

Three new species of *Lebbeus* (Crustacea: Decapoda: Hippolytidae) from the Northeastern Pacific

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Abstract

Three new species of hippolytid shrimps are described from the northeastern Pacific. *Lebbeus eludus* and *L. mundus* are often found at shallow depths (10–20 m) in the crevices of rock walls. Both have previously been mistaken for a western Pacific species, *L. schrencki* (Brashnikov) and are characterized by having an unusual, deep, transverse groove on the dorsal surface of the second abdominal somite, short rostrums, and epipods on the first three pereopods. The third shrimp, *L. acudactylus*, has been found at depths of 150–170 m and appears closely related to *L. grandimanus* (Brashnikov) and *L. balsii* Hayashi, but lacks a comb of spines on the mesial margin of the third maxillipeds that is characteristic of those two species. Color photos showing the unique patterns of all three new species are provided.

Key words: Caridea, Northeastern Pacific, new species, cleaner shrimp, Hippolytidae, *Lebbeus*

Introduction

The genus *Lebbeus* White consists of small to medium-sized hippolytid shrimps that occur primarily in the colder waters of the northern hemisphere. Although a few species are known from the Atlantic, South America, Africa and the Australia/Indo Pacific region, the vast majority of described species are found in the North Pacific, and nearly half of all described species are from the western North Pacific (Komai & Takeda 2004).

Many species of lebbeids have distinctive and often striking color patterns that greatly simplify identification in the field. While collecting shrimps from rock walls during night dives in Puget Sound, Washington, I frequently observed an unidentified lavender-colored shrimp that consistently eluded capture by rapidly retreating into deep crevices. I finally captured a number of specimens with the aid of a suction device and found they keyed out to the western Pacific species *Lebbeus schrencki* (Brashnikov 1907), yet clearly differed

from a brightly colored local shrimp that had previously been identified as that species. Closer examination revealed that neither form matched the description of *L. schrencki*, and both are described herein.

Trawl surveys by the National Marine Fisheries Service in the Gulf of Alaska and Aleutian Islands have revealed the presence of additional undescribed species of lebbeids. Color photos or notes are lacking for most of these; however, photographs were available for one new species that has very distinctive markings and its description is also included. In the following descriptions, the term “spine” is used for sharp projections that lack a basal articulation; “spinule” for robust, spine-like structures with a basal articulation, and “seta” for slender, flexible structures with a basal articulation.

***Lebbeus eludus* new species**

Figs. 1–3; 4A,B

Type material: Holotype male, postorbital carapace length 6.9 mm. Burrows Channel, Anacortes, Washington (48.29.4°N, 122.41.7°W), suction gun, 14 m, 6 December 1997, G.C. Jensen, collector. National Museum of Natural History, Smithsonian Institution, USNM 1092254. Also allotype, 6.5mm, same location and date, USNM 1092255.

Paratypes collected at the same location as above, and same date except as noted. U.S. National Museum of Natural History (2 males, USNM 1092256); California Academy of Sciences (2 males, 1 female, 21 November 1997, 16 m, CASIZ 174052); Natural History Museum of Los Angeles County (2 male, 1 female, 21 November 1997, 16 m, LACM CR 1997-140.1); National Science Museum, Tokyo (2 males, 1 female, NSMT-Cr 16842); British Columbia Provincial Museum (1 male, RBCM 006-00056). Female, 12.9 mm cl, Griffith Harbor, west coast of Banks Island, British Columbia, Canada (53.36.04°N, 130.32.55°W), 5–8 m, 20 July 1974, A. Peden, collector, RBCM 974-00383-3.

Description: Integument smooth, thick. Rostrum short, horizontal or descending, 0.31–0.48 carapace length; usually slightly exceeding cornea and reaching 0.66–0.75 length of first article of antennular peduncle. Carapace with two postorbital dorsal teeth, the anteriormost smaller and usually obscured in lateral view by the supraorbital spine. Rostrum lacking dorsal teeth (rarely with one tooth) and usually with one ventral, subterminal tooth. Supraorbital spine massive, with very deep ventral notch; suborbital and antennal spines strong; anterolateral margin extremely convex; pterygostomial spine distinct (Fig. 2A).

Abdomen smooth except for deep, dorsal, transverse furrow on the second abdominal somite. Dorsal posterior margin of third abdominal somite strongly produced. Pleuron of first abdominal somite with slight anterior lobe; ventral margin rounded. Pleura of abdominal somites 2 and 3 rounded; pleura of fourth and fifth abdominal somites with posteroventral spines; spine on fourth sometimes obsolescent in larger specimens. Sixth somite 1.3–1.6 times length of fifth somite. Telson 1.2–1.38 length of sixth somite, with

3–5 pairs of dorsolateral spinules; tip with three pairs of terminal spinules, outermost similar to dorsolateral series, innermost pair with setules; margin of telson with long dorsomesial plumose setae (Fig. 3E).

Eye diameter 0.17–0.19 carapace length; cornea pigmented, round, and subequal in diameter to cylindrical stalk; ocellus present.

Basal article of antennular peduncle (Fig. 2B) with 3–4 distal, dorsal spines and a strong subdistal, ventromesial spine; stylocerite reaching to middle or end of second article of antennular peduncle. Second article with large dorsolateral spine on distal margin; third article with erect dorsal spine. Dorsolateral flagella 0.85–1.0 carapace length, with 16–29 thickened segments; distal portion slender, with 8–13 segments; ventromesial flagella slightly longer than dorsolateral, with 33–42 segments.

Bascicerite of antenna with rounded dorsal lobe and blunt ventrolateral spine; carpocerite slightly exceeding end of third article of antennular peduncle. Antennal scale 2.3–2.7 times longer than wide and 0.56–0.7 carapace length; lateral margin straight, spine exceeded by lamella. Antennal flagellum 2.7–4.7 times carapace length.

Mandibles with sparsely setose, two-segmented palps; incisors slender, with 4–5 distal teeth. Molar of left mandible (Fig. 2C) large, subcylindrical, with large distal tooth. Right molar with 5–9 teeth on margin.

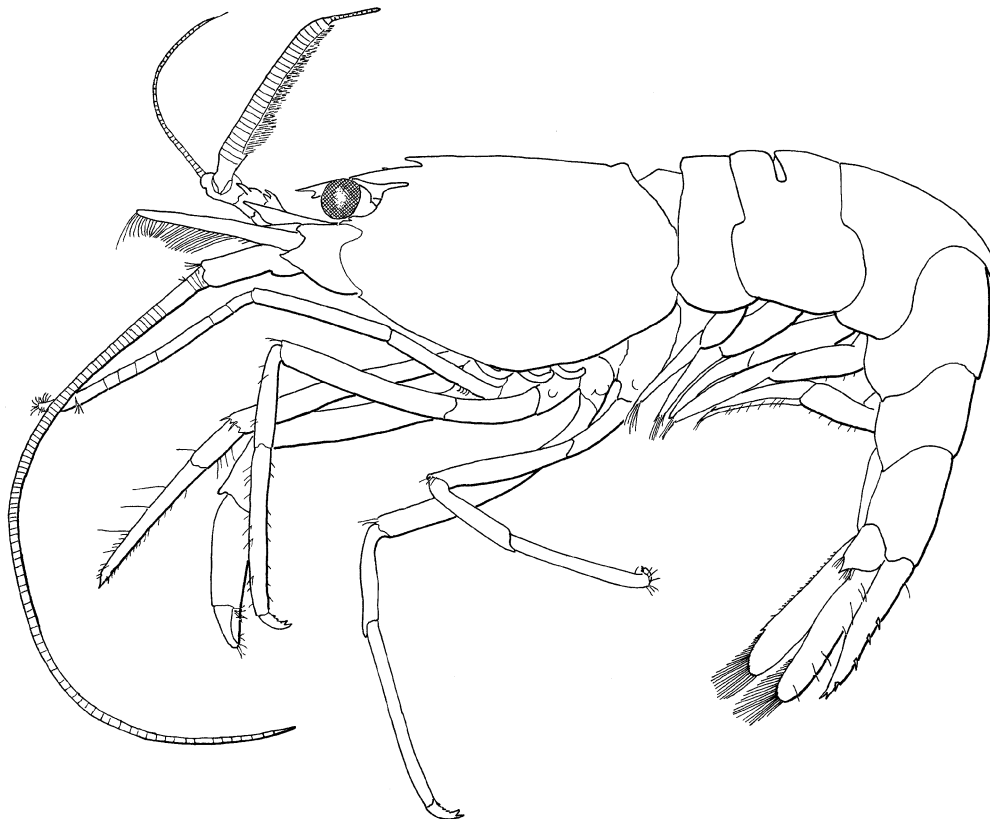


FIGURE 1. *Lebbeus eludus* sp. nov. Holotype male; carapace length 6.9 mm.

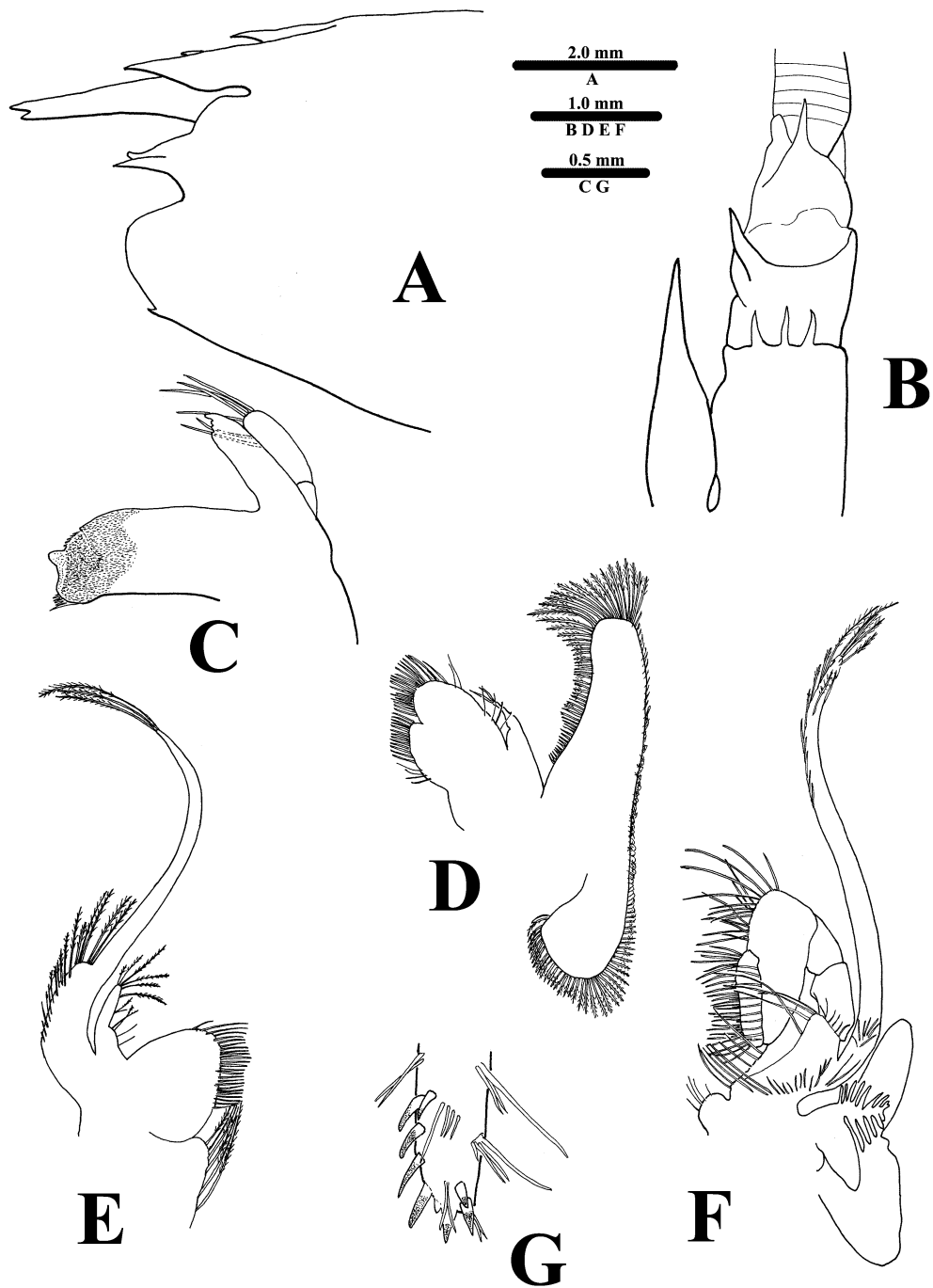


FIGURE 2. *Lebbeus eludus*, male paratype. A, anterior region of carapace; B, antennular peduncle (dorsal view); C, left mandible; D, second maxilla; E, first maxilliped; F, second maxilliped; G, tip of third maxilliped.

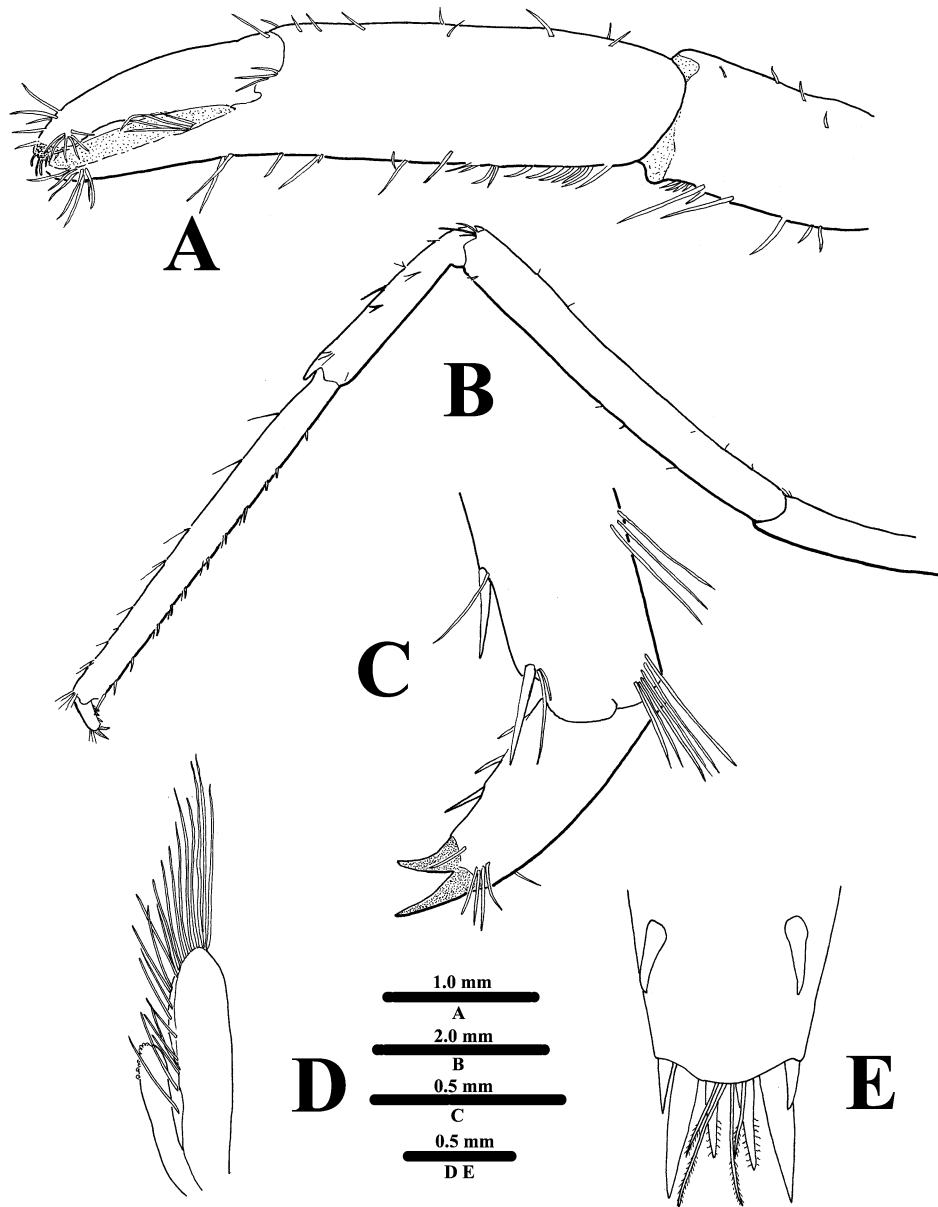


FIGURE 3. *Lebbeus eludus*, male paratype. A, chela of first pereopod, mesial view; B, third pereopod, lateral view; C, dactyl of third pereopod; D, appendix masculina and appendix interna; E, tip of telson.

First maxilla with shallowly bilobed palp, lateral lobe tipped with a slender simple seta and a subterminal slender seta; mesial lobe with a thicker, plumose seta. Distal endite oval, densely armed with spinules and setae on mesial margin; proximal endite with long, stout setae.

Second maxilla (Fig. 2D) with palp tipped by a long and a short seta. Basal endite

bilobed, mesial margin densely setose. Coxal endite very small, with 6–8 long, plumose setae. Scaphognathite densely fringed with plumose setae, longest anteriorly and anteromesially and along posterolateral margin. Anterior lobe of scaphognathite long, subrectangular; posterior lobe rounded.

First maxilliped (Fig. 2E) with two segmented palp, distal article subequal to proximal. Caridean lobe well developed and fringed with long plumose setae. Exopod long, tipped with setae. Endites well developed, densely setose on mesial margin. Epipod large, bilobed.

Second maxilliped (Fig. 2F) with ultimate article densely setose on mesial margin; penultimate article with many long setae. Exopod well developed, tipped with long setae. Epipod triangular, with small podobranch.

Third maxilliped (Fig. 2G) with 8–9 apical and subapical corneous spinules and slightly exceeding antennal scale; mesial margins of ultimate and penultimate articles densely setose. Antepenultimate article with strong distal spinule on lateral margin and small, subdistal, ventrolateral spinule. Hooked epipod present.

Pereopods 1–5 with pleurobranchs. First pereopods (Fig. 3A) equal, chelate, exceeding antennal scale by about 0.5 length of propodus. Dactyl 0.3–0.46 propodus length; propodus 0.56–0.6 female carapace length, 0.6–0.9 male carapace length; propodus 4.5–4.8 times longer than wide. Antennal cleaning brushes on propodus and carpus. Carpus 1.5–2 times longer than wide; merus length 3.7–4.9 greater than width and 1.9–2.4 length of carpus. Coxa with hooked epipod and setobranch.

Second pereopods equal, chelate, exceeding end of antennal scale by 1–5 distal segments of carpus; dactyl 0.31–0.47 propodus length. Carpus with 7 segments, third from merus longest. Merus 0.59–0.69 length of carpus. Coxa with hooked epipod and setobranch.

Third pereopod (Fig. 3B, C) dactyl with corneous, bifid tip preceded by 3–4 spinules on flexor margin. Propodus 11.6–14.2 times as long as wide; flexor margin with about 25 small spinules in two indistinct rows, spinules increasing with size distally. Carpus 3.5–5.0 times longer than wide. Merus 7–10 times longer than wide. Coxa with hooked epipod and setobranch. Fourth and fifth pereopods similar to third, but lacking epipods and decreasing in size; setobranch present on coxa of fourth pereopod; fifth pereopod with propodal grooming brush.

Endopod of first pleopod of female reaching middle of exopod. Endopod of first pleopod of male fused with appendix interna; overall length about two-thirds that of exopod. Lateral margin convex with long plumose setae and abrupt shoulder bearing several long setae; fingerlike appendix interna comprising distal 0.2 of length, with cincinnuli at tip; mesial margin somewhat concave with short, curved setae. Second pleopod of male with large appendix masculina (Fig. 3D), greatly exceeding appendix interna and tipped with numerous long spinules. Uropods subequal in length, both exceeding telson.

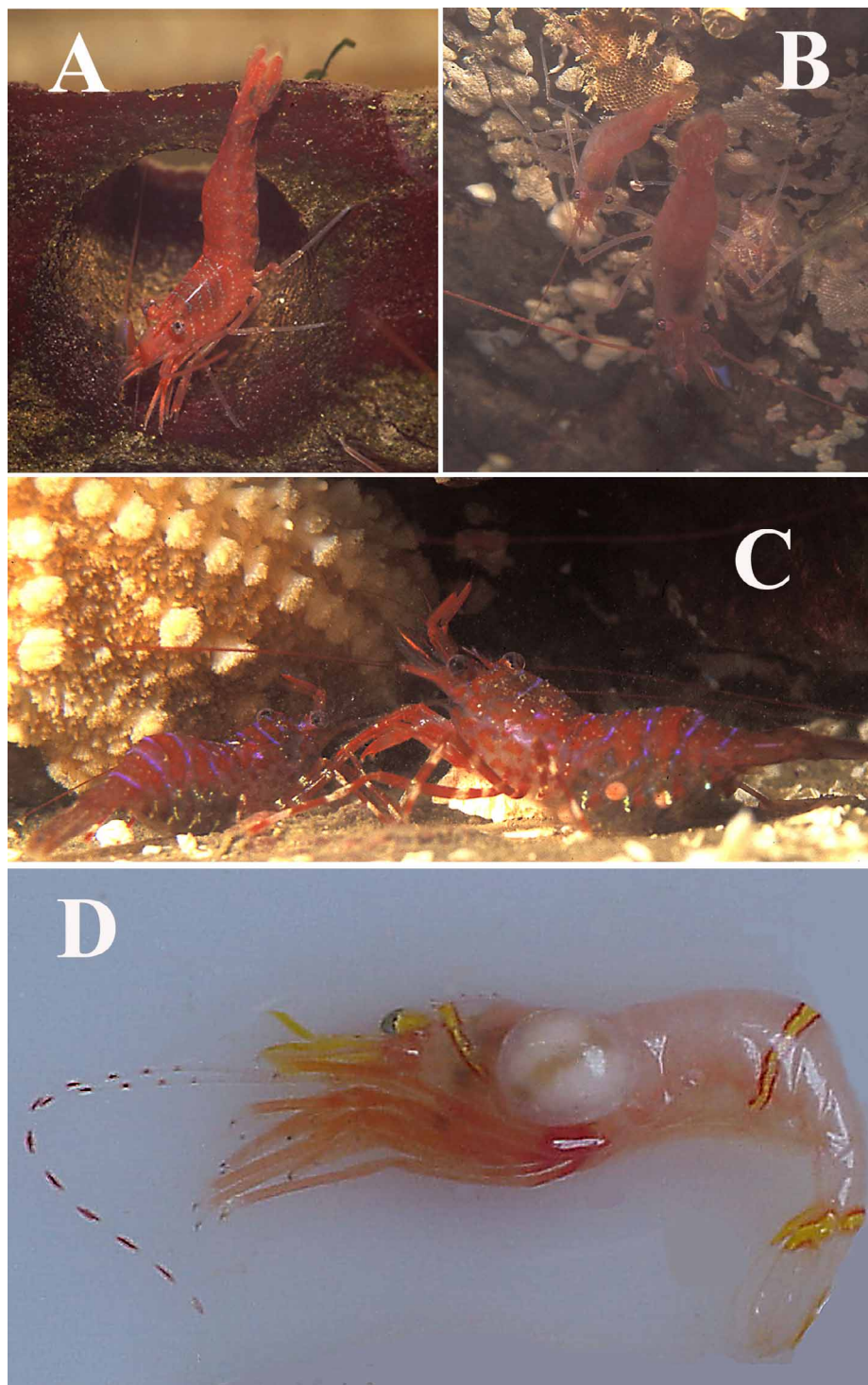


FIGURE 4. A, aquarium photo of *Lebbeus eludus* showing daytime coloration; B, *in situ* photo of *L. eludus* at night; C, *in situ* photograph of *L. mundus*; D, photograph of freshly-caught holotype of *L. acudactylus*. A–C by G.C. Jensen; D by K.P. Maslenikov.

Color: Carapace and abdomen a uniform reddish orange with scattered, minute white dots; carapace occasionally with 4–5 faint white or pale blue oblique lines (Fig. 4A). Appendages reddish with no banding. At night the entire shrimp fades to pale pink or lavender (Fig. 4B).

Distribution: Banks Island, Hecate Strait, British Columbia, Canada to Burrows Channel, Anacortes, Washington, USA; from 5–20 m.

Etymology: The specific name refers to the very evasive behavior of this shrimp. The common name “elusive lebbeid” is suggested.

***Lebbeus mundus* new species**

Figs. 4C, 5, 6

Type material: Holotype female, postorbital carapace length 7.2 mm, Willis Point, Vancouver Island, British Columbia, Canada (48.34.601°N, 123.29.319°W), suction gun, 9–12 m, 31 December 2005. G.C. Jensen, collector. National Museum of Natural History, Smithsonian Institution, USNM 1092257. Allotype, 5.9 mm, Burrows Island, Anacortes, Washington, U.S.A. (48.29.251°N, 122.41.536°W), suction gun, 12 m, 20 November 2004, G.C. Jensen, collector, USNM 1092258. Paratypes collected same date and location as holotype deposited at the U.S. National Museum of Natural History (1 male, 2 females, USNM 1092259), California Academy of Sciences (2 males, 2 females, CASIZ 174051), Natural History Museum of Los Angeles County (2 males, 2 females, LACM CR 2005-033.1), National Science Museum, Tokyo (1 male, 2 females, NSMT-Cr 16841), and British Columbia Provincial Museum (1 male, 1 female, RBCM 006-00055). Also female, Yeo Island Channel, Winchelsea Island, Strait of Georgia, British Columbia, Canada, 20 m, 26 October 1996, D. Gibbs, collector, RBCM 006-00057. Female, ovigerous, Barrie Reach, Gardner Canal, British Columbia, Canada (53.27.5°N, 128.10.5°W), <23m, 25 March 1976, P. Lambert and B. Cooke, collectors, RBCM 976-1034-20.

Other material examined: Two males, Pribilof Islands (56.36.79°N, 169.52.27°W), dredge, 85 m, 4 September 1983, G.C. Jensen, collector. Male, Pribilof Islands (57.06.37°N, 170.14.25°W), dredge, 27 m, 31 August 1983, G.C. Jensen, collector. Four specimens, off Larch Bay, Baranof Island, Alaska (56.12.1°N, 134.45.7°W), 134 m, 8 August 1983, A. Peden, collector, RBCM 983-01583-3. Male, Fitz Hugh Sound, Windsor Cove, mouth of Burke Channel, British Columbia (51.55.95°N, 127.52.95°W), 40–80 m, 21 August 1981, P. Lambert, collector, RBCM 981-00201-5.

Description: Integument smooth, fairly thick. Rostrum short, 0.37–0.5 carapace length, barely exceeding cornea; lateral face with longitudinal carina extending from base of supraorbital spine to 0.31–0.64 rostrum length. Carapace and rostrum (Fig. 6A) with 4 (occasionally 5) dorsal teeth, only 1–2 on carapace; females usually with dorsal carina extending 0.85–0.96 carapace length; carina not present in males. Rostrum usually lacking ventral teeth, rarely with a small subterminal tooth. Supraorbital spine very strong, with

deep V-shaped notch ventrally; dorsal margin sometimes continuing as subdorsal carina in females only, 0.3–0.8 carapace length. Suborbital in the form of a strong, rounded lobe, antennal spine strong and sharp with deep notch ventrally; anterolateral margin strongly convex, pterygostomian spine distinct. Females with lateral carina, 0.67–0.88 carapace length.

Abdominal somites smooth except for dorsal, transverse furrow on the second abdominal somite. Pleura of abdominal somites 1–3 rounded; pleura of fourth and fifth abdominal somites with posteroventral spines. Telson (Fig. 6 G) 1.3–1.6 length of sixth somite, with 4–5 pairs of dorsolateral spinules and three pairs of terminal spinules, lateral pair similar to dorsolateral series and middle pair with setules (Fig. 6H).

Eye somewhat pyriform; diameter 0.19–0.21 carapace length in females, 0.29–0.31 in males; cornea pigmented, ocellus present.

Basal article of antennular peduncle (Fig. 6B) with 3–4 distal, dorsal spines and a strong subdistal, ventromesial spine; stylocerite reaching to middle or middorsal end of second article of antennular peduncle. Second article with large dorsolateral spine on distal margin; third article with erect dorsal spine. Dorsolateral flagella of female 0.45–0.6 carapace length, with 14–20 thickened segments, distal portion slender, with 12–18 segments; entire flagella thickened and greatly elongated in males to 1.3–1.8 times carapace length, gradually tapering, with 38–50 segments. Ventromesial flagella longer than dorsolateral in females and subequal in males, with 30–45 segments.

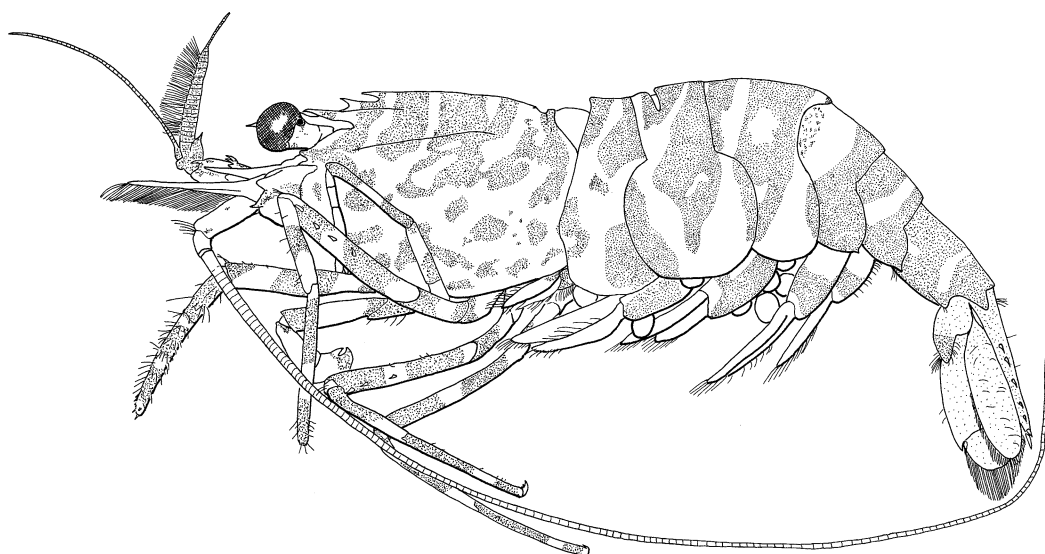


FIGURE 5. *Lebbeus mundus* sp. nov., Holotype female; carapace length 7.2 mm.

Basicerite of antenna with rounded dorsal lobe and strong ventrolateral spine; carpocerite reaching to end of second article of antennular peduncle. Antennal scale about 2.5 times as long as wide and about 0.65 carapace length in females, about 3 times longer

than wide and 0.78–0.8 carapace length in males; lateral margin straight, spine equal to or slightly exceeded by lamella. Antennal flagellum 4.6–7.4 times carapace length.

Mandible with two-segmented palp; distal article of palp densely setose, proximal article with a few sparse setae; incisors slender, with 4 distal teeth. Left molar large, subcylindrical, with large distal tooth and setal tufts. Right molar with 5–6 teeth on margin.

First maxilla with bilobed palp, lateral lobe tipped with a slender simple seta and a subterminal slender seta; mesial lobe with a thicker, plumose seta. Distal endite oval, densely armed with spinules and setae on mesial margin; proximal endite with long, stout setae.

Second maxilla with palp tipped by 2–3 long and one short seta. Basal endite bilobed, mesial margin densely setose. Coxal endite very small, with about 11 long, plumose setae. Scaphognathite densely fringed with plumose setae, longest anteriorly and anteromesially and along posterolateral margin. Anterior lobe of scaphognathite long, subrectangular; posterior lobe rounded.

First maxilliped palp densely setose, with two subequal articles. Caridean lobe well developed and fringed with long plumose setae. Exopod long, tipped with setae. Endites well-developed, densely setose on mesial margin. Epipod large, bilobed.

Second maxilliped with ultimate article densely setose on mesial margin; penultimate article with many long setae. Exopod well developed, tipped with long setae. Epipod somewhat oval, with small podobranch.

Third maxilliped with 10–11 apical and subapical corneous spinules; mesial margins of ultimate and penultimate articles densely setose. Distal margin of antepenultimate article with strong, subdorsal lateral spinule and smaller subventral spinule. Epipod present.

Pereopods 1–5 with pleurobranchs. First pereopods (Fig. 6C) equal, chelate, reaching to about the distal third of the antennal scale, sometimes to tip in small males. Dactyl 0.38–0.48 propodus length; propodus 3.5–3.7 times as long as wide and 0.37–0.47 carapace length. Antennal cleaning brushes on propodus and carpus. Carpus 1.2–2.1 times as long as wide; merus 2.3–4.0 times longer than wide and 1.4–1.8 times longer than carpus. Coxa with hooked epipod and setobranch.

Second pereopod equal, chelate, exceeding antennal scale by palm and most distal segment of carpus; dactyl 0.36–0.46 propodus length. Carpus with 7 segments, third from merus longest. Merus 0.51–0.62 carpus length. Coxa with hooked epipod and setobranch.

Third pereopod (Fig. 6D, E) dactyl with corneous, bifid tip preceded by 3–4 spinules on flexor margin. Propodus 12.2–14.4 times longer than wide in females and 8.9–13.4 times in males, with about 35 small spinules in two indistinct rows along flexor margin. Carpus 2.7–5.1 times as long as wide. Merus 5.6–10 times long as wide, with 3–5 lateral spinules increasing in size distally. Coxa with hooked epipod and setobranch.

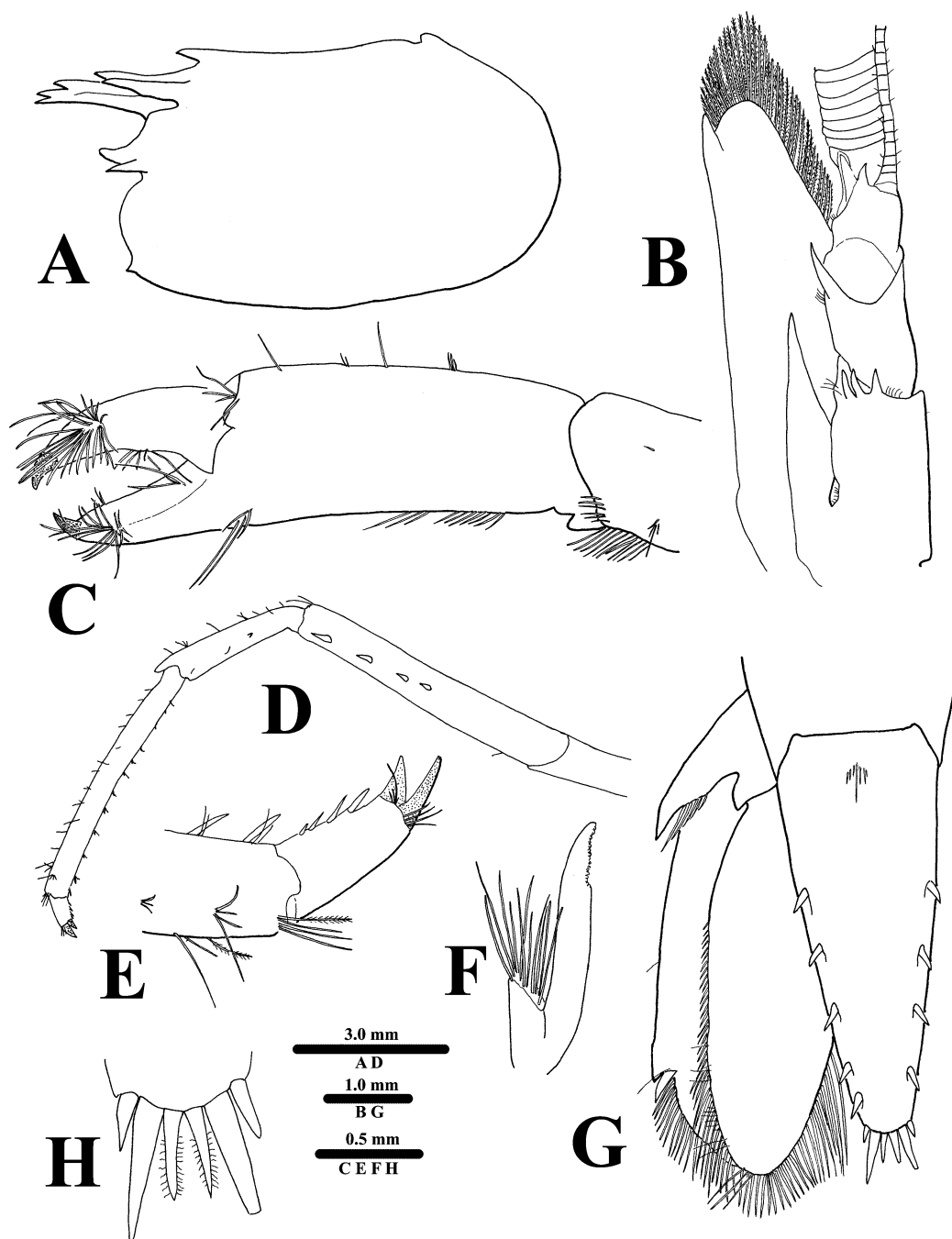


FIGURE 6. *Lebbeus mundus*, exuvium of male allotype. A, lateral view of carapace; B, antennular peduncle and antennal scale (dorsal view); C, chela of first pereopod, mesial view; D, third pereopod, lateral view; E, dactyl of third pereopod; F, appendix masculina and appendix interna; G, dorsal view of telson and uropods.

Fourth and fifth pereopods similar to third but decreasing in size and lacking epipods; fourth with 2–5 meral spinules and setobranch on the coxa; fifth with 0–1 spinule and propodal grooming brush.

Endopod of first pleopod of female subequal to exopod. Endopod of first pleopod of male broad, flat, about two-thirds length of exopod and fused with appendix interna. Lateral margin with long plumose setae, mesial margin with curved plumose setae decreasing in length distally; distal third strongly tapered into fingerlike appendix interna with cincinnuli at the tip. Appendix masculina (Fig. 6F) stout, slightly less than half length of appendix interna, and tipped with 10–12 long spinules. Uropods subequal, reaching to tip of longest telson spinules.

Eggs oval, 1.16–1.25 X 0.83–1.0 mm. Ovigerous females ranged in size from 5.2–10.7 mm carapace length.

Color: Color pattern consistent but varying in intensity with habitat and sex, being brighter in females and in specimens collected from areas with more brightly colored encrusting organisms. Branchial region of carapace with irregular red spots; dorsal region with four short, narrow, evenly spaced electric blue bands. Abdomen with broad red bands separated by blue; telson and uropods reddish with no banding. Blue color tends to be faint or lacking in males. Walking legs reddish with widely spaced yellow bands; antennae orange, unbanded (Fig. 4C).

Distribution: Pribilof Islands, Alaska (Jensen & Armstrong 1987, as *L. schrencki*) to Octopus Hole, Hood Canal, Washington (47°26.792'N, 123°06.842'W), at depths of 9–134 m.

Etymology: The Latin ‘mundus’ means clean, neat, or elegant, all terms appropriate for this shrimp given the cleaning behavior it exhibits (see Discussion) and its attractive markings. I recommend the common name ‘cleaner lebbeid’.

***Lebbeus acudactylus* new species**

Figs. 4D, 7–9

Type Material: Holotype female, postorbital carapace length 9.6 mm; with bopyrid parasite. Aleutian Islands, Alaska (51.86° N, 174.92°W), trawl, 155 m. 13 June 2000. K.P. Maslenikov collector. National Museum of Natural History, Smithsonian Institution, USNM 1092260. Also allotype, 9.0 mm, with bopyrid parasite, Gulf of Alaska (56.12° N, 157.76°W), trawl, 166 m. 12 June 2005. K.P. Maslenikov, collector, USNM 1092261. Paratype female, 7.1 mm, Aleutian Islands, Alaska (52.28°N, 174.76°W), trawl, 163 m. 15 June 2000. K.P. Maslenikov collector. California Academy of Sciences (CASIZ 174053).

Description: Integument smooth, somewhat thick. Rostrum moderately long, horizontal, 0.45–0.60 carapace length (Fig. 8A); greatly exceeding cornea and basal article of antennular peduncle and sometimes exceeding second article. Carapace and rostrum with 4–5 dorsal teeth, three postorbital; rostrum with 1–3 ventral teeth. Supraorbital spine

moderate; suborbital and antennal spines strong, pterygostomian spine distinct.

Abdomen smooth. Pleura of abdominal somites 1–4 rounded; pleura of fourth and fifth abdominal somites with posteroventral spines. Telson 1.5–1.6 times length of sixth somite, with 3–4 pairs of dorsolateral spinules and 14–15 terminal spinules (Fig. 9E).

Eye diameter 0.17–0.2 carapace length; cornea pigmented and slightly dilated; ocellus present.

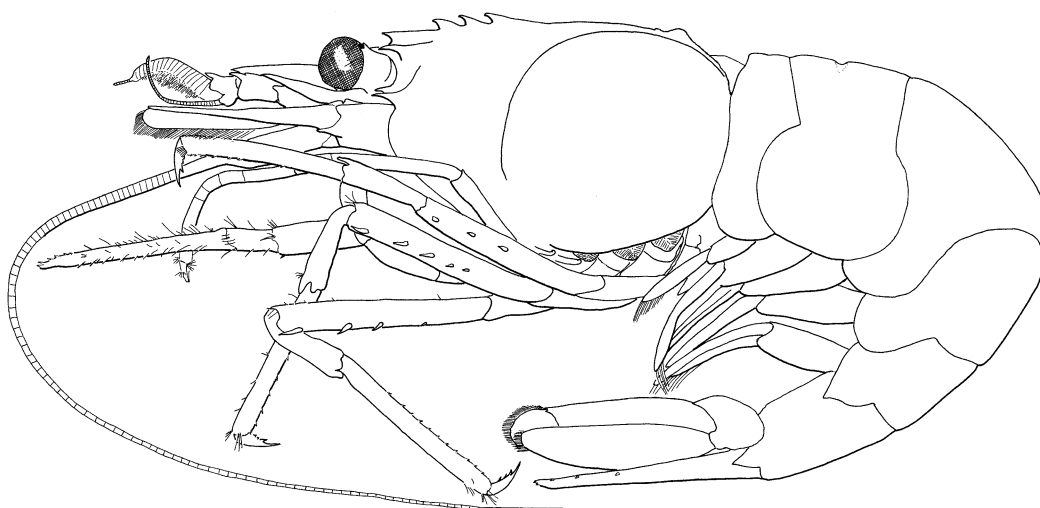


FIGURE 7. *Lebbeus acudactylus* sp. nov. Holotype female; carapace length 9.6 mm..

Basal article of antennular peduncle (Fig. 9A) with one distal, dorsal spine and a strong subdistal, ventromesial spine; stylocerite barely exceeding basal article or reaching to middle of second article of antennular peduncle. Second article with large dorsolateral spine on distal margin; third article with dorsal spine. Dorsolateral flagella with 15–23 thickened segments; distal portion slender, with at least 5 segments; tip of ventromesial flagella broken but probably subequal to dorsolateral flagella.

Basicerite of antenna with rounded dorsal lobe and strong ventrolateral spine; carpocerite reaching third article of antennular peduncle. Antennal scale 2.5 times longer than wide and about 0.7 carapace length; lateral margin straight; lamella exceeds spine. Antennal flagellum about 3.6 times carapace length.

Left mandible (Fig. 8B) with sparsely setose, two-segmented palp; incisor broad, with 6 small, uniform teeth and larger distal tooth. Left molar large, subcylindrical, with large distal tooth. Right molar not dissected.

First maxilla (Fig. 8C) with shallowly bilobed palp, lobes each tipped with a stout seta. Distal endite oval, bearing many plumose setae; proximal endite with long, stout setae.

Second maxilla (Fig. 8D) with palp tipped by two setae. Basal endite bilobed, mesial margin densely setose. Coxal endite damaged in dissection, bearing long, plumose setae. Scaphognathite densely fringed with plumose setae, longest anteriorly and anteromesially and along posterolateral margin. Anterior lobe of scaphognathite long, subrectangular;

posterior lobe rounded.

First maxilliped (Fig. 8E) with two-segmented palp, distal article subequal to proximal. Caridean lobe well developed and fringed with long plumose setae. Exopod long, tipped with setae. Endites well-developed, densely setose on mesial margin. Epipod large, bilobed.

Second maxilliped (Fig. 8F) with ultimate article densely setose on mesial margin; penultimate article with many long setae. Exopod well developed, tipped with long setae. Epipod kidney shaped, with small podobranch.

Third maxilliped (Fig. 8G) exceeding end of antennal scale by about half the length of the ultimate article and tipped with nine apical and subapical corneous spinules; mesial margins of ultimate and penultimate articles densely setose. Penultimate article about 0.23 of ultimate; antepenultimate article with small, subdistal, ventrolateral spinule. Hooked epipod present.

Pereopods 1–5 with pleurobranchs. First pereopods (Fig. 9B) equal, chelate. Dactyl 0.36–0.45 propodus length; propodus 3.6–4.0 times as long as wide and 0.44–0.48 carapace length. Antennal cleaning brushes on propodus and carpus. Carpus 1.5–2.5 times as long as wide; merus 3.1–4.2 times longer than wide and 1.6–1.8 times longer than carpus. Coxa with hooked epipod and setobranch.

Second pereopod equal, chelate, exceeding antennal scale by slightly more than palm; dactyl 0.40–0.45 propodus length. Carpus with 7 segments, third from merus longest. Merus 0.57–0.67 carpus length. Coxa with hooked epipod; setobranch greatly reduced or absent.

Third pereopod dactyl (Fig. 9C) with corneous, bifid tip preceded by 3–5 spinules on flexor margin. Propodus 8.9–9.9 times longer than wide; females with about 25 small spinules along flexor margin and male with about 40, as a single row proximally and in two indistinct rows distally. Carpus 2.5–2.8 times as long as wide. Merus 6.2–7.1 times long as wide, with 3–4 lateral spinules that increase in size distally. Fourth and fifth pereopods similar to third but decreasing in size; fourth with 3–5 meral spinules; fifth with 3–4 spinules and propodal grooming brush.

Endopod of first pleopod of female about two-thirds length of exopod. Endopod of first pleopod of male triangular, flat, subequal to exopod and fused with appendix interna; lateral margin with long setae, mesial margin with short, curved setae; distal one-fifth a fingerlike appendix interna tipped with cincinnuli. Appendix masculina (Fig. 9D) stout; tipped with several long spinules and subequal in length to appendix interna.

Color: Carapace and abdomen marked with bright yellow bands with red margins (Fig. 4D). First carapace band somewhat oblique, angling back from behind orbit; second band (not visible in photograph due to bopyrid) at rear of carapace. First band on abdomen at third segment, second band crossing bases of uropods. Distal half of telson yellow, as are the eyestalks and the lateral flagella of the first antennae. Walking legs unbanded, pink; antennal flagellum clear with dark red bands.

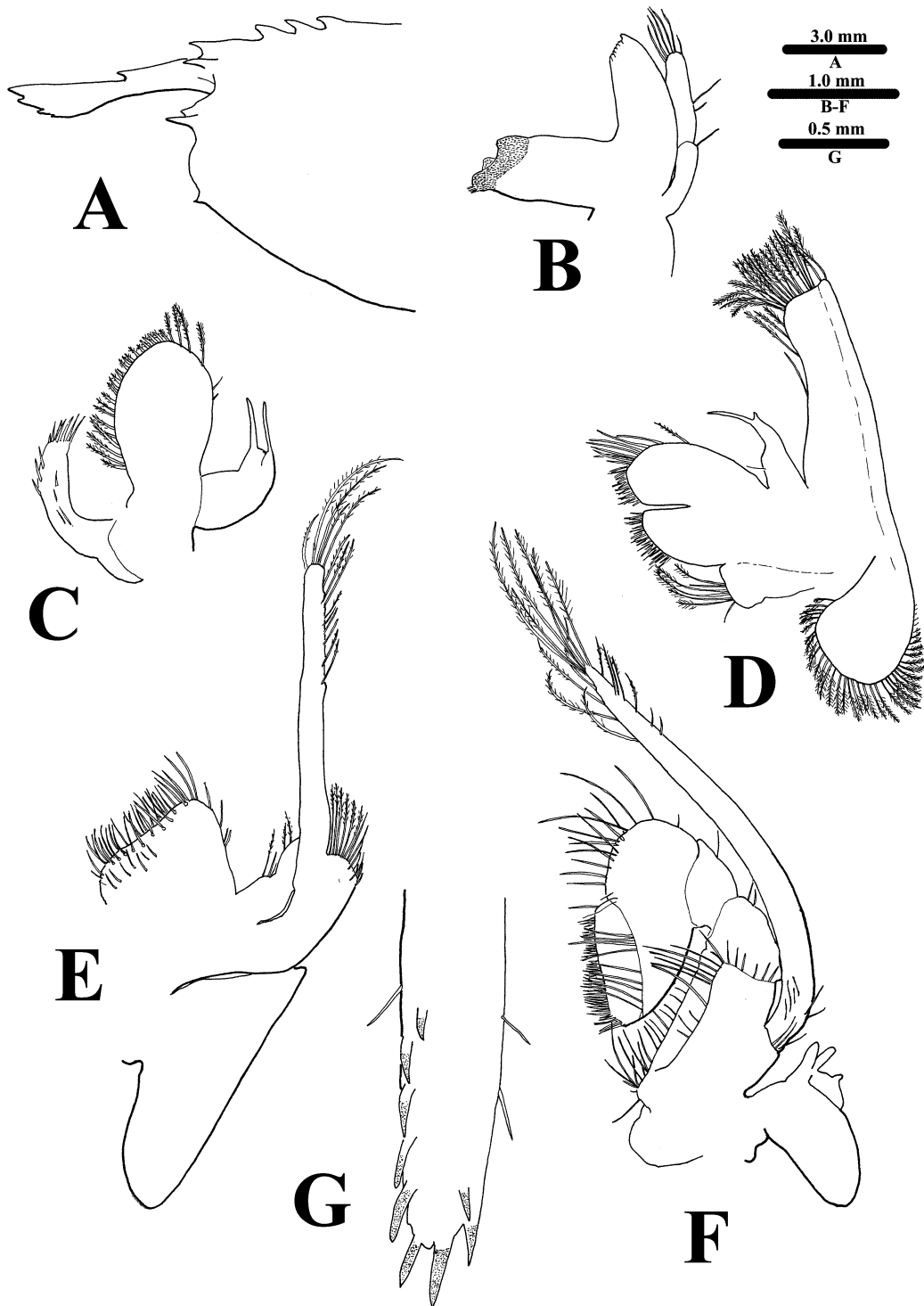


FIGURE 8. *Lebbeus acudactylus*. A, G: female holotype; B–F: female paratype. A, anterior region of carapace; B, left mandible; C, first maxilla; D, second maxilla; E, first maxilliped; F, second maxilliped; G, tip of third maxilliped.

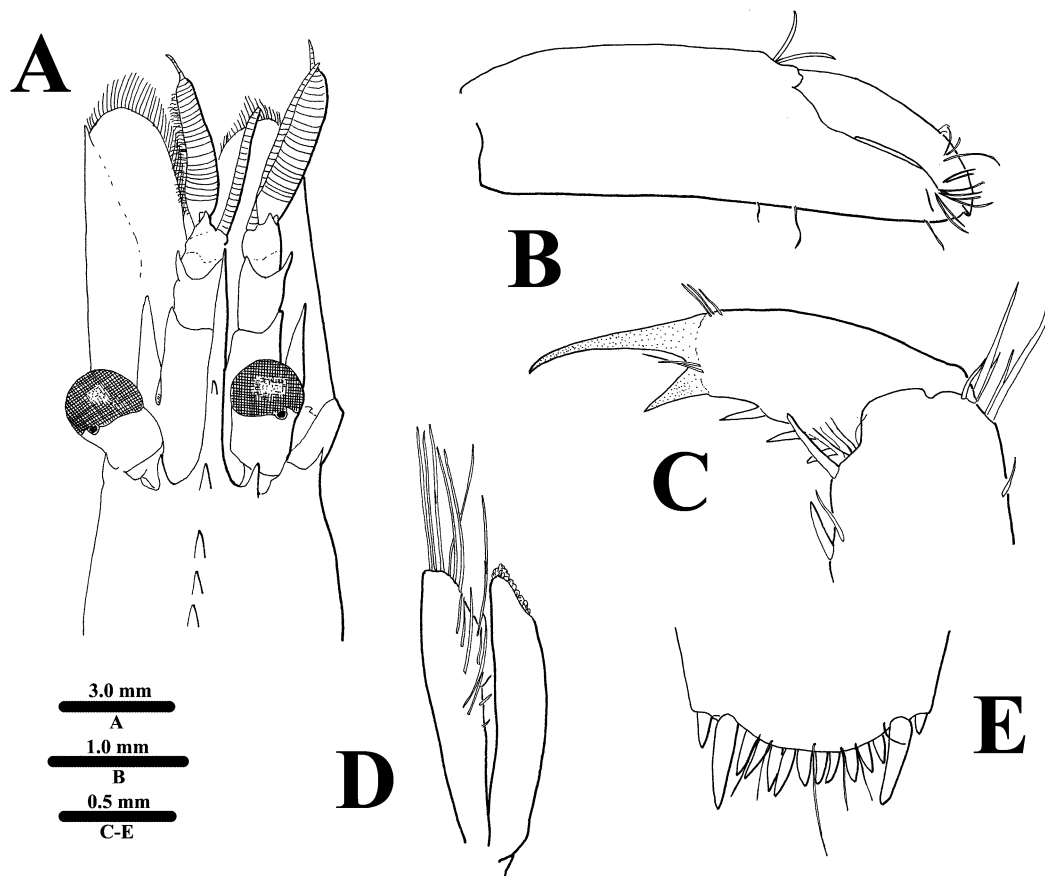


FIGURE 9. *Lebbeus acudactylus*. A, E: female holotype; B, C: female paratype; D: male allotype. A, anterior region in dorsal view; B, chela of first pereopod; C, dactyl of third pereopod; D, appendix masculina and appendix interna; E, tip of telson.

Distribution: So far this species is only known from the Aleutian Islands and the Gulf of Alaska, at depths of 150–170 m.

Etymology: The specific name refers to the bifid dactyls of the walking legs, in which the terminal spine is unusually long and sharp.

Discussion

Two of the new species described above, *Lebbeus eludus* and *L. mundus*, have previously been confused with a closely related species from the Sea of Okhotsk, *L. schrencki* (Brazhnikov). In his monograph on the shrimps of British Columbia, Butler (1980) reported *L. schrencki* from the eastern Pacific, and was first to note the presence of an unusual, deep, transverse groove on the dorsal surface of the second abdominal somite. However, the figure provided was actually a composite created from *L. mundus* and *L.*

eludus. In most respects the illustration clearly matches *L. eludus*, but it has spinules on the legs that are lacking in that species, and whose absence is one of several characters that distinguish it from *L. mundus*. Butler noted that the specimen shown actually lacked spinules on the merus of the walking legs, so “these were drawn from another specimen” (Butler 1980; pg.186). An inset showing rostral variation is also likely to have come from a specimen of *L. mundus*. In a personal communication shortly before he passed away, Butler indicated that this was an error and suggested it may have been drawn from a specimen of *L. grandimanus* Brazhnikov; however, given the shape and large size of the supraorbital spine and the deep notch beneath it, it seems more likely to have been drawn from *L. mundus*.

The type series of *L. schrencki* consists of three specimens that appear to represent two different species, since two of them have abdominal grooves and the third does not. Unfortunately, the walking legs of all the specimens are missing except for one disconnected leg, bearing four meral spinules, that is in the jar with the specimen lacking a groove. All three specimens have six or seven dorsal teeth, three of which are postrostral in position. *Lebbeus eludus* have a total of only two (rarely three) dorsal teeth, and *L. mundus* have 4–5 dorsal teeth, only one or two of which are postrostral. The specimens of *L. schrencki* have one or two teeth on the ventral margin of the rostrum, while *L. mundus* usually lack ventral teeth; only three of the 43 specimens examined had a small subterminal ventral tooth. The stylocerite of *L. schrencki* extends to the end of the spine on the second article of the antennular peduncle; in *L. mundus* it rarely reaches as far as the base of the spine. Brazhnikov (1907) also commented on the unusually short sixth abdominal somite of *L. schrencki*; in the two specimens having a groove this segment was 0.40–0.44 of the carapace length, while in *L. mundus* it is 0.48–0.61 of the carapace length. Brazhnikov’s (1907) figure of *L. schrencki* also showed no indication of a notch beneath the supraorbital spine, which is an obvious feature of *L. mundus*. This notch does appear in Vinogradov’s (1947) figure, lending additional support to Komai’s (2001) suggestion that Vinogradov’s specimens (which lacked spines on the fourth abdominal somites) were not *L. schrencki*.

The two new species share a number of features with several other members of the genus. *Lebbeus spongiarius* Komai, *L. microceros* (Kroyer), *L. carinatus* Zarenkov, *L. tosaensis* Hanamura and Abe and *L. comanthi* Hayashi and Okuno all bear multiple, dorsodistal spines on the margin of the first segment of the antennular peduncle and short rostrums that do not exceed that segment, have a small ventrolateral spine on the pleuron of the fourth segment of the abdomen, and have epipods on the first three pereopods. None of these species has the deep, dorsal transverse groove on the second abdominal somite of *L. eludus* and *L. mundus*. Another species, *L. polyacanthus* Komai *et al.* 2004, also shares these characters and has a fairly deep groove on the second abdominal somite, but is distinguished by the numerous lateral spinules (9–13) on the merus of the third pereopod and the much larger number of rostral spines (6–7 dorsal; 2–4 ventral). *Lebbeus eludus* is

also readily separated from the rest by the lack of lateral spinules on the merus of the walking legs, and in males, an unusually large appendix masculina. In *L. eludus* the appendix masculina is much longer than the appendix interna; in the other species it is half or less than half the length of the appendix interna.

Butler (1964) tentatively identified a specimen from Checleset Bay on the northeast coast of Vancouver Island as *L. zebra* (Leim), a North Atlantic species that has since been synonymized with *L. microceros* (Squires 1990). The identity of this specimen remains a mystery. The overall coloration was similar to the daytime coloration of *L. eludus* except that the telson and uropods were crossed by two broad, white bands separated by a dark red band; such markings were never seen in the many *L. eludus* that were captured or observed in the wild. The specimen also has greatly elongated third maxillipeds similar to those of a deep water Hawaiian species, *L. profundus* (Rathbun). As previously noted (Butler 1980) the second abdominal somite lacks the transverse groove; unfortunately all of the pereopods are missing. Although likely representing an undescribed species it should remain unnamed until more material becomes available, given the poor condition of the lone specimen.

It is also doubtful that a single specimen labeled '*L. schrencki*' from off Wakkanai, northern Hokkaido (HUMZ-C 138) is conspecific with the Russian type specimens, but given its damage (missing all but two of its pereopods) and sex (male; while all three types of *L. schrencki* are females) it is difficult to determine its status. The form of the rostrum and size and shape of the eye most closely resemble those of *L. mundus*, while the elongated palm of the first pereopod resembles that of a male *L. eludus*. As Komai (2001) noted, this specimen lacks the deep abdominal groove present in *L. mundus* and *L. eludus*, although a very shallow one is present.

The color pattern and morphology of *L. mundus* bears a striking resemblance to that of *L. microceros*. In *L. mundus* the walking legs are banded throughout their length, while only the proximal half is banded in *L. microceros*; the telson and uropods of *L. microceros* have white bands while those of *L. mundus* are unbanded. There is no transverse groove on the abdomen of *L. microceros*.

Butler (1980) speculated that the transverse groove facilitates assumption of the defensive cataleptic position, with the posterior margin of the first somite sliding into the groove on the second somite as the abdomen is elevated dorsally toward the head. This appears to be the case in *L. catalepsis* Jensen and *L. groenlandicus* (Fabricius), both of which have this furrow and commonly assume this posture. However, though I have maintained specimens of *L. eludus* and *L. mundus* in captivity for more than a year, neither species has been observed in any posture that would bring those two parts of the abdomen into contact. It is possible that the structure no longer has any functional significance in these two species and is merely a character left over from a shared 'cataleptic-type' ancestor. The groove is present even in very small specimens; larvae of *L. mundus* have been successfully raised at the Vancouver Aquarium and the furrow is apparent in

juveniles as small as 1.7 mm cl. The form of the groove is somewhat variable in both *L. eludus* and *L. mundus*; in some specimens the posterior margin projects forward and forms a hood over the groove, while other individuals collected at the same time from the same population have an open groove.

Although they share many morphological characters and occur in the same areas, *L. eludus* and *L. mundus* differ greatly in behavior. As the name suggests, *L. eludus* are extremely shy, venturing to the opening of their crevices at night and rarely allowing more than a fleeting glimpse before diving deep into their shelters. Specimens are usually observed singly, though on one occasion three were seen together. In contrast, *L. mundus* often occurs in large, mixed sex aggregations, and is sometimes common in octopus dens. It reportedly behaves like a cleaner shrimp, having been seen picking at the inside of the open mouths of fish including the dusky rockfish *Sebastes ciliatus* (Tilesius) and lingcod, *Ophiodon elongatus* Girard. At the type locality for *L. mundus*, many females carry enlarged, white eggs infected with a parasitic protozoan tentatively identified as *Syndinium*; infected eggs are visible on one of the specimens in Fig. 4C.

Lebbeus eludus and *L. mundus* are rarely caught in trawls and dredges because they reside in inaccessible places such as among boulders and in the crevices of vertical rock walls. The third species described here, *L. acudactylus* also appears to be rarely taken, but its habitat is not known. The three specimens collected to date were all caught in trawls at depths of 150–170 m, so it has never been observed *in situ*. Based on the mixed composition of the species caught from those hauls the bottom does not appear to be homogeneous, however in all three cases the predominant organisms were ones normally associated with mud or muddy sand. Given that two species that appear to be closely related to it (*L. grandimanus* and *L. balsii* Hayashi) are both symbiotic with sea anemones, it is possible that it lives in association with anemones as well.

Due to their similar markings and morphological characters, Hayashi & Okuno (1997) considered *L. balsii* a "cryptic" relative of *L. grandimanus*. It is possible that *L. acudactylus* has also been confused with that species; given its color, it could be mistaken in the field for an aberrant or pale *L. grandimanus* since both have bright yellow bands with red edges encircling the carapace and abdomen. In *L. grandimanus* there are four of these bands on the abdomen with electric blue markings in between, while in *L. acudactylus* the abdomen has only two yellow bands and no blue. The antennal flagellum of *L. grandimanus* is a uniform pale yellowish color, while *L. acudactylus* has strong dark red banding. There are six full white and red bands on the abdomen of *L. balsii*, along with several much shorter ones (Hayashi & Okuno 1997).

Morphologically, *L. acudactylus* is easily distinguished from both *L. grandimanus* and *L. balsii* by its third maxillipeds. Both *L. grandimanus* and *L. balsii* have a distinctive comb of numerous spinules on the mesial margin of the ultimate article of the third maxilliped (Hayashi 1992); *L. acudactylus*, like most other lebbeids, only has a few spinules near the tip. *L. acudactylus* is further distinguished from *L. grandimanus* by its

relatively shorter stylocerite which at most reaches the middle of the second segment of the antennular peduncle; in *L. grandimanus* it typically projects to the tip of the dorsolateral spine on the second segment. The numerous (14–15) terminal spinules on the telson of *L. acudactylus* can be used to distinguish it from *L. balsii*, which has only four spinules. Of the remaining described lebbeids that lack a posterolateral spine on the pleuron of the fourth abdominal somite and have epipods on two pereopods, *L. vinogradovi* Zarenkov and *L. longidactylus* (Kobjakova) have much longer rostrums (equal to or greater than the carapace length, respectively, as compared to half the carapace length or less) ; *L. yaldwyni* Kensley *et al.* has a bizarre, highly crested carapace, and *L. scrippsi* Wicksten and Méndez and *L. splendidus* Wicksten and Méndez both have multiple, distal spines on the basal article of the antennular peduncle.

Fransen (1997) cautioned that many species of *Lebbeus* are known from very few specimens, suggesting that the small differences between some putative species could reflect intraspecific variability. The carinae that are only present on the carapace of female *L. mundus* are an example of a character that could have easily been mistaken for a species-specific difference, had specimens of each sex been captured at disparate localities.

Color patterns are proving very useful in detecting and recognizing new species of *Lebbeus*. Unlike some other genera of hippolytids (e.g., *Spirontocaris*) color patterns are often consistent and distinctive within species, and the three species described herein were all first recognized due to their color. With the current ease of digital imaging, every effort should be made to document the color of specimens before they are preserved.

Komai and Takeda (2004) noted that the genus *Lebbeus* is the most diversified group within the Hippolytidae, and counting these three new species, the number of named species in this genus has more than doubled in the past 30 years. In addition to the possible unnamed forms already mentioned, additional undescribed species from the northeastern Pacific (pers. obs.), Australia (Poore 2004), and northwestern Pacific (T. Komai, pers. comm.) still remain.

Acknowledgements

Many thanks to Donna Gibbs, Danny Kent, Andy Lamb, and Allan Murray for providing specimens and/or observations of *L. mundus*; Pamela Jensen for help collecting specimens; Katherine Maslenikov and Jay Orr for specimens and photos of *L. acudactylus*; Frank Morado for identification of the egg parasites, and Ted Pietsch for examining the type specimens of *L. schrencki* while visiting St. Petersburg. Thanks also to Judith Price of the Canadian National Museum, Kelly Sendall and Gavin Hanke of the British Columbia Provincial Museum, and the Hokkaido University Laboratory of Marine Zoology for providing material for examination.

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