

A review of species of the genera *Spongicola* de Haan, 1844 and *Paraspongicola* de Saint Laurent & Cleva, 1981 (Crustacea, Decapoda, Stenopodidea, Spongicolidae)

Tomomi SAITO

Port of Nagoya Public Aquarium,
1-3 Minato-machi, Minato-ku, Nagoya 455-0033 (Japan)
t-saito@nagoyaminato.or.jp

Tomoyuki KOMAI

Natural History Museum and Institute, Chiba,
955-2 Aoba-cho, Chuo-ku, Chiba 260-8682 (Japan)
komai@chiba-muse.or.jp

Saito T. & Komai T. 2008. — A review of species of the genera *Spongicola* de Haan, 1844 and *Paraspongicola* de Saint Laurent & Cleva, 1981 (Crustacea, Decapoda, Stenopodidea, Spongicolidae). *Zoosystema* 30 (1): 87-147.

ABSTRACT

A review of species of the deep-sea sponge-associated shrimp genera *Spongicola* de Haan, 1844 and *Paraspongicola* de Saint Laurent & Cleva, 1981 (Decapoda, Stenopodidea) is presented on the basis of rich collections made by French expeditions in the Indo-West Pacific, supplemented by collections preserved in various institutions in the world. Seven species are recognized in *Spongicola*, of which three are new to science: *S. venustus* de Haan, 1844, *S. andamanicus* Alcock, 1901, *S. levigatus* Hayashi & Ogawa, 1987, *S. parvispinus* Zarenkov, 1990, *S. depressus* n. sp. from Loyalty Islands, *S. goyi* n. sp. from Japan, Indonesia, New Caledonia and Vanuatu, and *S. robustus* n. sp. from Mauritius and Mozambique. Subspecific division of *S. andamanicus* Alcock, 1901, proposed by de Saint Laurent & Cleva (1981), is abandoned, since our morphological analysis strongly suggests that the division does not reflect a population structure of the species; *S. holthuisi* de Saint Laurent & Cleva, 1981, is also reduced to a junior synonym of *S. andamanicus*. Two species are recognized in *Paraspongicola*, both previously described, viz. *P. pusillus* de Saint Laurent & Cleva, 1981 and *P. inflatus* (de Saint Laurent & Cleva, 1981) n. comb., of which the latter is here transferred from *Spongicola*. Keys in aid for identification are provided for each genus. Geographic and bathymetric distributions of species are briefly discussed. Association with host sponges was verified for some species.

KEY WORDS

Crustacea,
Decapoda,
Stenopodidea,
Spongicolidae,
Spongicola,
Paraspongicola,
new species.

RÉSUMÉ

Révision des espèces des genres *Spongicola* de Haan, 1844 et *Paraspongicola* de Saint Laurent & Cleva, 1981 (Crustacea, Decapoda, Stenopodidea, Spongicolidae).

Les espèces de crevettes d'eaux profondes des genres *Spongicola* de Haan, 1844 et *Paraspongicola* de Saint Laurent & Cleva, 1981 (Decapoda, Stenopodidea) associées à des éponges sont révisées d'après les riches collections provenant des campagnes françaises dans l'Indo-ouest Pacifique, ainsi que les collections de diverses institutions du monde. Sept espèces sont reconnues chez *Spongicola*, parmi lesquelles trois nouvelles pour la science : *S. venustus* de Haan, 1844, *S. andamanicus* Alcock, 1901, *S. levigatus* Hayashi & Ogawa, 1987, *S. parvispinus* Zarenkov, 1990, *S. depressus* n. sp. des îles Loyauté, *S. goyi* n. sp. du Japon, d'Indonésie, de Nouvelle-Calédonie et du Vanuatu, et *S. robustus* n. sp. de Maurice et du Mozambique. La séparation subsppécifique de *S. andamanicus* Alcock, 1901, proposée par de Saint Laurent & Cleva (1981), est abandonnée, en effet notre analyse morphologique suggère fortement que cette division ne reflète pas une structure populationnelle de l'espèce ; *S. holthuisi* de Saint Laurent & Cleva, 1981, est considéré comme synonyme plus récent de *S. andamanicus*. Deux espèces sont reconnues chez *Paraspongicola*, toutes deux déjà décrites, *P. pusillus* de Saint Laurent & Cleva, 1981 et *P. inflatus* (de Saint Laurent & Cleva, 1981) n. comb., cette dernière est ici transférée depuis *Spongicola*. Des clés d'identification sont présentées pour chaque genre. Les distributions géographiques et bathymétriques des espèces sont brièvement discutées. Les associations avec les éponges hôtes ont été vérifiées pour quelques espèces.

MOTS CLÉS

Crustacea,
Decapoda,
Stenopodidea,
Spongicolidae,
Spongicola,
Paraspongicola,
espèces nouvelles.

INTRODUCTION

Shrimps of the stenopodidean family Spongicolidae Schram, 1986 are primarily obligate symbionts of deep-water hexactinellid sponges, living in the atrium of hosts. The family contains six genera, *Globospongicola* Komai & Saito, 2006, *Microprosthemina* Stimpson, 1860, *Paraspongicola* de Saint Laurent & Cleva, 1981, *Spongicola* de Haan, 1844, *Spongicoloides* Hansen, 1908 and *Spongiocaris* Bruce & Baba, 1973. Only *Microprosthemina* comprises free living species in shallow coral reefs. The symbiotic spongicolid shrimps are generally characterized by a reduced armature of the body and appendages and by a rather depressed body form, representing a typical pattern of adaptation to a life in a confined space within the host animal (Bruce 1976). Furthermore, some of them show a trend toward reduction of the gills and exopods on maxillipeds (Holthuis 1946, 1993; Schram 1986; Saito & Takeda 2003;

Komai & Saito 2006). Spongicolids are distributed in warm temperate to tropical waters of the world. The genus *Spongicola*, the type genus of the family, was established by de Haan (1844) for a Japanese species, *S. venustus* de Haan, 1844. In spite of the ecological interests, the systematics of the family has been paid little attention. Many of the known species are represented only by a few, often damaged specimens, and perhaps this is one of the factors of the difficulty in making a correct identification. Saito & Takeda (2003) performed cladistic analysis of the shrimps belonging to the family Spongicolidae based on morphological characters. Their analysis suggests that most genera are not monophyletic, although they did not attempt to propose a new classification at generic level. They also noted that a comprehensive revisionary study is in urgent need.

Studies of rich collections of spongicolid shrimps made by various French expeditions led us to

review species and genera of the family. In this study, species of the two genera, *Spongiicola* and *Paraspongiicola*, are reviewed. The two genera are rediagnosed, and the previously described species are redescribed. *Spongiicola* is now represented by seven species, including three new species: *S. venustus*; *S. andamanicus* Alcock, 1901; *S. levigatus* Hayashi & Ogawa, 1987; *S. parvispinus* Zarenkov, 1990; *S. depressus* n. sp. (New Caledonia), *S. goyi* n. sp. (Japan, Indonesia, New Caledonia and Vanuatu), and *S. robustus* n. sp. (Mauritius and Mozambique). *Spongiicola japonicus* Kubo, 1942 and *S. cubanicus* Ortiz, Gómez & Lalana, 1994 are excluded from the genus, because the lack of an exopod on the third maxilliped sets them apart from *Spongiicola* and links to the genera *Spongiocoloides* or *Spongiocaris*. Saito & Takeda (2003) suggested the close phylogenetic relationship between these two species and the genera *Spongiocoloides* and *Spongiocaris* on the basis of two synapomorphies. They will be treated in a separate paper in progress. De Saint Laurent & Cleva (1981) recognized three subspecies in *S. andamanicus*, viz. *S. andamanicus andamanicus*, *S. andamanicus henshawi* Rathbun, 1906 and *S. andamanicus spinigerus* de Saint Laurent & Cleva, 1981. However, the subspecific division of *S. andamanicus* is not accepted in this study, because our morphological analysis strongly suggests that the subspecies recognized by de Saint Laurent & Cleva (1981) merely represent variants of a single species defined by combinations of intraspecifically variable characters, and therefore the subspecific division does not reflect the real population structure of *S. andamanicus*. *Spongiicola holthuisi* de Saint Laurent & Cleva, 1981 is also reduced to a junior subjective synonym of *S. andamanicus*. *Spongiicola inflatus* de Saint Laurent & Cleva, 1981, is transferred to *Paraspongiicola*, which is represented now by two species with the type species *P. pusillus* de Saint Laurent & Cleva, 1981.

For each species, differential description is given, accompanied by illustrations of selected parts providing diagnostic characters for species recognition. Intraspecific variations are assessed for species for which abundant material is available. Keys in an aid for the identification of species of the two genera are provided.

MATERIAL AND METHODS

The present study is based mainly on rich collections made by various French expeditions in the Philippines, Indonesia, New Caledonia, South Pacific islands and Madagascar, preserved in the Muséum national d'Histoire naturelle, Paris (MNHN). Specimens from other sources, including type materials, have been also examined during this study: Natural History Museum and Institute, Chiba (CBM); National Fisheries University, Shimonoseki (NFU); The Natural History Museum, London (NHM); National Science Museum, Tokyo (NSMT); Northern Territory Museum of Arts & Sciences, Darwin (NTM); Port of Nagoya Public Aquarium (PNPA); Nationaal Natuurhistorisch Museum, Leiden (RMNH); Seto Marine Biological Laboratory, Kyoto University (SMBL); Tokyo University of Marine Science and Technology (TUMT); National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM); University Museum, University of Tokyo (ZUMT).

Sex of specimens was determined primarily by identifying the position of the gonopores. In the "Material examined" section, postorbital carapace length is given. Abbreviations other than those for institutions are: juv., juvenile (sex undeterminable); ovig., ovigerous; spec., specimen; stn, station; CC, shrimp trawl; CP, beam trawl; DW, Warén dredge.

PRESENTATION AND TERMINOLOGY

Spongiolid species generally exhibit a certain degree of sexual dimorphism (e.g., Saito 2002; Komai & Saito 2006), and therefore it is advisable to compare diagnostic features between same sex. In this study, description of each species is primarily based on adult females in the case that specimens of both sexes are available, and short differential description is given for male in a separate "Male characteristics" section. The descriptive terminology is summarized in Figure 1. Two conditions are recognized in the development of the grooming apparatus on the third maxilliped and on the first pereopod: "well developed" indicates the presence of patches with numerous setae on the carpi and propodi, whereas

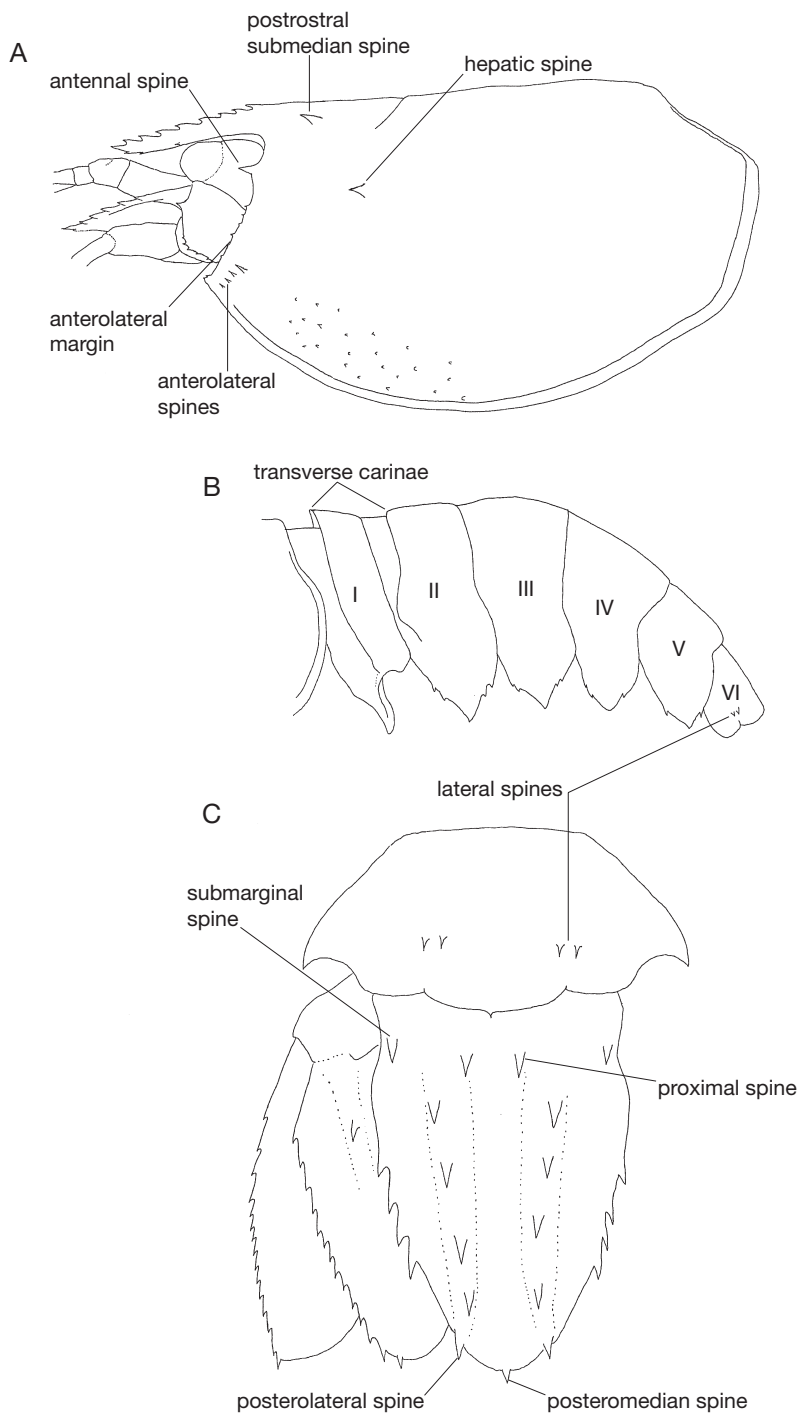


FIG. 1. — Terminology used in this study: **A**, carapace and cephalic appendages, lateral view; **B**, pleon, lateral view; **C**, sixth pleonal somite, telson and left uropod, dorsal view. I-VI, first to sixth somites.

“rudimentary” indicates that there are few, sparse setae. The mouthparts of the species treated in this study are generally similar, and therefore, those of the type species of *Spongicola*, *S. venustus*, are illustrated as representative (Fig. 2).

LIST OF SPECIES TREATED

- Genus *Spongicola* de Haan, 1844
Spongicola andamanicus Alcock, 1901
Spongicola depressus n. sp.
Spongicola goyi n. sp.
Spongicola levigatus Hayashi & Ogawa, 1987
Spongicola parvispinus Zarenkov, 1990
Spongicola robustus n. sp.
Spongicola venustus de Haan, 1844
 Genus *Paraspongicola* de Saint Laurent & Cleva, 1981
Paraspongicola inflatus (de Saint Laurent & Cleva, 1981) n. comb.
Paraspongicola pusillus de Saint Laurent & Cleva, 1981

SYSTEMATICS

Family SPONGICOLIDAE Schram, 1986

Genus *Spongicola* de Haan, 1844

Spongicola de Haan, 1844: pl. 46, fig. 9. — Bate 1888: 213. — Alcock 1901: 148. — A. Milne Edwards & Bouvier 1909: 264. — Holthuis 1946: 60; 1955: 147; 1993: 310. — Schram 1986: 284.

TYPE SPECIES. — *Spongicola venusta* [recte *venustus*] de Haan, 1844, by monotypy.

GENDER. — Masculine.

SPECIES INCLUDED. — The following seven species are recognized in the genus: *Spongicola andamanicus* Alcock, 1901; *S. depressus* n. sp.; *S. goyi* n. sp.; *S. levigatus* Hayashi & Ogawa, 1987; *S. parvispinus* Zarenkov, 1990; *S. robustus* n. sp. and *S. venustus* de Haan, 1844.

DISTRIBUTION. — All but one species of *Spongicola* are distributed in the Indo-West Pacific, at depths of 60-1060 m. Only *S. parvispinus* is known from the southeastern Pacific, at depths of 470-485 m.

DIAGNOSIS. — Rostrum short, usually dentate dorsally. Carapace usually with postrostral submedian spine on either side of midline; antennal spine small; lateral surface usually with oblique row or cluster of spines (anterolateral spines) anteroventrally; cervical groove present or absent. Sixth pleonal somite unarmed or armed

with lateral spine(s). Telson broadly triangular or lance shaped, with spinose dorsolateral carinae. Cornea well developed, globular, faceted, usually darkly pigmented; eyestalk armed with small spines. Second maxilliped with well developed exopod. Ischium of third maxilliped unarmed or armed with dorsolateral row of spines and ventral row of spines; exopod rudimentary or absent. First pereopod with well developed or rudimentary grooming apparatus. Second pereopod with all segments unarmed. Third pereopod largest; palm frequently with serrations on dorsal and ventral margins, sometimes with sharp dorsal carina. Dactyli of fourth and fifth pereopods usually biunguiculate; carpi and propodi sometimes subdivided. Lateral margins of uropodal exopod and endopod serrate; endopod often with 1 subproximal spine on middorsal carina.

GENERAL DESCRIPTION

Body stout; integument soft, surface naked. Rostrum short, directed forward, falling short of tip of antennal scale, narrow triangular in dorsal view; dorsal and ventral margins usually armed with small teeth; ventrolateral ridge distinct, confluent with orbital margin, occasionally with 1 or 2 tiny teeth. Carapace usually with postrostral submedian spine on either side of midline; antennal spine small, usually acuminate; hepatic spine(s) present or absent; orbital margin concave; pterygostomial angle produced anteriorly; anterolateral spines usually present, forming oblique row or cluster; cervical groove present or absent.

Thoracic sternum broadened posteriorly, with bi-lobed prominences on sixth to eighth somites; ventral surfaces of prominences concave.

Pleon smooth, somewhat depressed dorsoventrally, rounded dorsally. First somite short, divided in two sections, anterior section deeply depressed, overlapped by posterior part of carapace, overhung by prominent transverse carina; ventral margin of anterior section usually produced in blunt or acute projection (generally more acute in males than in females). Second somite sometimes with prominent transverse carina extending to pleuron. Third somite longest. Pleura of second to fifth somites rounded or bluntly pointed in females, acutely or subacutely pointed ventrally in males; pleural margins smooth in females, armed with tiny teeth or denticles in males. Sixth somite widened posteriorly, sometimes with small lateral spine(s) on dorsal surface and with tiny

median spine on posterior margin. Telson broadly triangular or lance shaped; dorsal surface usually with pair of spines near base (= proximal spines), dorsolateral carinae each bearing row of spines; lateral margins each with shallow subproximal concavity, and armed with 1 submarginal spine near base and row of spines thereafter; posterior half of lateral margin fringed with plumose setae; posterolateral angle usually with 1 spine (posterolateral spine); posterior margin rounded, usually with 1 median spine (posteromedian spine).

Cornea well developed, globular, usually darkly pigmented, distinctly faceted; eyestalk armed with small spines on dorsal and mesial faces. Antennular peduncle overreaching rostrum but not reaching distal margin of antennal scale; first segment longest, 2-3 times length of second segment, stylocerite short; second segment longer than third; third segment nearly as long as wide, unarmed. Antennal basicerite stout, with small spine at distolateral angle and additional smaller spines on ventrolateral margin; dorsomesial surface with 1 small laminate process; antennal scale subsemicircular, lateral margin slightly concave, serrate, mesial margin fringed with plumose setae; dorsal surface with longitudinal carinae; carpocerite short, not reaching midlength of antennal scale.

Mandible (Fig. 2A, B) with palp consisting of 3 articles, distal article tapering distally, outer margin convex; molar and incisor processes clearly separated; mesial margin of incisor process bidentate, bordered by thin corneous edge. Maxillule (Fig. 2C) with simple, slender endopod tapering distally; coxal endite suboval, with submarginal row of stiff setae on outer surface; basal endite moderately broad, truncate distally, with several slender spines. Maxilla (Fig. 2D) with curved, slender endopod; coxal and basal endites both deeply bilobed, all lobes subequal in length; scaphognathite well developed, posterior lobe slightly elongate, subtruncate terminal margin with very long setae exceeding length of scaphognathite. First maxilliped (Fig. 2E) with broad endopod consisting of 2 or 3 articles; coxal endite bilobed; basal endite large, subtriangular, with concave mesial margin; exopod well developed, flagellar; epipod large, distinctly bilobed. Second maxilliped (Fig. 2F) with endopod composed of 7 segments; coxa with small rounded tubercles

laterally; basis and ischium incompletely fused, trace of articulation still discernible (Fig. 2G); ischium very short; merus elongate, longer than distal three segments combined; carpus cup-shaped; propodus slightly broadened distally; dactylus large, subequal in length to propodus, with complicated pattern of setation; epipod slender, with well developed, distinctly lamellate podobranch; exopod well developed, flagellar. Third maxilliped with endopod composed of 7 segments; basis very short (Fig. 2H); ischium compressed, usually with dorsolateral and ventral rows of spines; merus somewhat twisted, sometimes with row of lateral spines; ventrodiscal angle of carpus not produced; propodus as long as carpus, with well developed grooming apparatus; dactylus tapering distally; epipod slender; exopod rudimentary (Fig. 2H).

First pereopod unarmed on each segment; grooming apparatus well developed or rudimentary; palm cylindrical; carpus longest. Second pereopod generally similar to first pereopod, but distinctly longer, lacking grooming apparatus. Third pereopod largest; fingers each terminating in curved claw; dactylus often serrated on dorsal margin, cutting edge consisting of chitinous ridge; palm subcylindrical; dorsal margin serrated, sometimes carinated; ventral margin also with serration extending onto fixed finger; carpus broadened distally, sometimes armed with lateral spines; merus sometimes with dorsal row of teeth, distalmost strong, lateral margin usually armed with 1 prominent distolateral spine; ischium usually armed with strong dorsodistal spine, and row of small teeth or denticles on dorsal and ventral margins.

Fourth pereopod moderately long and slender; dactylus compressed laterally, biunguiculate (ventral unguis shorter than dorsal unguis and clearly demarcated from corpus), sometimes triunguiculate in large specimens; propodus and carpus combined longer than merus and ischium combined; propodus sometimes subdivided, armed with single row of movable spines on ventral margin; carpus longest, sometimes subdivided, often with 1 small spine at ventrodiscal angle; ischium and merus obliquely articulated; ischium unarmed. Fifth pereopod similar to fourth.

Pleopods without appendices internae; first pleopod lacking endopod; second to fifth pleopods



FIG. 2. — *Spongicola venustus* de Haan, 1844, ♀ 6.8 mm, Ushibuka, western Kyushu, Japan (CBM-ZC 977), left mouth parts: **A**, mandible, outer view; **B**, same, mesial view (basal article of palp hidden); **C**, maxillule, outer view; inset, endopod, lateral view; **D**, maxilla, outer view; **E**, first maxilliped, outer view; **F**, second maxilliped, outer view; **G**, same, coxa, basis and ischium, inner view; **H**, coxa and basis of third maxilliped, lateral view (arrow indicates exopod).

TABLE 1. — Branchial formulae of the genera *Spongicola* de Haan, 1844 and *Paraspongicola* de Saint Laurent & Cleve, 1981. Abbreviation: r, rudimentary.

	Maxillipeds			Pereopods				
	I	II	III	I	II	III	IV	V
<i>Spongicola</i>								
Pleurobranchs	–	–	1	1	1	1	1	1
Arthrobranchs	1	1	2	2	2	2	2	–
Podobranch	–	1	–	–	–	–	–	–
Epipods	1	1	1	1	1	1	1	–
Exopods	1	1	r/–	–	–	–	–	–
<i>Paraspongicola</i>								
Pleurobranchs	–	–	1	1	1	1	1	1
Arthrobranchs	1	1	2	2	2	2	2	–
Podobranch	–	1	–	–	–	–	–	–
Epipods	1	1	1	1	1	1	1	–
Exopods	1	1	1	–	–	–	–	–

biramous. Uropod with protopod stout; both rami elongate oval in shape; exopod serrated on lateral margin, with smooth carinae on dorsal surface; endopod serrated on lateral margin often with 1 subproximal spine on middorsal carina.

Gills trichobranchiate, 19 pairs; branchial formula summarized in Table 1.

Eggs numerous and small, diameter 0.4–1.1 mm (Table 5).

SEXUAL DIMORPHISM

Species of *Spongicola* show noticeable sexual dimorphism in general body shape (more stout and more strongly depressed dorsoventrally in females than in males), strength of armature on the carapace, pleonal pleura and appendages (spines or teeth are larger in males than in females), lengths of the pereopods (longer in males than in females), shape and structure of the pleopods (much more compressed laterally and broader in females than in males), and width of the thoracic sternum (wider in matured females than in males). Spawning females

show terminal conditions of the above characters (Saito 2002).

REMARKS

Two species that have been assigned to *Spongicola*, *S. japonicus* Kubo, 1942 and *S. cubanicus* Ortiz, Gómez & Lalana, 1994, are not treated in this study, because the lack of an exopod on the third maxilliped set them apart from *Spongicola*. Furthermore, *S. japonicus* is characteristic in the lack of an exopod on the second maxilliped. In *Spongicola* and *Paraspongicola*, both exopods on the second and third maxilliped are well developed, flagellum-like. The lack of an exopod on the third maxilliped, which is considered to be apomorphic, links these two species to *Spongicoloides* and *Spongiocaris* (see Saito & Takeda 2003). The quadrangular shape of the telson, an apomorphic character, is also shared by these two species, *Spongicoloides* and *Spongiocaris* (Saito & Takeda 2003). Until full assessment of the systematic position of these two species will be made in a separate paper in progress, these two species are provisionally referred to *Spongicola*.

KEY TO THE SPECIES OF *SPONGICOLA* DE HAAN, 1844

1. Lateral margin of uropodal endopod unarmed *S. parvispinus*
- Lateral margin of uropodal endopod serrated 2
2. Carapace without postrostral submedian and anterolateral spines 3
- Carapace with postrostral submedian and anterolateral spines 4

3. Carapace with small tubercle on hepatic region; dorsal margin of palm of third pereopod sharply carinate, with row of setae *S. depressus* n. sp.
— Carapace unarmed on hepatic region; dorsal margin of palm of third pereopod not carinate, but serrate *S. levigatus*
4. Carapace with scattered spinules on branchial region; merus of third pereopod unarmed or armed with row of small teeth or denticles on lateral margin *S. goyi* n. sp.
— Carapace unarmed on branchial region; merus of third pereopod armed with 1 large tooth on lateral margin 5
5. First pereopod with well developed grooming apparatus; second pereopod naked, with carpus being subequal in length to merus *S. andamanicus*
— First pereopod with rudimentary grooming apparatus; second pereopod with numerous setae, with carpus being longer than merus 6
6. Cornea of eye darkly pigmented; second pereopod 1.2-2.1 times longer than carapace in females, 1.5-2.2 times in males *S. venustus*
— Cornea of eye opaque; second pereopod 2.1-2.2 times longer than carapace in females, 2.4-2.6 times in males *S. robustus* n. sp.

Spongiicola andamanicus Alcock, 1901
(Figs 3-7)

Spongiicola andamanica Alcock, 1901: 148, pl. 2, fig. 2. — Alcock & McArdle 1902: pl. 58, fig. 3. — Rathbun 1906: 901. — Bouvier 1908a: 889. — A. Milne-Edwards & Bouvier 1909: 264. — Holthuis 1946: 66. — Saito & Takeda 2003: 120.

Spongiicola andamanica andamanica – de Saint Laurent & Cleva 1981: 188.

Spongiicola henshawi Rathbun, 1906: 901, pl. 24, fig. 8. — Holthuis 1946: 67.

Spongiicola henshawi henshawi – de Saint Laurent & Cleva 1981: 171, figs 9, 10a, c-e, 11a, b, d-f, i. — Saito & Takeda 2003: 120.

Spongiicola henshawi spinigera de Saint Laurent & Cleva, 1981: 174, figs 10b, 11c, g, h. — Saito & Takeda 2003: 120.

Spongiicola holthuisi de Saint Laurent & Cleva, 1981: 177, fig. 12a-i. — Saito & Takeda 2003: 120.

TYPE LOCALITY. — Andaman Sea.

TYPE MATERIAL. — Syntypes of *Spongiicola andamanicus*: Andaman Sea, 310 and 435-530 m, number of specimens and sexes were not indicated, deposited in the Indian Museum, Calcutta, registration number 25/7 (Alcock 1901). Not examined.

Holotype of *Spongiicola henshawi*: *Albatross*, stn 3835, south coast of Molokai Island, Hawaii, 310-440 m, 3.IV.1902,

ovig. ♀ 6.2 mm (USNM 30538). Examined.
Holotype of *Spongiicola holthuisi*: MUSORSTOM 1, stn 27, Philippines, 13°59.8'N, 120°18.6'E, 192-188 m, 22.III.1976, ovig. ♀ 3.0 mm (MNHN-Na 2924). Examined.

OTHER MATERIAL EXAMINED. — **Japan**. TV *Shin'yo-maru*, 1993 research cruise, Ohmuro-dashi Bank, Sagami Sea, 19.X.1993, 1 ♂ 3.8 mm, 1 ovig. ♀ 4.2 mm (CBM-ZC 963). — 2002 research cruise, stn 33, NW of Izu-Oshima Island, 34°42.17'N, 139°19.00'E, 139-124 m, 24.X.2002, 1 ♂ 2.1 mm (NSMT-Cr S). — Stn 35, NW of Izu-Oshima Island, 34°43.24'N, 139°16.84'E, 171-181 m, 24.X.2002, 1 ♂ 3.1 mm (NSMT-Cr S). — Stn 41, Mera-se Bank, off Boso Peninsula, 34°51.3'N, 139°40.10'E, 172-135 m, 25.X.2002, 1 ♂ 3.0 mm, 1 ♀ 2.9 mm (CBM-ZC 8819).

TV *Toyoshio-maru*, 2001-6 cruise, stn 7-2, W of Amami-Oshima Island, 28°21.00'N, 129°13.05'E, 285-290 m, 28.V.2001, 2 ovig. ♀♀ 2.2, 3.0 mm (CBM-ZC 8778). — 2002 cruise, stn 9, 26°30.72'N, 127°25.99'E, 439 m, off Aguni Island, 26.V.2002, 3 ♂♂ 3.0-3.9 mm, 4 ♀♀ 3.9-4.3 mm, 7 ovig. ♀♀ 3.6-4.2 mm (NSMT-Cr). — 2004-2005 cruise, stn X, W of Amami-Oshima Island, 21.V.2004, 2 ♂♂ 2.4, 2.5 mm, 1 ♀ 2.3 mm, 1 ovig. ♀ 2.2 mm (NSMT-Cr).

Philippines. *Albatross*, stn 5113, 13°51.5'N, 120°50.5'E, 286 m, 1 ♂ 3.9 mm (USNM 173640). — Stn 5440, 10.V.1909, 1 ♂ 2.4 mm, 1 ♀ 3.6 mm (ZUMT). — Stn 5519, 08°47'N, 123°31.2'E, 333 m, 9.VIII.1909, 1 ♀ 4.3 mm (USNM 173639).

MUSORSTOM 1, stn 62, 13°59.5'N, 120°15.6'E, 179-194 m, 27.III.1976, 1 ♂ 2.3 mm (MNHN-Na 2928). — Stn 63, 14°00.8'N, 120°15.8'E, 191-195 m,

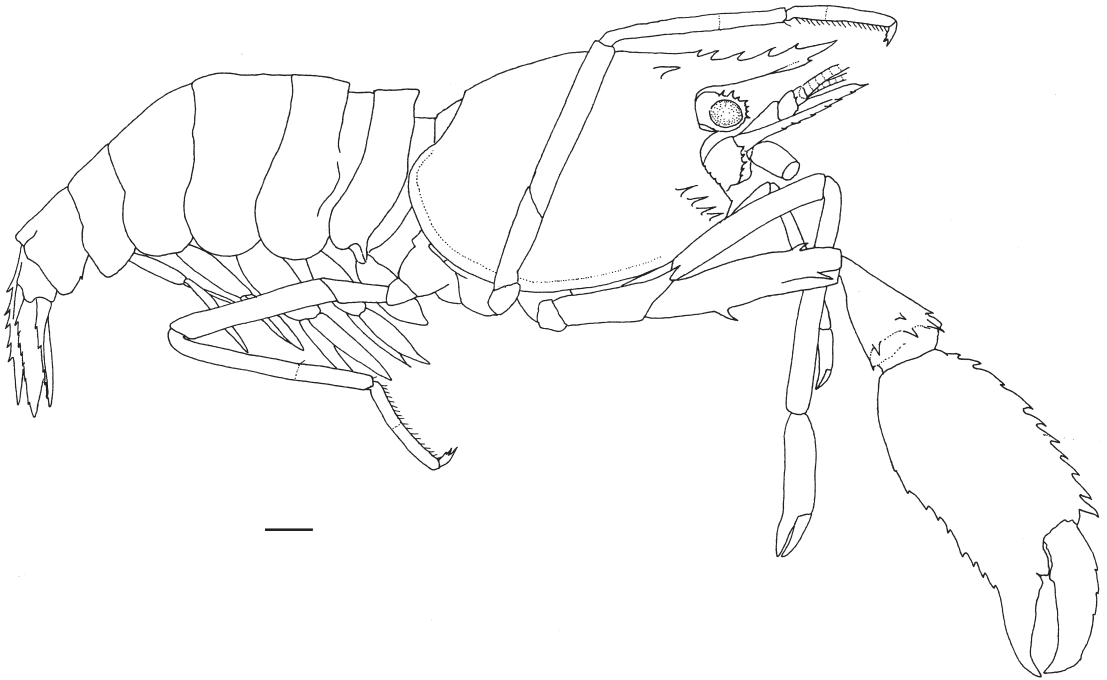


Fig. 3. — *Spongiicola andamanicus* Alcock, 1901, ♀ 5.1 mm, Kai Islands, Indonesia (KARUBAR, stn CP 09) (MNHN-Na 16274), entire animal in lateral view. Scale bar: 1 mm.

27.III.1976, 1 ovig. ♀ 3.2 mm (MNHN-Na 2929).

Indonesia. KARUBAR, stn CP 05, Kai Islands, 05°49'S, 132°18'E, 296-299 m, 22.X.1991, 2 ♀♀ 2.8, 5.5 mm (MNHN-Na 16272). — Stn CP 06, Kai Islands, 05°49'S, 132°21'E, 298-287 m, 22.X.1991, 1 ♂ 4.5 mm (MNHN-Na 16273). — Stn CP 09, Kai Islands, 05°23'S, 132°29'E, 368-389 m, 23.X.1991, 2 ovig. ♀♀ 5.1, 6.1 mm (MNHN-Na 16274). — Stn CP 35, Kai Islands, 06°08'S, 132°45'E, 390-502 m, 27.X.1991, 1 ovig. ♀ 6.2 mm (MNHN-Na 16275). — Stn DW 18, Kai Islands, 05°18'S, 133°01'E, 205-212 m, 24.X.1994, 3 ♂♂ 2.6-3.6 mm, 2 ovig. ♀♀ 3.1, 3.2 mm, 9 ♀♀ 2.2-3.3 mm (MNHN-Na 16276). — Stn DW 50, Tanimbar Islands, 07°59'S, 133°02'E, 184-186 m, 29.X.1991, 1 ♀ 2.9 mm (MNHN-Na 16277).

New Caledonia. BIOCAL, stn CP 52, 23°05.79'S, 167°46.54'E, 540-600 m, 31.VIII.1985, 1 ♂ 4.2 mm, 1 ovig. ♀ 5.0 mm (MNHN-Na 11979). — Stn DW 66, 24°55.43'S, 168°21.67'E, 505-515 m, 3.IX.1985, 1 ♀ 2.7 mm (MNHN-Na 11983). — Stn DW 83, 20°35.07'S, 166°53.99'E, 460 m, 6.IX.1985, associated with *Pheronema* sp., 1 ♂ 2.6 mm, 1 ovig. ♀ 6.3 mm (MNHN-Na 11981).

MUSORSTOM 4, stn CP 172, 19°01.20'S, 163°20'E, 275-330 m, 17.IX.1985, 1 ♀ 2.6 mm (MNHN-Na 11973). — Stn CP 180, 18°56.8'S, 163°17.7'E, 440 m, 18.IX.1985, 1 ovig. ♀ 4.2 mm (MNHN-Na 11976),

1 ovig. ♀ 3.8 mm (MNHN-Na 11972). — Stn CP 214, 22°53.8'S, 167°13.9'E, 425-440 m, 28.IX.1985, 1 juv. 1.6 mm (MNHN-Na 11969). — Stn 216, 22°59.5'S, 167°22.0'E, 490-515 m, 29.IX.1985, 1 ♂ 3.8 mm (MNHN-Na 11975). — Stn CP 238, 22°13.0'S, 167°14.0'E, 500-510 m, 02.X.1986, 1 ♂ 5.2 mm (MNHN-Na 11977).

MUSORSTOM 5, stn DW 339, 19°53.40'S, 158°37.90'E, 380-395 m, 16.X.1986, 1 ♀ 4.0 mm (MNHN-Na 11978). — Stn DW 348, 19°36.00'S, 158°31.70'E, 260 m, 17.X.1986, 1 ♀ 1.8 mm (MNHN-Na 11980).

CHALCAL 2, stn DW 76, 23°40.50'S, 167°45.20'E, 470 m, 30.X.1986, 1 ovig. ♀ 4.9 mm, 1 ♀ 3.6 mm (MNHN-Na 11971). — Stn DW 77, 23°38.35'S, 167°42.68'E, 435 m, 30.X.1986, 1 ovig. ♀ 4.2 mm (MNHN-Na 11968).

CALSUB, dive 18, SW of Isle of Pines, 22°46'S, 167°20'E, 200-300 m, 9.III.1989, 1 ovig. ♀ 2.4 mm (MNHN-Na 11970).

SMIB 8, stn DW 146, 514-522 m, 27.I.1993, 1 ♂ 2.5 mm (MNHN-Na 16279). — Stn DW 178, E of Jumeau Bank, 400 m, 30.I.1993, 1 ♀ 2.7 mm (MNHN-Na 16280).

BATHUS 3, stn CP 811, Norfolk Ridge, 23°41.42'S, 168°15.50'E, 383-408m, 28.XI.1993, 1 ♂ 3.2 mm (MNHN-Na 16281). — Stn DW 817, Norfolk Ridge, 23°42.38'S, 168°15.51'E, 405-410 m, 28.XI.1993,

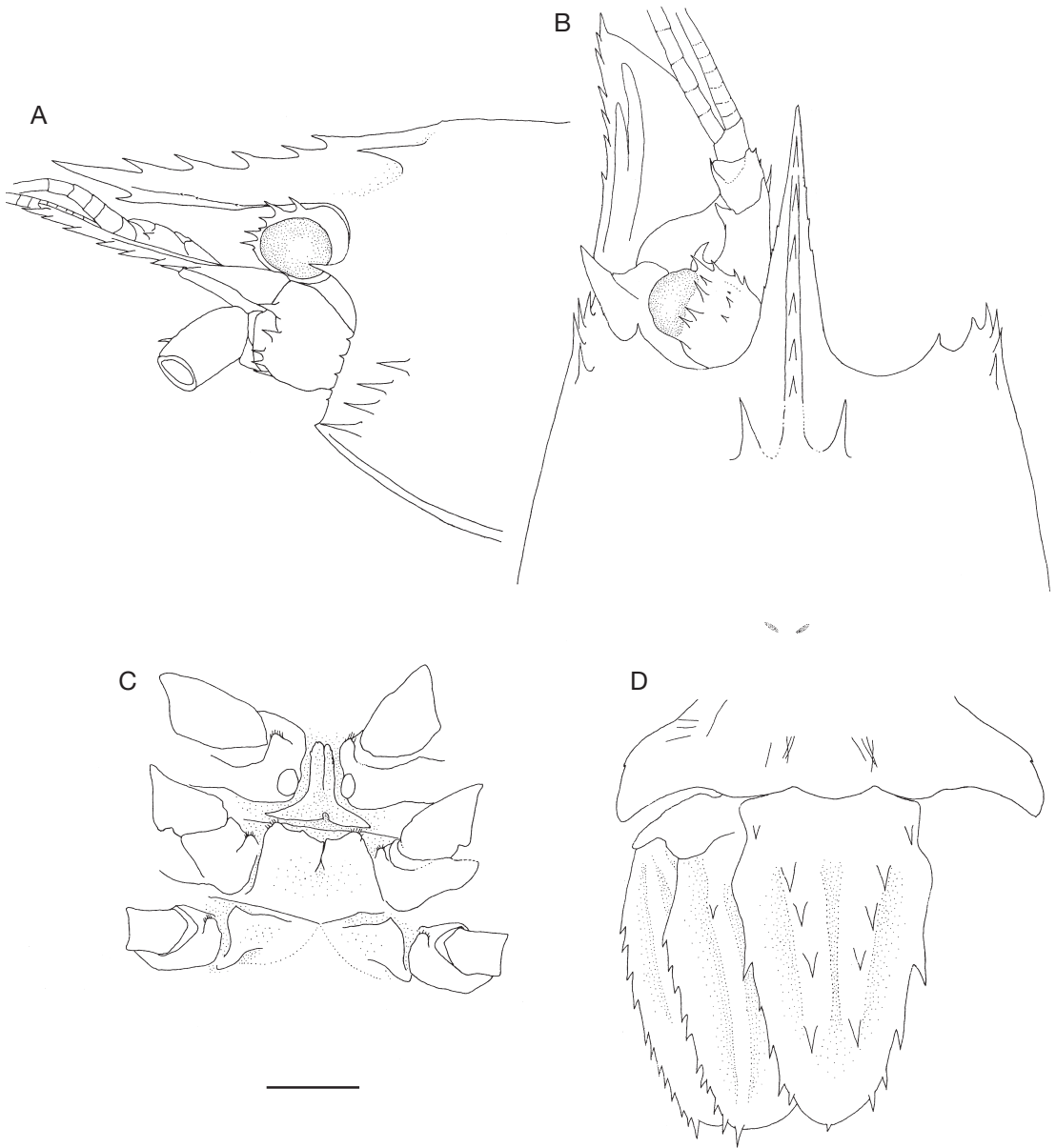


FIG. 4. — *Spongicola andamanicus* Alcock, 1901, ♀ 5.1 mm, Kai Islands, Indonesia (KARUBAR, stn CP 09) (MNHN-Na 16274): **A**, anterior part of carapace and cephalic appendages, lateral view; **B**, same, dorsal view (right eye and antennae omitted); **C**, thoracic prominences on sixth to eighth somites, ventral view; **D**, sixth pleonal somite, telson and left uropod, dorsal view (right uropod and marginal setae omitted). Scale bar: 1 mm.

1 ♂ 3.1 mm, 1 ovig. ♀ 3.5 mm (MNHN-Na 16282). — Stn CP 818, Norfolk Ridge, 23°43.89'S, 168°16.32'E, 394-401 m, 28.XI.1993, 1 ♂ 3.0 mm, 1 ovig. ♀ 3.5 mm (MNHN-Na 16283). — Stn CP 833, Norfolk Ridge,

23°02.75'S, 166°58.23'E, 441-444 m, 30.XI.1993, 2 ovig. ♀♀ 3.3, 3.8 mm, 1 spec. (damaged) (MNHN-Na 16284). — Stn CP 846, Norfolk Ridge, 23°02.90'S, 166°57.97'E, 500-514 m, 1.XII.1993, 1 ovig. ♀ 4.1 mm

(MNHN-Na 16285).

LITHIST, stn DW 04, Bank Stylaster, 23°38.4'S, 167°43.1'E, 419-440 m, 10.VIII.1999, 1 ovig. ♀ 3.9 mm (MNHN-Na 16286).

Loyalty Islands. MUSORSTOM 6, stn DW 391, 20°47.35'S, 167°05.70'E, 390 m, 13.II.1989, 3 ovig. ♀♀ 2.0-2.9 mm (MNHN-Na 16351). — Stn DW 406, 20°40.65'S, 167°06.8'E, 373 m, 15.II.1989, 1 ♂ 1.9 mm, 1 ovig. ♀ 2.7 mm (MNHN-Na 11962). — Stn DW 487, 21°23.30'S, 167°46.40'E, 500 m, 23.II.1989, 1 ♀ 2.5 mm (MNHN-Na 16278).

LIFOU 2000, stn CP 02, 430-480 m, 24.XI.2000, 1 ♀ 2.7 mm (MNHN-Na 16287).

Vanuatu. MUSORSTOM 8, stn CP 1088, 15°09'S, 167°15'E, 425-455 m, 6.X.1994, 1 ♂ 2.9 mm (MNHN-Na 16289). — Stn CP 1099, 15°05'S, 167°10'E, 275-284 m, 7.X.1994, 1 ovig. ♀ 3.9 mm (MNHN-Na 16290).

Fiji. BORDAU 1, stn CP 1434, Vanua Balavu, 17°11.48'S, 178°41.38'W, 400-401 m, 2.III.1999, 1 ♀ 2.1 mm (MNHN-Na 16288).

Australia. NW of Shey, Western Australia, 188-815 m, 10.II.1984, 1 ovig. ♀ 6.6 mm (NTM-Cr 002014).

Banjoe wangle-Darwin cables, Sahul Bank, 126 m, 20.IX.1911, 1 spec. (NHM 1911.09.20.16).

Madagascar. VAUBAN, stn CH 17, 12°37.5'S, 48°16.0'E, 370-355 m, 18.I.1972, 1 ♂ 2.1 mm (MNHN-Na 3593). — Stn CH 28, 12°42.9'S, 48°12.1'E, 445-455 m, 12.IX.1972, 1 ♀ 3.3 mm (MNHN-Na 3594). — Station not indicated, off NW coast, 12°39.5'S, 48°15.6'E, 450 m, 1.VIII.1973, 1 ♂ 2.7 mm, 1 ♀ 2.6 mm (MNHN-Na 3595). — Stn CH 52, 15°21.0'S, 46°12.5'E, 150 m, 9.XI.1972, 3 ♂♂ 1.9-2.5 mm, 1 ♀ 2.8 mm (MNHN-Na 3598). — Stn CP 57, off Majunga, 226 m, 1 ♂ 2.5 mm (MNHN-Na 16352). — Stn CH 63, 23°36.3'S, 43°32.5'E, 250 m, 28.II.1973, 2 ♂♂ 2.6, 2.7 mm, 1 ovig. ♀ 3.0 mm (MNHN-Na 3597). — Stn CH 110, 22°16.8'S, 43°07.9'E, 195-200 m, 1.XII.1973, 1 ovig. ♀ 3.3 mm (MNHN-Na 3596).

DISTRIBUTION. — This species is widely distributed in the Indo-West Pacific: Hawaii, Japan, Philippines, Indonesia, Fiji Islands, Vanuatu, New Caledonia, Loyalty Islands, Australia and Madagascar, 124-815 m (Figs 36; 37; Table 6).

HOST. — *Pheronema* sp. (Table 7).

DESCRIPTION OF FEMALES

Rostrum (Fig. 4A, B) 0.44-0.66 of carapace length, straight or slightly curved dorsally, falling short of or reaching tip of antennal scale; dorsal margin slightly concave or straight, armed with 4-11 teeth; ventral margin unarmed or armed with 1 subterminal tooth; ventrolateral ridge sharp, unarmed or armed with

1-3 tiny teeth at midlength. Carapace (Fig. 4A, B) with postrostral median ridge extending to level of postrostral submedian spine; postrostral submedian spine moderately large; antennal spine acuminate; hepatic spine present or absent; 3-5 anterolateral spines relatively large, forming single oblique row; anterolateral margin with 4-7 minute denticles; pterygostomial angle reaching or overreaching antennal spine; branchial region smooth; cervical groove rudimentary.

Sixth thoracic sternites (Fig. 4C) with pair of narrow, closely set lobes, terminating bluntly, each lateral margin unarmed or armed with a few minute denticles; seventh sternites with pair of broad, trapezoid lobes, each distolateral angle weakly produced and rounded; eighth sternite with pair of triangular lobes, each distolateral angle slightly produced, acute or subacute.

First pleonal somite (Fig. 3) with ventral projection supported by short, distinct ridge, terminating in subacute point; pleuron unarmed on posteroventral margin; transverse carina high, its margin overhanging depressed anterior section. Second somite with distinct transverse carina, its margin slightly overhanging depressed anterior section. Second to fifth somites smooth, pleura unarmed on lateral surfaces, each occasionally armed with 1 or 2 anteroventral and posteroventral teeth. Sixth somite (Fig. 4D) widened posteriorly, devoid of lateral spines. Telson (Fig. 4D) subtriangular, 1.3-1.7 times longer than broad; dorsal surface usually with pair of proximal spines, dorsolateral carinae each bearing 2-5 spines; lateral margins each with shallow subproximal concavity, and with 1 submarginal and row of 2-6 spines; posterolateral spines present; posterior margin convex, with postero-median spine.

Cornea (Fig. 4A, B) well developed, darkly pigmented; eyestalk armed with 3-7 small spines dorsally and 3 or 4 similar spines mesially. Antennular peduncle (Fig. 4B) reaching to midlength of antennal scale; first segment distinctly longer than distal two segments combined; stylocerite acute, curved mesially; second segment unarmed or armed on distolateral and mesial margins. Antennal basicerite (Fig. 4A, B) stout, with moderately small spine at distolateral angle, and with row of 2-6 additional

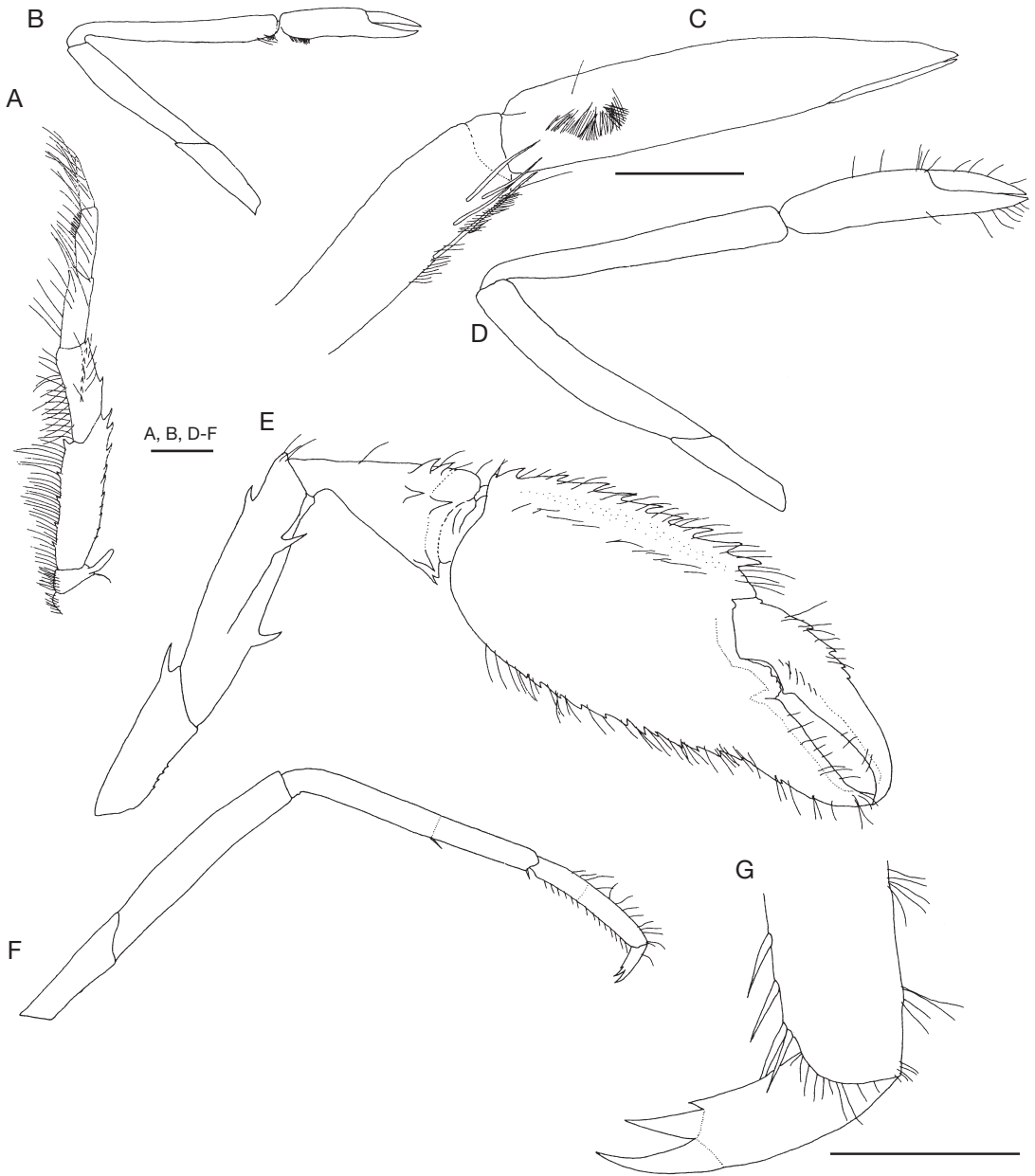


FIG. 5. — *Spongicola andamanicus* Alcock, 1901, ♀ 5.1 mm, Kai Islands, Indonesia (KARUBAR, stn CP 09) (MNHN-Na 16274), thoracic appendages: **A**, left third maxilliped, lateral view; **B**, right first pereopod, lateral view; **C**, same, propodus and carpus, ventral view; **D**, right second pereopod, lateral view; **E**, right third pereopod, lateral view; **F**, right fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view. Scale bars: A, B, D-F, 1 mm; C, G, 0.5 mm.

small spines on ventrolateral margin; antennal scale about twice longer than wide, lateral margin nearly straight or slightly concave, armed with 4-7 teeth,

dorsal surface with 2 distinct longitudinal carinae; carpuccerite short, reaching of first segment of antennular peduncle.

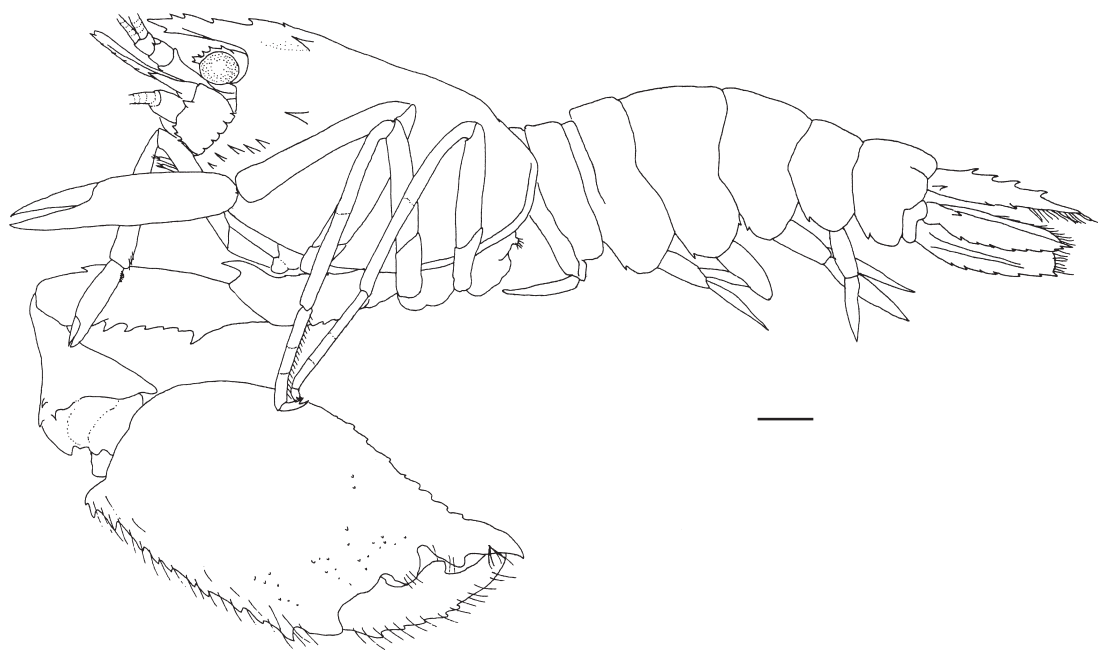


FIG. 6. — *Spongicola andamanicus* Alcock, 1901, ♂ 3.8 mm, Ohmuro-dashi Bank, Sagami Sea, Japan (CBM-ZC 963), entire animal in lateral view. Scale bar: 1 mm.

Third maxilliped (Fig. 5A) overreaching antennal scale by length of dactylus and propodus; dactylus subequal in length to propodus; propodus about 0.9 of carpal length; carpus about 0.8 of meral length, ventrodistal margin not markedly produced; merus about 0.6 length of ischium, armed with a few spines on dorsolateral margin and row of 4-7 spines on lateral surface; ischium armed with 5-11 spines on dorsolateral margin, ventral margin unarmed or armed with 1-5 spines. Exopod very short.

First pereopod (Fig. 5B, C) overreaching antennal scale by length of chela and half of carpus, with well developed grooming apparatus (Fig. 5C); dactylus 0.4 of chela length; carpus 1.5 of chela length; merus 0.8 of carpal length; ischium 0.6 of meral length. Second pereopod (Fig. 5D) 2.8-2.9 times longer than carapace, reaching tip of antennal scale by length of chela and 0.8 of carpus; dactylus 0.4 of chela length; carpus 1.2 of chela length; merus 0.9 of carpal length; ischium half of meral length. Third pereopod (Fig. 5E) reaching antennal scale by length of chela and carpus; dactylus about half

of chela length, serrated on proximal half of dorsal margin; fixed finger serrated on proximal 0.6-0.7 of ventral margin; chela 1.0-1.5 of carapace length; palm broad, about 1.3 times longer than wide, serrated on dorsal and ventral margins; carpus about 1.5 times longer than wide, 0.4 of chela length, unarmed or armed with 1-6 lateral spines; merus subequal in length to palm, dorsal and ventrolateral margins each with prominent subdistal spine, and ventromesial margin with 1 large spine slightly proximal to midlength and sometimes with row of small denticles; ischium 0.6 of meral length, with large dorsodistal spine, and sometimes with row of small teeth on dorsal and ventral margins.

Fourth pereopod (Fig. 5F, G) overreaching antennal scale by half length of carpus; dactylus (Fig. 5G) about 0.3 length of propodus, 3.5 times longer than wide, biunguiculate, occasionally with small accessory tooth at base of ventral unguis, particularly in large specimens; propodus about half length of carpus, often subdivided into 2 or 3 articles; carpus often subdivided into 2-4 articles;

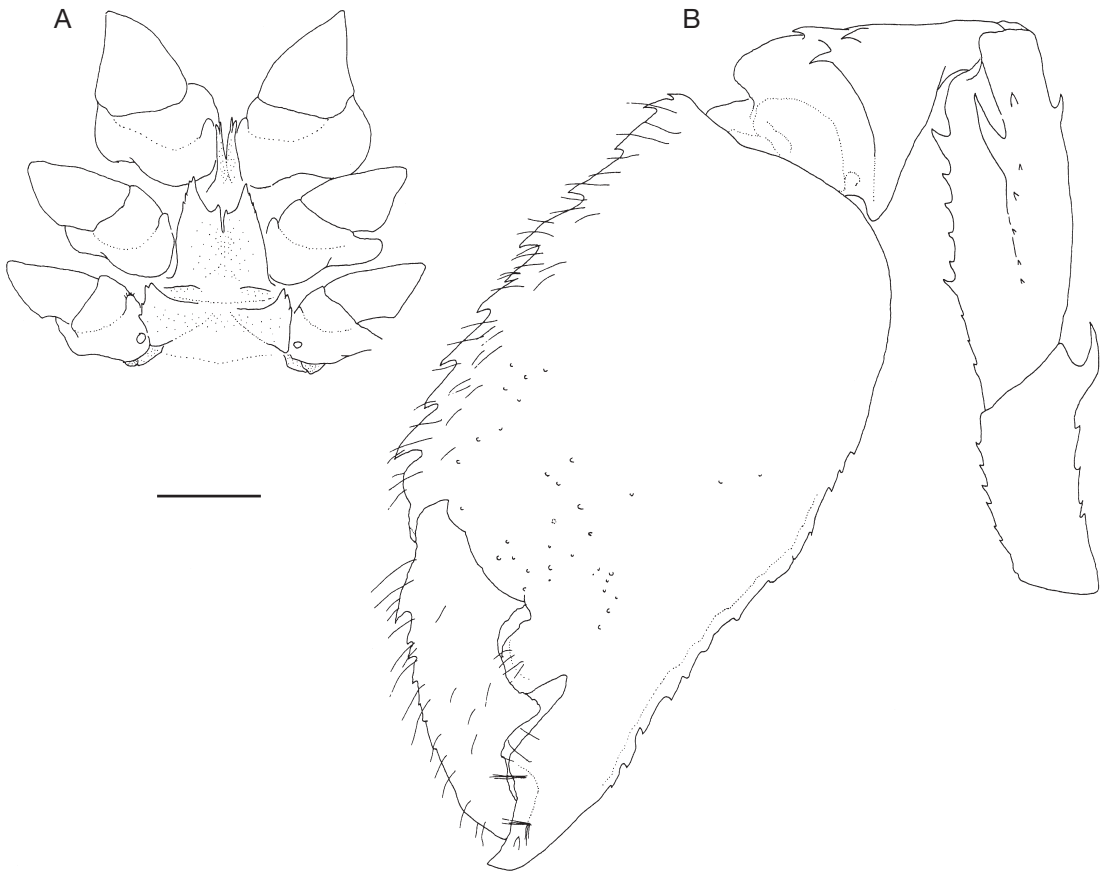


FIG. 7. — *Spongiicola andamanicus* Alcock, 1901, ♂ 3.8 mm, Ohmuro-dashi Bank, Sagami Sea, Japan (CBM-ZC 963): **A**, thoracic prominences on sixth to eighth somites, ventral view; **B**, left third pereopod, lateral view. Scale bar: 1 mm.

merus 0.9 of carpal length; ischium about half of meral length, unarmed. Fifth pereopod similar to fourth.

Exopod of uropod (Fig. 4D) with 9-12 teeth on lateral margin, dorsal surface with 2 smooth longitudinal carinae; endopod with 13-15 teeth on lateral margin and 1 subproximal spine on middorsal carina.

Eggs counting 631, diameter 0.6-0.8 mm (example: ovig. ♀ 6.6 mm, NTM-Cr 002014) (Table 5).

MALE CHARACTERISTICS

Rostrum (Fig. 6) 0.50-0.64 of carapace length. Sixth thoracic sternite (Fig. 7A) with slender, nar-

rowly separated lobes, each terminating in bifid tip; seventh sternite with subtriangular lobes, each tip acute, lateral margin serrate, anteromesial margin with 1 small tooth mesially; eighth sternite with triangular lobes, smaller than those on seventh sternite, each tip produced anteriorly, blunt or subacute, each lateral margin irregularly serrate. Pleura of second to sixth pleonal somites (Fig. 6) often armed with 1 or 2 anteroventral and 1 or 2 posteroventral teeth. Third pereopod (Fig. 7B) generally similar to that of females, but palm bearing many scattered granules on lateral surface distally, ventral and lateral margins of merus often armed with row of small teeth or denticles; chela 1.5-1.8 of carapace length.

TABLE 2. — Morphs in *Spongicola andamanicus* Alcock, 1901. +, present; –, absent.

Characters		A (= <i>S. a. andamanicus</i>)	B (= <i>S. a. henshawi</i>)	C (= <i>S. a. spinigerus</i>)	D	E (= <i>S. holthuisi</i>)
Carapace	hepatic spine	–	–	+	–	+
Third maxilliped	ventral spines on ischium	?	–	+	+	–
Third pereopod	lateral spines on carpus	–	+	+	+	–
Bathymetric ranges (m)		311-531	126-815	124-373	184-502	188-390

TABLE 3. — Occurrences of morphs of *Spongicola andamanicus* Alcock, 1901. Morphs A-E are indicated in Table 2.

Area	Hawaii	Japan	Philippines	Indonesia	New Caledonia	Vanuatu	Fiji	Is. Australia	Andaman Sea	Madagascar
Morphs recognised	B	BC	BCE	BCD	BCE	BC	B	B	ABC	BC

REMARKS

Spongicola andamanicus and *S. henshawi* were described based on two specimens from the Andaman Sea and a single specimen from Hawaii, respectively (Alcock 1901; Rathbun 1906). Although de Saint Laurent & Cleva (1981) initially recognized two subspecies in *S. henshawi*, viz. *S. henshawi henshawi* and *S. henshawi spinigerus* de Saint Laurent & Cleva, 1981, after examining two syntypes of *S. andamanicus*, the authors (1981: 188, addendum) finally concluded that the two subspecies of *S. henshawi* should be merged in *S. andamanicus*, viz. *S. andamanicus andamanicus*, *S. andamanicus henshawi*, and *S. andamanicus spinigerus*. They used the following three characters in discriminating the three subspecies of *S. andamanicus*: 1) presence or absence of the hepatic spine on the carapace; 2) presence or absence of a ventral row of spines on the ischium of the third maxilliped; and 3) presence or absence of lateral spines on the carpus of the third pereopod. Diagnoses of the three taxa are summarized in Table 2. It is obvious that these subspecific taxa are not defined by a single character, but a combination of characters. During the present study, an additional, fourth morph (morph D), characterized by the absence of the hepatic spine, the presence of ventral spines on the ischium of the third maxilliped, and the presence of lateral spines

on the carpus of the third pereopod, has been found in the material from Indonesia. The occurrence of the four morphs according to geographical regions is summarized in Table 3. It is obvious that more than single morphs frequently occur in a same geographical area. The morph B, corresponding to *S. andamanicus henshawi*, is widespread in the Indo-Pacific ranging from Hawaii to Madagascar. Furthermore, morphs B, C and D are found in the material from the Philippines and New Caledonia, from where many specimens were available for examination; morphs B and C are found also in Japan, Vanuatu and Madagascar. It can be said that there is no correlation between the occurrence of the morphs and their geographical patterns. Although de Saint Laurent & Cleva (1981) discussed that the bathymetric range was also different among the three subspecies taxa, our examination shows that the bathymetrical ranges among them partially or greatly overlap for each other (see Table 2). By definition, subspecies divisions are considered for geographically separated populations. Our observation strongly suggests that the morphological differences cited by de Saint Laurent & Cleva (1981) merely reflect intraspecific variability. Saito & Takeda (2003) used these characters in their phylogenetic analysis and recognized a paraphyletic relation between *S. andamanicus* and *S. henshawi* subspecies group,

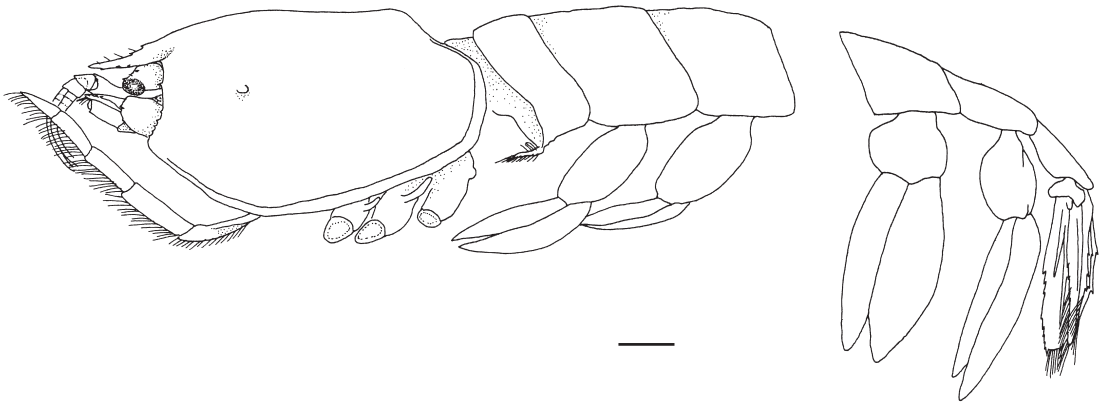


FIG. 8. — *Spongicola depressus* n. sp., holotype ovig. ♀ 4.7 mm, Loyalty Islands (MUSORSTOM 6, strn?) (MNHN-Na 16293), entire animal in lateral view (pereopods all detached; setae on pleonal appendages and telson partially omitted). Scale bar: 1 mm.

however, the present examination of the extensive material showed that these characters are quite variable and phylogenetically uninformative. Therefore, we do not accept the subspecific division proposed by de Saint Laurent & Cleva (1981), because it does not really reflect the population structure. The name *Spongicola andamanicus* has a priority over *S. henshawi* or *S. spinigerus*.

De Saint Laurent & Cleva (1981) further described a new species, *S. holthuisi*, based on a single ovigerous female from the Philippines, acknowledging a close similarity to *S. andamanicus*. *Spongicola holthuisi* was distinguished from *S. andamanicus* by the presence of an additional pair of submedian spines on the dorsolateral carinae of the telson and the relatively short propodi of the fourth and fifth pereopods. Our examination of the present extensive material, however, showed again that these characters are quite variable, and that there is no correlation between these characters and the other supposedly diagnostic characters mentioned above. Therefore, we conclude that *S. holthuisi* is a junior subjective synonym of *S. andamanicus*.

Spongicola depressus n. sp.
(Figs 8-10)

TYPE MATERIAL. — Holotype: MUSORSTOM 6, strn?, Loyalty Islands, ovig. ♀ 4.7 mm (MNHN-Na 16293).

ETYMOLOGY. — The specific name *depressus* refers to the depressed body form, one of the characteristics of the new species.

DISTRIBUTION. — Loyalty Islands, depth unknown (Fig. 37; Table 6).

HOST. — *Pheronema* sp. (Table 7).

DESCRIPTION OF FEMALE HOLOTYPE

Rostrum (Fig. 9A, B) 0.23 of carapace length, slightly upturned, reaching distal margin of first segment of antennular peduncle; dorsal margin slightly concave, armed with 2 teeth in proximal 0.3, unarmed posteriorly; ventral margin with 1 subdistal tooth; ventrolateral ridge sharp, with 2 (left) or 3 (right) small teeth around midlength. Carapace (Fig. 9A, B) without postrostral median ridge; postrostral submedian and anterolateral spines absent; antennal spine small, acute; hepatic region with 1 tiny tubercle; anterolateral margin minutely denticulate; pterygostomial angle relatively weakly produced, exceeding antennal spine; branchial region smooth; cervical groove rudimentary.

Sixth thoracic sternite (Fig. 9C) with moderately narrow lobes, each terminating in obliquely truncated tip, lateral margins faintly sinuous. Seventh sternite with broadly rounded lobes, each bearing 1 tiny denticle at anteromesial angle. Eighth sternite with triangular plates, each terminating bluntly.

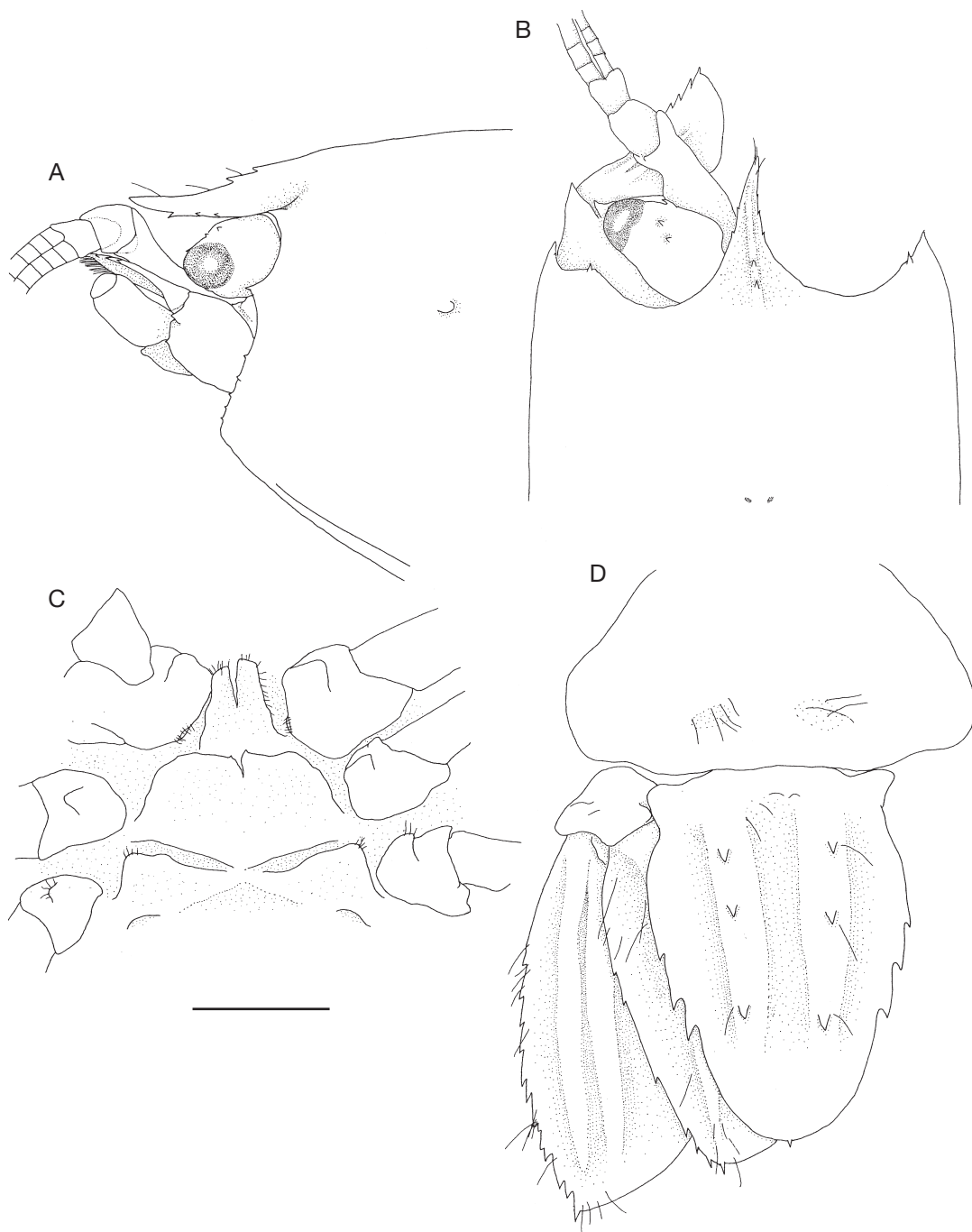


FIG. 9. — *Spongiicola depressus* n. sp., holotype ovig. ♀ 4.7 mm, Loyalty Islands (MUSORSTOM 6, strn?) (MNHN-Na 16293): **A**, anterior part of carapace and cephalic appendages, lateral view; **B**, same, dorsal view (right eye and antennae omitted); **C**, thoracic prominences on sixth to eighth somites, ventral view; **D**, sixth pleonal somite, telson and left uropods, dorsal view (right uropod and marginal setae omitted). Scale bar: 1 mm.

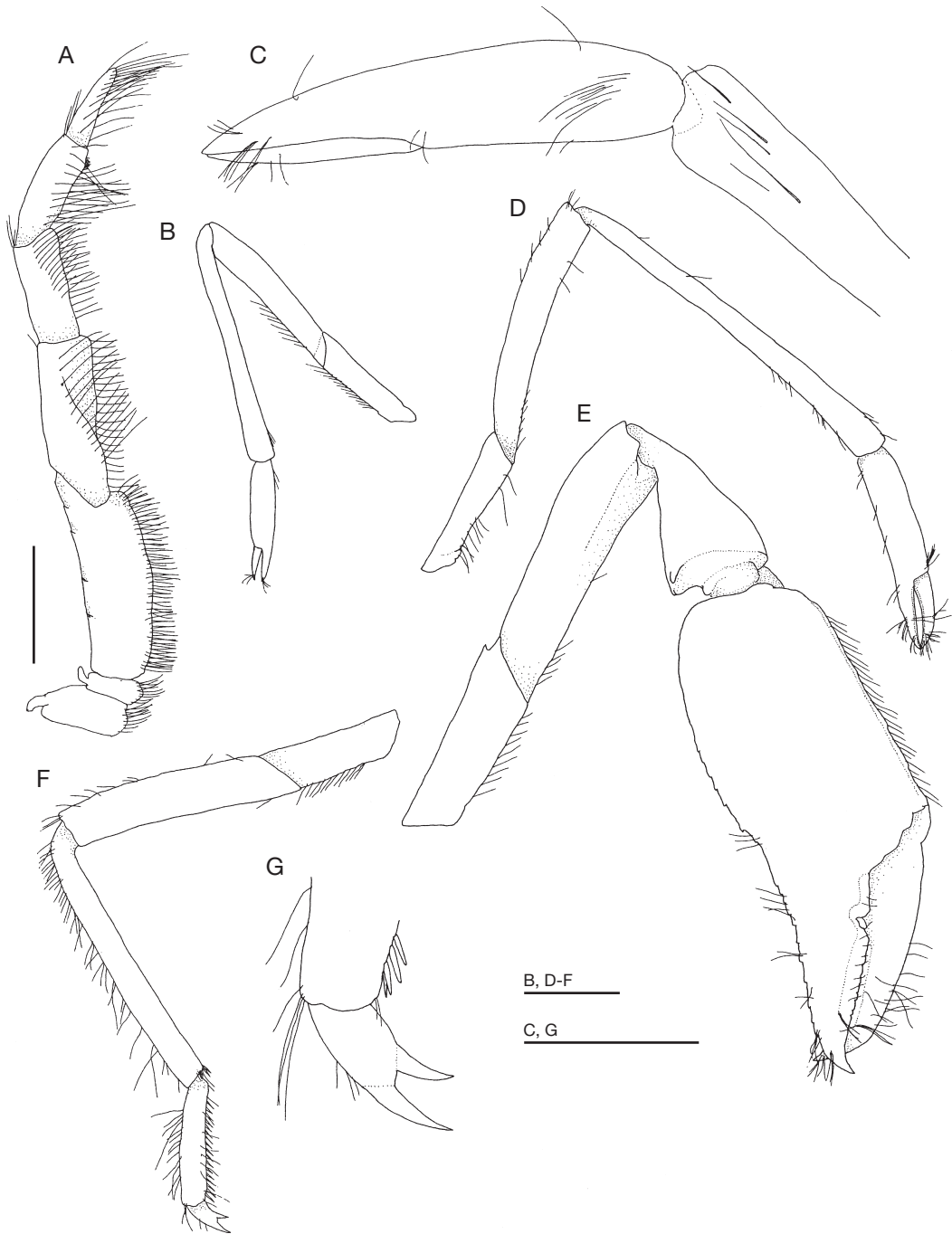


FIG. 10. — *Spongicola depressus* n. sp., holotype ovig. ♀ 4.7 mm, Loyalty Islands (MUSORSTOM 6, strn?) (MNH-Na 16293), thoracic appendages: **A**, right third maxilliped, lateral view; **B**, left first pereopod, lateral view; **C**, same, chela and carpus, ventral view; **D**, right second pereopod, lateral view; **E**, right third pereopod, lateral view; **F**, left fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view. Scale bars: A, B, D-F, 1 mm; C, G, 0.5 mm.

Pleon (Fig. 8) strongly depressed dorsoventrally. First somite with relatively low transverse carina, its margin not overhanging depressed anterior section; anteroventral projection very small; posterolateral margin smooth. Second somite without conspicuous transverse carina. Pleura of first to fifth somites unarmed. Sixth somite (Fig. 9D) widened posteriorly, lacking lateral spines. Telson (Fig. 9D) broadly triangular, 1.4 times longer than broad; dorsal surface without proximal spines; dorsolateral carinae each bearing 3 spines; lateral margins each with subproximal concavity, and armed with row of 3 spines; posterolateral angles not delimited, unarmed; posterior margin convex, with posteromedian spine.

Cornea (Fig. 9A, B) relatively small, distinctly narrower than eyestalk, darkly pigmented; base of cornea not constricted; eyestalk widened basally, armed with 2 spines dorsally and 1 similar spine mesially. Antennular peduncle (Fig. 9A, B) reaching tip of antennal scale, all segments unarmed; first segment 3.0 times longer than second segment; stylocerite blunt, straight. Antennal basicerite (Fig. 9A, B) stout, with small distolateral spine and with 1 additional small denticle on ventrolateral margin; antennal scale small, 0.2 of carapace length, subsemicircular, 2.2 times longer than wide; lateral margin slightly concave, armed with 4 teeth including distolateral tooth, dorsal surface with 2 distinct longitudinal carinae; carpocerite short, reaching second segment of antennular peduncle, unarmed.

Third maxilliped (Fig. 10A) overreaching antennal scale by length of dactylus and propodus; dactylus 0.7 of carpal length; propodus subequal in length to carpus; carpus 0.7 of meral length; merus about 0.8 of ischial length; ischium with 4 spinules on dorsolateral margin, unarmed on ventral margin. Exopod rudimentary.

First pereopod (Fig. 10B, C) with rudimentary grooming apparatus; dactylus 0.3 of chela length; carpus slender, 2.0 of chela length; merus 0.8 of carpal length; ischium 0.7 of meral length. Second pereopod (Fig. 10D) generally similar to first pereopod, but distinctly longer, about 2.3 times longer than carapace; dactylus 0.4 of chela length; carpus slender and longest, 1.9 of chela length; merus 0.7 of carpal length; ischium 0.6 of meral length. Third pereopod (Fig. 10E) with chela about

1.1 of carapace length; dactylus 0.6 of chela length, smooth on dorsal margin; fixed finger with row of tiny denticles extending onto distal 0.6 of palm; palm subcylindrical, about 1.6 times longer than wide, dorsal margin carinate with row of short setae, ventral margin with sparse setae; carpus broadened distally, 1.7 times longer than wide, 0.4 of chela length, unarmed; merus 1.5 of carpal length, unarmed; ischium 0.7 of meral length, with weak spine on dorsodistal angle, ventral margin unarmed. Fourth pereopod (Fig. 10F, G) relatively short, moderately slender; dactylus (Fig. 10G) 0.4 of propodal length, moderately broad, 2.9 times longer than wide, clearly biunguiculate; propodus 0.4 of carpal length; carpus longest, about 2.3 of propodal length, armed with 2 small spines on ventrodistal angle; merus 0.8 of carpal length; ischium 0.6 of meral length. Fifth pereopod similar to fourth.

Exopod of uropod (Fig. 9D) with 13 teeth on lateral margin, dorsal surface with 2 smooth longitudinal carinae; endopod with 7 teeth on lateral margin.

Eggs counting 50, diameter about 0.8 mm (Table 5).

REMARKS

Spongicola depressus n. sp. is most similar to *S. levigatus* in the relatively short rostrum, generally reduced armament on the carapace and the rudimentary grooming apparatus on the first pereopod, but it is distinctive in the genus by the strongly depressed pleon and weak armature of the body and of the third pereopod.

The characters differentiating *S. depressus* n. sp. and *S. levigatus* include the development of the hepatic spine on the carapace, and the structure and armament of the third pereopod. In *S. depressus* n. sp., the carapace possesses small tubercle on the hepatic region, possibly representing a rudimentary hepatic spine, whereas there is no trace of hepatic spine in *S. levigatus*. The palm of the third pereopod is carinate but unarmed on the dorsal margin in *S. depressus* n. sp., whereas the dorsal margin of the palm is armed with row of small teeth in *S. levigatus*. The merus of the third pereopod is unarmed in *S. depressus* n. sp., but armed with spines in *S. levigatus*.

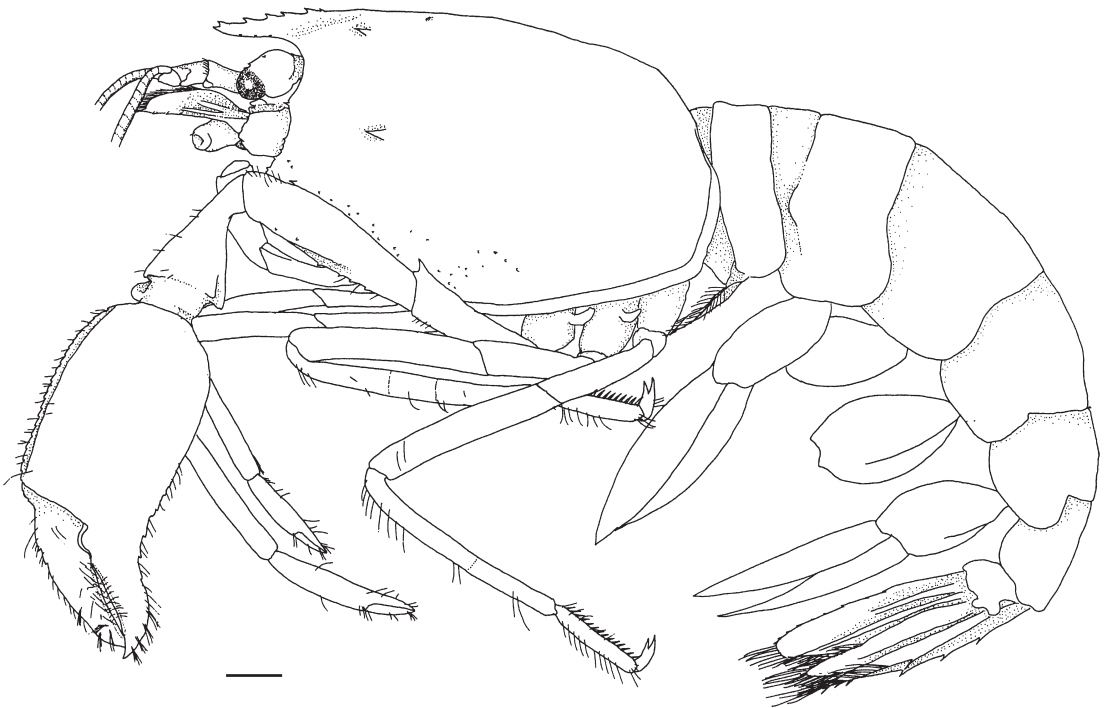


FIG. 11. — *Spongicola goyi* n. sp., holotype ovig. ♀ 6.3 mm, New Caledonia (MUSORSTOM 4, stn CP 217) (MNHN-Na 11986), entire animal in lateral view. Scale bar: 1 mm.

Spongicola goyi n. sp.
(Figs 11-15)

TYPE MATERIAL. — Holotype: MUSORSTOM 4, stn CP 217, 850 m, 22°03.60'S, 167°27.00'E, 29.IX.1985, ovig. ♀ 6.3 mm (MNHN-Na 11986a).

Paratypes: same data as holotype, 1 ♂ 6.5 mm (MNHN-Na 11986b).

BATHUS 4, stn CP 892, 21°01.71'S, 164°27.32'E, 580-600 m, 2.VIII.1994, 1 ♀ 3.7 mm (MNHN-Na 16294).

HALIPRO 2, stn BT 15, Mount K, Norfolk Ridge, 24°36.28'S, 170°03.85'E, 900-1005 m, 8.XI.1996, 1 ♂ 6.8 mm (MNHN-Na 16295). — Stn BT 94, Mount Stylander, 23°36.97'S, 167°41.66'E, 448-880 m, 24.XI.1996, 3 ♂♂ 4.8-6.2 mm, 1 ♀ 4.7 mm, 2 ovig. ♀♀ 5.3, 7.9 mm (MNHN-Na 16296).

OTHER MATERIAL EXAMINED. — **Japan.** RV *Tansei-maru*, KT95-5 cruise, stn TB-16, SE of Taito-saki, Boso Peninsula, 35°06.3'N, 140°50.2'E, 637-673 m, 25.IV.1995, 1 ♂ 4.2 mm (CBM-ZC 1398). — KT94-9 cruise, stn 3, SE of Amami Oshima Island, 28°02.5'N, 129°34.5'E, 815-789 m, 1.VII.1994, 1 ♀ 5.6 mm (CBM-ZC 9417).

Indonesia. KARUBAR, stn CP 09, Kai Islands, 05°23'S,

132°29'E, 368-389 m, 23.X.1991, 1 ♂ 3.3 mm (MNHN-Na 16297). — Stn CP 16, Kai Islands, 05°17'S, 132°50'E, 315-349 m, 24.X.1991, 1 ovig. ♀ 4.2 mm (MNHN-Na 16298). — Stn CC 21, Kai Islands, 05°14'S, 133°00'E, 688-694 m, 25.X.1991, 1 ♀ 4.5 mm (MNHN-Na 16299).

New Caledonia. BATHUS 3, stn DW 776, 24°44.24'S, 170°08.01'E, 770-830 m, 24.XI.1993, 1 ovig. ♀ 4.2 mm, 2 ♀♀ 4.3, 4.6 mm (MNHN-Na 16300). — Stn DW 778, 24°43.49'S, 170°07.07'E, 750-760 m, 24.XI.1993, 1 ♂ 4.6 mm, 1 ovig. ♀ 6.0 mm (MNHN-Na 16301).

HALIPRO 2, stn BT 01, Norfolk Ridge, 23°04.34'S, 167°43.13'E, 724-738 m, 5.XI.1996, 1 ♂ 7.0 mm (MNHN-Na 16302). — Stn BT 28, Mount South, Norfolk Ridge, 25°23.65'S, 170°29.86'E, 960-1011 m, 11.XI.1996, 2 ♂♂ 6.8, 7.2 mm, 2 ovig. ♀♀ 7.4, 7.5 mm (MNHN-Na 16303). — Stn BT 83, Mount Jumeau E, Norfolk Ridge, 23°38.95'S, 168°15.79'E, 820-1060 m, 22.XI.1996, 1 ♂ 6.1 mm, 1 ovig. ♀ 6.4 mm (MNHN-Na 16304). — Stn BT 93, Mount Stylander, 23°37.28'S, 167°39.37'E, 486-962 m, 24.XI.1996, 1 ♂ 8.8 mm (MNHN-Na 16305).

EBISCO, stn CP 2644, South Lansdowne, 20°54.0'S, 160°59.0'E, 600-625 m, 22.X.2005, 1 ovig. ♀ 4.2 mm (MNHN-Na 16353).



FIG. 12. — *Spongiicola goyi* n. sp., holotype ovig. ♀ 6.3 mm, New Caledonia (MUSORSTOM 4, stn CP 217) (MNHN-Na 11986): **A**, anterior part of carapace and cephalic appendages, lateral view; **B**, same, dorsal view (right eye and antennae omitted); **C**, thoracic prominences on sixth to eighth somites, ventral view; **D**, sixth pleonal somite, telson and left uropod, dorsal view (right uropod and marginal setae omitted). Scale bar: 1 mm.

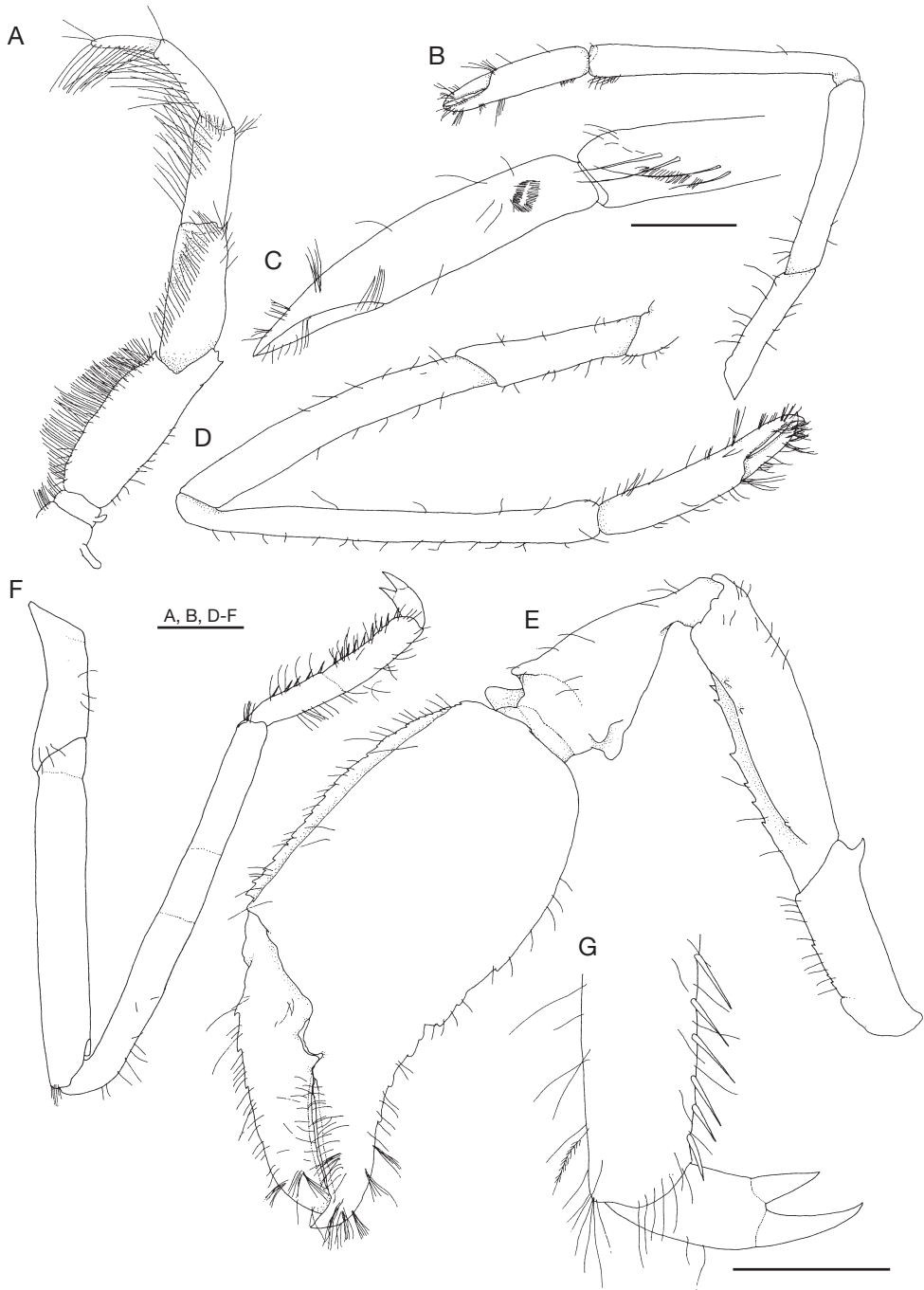


FIG. 13. — *Spongicola goyi* n. sp., holotype ovig. ♀ 6.3 mm, New Caledonia (MUSORSTOM 4, stn CP 217) (MNHN-Na 11986), left thoracic appendages: **A**, third maxilliped, lateral view; **B**, first pereopod, lateral view; **C**, same, chela and carpus, ventral view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view. Scale bars: A, B, D-F, 1 mm; C, G, 0.5 mm.



FIG. 14. — *Spongicola goyi* n. sp., paratype ♂ 6.2 mm, New Caledonia (HALIPRO 2, stn BT 94) (MNHN-Na 16296), entire animal in lateral view. Scale bar: 1 mm.

Vanuatu. MUSORSTOM 8, stn DW 1128, Guyot Bougainville, 16°02'S, 166°38'E, 778-811 m, 10.X.1994, 1 ♀ 5.9 mm (MNHN-Na 16306).

ETYMOLOGY. — This species is dedicated to Joseph Goy in recognition of his contributions to the taxonomy of the Stenopodidea.

DISTRIBUTION. — Japan, Indonesia, New Caledonia and Vanuatu, 315-1060 m (Figs 36; 37; Table 6).

HOSTS. — *Demospongia* sp., Hexactinellidae sp., *Hyalonema* sp., *Euplectella* sp. and *Pheronema semiglobosum* (Table 7).

DESCRIPTION OF FEMALES

Rostrum (Fig. 12A, B) 0.26-0.40 of carapace length, straight, slightly falling short of or reaching distal margin of first segment of antennular peduncle; dorsal margin nearly straight, armed with 4-9 teeth, including 1 or 2 teeth posterior to orbital margin; ventral margin smooth or armed with 1 or 2 small teeth subdistally; ventrolateral ridge sharp, unarmed or armed with 1-3 spinules. Carapace (Fig. 12A, B) with postrostral median ridge extending to level of postrostral submedian spines; postrostral submedian

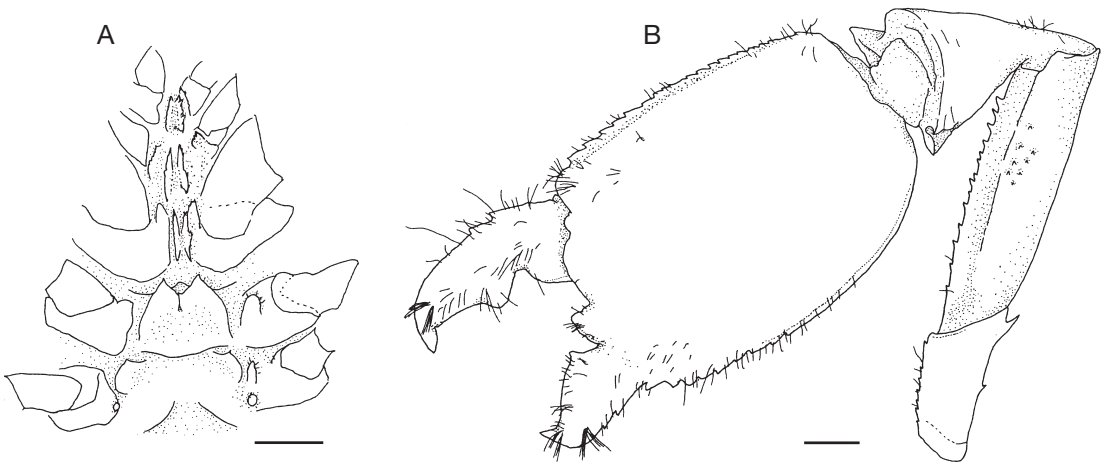


FIG. 15. — *Spongiicola goyi* n. sp., paratype ♂ 6.5 mm, New Caledonia (MUSORSTOM 4, stn CP 217) (MNHN-Na 11986): **A**, thoracic prominences on sixth to eighth somites, ventral view; **B**, left third pereopod, lateral view. Scale bars: 1 mm.

spine small, straight, directed forward; 1 or 2 additional spinules often present on postorbital region; antennal spine small, acuminate; hepatic spine moderately small; 1-9 small anterolateral spines present, occasionally forming cluster of spines; anterolateral margin with row of spinules, sometimes extending to pterygostomial margin; pterygostomial angle moderately produced, exceeding antennal spine; lower part of branchial region usually with scattered spinules or granules; cervical groove rudimentary.

Sixth thoracic sternite (Fig. 12C) with slender, contiguous lobes, each terminating in blunt point; lateral margins smooth. Seventh sternite with broad subrectangular lobes separated by narrow median notch, anterolateral angles rounded or subacute; each anterior margin slightly concave, rounded at anteromesial angle; each lateral margin smooth. Eighth sternite with triangular lobes, anterolateral angles slightly produced, rounded.

Pleon weakly depressed dorsoventrally. First pleonal somite (Fig. 11) with relatively low transverse carina, its margin slightly overhanging somewhat depressed anterior section; anteroventral projection small; pleuron unarmed or armed with 1 tiny tooth on posteroventral margin. Second somite with low transverse carina, its margin not overhanging anterior section. Pleura of second to fifth somites rounded, unarmed. Sixth somite (Fig. 12D) widened

posteriorly, unarmed. Telson (Fig. 12D) 1.4-1.6 times longer than broad; dorsal surface devoid of proximal spines; dorsolateral carinae each bearing 3-5 spines; lateral margins each with relatively deep proximal concavity and with 1-4 spines; posterolateral spine present; posterior margin slightly convex or nearly truncate, unarmed or armed with posteromedian spine.

Cornea (Fig. 12A, B) relatively small, narrower than eyestalk, darkly pigmented; base of cornea not markedly restricted; eyestalk somewhat inflated basally, armed with 1-3 spinules dorsally and 2 spinules mesially. Antennular peduncle (Fig. 12A, B) reaching distal 0.2 of antennal scale, all segments unarmed; first segment 1.4 times longer than distal two segments combined; stylocerite subacute, straight. Antennal basicerite (Fig. 12A, B) stout, with triangular projection at distolateral angle, ventrolateral margin unarmed or armed with 1 or 2 additional small spines; antennal scale subsemicircular, 2.2 times longer than wide, lateral margin nearly straight, armed with 4-6 teeth including distolateral tooth, dorsal surface with 2 distinct longitudinal carinae; carpoplite short, reaching distal margin of first segment of antennular peduncle.

Third maxilliped (Fig. 13A) overreaching antennal scale by distal three segments; dactylus 0.7 of propodal length; propodus subequal in length to

carpus; carpus 0.7 of meral length, ventrodistal margin weakly produced; merus 0.7-0.8 of ischial length, with 1 spine on dorsodistal margin; ischium with 0-4 spinules on dorsolateral margin and 1 small spine at ventrodistal angle. Exopod rudimentary.

First pereopod (Fig. 13B, C) overreaching antennal scale by distal 0.3 of carpus, with well developed grooming apparatus (Fig. 13C); dactylus 0.4 of chela length; carpus longest, about 1.8 of chela length; merus 0.8 of carpal length; ischium 0.8 of meral length. Second pereopod (Fig. 13D) about 1.9 times longer than carapace, overreaching antennal scale by length of chela and carpus; dactylus 0.4 of chela length; carpus 1.8 of chela length; merus 0.8 of carpal length; ischium 0.6 of meral length. Third pereopod (Fig. 13E) overreaching antennal scale by length of chela; chela 1.1-1.4 length of carapace; dactylus 0.6 of chela length, with row of sparse small teeth or denticles on dorsal margin; fixed finger with row of sparse teeth or tubercles on ventral margin, extending from midlength of fixed finger onto midlength of palm; palm 1.3-1.4 times longer than wide, dorsal margin distinctly carinate and with row of small denticles and row of sparse short setae; carpus 1.6-1.7 times as long as wide, 0.4 of chela length, unarmed; merus 1.5 of carpal length, lacking strong teeth on each dorsodistal and distolateral angles, with row of small teeth or denticles on lateral surface and ventromesial margin; ischium 0.6-0.7 of meral length, with large dorsodistal spine, and row of small teeth or denticles on ventral margin and occasionally on dorsal margin. Fourth pereopod (Fig. 13F, G) overreaching tip of antennal scale by half of carpus; dactylus (Fig. 13G) 0.3-0.4 of propodal length, moderately broad, 3.4 times longer than wide, clearly biunguiculate; propodus about half of carpus, subdivided into 2 or 3 articles; carpus subdivided into 3 or 4 articles, sometimes with 1 small movable spine at ventrodistal angle; merus 0.8 of carpal length; ischium about half length of merus, unarmed. Fifth pereopod similar to fourth.

Exopod of uropod (Fig. 12D) with 6-11 teeth on lateral margin, dorsal surface with 2 smooth longitudinal carinae; endopod with 4-12 teeth on lateral margin.

Eggs counting 23-235, diameter 0.7-0.8 mm (Table 5).

MALE CHARACTERISTICS

Rostrum (Fig. 14) 0.31-0.36 of carapace length. Sixth (Fig. 15A) thoracic sternite with slender lobes, clearly separated, each terminating in acute tip, lateral margin irregularly serrated; seventh sternite with broad subtriangular lobes, separated by very narrow median incision, each terminating in acute tooth; eighth sternites with subrectangular lobes, smaller than those of seventh somite, each anterolateral angle acutely pointed. First pleonal somite (Fig. 14) with prominent ventral projection supported by short, but distinct ridge, terminating in subacute point. Second to fifth pleonal pleura (Fig. 14) unarmed or armed with tiny marginal denticles; sixth somite with tiny denticle at posteroventral angle. Chela of third pereopod (Fig. 15B) about 1.4 of carapace length.

REMARKS

Spongicola goyi n. sp. resembles *S. andamanicus*. The possession of scattered spinules on the branchial region of the carapace, the absence of a strong tooth at the dorsal and ventrolateral margins of the merus of the third pereopod, and the distinctly carinate dorsal margin of the palm of the third pereopod immediately distinguish the present new species from *S. andamanicus*. In *S. andamanicus*, the branchial region is smooth; the merus of the third pereopod is armed with a conspicuous subdistal tooth on each dorsal and ventrolateral margin; and the palm of the third pereopod is rounded on the dorsal surface.

Spongicola levigatus Hayashi & Ogawa, 1987 (Figs 16-19)

Spongicola levigata Hayashi & Ogawa, 1987: 367 [type locality: East China Sea, about 200 m]. — Saito & Takeda 2003: 120.

TYPE MATERIAL. — Holotype: RV *Koyo-maru*, East China Sea, 30°44.07'N, 127°48.03'E, about 200 m, 14.VII.1978, otter trawl, coll. O. Tabeta & K. Hayashi, ♂ 2.8 mm (NFU). Examined.

Paratypes: same data as holotype, 1 ♂ 2.9 mm, 1 ♀, 3 ovig. ♀♀ 2.7-3.4 mm (SUF). Examined.

OTHER MATERIAL EXAMINED. — Japan. RV *Koyo-maru*, same data as type series, 7 ♂♂ 2.3-3.2 mm, 5 ovig. ♀♀ 2.3-2.9 mm (USNM 256955).

TV *Toyoshio-maru*, 2002 cruise, stn 9, off Aguni Island,

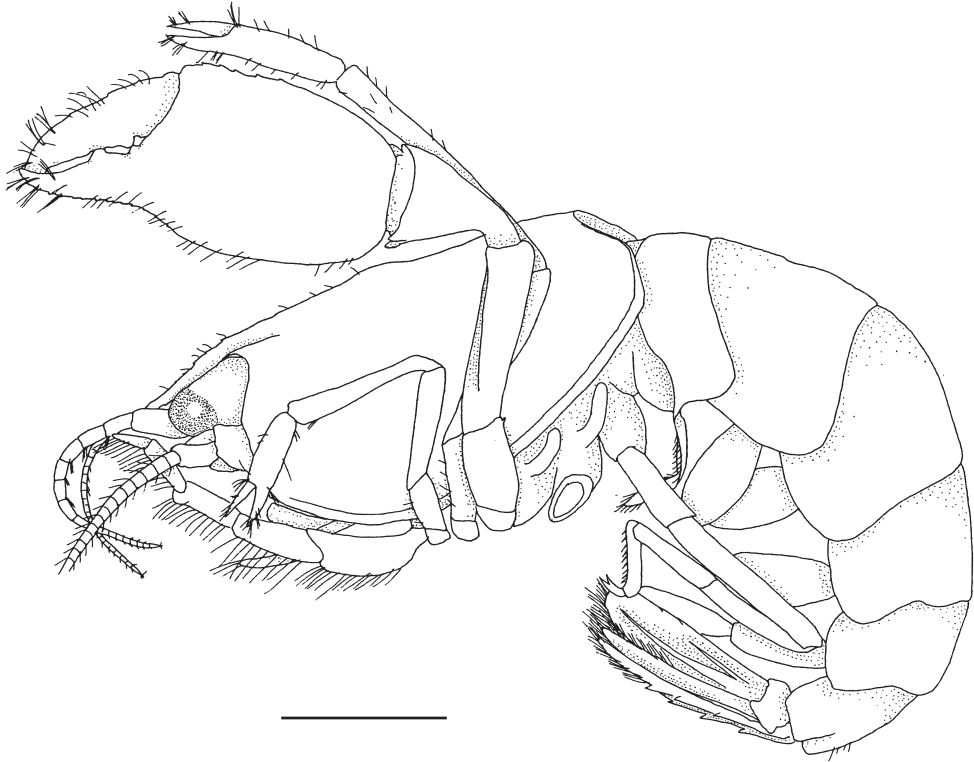


FIG. 16. — *Spongicola levigatus* Hayashi & Ogawa, 1987, ovig. ♀ 2.1 mm, Loyalty Islands (MUSORSTOM 6, stn DW 412) (MNHN-Na 16312), entire animal in lateral view. Scale bar: 1 mm.

Okinawa Islands, 26°30.72'N, 127°25.99'E, 439 m, 26.V.2002, 1 ♀ 2.0 mm (NSMT-Cr).

Indonesia. KARUBAR, stn CP 05, Kai Islands, 05°49'S, 132°18'E, 296-299 m, 22.X.1991, 1 spec. (not measured) (MNHN-Na 16307). — Stn CP 36, Kai Islands, 06°05'S, 132°44'E, 268-210 m, 27.X.1991, 1 ♂ 2.8 mm, 1 ovig. ♀ 2.8 mm, 3 specs (damaged) (MNHN-Na 16308).

New Caledonia. BIOCAL, stn DW 83, 20°35.07'S, 166°53.99'E, 460 m, 6.IX.1985, 1 ♂ 3.9 mm, 2 ovig. ♀♀ 4.4, 4.6 mm (MNHN-Na 11981).

MUSORSTOM 4, stn CP 214, 22°53.80'S, 167°13.90'E, 425-440 m, 28.IX.1985, 5 ♂♂ 2.9-4.4 mm, 7 ovig. ♀♀ 3.3-4.7 mm, 2 ♀♀ 3.2, 4.4 mm (MNHN-Na 11987). — Stn DW 230, 22°52.50'S, 167°11.80'E, 390-420 m, 30.IX.1985, 3 ovig. ♀♀ (not measured) (MNHN-Na 11974). — Same data, 1 ♂ 3.3 mm, 2 ovig. ♀♀ 3.0, 3.2 mm (MNHN-Na 11985).

SMIB 1, stn DW 02, 22°51.9'S, 167°13'E, 415 m, 5.II.1986, 1 ♂ 3.1 mm (MNHN-Na 16309).

MUSORSTOM 5, stn CP 332, 20°17.44'S, 158°48.86'E, 400 m, 15.X.1986, 1 ♂ 2.7 mm, 1 ovig. ♀ 2.5 mm (MNHN-Na 16310).

BIOGEOCAL, stn DW 307, 20°35.38'S, 166°55.25'E, 470-

480 m, 1.V.1987, 1 ♀ 5.6 mm (MNHN-Na 11961).

(Project name not indicated), DP 184, 1 ♂ 2.0 mm, 1 ovig. ♀ 1.8 mm (MNHN-Na 16345).

Loyalty Islands. MUSORSTOM 6, stn DW 391, 20°47.35'S, 167°05.70'E, 390 m, 13.II.1989, 4 ♂♂ 2.8-3.3 mm, 5 ovig. ♀♀ 2.8-3.4 mm, 1 ♀ 2.6 mm (MNHN-Na 16311). — Stn DW 406, 20°40.65'S, 167°06.80'E, 373 m, 15.II.1989, 2 ♂♂ 2.4, 2.8 mm, 1 ovig. ♀ 2.4 mm (MNHN-Na 11963). — Stn DW 412, 20°40.60'S, 167°03.75'E, 437 m, 3 ♂♂ 1.8-2.6 mm, 1 ovig. ♀ 2.1 mm (MNHN-Na 16312). — Stn DW 487, 21°23.30'S, 167°46.40'E, 23.II.1989, 3 ovig. ♀♀ 2.8 mm (2 specs not measured) (MNHN-Na 11965).

Wallis and Futuna Islands. MUSORSTOM 7, stn CP 609, 13°21.5'S, 176°08.5'W, 430 m, 26.V.1992, 1 ♂ 2.9 mm, 1 ovig. ♀ 4.1 mm (MNHN-Na 16313).

Tonga. BORDAU 2, stn CP 1511, Tongatapu, 21°08'S, 175°22'W, 384-402 m, 31.V.2000, 3 ♂♂ 2.4-3.0 mm, 1 ovig. ♀ 2.6 mm (MNHN-Na 16314).

DISTRIBUTION. — Japan, Indonesia, New Caledonia, Loyalty Islands, Wallis and Futuna Islands and Tonga, 200-480 m (Figs 36; 38; Table 6).

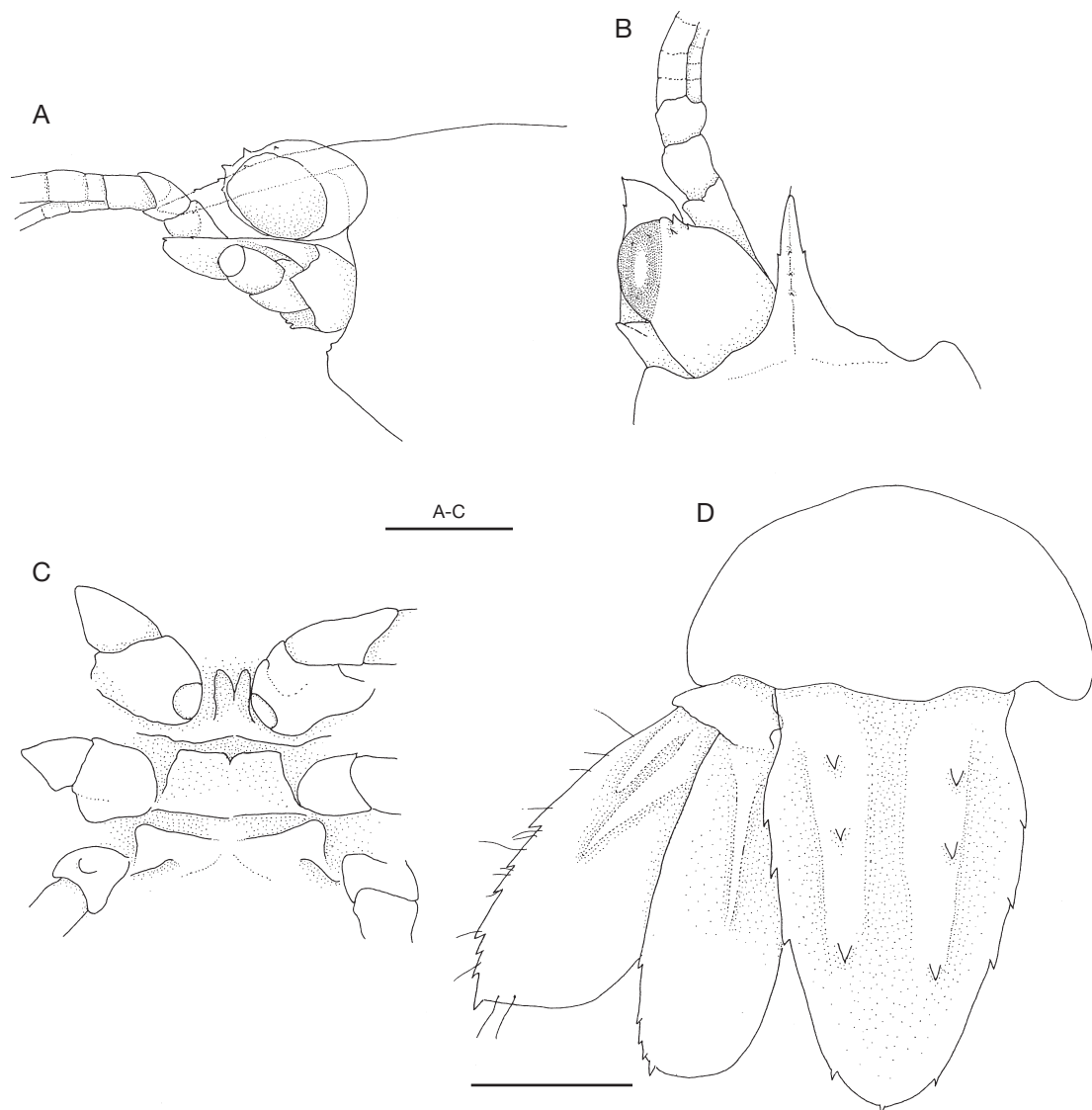


FIG. 17. — *Spongicola levigatus* Hayashi & Ogawa, 1987, ovig. ♀ 2.1 mm, Loyalty Islands (MUSORSTOM 6, stn DW 412) (MNHN-Na 16312): **A**, anterior part of carapace and cephalic appendages, lateral view; **B**, same, dorsal view (right eye and antennae omitted); **C**, thoracic prominences on sixth to eighth somites, ventral view; **D**, sixth pleonal somite, telson and left uropod, dorsal view (right uropod and marginal setae omitted). Scale bars: 0.5 mm.

HOSTS. — *Hyalonema* sp., *Semperella* sp., *Pheronema semiglobosum* and *Euplectella* sp. (Table 7).

DESCRIPTION OF FEMALES

Rostrum (Fig. 17A, B) 0.22-0.37 of carapace length, straight, slightly directed downward,

reaching distal margin of antennal scale; dorsal margin nearly straight, unarmed or armed with 1-7 tiny denticles; ventral margin unarmed or armed with 1-3 tiny denticles; ventrolateral ridge sharp, unarmed or armed with 1 spinule at midlength. Carapace (Fig. 17A, B) without postrostral median

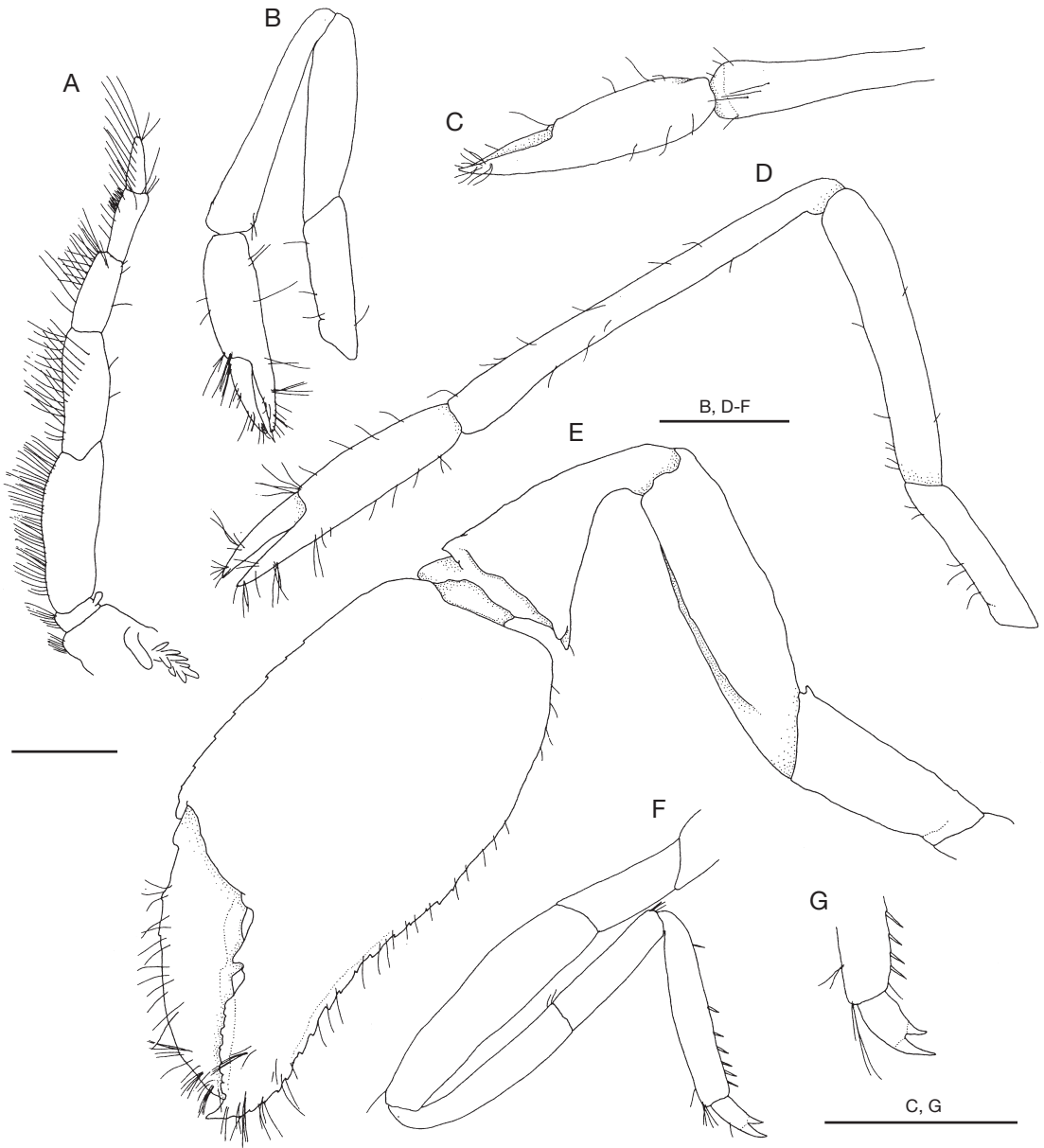


FIG. 18. — *Spongicola levigatus* Hayashi & Ogawa, 1987, ovig. ♀ 2.1 mm, Loyalty Islands (MUSORSTOM 6, stn DW 412) (MNHN-Na 16312), left thoracic appendages: **A**, third maxilliped, lateral view; **B**, first pereopod, lateral view; **C**, same, chela and carpus, ventral view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view. Scale bars: 0.5 mm.

ridge; postrostral submedian, hepatic and anterolateral spines absent; antennal spine absent or rudimentary; anterolateral margin smooth or with

a few minute denticles; branchial region smooth; pterygostomial angle weakly produced; cervical groove absent.

Sixth thoracic sternite (Fig. 17C) with moderately slender lobes, each tip rounded, margins unarmed. Seventh sternite with broadly triangular plates separated by shallow median notch on anterior margin, anterolateral angle blunt or subacute, lateral margin smooth. Eighth sternite with rounded lobes.

Pleon (Fig. 16) weakly depressed dorsoventrally. First somite with relatively low transverse carina, its margin not markedly overhanging weakly depressed anterior section; anteroventral projection very small. Second somite without distinct transverse carina. First to fifth pleura unarmed. Sixth somite (Fig. 17D) widened posteriorly, unarmed. Telson (Fig. 17D) about 1.6 times longer than broad; dorsal surface devoid of proximal spines, dorsolateral carinae each bearing 2 or 3 spines; lateral margins each with shallow subproximal concavity, and with row of 2-5 spines thereafter; posterolateral spine usually present; posterior margin convex, unarmed or armed with median spine.

Cornea (Fig. 17A, B) narrower than eyestalk, darkly pigmented; eyestalk unarmed or armed with 1 or 2 spinules dorsally and 1-3 spinules or tubercles mesially, these spinules occasionally rudimentary. Antennular peduncle (Fig. 17A, B) overreaching tip of antennal scale by length of third segment, all segments unarmed; first segment 3.0 times longer than second segment; stylocerite subacute, straight. Antennal basicerite (Fig. 17A, B) stout, with distolateral margin produced in triangular projection, and occasionally with 1 additional small denticle or spinule on ventrolateral margin; antennal scale somewhat reduced, subsemicircular, about 0.2 of carapace length, about twice longer than wide; lateral margin slightly concave or nearly straight, armed with 2-5 teeth including distolateral tooth, dorsal surface with 2 distinct longitudinal carinae; carpopercite short, not reaching distal margin of first segment of antennular peduncle, unarmed.

Third maxilliped (Fig. 18A) overreaching antennal scale by length of dactylus and propodus; dactylus 0.8 of carpal length; propodus nearly subequal in length to carpus; carpus 0.6 of meral length; merus about 0.8 of ischial length; ischium unarmed or armed with 1-3 small spines on dorsolateral margin, ventral margin unarmed. Exopod rudimentary.

First pereopod (Fig. 18B, C) overreaching tip of antennal scale by length of chela, with rudimentary grooming apparatus (Fig. 18C); dactylus 0.4 of chela length; carpus 1.2 of chela length; merus 0.8 of carpal length; ischium 0.8 of meral length. Second pereopod (Fig. 18D) 2.1 times longer than carapace, overreaching antennal scale by length of chela and carpus; dactylus 0.4 of chela length; carpus 1.6 of chela length; merus 0.7 of carpal length; ischium 0.6 of meral length. Third pereopod (Fig. 18E) overreaching antennal scale by length of chela and carpus; chela 0.8-1.3 of carapace length; dactylus about half of chela length, with row of a few small denticles or tubercles on proximal half of dorsal margin; fixed finger with row of small teeth or denticles extending onto midlength of palm; palm broad, about 1.3 times longer than wide, dorsal margin with row of tiny denticles, lacking setae, ventral margin with row of sparse short setae; carpus broadened distally, 1.4 times longer than wide, 0.4 of chela length, unarmed on lateral surface; merus 1.5 of carpal length, unarmed; ischium 0.6 of meral length, with small dorsodistal spine, ventral margin smooth. Fourth pereopod (Fig. 18F, G) overreaching tip of antennal scale by length of dactylus and propodus; dactylus (Fig. 18G) 0.3 of propodal length, moderately broad, 2.7 times longer than wide, clearly biunguiculate, ventral margin unarmed; propodus 0.6 of carpal length; carpus often subdivided into 2 articles, often armed with 1 small spine at ventrodistal margin; merus 0.8 of carpal length; ischium about half of meral length. Fifth pereopod similar to fourth.

Exopod of uropod (Fig. 17D) with 5-12 teeth on lateral margin, dorsal surface with 2 smooth longitudinal carinae; endopod with 3-11 teeth on lateral margin.

Eggs counting 3-137, diameter 0.4-0.7 mm (Table 5).

MALE CHARACTERISTICS

Rostrum 0.25-0.38 of carapace length. Sixth thoracic sternite (Fig. 19A) with slender lobes, separated by narrow median incision, each terminating in subacute tip, margins unarmed or irregularly serrated; seventh sternite with broad triangular lobes, each terminating in anterolateral angle rounded, margins sinuous; eighth sternite with subrectangular

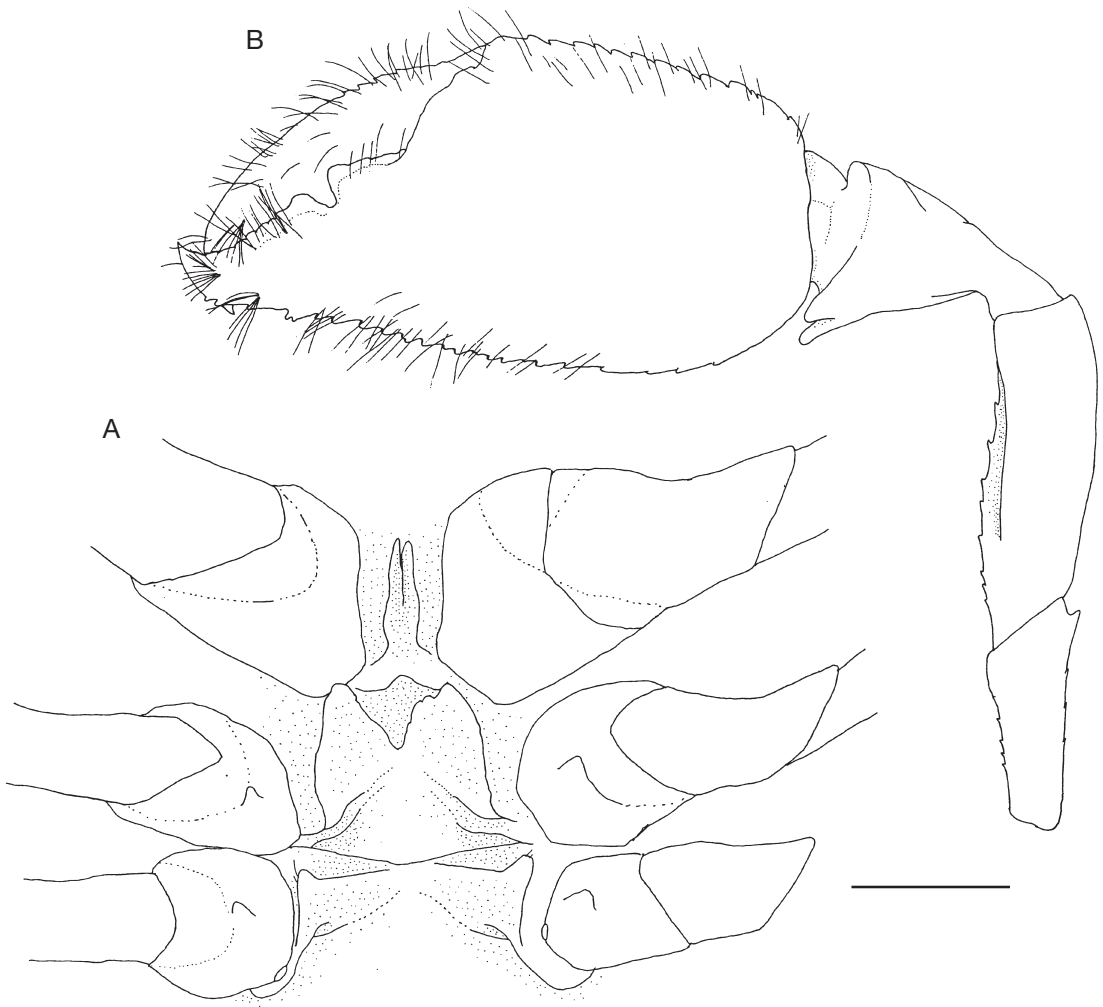


FIG. 19. — *Spongiicola levigatus* Hayashi & Ogawa, 1987, ♂ 3.1 mm, Loyalty Islands (MUSORSTOM 6, stn DW 391) (MNHN-Na 16311): **A**, thoracic prominences on sixth to eighth somites, ventral view; **B**, left third pereopod, lateral view. Scale bar: A, 0.5 mm; B, 1 mm.

lobes, smaller than those of seventh somite, each anterolateral angle rounded. Merus and ischium of third pereopod (Fig. 19B) with row of small teeth or denticles on ventral margins. Chela of third pereopod 1.4–1.7 of carapace length.

REMARKS

Specimens from various localities are generally similar. However, three ovigerous females from

Loyalty Islands (MUSORSTOM 6, stn CP 412 and DW 487; and project name not indicated, DP 184) have much fewer eggs than the other ovigerous females do (3–7 versus 137). The former specimens are generally smaller than the latter (1.8–2.1 mm versus 2.0–4.1 mm). Furthermore, in the small ovigerous females, the carpi of the fourth and fifth pereopods are always entire, whereas in other specimens, they are usually subdivided, although

this character is intraspecifically variable in other congeners (this study). For the time being, the small ovigerous females are provisionally referred to *S. levigatus*, because we could not find other morphological differences warranting to separate them from *S. levigatus* as a distinct species.

In the original description of *S. levigatus*, Hayaishi & Ogawa (1987) stated that the carpus of the first pereopod bore small subterminal spine on the inner side. However, our study revealed that there are actually a few stiff setae on the ventromesial portion of the carpus of the first pereopod, instead of a spine.

Spongicola parvispinus Zarenkov, 1990

Spongicola parvispina Zarenkov, 1990: 218. — Saito & Takeda 2003: 120.

TYPE MATERIAL. — Holotype: RV *Prof. Stockman*, stn 2034, Sala-y-Gomes ridges, southeastern Pacific, 470-485 m, ovig. ♀ 9.0 mm. Not examined.

Paratypes: same data as holotype, 4 ♂♂, 7 ovig. ♀♀. Not examined.

MATERIAL EXAMINED. — None.

DISTRIBUTION. — Sala-y-Gomes ridges, 470-485 m (Fig. 36; Table 6).

HOST. — Unknown.

DIAGNOSIS. — Derived from the original description of Zarenkov (1990). Rostrum armed with 3 or 4 teeth on dorsal margin, reaching midlength of antennal scale; ventral margin smooth. Carapace with postrostral submedian spine; hepatic spine present; 3 anterolateral spines forming single oblique row; branchial region smooth; cervical groove indistinct. Second pleonal somite without transverse carina; sixth somite lacking lateral spines. Telson broadly triangular, with 1 spine on each lateral margin; posterolateral angle not delimited, unarmed; posterior margin unarmed. Cornea well developed, darkly pigmented. Antennal scale moderately long, with 3 or 4 teeth on lateral margin. Third maxilliped with merus and ischium unarmed; exopod rudimentary. Third pereopod with row of teeth on dorsal and ventral margins of palm; carpus unarmed; merus with row of small denticles on ventromesial margin; ischium with large dorsodistal spine, and with row of small teeth on dorsal and ventral margins. Fourth and fifth pereopods with dactyli biunguiculate; carpi and propodi entire. Uropodal exopod serrated on lateral margin; endopod unarmed.

REMARKS

We have had no access to the type series of this species. No other specimen referable to *S. parvispinus* has been available for this study. Nevertheless, *S. parvispinus* is easily distinguished from all other congeners by the smooth lateral margin of the uropodal endopod, and the absence of the posterolateral and posteromedian spines of the telson (Zarenkov 1990).

Spongicola robustus n. sp. (Figs 20-24)

TYPE MATERIAL. — Holotype: RV *Vitiaz II*, stn 2809, Mauritius, 10°29.7'S, 61°12.4'E, 115-110 m, ovig. ♀ 5.9 mm (MNHN-Na 16315).

Paratypes: same data as holotype, 1 ♂ 7.1 mm (MNHN-Na 16316).

Mozambique, RV *Vitiaz II*, stn 1376, position not indicated, 1 ovig. ♀ 6.5 mm (MNHN-Na 16317). — Stn 2635, S of Mozambique, 25°05.0'S, 35°15.3'E, 230-210 m, 1 ♂ 4.7 mm, 1 ♀ 6.0 mm (MNHN-Na 16318).

SAM 18, RV *Algoa*, 23°28'S, 35°43'E, 185 m, 12.VI.1994, 2 ♀♀ 6.2, 6.5 mm (MNHN-Na 16346).

ETYMOLOGY. — From the Latin *robustus* (robust), referring to the relatively robust body of this new species.

DISTRIBUTION. — Western Indian Ocean from Mauritius and Mozambique, 110-230 m (Figs 36; 38; Table 6).

HOST. — *Regadrella* sp. (Table 7).

DESCRIPTION OF FEMALES

Rostrum (Fig. 21A, B) 0.37-0.41 of carapace length, directed forward, narrow triangular in dorsal view, overreaching midlength of antennal scale; dorsal margin slightly arched, armed with 6-12 teeth, all located anterior to orbital margin; ventral margin armed with 1 or 2 tiny subterminal teeth; ventrolateral ridge sharp, unarmed or armed with 1 or 2 minute teeth. Carapace (Fig. 21A, B) with postrostral median ridge extending to level of postrostral submedian spines; postrostral submedian spine relatively slender, straight; antennal spine relatively large, acuminate; hepatic spine relatively large; 3-7 anterolateral spines relatively large, forming obliquely vertical row; anterolateral margin with 2-6 small spines; pterygostomial angle moderately produced, exceeding tip of antennal spine; branchial region smooth; cervical groove distinct.

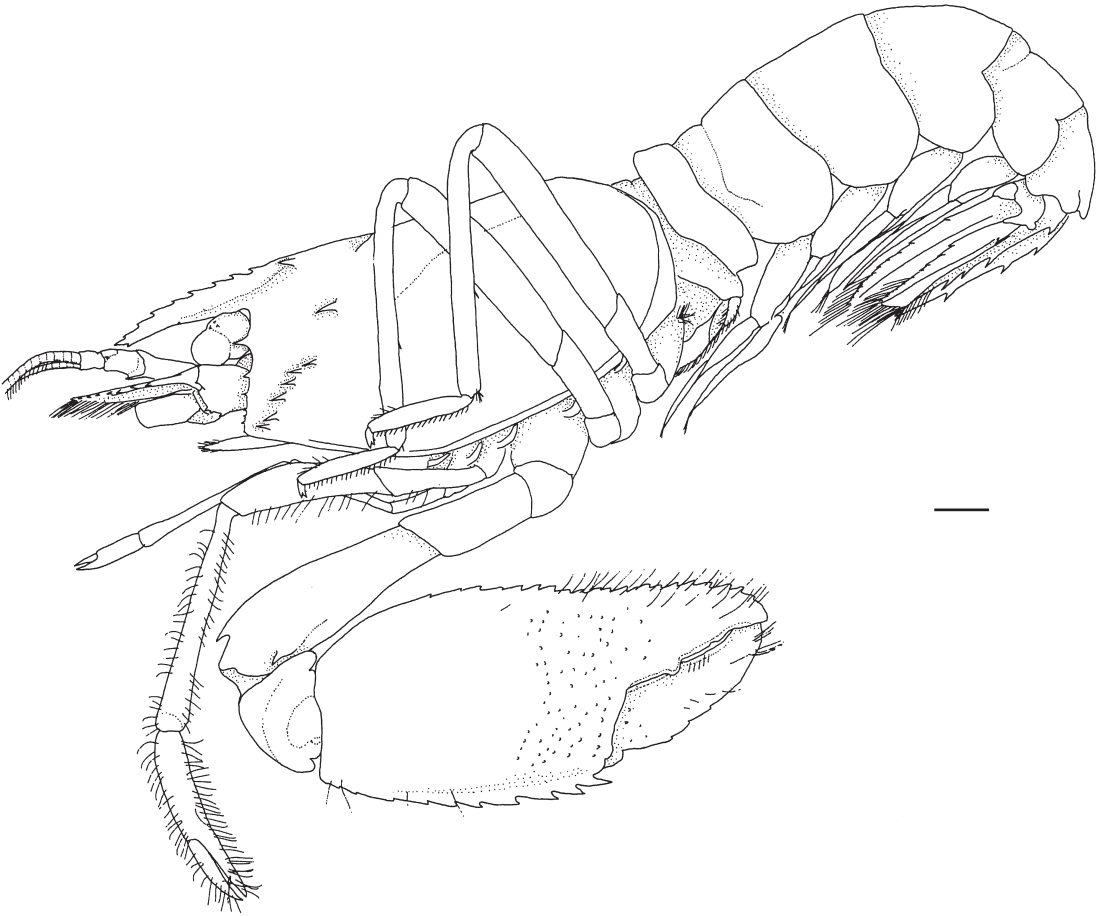


FIG. 20. — *Spongicola robustus* n. sp., holotype ovig. ♀ 5.9 mm, off Mauritius (RV *Vitiaz II*, stn 2809) (MNHN-Na 16315), entire animal in lateral view. Scale bar: 1 mm.

Sixth thoracic sternite (Fig. 21C) with moderately slender lobes separated by narrow median incision, each terminating in acute or subacute point; lateral margins sinuous, smooth. Seventh sternite with broad subtriangular lobes separated by moderately deep median notch, each anterolateral angle weakly produced, acute or subacute. Eighth sternite with triangular lobes, anterolateral angles weakly produced, terminating in acute or subacute point.

Pleon moderately depressed dorsoventrally. First somite with distinct transverse carina, its margin overhanging deeply depressed anterior section; anteroventral projection small. Second somite without distinct transverse carina, only shallow

transverse groove evident. First pleuron (Fig. 20) unarmed on ventral margin of posterior section; second to fifth pleura each unarmed or armed with tiny teeth or denticles on ventral margins. Sixth somite (Fig. 21D) widened posteriorly, lacking lateral spines; pleuron unarmed. Telson (Fig. 21D) about 1.5 times longer than broad; dorsal surface often with pair of proximal spines, dorsolateral carinae each bearing 3 or 4 spines; lateral margins each with shallow subproximal concavity, and armed with 1 small submarginal spine and row of 2-5 spines thereafter; posterolateral spines relatively large; posterior margin convex, with posteromedian spine.

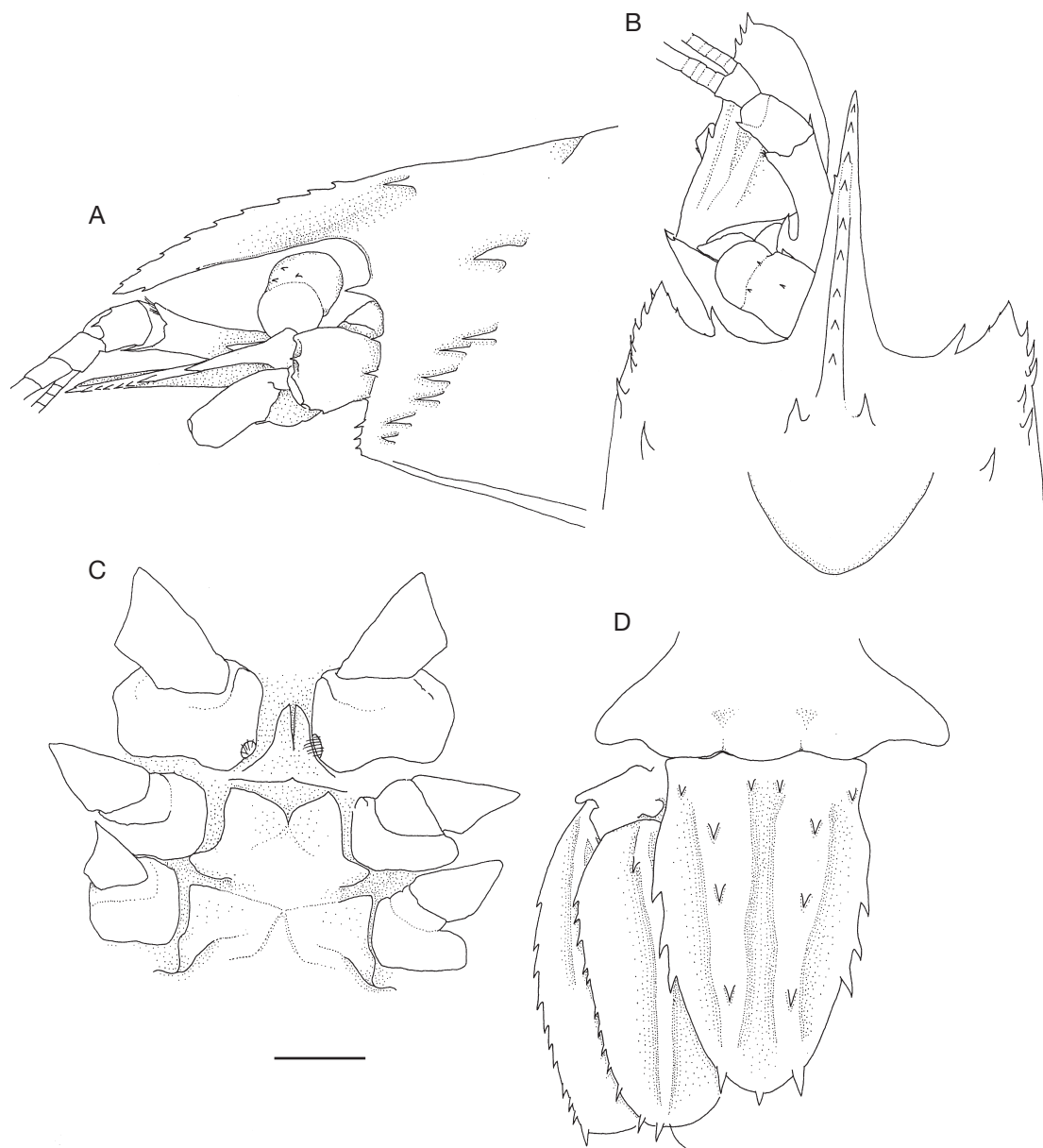


FIG. 21. — *Spongiicola robustus* n. sp., holotype ovig. ♀ 5.9 mm, off Mauritius (RV *Vitiaz II*, stn 2809) (MNHN-Na 16315): **A**, anterior part of carapace and cephalic appendages, lateral view (setae omitted); **B**, same, dorsal view (right eye and antennae omitted); **C**, thoracic prominences on sixth to eighth somites, ventral view; **D**, sixth pleonal somite, telson and left uropods, dorsal view (right uropod and marginal setae omitted). Scale bar: 1 mm.

Cornea (Fig. 21A, B) moderately large, as wide as eyestalk, opaque; eyestalk not particularly inflated basally, armed with 3 spinules dorsally and 1

spinule mesially. Antennular peduncle (Fig. 21A, B) reaching distal 0.3 of antennal scale; first segment 1.7 times longer than length of distal 2 segments

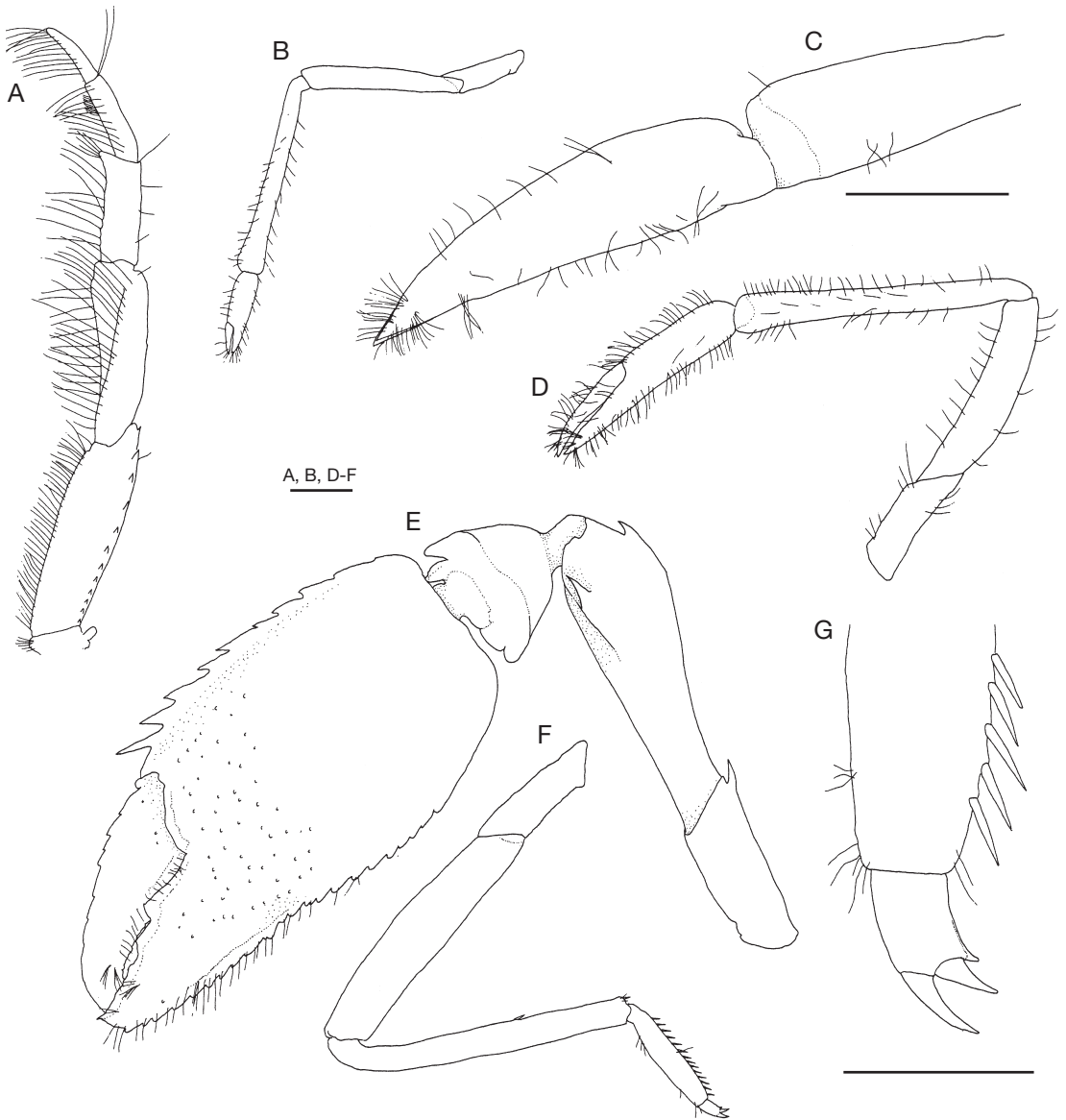


FIG. 22. — *Spongiicola robustus* n. sp., holotype ovig. ♀ 5.9 mm, off Mauritius (RV *Vitiaz II*, stn 2809) (MNNHN-Na 16315), left thoracic appendages: **A**, third maxilliped, lateral view; **B**, first pereopod, lateral view; **C**, same, chela and carpus, ventral view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view. Scale bars: A, B, D-F, 1 mm; C, G, 0.5 mm.

combined, unarmed or armed with 1 spine on distomesial margin; stylocerite acuminate, straight or slightly curved mesially; second segment with a few small spines on distolateral margin. Antennal

basicerite (Fig. 21A, B) stout, with small dorsolateral spine and 3 or 4 additional spinules or denticles on ventrolateral margin; antennal scale subsemicircular, about 0.4 of carapace length, 1.9 times

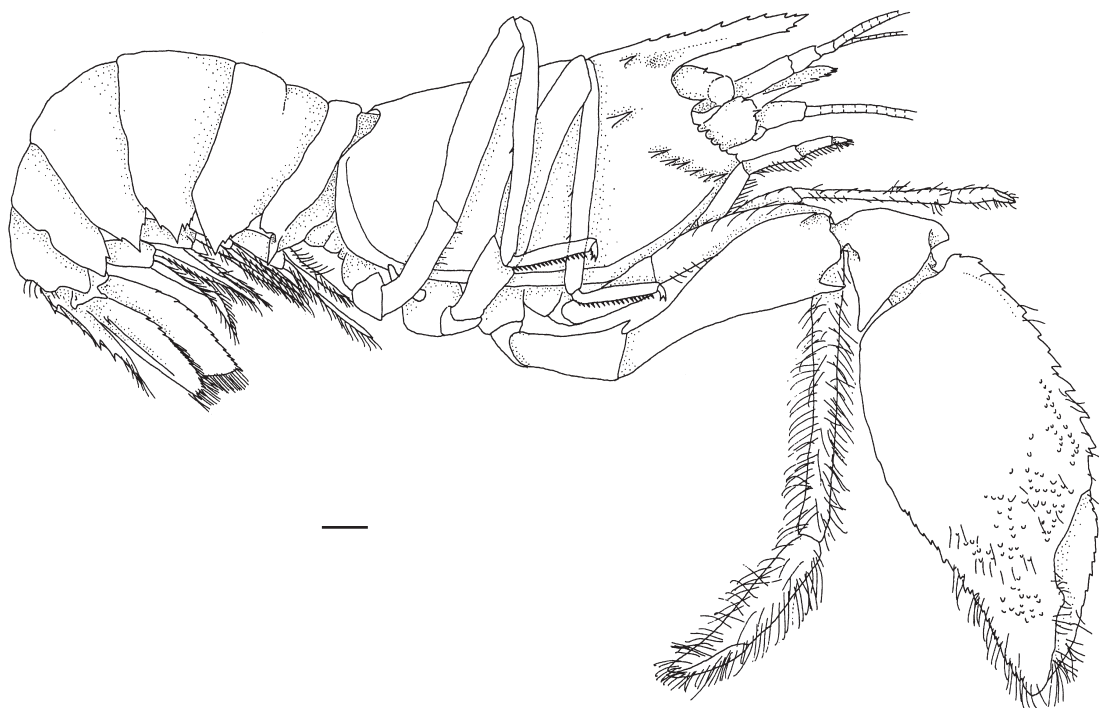


FIG. 23. — *Spongicola robustus* n. sp., paratype ♂ 7.1 mm, off Mauritius (RV *Vitiaz II*, strn 2809) (MNHN-Na 16316), entire animal in lateral view. Scale bar: 1 mm.

longer than wide; lateral margin slightly concave or nearly straight, armed with 5-8 teeth including distolateral tooth, dorsal surface with 2 distinct longitudinal carinae; carpocerite moderately short, reaching to distal margin of first segment of antennular peduncle, unarmed.

Third maxilliped (Fig. 22A) overreaching antennal scale by length of dactylus; dactylus 0.7 of propodal length; propodus subequal in length to carpus; carpus 0.6 of meral length, ventrodistal margin distinctly produced; merus 0.8 length of ischium, unarmed; ischium with 2-12 spines on dorsolateral margin, ventral margin unarmed. Exopod rudimentary.

First pereopod (Fig. 22B, C) overreaching antennal scale by length of chela, with rudimentary grooming apparatus (Fig. 22C); chela and carpus with sparse short setae; dactylus 0.4 of chela length; carpus about 2.4 of chela length; merus 0.8 of carpal length; ischium about half of meral length. Second pereopod (Fig. 22D) 2.1-2.2 times longer than carapace, overreaching antennal scale by length

of chela and half of carpus; chela and carpus with scattered short setae on surfaces; dactylus 0.5 of chela length; carpus 1.4 of chela length; merus 0.7 of carpal length; ischium 0.6 of meral length. Third pereopod (Fig. 22E) overreaching antennal scale by length of chela and carpus; chela 1.2-1.4 length of carapace; dactylus 0.4 of chela length, with row of spinules or denticles on dorsal margin; fixed finger with row of small spines or denticles extending onto palm beyond midlength and row of short setae; palm 1.3 times longer than wide, with row of acute teeth increasing in size distally on dorsal margin; lateral surface with numerous scattered granules on distal half; carpus broadened distally, 1.1 times longer than wide, 0.3 of chela length, unarmed on lateral surface; merus 0.4 of carpal length, armed with moderately small subdistal spine on dorsal margin and large subdistal spine on ventrolateral ridge, ventral margin smooth; ischium 0.6 of meral length, with moderately small dorso-distal spine. Fourth pereopod (Fig. 22F, G) over-

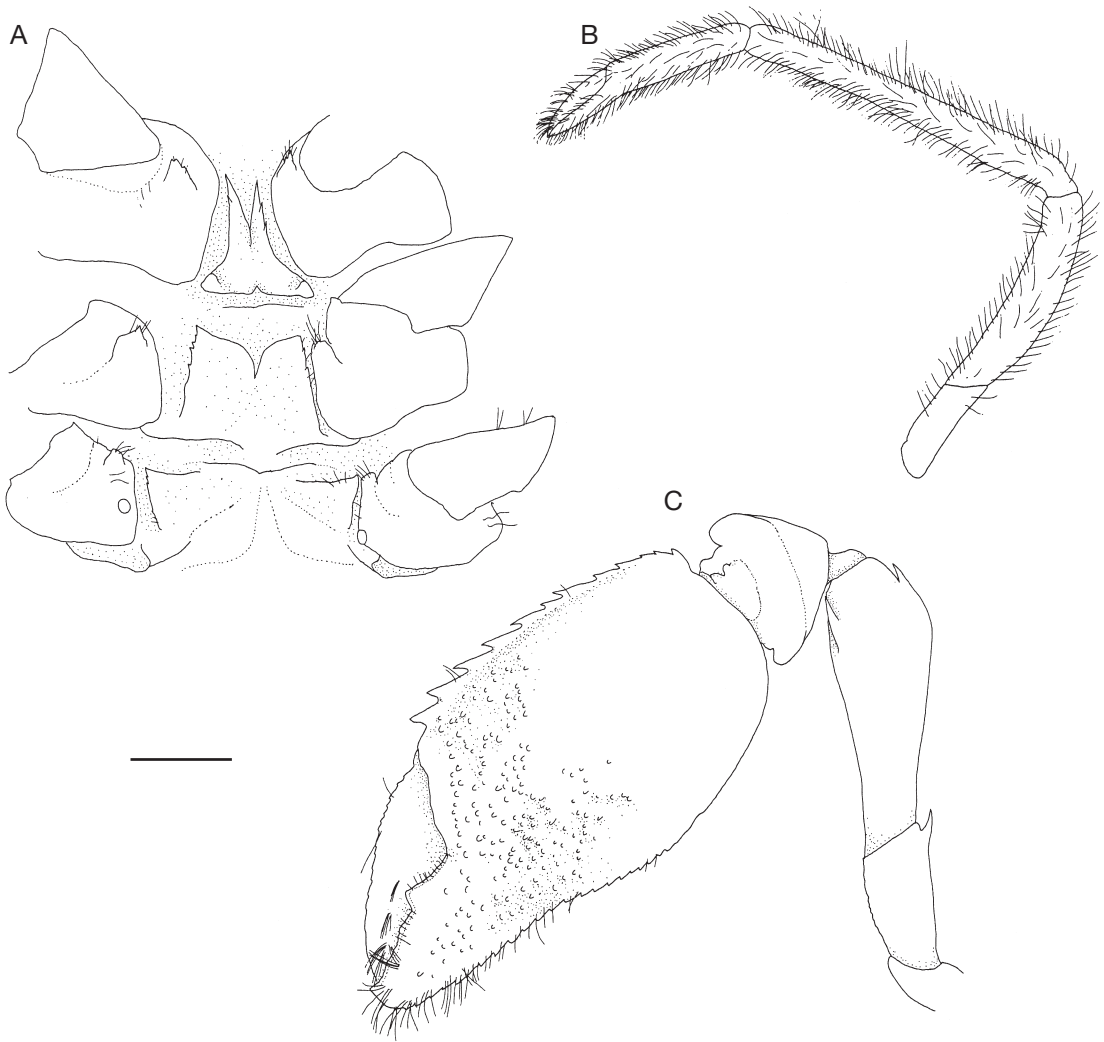


FIG. 24. — *Spongicola robustus* n. sp., paratype ♂ 7.1 mm, off Mauritius (RV *Vitiaz II*, stn 2809) (MNH-Na 16316): **A**, thoracic prominences on sixth to eighth somites, ventral view; **B**, left second pereopod, lateral view; **C**, left third pereopod, lateral view. Scale bar: 0.5 mm.

reaching antennal scale by half of carpus; dactylus (Fig. 22G) 0.2 of propodal length, relatively broad, 2.4 times longer than wide, clearly biunguiculate, ventral margin with relatively large accessory tooth at base of ventral unguis; propodus about half of carpal length; carpus longest, entire or subdivided into 2 articles, with 1 small spine at ventrodistal margin and 1 spine at distal to midlength of ventral margin; merus 0.8 of carpal length; ischium half

of meral length, unarmed. Fifth pereopod similar to fourth pereopod.

Exopod of uropod (Fig. 21D) with 10-16 teeth on lateral margin, dorsal surface with 2 smooth longitudinal carinae; endopod with 11-13 acute teeth on lateral margin and 1 subproximal spine on middorsal carina.

Eggs counting 50, diameter 0.7-0.9 mm (holotype female) (Table 5).

MALE CHARACTERISTICS

Rostrum (Fig. 23) 0.51 of carapace length. Sixth thoracic sternite (Fig. 24A) with slender, acuminate lobes clearly separated by deep U-shaped median notch, each lateral margin with 1 or 2 spinules or denticles. Seventh sternite with moderately broad, subtriangular lobes, each terminating in acute tip, each lateral margin denticulate. Eighth sternite with triangular lobes, smaller than those on seventh sternite, each tip acute, lateral margin minutely denticulate. First pleonal somite (Fig. 23) with prominent ventral projection supported by short, but distinct ridge, terminating in subacute point. Second to sixth pleonal somites (Fig. 23) with pleura unarmed or armed with small teeth or denticles on margins. Second pereopod (Fig. 24B) 2.4-2.6 times longer than carapace. Chela of third pereopod (Fig. 24C) 1.5-1.6 of carapace length; palm with more numerous spinules or granules on distal part of lateral surface than in females.

REMARKS

Spongiicola robustus n. sp. is very similar to *S. venustus*. Shared characteristics include: the dorsal margin of the rostrum is slightly arched; the grooming apparatus of the first pereopod is rudimentary; the second pereopod is covered with numerous short setae; and the merus of the third pereopod is armed with a large subdistal spine on the ventrolateral margin. The two species can be distinguished by minor morphological traits. The dorsal rostral series is restricted to the rostrum proper in *S. robustus* n. sp. In contrast, in *S. venustus*, one or two teeth are present on the carapace posterior to the level of the orbital margin. The second segment of the antennular peduncle is armed with two small teeth in *S. robustus* n. sp., rather than being unarmed in *S. venustus*. The second pereopod is proportionally longer in *S. robustus* n. sp. than in *S. venustus* (2.1-2.2 times longer than the carapace versus 1.2-2.1 in females, and 2.4-2.6 versus 1.5-2.2 in males). The spination of the carapace and third pereopod are much stronger in *S. robustus* n. sp. than in *S. venustus*. Furthermore, the cornea is opaque in *S. robustus* n. sp., whereas darkly pigmented in *S. venustus*.

Spongiicola venustus de Haan, 1844
(Figs 25-29)

Spongiicola venusta de Haan, 1844: pl. 46 fig. 9; 194, pl. P. — Herklots 1861: 148. — Miers 1878: 507, pl. 24 figs 1, 2. — Bate 1888: 213, figs 41, 42, pl. 29. — Ortmann 1890: 539. — Thallwitz 1892: 50. — Stebbing 1893: 212. — Caullery 1896: 382. — Ijima 1901: 87, 201, 215. — Thompson 1901: 18. — Doflein 1902: 642. — Bouvier 1905: 983; 1908a: 889; 1908b: 151. — A. Milne-Edwards & Bouvier 1909: 264. — Kemp 1910: 409. — Balss 1914: 74. — Parisi 1919: 92. — Arndt 1933: 251. — Yokoya 1933: 44. — Estampador 1937: 497. — Holthuis 1946: 62, pl. 3j. — Fujino & Miyake 1970: 302. — Holthuis & Sakai 1970: 294. — Kim 1977: 322, fig. 144; pl. 56, fig. 70. — de Saint Laurent & Cleve 1981: 169, figs 1, 8a-h. — Miyake 1982: 19, pl. 7. — Takeda 1982: 38. — Tung *et al.* 1988: 21, fig. 19. — Yamaguchi & Baba 1993: 213, fig. 35. — Saito & Takeda 2003: 120.

Spongiicola venustus Holthuis 1993: 310, fig. 305.

TYPE MATERIAL. — Lectotype (designated by Yamaguchi & Baba 1993): Japan, 1823-1834, coll. Ph. F. von Siebold and H. Bürger, ♂ (RMNH D 1132). Not examined. Paralectotypes: same data as lectotype, 1 ♀ (RMNH D 1132); 6 specs (RMNH D 2921). Not examined.

MATERIAL EXAMINED. — **Japan.** Off Kominato, Boso Peninsula, 2 ♂♂ 6.3, 9.0 mm, 1 ♀ 8.3 mm (TUMT). — Sagami Bay, 8 ♂♂ 4.3-7.9 mm, 4 ♀♀ 2.7-8.0 mm, 7 specs (not measured) (ZUMT). — Off Sunosaki, 150-200 m, 13.VII.1894, 1 ♂ 7.9 mm, 1 ♀ 8.0 mm (ZUMT). — Off Kii, II.1973, 1 ♂ 10.5 mm (NSMT-Cr 4859); 1 ♀ 10.4 mm (NSMT-Cr 4860). — Off Minabe, Kii Peninsula, III.1944, 4 ♂♂ 6.7-9.6 mm, 2 ♀♀ 7.3, 8.6 mm (SMBL, Ordinary Specimen Macrura-18). — Tosa Bay, I.II.1988, 8 ♂♂ 6.7-8.8 mm (NSMT-Cr 10072), 5 ♀♀ 7.1-8.8 mm (NSMT-Cr 10959). — 12 miles NE of Okino-shima Island, Genkai-nada Sea, 113 m, 15.VII.2004, 1 ♂ 8.5 mm, 1 ♀ 6.5 mm, 6 ovig. ♀♀ 5.7-8.0 mm (PNPA). — Off Ushibuka, Amakusana, western Kyushu, depth not recorded, 17.III.1989, coll. M. Osawa, 1 ♂ 6.9 mm, 1 ♀ 6.8 mm (CBM-ZC 977). — Off Amakusa, Kumamoto Prefecture, III.1988, 1 ♀ 7.3 mm (NSMT-Cr 12157). — Okinawa Island, Ryukyu Islands, 10.IX.1986, 1 ♂ 8.8 mm, 1 ovig. ♀ 8.4 mm (PNPA).

Philippines. MUSORSTOM 1, stn 4, 14°01.8'N, 120°17.2'E, 182-194 m, 19.III.1976, 1 ovig. ♀ 8.3 mm (MNHN-Na 2917). — Stn 15, 200-191 m, 1 ovig. ♀ 9.3 mm (MNHN-Na 2918). — Stn 32, 14°02.2'N, 120°17.7'E, 193-184 m, 23.III.1976, 1 ovig. ♀ 8.0 mm (MNHN-Na 2919). — Stn 41, 25.XI.1980, 6 ♀♀ 6.9-7.8 mm, 4 ♂♂ 7.4-9.0 mm (MNHN-Na 3891). — Stn 51, 13°49.4'N, 120°04.2'E, 200-170 m, 25.III.1976,



FIG. 25. — *Spongicola venustus* de Haan, 1844, ♀ 8.0 mm, off Sunosaki, Sagami Sea, Japan (ZUMT), entire animal in lateral view. Scale bar: 1 mm.

1 ♂ 8.3 mm (MNHN-Na 2921).
 MUSORSTOM 3, stn 98, W of Luzon, 14°00.2'N, 120°17.9'E, 180-190 m, 1.VI.1985, 1 ♂ 7.6 mm, 1 ovig. ♀ 7.8 mm (MNHN-Na 16319). — Stn 103, W of Luzon, 14°00.4'N, 120°18.15'E, 178-185 m, 1.VI.1985, 1 ♀ 3.0 mm, 1 ♂ 1.7 mm (MNHN-Na 16320). — Stn 108, W of Luzon, 14°01.1'N, 120°17.9'E, 181-174 m, 2.VI.1985, 2 ♂♂ 7.5, 7.7 mm, 1 ovig. ♀ 7.5 mm (MNHN-Na 16321). — Stn 116, SW of Mindoro, 12°32.2'N, 120°46.4'E, 804-812 m, 3.VI.1985, 2 ♂♂ 7.0, 10.6 mm (MNHN-Na 16322). — Stn 124, between Mindoro and Panay, 12°02.6'N, 121°35.5'E, 114-111 m, 4.VI.1985, 1 ♂ 6.7 mm (MNHN-Na 16323).
 Sarawak. RV *Vitiaz II*, stn 6482, W coast of Sarawak,

04°31.2'N, 112°55.7'E, 88-85 m, 1 ♂ 9.1 mm, 1 ovig. ♀ 7.8 mm (MNHN-Na 16347).

DISTRIBUTION. — Japan, Philippines and Sarawak, 60-482 m (Figs 36; 38; Table 6).

HOSTS. — Associated with several species of hexactinellid sponges such as *Euplectella aspergillum*, *E. curvistellata*, *E. imperialis*, *E. marshalli*, *E. oweni* and *Hyalonema sieboldi* (Table 7).

DESCRIPTION OF FEMALES

Rostrum (Fig. 26A, B) 0.25-0.39 of carapace length, directed forward, reaching midlength

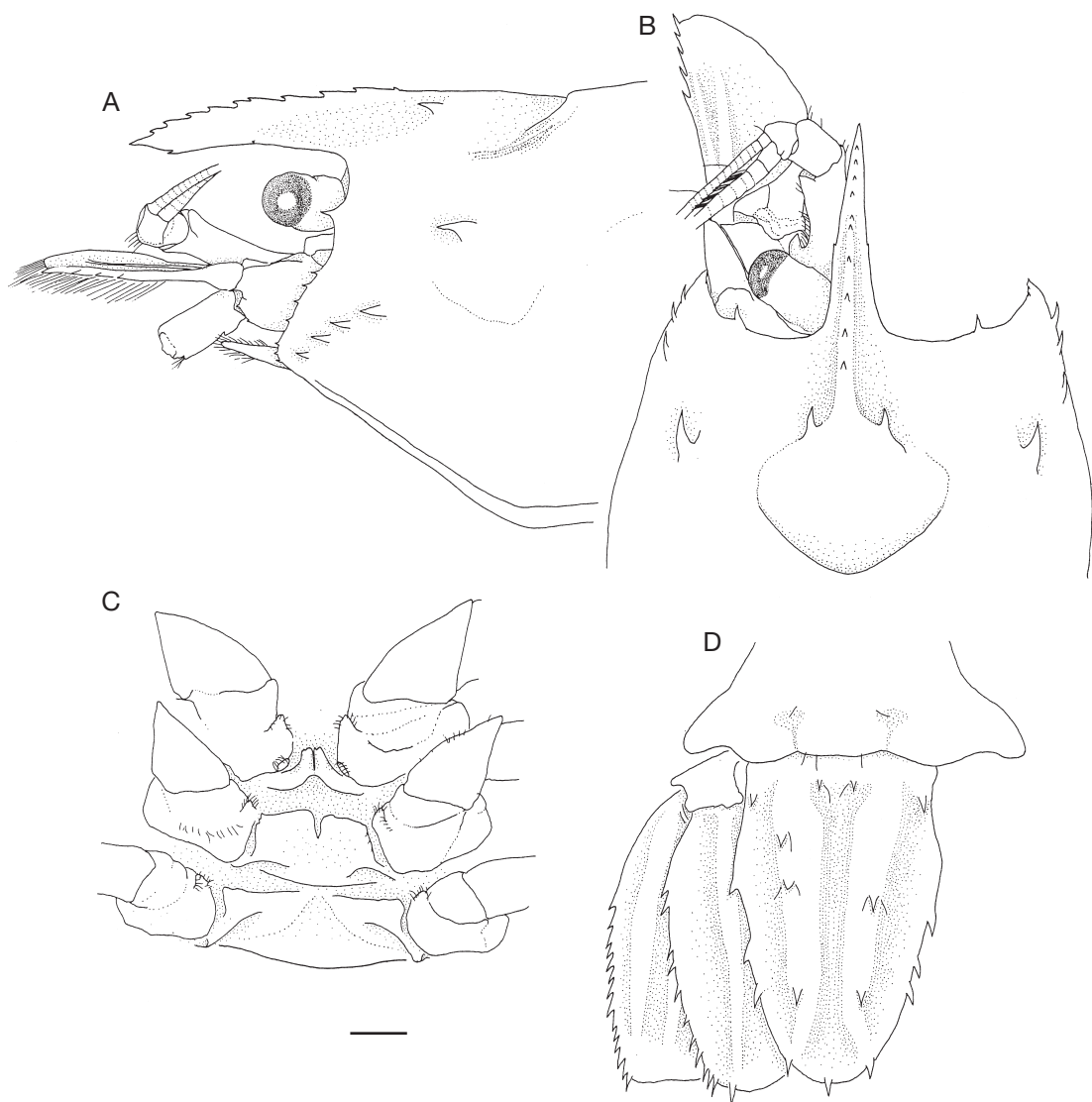


FIG. 26. — *Spongicola venustus* de Haan, 1844, ♀ 8.0 mm, off Sunosaki, Sagami Sea, Japan (ZUMT): **A**, anterior part of carapace and cephalic appendages, lateral view; **B**, same, dorsal view (right eye and antennae omitted); **C**, thoracic prominences on sixth to eighth somites, ventral view; **D**, sixth pleonal somite, telson and left uropods, dorsal view (right uropod and marginal setae omitted). Scale bar: 1 mm.

of antennal scale at most; dorsal margin slightly arched in lateral view, armed with 8-12 teeth, including 1 or 2 teeth posterior to orbital margin; ventral margin unarmed or armed with 1 subterminal tooth; ventrolateral ridge sharp, unarmed or armed with 1 or 2 very small teeth.

Carapace (Fig. 26A, B) with postrostral median ridge extending to level of postrostral submedian spines; postrostral submedian spine relatively small, directed forward; antennal spine moderately small, acuminate; single hepatic spine relatively large; 3-5 anterolateral spines moderately small,

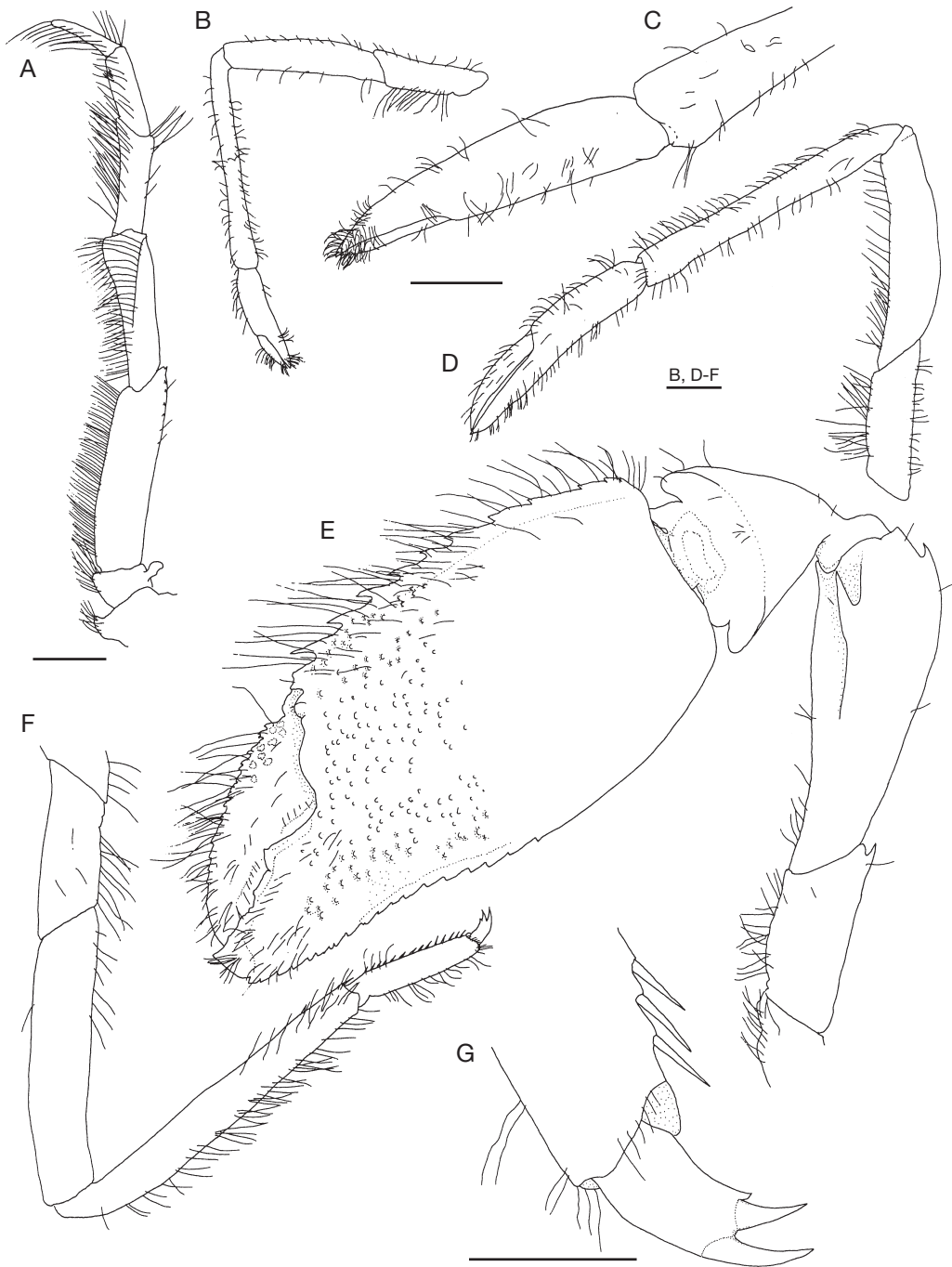


FIG. 27. — *Spongicola venustus* de Haan, 1844, ♀ 8.0 mm, off Sunosaki, Sagami Sea, Japan (ZUMT), left thoracic appendages: **A**, third maxilliped, lateral view; **B**, first pereopod, lateral view; **C**, same, chela and carpus, ventral view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view. Scale bars: A, B, D-F, 1 mm; C, G, 0.5 mm.



FIG. 28. — *Spongicola venustus* de Haan, 1844, ♂ 7.9 mm, off Sunosaki, SagamiSea, Japan (ZUMT), entire animal in lateral view. Scale bar: 1 mm.

forming oblique row; anterolateral margin with row of spinules; pterygostomial angle produced, distinctly overreaching antennal spine; branchial region smooth; cervical groove distinct.

Sixth thoracic sternite (Fig. 26C) with small lobes separated by very narrow median notch, each tip weakly bifid, lateral margins smooth. Seventh sternite with rectangular lobes separated by narrow V-shaped median notch, each anterolateral angle rounded or subacute, distomesial angle rounded; lateral margin smooth or weakly serrated. Eighth sternite with subtriangular lobes, each anterolateral angle weakly produced, rounded or angular.

Pleon moderately depressed dorsoventrally. First somite with distinct transverse carina, its margin overhanging deeply depressed anterior section; anteroventral projection small. Second somite

without distinct transverse carina, only shallow transverse groove evident. First pleuron (Fig. 25) unarmed on posteroventral margin; second to fifth pleura unarmed on lateral surfaces and margins. Sixth somite (Fig. 26D) widened posteriorly, lacking lateral spines; pleural margin smooth. Telson (Fig. 26D) about 1.6 times longer than broad; dorsal surface often with pair of small proximal spines, dorsolateral carinae each with 2-4 spines; lateral margins each with shallow subproximal concavity, and armed with a small submarginal spine and row of 2-6 spines thereafter; posterolateral spines present; posterior margin convex, with posteromedian spine.

Cornea (Fig. 26A, B) well developed, moderately large, as broad as eyestalk, darkly pigmented; eyestalk not markedly inflated basally, unarmed or armed with 1-4 spinules dorsally and 1 or 2

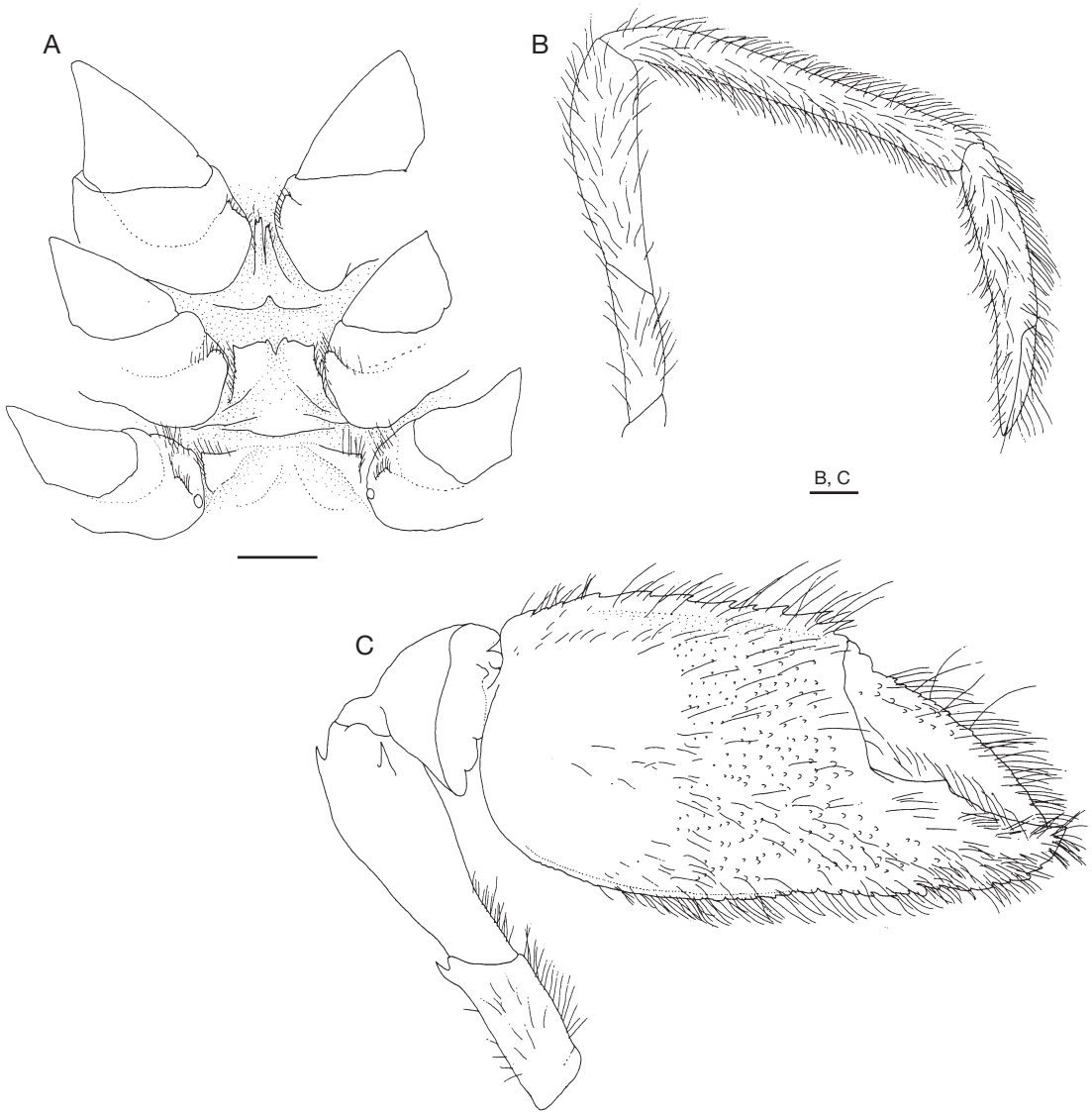


FIG. 29. — *Spongicola venustus* de Haan, 1844, ♂ 7.9 mm, off Sunosaki, Sagami Sea, Japan (ZUMT): **A**, thoracic prominences on sixth to eighth somites, ventral view; **B**, right second pereopod, lateral view; **C**, right third pereopod, lateral view. Scale bars: 1 mm.

spinules mesially. Antennular peduncle (Fig. 26A, B) overreaching midlength of antennal scale; first segment about 2.6–2.8 length of second segment; stylocerite subacute, straight; second segment unarmed on distolateral margin. Antennal basicerite (Fig. 26A, B) stout, with small distolateral spine and a few additional small spines on ventrolateral

margin; antennal scale subsemicircular, about 1.8 times longer than wide; lateral margin slightly concave to nearly straight, armed with 5–7 teeth including distolateral tooth, dorsal surface with 2 distinct longitudinal carinae; carpocerite short, reaching midlength of first antennular peduncle, unarmed.

Third maxilliped (Fig. 27A) overreaching antennal scale by length of dactylus; dactylus 0.8 of propodal length; propodus 0.8 of carpal length; carpus 0.7 of meral length; merus 0.8 length of ischium, unarmed; ischium armed with 2-7 small spines on dorsolateral margin, ventral margin unarmed. Exopod rudimentary.

First pereopod (Fig. 27B, C) overreaching antennal scale by length of chela, with rudimentary grooming apparatus (Fig. 27C); dactylus 0.4 of chela length; carpus longest, twice of chela length; merus 0.7 of carpal length; ischium 0.7 of meral length. Second pereopod (Fig. 27D) 1.2-2.1 times longer than carapace, setose, reaching antennal scale by half of carpus; dactylus half of chela length; carpus longest, 1.2 of chela length; merus 0.8 of carpal length; ischium 0.7 of meral length. Third pereopod (Fig. 27E) overreaching antennal scale by length of chela and carpus; chela 1.2-1.5 length of carapace; dactylus 0.4 of chela length, with row of small spines or tubercles and moderately long setae on dorsal margin; fixed finger with row of small denticles or tubercles on ventral margin, extending onto midlength of palm; palm broad, about 1.4 times as long as deep, dorsal margin with row of small spines over entire length, decreasing in size proximally, and rows of moderately long setae; lateral surface of palm with numerous scattered granules on distal half, extending to basal half of fixed finger, and with short to moderately long setae dorsally; carpus broadened distally, 1.1 times longer than wide, 0.3 of chela length, unarmed on lateral surface; merus 0.6 of carpal length, usually armed with 1 small subdistal spine on dorsal margin and 1 large subdistal spine on ventrolateral margin, and unarmed on ventromesial margin; ischium 0.6 of meral length, with small dorsodistal spine. Fourth pereopod (Fig. 27F, G) overreaching antennal scale by half of carpus; dactylus (Fig. 27G) 0.3 length of propodus, moderately broad, 2.3 times longer than wide, clearly biunguiculate, bearing tiny accessory tooth on ventral margin at base of ventral unguis; propodus 0.4 of carpal length; carpus longest, sometimes subdivided into 2 articles, unarmed or armed with 1 small movable spine at ventrodistal margin and 1 small spine at midlength of ventral

margin; merus 0.8 of carpal length; ischium 0.6 of meral length, unarmed.

Exopod of uropod (Fig. 26D) with 12-16 teeth on lateral margin, dorsal surface with 2 smooth longitudinal carinae; endopod with 11-13 teeth on lateral margin and sometimes with 1 subproximal spine on middorsal carina.

Eggs counting 240, diameter 0.9-1.1 mm (1 example, PNPA) (Table 5).

MALE CHARACTERISTICS

Rostrum (Fig. 28) 0.25-0.46 of carapace length. Sixth thoracic sternite (Fig. 29A) with slender, acuminate lobes clearly separated by deep U-shaped median notch, each terminating in bilobed tip, each lateral margin unarmed or armed with a few spinules or denticles. Seventh sternite with moderately broad, trapezoid lobes, each terminating in acute tip, each lateral margin minutely denticulate. Eighth sternite with triangular lobes, smaller than those on seventh sternite, each tip acute, lateral margin minutely denticulate. First pleonal somite (Fig. 28) with prominent ventral projection supported by short, but distinct ridge, terminating in subacute point. Pleura of second to sixth pleonal somites (Fig. 28) unarmed or armed with marginal teeth or denticles. Second pereopod (Fig. 29B) 1.5-2.2 times longer than carapace. Chela of third pereopod (Fig. 29C) 1.3-1.6 length of carapace.

REMARKS

The present material slightly extends the geographical range of *S. venustus* to south (Sarawak) and the bathymetric range up to 60 m and down to 482 m.

Genus *Paraspongicola* de Saint Laurent & Cleva, 1981

Paraspongicola de Saint Laurent & Cleva, 1981: 181. — Holthuis 1993: 310.

TYPE SPECIES. — *Paraspongicola pusillus* de Saint Laurent & Cleva, 1981, by original designation.

GENDER. — Masculine.

DIAGNOSIS. — Rostrum short, straight, directed for-

ward. Carapace with postrostral submedian spines; antennal spine small; anterolateral spines forming obliquely vertical row. Sixth pleonal somite usually with lateral spine(s). Telson broadly triangular. Cornea globular, well developed, darkly pigmented, distinctly faceted; eyestalk with small spines. Mouthparts similar to those of *Spongiicola* (Fig. 2). Ventrodistal margin of carpus of third maxilliped markedly produced; ischium with row of spines on dorsolateral margin; exopod well developed, flagellum-like. First pereopod with well developed grooming apparatus. Second pereopod of males more robust than that of females; unarmed or armed with small spines. Third pereopod more robust than that of second, but its length occasionally subequal; palm serrated on dorsal and ventral margins. Dactyli of fourth and fifth pereopods triunguiculate with prominent accessory spine on ventral margin at base of ventral unguis; carpi and propodi sometimes subdivided. Lateral margins of uropodal exopod and endopod serrated; endopod often with 1 subproximal spine on middorsal carina. Armature on carapace, telson, thoracic appendages and uropods relatively stronger in *Paraspongiicola* than in *Spongiicola*. Branchial formula identical with that of *Spongiicola* (Table 1). Eggs numerous and small, diameter 0.6-1.0 mm (Table 5).

SPECIES INCLUDED. — *Paraspongiicola inflatus* (de Saint Laurent & Cleva, 1981) n. comb.; and *P. pusillus* de Saint Laurent & Cleva, 1981.

DISTRIBUTION. — Tropical and warm temperate regions in the Indo-West Pacific; 120-493 m.

SEXUAL DIMORPHISM

As in other spongiolid species, the two species of the genus exhibit sexual dimorphism in general body shape (more stout and depressed in females than in males), strength of armature on the carapace, pleonal pleura and appendages (spines or teeth are larger in males than in females), lengths and thickness of the

pereopods (longer and more robust in males than in females), shape and structure of the pleopods (much more compressed laterally and broader in females than in males), and widths of the pleon and the thoracic sternum (wider in spawning females than in males).

REMARKS

The presence or absence of exopods on the first to third maxillipeds is generally considered to be of great importance in the generic classification in the family Spongiolidae (de Saint Laurent & Cleva 1981; Holthuis 1993; Saito & Takeda 2003; Komai & Saito 2006). *Paraspongiicola* is characterized by the possession of a well developed, flagellum-like exopod on the third maxilliped (de Saint Laurent & Cleva 1981). De Saint Laurent & Cleva (1981) assigned their new species *Spongiicola inflatus* to *Spongiicola* because of the similarity in the armature of the carapace to species of *Spongiicola*, although the authors noticed that the species has a well developed exopod on the third maxilliped. During the present study, we found that *S. inflatus* is allied to *P. pusillus*, the type species of *Paraspongiicola*, in the frequent presence of the lateral spines on the sixth pleonal somite, the produced ventrodistal angle of the carpus of the third maxilliped, the second pereopod being occasionally subequal in the length to the third pereopod, and the triunguiculate dactyli of the fourth and fifth pereopods, as well as the development of the exopod of the third maxilliped. Saito & Takeda (2003) suggested *S. inflatus* and *P. pusillus* are sister taxa at a clade of their phylogenetic analysis. Therefore, we propose to transfer *S. inflatus* to *Paraspongiicola*.

KEY TO THE SPECIES OF *PARASPONGICOLA* DE SAINT LAURENT & CLEVA, 1981

- Telson with 2-5 spines on lateral margin; palm of first pereopod with grooming apparatus extending entire ventral surface; second pereopod unarmed; merus of third pereopod armed with large subterminal spine on ventrolateral margin *P. inflatus* n. comb.
- Telson with 8 or 9 spines on lateral margin; palm of first pereopod with grooming apparatus restricted to proximoventral portion; merus of second pereopod with subterminal spine on dorsal margin and row of small spines on ventral margin; merus of third pereopod with row of small spines on ventrolateral margin, in addition to large subterminal spine *P. pusillus*



FIG. 30. — *Paraspongicola inflatus* (de Saint Laurent & Cleva, 1981) n. comb., ♀ 3.6 mm, Kai Island, Indonesia (KARUBAR, stn DW 01) (MNHN-Na 16324), entire animal in lateral view. Scale bar: 1 mm.

Paraspongicola inflatus

(de Saint Laurent & Cleva, 1981) n. comb.

(Figs 30-34)

Spongicola inflata de Saint Laurent & Cleva, 1981: 179, figs 14a-g, 15a-g. — Saito & Takeda 2003: 120.

TYPE MATERIAL. — Holotype: Philippines, MUSORSTOM 1, stn 32, 14°02.2'N, 120°17.7'E, 193-184 m, 23.III.1976, ♂ 2.5 mm (MNHN-Na 2926). Examined.

Paratype: Philippines, MUSORTOM 1, stn 60, 14°06.6'N, 120°18.2'E, 129-124 m, 27.III.1976, 1 ♂ 1.6 mm (MNHN-Na 2927). Examined.

OTHER MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 3, stn CP 131, 11°37'S, 121°43'E, 120-122 m, 5.VI.1985, 1 ♂ 4.5 mm (MNHN-Na 16354).

Indonesia. KARUBAR, stn DW 01, Kai Islands, 05°46'S, 132°10'E, 156-305m, 22.X.1991, 1 ♂ 4.7 mm, 2 ♀♀ 3.6 mm, damaged (MNHN-Na 16324).

New Caledonia. BIOCAL, stn DW 37, 22°55.99'S, 167°15.65'E, 350 m, 30.VIII.1985, 1 ♂ 3.6 mm, 1 ovig. ♀ 3.1 mm, 2 ♀♀ 3.2, 3.3 mm (MNHN-Na 16325); 1 ♂ 3.2 mm (MNHN-Na 11982).

MUSORSTOM 4, stn DW 222, 22°57.6'S, 167°33.0'E, 410-440 m, 30.IX.1985, associated with *Crathrochone clathroclada*, 1 ovig. ♀ 4.0 mm (MNHN-Na 16326). — Stn DW 226, 22°47.2'S, 167°21.6'E, 395 m, 30.IX.1985, 1 ♂ 3.7 mm (MNHN-Na 16327).

CHALCAL 2, stn CP 27, 23°15.29'S, 168°04.55'E, 289 m, 31.X.1986, 4 ♂♂ 2.9-4.0 mm, 1 ovig. ♀ 3.8 mm (MNHN-Na 16328).

VOLSMAR, stn DW 39, Matthew and Hunter islands, 22°20.50'S, 168°43.50'E, 305 m, 8.VI.1989, 1 ♂ 4.5 mm (MNHN-Na 16329).

SMIB 5, stn DW 97, Azteque Bank, 23°01.1'S, 168°18.0'E, 300 m, 14.IX.1989, 1 ♂ 3.8 mm, 1 ♀ 3.8 mm (MNHN-Na 11967). — Stn DW 102, Norfolk Ridge, 23°19.6'S, 168°04.7'E, 290-305 m, 14.IX.1989, 1 ♂ 4.1 mm (MNHN-Na 11966).

BERYX 11, stn DW 40, Norfolk Ridge, 23°41'S, 168°01'E, 240-300 m, 20.X.1992, 1 ♂ 4.4 mm (MNHN-Na 16330). — Stn CP 44, Norfolk Ridge, 23°41'S, 168°01'E, 230-250 m, 20.X.1992, 1 ♂ 3.8 mm (MNHN-Na 16331). — Stn CP 45, 23°40'S, 168°01'E, 270-290 m, 20.X.1992, 4 ♂♂ 3.7-4.6 mm, 3 ovig. ♀♀ 3.6-4.0 mm, 2 ♀♀ 3.8, 4.0 mm (MNHN-Na 16332). — Stn CP 46, 23°42'S, 168°01'E, 300-350 m, 20.X.1992, 1 ♂ 3.7 mm, 1 ovig. ♀ 3.5 mm (MNHN-Na 16333).

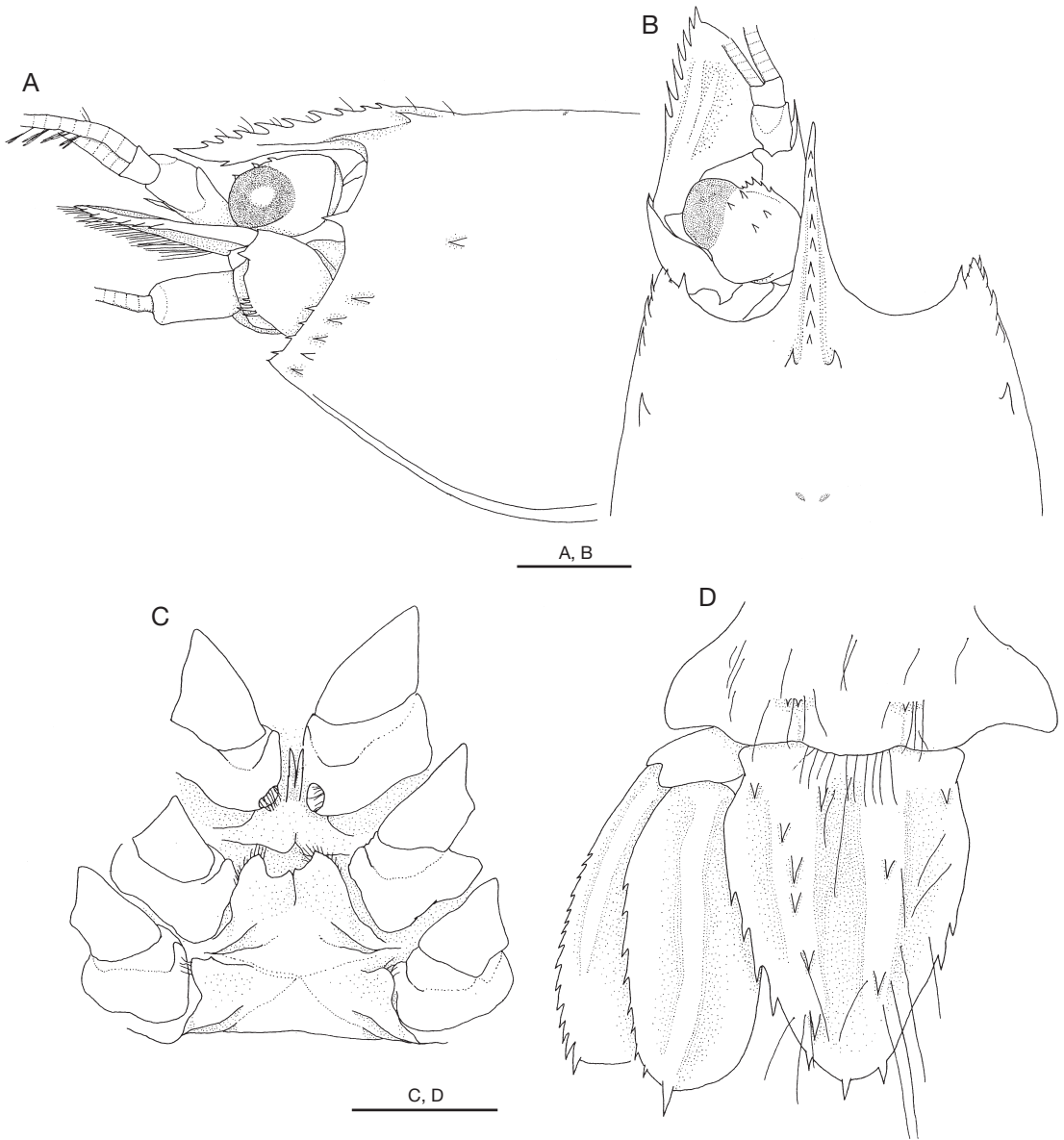


FIG. 31. — *Paraspongicola inflatus* (de Saint Laurent & Cleve, 1981) n. comb., ♀ 3.6 mm, Kai Island, Indonesia (KARUBAR, stn DW 01) (MNHN-Na 16324): **A**, anterior part of carapace and cephalic appendages, lateral view; **B**, same, dorsal view (right eye and antennae omitted); **C**, thoracic prominences on sixth to eighth somites, ventral view; **D**, sixth pleonal somite, telson and left uropod, dorsal view (right uropod and marginal setae omitted). Scale bars: 1 mm.

SMIB 8, stn DW 182, Azteque Bank, 23°19.3'S, 168°04.8'E, 314-340 m, 31.I.1993, 1 ♂ 4.7 mm (MNHN-Na 16355).

BATHUS 3, stn CP 804, 23°41.40'S, 168°00.42'E, 244-278 m, 27.XI.1993, 7 ♂ 3.7-4.9 mm, 2 ovig. ♀♀ 4.1,

4.9 mm (MNHN-Na 16334). — Stn CP 812, 23°43.38'S, 168°15.98'E, 391-440 m, 28.XI.1993, 1 ♂ 4.4 mm, 2 ovig. ♀♀ 3.9, 4.4 mm (MNHN-Na 16335).

LITHIST, stn CP 15, W of Jumeau Bank, 23°40.4'S, 168°15.0'E, 389-404 m, 12.XII.1999, 1 ♀ 4.2 mm

(MNHN-Na 16336).

NORFOLK 1, stn DW 1667, Jumeau-west Bank, 23°40'S, 168°01'E, 237-250 m, 21.VI.2001, 1 ♂ 4.0 mm (MNHN-Na 16337). — Stn DW 1707, Jumeau-east Bank, 23°43'S, 168°16'E, 381-493 m, 25.VI.2001, 1 ♀ 4.9 mm (MNHN-Na 16338).

NORFOLK 2, stn 2024, Banc Brachiopode, 23°27.92'S, 167°50.90'E, 370-371 m, 21.X.2003, 1 ♂ 3.9 mm, 1 ♀ 3.6 mm (MNHN-Na 16356).

Loyalty Island. MUSORSTOM 6, stn CP 401, 20°42.15'S, 167°00.35'E, 270 m, 14.II.1989, 1 ovig. ♀ 3.5 mm (MNHN-Na 11964).

Madagascar. VAUBAN, stn CH 14, 12°43.3'S, 48°15.7'E, 242-255 m, calcareous sand, 15.IV.1971, 1 ♂ 2.4 mm, 3 ♀♀ 3.0 mm (MNHN-Na 3559); 1 ovig. ♀ (MNHN-Na 3600).

Project not indicated: stn DP 14, 1 ovig. ♀ 3.0 mm, 2 ♀♀ 2.8, 3.1 mm (MNHN-Na 16348). — Stn DP 100, associated with *Crathrochone clathroclada*, 1 ♂ 3.2 mm (MNHN-Na 16349). — Stn DP 183, associated with *Crathrochone clathroclada*, 1 ♂ 3.5 mm (MNHN-Na 16350).

DISTRIBUTION. — Philippines, Indonesia, New Caledonia, Loyalty Islands and Madagascar, 120-493 m (Figs 36; 39; Table 6).

HOST. — Hyalonematidae sp. and *Crathrochone clathroclada* (Table 7).

DESCRIPTION OF FEMALES

Rostrum (Fig. 31A, B) 0.35-0.59 of carapace length, directed slightly downward, reaching midlength of second segment of antennular peduncle; dorsal margin straight, armed with 6-10 teeth, including 1 or 2 teeth on carapace posterior to orbital margin; ventral margin unarmed or armed with 1 subterminal tooth; ventrolateral ridge sharp, unarmed. Carapace (Fig. 31A, B) with postrostral median ridge extending to base of postrostral submedian spines; postrostral submedian spine small; antennal spine moderately small, acuminate; hepatic spine small, sometimes rudimentary or absent; 3-5 anterolateral spines forming single oblique row; anterolateral margin with row of spinules; pterygostomial angle produced, terminating in acute point; cervical groove rudimentary.

Sixth thoracic sternite (Fig. 31C) with very slender, spiniform lobes, narrowly separated, each lateral margin with 1 or 2 denticles. Seventh sternite with moderately broad lobes, separated by very narrow slit; each anterior margin strongly concave, antero-

lateral angle produced, terminating in acute or subacute tooth, anteromesial angle terminating in acute point; lateral margins faintly sinuous, unarmed. Eighth sternite with rounded, laterally directed lobes, smaller than those on seventh sternite.

Pleon moderately depressed dorsoventrally. First somite (Fig. 30) with distinct transverse carina, its margin partially overhanging deeply depressed anterior section; ventral margin of anterior section produced in blunt process; posteroventral margin of posterior section unarmed. Second somite without distinct transverse carina, only shallow transverse groove evident. Second to fourth pleura rounded, unarmed on ventral margin. Pleuron of fifth somite generally rounded, sometimes with 1 or 2 minute teeth anteroventrally. Sixth somite (Fig. 31D) slightly widened posteriorly, unarmed or armed with 1-3 lateral spines on either side; pleuron unarmed or armed with 1 or 2 minute denticles marginally. Telson (Fig. 31D) broadly triangular, about 1.4 times longer than broad; dorsal surface often pair of proximal spines near base, dorsolateral carinae each with 2-5 spines; lateral margins each with shallow subproximal concavity, and armed with 1 small submarginal spine and with a row of 2-5 spines; posterolateral spines present; posterior margin rounded, with posteromedian spine.

Cornea (Fig. 31A, B) darkly pigmented, narrower than eyestalk; eyestalk somewhat inflated at midlength, armed with 2-4 small spines dorsally and 4 or 5 similar spines mesially. Antennular peduncle (Fig. 31A, B) overreaching midlength of antennal scale; first segment about twice in length to second segment, ventrodiscal mesial angle produced in prominent spine; stylocerite acute, straight or slightly curved mesially; second segment unarmed. Antennal basicerite (Fig. 31A, B) stout, bearing small distolateral spine and with 0-4 small additional spines on ventrolateral margin; antennal scale subsemicircular, about 2.1 times longer than wide, lateral margin nearly straight, serrated with row of 5-8 teeth, dorsal surface with 2 distinct longitudinal carinae; carapocerite reaching nearly second segment of antennular peduncle.

Third maxilliped (Fig. 32A) overreaching antennal scale by length of dactylus and propodus; dactylus subequal in length to propodus; propodus 0.8 of

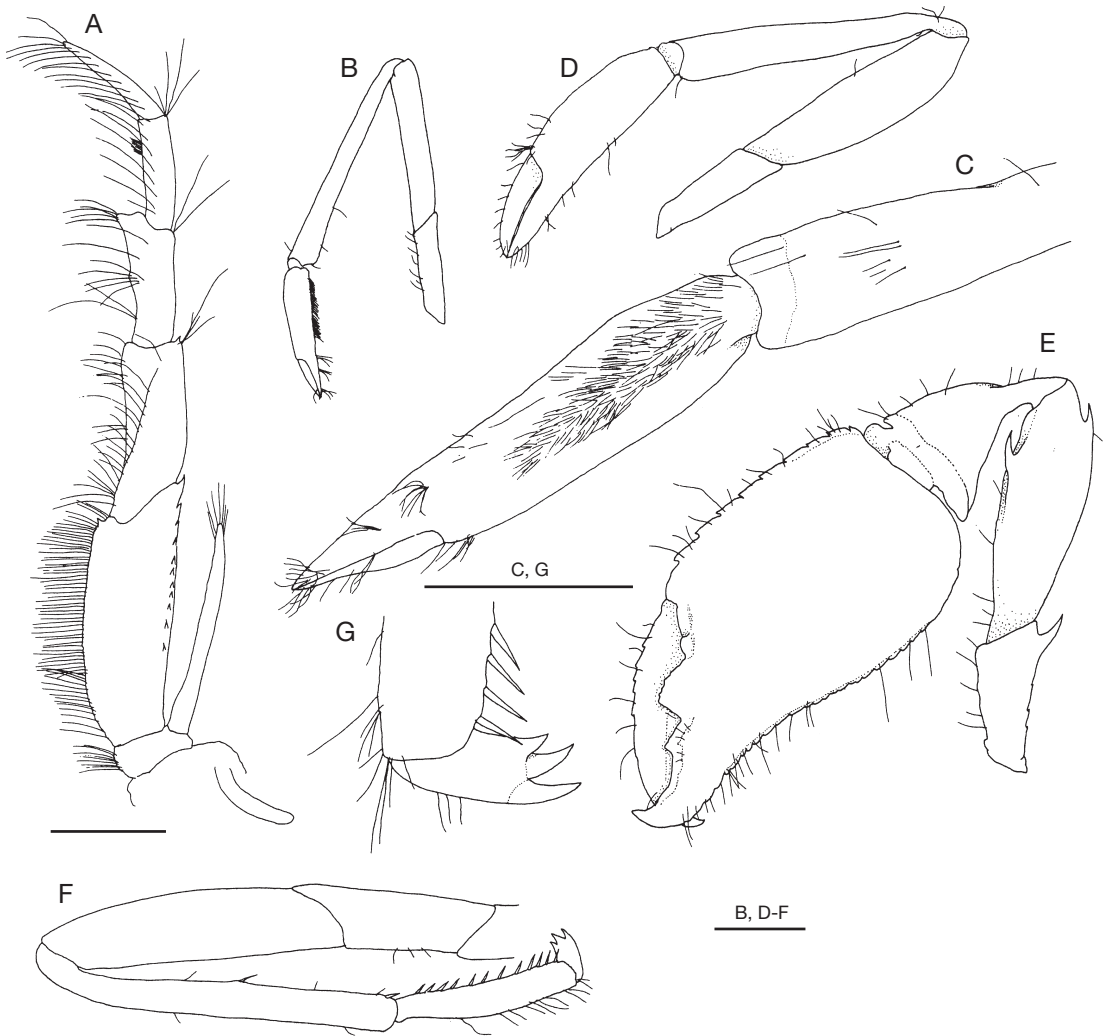


FIG. 32. — *Paraspongicola inflatus* (de Saint Laurent & Cleve, 1981) n. comb., ♀ 3.6 mm, Kai Island, Indonesia (KARUBAR, strn DW 01) (MNHN-Na 16324), left thoracic appendages: **A**, third maxilliped, lateral view; **B**, first pereopod, lateral view; **C**, same, chela and carpus, ventral view; **D**, second pereopod, lateral view; **E**, third pereopod, lateral view; **F**, fourth pereopod, lateral view; **G**, same, dactylus and distal part of propodus, lateral view. Scale bars: A, B, D-F, 1 mm; C, G, 0.5 mm.

carpal length; carpus 0.8 of meral length, ventrodistal margin produced into blunt process; merus somewhat twisted, 0.7 of ischial length, with small distolateral spine; ischium armed with 7-16 spines on dorsolateral margin, distalmost spine strongest. Exopod nearly reaching to proximal margin of merus.

First pereopod (Fig. 32B, C) overreaching antennal scale by length of chela and carpus; dactylus 0.3 of

chela length; palm with grooming setae on entire ventral surface (Fig. 32C); carpus longest, 1.5-2.3 of chela length, with sparse grooming setae ventrodistally; merus about 0.8 of carpal length; ischium 0.5-0.6 of meral length. Second pereopod (Fig. 32D) 3.2 times longer than carapace, overreaching tip of antennal scale by length of chela and carpus; dactylus 0.4 of chela length; palm subcylindrical,

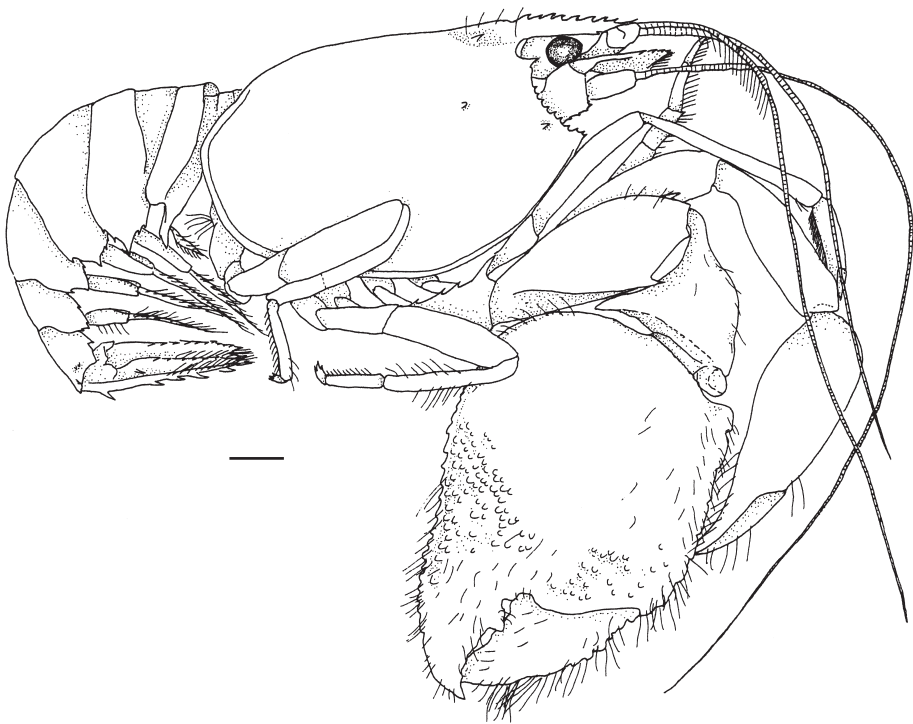


FIG. 33. — *Paraspongicola inflatus* (de Saint Laurent & Cleve, 1981) n. comb., ♂ 4.6 mm, New Caledonia (BATHUS 3, stn CP 804) (MNHN-Na 16334), entire animal in lateral view. Scale bar: 1 mm.

about 2.6 times longer than wide; carpus 1.2 of chela length; merus 0.8 of carpal length; ischium 0.5-0.6 of meral length, all segments unarmed. Third pereopod (Fig. 32E) overreaching tip of antennal scale by length of chela and carpus; chela 1.4-1.9 times longer than carapace; dactylus about half of chela length, with row of small teeth or denticles on proximal half of dorsal margin; fixed finger with row of small denticles or tubercles extending onto palm; palm broad, about 1.2 times longer than wide, with row of small teeth and sparse setae on dorsal margin, ventral margin also with sparse setae, lateral surface smooth; carpus broadened distally, about 1.3 times longer than wide, 0.4 of chela length, unarmed or armed with 3 or 4 spines on lateral surface; merus 0.6 of carpal length, with 1 moderately large subterminal spine on dorsal margin, ventrolateral margin also with 1 large subterminal spine, ventromesial margin nearly smooth; ischium half of meral length, with large dorsodistal spine, and

row of small teeth or denticles on dorsal and ventral margins. Fourth pereopod (Fig. 32F) overreaching antennal scale by length of dactylus and propodus; dactylus (Fig. 32G) about 0.3 of propodal length, broad, 2.7 times longer than wide, trianguiculate (dorsal and ventral unguis subequal, accessory tooth on ventral margin large, exceeding half length of ventral unguis); propodus about half of carpus, entire, with row of slender movable spines on ventral margin; carpus longest, entire or subdivided into 2 articles, with small movable spine at ventrodistal margin and midlength of ventral margin; merus 0.8 of carpal length; ischium 0.7 of meral length, unarmed. Fifth pereopod similar to fourth.

Exopod of uropod (Fig. 31D) with serration of 11-14 teeth on lateral margin, dorsal surface with 2 longitudinal carinae; endopod with serration of 9-13 teeth on lateral margin, posteriormost tooth enlarged, and occasionally with 1 subproximal spine on middorsal carina.

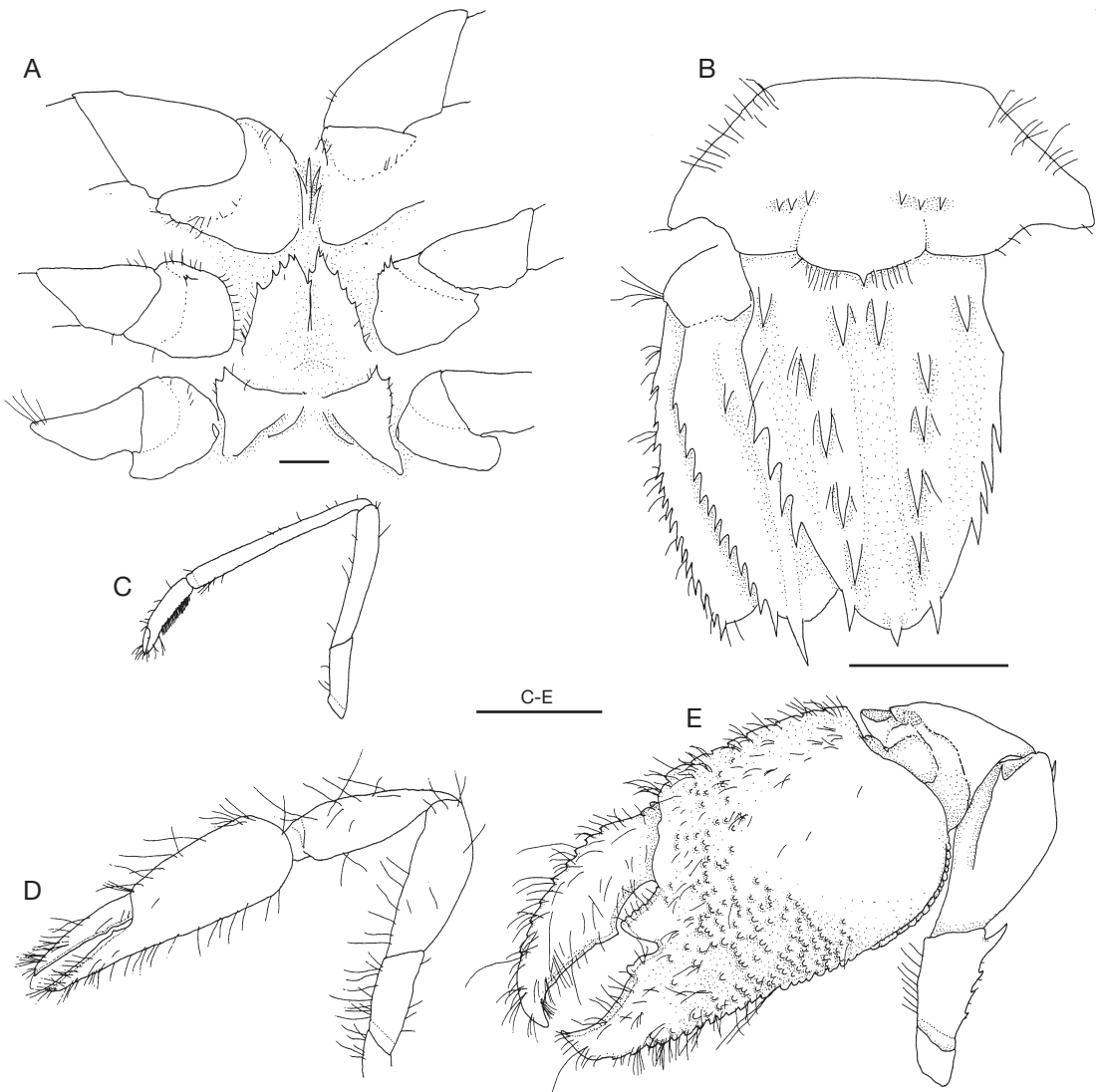


FIG. 34. — *Paraspongicola inflatus* (de Saint Laurent & Cleve, 1981) n. comb.: **A**, ♂ 4.3 mm, New Caledonia (BATHUS 3, stn CP 804) (MNHN-Na 16334), thoracic prominences on sixth to eighth somites, ventral view; **B**, ♂ 4.7 mm, Kai Islands, Indonesia (KARUBAR, stn DW 01) (MNHN-Na 16324), sixth pleonal somite, telson and left uropod, dorsal view (right uropod and marginal setae omitted); **C-E**, ♂ 4.6 mm, New Caledonia (BATHUS 3, stn CP 804) (MNHN-Na 16334), left first to third pereopods, lateral view. Scale bars: 1 mm.

Eggs counting 91, diameter 0.6-0.9 mm (1 example, MNHN-Na 11964) (Table 5).

MALE CHARACTERISTICS

Rostrum (Fig. 33) 0.35-0.56 of carapace length. Sixth (Fig. 34A) thoracic sternite with very slender, strongly bifurcate lobes; seventh sternite with relatively narrow

subtriangular lobes, each terminating in simple or bifid point, lateral margin with row of small teeth or denticles. Eighth sternite with triangular lobes directed anterolaterally, each anterolateral angle terminating in bifid tooth, lateral margins sinuous. First pleonal somite (Fig. 33) with prominent ventral projection supported by short, but distinct ridge, terminating

TABLE 4. — Variation in *Paraspongiicola inflatus* (de Saint Laurent & Cleva, 1981) n. comb. Abbreviations: r, rudimentary; +, present; –, absent.

	Philippines		Indonesia		New Caledonia		Madagascar	
	♂	♀	♂	♀	♂	♀	♂	♀
Number (and CL mm) of examined materials	3 (1.6-4.5)	2 (2.4-2.9)	1 (4.7)	1 (3.6)	7 (3.7-4.9)	5 (3.8-5.1)	1 (2.4)	4 (3.0-3.9)
Carapace								
rostrum/carapace	0.38-0.56	0.50-0.59	0.35	0.47	0.37-0.44	0.35-0.44	0.53	0.39-0.50
hepatic spine	+	+	+	+	r/–	r/–	+	+/–
Sixth pleonal somite								
lateral spines	+/–	+	+	+	+	+/–	–	+/–
First pereopod								
carpus/chela	1.5-2.0	1.5	1.5	1.7	1.8-2.3	2.0-2.3	1.4	1.5
merus/chela	1.1-1.6	1.1	1.1	1.3	1.4-1.8	1.5-1.8	1.1	1.3
Third pereopod								
lateral spines of carpus	+/–	+/–	–	–	–	–	+	+

in subacute point. Pleura of second to sixth pleonal somites (Fig. 34B) produced in acute tooth ventrally or posteroventrally, with additional small teeth or denticles on margins. First pereopod (Fig. 34C) with carpus 1.4-2.3 of chela length. Second pereopod (Fig. 34D) more robust than that of female; dactylus 0.4 of chela length; palm conic, broadened posteriorly, about twice as long as wide; carpus subequal in length to palm. Third pereopod (Fig. 34E) with chela 1.8-2.0 times longer than carapace; palm about 1.1 times longer than wide, bearing many scattered granules or small tubercles on distal part of lateral surface.

REMARKS

Paraspongiicola inflatus n. comb. was originally described based only on two male specimens from the Philippines (de Saint Laurent & Cleva 1981). The present male specimens from Indonesia, New Caledonia and Madagascar are generally similar to the type specimens, but some differences are noted (Table 4). The males from New Caledonia differ from the types and other specimens in the following particulars: the hepatic spine is rudimentary or absent in the New Caledonian specimens, but distinct in the types and other specimens; the carpus and merus of the first pereopod is relatively longer, the length ratios of carpus and merus against chela of the first pereopod is 1.8-2.3 and 1.4-1.8 in the New Caledonian specimens, but 1.4-2.0 and 1.1-1.6 in the types, the Indonesian and Madagascan specimens. The females from the Philippines, Indonesia, New Caledonia and Madagascar are also generally similar,

but different in the following respects (Table 4): 1) the rostrum is relatively shorter in the New Caledonian specimen than in the other specimens (0.35-0.44 of the carapace length versus 0.50-0.59 in the Philippine, 0.47 in the Indonesian, and 0.39-0.50 in the Madagascan specimens); 2) the hepatic spine is rudimentary or absent in the New Caledonian specimens compared to distinct one in the other specimens, but this is often absent in Madagascan specimens; and 3) the carpus and merus of the first pereopod is relatively longer in the New Caledonian specimens, the length ratios of carpus and merus against chela of the first pereopod is 2.0-2.3 and 1.5-1.8 in the New Caledonian specimens, but 1.5-1.7 and 1.1-1.3 in the other specimens. During this study, only a few specimens from the Philippines were available. Therefore, it is difficult to fully assess whether the observed differences among the specimens from the Philippines, Indonesia, New Caledonia and Madagascar are species-specific or intraspecific variations. The present assignment of the specimens from Indonesia, New Caledonia and Madagascar to *P. inflatus* n. comb. should be considered provisional.

Paraspongiicola pusillus
de Saint Laurent & Cleva, 1981
(Fig. 35)

Paraspongiicola pusilla de Saint Laurent & Cleva, 1981: 181, figs 14a-g, 15a-g [type locality: Philippines, 150-159 m].— Saito & Takeda 2003: 120.

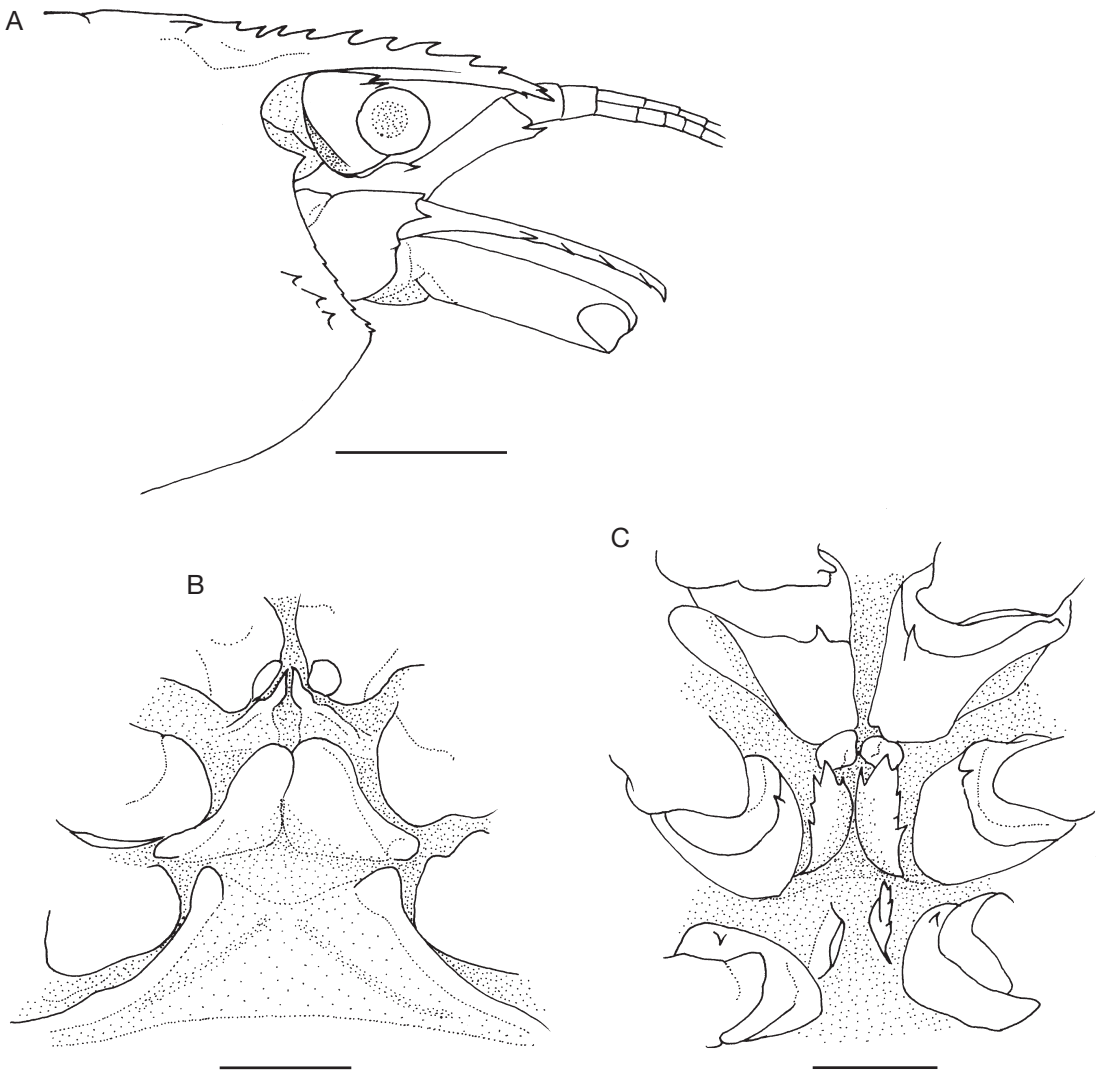


FIG. 35. — *Paraspongicola pusillus* de Saint Laurent & Cleve, 1981: **A, B**, paratype ♀ 3.1 mm, Philippines (MUSORSTOM 1, stn 18) (MNHN-Na 2931); **C**, holotype ♂ 3.2 mm, Philippines (MUSORSTOM 1, stn 18) (MNHN-Na 2932); **A**, anterior part of carapace and cephalic appendages, lateral view (right antennule missing; mesial face of left antennule is shown); **B, C**, coxae of third to fifth pereopods and thoracic prominences, ventral views. Scale bars: A, 1 mm; B, C, 0.5 mm.

TYPE MATERIAL. — Holotype: MUSORSTOM 1, stn 18, Philippines, 13°56.3'N, 120°16.2'E, 150-159 m, 21.II.1976, ♂ 3.2 mm (MNHN-Na 2932). Examined.

Paratype: same data as holotype, 1 ovig. ♀ 3.1 mm (MNHN-Na 2931). Examined.

DISTRIBUTION. — Known only from the Philippines, 150-159 m (Figs 36; 39; Table 6).

HOST. — Unknown.

DESCRIPTION OF FEMALE

Rostrum (Fig. 35A) 0.53 of carapace length, straight, narrow triangular in dorsal view, reaching midlength of antennal scale; dorsal margin straight, armed with 10 teeth, including 3 teeth posterior to orbital

margin; ventral margin armed with 1 minute subdistal tooth; ventrolateral ridge sharp, unarmed, confluent with orbital margin. Carapace (Fig. 35A) smooth, with postrostral median ridge extending to base of postrostral submedian spine; postrostral submedian spine small; antennal spine acute; hepatic spine absent; 3 anterolateral spines forming single oblique row; anterolateral margin minutely denticulate; cervical groove rudimentary.

Sixth thoracic sternite (Fig. 35B) with slender, spiniform lobes, narrowly separated medially, each lateral margin unarmed. Seventh sternite with broad, rounded lobes, separated by very narrow median incision; lateral margins sinuous, unarmed. Eighth sternite with bluntly triangular lobe, each lobe directed anterolaterally.

First pleonal somite divided in two sections by distinct transverse carina, posterior section partially overhanging deeply depressed anterior section; ventral margin produced in blunt process; posteroventral margin of posterior section unarmed. Second somite smooth, lacking transverse carina; pleura rounded and unarmed on ventral margin. Third to fifth pleura rounded, unarmed or armed with 1–4 small teeth on anteroventral and posteroventral margins. Sixth somite slightly widened posteriorly, with 1 lateral spine on either side; pleuron armed with 1 minute tooth on anteroventral margin. Telson broadly triangular, 1.5 times longer than broad; dorsolateral carinae each with 4 spines; lateral margins each with shallow subproximal concavity, and armed with 1 small submarginal spine and row of 8 or 9 spines; posterolateral angles each with 1 spine; posterior margin rounded, with posteromedian spine.

Cornea lightly pigmented in preservative, corneal surface distinctly faceted; eyestalk broadened basally, armed with 4 or 5 dorsal and 4 mesial spines, proximolateral margin sharply carinate.

Antennular peduncle reaching midlength of antennal scale; first segment longer than distal two segments combined, ventrodistal angle with 1 spine; stylocerite acute, curved mesially. Antennal basicerite stout, with dorsolateral distal angle produced in bifid projection, unarmed on ventrolateral margin; antennal scale subsemicircular, about 2.9 times longer than wide, lateral margin slightly concave, armed with 5 teeth including terminal

tooth, dorsal surface with 1 obsolete longitudinal ridge; carpocerite long, only slightly falling short of tip of antennal scale.

Third maxilliped overreaching antennal scale by length of dactylus; dactylus 0.7 of propodal length, tapering distally; propodus 0.8 of carpal length, with grooming apparatus on distolateral part of ventral surface; carpus 0.7 of meral length, ventrodistal margin slightly produced; merus somewhat twisted, 0.6 ischial length, with 2 small spine distolaterally; ischium with row of 9 dorsolateral spines, distalmost strongest, ventral margin with 1 distal spine. Exopod nearly reaching to proximal margin of merus. First pereopod overreaching antennal scale by length of chela and half of carpus; dactylus 0.4 of chela length; palm with grooming apparatus restricted to proximoventral portion; carpus 1.6 of chela length, with grooming apparatus ventrodistally; merus 0.7 of carpal length; ischium 0.7 of meral length. Second pereopod relatively robust, slightly longer than third pereopod, about 3.0 times longer than carapace, overreaching tip of antennal scale by length of chela and carpus; dactylus 0.4 of chela length; palm subconical; carpus 0.7 of palm length; merus 1.4 of carpal length, with row of acute teeth on ventrolateral margin; ischium 0.6 of meral length. Third pereopod overreaching antennal scale by length of chela and carpus; dactylus half of chela length, with a few small teeth on proximal 0.3 of dorsal margin; fixed finger serrated on ventral margin over entire length; palm broad, 1.2 times longer than wide, serrated on dorsal and ventral margins; carpus broadened distally, 1.2 times as long as wide, 0.4 of chela length, unarmed; merus 1.6 of carpal length, with strong spine at dorsodistal angle, lateral margin with row of small teeth, distalmost strongest, proximomesial angle with 2 spines; ischium 0.6 of meral length, with strong dorsodistal spine, and row of small teeth or denticles on ventral margin.

Fourth and fifth pereopods similar, former overreaching antennal scale by length of dactylus and propodus; dactylus 0.3 of propodal length, broad, 2.5 times longer than wide, trianguiculate with 2 acuminate unguis and triangular projection at ventrodistal angle of corpus; propodus about half of carpus; merus 0.8 of carpal length; ischium 0.8 of meral length, unarmed.

TABLE 5. — Egg sizes (in mm long axis) and numbers of the species of *Spongicola* de Haan, 1844 and *Paraspongicola* de Saint Laurent & Cleva, 1981.

Species	Number and CL and registration numbers of examined females	Egg size	Egg number
<i>S. andamanicus</i>	3 (2.0-6.6 mm, NTM-Cr 002014)	0.6-0.8	631
<i>S. depressus</i> n. sp.	1 (4.7 mm, MNHN-Na 16293)	0.8	50
<i>S. goyi</i> n. sp.	4 (4.2-7.9 mm, MNHN-Na 11986)	0.7-0.8	23-235
<i>S. levigatus</i>	9 (1.8-4.4 mm, MNHN-Na 11981, 11985, 11987)	0.4-0.7	3-137
<i>S. parvispinus</i>	—	0.6-0.7	?
<i>S. robustus</i> n. sp.	2 (5.9-6.5 mm, MNHN-Na 16315)	0.7-0.9	50
<i>S. venustus</i>	4 (5.7-8.4 mm, MNHN-Na 3891, PNPA)	0.9-1.1	240
<i>P. inflatus</i> n. comb.	3 (3.5-4.9 mm, MNHN-Na 11964)	0.6-0.9	91
<i>P. pusillus</i>	1 (3.1 mm, MNHN-Na 2931)	0.7-1.0	?

Uropod with stout protopod; exopod with 20 (left) or 22 (right) acute teeth on lateral margin, dorsal surface of exopod with 2 longitudinal carinae; endopod with 10 (left) or 14 (right) acute teeth on lateral margin, terminal tooth strongest.

Egg diameter 0.7-1.0 mm (MNHN-Na 2931) (Table 5).

MALE CHARACTERISTICS

Rostrum 0.52 of carapace length; dorsal margin with 11 teeth. Sixth thoracic sternite (Fig. 35C) with pair of rounded, contiguous lobes; seventh sternite with subtriangular lobes, each lobe nearly perpendicular, ventrolateral and distomesial margins serrated; eighth sternite with small, perpendicular lobes, each lobe acuminate, ventral margin denticulate. First pleonal somite with acute, elongate ventral projection on posterior section of pleuron; pleura of second to sixth somite acutely pointed posteroventrally, with serrated ventral margins. Second pereopod more robust than that of female; dactylus 0.4 of chela length; palm subcylindrical; palm and carpus subequal in length to merus respectively; ischium 0.6 of meral length.

REMARKS

Paraspongicola pusillus is so far represented only by the type series, including the male holotype and female paratype. We provide here figures of selected parts, including the thoracic sternum, in order to supplement the original description. The eyestalk of *P. pusillus* appears characteristic in having a sharp proximolateral carina. Shape of the thoracic lobes seems to be different

between *P. pusillus* and *P. inflatus* n. comb. The sternal lobes on the seventh somite in females are rounded in *P. pusillus*, whereas they are subacute with distinctly concave anteromesial margins in *P. inflatus* n. comb. The sternal lobes on the sixth somite in males are rounded in *P. pusillus*, but they are bifid, very slender projections in *P. inflatus* n. comb.

DISCUSSION

GENERAL REMARKS

Although the present study is based on rather extensive material from various localities in the Indo-West Pacific region, some taxonomic problems remain unsolved. For example, specific identities of the populations from Indonesia and New Caledonia, here provisionally referred to *Paraspongicola inflatus* n. comb., remain not fully established, since it is difficult to fully assess the significance of minor differences noted among the populations because of the small number of specimens, particularly from the Philippines, the type locality of the species. Future study may possibly reveal that the two populations are distinct from *P. inflatus* n. comb. The new species of *Spongicola*, *S. depressus* n. sp. is described only from a single damaged female specimen. Assessment of diagnostic characters of this species will be made more precisely when more specimens become available.

BATHYMETRIC RANGES

Bathymetric ranges of the species treated in this study are summarized in Figure 36. All species are

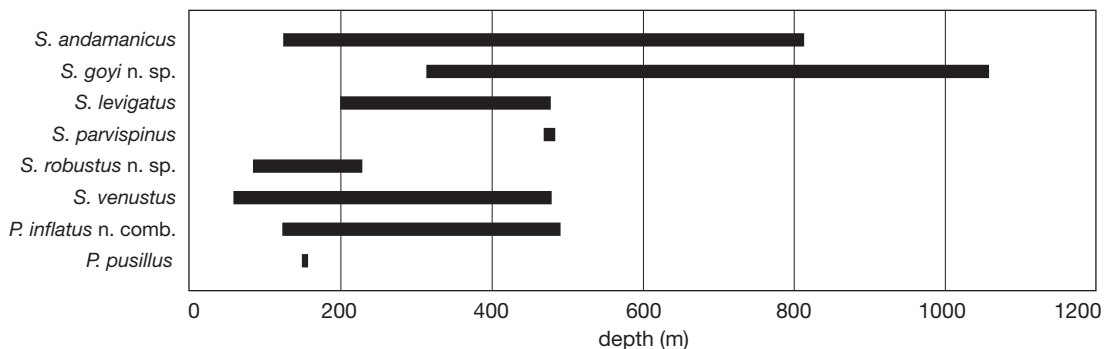


FIG. 36. — Bathymetric ranges of species of the genera *Spongiicola* de Haan, 1844 and *Paraspongiicola* de Saint Laurent & Cleva, 1981.

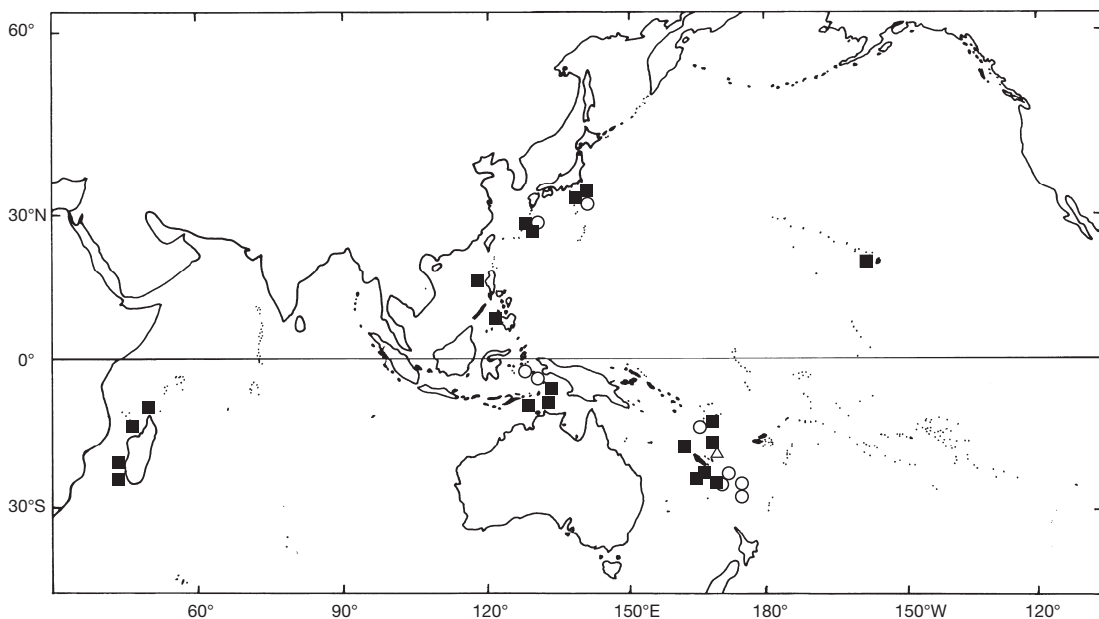


FIG. 37. — Geographic ranges of *Spongiicola andamanicus* Alcock, 1901 (■), *S. depressus* n. sp. (▲) and *S. goyi* n. sp. (○).

included in the depth range of 200–700 m. Only *Spongiicola goyi* n. sp. extends to depth greater than 1000 m, representing the deepest record among the species. Five species, *S. andamanicus*, *S. robustus* n. sp., *S. venustus*, *Paraspongiicola inflatus* n. comb. and *P. pusillus*, also occur in lower sublittoral zone. *Spongiicola andamanicus* and *S. goyi* n. sp. have rather wide bathymetric ranges, the former ranging from 28 to 815 m, and the latter from 315 to 1060 m,

but this may merely reflect the large sample size of the two species. Precise ranges of *S. depressus* n. sp., *S. parvispinus* and *P. pusillus* remain unknown, as these species are represented only by a single or a few type specimens.

GEOGRAPHIC DISTRIBUTION

The present material enables a rough description of the geographical distribution of species of *Spongiicola*

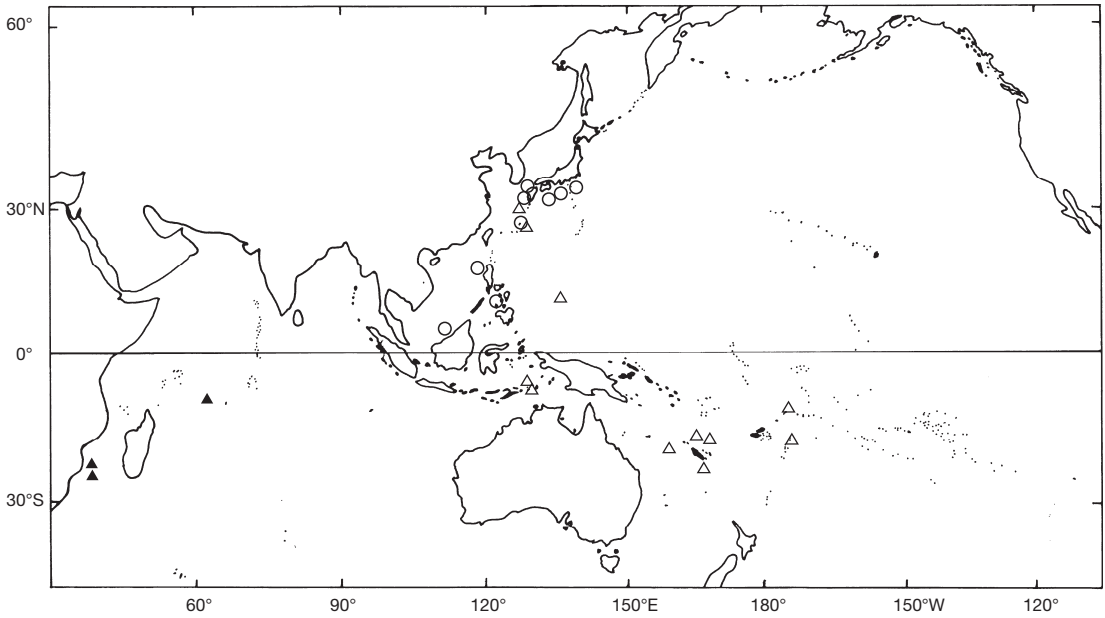


FIG. 38. — Geographic ranges of *Spongiicola levigatus* Hayashi & Ogawa, 1987 (▲), *S. robustus* n. sp. (▲) and *S. venustus* de Haan, 1844 (○).

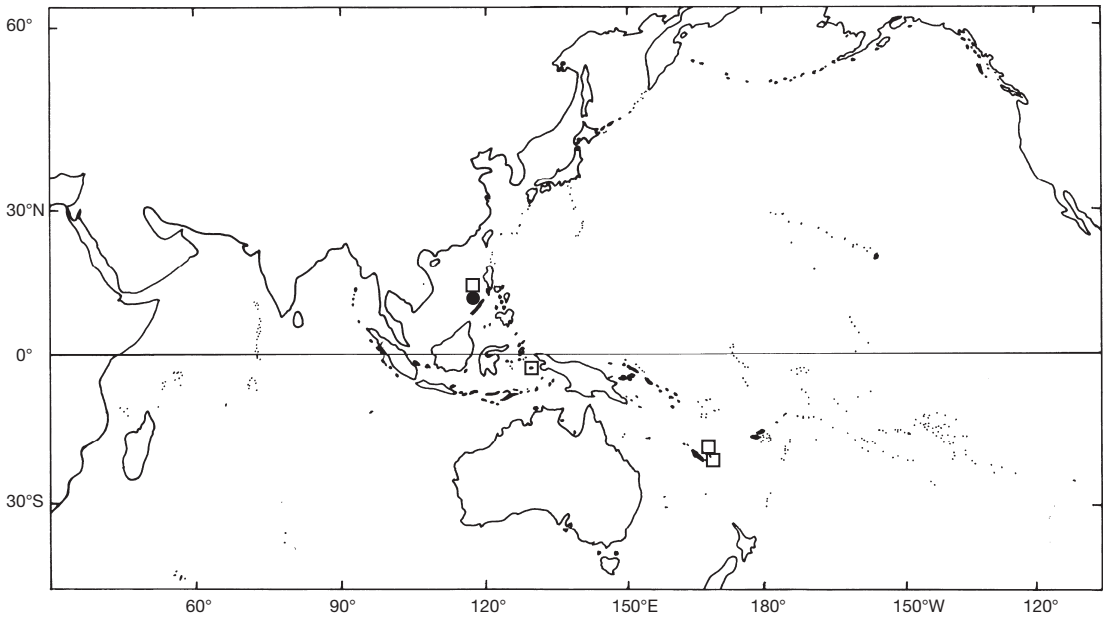


FIG. 39. — Geographic ranges of *Paraspongiicola inflatus* (de Saint Laurent & Cleve, 1981) n. comb. (□) and *P. pusillus* de Saint Laurent & Cleve, 1981 (●).

TABLE 6. — Geographic ranges of the species of *Spongicola* de Haan, 1844 and *Paraspongicola* de Saint Laurent & Cleva, 1981. ●, observed.

	West Pacific										Indian Ocean	East Pacific		
	Hawaii	Japan	Philippines	Indonesia	New Caledonia	Loyalty Is.	Wallis and Futuna Is.	Vanuatu	Fiji Is.	Tonga	Australia	Andaman Sea	Madagascar	Sala-y-Gomez
<i>Spongicola</i>														
<i>andamanicus</i>	●	●	●	●	●	●		●	●		●	●	●	
<i>depressus</i> n. sp.						●								
<i>goyi</i> n. sp.		●		●	●		●							
<i>levigatus</i>		●		●	●	●	●			●				
<i>parvispinus</i>														●
<i>robustus</i> n. sp.													●	
<i>venustus</i>		●	●											
Number of species	1	4	2	3	3	3	1	2	1	1	1	1	2	1
<i>Paraspongicola</i>														
<i>inflatus</i> n. comb.			●	●	●	●							●	
<i>pusillus</i>			●											
Number of species	0	0	2	1	1	1	0	0	0	0	0	1	0	0
Total number of species	1	4	4	4	4	4	1	2	1	1	1	3	1	1

TABLE 7. — Records of hosts and symbionts of *Spongicola* de Haan, 1844 and *Paraspongicola* de Saint Laurent & Cleva, 1981.

	Host	Demospongia	Hexactinellida	Hyalonematidae sp.	<i>Hyalonema</i> sp.	<i>H. sieboldi</i>	Pheronematidae sp.	<i>Semperella</i> sp.	<i>Pheronema</i> sp.	<i>P. semiglobosum</i>	Euplectellidae sp.	<i>Euplectella</i> sp.	<i>E. aspergillum</i>	<i>E. curvistellata</i>	<i>E. imperialis</i>	<i>E. marshalli</i>	<i>E. oweni</i>	<i>Regadrella</i> sp.	Rosellidae sp.	<i>Crateromorpha clathroclada</i>	
<i>S. andamanicus</i>			●				●		●												
<i>S. depressus</i> n. sp.			●				●		●												
<i>S. goyi</i> n. sp.		●	●	●	●	●	●	●	●	●	●	●									
<i>S. levigatus</i>			●	●	●		●	●	●	●	●	●						●			
<i>S. robustus</i> n. sp.			●								●							●			
<i>S. venustus</i>			●	●	●	●					●	●	●	●	●	●	●				
<i>P. inflatus</i> n. comb.			●	●							●	●							●	●	

and *Paraspongicola* (Figs 37-39; Table 6). All of the species are distributed in tropical to warm temperate waters, not penetrating to cold or cool

waters. Northern limit in the Northwest Pacific is off Kominato, Boso Peninsula, Japan (35°N) (*S. venustus*) and the southernmost record is the

Tasman Sea (25°S) (*S. goyi* n. sp.). Southern limit in the Indian Ocean is Mozambique Channel (25°S) (*S. robustus* n. sp.) and that of East Pacific is Sala-y-Gomez ridges (27°S) (*S. parvispinus*).

Most species of the two genera are rather restricted in their distributional range. The most widely distributed species is *Spongicola andamanicus*, recorded from Hawaii, Japan, Philippines, Indonesia and Madagascar. On the other hand, *S. goyi* n. sp., *S. levigatus* and *S. venustus* are limited to the western Pacific: the former two species are recorded from Japan to Vanuatu, and the latter from Japan to Sarawak; *Paraspongicola inflatus* n. comb. is limited to the southwestern Pacific; *S. robustus* n. sp. is so far known only from the western Indian Ocean. Geographical ranges of the other three species, *S. depressus* n. sp., *S. parvispinus* and *P. pusillus* remain unclear, because these species are represented only by the holotype or a few specimens from each single locality. *Spongicola parvispinus* is the sole representative known from the eastern Pacific. None of the two genera are known from the Atlantic Ocean, because *S. cubanicus* should be transferred to a separate genus (see above).

HABITATS

During this study, association with sponges is confirmed for seven species (Table 7). *Spongicola levigatus*, *S. venustus* and *Paraspongicola inflatus* n. comb. are found in association with a wide variety of glass sponges of more than two families. It is remarkable that *Spongicola goyi* n. sp. has been found to use a species of *Demospongia*, as well as hexactinellids. Other species are exclusively associated with hexactinellids. There is no example that a shrimp species is limited to a single host sponge species.

Acknowledgements

Without the encouragement of A. Crosnier (MNHN) and the rich collections of the MNHN, made available by A. Crosnier and B. Richer de Forges (IRD; Institut de Recherche pour le Développement, formerly ORSTOM), our research would not have been possible. Our hearty thanks go to both of them. We are grateful to K.-I. Hayashi (NFU); K. Baba

(Kumamoto University); T. Nishikawa (Nagoya University Museum); A. J. Bruce (Queensland Museum) for valuable information; and K. Konishi (National Research Institute of Aquaculture) for encouragement. We also acknowledge following personnel for loan of specimens: R. Cleva (MNHN); J. C. Walker (USNM); R. Webber (Te Papa National Museum of New Zealand); G. Dally (NTM); J. Olesen (Zoologisk Museum, University of Copenhagen); C. Fransen (RMNH); R. König (Zoologisches Museum, Christian-Albrechts-Universität zu Kiel); S. Kubota (SMBL); and M. Takeda (NSMT). Cordial thanks are also due to the following personnel, Y. Fujita of Marine Learning Center (NPO) and M. Osawa of Ryukyu University, for providing valuable information; K. Ikeue, for collecting materials; M. Mitsubishi of the National Taiwan Ocean University for her help and anonymous reviewers for critically reading the manuscript and offering valuable comments for improvements. The senior author also thanks the staff of the aquarium for financial supporting, technical advice and encouragement. This study was supported by the research grants from Research Institute of Marine Invertebrates Foundation.

REFERENCES

- ALCOCK A. 1901. — *A Descriptive Catalogue of the Indian deep-sea Crustacea Decapoda Macrura and Anomala, in the Indian Museum. Being a Revised Account of the Deep-Sea Species Collected by the Royal Indian Marine Survey Ship Investigator*. Trustees of Indian Museum, Calcutta, 286 + iv p., 3 pls.
- ALCOCK A. & MCARDLE A. F. 1902. — *Illustrations of the Zoology of the Royal Indian Marine Survey Ship Investigator, Under the Command of Captain T. H. Heming, R. N. Crustacea*, Part X. Office of the Superintendent of Government Printing, Calcutta, pls 56-67.
- ARNDT W. 1933. — Die biologischen Beziehungen zwischen Schwämmen und Krebsen. *Mitteilungen aus dem Zoologischen Museum in Berlin* 19: 221-305.
- BALSS H. 1914. — Ostasiatische Decapoden II. Die Natantia und Reptantia, in DOFLEIN F. (ed.), Beiträge zur Naturgeschichte Ostasiens. *Abhandlungen der Königlichen bayerischen Akademie der Wissenschaften* (suppl.) 2 (10): 1-101.
- BATE C. S. 1888. — Report on the Crustacea Macrura collected by H. M. S. *Challenger* during the years

- 1873-76. *Report on the Scientific Results of the Voyage of H. M. S. Challenger, During the Years 1873-76*, (Zool.). Her Majesty's Stationery Office, London, 24, xc + 942 p.
- BOUVIER E. L. 1905. — Sur les pénéides et les sténopides recueillis par les expéditions françaises et monégasques dans l'Atlantique orientale. *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences* 140: 980-983.
- BOUVIER E. L. 1908a. — Sur les relations zoologiques des crevettes de la tribu des sténopides. *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences* 146: 887-891.
- BOUVIER E. L. 1908b. — Catalogue des crustacés de la famille des Sténopides des collections du Muséum d'Histoire naturelle. *Bulletin du Muséum national d'Histoire naturelle* 14: 150-151.
- BRUCE A. J. 1976. — Shrimps and prawns of coral reefs, with special reference to commensalisms, in JONES O. A. & ENDEAN R. (eds), *Biology and Geology of Coral Reefs* 3, *Biology* 2. Academic Press, New York: 37-94.
- CAULLERY M. 1896. — Crustacés schizopodes et décapodes, in KOEHLER R. (ed.), Résultats scientifiques de la campagne du "Caudan" dans le Golfe de Gascogne, août-septembre 1895. *Annales de l'Université de Lyon* 26: 365-419, pls 13-17.
- DOFLEIN F. 1902. — Ostasiatische Dekapoden. *Abhandlungen der mathematisch-physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaften* 21 (3): 613-670.
- ESTAMPADOR E. P. 1937. — A check list of Philippine crustacean decapods. *Philippine Journal of Science* 62: 465-559.
- FUJINO T. & MIYAKE S. 1970. — Caridean and Stenopodidean shrimps from the East China and the Yellow seas (Crustacea, Decapoda, Natantia). *Journal of the Faculty of Agriculture, Kyushu University* 16 (3): 237-312.
- HAAN W. DE 1844. — Crustacea. Fascicle 6-7, in SIEBOLD P. F. VON (ed.), *Fauna Japonica, sive descriptio animalium, quae in itinere per Japoniam, jussu et auspiciis superiorum in India Batava Imperium tenent, suscepto, annis 1823-1830 collegit, notis, observationibus et adumbrationibus illustravit*. J. Müller & Co., Amsterdam: pls 38, 43-46, 48, 51-55, I-N.
- HAYASHI K.-I. & OGAWA Y. 1987. — *Spongicola levigatus* sp. nov., a new shrimp associated with hexactinellid sponge from the East China Sea (Decapoda, Stenopodidae). *Zoological Science* 4: 367-373.
- HERKLOTS J. A. 1861. — Symbolae Carcinologicae. I. Catalogue des crustacés qui ont servi de base au système carcinologique de M. W. de Haan, rédigé d'après la collection du musée des Pays-Bas et les crustacés de la faune du Japon. *Tijdschrift voor Entomologie* 4: 116-156.
- HOLTHUIS L. B. 1946. — The Stenopodidae, Nephropsidae, Scyllaridae and Palinuridae. The Decapoda Macrura of the Snellius Expedition. I. Biological results of the Snellius Expedition XIV. *Temminckia* 7: 1-178.
- HOLTHUIS L. B. 1955. — The recent genera of the caridean and stenopodidean shrimps (class Crustacea, order Decapoda, supersection Natantia) with keys for their determination. *Zoologische Verhandlungen* 26: 1-157.
- HOLTHUIS L. B. 1993. — *The Recent Genera of the Caridean and Stenopodidean Shrimps (Crustacea, Decapoda) with an Appendix on the Order Amphionidacea*. Nationaal Natuurhistorisch Museum, Leiden, 328 p.
- HOLTHUIS L. B. & SAKAI T. 1970. — *Ph. F. von Siebold and Fauna Japonica. A History of Early Japanese Zoology*. Academic Press of Japan, Tokyo, 18 + 323 p., 32 + 7 pls, 1 map.
- IJIMA I. 1901. — Studies on the Hexactinellida contribution I (Euplectellidae). *Journal of College of Science, Imperial University of Tokyo* 15: 1-299, 14 pls.
- KEMP S. W. 1910. — The Decapoda collected by the "Huxley" from the north side of the Bay of Biscay in August, 1906. *Journal of the Marine Biological Association of the United Kingdom*, n. ser. 8: 407-420.
- KIM H. S. 1977. — *Macrura. Illustrated Flora and Fauna of Korea*. Ministry of Education, Seoul, 19, 416 p.
- KOMAI T. & SAITO T. 2006. — A new genus and two new species of Spongicolidae (Crustacea, Decapoda, Stenopodidea) from the South-West Pacific, in JUSTINE J.-L. & RICHER DE FORGES B. (eds), Tropical deep-sea benthos, volume 24. *Mémoires du Muséum national d'Histoire naturelle* 193: 265-284.
- MIERS E. J. 1878. — On species of Crustacea living within the Venus's Flower-basket (*Euplectella*) and in *Meyerina aviformis*. *Journal of the Linnean Society of London, Zoology* 13: 506-512, pl. 24.
- MILNE EDWARDS A. & BOUVIER E. L. 1909. — Les pénéides et sténopides. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877-78), in the Caribbean Sea (1878-79) and along the Atlantic coast of the United States (1880), by the U.S. Coast survey steamer "Blake". XLIV. *Memoirs of the Museum of Comparative Zoology at Harvard College* 27: 177-274, pls 1-9.
- MIYAKE S. 1982. — *Japanese Crustacean Decapods and Stomatopods in Color*. Vol. I. *Macrura, Anomura and Stomatopoda*. Hoikusha, Osaka, 261 p. (in Japanese).
- ORTMANN A. 1890. — Die Unterordnung Natantia Boas. Die Decapoden-Krebse des Strassburger Museums, mit besonderer Berücksichtigung der von Herrn Dr. Döderlein bei Japan und bei den Liu-Kiu-Inseln gesammelten und z.Z. im Strassburger Museum aufbewahrten Formen. *Zoologische Jahrbücher Abtheilung für Systematik, Geographie und Biologie der Thiere* 5: 437-542, pls 36, 37.

- PARISI B. 1919. — Decapodi Giapponesi del Museo di Milano. VII. Natantia. *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale* 58: 59-99, pls 3-6.
- RATHBUN M. J. 1906. — The Brachyura and Macrura of the Hawaiian Islands. *Bulletin of the U.S. Fish Commission* 23 (3): 827-930.
- SAINT LAURENT M. DE & CLEVA R. 1981. — Crustacés décapodes: Stenopodidea, in Résultats des campagnes MUSORSTOM 1. Philippines (18-28 mars 1976), volume 1. *Mémoires ORSTOM* 91: 151-188, figs 1-17.
- SAITO T. 2002. — Development of the external sexual characters in the deep-sea sponge-associated shrimp, *Spongicola japonica* Kubo (Decapoda: Stenopodidea: Spongicolidae). *Journal of Natural History* 36: 819-829.
- SAITO T. & TAKEDA M. 2003. — Phylogeny of the family Spongicolidae (Crustacea, Stenopodidea): evolutionary trend from shallow-water freeliving to deep-water sponge-associated habitat. *Journal of the Marine Biological Association of the United Kingdom* 83: 119-131.
- SCHRAM F. R. 1986. — Euzygida, in SCHRAM F. R. (ed.), *Crustacea*. Oxford University Press, New York: 276-285.
- STEBBING T. R. R. 1893. — *A History of Crustacea, Recent Malacostraca*. The International Scientific Series 71. Kegan Paul, Trench, Trubner & Co., London, xvii + 466 p.
- TAKEDA M. 1982. — *Keys to the Japanese and Foreign Crustaceans Fully Illustrated in Colors*. Hokuryukan, Tokyo, vi + 58 + 284 p.
- THALLWITZ J. 1892. — Decapoden-Studien, insbesondere basirt auf A. B. Meyer's Sammlungen im Ost-indischen Archipel, nebst einer Aufzählung der Decapoden und Stomatopoden des Dresdener Museums. *Abhandlungen und Berichte des Königlich Zoologischen und Anthropologisch-Ethnographischen Museums zu Dresden* 1890-91 (3): 1-55, pl. 1.
- THOMPSON D'ARCY W. 1901. — *A Catalogue of Crustacea and of Pycnogonida contained in the Museum of University College, Dundee*. University St Andrews, Dundee, 56 p.
- TUNG Y. M., CHEN Y. S., WANG F. Z., WANG B. Y. & LI Z. C. 1988. — *Report on Crustaceans of the Deep East China Sea*. Zhejiang Science and Technology Publishing House, Zhejiang, 132 p. (in Chinese).
- YAMAGUCHI T. & BABA K. 1993. — Crustacean specimens collected in Japan by Ph. F. von Siebold and H. Bürger and held by the Nationaal Natuurhistorisch Museum in Leiden and other museums, in YAMAGUCHI T. (ed.), *Ph. F. von Siebold and Natural History of Japan, Crustacea*. Carcinological Society of Japan, Tokyo, 731 p., pls 1-24.
- YOKOYA Y. 1933. — On the distribution of decapod crustaceans inhabiting the continental shelf around Japan, chiefly based upon the materials collected by S. S. *Sōyō-Maru*, during the years 1923-1930. *Journal of the College of Agriculture, Imperial University of Tokyo* 12 (1): 1-226.
- ZARENKOV N. A. 1990. — Decapods (Stenopodidea, Brachyura, Anomura) of the Naska and Sala-y-Gomes underwater ridges. *Trudy Instituta Okeanologii* 124: 218-244 (in Russian).

Submitted on 25 October 2006;
accepted on 21 May 2007.