

# *Lebbeus spongiaris*, a New Species of Deep-water Shrimp (Crustacea: Decapoda: Caridea: Hippolytidae) from Izu Islands, Japan

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**Abstract** A new species of hippolytid shrimp, *Lebbeus spongiaris*, is described on the basis of two specimens (one male and one female) from off Izu-Oshima Island, Izu Islands, Japan, at depths of 257-264 m. The pair of specimens were found in an opened cavity of an unidentified sponge. The new species may represent the first example of commensalism with sponges in the genus *Lebbeus*. It appears close to *L. microceras* (Krøyer), *L. schrencki* (Brashnikov), *L. carinatus* Zarenkov and *L. comanthi* Hayashi and Okuno. Differences between the new species and the other four close relatives are discussed.

**Key words:** *Lebbeus spongiaris*, new species, Izu Islands, Japan, commensalism.

A survey on the deep-water fauna of the Izu Islands, off central Japan, carried out by the RV "Tansei-maru" of the Ocean Research Institute, University of Tokyo, in 1998, produced a small but important collection of decapod crustaceans from this little-investigated region. Among the decapod material collected were a pair of specimens of an undescribed hippolytid shrimp of the genus *Lebbeus*. The specimens were found in an open cavity of an unidentified sponge in life. A new species, *Lebbeus spongiaris*, is described herein based on these two specimens, and compared with its closest relatives, *L. microceras* (Krøyer, 1841) from the North-western Atlantic, *L. schrencki* (Brashnikov, 1907) from the North Pacific, *L. carinatus* Zarenkov, 1976 from off Peru, and *L. comanthi* Hayashi and Okuno, 1997 from Japan.

## Materials and Methods

The specimens examined in this study are deposited in the Natural History Museum and Institute, Chiba (CBM, with code of ZC) and the Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University (HUMZ, with code of C). The illustrations were prepared with the aid of a drawing tube mounted on a LEICA MZ8 stereomicroscope. The postorbital carapace length (cl) is used as a standard measurements indicating the size

of specimen.

For comparative purpose, the following specimens were examined.

*Lebbeus schrencki*: 1 male (cl 4.1 mm), off Wakkanai, northern Hokkaido, depth unknown, 24. III. 1987 (HUMZ-C 138).

*Lebbeus comanthi*: holotype, male (cl 2.7 mm), Izu Ocean Park, Sagami Bay, 15 m, 25. VIII. 1995, SCUBA diving, coll. J. Okuno and M. Yokota (CBM-ZC 3333); paratype, 1 male, off Kamogawa, Boso Peninsula, 10 m, 26. XII. 1996, SCUBA diving, coll. M. Aizawa (CBM-ZC 3335).

## Taxonomy

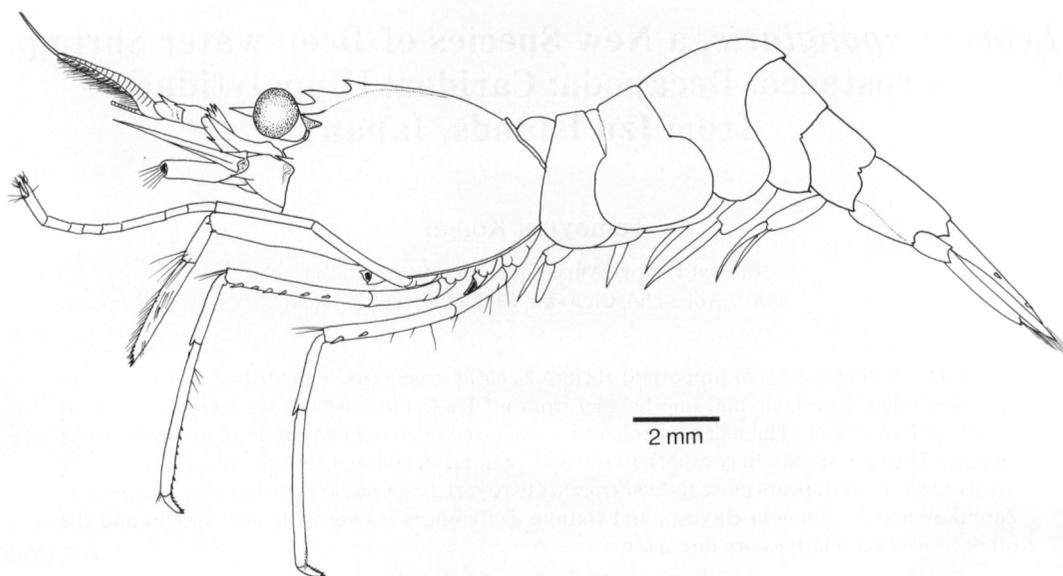
### *Lebbeus spongiaris* sp. nov.

(Figs. 1-4)

*Material examined.* RV "Tansei-maru": KT-98-14 cruise, stn 2, W of Izu-Oshima Island, Izu Islands, 34°44.538'N, 139°19.723'E, 257-264 m, 29. VIII. 1998, ORI dredge with 1 m span, coll. T. Komai, 1 male (paratype, cl 4.3 mm) (CBM-ZC 5567), 1 female (holotype, cl 4.8 mm) (CBM-ZC 5568).

*Description of holotype (female).* Body (Fig. 1) moderately slender, generally glabrous.

Rostrum (Fig. 2A, B) straight, directed forward, not reaching distal margin of first segment of antennular peduncle, 0.4 times as long as carapace, compressed laterally, grad-



**Fig. 1.** *Lebbeus spongiaris* sp. nov. Holotype female from off Izu-Oshima Island (cl 4.8 mm, CBM-ZC 5568). Entire animal in lateral view, antennal flagellum, first and fourth pereopods missing.

ually tapering to acute apex; dorsal margin armed with 3 sharp teeth, including 2 on posterior to level of supraorbital margin, distal half unarmed; lateral face with thin longitudinal carina extending from base of supraorbital spine to 0.7 length of rostrum; ventral margin unarmed. Carapace (Figs. 1, 2A, B) smooth, dorsal surface somewhat inflated in gastric region; postrostral median carina distinct, extending beyond midlength of carapace, with posteriormost tooth arising from 0.21 of carapace length; supraorbital spine moderately strong; deep U-shaped notch just ventral to base of supraorbital spine; anterolateral margin between notch and suborbital lobe generally concave; suborbital lobe obtusely triangular, not reaching supraorbital spine; antennal spine slender, slightly overreaching suborbital lobe; pterygostomian spine small; anterolateral margin between antennal spine and pterygostomian spine with distinct U-shaped notch just ventral to base of antennal spine, remainder slightly concave.

Abdomen (Fig. 1) with somites dorsally rounded, not carinate or strongly produced; pleura of first 3 somites broadly rounded, those of fourth and fifth each with small

posteroventral tooth. Sixth somite 1.5 times longer than fifth, 1.5 times longer than deep, with small posteroventral tooth; posterolateral process terminating acutely. Telson (Fig. 2C, D) 1.6 times longer than sixth somite, 3.5 times longer than anterior width, lateral margins parallel in anterior half, convergent posterior to obtusely triangular posterior margin; with 2 pairs of dorsolateral spines (excluding pair at posterolateral corner); posterior margin with 2 pairs of spines laterally (mesial spine about 3 times longer than lateral spine) and 2 pairs of stout plumose setae mesially).

Branchial formula summarized in Table 1. Epipods present on first to third pereopods.

Sixth to eighth thoracic sternites each with pair of long teeth arising from posterior to coxae of pereopods. First to third abdominal sternites each with paired submedian teeth (spines on first and second sternites strongly curved anteriorly, spines on third sternite straight); fourth and fifth abdominal sternites each with acutely triangular median tooth; sixth abdominal somite with small preanal spine.

Eye (Fig. 2A) subpyriform; cornea wider than stalk; ocellus absent.

**Table 1.** *Lebbeus spongiaris* sp. nov. Branchial formula.

Thoracic somites	1	2	3	4	5	6	7	8
	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	+	+	+	+	+
Arthrobranch	—	—	—	—	—	—	—	—
Podobranch	—	+	—	—	—	—	—	—
Epipods	+	+	+	+	+	+	—	—
Setobranchs	—	—	—	+	+	+	+	—
Exopods	+	+	—	—	—	—	—	—

Antennular peduncle (Fig. 2A) reaching 0.7 of scaphocerite length. Basal segment reaching 0.3 length of scaphocerite, with 3 prominent teeth on dorsodistal margin; ventromesial ridge with prominent subdistal tooth; stylocerite slightly overreaching distal margin of basal segment, acutely pointed, with low, blunt projection subproximally on dorsolateral margin. Penultimate segment about half length of basal segment, with strong dorsodistal lateral tooth. Ultimate segment short, with prominent dorsodistal spine. Dorsal flagellum stout, thickened aesthetasc-bearing portion 0.62 times as long as carapace; ventral flagellum broken.

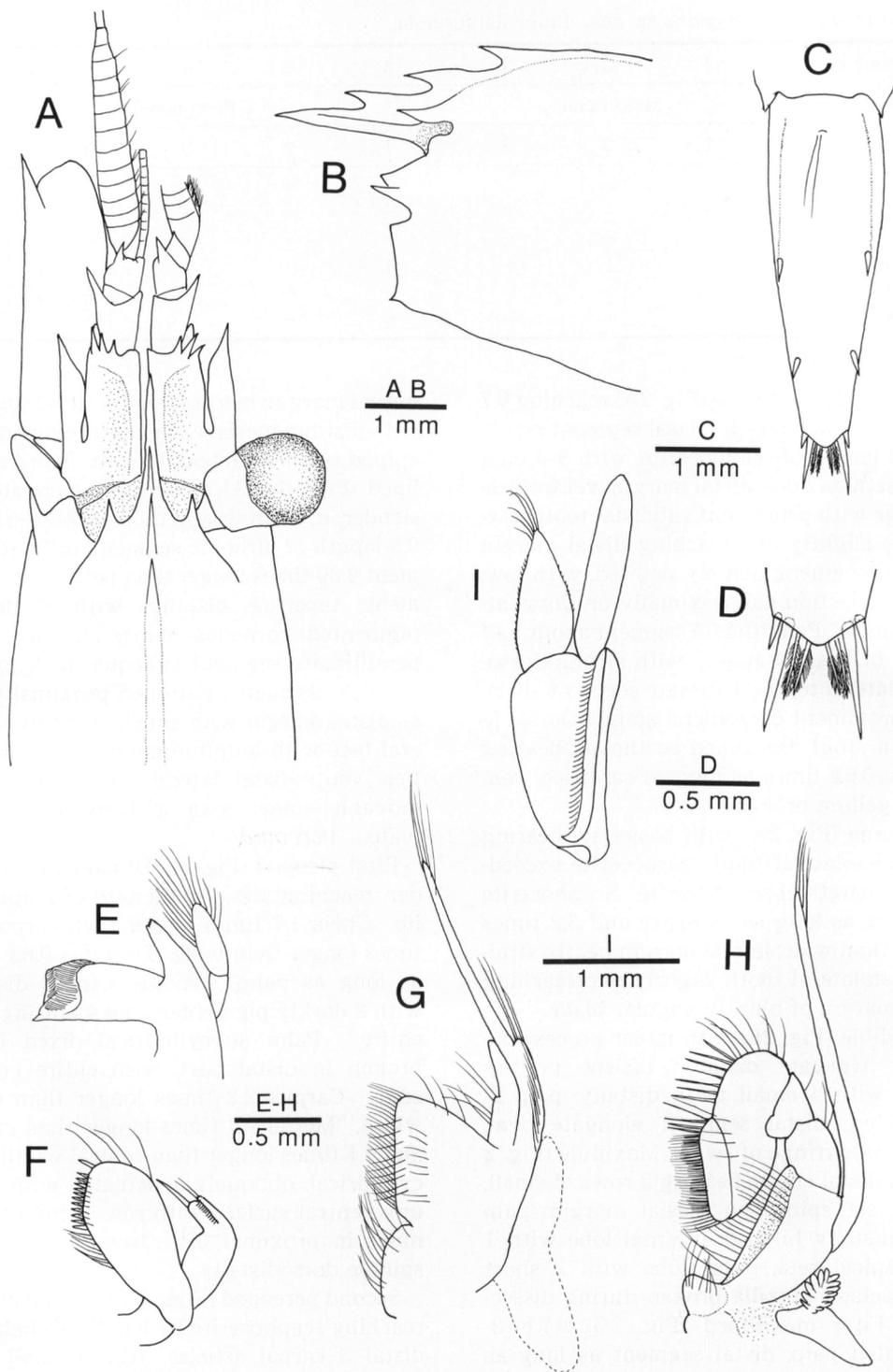
Antenna (Fig. 2A) with basicerite bearing small distolateral tooth; carpocerite exceeding mid-length of scaphocerite. Scaphocerite 0.7 times as long as carapace and 3.2 times longer than wide; lateral margin nearly straight; distolateral tooth slightly overreaching distal margin of bluntly angular blade.

Mandible (Fig. 2E) with molar process obliquely truncate distally; incisor process feeble, with 4 small teeth distally; palp 2-segmented, distal segment elongate oval, with sparse fringe of setae. Maxillule (Fig. 2F) with distal endite bearing 2 rows of small, closely set spines on mesial margin; palp stout, distally bilobed, internal lobe with 1 stout apical seta, outer lobe with 2 short apical setae. Maxilla broken during dissection. First maxilliped (Fig. 2G) with 2-segmented palp, distal segment as long as proximal segment; caridean lobe narrow; exopod long; epipod large, bilobed. Second maxilliped (Fig. 2H) with dactylus bearing rows of numerous setae on mesial margin; propodus with slender spines and setae on

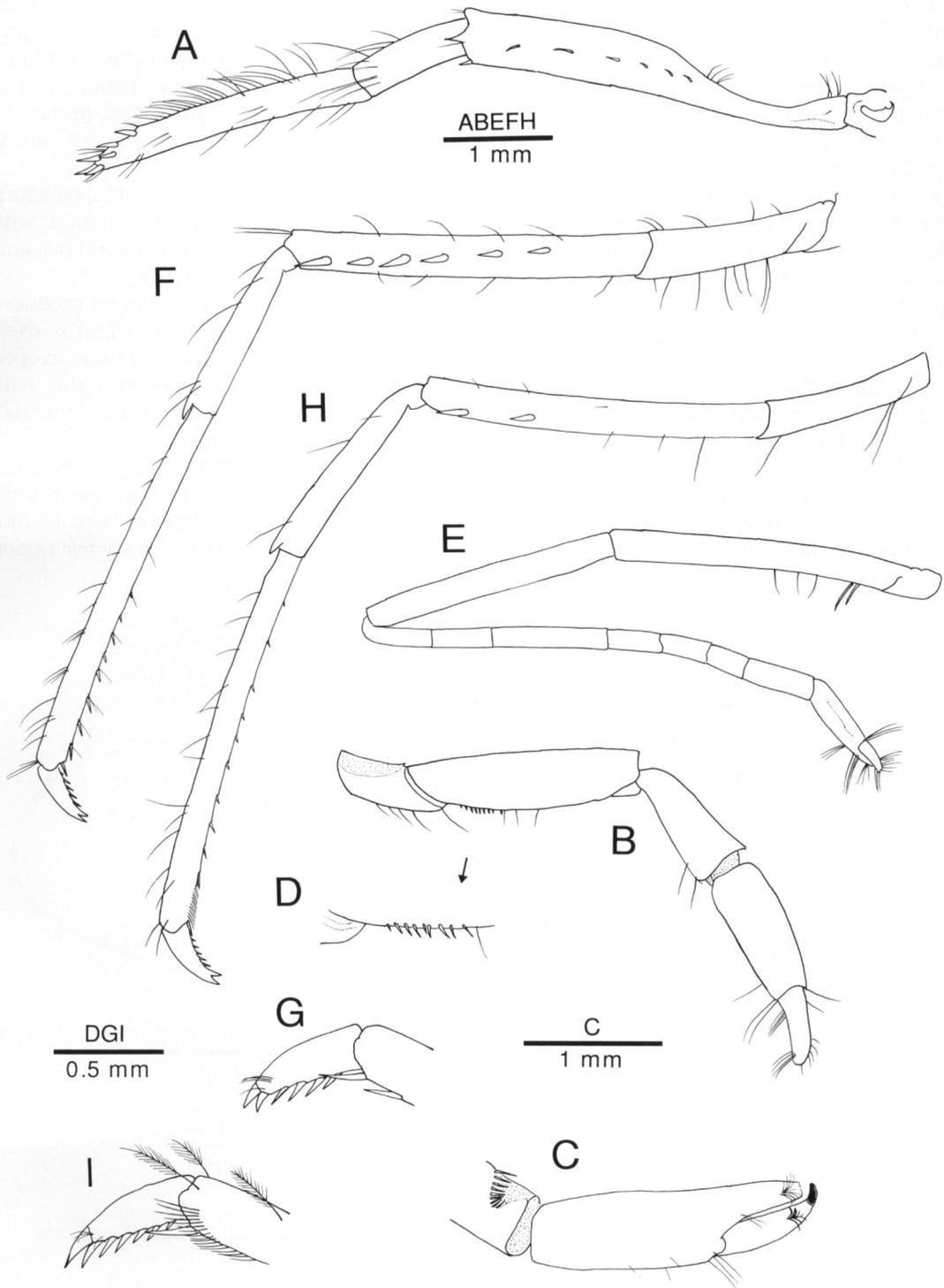
mesial margin; merus-ischium fused segment with distinct mesial excavation; exopod long; epipod small, with podobranch. Third maxilliped (Figs. 1, 3A) moderately elongate and slender, exceeding antennal scaphocerite by 0.3 length of ultimate segment; ultimate segment 2.39 times longer than penultimate segment, tapering distally, with 6 darkly-pigmented corneous spines distally; antepenultimate segment subequal in length to distal 2 segments, flattened proximally, lateral distal margin with small, acute tooth, lateral face with longitudinal row of tiny bristles, ventrodistal lateral angle with small movable spine; coxa without oval lateral plate. ~~pereopod~~

First ~~pleopod~~ (Fig. 3B-D) moderately slender, reaching about midlength of scaphocerite. Chela 1.7 times longer than carpus, 3.8 times longer than wide. Dactylus 0.63 times as long as palm, strongly curved distally, with 2 darkly pigmented claws; cutting edge entire. Palm subcylindrical, fixed finger broken in distal part, with entire cutting edge. Carpus 2.3 times longer than distal width. Merus 1.8 times longer than carpus and 4.1 times longer than central width, subcylindrical, obliquely articulated with ischium; ventral surface with row of minute spinules in proximal 0.4. Ischium with tiny spinule dorsodistally.

Second pereopod (Figs. 1, 3E) slender, overreaching scaphocerite by length of chela and distal 3 carpal articles. Chela small with subcylindrical palm; dactylus 0.7 times as long as palm, with 2 terminal claws; fixed finger with 1 terminal claw; cutting edges of dactylus and fixed finger entire. Carpus 3.5 times longer than chela, 7-articulated, with



**Fig. 2.** *Lebbeus spongiaris* sp. nov. Holotype female from off Izu-Oshima Island (cl 4.8 mm, CBM-ZC 5568). A, anterior part of carapace and cephalic appendages, dorsal, left eye removed; B, anterior part of carapace, lateral; C, telson, dorsal; D, posterior margin of telson, dorsal; E, left mandible, external; F, left maxillule, external, proximal endite broken off; G, left first maxilliped, external, epipod broken off; H, left second maxilliped, external; I, left first pleopod, ventral, setae partially omitted.



**Fig. 3.** *Lebbeus spongiaris* sp. nov. Holotype female from off Izu-Oshima Island (cl 4.8 mm, CBM-ZC 5568). A, left third maxilliped, lateral; B, right first pereopod, lateral; C, same, chela, dorsal; D, same, posterior part of ventral surface of merus, lateral; E, left second pereopod, lateral; F, left third pereopod, lateral; G, same, dactylus, lateral; H, left fifth pereopod, lateral; I, same, dactylus, lateral.

articles in following ratios from proximal end 1.0 : 0.86 : 1.57 : 0.71 : 0.68 : 0.54 : 1.0. Merus 0.56 times as long as carpus. Ischium 1.3 times longer than merus, with few stout setae on ventral margin proximally.

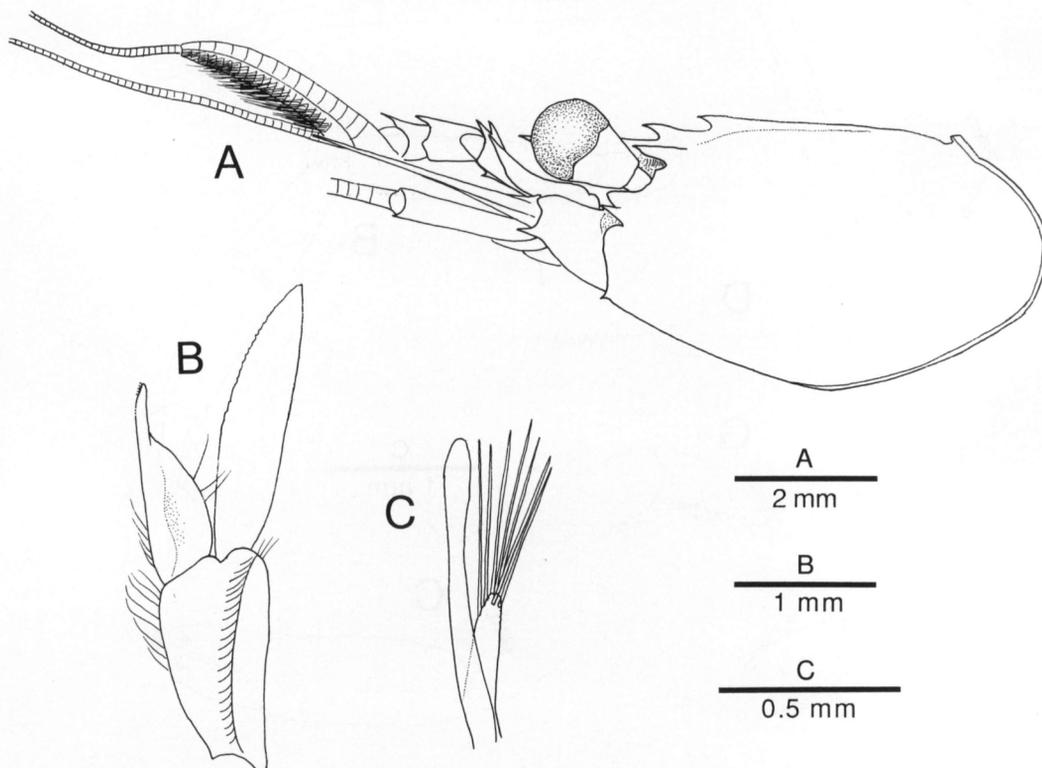
Ambulatory pereopods long and slender. Third pereopod (Figs. 1, 3F, G) overreaching scaphocerite by length of dactylus and 0.4 of propodus; dactylus compressed laterally, about 2.8 times longer than deep and 0.17 times as long as propodus, with 5 accessory spinules on flexor margin; propodus about 13 times longer than deep, with 2 rows of spinules on flexor surface; carpus 0.49 times as long as propodus, unarmed; merus 8 times longer than deep, with 6 lateral spines; ischium about half length of merus, unarmed. Fourth pereopods missing. Fifth pereopod (Figs. 1, 3H, I) generally similar to third, but slightly shorter, overreaching scaphocerite by length of dactylus and 0.15 of propodus;

dactylus 0.21 times as long as propodus, with 6 accessory spinules on flexor margin; propodus 14 times longer than deep, with longitudinal rows of serrate setae distally; carpus 0.53 times as long as propodus; merus 9.3 times longer than deep, with 2-3 lateral spines.

First pleopod (Fig. 2I) with endopod shorter than exopod, elongate subtriangular, with minute bristles on mesial and lateral margins and few long setae apically.

Uropod with protopodite acutely produced posteroventrally; both rami slightly overreaching posterior margin of telson; exopod with lateral margin nearly straight, with small acute distal tooth accompanied mesially by small movable spine.

*Description of paratype (male).* Generally similar to female holotype, but less robust. Rostrum (Fig. 4A) 0.44 times as long as carapace. Carapace (Fig. 4A) with gastric region



**Fig. 4.** *Lebbeus spongiaris* sp. nov. Paratype male from off Izu-Oshima Island (cl 4.3 mm, CBM-ZC 5567). A, carapace and cephalic appendages, lateral; B, left first pleopod, ventral; C, appendix interna and appendix masculina of second pleopod, dorsomesial.

not inflated, thus dorsal profile in lateral view nearly straight. Dorsal flagellum of antennule (Fig. 4A) longer than in female, 0.75 times as long as carapace; ventral flagellum (Fig. 4A) slightly longer than total of dorsal flagellum. Dactyli of third to fifth pereopods each with 6 accessory spinules; meri with 3-4 lateral spines in third, 4 lateral spines in fourth and 3 lateral spines in fifth. First pereopod (Fig. 4B) with endopod elongate subtriangular, with few marginal setae; appendix interna terminal, elongate, about half length of endopod proper. Second pleopod with appendix masculina (Fig. 4C) about 0.4 length of appendix interna, bearing about 7 long bristles.

*Variation.* As is apparent from the description, this new species exhibits variability in the shape of the carapace and development of the antennular flagella, which is attributable to sexual dimorphism. The female holotype has a well developed ovary that is visible through the integument of the carapace. The inflation of the gastric region of the carapace in the female is probably due to the development of the ovary. The dorsal flagellum of the antennule is more elongate in male than in female (0.75 times as long as the carapace versus 0.62 times as long).

*Color in life.* Entirely light pink; eye darkly pigmented (based on field note).

*Distribution.* Known only from off Izu Oshima Island, at depths of 257-264 m.

*Habitat.* The two specimens were found in an open cavity of unidentified sponge.

*Etymology.* This new species is named in reference to the possible commensalism with sponge.

*Remarks.* Grouping of the species of *Lebbeus* according to the number of the epipods has been generally adopted by various authors (e.g., Rathbun, 1904; Holthuis, 1947; Butler, 1980; Hayashi, 1992). The new species belongs to the group of species with epipods on the first to third pereopods. Further, the following features separate *L. spongiaris*, *L. microceras* (Krøyer, 1841), *L. carinatus* Zarenkov, 1976, and *L. comanthi* Hayashi and Okuno, 1997 from other species of the group: rostrum short, not reaching distal margin of basal segment of antennular peduncle; fourth abdominal pleuron with post-

eroventral tooth; basal segment of antennular peduncle armed with two or more than two spines on dorsodistal margin. The new species appears distinctive in having the unarmed ventral margin of the rostrum, the distinct median postrostral carina which extends beyond the midlength of the carapace and the presence of only two pairs of dorsolateral spines on the telson. In other three species, the ventral margin of the rostrum is armed with one or more than one teeth; the postrostral carina does not reach the midlength of the carapace; and the telson bears more than two pairs of dorsolateral spines. The actual number of the dorsolateral spines on the telson is unknown in *L. carinatus*, because the distal part of the telson is broken off in the holotype from off Peru, which is the only known representative of the species (Fransen, 1997). However, it can be assumed that there are more than two pairs of dorsolateral spines on the telson in *L. carinatus*, because the preserved part of the telson has two pairs of spines. *Lebbeus spongiaris* further differs from *L. microceras* in the slightly concave anterolateral margin of the carapace between the antennal and pterygostomial spines and less elongate stylocerite which reaches or slightly overreaches the distal margin of the basal segment of the antennular peduncle. In *L. microceras*, the mentioned margin of the carapace is distinctly convex; and the stylocerite overreaches the distal margin of the penultimate segment of the antennular peduncle (Squires, 1990). The nearly straight, rather than convex, anterolateral margin of the carapace between the antennal and pterygostomial spines will distinguish *L. spongiaris* from *L. carinatus*. *Lebbeus spongiaris* is easily differentiated from *L. comanthi* by the much longer ambulatory pereopods and the rounded posterior margin of the telson. For example, the third pereopod overreaches the scaphocerite by the length of dactylus and 0.4 of the propodus in the new species, while it overreaches the scaphocerite only by the length of the dactylus in *L. comanthi*. The posterior margin of the telson is acutely pointed in *L. comanthi*.

*Lebbeus schrencki* (Brashnikov, 1907) described from the Sea of Okhotsk also appears similar to these four species. Comparison

with the original description has shown that the new species is clearly different from *L. schrencki* in the unarmed ventral margin of the rostrum and the less elongate stylocerite of the antennule. In *L. schrencki*, the rostrum is armed with one or two ventral spines and the stylocerite extends to the distal margin of the penultimate segment of the antennular peduncle. The real taxonomic status of *L. schrencki*, however, remains unclear, as suggested by Fransen (1997). This species has been reported by some authors since the original description (e.g., Vinogradov, 1947; Butler, 1964, 1980; Wicksten and Méndez, 1982). Vinogradov (1947) clearly stated that the pleuron of the fourth abdominal somite was rounded in his specimens from the Sea of Okhotsk, but Butler (1980) mentioned the presence of posteroventral tooth on the fourth pleuron. Butler (1964, 1980), Wicksten and Méndez (1982) and Wicksten (1990; key) noted the presence of a deep transverse groove on the tergum of the second abdominal somite, but the original author and Vinogradov (1947) did not mention the presence of such a groove. Butler (1964) suggested that *L. schrencki* might be conspecific with *L. microceras*. I have examined one specimen from off Wakkanai, northern Hokkaido (HUMZ-C 138), referable to *L. schrencki* following the key of Hayashi (1992), and confirmed that the tergum of the second abdominal somite is devoid of a deep transverse groove and that the fourth abdominal pleuron bears a small but distinct posteroventral tooth. There is a possibility that two or more species are mixed up under the name *L. schrencki*.

From the observation of the ovary through the transparent integument of the carapace, it is assumed that *L. spongiaris* has large and few eggs.

### Discussion

Hayashi (1992) summarized taxonomic information on the genus *Lebbeus*, recognizing 34 taxa from the world oceans. Since then, three new species have been added (Fransen, 1997; Hayashi and Okuno, 1997; Crosnier, 1999), and thus 38 taxa are now known in the genus, including the present new species. From Japanese waters, 14 species have been

reported (Hayashi, 1992; Kikuchi and Ohta, 1995; Hayashi and Okuno, 1997). Although little information on ecology is available for the members of *Lebbeus*, symbiotic relationship has been reported for the following three species: *L. grandimanus* (Brashnikov, 1907), associated with actinarian sea anemone (Butler, 1980; Hayashi and Okuno, 1997); *L. balssi* Hayashi, 1992, also associated with actinarian sea anemone (Hayashi and Okuno, 1997); and *L. comanthi*, associated with crinoid, *Oxycomanthus japonicus* (see Hayashi and Okuno, 1997). The discovery of paired specimens of *L. spongiaris* from an open cavity of an unidentified sponge suggests that this species is associated with the sponge. It is assumed that *L. spongiaris* is rather freely associated with the host, because this species is generally similar in general morphology to the other free living species of the genus. Regarding to other taxa of the Hippolytidae, three species are known to be associated with Porifera. *Gelastocaris paronae* (Nobili, 1905) lives on the external surface of shallow-water Indo-West Pacific sponges (Bruce and Chace, 1986). *Paralebbeus zothecculatus* Bruce and Chace, 1986 and *P. zygius* Chace, 1997 inhabit in small closed chambers inside hexactenellid sponges (Bruce and Chace, 1986).

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This study is dedicated to the memory of late Tsuchida, who greatly contributed to enrich the decapod collection of our museum.

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## 伊豆諸島海域から採集された イバラモエビ属の1新種

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伊豆諸島海域伊豆大島西方沖の水深 257-263 m よりドレッジを用いて採集された雌雄1対の標本に基づき、イバラモエビ属 *Lebbeus* の1新種 *L. spongiaris* (新称: カイメンヤドリモエビ) を記載した。本新種は、*L. microceras* (北西大西洋産)、*L. schrenckii* (北太平洋産)、*L. carinatus* (東太平洋ペルー沖産)、*L. comanthi* (日本産) の4既知種に類似するが、額角の下縁に歯が全くないこと、頭胸甲上の正中隆起が頭胸甲長の半分を越えて伸長すること、尾節の背側棘が2本であり、本属としては少ないことなどの点で容易に識別される。本新種の標本は、採集時にカイメンの1種の腔所に存在していたことから、本新種はカイメンと共生している可能性が示唆される。イバラモエビ属では、2種(ヤドリイバラモエビ *L. grandimanus*、バルスイバラモエビ *L. balssi*) がイソギンチャクと、1種 (*L. comanthi*) がウミシダと共生することが知られていたが、カイメンとの共生例は、本新種が初めてである。