

Two new species of the shrimp genus *Lebbeus* White from the Sea of Japan, with redescription of *Lebbeus kuboii* Hayashi (Decapoda: Caridea: Hippolytidae)

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Abstract.—Two new species of hippolytid shrimp, *Lebbeus elegans* sp. nov. and *L. polyacanthus* sp. nov., are described from the Sea of Japan, at depths of 250-400 m. *Lebbeus elegans* is characterized by the absence of epipods on the second and third pereopods, distinct ventral blade of the rostrum and the rounded fourth abdominal pleuron. *Lebbeus polyacanthus* is compared with *L. antarcticus* (Hale, 1941), *L. carinatus* Zarenkov, 1976, and *L. washingtonianus* (Rathbun, 1902). *Lebbeus polyacanthus* differs from the latter three species in the more posteriorly arising posteriormost tooth of the dorsal rostral series and more numerous lateral spines on the meri of the third to fifth pereopods. Examination of the newly obtained material of *L. kuboii* Hayashi, 1992, enabled us to assess intraspecific variations of the species, including a variation in the development of the pereopodal epipods. Redescription of *Lebbeus kuboii* is provided and its affinity is discussed. These three species occur sympatrically. A brief note on the taxonomy and distribution of species of *Lebbeus* is also provided.

Introduction

Thanks to a number of taxonomic or faunal studies (e.g. Brashnikov, 1907; Yokoya, 1933; Derjugin & Kobjakova, 1935; Kobjakova, 1936, 1937, 1967; Vinogradov, 1950; Miyake & Hayashi, 1967; Hayashi, 1976, 1977, 1991, 1992; Komai *et al.*, 1992; Komai, 1994, 1997, 1999; Komai & Hayashi, 2002), the deep-water shrimp fauna of the

Sea of Japan has been well documented. However, recent examination of a collection of shrimps from Toyama and Ishikawa Prefectures, Japan, has resulted in significant finding of two undescribed species of the hippolytid shrimp genus *Lebbeus* White, 1847, here named as *L. elegans* and *L. polyacanthus*. Many specimens of the recently described species *Lebbeus kuboii* Hayashi, 1992, were also included in the collection. The newly obtained material enabled us to assess the morphological variation of this poorly known species more precisely. It has been found that the development of the epipod on the third pereopod varies considerably in *L. kuboii*, although the development of the pereopodal epipods has been effectively used in separating species of the genus (Rathbun, 1904; Holthuis, 1947; Butler, 1980; Wicksten, 1990; Hayashi, 1992; Fransen, 1997). Therefore, further comparison with other congeneric species is made in this study.

Specimens used in this study are deposited in the Natural History Museum and Institute, Chiba (CBM), National Fisheries University, Shimonoseki (NFU), and National Science Museum, Tokyo (NSMT). The postorbital carapace length (CL) is used as a standard measurement indicating the size of specimens.

Taxonomic Account

Lebbeus elegans, new species

(Figs. 1-3)

[new Japanese name: Miyabi-ibara-moebi]

Material examined.—All specimens were collected from off Togi, Hakui District,

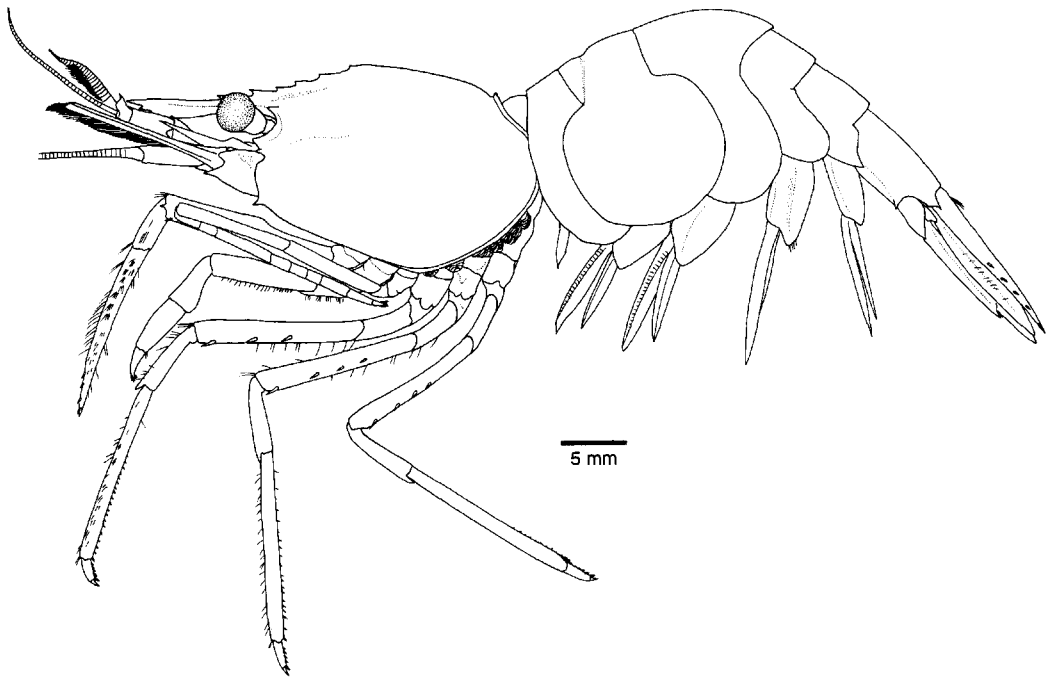


Fig. 1. *Lebbeus elegans*, new species. Holotype ovigerous female (CL 17.0 mm; CBM-ZC 7875) from off Togi, west coast of Noto Peninsula, Sea of Japan. Habitus, lateral view.

Ishikawa Prefecture, west coast of Noto Peninsula, Sea of Japan, 400 m, commercial shrimp trap, coll. H. Kohtsuka. Holotype: ovigerous female (CL 17.0 mm), 14 April 2002, CBM-ZC 7875. Paratypes: 1 female CL 16.7 mm, same data as holotype, CBM-ZC 7876; 11 females (CL 11.5–17.1 mm), 2 ovigerous females (CL 14.3–15.5 mm), 27 April 2003, CBM-ZC 7877; 1 female (CL 16.1 mm), 1 ovigerous female (CL 15.1 mm), same data, NSMT-Cr 16083; 5 females (CL 14.0–17.1 mm), 2 ovigerous females (CL 14.4, 16.0 mm), 27 April 2002 NFU 530-2-2558.

Description (female).—Body relatively robust for genus (Fig. 1); integument naked, glabrous, not particularly hard; spines and teeth on body and appendages frequently darkly pigmented.

Rostrum (Figs. 1, 2A, B) nearly straight, styliform, reaching distal margin of second segment of antennular peduncle (occasional-

ly reaching or slightly overreaching distal margin of third segment), 0.61–0.80 times as long as carapace; dorsal margin armed with 4–7 (most frequently 5 or 6) relatively small, widely spaced teeth, including 2 or 3 (rarely 4) teeth on carapace and 2 or 3 on rostrum proper, distal 0.25–0.60 unarmed; lateral surface with low, blunt carina extending from base of supraorbital spine to tip of rostrum; ventral blade distinct with convex ventral margin, armed with 1 or 2 (rarely 3 or 4) small teeth, none of them posterior to level of anteriormost tooth of dorsal series. Carapace (Figs. 1, 2A, B) with dorsal surface somewhat inflated; postrostral median ridge extending to 0.80 of carapace length; posteriormost tooth of dorsal rostral series arising from 0.30–0.35 of carapace length; orbital region weakly depressed; supraorbital tooth small, arising from level of orbital margin, without distinct notch ventrally; orbital margin evenly concave; suborbital lobe well-developed, triangular, reaching or slightly

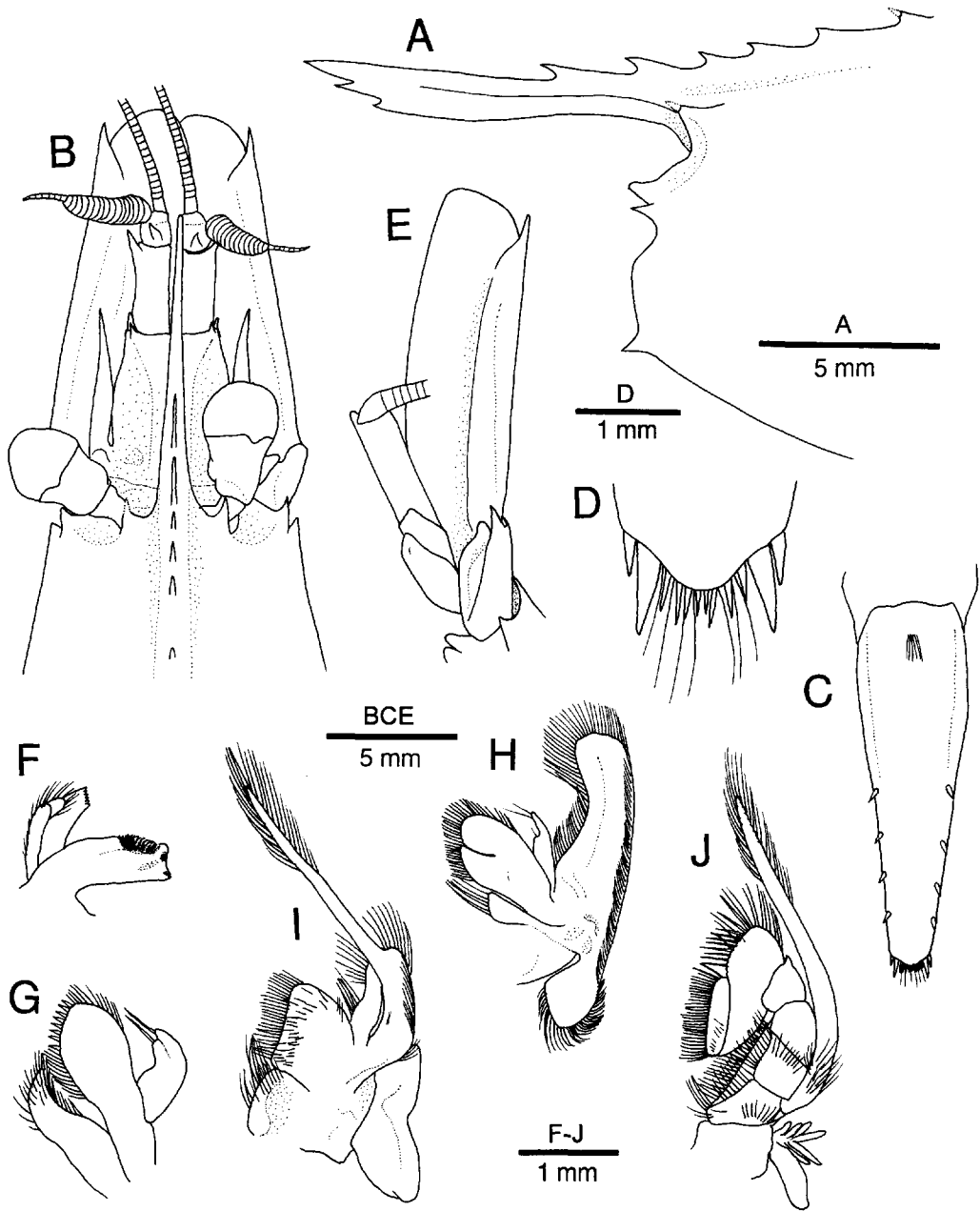


Fig. 2. *Lebbeus elegans*, new species. Holotype ovigerous female (CL 17.0 mm; CBM-ZC 7875) from off Togi, west coast of Noto Peninsula, Sea of Japan. A, rostrum and anterior part of carapace, lateral view; B, rostrum, anterior part of carapace and cephalic appendages, dorsal view; C, telson, dorsal view; D, posterior part of telson, dorsal view; E, left antenna, ventral view; F, left mandible, dorsal view; G, left maxillule, ventral view; H, left maxilla, ventral view; I, left first maxilliped, ventral view; J, left second maxilliped, ventral view.

overreaching antennal tooth, terminating in rounded process; antennal tooth small; pterygostomial tooth small, reaching or slightly overreaching antennal tooth; anterolateral margin between antennal and branchiostegal teeth with distinct U-shaped notch just inferior to antennal spine, remainder sinuous.

Abdomen (Fig. 1) dorsally rounded. Second somite with shallow transverse groove on tergum; posterior border of transverse groove not ridged. Posterodorsal margin of third somite well produced. Pleura of anterior four somites broadly rounded, fifth pleuron with moderately strong posteroventral tooth. Sixth somite about 1.50–1.60 times as long as fifth somite and 1.80–1.95 times as long as height, bearing small, weakly buttressed posteroventral tooth; posterolateral process sharply pointed. Telson (Fig. 2C, D) 1.50–1.60 times as long as sixth somite, 3.00–3.20 times longer than anterior width, lateral margins parallel in anterior 0.30, and thereafter tapering posteriorly to convex posterior margin, with 3 or 4 dorso-lateral spines on either side in posterior half; posterior margin with 2 pairs of lateral spines (mesial pair largest) and 8–10 short spines and 8–10 long setae between 2 lateral pairs.

Eye (Fig. 2B) subpyriform with cornea distinctly wider than eye-stalk; ocellus not distinctly delimited, but ocellar sinus evident on dorsal surface; maximum diameter of cornea about 0.15–0.17 of carapace length.

Antennular peduncle (Fig. 2B) reaching 0.75 of antennal scale. First segment longer than distal two segments combined, reaching mid-length of antennal scale, armed with 1 small spine on dorsodistal lateral angle; stylocerite slightly overreaching distal margin of first segment, sharply pointed, bearing low elevation subproximally, mesial margin slightly convex, slightly overlapping lateral margin of first segment; second segment about 0.60 length of first segment, with moderately large spine at dorsodistal lateral angle; third segment short, with moderately large spine on dorsodistal margin. Lateral

flagellum with thickened aesthetasc-bearing portion 0.30–0.35 times as long as carapace in females.

Antenna (Fig. 2B, E) with moderately small ventrolateral tooth on basicerite; car-pocerite reaching midlength of antennal scale. Antennal scale 0.70–0.80 times as long as carapace and 3.10–3.30 times as long as wide; lateral margin straight; distolateral tooth slightly falling short of rounded distal margin of blade.

Mouthparts typical of genus (Fig. 2F–J). Third maxilliped (Fig. 3A, B) moderately long, overreaching antennal scale by half length of ultimate segment; ultimate segment 3.40–3.50 times as long as carpus (= penultimate segment), tapering distally, with several corneous spines on distal part; antepenultimate segment shorter than distal two segments combined, armed with 2 small, movable spines on distolateral margin, lateral surface bluntly ridged.

Strap-like epipod normally present on third maxilliped, but occasionally absent; epipod on first pereopod present or absent, if present, strap-like with terminal hook; second to fifth pereopods always lacking epipod. Setobranch on first pereopod always present; setobranch on second pereopod absent.

First pereopod (Fig. 3C, D) moderately stout, not reaching distal margin of antennal scale; chela 1.70–1.85 times as long as carpus, 4.50–4.60 times longer than wide; dactylus 0.65–0.75 times as long as palm, terminating in 2 corneous claws; merus 1.70–1.80 times as long as carpus and 4.00–4.10 times longer than greatest height, subcylindrical, obliquely articulated with ischium, bearing row of slender spinules on proximal half of ventral surface; lateral face of merus with tiny spiniform tubercle near articulation with ischium. Second pereopod (Fig. 3E) overreaching antennal scale by length of chela; chela small with subcylindrical palm; dactylus 0.65–0.70 times as long as palm, terminating in 2 small claws; carpus 4.50–4.60 times as long as chela, divided in 7 articles; merus 0.60 times as long as carpus; ischium

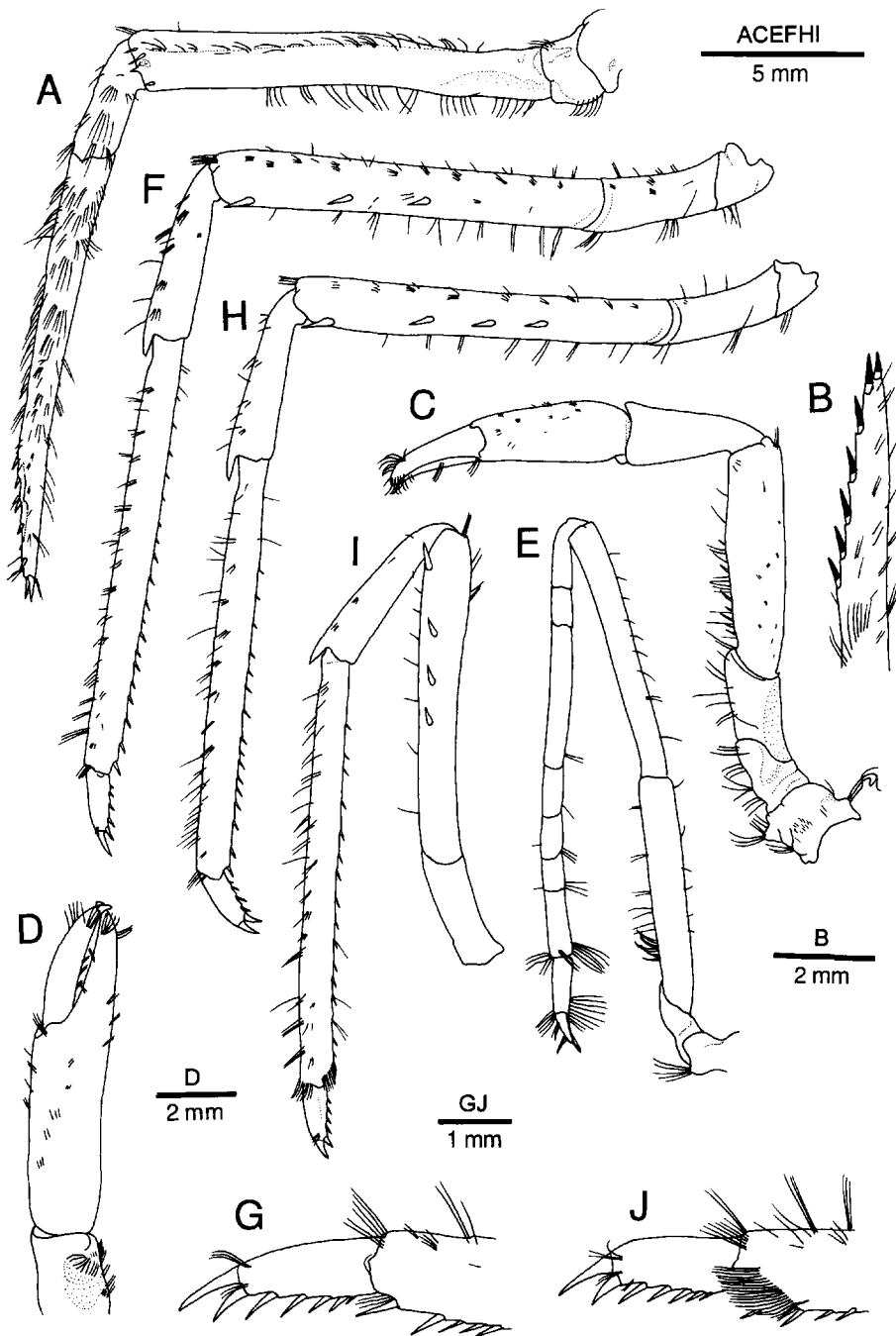


Fig. 3. *Lebbeus elegans*, new species. Holotype ovigerous female (CL 17.0 mm; CBM-ZC 7875) from off Togi, west coast of Noto Peninsula, Sea of Japan. Left appendages. A, third maxilliped, lateral view; B, same, distal part of ultimate segment, mesial view; C, first pereopod, lateral view; D, same, chela and distal part of carpus, ventral view; E, second pereopod, lateral view; F, third pereopod, lateral view; G, same, dactylus and distal part of propodus, lateral view; H, fourth pereopod, lateral view; I, fifth pereopod, lateral view; J, same, dactylus and distal part of propodus, lateral view.

0.85–0.90 times as long as merus, with short row of spiniform setae on ventral margin proximally. Third to fifth pereopods moderately long and slender for genus. Third pereopod (Fig. 3F) overreaching antennal scale by length of dactylus and half of propodus; dactylus (Fig. 3G) 0.20–0.25 times as long as propodus, moderately stout (3.50–3.70 times as long as height), terminating in elongate unguis, armed with 5 or 6 relatively long accessory spinules; propodus with 2 rows of relatively long spinules on ventral surface; carpus 0.40–0.43 times as long as propodus; merus 7.90–8.50 times as long as height, armed with 4–7 spines on lateral surface ventrally. Fourth pereopod (Fig. 3H) similar to third pereopod, overreaching antennal scale by length of dactylus; merus with 3–6 spines on lateral surface ventrally. Fifth pereopod (Fig. 3I) not reaching distal margin of antennal scale, generally similar to third and fourth pereopod, but merus relatively shorter; propodus (Fig. 3J) with submarginal row of stiff setae distoventrally; merus with 2–5 spines on lateral surface ventrally.

Female pleopods typical of genus, without distinctive feature. Uropod (Fig. 1) with both rami slightly overreaching posterior margin of telson; exopod slightly longer than endopod.

Coloration in life.—Body generally translucent; carapace with thin yellow transverse band posterior to midlength; abdomen with 7 thin yellow transverse bands, most of them extending to ventral margin of pleura (1 on first, fourth and fifth somites, and 2 on second and third somites, anterior band on third somite short, restricted to tergum). Antennal flagellum banded with red. Pereopods translucent, with tint of yellow on each segment.

Variations.—The development of the epipod on the third maxilliped and first pereopod varies. Twenty of 25 specimens have well-developed, hooked epipods on both third maxillipeds, but four specimens have an epipod on the third maxilliped only on one side. In one specimen, both third maxil-

lipeds bear rudimentary epipods. Even in the case that the epipod is absent, the corresponding setobranch on the first pereopod is present in all specimens. Therefore, it can be said that this species normally has an epipod on the third maxilliped. Sixteen of 25 specimens have hooked epipods on the first pereopods, while seven specimens lack epipods on both first pereopods. Two specimens bear an epipod only on one side on the first pereopod. It should be noted that the presence of the epipod on the first pereopod correlates strictly to the presence of the epipod on the third maxilliped.

Distribution.—So far known only from off Togi, west coast of Noto Peninsula, Sea of Japan, at depths of 300–400 m.

Etymology.—Named *elegans*, from the Latin meaning “beautiful”, alluding to the beautiful appearance of the species.

Remarks.—Grouping of species within the genus *Lebbeus* according to the number of pereopodal epipods was first applied by Rathbun (1904), and later accepted by Holthuis (1947), Butler (1980), Wicksten (1990) and Hayashi (1992). However, this new species shows variation in the development of the epipods on the third maxilliped and first pereopod, as noted above. A similar pattern of variation in the development of the epipods is known in *Lebbeus longipes* Kobjakova, 1936 (Hayashi 1992). The following comparison is restricted to females, as no male specimens of *L. elegans* have been available for study. This new species is immediately distinguished from *L. longipes* by the length of the rostrum, armature of the fourth abdominal pleuron, and shape of the sixth abdominal somite. The rostrum is proportionally shorter in *L. elegans* than in *L. longipes* (0.61–0.80 as long as the carapace versus 0.95–1.10 times as long). The fourth abdominal pleuron is rounded in *L. elegans*, but sharply pointed at the posteroventral angle in *L. longipes*. The sixth abdominal somite is less slender in *L. elegans* than in *L. longipes* (less than twice length of the proximal height versus more than twice).

Occasional presence of an epipod on the

first pereopod in the new species requires a comparison with *L. vicinus vicinus* (Rathbun, 1902) and *L. vicinus montereyensis* Wicksten & Mèndez, 1982. Comparison with the descriptions of the latter two taxa (Rathbun, 1902, 1904; Wicksten & Mèndez, 1982) reveals some morphological differences between the new species and the latter two taxa. The new species differs from *L. vicinus vicinus* in the length and armature of the rostrum and the length of the antennular peduncle. The rostrum is shorter in *L. elegans* than in *L. vicinus vicinus* (0.61–0.80 as long as the carapace versus about 1.00 times as long). Furthermore, the posteriormost ventral tooth arises far more anterior to the anteriormost dorsal tooth in *L. elegans*, whereas it arises posterior to the second tooth of the dorsal series in *L. vicinus vicinus*. The antennular peduncle reaches 0.75–0.80 of the antennal scale in *L. elegans*, rather than reaching nearly to the distolateral tooth of the antennal scale in *L. vicinus vicinus*. The known specimens of *L. vicinus montereyensis* are all damaged (Wicksten & Mèndez, 1982). Nevertheless, *L. elegans* can be differentiated from *L. vicinus montereyensis* by the shape and armature of the rostrum. The ventral blade of the rostrum of *L. elegans* is well developed, showing as a convex lamina, while *L. vicinus montereyensis* lacks a ventral blade on the rostrum. The posteriormost tooth of the dorsal rostral series arises more posteriorly in the new species than in *L. vicinus montereyensis* (0.30–0.35 of the carapace length versus about 0.10). In addition, as mentioned by Wicksten & Mèndez (1982), *L. montereyensis* seems to adapt to life at greater depths, as the available specimens of that taxon were collected at depths of 954–2824 m.

***Lebbeus polyacanthus*, sp. nov.**

(Figs. 4–6)

[new Japanese name: Torafu-ibara-moebi]

Material examined.—Holotype: ovigerous female (CL 15.0 mm), off Togi, Hakui

District, west coast of Noto Peninsula, 400 m, 23 February 2004, commercial trap, coll. H. Kohtsuka, CBM-ZC 7880.

Paratypes: 2 females (CL 13.5, 16.2 mm), off Mizuhashi, Toyama Bay, 250 m, 12 December 2003, coll. T. Watanabe, NUF 530-2-2559; 1 ovigerous female (CL 15.0 mm), off Togi, 14 April 2002, commercial trap, coll. by H. Kohtsuka, CBM-ZC 7878; 1 female (CL 13.3 mm), 1 ovigerous female (CL 15.5 mm), similar locality, 400 m, 27 April 2002, commercial trap, coll. H. Kohtsuka, CBM-ZC 7879; 4 females (CL 15.5 mm), 3 ovigerous females (CL 15.5–16.0 mm), same data as holotype, CBM-ZC 7881; 1 female (CL 14.4 mm), 1 ovigerous female (CL 16.1 mm), same data as holotype, NSMT-Cr 16084.

Description (female).—Body (Fig. 4) moderately robust for genus; integument naked, glabrous, not particularly hard; spines and teeth on body and appendages usually not darkly pigmented.

Rostrum (Fig. 5A, B) nearly straight, styliform, directed forward, slightly falling short of or slightly overreaching distal margin of first segment of antennular peduncle, 0.44–0.55 times of carapace length; dorsal margin armed with 6 or 7 moderately large teeth at subequal distances, including 3 or 4 teeth on carapace and 3 or 4 on rostrum proper; lateral surface with low, but distinct carina extending from base of supraorbital spine to midlength of rostrum; ventral blade very shallow, armed with 2–4 small teeth in distal 0.15–0.20, none of them posterior to level of anteriormost tooth of dorsal series. Carapace (Figs. 4, 5A, B) with dorsal surface somewhat inflated particularly in spawning molt; postrostral median ridge distinct, extending to 0.75 of carapace length; posteriormost tooth of dorsal rostral series arising from 0.36–0.44 of carapace length; orbital region somewhat depressed; supraorbital spine large, arising posterior to level of orbital margin, with deep V-shaped notch ventrally; suborbital lobe well-developed, triangular, reaching or slightly overreaching

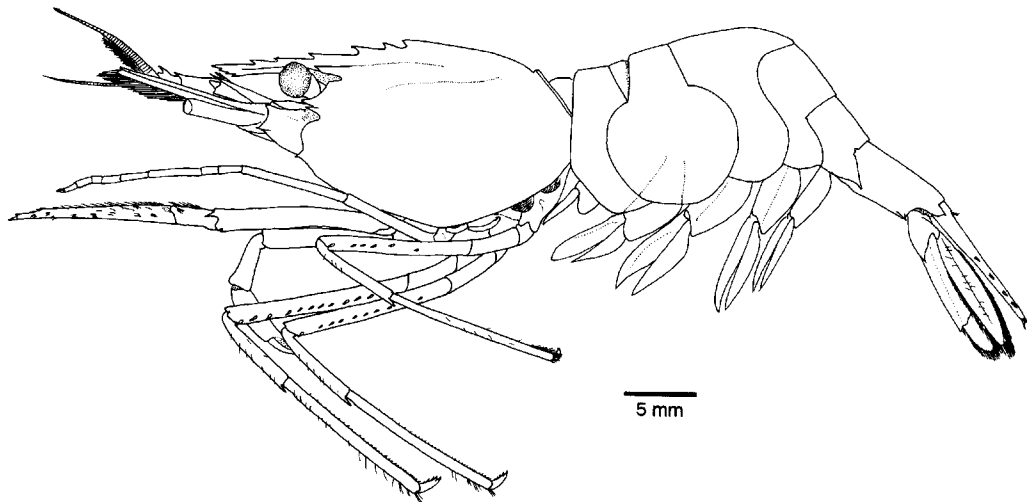


Fig. 4. *Lebbeus polyacanthus*, new species. Holotype ovigerous female (CL 15.0 mm; CBM-ZC 7880) from off Togi, west coast of Noto Peninsula, Sea of Japan. Habitus, lateral view.

antennal tooth, terminating bluntly or subacutely; antennal tooth moderately small; pterygostomial tooth slender, reaching or slightly overreaching antennal tooth; anterolateral margin between antennal and branchiostegal spines with deep U-shaped notch just inferior to antennal spine, remainder strongly convex or sinuous.

Abdomen (Fig. 4) dorsally rounded. Tergum of second somite with transverse groove bordered posteriorly by distinct ridge, posterior part higher than anterior part (Fig. 5C). Posterodorsal margin of third somite strongly produced. Pleura of anterior three somites broadly rounded, fourth pleuron armed with small posteroventral tooth, fifth pleuron with large posteroventral tooth. Sixth somite about 1.50–1.60 times as long as fifth and 1.80–1.90 times as long as height, bearing small, buttressed posteroventral tooth; posterolateral process sharply pointed. Telson (Fig. 5D, E) 1.60–1.65 times longer than sixth somite, 1.80–1.90 times longer than anterior width, lateral margins parallel in anterior 0.30, and tapering posteriorly to convex posterior margin, with 4–6 dorsolateral spines on either side in posterior 0.70; posterior margin with 2 pairs of lateral spines (mesial pair largest)

and 4 mesial spinules.

Eye (Fig. 5B) subpyriform with cornea distinctly wider than eye-stalk; ocellus clearly delineated; maximum diameter of cornea 0.15–0.18 of carapace length.

Antennular peduncle (Fig. 5B) reaching 0.70 of antennal scale. First segment longer than distal two segments combined, reaching mid-length of antennal scale, armed with 2 or 3 long, slender teeth on dorsolateral distal angle; stylocerite reaching or slightly overreaching distal margin of first segment, sharply pointed, bearing low convexity subproximally, mesial margin slightly convex, not overlapping lateral margin of first segment; second segment about half length of first segment, with long tooth at dorsodistal lateral angle; third segment short, with moderately large tooth on dorsodistal margin. Lateral flagellum with thickened aesthetasc-bearing portion 0.30–0.35 times as long as carapace.

Antenna (Fig. 5B, F) with moderately large ventrolateral tooth on basicerite; carocerite reaching or slightly overreaching midlength of antennal scale. Antennal scale 0.80–0.85 times of carapace and 3.30–3.80 times longer than wide; lateral margin slightly concave; distolateral tooth slightly falling

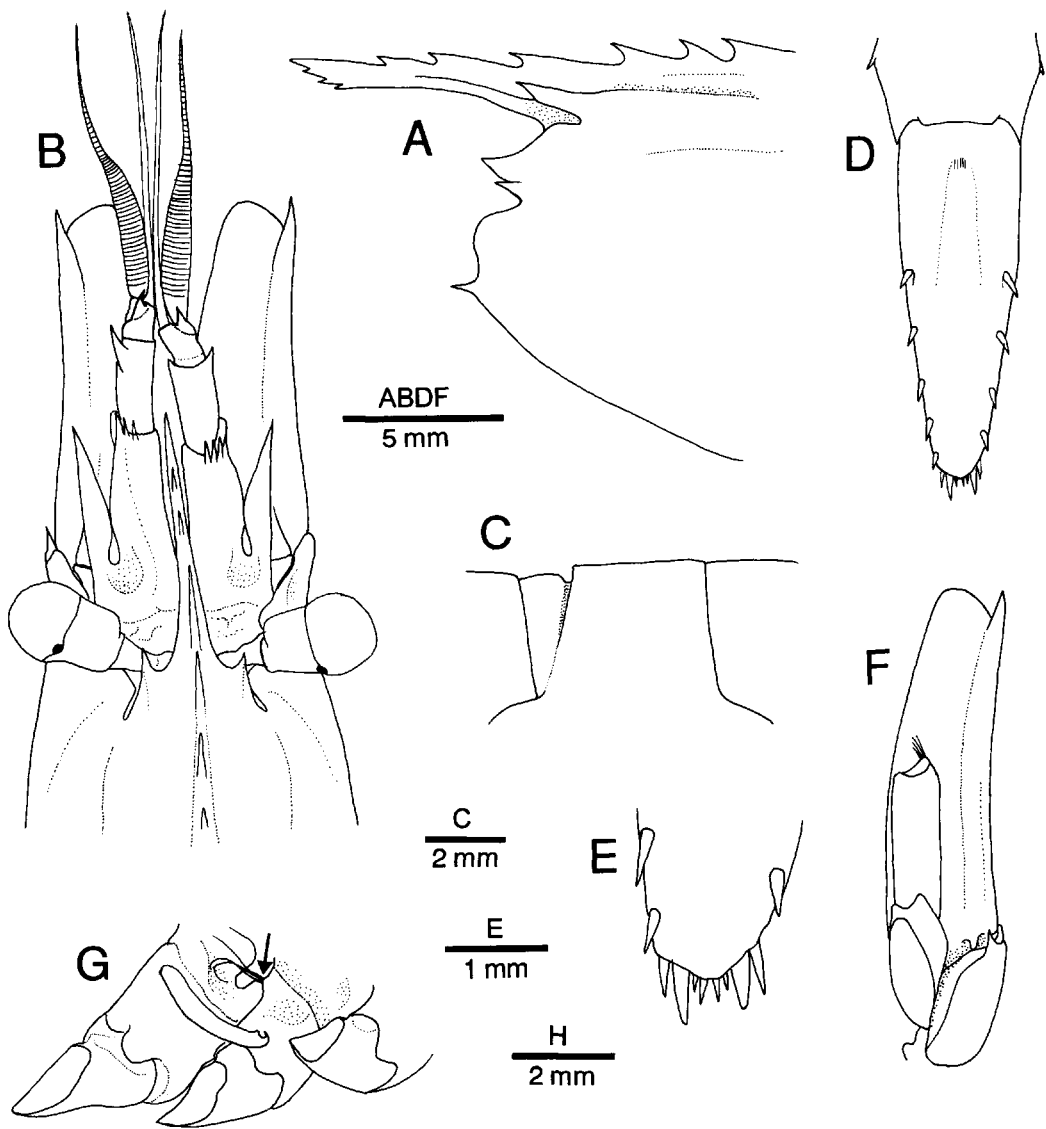


Fig. 5. *Lebbeus polyacanthus*, new species. Holotype ovigerous female (CL 15.0 mm; CBM-ZC 7880) from off Togi, west coast of Noto Peninsula, Sea of Japan. A, rostrum and anterior part of carapace, lateral view; B, rostrum, anterior part of carapace and cephalic appendages, dorsal view; C, tergite of second abdominal somite, lateral view; D, telson, dorsal view; E, posterior part of telson, dorsal view; F, left antenna, ventral view (flagellum missing); G, coxae of third to fifth pereopods, lateral view, arrow indicating setobranch on fourth pereopod.

short of or slightly overreaching rounded distal margin of blade.

Mouthparts typical of genus. Third maxilliped (Figs. 4, 6A, B) moderately long, overreaching antennal scale by 0.5–0.6 length of ultimate segment; ultimate segment 3.30–

3.50 times as long as carpus (= penultimate segment), tapering distally, with several darkly pigmented spines in distal part; antepenultimate segment shorter than distal two segments combined, armed with 1 long fixed tooth on distolateral margin, lateral

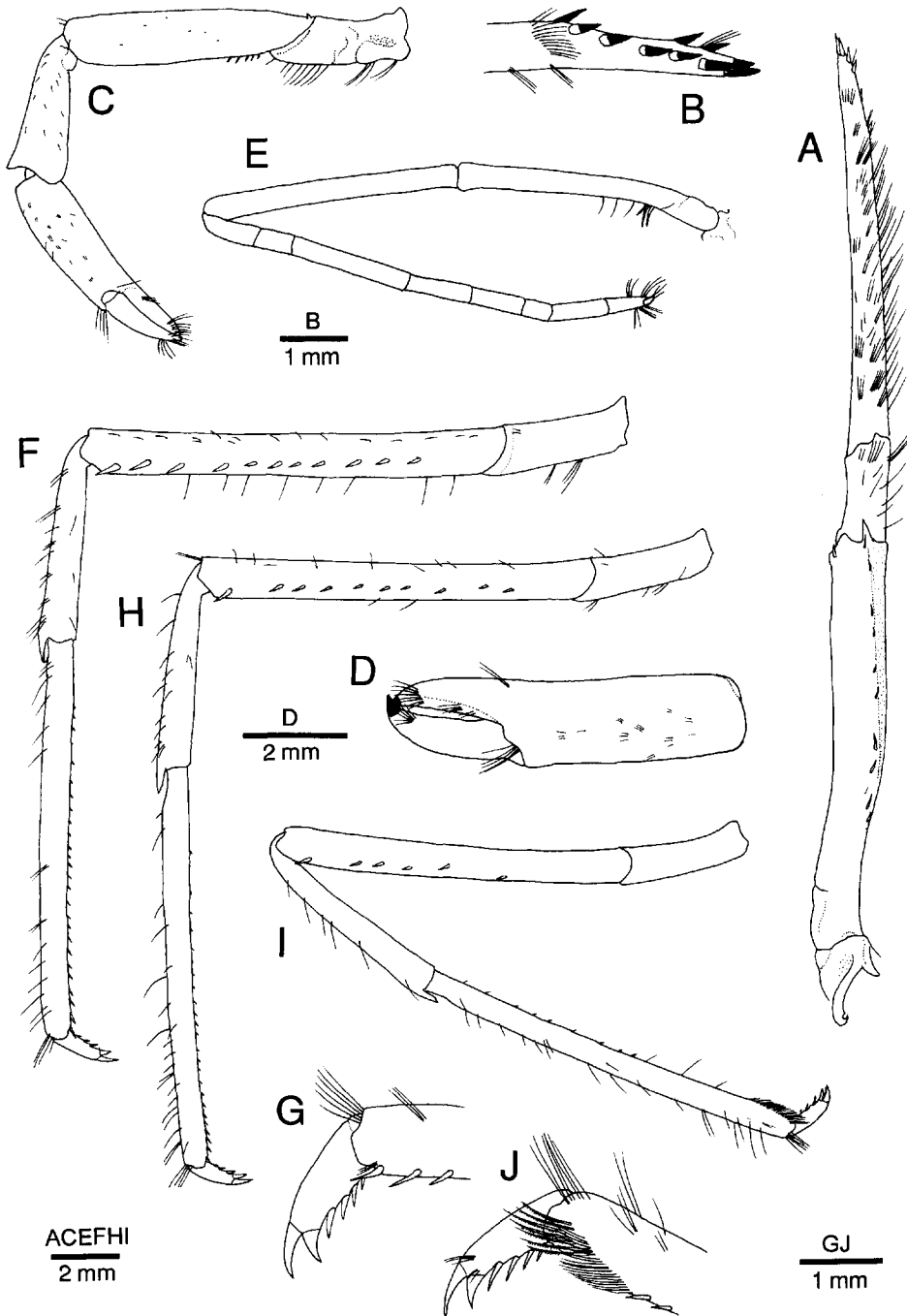


Fig. 6. *Lebbeus polyacanthus*, new species. Holotype ovigerous female (CL 15.0 mm; CBM-ZC 7880) from off Togi, west coast of Noto Peninsula, Sea of Japan. Left appendages. A, third maxilliped, lateral view; B, same, distal part of ultimate segment, mesial view; C, first pereopod, lateral view; D, same, chela, dorsal view; E, second pereopod, lateral view; F, third pereopod, lateral view; G, same, dactylus and distal part of propodus, lateral view; H, fourth pereopod, lateral view; I, fifth pereopod, lateral view; J, same, dactylus and distal part of propodus, lateral view.

surface bluntly ridged.

Strap-like epipod present on third maxilliped to third pereopod, all bearing terminal hook; corresponding setobranchs present on first to fourth pereopods (Fig. 5G).

First pereopod (Figs. 4, 6C) moderately stout, reaching distal margin of antennal scale: chela (Fig. 6D) 1.70–1.85 times as long as carpus, 4.50–4.60 times longer than wide; dactylus 0.60–0.75 of palm length, terminating in 2 corneous claws; merus 1.70–1.85 times as long as carpus and 4.00–5.00 times longer than greatest height, subcylindrical, obliquely articulated to ischium, bearing row of slender spinules on proximal half of ventral surface; lateral face of merus with tiny spiniform tubercle near articulation with ischium. Second pereopod (Figs. 4, 6E) overreaching antennal scale by length of chela and half of carpus; chela small with subcylindrical palm; dactylus 0.65–0.70 times as long as palm, terminating in 2 small claws; carpus 5.50–5.70 times longer than chela, divided in 7 articles; merus 0.55–0.60 times as long as carpus; ischium 0.85–0.90 times as long as merus, with short row of spiniform setae on ventral margin proximally. Third to fifth pereopods relatively long and slender for genus. Third pereopod (Figs. 4, 6F) overreaching antennal scale by length of dactylus and 0.50–0.90 of propodus; dactylus (Fig. 6G) 0.13–0.17 times as long as propodus, moderately stout (3.50–3.70 times as long as height), terminating in moderately long unguis, armed with 5 or 6 relatively long accessory spinules; propodus with 2 rows of spinules on ventral surface; carpus 0.50–0.55 times as long as propodus; merus 9.00–10.00 times as long as height, armed with 9–13 spines on lateral surface ventrally. Fourth pereopod (Figs. 4, 6H) similar to third pereopod, overreaching antennal scale by length of dactylus and 0.20–0.60 of propodus; merus with 8–11 spines on lateral surface. Fifth pereopod (Figs. 4, 6I) overreaching distal margin of antennal scale by length of dactylus and 0.10–0.20 of propodus, generally similar to third and fourth pereopods, but merus rela-

tively shorter; propodus with subdistal cluster of short setae ventrally (Fig. 6J); merus with 5–10 spines on lateral surface.

Female pleopods typical of genus, without distinctive feature. Uropod (Fig. 4) with both rami slightly overreaching posterior margin of telson; exopod slightly longer than endopod.

Coloration in life.—Carapace with reticulate pattern of red on transparent background. Abdomen reddish orange with 5 or 6 white transverse bands on anterior four somites, each band extending obliquely anteriorly and irregularly branched, forming reticulate pattern on pleura; sixth abdominal somite with white longitudinal stripe on lateral face; tailfan with 2 or 3 white transverse bands. Antennae uniformly reddish orange. Third maxilliped generally reddish, with middle white band on ultimate segment. First pereopod light reddish orange. Third to fifth pereopods generally transparent, with 2 red bands on each merus.

Distribution.—So far known only from Toyama Bay and west coast of Noto Peninsula; 250–400 m.

Etymology.—The specific epithet is derived from the Greek *poly*, meaning “many”, and *acanthus*, meaning “thorny”, alluding to the large number of lateral spines on the meri of the last three pereopods.

Remarks.—*Lebbeus polyacanthus* belongs in the group of species with epipods on the first three pereopods, containing 24 species (Table 1). The new species is similar to *L. antarcticus* (Hale, 1941), *L. carinatus* Zarenkov, 1976 and *L. washingtonianus* (Rathbun, 1902) in the following respects: the rostrum reaches or slightly overreaches the distal margin of the basal segment of the antennular peduncle, armed with more than three dorsal teeth and more than one ventral teeth in females; a deep, V-shaped notch is present just inferior to the supraorbital tooth on the carapace; the anterolateral margin of the carapace is strongly sinuous with a prominent notch just inferior to the antennal tooth; and the fourth abdominal somite is armed with a posteroventral tooth (Butler,

1980; Ward, 1985; Komai *et al.*, 1996; Fransen, 1997). No information on the male is available for this new species, *L. carinatus* and *L. washingtonianus*. Therefore, the following comparison is limited to females. The more posteriorly arising posteriormost tooth of the dorsal rostral series distinguishes *L. polyacanthus* from the latter species (0.36–0.44 of the carapace length versus 0.20–0.30). Furthermore, the possession of five to ten lateral spines on the merus of the fifth pereopod separates this new species from *L. washingtonianus*, in which there is only one spine on the merus of the fifth pereopod (Butler, 1980). The count of meral spines on the fifth pereopod is unknown in *L. antarcticus* and *L. carinatus*. *L. polyacanthus* appears different from *L. carinatus* in the more numerous teeth of the dorsal rostral series (six or seven versus four).

Lebbeus kuboi is also similar to *L. polyacanthus* in the features cited above, although the development of the epipod on the third pereopod is variable in the former. However, the features of the carapace and pereopods can differentiate these two species. The new species is primarily distinguished from *L. kuboi* by the more numerous meral spines on the third to fifth pereopods (nine to 13 in third, nine to 11 in fourth, five to ten in fifth versus five to nine in third, four to ten in fourth and one to four in fifth) and the possession of a setobranch on the fourth pereopod corresponding to the epipod on the third pereopod. *Lebbeus kuboi* lacks a setobranch on the fourth pereopod. Female *L. polyacanthus* further differs from female *L. kuboi* by the more posteriorly arising posteriormost tooth of the dorsal rostral series. The color in life is also different between the two. In *L. polyacanthus*, the white bands on the abdomen are branched, forming a reticulate pattern; the sixth abdominal somite has a white longitudinal band on the lateral surface; the tailfan (= telson + uropods) has two or three white transverse bands. On the other hand, in *L. kuboi*, the white bands on the abdomen are simple; the sixth abdominal somite is uniformly red-

dish orange; and the tailfan bears only one transverse band proximally. Furthermore, the new species is characterized by its relatively small size in the female, attaining a carapace length of much more than 17 mm, a size at which *L. kuboi* have barely reached spawning molt.

***Lebbeus kuboi* Hayashi, 1992**
(Figs. 7–11)

Lebbeus kuboi Hayashi, 1992: 123, figs. 6–8 [type locality: off Namerikawa, Toyama Prefecture, Sea of Japan, 200 m]; 1993: 6, figs. 236a, 237a; Komai *et al.*, 1992: 193.

Material examined.—Paratype: 1 ovigerous female (CL 23.5 mm), Toyama Bay off Namerikawa, 200 m, 4 May 1965, coll. K. Oonari, NUF.

Non-type: 1 ovigerous female (CL 23.0 mm), off Togi, Hakui District, west coast of Noto Peninsula, 400 m, 14 April 2002, commercial shrimp trap, coll. H. Kohtsuka, CBM-ZC 7882; 12 females (CL 15.6–22.3 mm), 3 ovigerous females (CL 19.3–22.3 mm), same data, CBM-ZC 7883; 10 females (CL 14.0–20.5 mm), similar locality, 27 April 2002, commercial shrimp trap, coll. H. Kohtsuka, CBM-ZC 7884; 1 male (CL 13.5 mm), 4 females (CL 18.5–20.2 mm), off Mizuhashi, Toyama Bay, 250 m, 12 December 2002, coll. T. Watanabe, NUF 530-2-2560.

Redescription (female).—Body (Fig. 7) moderately robust for genus; integument naked, glabrous, not particularly hard; spines and teeth on body and appendages occasionally darkly pigmented.

Rostrum (Fig. 8A, B) straight to weakly curved dorsally, usually slightly falling short of or slightly overreaching distal margin of first segment of antennular peduncle, 0.44–0.56 of carapace length; dorsal margin armed with 5–7 (rarely 8) moderately large teeth at subequal distances, including 2 or 3 teeth on carapace and 2–4 (rarely 5) on rostrum proper; lateral surface with low, but

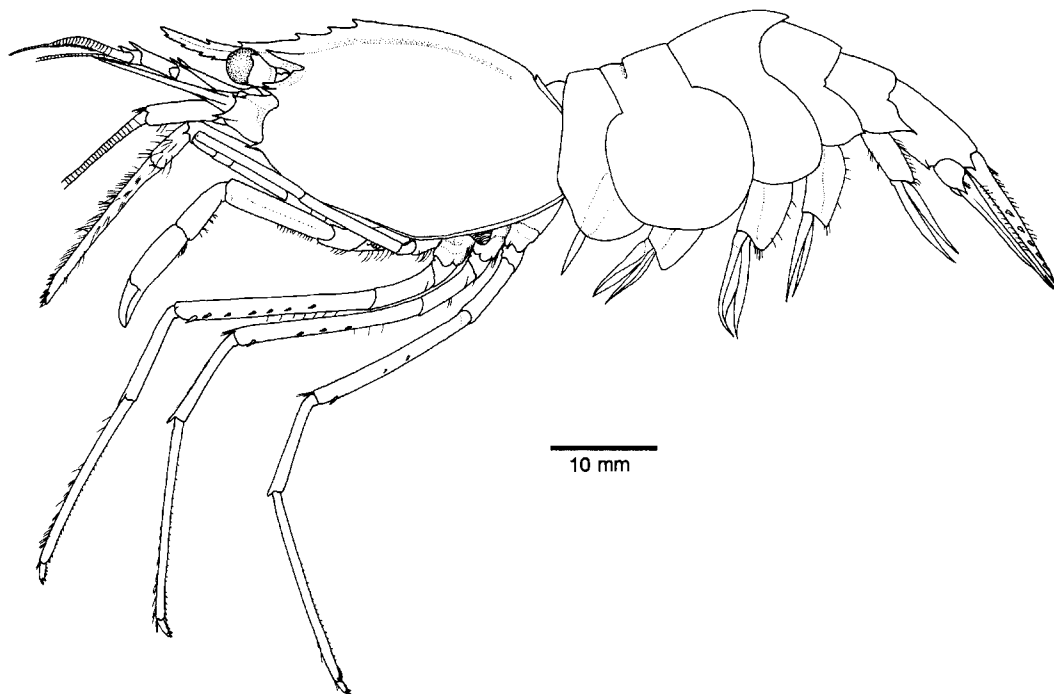


Fig. 7. *Lebbeus kuboi* Hayashi, 1992. Ovigerous female (CL 23.0 mm; CBM-ZC 7882) from off Togi, west coast of Noto Peninsula, Sea of Japan. Habitus, lateral view.

distinct carina extending from base of supra-orbital spine to midlength of rostrum; ventral blade very shallow, armed with 2–5 small teeth in distal 0.15–0.20. Carapace (Figs. 7, 8A, B) with dorsal surface weakly to somewhat inflated, particularly notable in spawning molt; postrostral median ridge distinct, extending to 0.75 of carapace length; posteriormost tooth of dorsal rostral series arising from 0.24–0.29 of carapace length; orbital region somewhat depressed; supra-orbital tooth large, arising from posterior to level of orbital margin, with deep V-shaped notch ventrally; suborbital lobe well-developed, triangular, reaching or slightly overreaching antennal tooth, terminating bluntly or subacutely; antennal tooth moderately small; pterygostomial tooth slender, reaching or slightly overreaching antennal tooth; anterolateral margin between antennal and branchiostegal spines with deep U-shaped notch just inferior to antennal spine, remainder strongly convex or sinuous.

Abdomen (Fig. 7) dorsally rounded. Tergum of second somite with transverse furrow bordered posteriorly by distinct ridge, posterior part slightly higher than anterior part (Fig. 8C). Posterodorsal margin of third somite distinctly produced. Pleura of anterior three somites broadly rounded, fourth pleuron armed with small posteroventral tooth, fifth pleuron with large, sometimes elongate posteroventral tooth. Sixth somite about 1.50–1.60 times as long as fifth and 1.80–1.90 times as long as height, bearing small, buttressed posteroventral tooth; posterolateral process sharply pointed. Telson (Fig. 8D, E) 1.60–1.65 times longer than sixth somite, 1.80–1.90 times longer than anterior width, lateral margins parallel in anterior 0.30, and tapering posteriorly to convex posterior margin, with 4–7 (rarely 3) dorsolateral spines on either side on posterior 0.70; posterior margin with 2 pairs of lateral spines (mesial pair largest) and 6 mesial spinules.

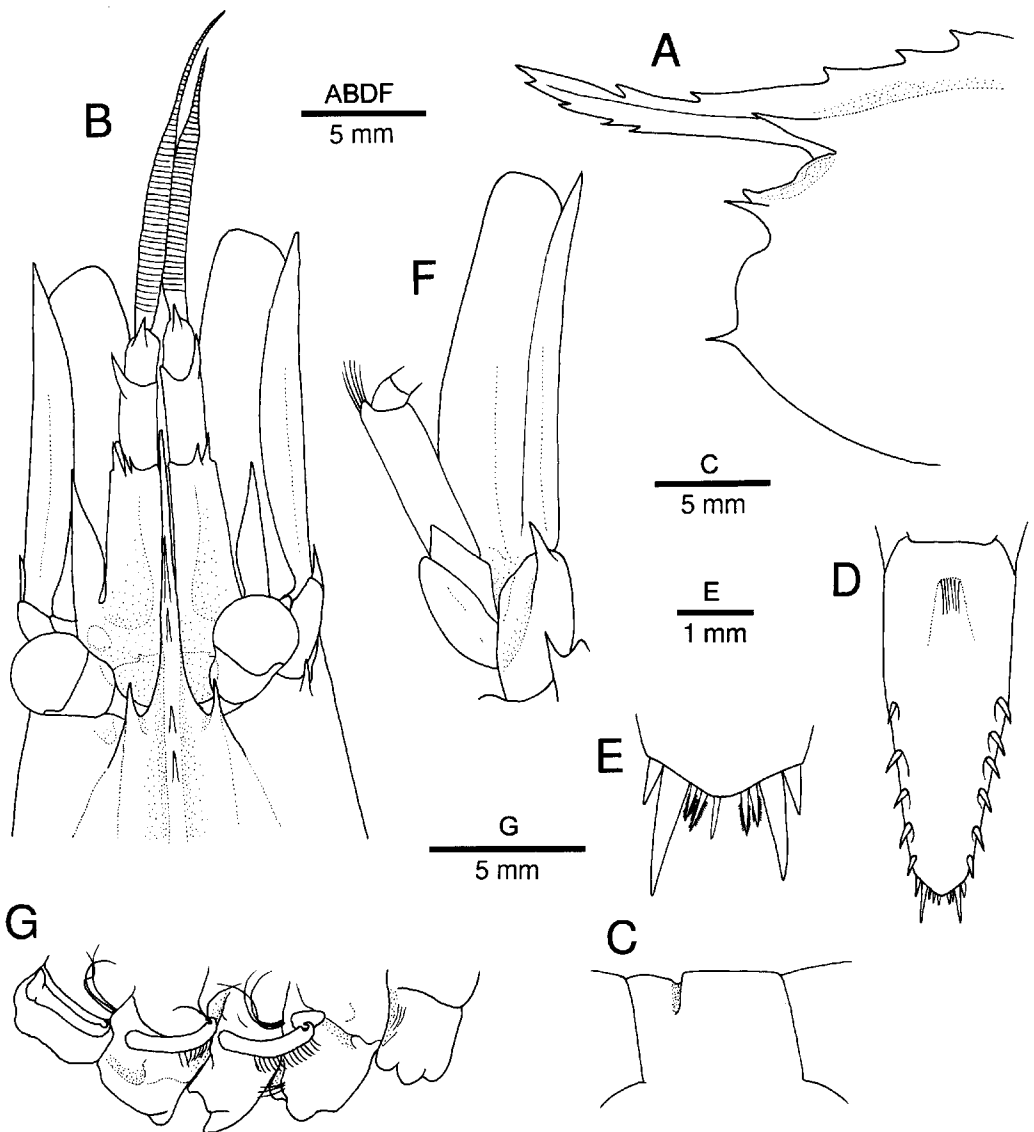


Fig. 8. *Lebbeus kuboï* Hayashi, 1992. Ovigerous female (CL 23.0 mm; CBM-ZC 7882) from off Togi, west coast of Noto Peninsula, Sea of Japan. A, rostrum and anterior part of carapace, lateral view; B, rostrum, anterior part of carapace and cephalic appendages, dorsal view; C, tergum of second abdominal somite, lateral view; D, telson, dorsal view; E, same, posterior part, dorsal view; F, left antenna, ventral view; G, coxae of left third maxilliped to fourth pereopod, ventrolateral view.

Eye (Fig. 8B) subpyriform with cornea distinctly wider than eye-stalk; ocellus not distinctly delineated, but ocellar sinus evident on dorsal surface; maximum diameter of cornea about 0.15–0.18 of carapace length.

Antennular peduncle (Fig. 8B) reaching 0.70 of antennal scale. First segment longer

than distal two segments combined, reaching mid-length of antennal scale, armed with 2 or 3 long, slender teeth on dorsodistal lateral angle; stylocerite reaching or slightly overreaching distal margin of first segment, sharply pointed, bearing low convexity subproximally, mesial margin slightly convex,

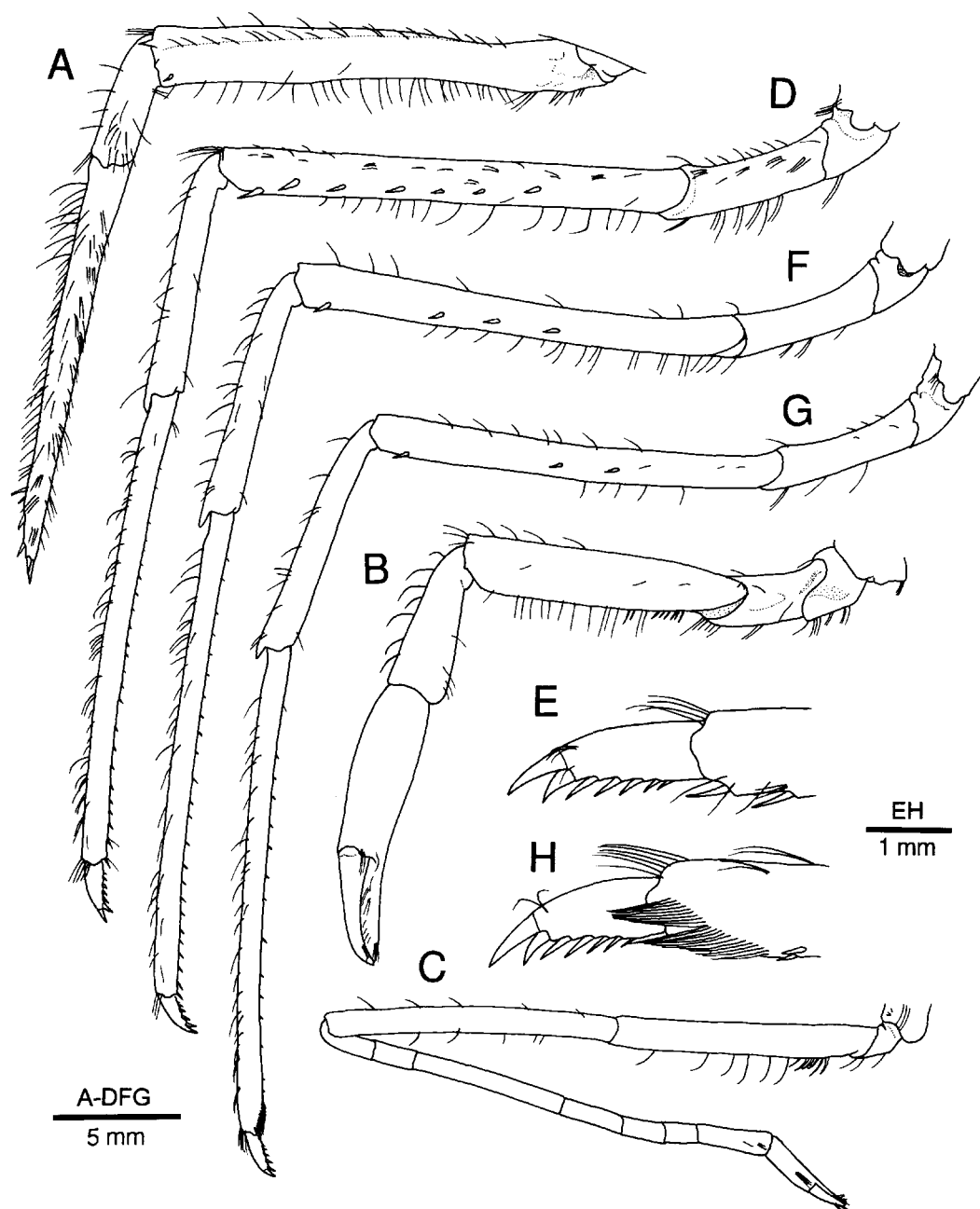


Fig. 9. *Lebbeus kuboï* Hayashi, 1992. Ovigerous female (CL 23.0 mm; CBM-ZC 7882) from off Togi, west coast of Noto Peninsula, Sea of Japan. Left appendages. A, third maxilliped, lateral view; B, first pereopod, lateral view; C, second pereopod, lateral view; D, third pereopod, lateral view; E, same, dactylus and distal part of propodus, lateral view; F, fourth pereopod, lateral view; G, fifth pereopod, lateral view; H, same, dactylus and distal part of propodus, lateral view.

not overlapping lateral margin of first segment; second segment about half length of first segment, with long tooth at dorsodistal lateral angle; third segment short, with moderately large tooth on dorsodistal margin. Lateral flagellum with thickened aesthetasc-bearing portion 0.30–0.35 times as long as carapace.

Antenna (Fig. 8B, F) with moderately large ventrolateral tooth on basicerite; carapocerite reaching or slightly overreaching midlength of antennal scale. Antennal scale 0.80–0.85 times of carapace and 3.30–3.80 times longer than wide; lateral margin slightly concave; distolateral tooth slightly falling short of or slightly overreaching rounded distal margin of blade.

Mouthparts typical of genus. Third maxilliped (Fig. 9A) moderately long, overreaching antennal scale by 0.5–0.6 length of ultimate segment; ultimate segment 3.30–3.50 times as long as carpus (= penultimate segment), tapering distally, with several darkly pigmented spines in distal part; antepenultimate segment shorter than distal two segments combined, armed 1 long tooth on distolateral margin, lateral surface bluntly ridged.

Strap-like epipods present on third maxilliped to second pereopod, all bearing terminal hook (Fig. 8G); development of epipod on third pereopod variable from normally developed with terminal hook to rudimentary, rarely completely reduced; corresponding setobranchs present on first to third pereopods, but absent on fourth pereopod even in case that third pereopod bearing normally developed epipod.

First pereopod (Fig. 9B) moderately stout, reaching distal margin of antennal scale: chela 1.70–1.85 times as long as carpus, 4.50–4.60 times longer than wide; dactylus 0.60–0.75 times as long as palm, terminating in 2 corneous claws; merus 1.70–1.85 times as long as carpus and 4.00–5.00 times longer than greatest height, subcylindrical, obliquely articulated to ischium, bearing row of slender spinules on proximal half of ventral surface; lateral face of merus with tiny

spiniform tubercle near articulation with ischium. Second pereopod (Fig. 9C) overreaching antennal scale by length of chela and half of carpus; chela small with subcylindrical palm; dactylus 0.65–0.70 times as long as palm, terminating in 2 small claws; carpus 5.50–5.70 times longer than chela, divided in 7 articles; merus 0.55–0.60 times as long as carpus; ischium 0.85–0.90 times as long as merus, with short row of spiniform setae on ventral margin proximally. Third to fifth pereopods relatively long and slender for genus. Third pereopod (Fig. 9D) overreaching antennal scale by length of dactylus and 0.50–0.90 of propodus; dactylus (Fig. 9E) 0.13–0.17 times as long as propodus, moderately stout (3.40–3.90 times as long as height), terminating in moderately long unguis, armed with 5 or 6 relatively long accessory spinules; propodus with 2 rows of spinules on ventral surface; carpus 0.50–0.55 times as long as propodus; merus 9.00–10.00 times as long as height, armed with 5–9 spines on lateral surface ventrally. Fourth pereopod (Fig. 9F) similar to third pereopod, overreaching antennal scale by length of dactylus and 0.20–0.60 of propodus; merus with 4–10 spines on lateral surface. Fifth pereopod (Fig. 9G) overreaching distal margin of antennal scale by length of dactylus and 0.10–0.20 of propodus, generally similar to third and fourth pereopods, but merus relatively shorter; propodus with subdistal cluster of short, occasionally setulose setae ventrally (Fig. 9G); merus with 1–4 spines on lateral surface.

Pleopods typical of genus, without distinctive feature. Uropod (Fig. 7) with both rami slightly overreaching posterior margin of telson; exopod slightly longer than endopod.

Male characteristics.—Body less robust than in females. Rostrum (Fig. 10A) slender, lacking ventral blade; dorsal margin armed with 5 or 6 teeth, including 2 or 3 on carapace and 2 or 3 on rostrum proper; ventral margin with 2–4 teeth. Carapace (Fig. 10A) with dorsal surface not inflated, with posteriormost tooth of dorsal rostral series

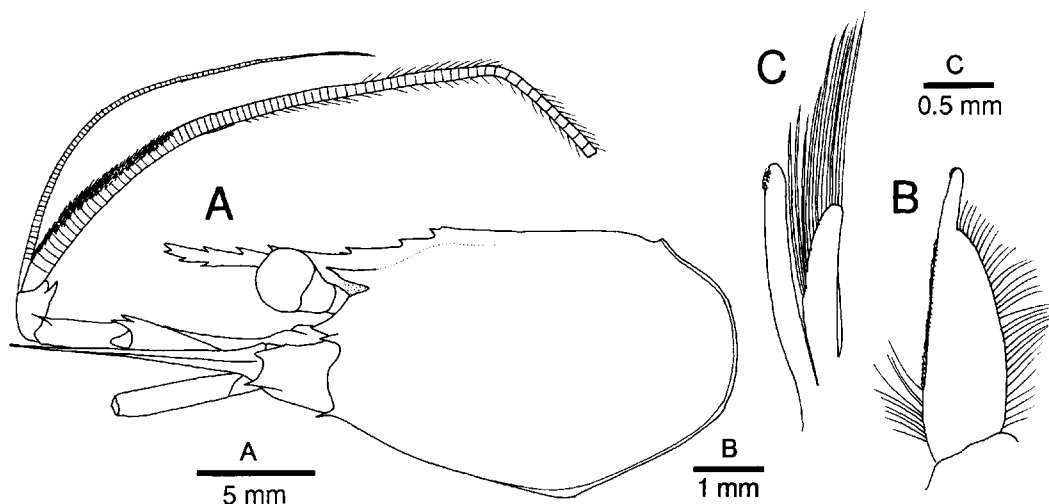


Fig. 10. *Lebbeus kuboi* Hayashi, 1992. Male (CL 13.5 mm; NUF) from off Mizuhashi, Toyama Bay. A, carapace and cephalic appendages, lateral view (distal part of outer antennular flagellum broken off); B, endopod of left first pleopod, ventral view; C, appendix interna and masculina of left second pleopod, mesial view.

arising at 0.26 of carapace length; postrostral ridge low, reaching 0.70 of carapace length.

Antennular peduncle (Fig. 10A) more elongate, reaching distal margin of antennal scale. Outer flagellum elongate, flattened, more than 2.3 times longer than carapace, not abruptly tapering distal to aesthetasc-bearing portion; aesthetasc-bearing portion occupying about proximal 0.30 of entire length; inner flagellum also elongate, about 1.70 times longer than carapace.

Third to fifth pereopods more elongate and slender, third pereopod overreaching distal margin of antennal scale by length of dactylus and full of propodus.

Endopod of first pleopod (Fig. 10B) with well-developed appendix interna. Appendix masculina (Fig. 10C) shorter than appendix interna, bearing about 15 long spiniform setae.

Coloration in life.—Body generally reddish orange. Carapace with white transverse band near posterior margin. Abdomen with 4 white transverse bands on second to fifth somites, bands on third to fifth somites extending from tergum to pleura of preceding somite; sixth abdominal

somite uniformly reddish orange; tailfan with 1 white transverse band proximally. Antennae uniformly reddish orange. Thoracic appendages generally reddish orange; distal two segments of third maxilliped and chela to merus of first pereopod with white blotches on lateral surfaces; propodi and carpi of third to fifth pereopods whitish, but distal part reddish orange; meri each with 1 or 2 white blotches.

Variations.—The development of epipod on the third pereopod varies considerably (Fig. 11), although the coxa of the fourth pereopod is always devoid of a setobranch. Among 29 specimens examined, 21 specimens (72.4 %) have epipods on both sides, although epipods are rudimentary on both sides in nine specimens. Only a single specimen completely lacks epipods on the third pereopods. Seven specimens (24.1 %) show asymmetric patterns of development; in three specimens (10.3 %), one side lacks the epipod, while the other side has a rudimentary epipod; in four specimens (13.8 %), one side has a rudimentary epipod, while the other side has a fully developed, terminally hooked epipod. It can be said that this

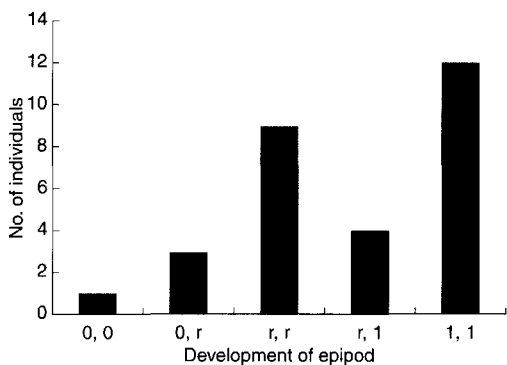


Fig. 11. *Lebbeus kuboi* Hayashi, 1992. Summary of variation in the development of epipod on the third pereopod. 0: epipod absent; r: rudimentary epipod present; 1: well-developed epipod present. Asymmetrical combination of symbols does not always reflect actual side.

species is undergoing evolutionary transformations from the possession of the epipod on the third pereopod to the loss of it.

The rostrum usually reaches or slightly overreaches the distal margin of the first segment of the antennular peduncle. Only in a single female specimen (CL 19.7 mm; CBM-ZC 7884), the rostrum overreaches the distal margin of the second segment of the antennular peduncle with the ratio against to the carapace length of 0.71.

As is apparent from the above description, this species exhibits notable sexual dimorphism in the shape of the rostrum, development of the antennule, and shape of the pereopods.

Distribution.—Sea of Japan from Hiyama District, Hokkaido to Mishima Island, Yamaguchi Prefecture; 200–400 m.

Remarks.—In the original description of *Lebbeus kuboi*, Hayashi (1992) referred it to the group characterized by having epipods on the first and second pereopods, and compared it with *L. brandti* (Brashnikov, 1907) and *L. scrippsi* Wicksten & Mendez, 1982. However, the present study demonstrates that this species frequently has epipods on the first to third pereopods. This finding

requires a further comparison of *L. kuboi* with other species belonging in the group characterized by having epipods on the anterior three pereopods. *Lebbeus kuboi* is very similar to *L. antarcticus*, *L. carinatus*, *L. polyacanthus* sp. nov., and *L. washingtonianus*. These species share the following characters: the rostrum reaches or slightly overreaches the distal margin of the basal segment of the antennular peduncle, armed with more than three dorsal teeth and more than one ventral teeth in females; a deep, V-shaped notch is present just inferior to the supraorbital tooth on the carapace; the anterolateral margin of the carapace is strongly sinuous with a prominent notch just inferior to the antennal tooth; and the fourth abdominal pleuron is armed with a posteroventral tooth. Differences between *L. kuboi* and *L. polyacanthus* are discussed under the account of the latter species. Minor or subtle differences can be detected among *L. kuboi*, *L. antarcticus* and *L. washingtonianus*, although only limited information on morphology is available from literature for the latter two species (Rathbun, 1904; Wicksten, 1978; Butler, 1980; Ward, 1985; Komai *et al.*, 1996). Female *Lebbeus kuboi* seems to differ from female *L. antarcticus* by the more elongate pterygostomial tooth on the carapace and more numerous dorsolateral spines on the telson (four to seven, usually five or six versus three to five, usually four). The more numerous dorsal rostral teeth (five to seven versus two to five) may be useful in discriminating female *L. kuboi* from female *L. washingtonianus*. Further, *L. washingtonianus* is characterized by its relatively small size. The known ovigerous specimen of *L. washingtonianus* is about 9.0 mm in the postorbital carapace length (Rathbun, 1904), a size at which *L. kuboi* have not reached maturity. Male *L. kuboi* may be distinguished from male *L. antarcticus* and male *L. washingtonianus* by the antennular peduncle reaching the distal margin of the antennal scale, rather than falling short of it in the latter two, and much more elongate, entirely flattened outer

antennular flagellum (more than 2.3 times longer than carapace versus about 0.70 times). In the latter two species, the outer antennular flagellum is not flattened, and abruptly tapers in the distal part distal to the aesthetasc-bearing portion.

Discussion

At present, 42 taxa of *Lebbeus* are known from the world oceans (Table 1). As has been pointed by some authors (Hayashi, 1992; Komai *et al.*, 1996; Fransen, 1997; Komai, 2001; Komai & Takeda, 2004), the taxonomy of *Lebbeus* needs further study. Several species, i.e. *L. heterochaelus*, *L. profundus*, *L. spirostris*, *L. uchakovi*, and *L. vinogradowi*, are known only by the insufficient type descriptions and/or a few subsequent reports (Kobjakova, 1937; Vinogradov, 1950). Redescriptions of these species based on the type material are needed in order to evaluate the affinities of these taxa more precisely. Although de Saint Laurent (1984) named a new species of *Lebbeus* from the hydrothermal vent sites on the East Pacific Rise as *L. carinatus*, the name is preoccupied by *L. carinatus* Zarenkov, 1976. Therefore, de Saint Laurent's taxon should be renamed. A redescription of de Saint Laurent's species is under preparation by T. Komai and M. Segonzac. Relationship between *L. microceras* and *L. zebra* remains unclear (Fransen, 1997). Komai (2001) suggested that more than one species may be mixed up in *L. schrencki*. *Lebbeus washingtonianus* has been recorded from two far remote localities, i.e. northwest coast of North America and the Okinawa Trough, Ryukyu Islands (Wicksten, 1978; Butler, 1980; Kikuchi & Ohta, 1995). Wicksten (1978) noted that the species is strictly an inhabitant of the continental slope, but Kikuchi & Ohta's (1995) material was collected from a hydrothermally influenced field at the Iheya Ridge. The real identity of *L. washingtonianus* sensu Kikuchi & Ohta (1995) needs to be verified on the basis of direct comparison with material from the

northeastern Pacific.

Of the 42 species recognized at present, 25 species (60%) are known to occur in East Asian waters (including Japan, Russia, Korea, and northern China). It is interesting to mention that the species composition is considerably different between the Pacific coast of Japan and the Sea of Japan and the Sea of Okhotsk (Table 2). There are many species probably endemic to the marginal seas (Sea of Okhotsk and/or the Sea of Japan), such as *L. elegans* sp. nov., *L. heterochaelus*, *L. kuboii*, *L. longidactylus*, *L. polycanthus* sp. nov., *L. vinogradowi*, *L. spirostris* and *L. uschakovi*. While the six species, *L. comanthi*, *L. compressus*, *L. miyakei*, *L. nudirostris*, *L. spongiaris*, *L. tosaensis*, are so far known only from warm temperate waters in the Pacific coast of Japan. Five species have been recorded from the Pacific coast of northern Japan, of which four are widely distributed in the northern North Pacific. These include *L. brandti*, *L. grandimanus*, *L. groenlandicus*, and *L. speciosus*. *Lebbeus fasciatus* is so far restricted to the East Asian waters. *Lebbeus balssi* is known from both side of Honshu Island of Japan, but it is assumed that the species is primarily an inhabitant of warm temperate waters, as there has been no record of this species from cold or cool temperate waters. It is remarkable that *L. unalaskensis* has not been recorded from the Pacific coast of northern Japan, including Hokkaido and Tohoku district, although the species are known from Alaska, the Sea of Okhotsk and the Sea of Japan. This raises a question on the identity of the East Asian population.

The two new species described in this paper are so far known only from the Sea of Japan, but it remains uncertain whether these species are endemic to that area. Considering the fishing gear, these species may prefer hard bottom where trawling fisheries are difficult to operate. Other species occurring in the Sea of Japan are all reported from the Sea of Okhotsk, and therefore future collections may eventually reveal the

Table 1. List of known species of *Lebbeus* grouped by the number of pereopodal epipods and their geographical ranges.

Species	Geographical range	Source
No epipod on pereopod (1 species)		
<i>L. elegans</i> , new species.	Sea of Japan	this study
First pereopod with epipod (3 species and 1 sub species)		
<i>L. elegans</i> , new species.	Sea of Japan	this study
<i>L. longipes</i> (Kobjakova, 1936)	Sea of Japan, Sea of Okhotsk	Hayashi (1992)
<i>L. vicinus vicinus</i> (Rathbun, 1902)	Alaska	Wicksten & Méndez (1982)
<i>L. vicinus montereyensis</i> Wicksten & Méndez, 1982	California	Wicksten & Méndez (1982)
First and second pereopods with epipods (15 species)		
<i>L. balssi</i> Hayashi, 1992	Japan	Hayashi (1992)
<i>L. brandti</i> (Brashnikov, 1907)	Northern North Pacific	Hayashi (1992)
<i>L. carinatus</i> de Saint Laurent, 1984	East Pacific Rise	de Saint Laurent (1984)
<i>L. compressus</i> Holthuis, 1947	Japan	Hayashi (1992)
<i>L. grandimana</i> (Brashnikov, 1907)	Northern North Pacific	Butler (1980), Hayashi (1992)
<i>L. heterochaelus</i> (Kobjakova, 1936)	Sea of Okhotsk	Kobjakova (1937), Vinogradov (1950)
<i>L. kuboii</i> Hayashi, 1992	Sea of Japan, Sea of Okhotsk	Hayashi (1993), this study
<i>L. laevirostris</i> Crosnier, 1999	Makassar Strait	Crosnier (1999)
<i>L. longidactylus</i> (Kobjakova, 1936)	Sea of Okhotsk	Kobjakova (1937), Vinogradov (1950)
<i>L. polaris</i> (Sabine, 1824)	North Atlantic, North Pacific	Squires (1990), Hayashi (1992)
<i>L. scripssi</i> Wicksten & Méndez, 1982	Eastern Pacific	Wicksten & Méndez (1982)
<i>L. splendidus</i> Wicksten & Méndez, 1982	Eastern Pacific off Peru	Wicksten & Méndez (1982)
<i>L. unalaskensis</i> (Rathbun, 1902)	Northern North Pacific	Rathbun (1904), Hayashi (1992)
<i>L. vinogradowi</i> Zarenkov, 1960	Sea of Okhotsk	Zarenkov (1960)
<i>L. yaldwyni</i> Kensley, Tranter & Griffin, 1987	Eastern Australia	Kensley <i>et al.</i> (1987)
First to third pereopods with epipods (24 species)		
<i>L. africanus</i> Fransen, 1997	Southwestern Africa	Fransen (1997)
<i>L. antarcticus</i> (Hale, 1941)	Antarctica	Ward (1985), Komai <i>et al.</i> (1996)
<i>L. bidentatus</i> Zarenkov, 1976	Eastern Pacific off Chile	Fransen (1997)
<i>L. carinatus</i> Zarenkov, 1976	Eastern Pacific off Peru	Fransen (1997)
<i>L. catalepsis</i> Jensen, 1987	Washington State	Jensen (1987)
<i>L. comanthi</i> Hayashi & Okuno, 1997	Pacific coast of Japan	Hayashi & Okuno (1997)
<i>L. fasciatus</i> (Kobjakova, 1936)	Northwestern Pacific	Hayashi (1992)
<i>L. groenlandicus</i> (Fabricius, 1798)	North Atlantic, North Pacific	Butler (1980), Hayashi (1992)
<i>L. indicus</i> Holthuis, 1947	Indonesia	Holthuis (1946)
<i>L. lagunae</i> (Schmitt, 1921)	California	Schmitt (1921), Jensen (1987)
<i>L. microceras</i> (Krøyer, 1841)	Northwestern Atlantic	Squires (1990)
<i>L. miyakei</i> Hayashi, 1992	Japan	Hayashi (1992)
<i>L. nudirostris</i> Komai & Takeda, 2004	Pacific coast of Japan	Komai & Takeda (2004)
<i>L. polyacanthus</i> , new species.	Sea of Japan	this study
<i>L. profundus</i> (Rathbun, 1906)	Hawaii	Rathbun (1906)
<i>L. saldanhae</i> (Barnard, 1947)	South Africa	Fransen (1997)
<i>L. schrencki</i> (Brashnikov, 1907)	North Pacific	Brashnikov (1907), Butler (1980)
<i>L. speciosus</i> (Urita, 1942)	Northern North Pacific	Hayashi (1992)
<i>L. spinirostris</i> (Kobjakova, 1936)	Sea of Okhotsk	Kobjakova (1937), Vinogradov (1950)
<i>L. spongiaris</i> Komai, 2001	Pacific coast of Japan	Komai (2001), Komai & Takeda (2004)
<i>L. tosaensis</i> Hanamura & Abe, 2003	Pacific coast of Japan	Hanamura & Abe (2003), Komai & Takeda (2004)
<i>L. uschakovii</i> (Kobjakova, 1936)	Sea of Okhotsk	Kobjakova (1937), Vinogradov (1950)
<i>L. washingtonianus</i> (Rathbun, 1902)	Northeastern Pacific, ?Okinawa Trough	Rathbun (1904), Butler (1980), Kikuchi & Ohta (1995)
<i>L. zebra</i> (Leim, 1921)	Northeastern Pacific	Wicksten (1990)

Table 2. List of species of *Lebbeus* known from East Asian waters according to geographical regions.

Sea of Japan	Sea of Okhotsk	Pacific coast of Japan northward to Boso Pen.	Pacific coast of Japan southward to Boso Pen.
<i>L. balssi</i>	<i>L. brandti</i>	<i>L. brandti</i>	<i>L. balssi</i>
<i>L. brandti</i>	<i>L. fasciatus</i>	<i>L. fasciatus</i>	<i>L. comanthi</i>
<i>L. fasciatus</i>	<i>L. grandimana</i>	<i>L. grandimana</i>	<i>L. compressus</i>
<i>L. elegans</i> , new species.	<i>L. groenlandicus</i>	<i>L. groenlandicus</i>	<i>L. miyakei</i>
<i>L. grandimana</i>	<i>L. heterochaelus</i>	<i>L. speciosus</i>	<i>L. nudirostris</i>
<i>L. groenlandicus</i>	<i>L. kuboi</i>		<i>L. spongiaris</i>
<i>L. kuboi</i>	<i>L. longidactylus</i>		<i>L. tosaensis</i>
<i>L. longipes</i>	<i>L. longipes</i>		<i>L. "washingtonianus"</i>
<i>L. polaris</i>	<i>L. polaris</i>		
<i>L. polyacanthus</i> , new species.	<i>L. speciosus</i>		
<i>L. schrencki</i>	<i>L. spinirostris</i>		
<i>L. speciosus</i>	<i>L. unalaskensis</i>		
<i>L. unalaskensis</i>	<i>L. uschakovi</i>		
	<i>L. vinogradowi</i>		
13 spp.	14 spp.	5 spp.	8 spp.

presence of these two new species in the Sea of Okhotsk. Regarding the decapod crustaceans, Komai (1997) suggested that the crangonid *Argis toyamaensis* (Yokoya, 1933) was endemic to the Sea of Japan.

Acknowledgements

We sincerely thank Mr. Hideo Nishizaki, captain of the fishery boat Sakae-maru No. 3, for collecting the specimens from off Togi, west coast of Noto Peninsula. We also thank Drs. Alexander J. Bruce, Charles H. J. M. Fransen and Mary K. Wicksten for reviewing the manuscript.

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