Expedition, is the holotype.

DIAGNOSIS. — Shell not fragile. Rostrum long, probably reaching anterior margin of carapace. Carapace dorsally carinated on anterior 1/3, rounded posteriorly; branchiostegal sinus obscure. First to fifth abdominal somites dorsally rounded, sixth somite sharply carinated dorsally. Posterior margin of telson convex, with 4 pairs of spines. First pereopod with 10-12 spines on merus and unarmed on basis excluding posterodistal spine. Second pereopod with 16-18 spines on merus, and unarmed on ischium, and unarmed on basis excluding posterodistal spine. Ischium of third pereopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae from fourth to eighth thoracic somites, that on eighth somite rudimentary. Holotype male 17 mm, and additional female 12.8 mm.

DESCRIPTION. — Rostrum probably not short, reaching more than halfway between base of rostrum and anterior margin of carapace (Fig. 18a). Branchiostegal sinus indistinct (Fig. 18a).

Sixth abdominal somite 1.7 times as long as fifth somite and 1.9 times as long as deep; ventrodistal corner with shallow convexity, and with a small pointed process (Fig. 18b). Telson 0.6 times as long as sixth somite, deeply grooved dorsally with clear longitudinal ridges lateral to groove (Fig. 18c); a rather high process proximal

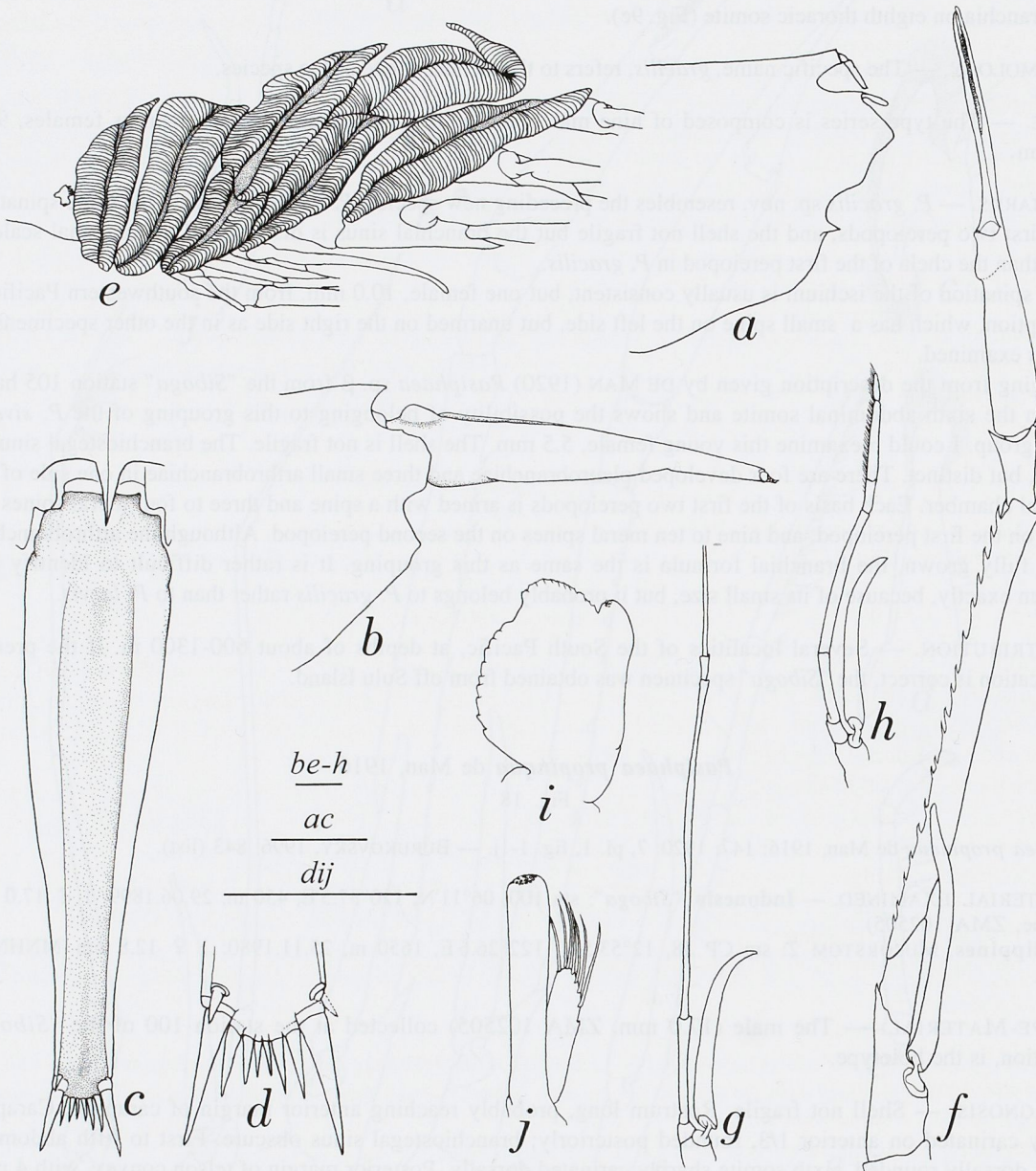


FIG. 18. — *Pasiphaea propinqua* de Man, 1916: **a, c-d**, ♀ 12.8 mm (MNHN-Na 13387), the Philippines; **b, e-j**, holotype, ♂ 17.0 mm (ZMA 102505), Sulu Sea.

a, anterior part of carapace in lateral view; **b**, distal end of sixth abdominal somite in lateral view; **c**, telson in dorsal view; **d**, distal end of telson; **e**, branchial chamber; **f**, second pereiopod; **g**, third pereiopod; **h**, fourth pereiopod; **i**, endopod of first pleopod; **j**, appendices interna and masculina. Scales = 1 mm.

to base of groove (Fig. 18b); distal margin convex with four pairs of spines like other species of the *P. sivado* species group, but with a pair of large additional seta near base of outer spines (Fig. 18d).

Stylocerite falling short of end of first segment of antennular peduncle. Antennal scale 3.6 times as long as wide, and 1.2 times as long as chela of first pereopod. Mouth-parts not apparently different from those of other species.

First pereopod with spine at posterodistal end of basis; ischium unarmed; merus with 12 to 14 spines on posterior margin. Basis of second pereopod ending in spine, posterior margin unarmed; ischium unarmed; merus with 16 to 18 spines on posterior margin (Fig. 18f). Third to Fifth pereopods similar to those of other species (Fig. 18g-h). No spinules on ischium of third pereopod (Fig. 18g).

Endopod of first pleopod of holotype composed of three lobes, though entirely without setae; mesial lobe small, with a very few retinaculæ in central part (Fig. 18i). Endopod of second pleopod of holotype similar to preceding species; appendix masculina with some, probably less than ten, long setae (Fig. 18j).

Distribution of branchiae, epipods, and exopods as follows:

Thoracic Somite	I (Mxp1)	II (Mxp2)	III (Mxp3)	IV (P1)	V (P2)	VI (P3)	VII (P4)	VIII (P5)
Pleurobranchiae	-	-	-	1	1	1	1	r
Arthrobranchiae	-	-	-	1	1	1	-	-
Podobranchiae	-	-	-	-	-	-	-	-
Epipods	-	-	-	-	-	-	-	-
Exopods	-	-	1	1	1	1	1	1

Eighth thoracic somite with pleurobranchia, but always rudimentary, only a very small piece, with a few short papilla-like lamellae (Fig. 18e).

SIZE. — The male holotype is 17.0 mm CL, the present additional female, 12.8 mm.

REMARKS. — The present species was based on a single male type, described in detail (DE MAN, 1920), which was fortunately reexamined. The branchial formula and the spination of the sixth abdominal somite are the same as in *P. sivado*, having a rudimentary pleurobranchia on the eighth thoracic somite, and a well-developed spine on the posterior end of the dorsal margin of the sixth somite (Fig. 18b).

As mentioned by DE MAN (1920), *P. propinqua* has the carapace anteriorly carinated, the sixth abdominal somite entirely carinated, and the telson with convex end. Moreover there is a well developed process at the beginning of the dorsal groove of the telson. The groove is deeper and is better defined than that of other species by distinct longitudinal ridges on both sides. These characters apparently separate *P. propinqua* from all other members of the *P. sivado* species group. The present female specimen from the Philippines agrees well with the holotype in these unique characters.

The rostrum is mostly missing in the holotype. In the additional specimen it is also broken, but some distal parts remain attached to the rostrum base, which shows that it is probably not short, but long, extending nearly to the anterior margin of carapace. The branchiostegal spine is almost marginal (Fig. 18a), at least the dorsal margin of the spine is apparently continuous with the anterior margin of the carapace in both specimens examined.

In the holotype, the meri of the second pereopods are armed with 16 spines on the right side and 18 spines on the left side, with 17 spines on both sides in the additional material. The ischium and the basis are unarmed on both sides, except for the posterodistal spine on the basis in both specimens.

The pleopods of the holotype have retained their shape, though they are now mostly without setae, and they do not differ from those of the other species of the *P. sivado* species group.

DISTRIBUTION. — Sulu Sea, at depth of 450 m (type locality). The subsequent specimen was found in one haul from Philippine waters at a depth of 1650 m. This haul contained two pasiphaeids, both however were thought to have been entangled in the net during the rising of the net (CROSNIER personal communication).

Pasiphaea sivado (Risso, 1816)

Fig. 19

Restricted synonymy

Alpheus sivado Risso, 1816: 93, pl. 3, fig. 4.*Pasiphaea savignyi* H. Milne Edwards, 1837: 426.*Pasiphaea brevisrostris* H. Milne Edwards, 1837: 426.*Pasiphaea sivado* - H. MILNE EDWARDS, 1837: 426. — BELL, 1853: 312, with fig. — HELLER, 1863: 243, pl. 8, figs 4-6.

— KEMP, 1910: pl. 4, fig. 12. — PESTA, 1914: figs 22-23; 1918: 64, figs 19-20. — ZARIQUIEY ALVAREZ, 1957: 4, figs

1-4, pls 1-3; 1968: 70, fig. 30. — SMALDON, 1979: 26, fig. 6. — SIVERTSEN & HOLTHUIS, 1956: 29. — OMORI, 1976:

254, figs 3-5. — BURUKOVSKY & ROMENSKY, 1987: 58 (list). — IWASAKI, 1989: 199. — HOLTHUIS, 1993: 28, fig. 9.

— BURUKOVSKY, 1996: 843 (list).

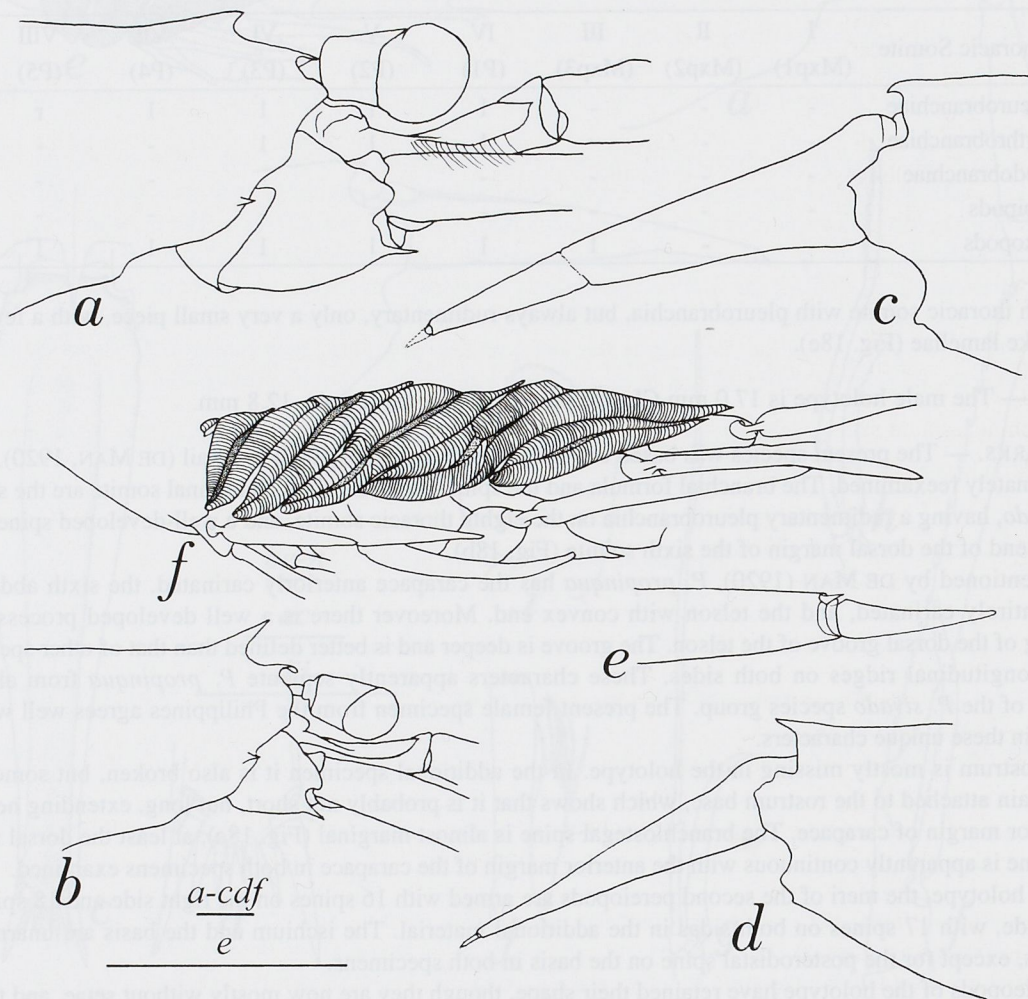
Pasiphaea Sivado - DE MAN, 1920, pl. 1, figs 2, 2a.

FIG. 19. — *Pasiphaea sivado* (Risso, 1816): **a, c**, ♂ 23.9 mm (MNHN-Na 13389, part); **b, d**, ♂ 14.4 mm (MNHN-Na 13389, part); **e**, ovig. ♀ 18.6 mm (MNHN-Na 13388, part); **f**, ♀ 14.3 mm (MNHN-Na 1834, part). a-d, from West Mediterranean Sea; e-f, from Ibero-Moroccan Gulf.

a-b, anterior part of body in lateral view; **c-d**, distal part of sixth abdominal somite and telson in lateral view; **e**, distal part of telson in lateral view; **f**, branchial chamber. Scales = 1 mm.

MATERIAL EXAMINED. — **Ibero-Moroccan Gulf.** "*Talisman*", 36°36'N, 07°26'W, Dredge, 440 m, 25.08.1883: 3 ♂ 13.6-18.6 mm; 9 ♀ 13.2-17.2 mm (MNHN-Na 1834).

BALGIM: stn CP 89, 34°20'N, 07°18'W, 719-724 m, 7.06.1984: 1 ♂ 22.4 mm; 3 ovig. ♀ 17.9-19.4 mm (MNHN-Na 13388).

Mediterranean Sea. Alboran Sea. BALGIM: stn CP 119, 35°50'N, 05°13'W, 483-551 m, 13.06.1984: 2 ♂ 14.4, 23.9 mm; 7 ♀ 10.9-14.3 mm (MNHN-Na 13389).

DIAGNOSIS. — Shell not fragile. Rostrum not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus shallow. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereopod with 2-7, usually 4-5 spines on merus and unarmed on basis excluding posterodistal spine. Second pereopod with 9-13, usually 9-11, spines on merus, unarmed on ischium, and unarmed on basis excluding posterodistal spine. Ischium of third pereopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae on fourth to eighth thoracic somites, that on eighth somite rudimentary. Ovigerous females 18-20 mm.

DESCRIPTION. — Rostrum rather high, variable in length, usually reaching halfway between base of rostrum and anterior margin of carapace. Branchiostegal sinus shallow, but quite distinct (Fig. 19a-b).

Sixth abdominal somite compressed but not carinated dorsally, 1.5-1.9 times as long as fifth somite and 1.7-2.0 times as long as deep; ventrodistal corner slightly convex, ending in minute spine (Fig. 19c-d). Telson 0.7-0.8 times as long as sixth somite, with shallow and broad groove dorsally; distal margin truncated with four pairs of spines, outer pair longest, with small spine-like seta at base (Fig. 19e).

Stylocerite almost reaching first segment of antennular peduncle (Fig. 19a-b). Antennal scale 3.6-4.1 times as long as wide, and slightly shorter than chela of first pereopod. Mouth-parts showing typical shape of group.

First pereopod with large spine at posterodistal end of basis; ischium unarmed; merus with two to seven spines on posterior margin; palm 1.1-1.4 times as long as finger. Basis of second pereopod ending in large spine; ischium unarmed; merus with 9 to 13 spines on posterior margin.

Endopod of male first pleopod composed of two lobes like other species mentioned above. Endopod of male second pleopod of typical shape of group; appendix masculina with many long setae.

Branchial formula same as *P. propinqua*. Fifth pleurobranchia on eighth thoracic somite always rudimentary (Fig. 19f).

SIZE. — Local variation in size is present, but the maximum overall size is 100 mm, usually not more than 80 mm (SMALDON, 1979). The males examined are 13.6-23.9 mm CL, the ovigerous females are 17.9-19.4 mm CL, and non-ovigerous females are 13.2-17.2 mm. Eggs are large, 1.0 x 1.8 mm in size, and relatively few in number.

REMARKS. — *P. sivado* is the best known and the representative species of the genus as well as this species group, having a pleurobranchia on the eighth thoracic somite, though it is rudimentary even in the largest male and the ovigerous females examined, as first pointed out by KEMP (1910).

OMORI (1976) showed that the present species is distinguished from *P. japonica* Omori by the comparative length of the antennal scale and the spination of the meri of the first and second pereopods. The present Atlantic specimens of *P. sivado* have the antennal scale always shorter than the chela of the first pereopod (0.86-0.98), and fewer spines on the meri of the first and second pereopods (less than eight on the first, less than 14 on the second), while the Japanese specimens of *P. japonica* have the antennal scale usually longer than the chela of the first pereopod and more than eight spines on the merus of the first pereopod and more than 15 spines on the merus of the second pereopod.

As already shown by DE MAN (1920), an accessory seta is present on the base of the outer pair of spines on the telson end. It is as large as that of *P. marisrubri*, but may probably be more easy to detach in *P. sivado* (IWASAKI, 1989).

DISTRIBUTION. — This well known species is now restricted to the Atlantic Ocean from Norway southwards to the Morocco coast and the Mediterranean Sea (SMALDON, 1979).

Pasiphaea japonica Omori, 1976

Fig. 20

Pasiphaea sirado (sic) - BALSS, 1914: 20.*Pasiphaea sivado* - KIKUCHI, 1932: 2. — YOKOYA, 1933: 14. — KUBO, 1965: 605, with fig. — AIZAWA, 1974: 28. — KENSLEY, 1977: 32, fig. 10A. Not Risso, 1816.*Pasiphaea japonica* Omori, 1976: 250, figs 1-8. — BURUKOVSKY & ROMENSKY, 1987: 58 (list). — BURUKOVSKY, 1993: 38, figs 2, 14-19; 1996: 843 (list).*Pasiphaea* aff. *sivado* - CROSNIER, 1976: 231. Not Risso, 1816.

MATERIAL EXAMINED. — **Madagascar.** "Vauban": Trawl 30, 12°40.0'S, 48°09.5'E, 595-605 m, 13.09.1972: 1 ovig. ♀ 18.3 mm; 3 ♀ 13.0-20.0 mm (MNHN-Na 13390). — Trawl 49, 15°18.3'S, 46°10.3'E, 500-550 m, 8.11.1972: 1 ♂ 13.8 mm (MNHN-Na 13391). — Trawl 59, 23°26.0'S, 43°29.6'E, 600-610 m, 27.02.1973: 1 ♂ 15.3 mm; 1 ovig. ♀ 15.3 mm; 1 ♀ 14.9 mm (MNHN-Na 13392). — Trawl 60, 23°36.5'S, 43°28.8'E, 710 m, 27.02.1973: 5 ovig. ♀ 15.0-21.0 mm; 2 ♀ 15.0, 16.6 mm (MNHN-Na 13393). — Trawl 65, 23°35.0'S, 43°28.6'E, 740-760 m, 29.02.1973: 2 ovig. ♀ 17.5 mm; 1 ♀ 16.7 mm (MNHN-Na 13394).

"FAO 60": stn Chalutage 73/60, 21°17'S, 43°23'E, 490-530 m, 6.06.1973: 1 ♂ 20.2 mm (MNHN-Na 13395). — Stn Chalutage 73/70, 15°18'S, 46°15'E, 600-650 m, 25.06.1973: 1 ♀ 15.6 mm (MNHN-Na 13396). — Stn Chalutage 73/94, 25°24'S, 46°58'E, 300 m, 12.08.1973: 1 ovig. ♀ 19.9 mm (MNHN-Na 13397). — Stn Chalutage, 22°15.7'S, 43°01.5'E, 750-810 m, 29.11.1973: 1 ♀ 18.0 mm (MNHN-Na 13398).

Réunion. Le Port, P. GUÉZÉ leg.: 1 ♀ 16.5 mm (MNHN-Na 6910).**South Africa.** "Meiring Naude": stn SM63, 27°10.5'S, 33°14.5'E, 140-0 m, 19.05.1976: 2 ♀ 10.0, 14.6 mm (SAM A15153). — Stn SM85, 27°59.5'S, 34°40.8'E, 550 m, Agassiz Trawl, 22.05.1976: 2 ♀ 12.4 mm (SAM A15152).**Indonesia.** KARUBAR: stn CP 09, 05°23'S, 132°29'E, 368-389 m, 23.10.1991: 1 ♂ 26.3 mm; 2 ♀ 22.1, 26.2 mm (MNHN-Na 13399).**Japan.** Toyama Bay, off Miwa, set net, July 1975, N. HORII leg.: 1 ovig. ♀ ca. 17 mm; 1 ♀ 16.2 mm (NFU Cat. No. 530-2-613).**East China Sea.** "Nansei Maru", 30.10.1976, Kagoshima Prefectural Fisheries Experimental Station leg.: 2 ♂ 14.4, 15.0 mm; 3 ovig. ♀ 14.0-16.0 mm; 7 ♀ 13.8-16.7 mm (NFU Cat. No. 530-2-1352).

DIAGNOSIS. — Shell moderately firm. Rostrum short, not reaching anterior margin of carapace. Carapace dorsally rounded; branchiostegal sinus shallow. Abdominal somites dorsally rounded. Posterior margin of telson truncate, with 4 pairs of spines. First pereopod with 5-12 spines on merus and unarmed on basis excluding posterodistal spine. Second pereopod with 14-23 spines on merus, unarmed on ischium, and unarmed on basis excluding posterodistal spine. Ischium of third pereopod without spinules. Developed arthrobranchiae present on fourth to sixth thoracic somites. Pleurobranchiae on fourth to eighth thoracic somites, that on eighth somite rudimentary. Ovigerous females 15-22 mm.

DESCRIPTION. — Rostrum small, reaching halfway between base of rostrum and anterior margin of carapace. Branchiostegal sinus shallow (Fig. 20a).

Sixth abdominal somite compressed but not carinated dorsally, 1.4-1.9 times as long as fifth somite and 1.7-2.1 times as long as deep; ventrodistal corner uniformly convex, ending usually in minute spine (Fig. 20b). Telson 0.6-0.7 times as long as sixth somite; dorsal groove very shallow at proximal half and prominent in distal part; distal margin truncated with four pairs of spines, outer pair longest, with small seta on base (Fig. 20c).

Stylocerite reaching nearly to first segment of antennular peduncle (Fig. 20a). Antennal scale 3.5-4.5 times as long as wide, and 1.1 times as long as finger of first pereopod. Mouth-parts showing typical shape of genus.

First pereopod with large spine at posterodistal end of basis; ischium unarmed (Fig. 20e); merus with 5 to 12 spines on posterior margin; palm 1.1 times as long as finger. Basis of second pereopod ending in large spine; ischium unarmed (Fig. 20f); merus with 14 to 23 spines on posterior margin.

Endopods of male first and second pleopods (Fig. 20g-h) similar to those of *P. sivado*.

Branchial formula same as in *P. sivado* and *P. propinqua*. Eighth thoracic somite with a rudimentary pleurobranchia only (Fig. 20d).

SIZE. — The males are 13.8-26.3 mm CL and the ovigerous females, 15.3-26.2 mm. Eggs are large, 1.0 x 1.6 mm in size, and relatively few in number.

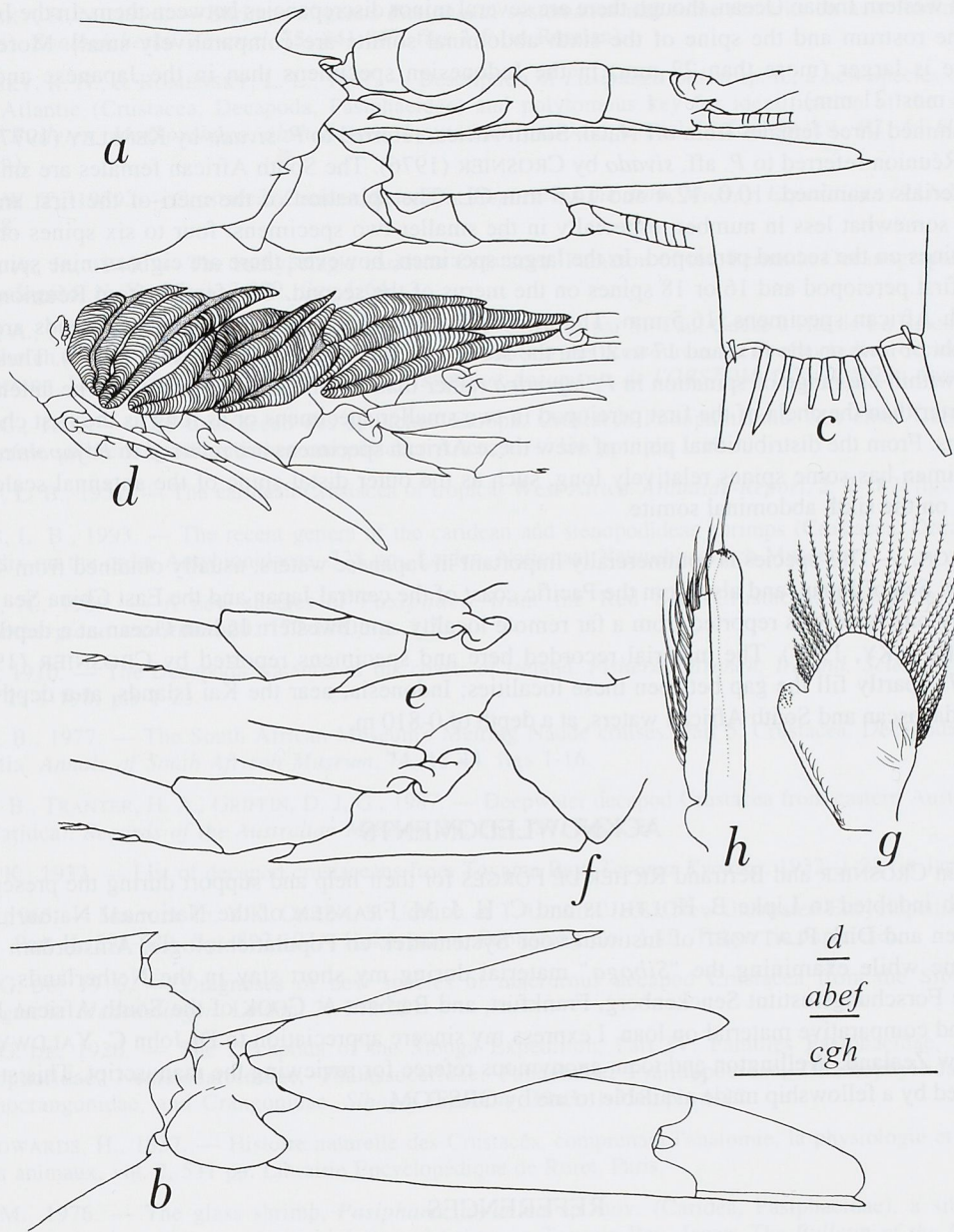


FIG. 20. — *Pasiphaea japonica* Omori, 1976: **a-b**, ♀ 22.1 mm (MNHN-Na 13399, part); **c, g-h**, ♂ 26.3 mm (MNHN-Na 13399, part); **d**, ovig. ♀ 21.0 mm (MNHN-Na 13393, part); **e-f**, ♀ 26.2 mm (MNHN-Na 13399, part). All from Indonesia, except **d** which is from Madagascar.

a, anterior part of body in lateral view; **b**, distal part of abdomen in lateral view; **c**, distal end of telson; **d**, branchial chamber; **e**, basal part of first pereiopod; **f**, basal part of second pereiopod; **g**, endopod of first pleopod; **h**, appendices interna and masculina. Scales = 1 mm.

REMARKS. — From the branchial formula the present species belongs to the *P. sivado* and *P. propinqua* groupings. From *P. propinqua* it clearly differs in having the dorsal surface of the sixth abdominal somite smooth. OMORI (1976) has already recorded the differences between *P. sivado* and the Japanese specimens of *P. japonica*. I could not find any distinctive differences between the Japanese specimens and the present additional material from

Indonesia and western Indian Ocean, though there are several minor discrepancies between them. In the Indonesian specimens, the rostrum and the spine of the sixth abdominal somite are comparatively small. Moreover, the specimen size is larger (more than 22 mm) in the Indonesian specimens than in the Japanese and African specimens (at most 21 mm).

I have examined three females from off Natal, South Africa, referred to *P. sivado* by KENSLEY (1977) and one female from Réunion referred to *P. aff. sivado* by CROSNIER (1976). The South African females are smaller than the other materials examined, 10.0, 12.4 and 14.6 mm CL. The spination of the meri of the first and second pereopods is somewhat less in number, especially in the smaller two specimens: four to six spines on the first and 8 to 12 spines on the second pereopod. In the larger specimen, however, there are eight or nine spines on the merus of the first pereopod and 16 or 18 spines on the merus of the second. One female from Réunion is larger than the South African specimens, 16.5 mm. The meral spines on the first and second pereopods are slightly numerous, eight or nine on the first and 17 to 20 on the second, as mentioned by CROSNIER (1976). These values, however, fall within the range of spination in *P. japonica* rather than within that of *P. sivado*. The antennal scale is slightly shorter than the chela of the first pereopod in two smaller specimens or as long as the first chela in the large specimens. From the distributional point of view these African specimens are referred to *P. japonica*, though the large specimen has some spines relatively long, such as the outer distal spine of the antennal scale and the terminal spine on the sixth abdominal somite.

DISTRIBUTION. — This species is commercially important in Japanese waters, usually obtained from 40-120 m in Toyama Bay, Sea of Japan, and also from the Pacific coast of the central Japan and the East China Sea (OMORI, 1976). Recently one male was reported from a far remote locality, southwestern Indian Ocean at a depth of 430-350 m (BURUKOVSKY, 1993). The material recorded here and specimens reported by CROSNIER (1976) and KENSLEY (1977) partly fill the gap between these localities; Indonesia, near the Kai Islands, at a depth of 368-389 m and Madagascan and South African waters, at a depth of 0-810 m.

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