

A new species of the hippolytid shrimp genus *Eualus* Thallwitz, 1891 (Crustacea: Decapoda: Caridea) from Toyama Bay, the Sea of Japan

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Abstract.—A new species of the caridean family Hippolytidae, *Eualus horii*, is described and illustrated based on seven specimens from Toyama Bay, Sea of Japan. A small subproximal spine on the lateral margin of the antennular stylocerite, and the comparatively long rostrum (0.58–0.70 times as long as the carapace), distinguish the present new species from the northwestern Pacific congeners. These characters are shared with *E. lineatus* Wicksten & Butler from the northeastern Pacific. The new species, however, differs from *E. lineatus* in shape of the subproximal spine on the stylocerite and armature of the basal segment of the antennular peduncle and merus of third pereopod.

A large collection of shrimps from Toyama Bay, situated on the Sea of Japan coast of the Honshu main island of Japan, was sent to the junior author by Mr. Naajiro Horii of the Uozu Aquarium. The study of this collection showed the presence of an undescribed species of *Eualus* Thallwitz, 1891, a hippolytid genus currently represented by about 30 species chiefly distributed in cold and temperate waters of the world oceans (Noël 1978, Chace 1997). In this paper, we describe this new species based on seven specimens. The new species is compared with *Eualus lineatus* Wicksten & Butler, 1983, known from the northeastern Pacific. The discovery of the new species from Toyama Bay is remarkable because Toyama Bay is a commercially important area for fisheries and the marine fauna is well documented.

The type specimens are deposited in the National Fisheries University, Shimonoseki, Japan (NFU). Comparative materials of other species of *Eualus* (see Appendix) are deposited in NFU, Natural History Museum and Institute, Chiba (CBM, with code of ZC); Laboratory of Marine Zoology, Fac-

ulty of Fisheries, Hokkaido University (HUMZ, with code of C); Kitakyushu Museum of Natural History (KMNH); and the private collection of Dr. G. J. Jensen (University of Washington). Carapace length (cl) represents specimen size, measured from the posterior margin of the orbit to the midpoint of the posterior margin of the carapace.

Eualus horii, new species
Figs. 1–5

Material examined.—Holotype: female (cl 3.0 mm), off Hayatsuki-gawa Rivermouth, Toyama Bay, 80 m, 17 Jun 1979, commercial trawler, coll. N. Horii, NFU 530-2-2297.

Paratypes: 1 male (cl 3.2 mm), 1 female (cl 2.3 mm), Toyama Bay, 80–160 m, 25 Jan 1976, commercial trawler, coll. N. Horii, NFU 530-2-601; 1 female (cl 2.5 mm), same data, NFU 530-2-2055; 3 ovig. females (cl 2.9–3.8 mm), off Uozu, Toyama Bay, 80 m, 17 Jun 1976, commercial trawler, coll. N. Horii, NFU 530-2-2298.

Description of female.—Body (Fig. 1) moderately slender, integument glabrous.

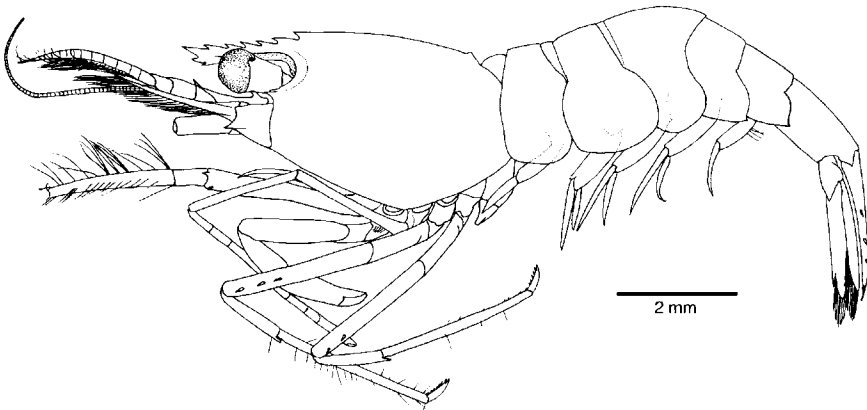


Fig. 1. *Eualus horii*, new species. Holotype female (cl 3.0 mm), Toyama Bay, Sea of Japan, NFU 530-2-2297. Entire animal in lateral view (distal part of third maxilliped broken off, and fifth pereopod missing).

Rostrum (Fig. 2A, B) straight, slightly descending or directed forward, distinctly overreaching distal margin of first segment of antennular peduncle, but not overreaching distal margin of second segment, 0.58–0.70 times as long as carapace; dorsal margin armed with 4–6 (usually 6) sharp teeth over entire length (posteriormost spine sometimes arising just posterior to level of orbital margin); lateral face with thin longitudinal carina extending from orbital margin to distal 0.20–0.30; ventral margin with blade becoming somewhat deeper distally, with 1–3 subdistal teeth. Carapace (Fig. 1) with dorsal outline slightly convex in lateral view; postrostral median carina absent; suborbital projection (Fig. 2A) distinct, triangular, not reaching antennal spine; antennal spine moderately strong; pterygostomial spine small; anterolateral margin between antennal spine and pterygostomial spine slightly sinuous.

Abdomen (Fig. 1) with somites dorsally rounded, not carinate or strongly produced dorsally; pleura of first 3 somites broadly rounded, those of fourth and fifth each with small posteroventral tooth. Sixth somite 1.60–1.70 times longer than fifth, 1.90–2.00 times longer than deep, with small posteroventral tooth; posterolateral process terminating acutely. Telson (Fig. 2D) 1.40 times longer than sixth somite, 2.80 times

longer than anterior width; lateral margins parallel in anterior 0.40, tapering thereafter to rounded posterior margin; dorsal surface with 3 pairs of dorsolateral spines (excluding 1 pair at posterolateral corner); posterior margin with small median tooth and 3 pairs of basally articulated spines (intermediate pair longest; 2 lateral pairs simple, 1 mesial pair plumose).

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

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

Eye (Fig. 2A, B) subpyliform; cornea wider than stalk; ocellus present.

Antennular peduncle (Fig. 2A, B) reaching 0.60–0.70 of scaphocerite. Basal segment reaching 0.40 of scaphocerite, usually with 1 strong, acute dorsal tooth on distal margin; ventromesial ridge with prominent subdistal tooth; stylocerite slightly overreaching distal margin of basal segment, acutely pointed, subproximally with small, hook-like tooth on dorsolateral margin.

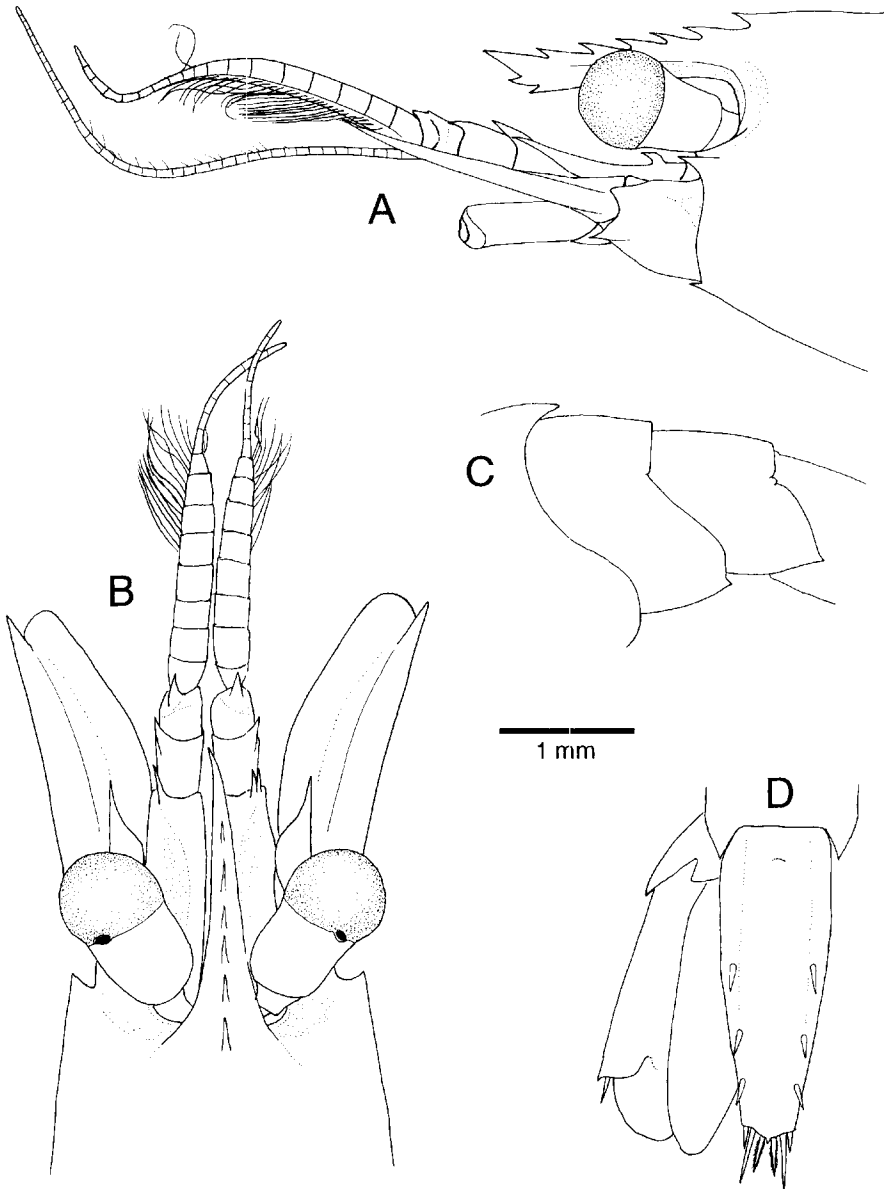


Fig. 2. *Eualus horii*, new species. Holotype female (cl 3.0 mm), Toyama Bay, Sea of Japan, NFU 530-2-2297. A, anterior part of carapace and cephalic appendages, lateral (antennal flagellum missing); B, same, dorsal (setae omitted); C, fourth and fifth abdominal somites, lateral; D, telson and left uropod, dorsal (setae omitted).

Penultimate segment less than half length of basal segment, with strong lateral tooth on distal margin. Ultimate segment short, with marginal tooth. Dorsal flagellum stout, thickened aesthetasc-bearing portion 0.60–0.70 times as long as carapace; ventral flagellum somewhat longer than dorsal flagellum.

Antenna (Fig. 2A, B) with basicerite bearing small distolateral tooth; dorsodistal corner bluntly produced; carpocerite reaching mid-length of scaphocerite. Scaphocerite 0.70–0.80 times as long as carapace, 3.20–3.30 times longer than wide; lateral margin nearly straight; distolateral tooth slightly overreaching distal margin of rounded blade.

Table 1.—*Eualus horii*, new species. Branchial formula.

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

Mouthparts (Fig. 3A–E) typical of genus. Third maxilliped (Fig. 3F) moderately elongate and slender, overreaching antennal scaphocerite by half length of ultimate segment; ultimate segment 4.20–4.30 times longer than penultimate segment, tapering distally, with 5 or 6 darkly pigmented corneous spines distally; antepenultimate segment shorter than distal 2 segments combined, somewhat flattened proximally, distolateral margin (Fig. 3G) with small, acute tooth and 1 long spiniform seta, lateral face with longitudinal row of minute spiniform setae and distoventrally with small movable spine; coxa without oval lateral plate.

First pereopod (Fig. 4A, B) moderately slender, reaching distal margin of scaphocerite. Chela 1.50 times longer than carpus, 4.50 times longer than wide. Dactylus about half length of palm, weakly curved, with 2 darkly pigmented claws; cutting edge entire. Palm subcylindrical; fixed finger terminating in simple, darkly pigmented claw; cutting edge entire. Carpus 2.40 times longer than distal width. Merus 1.60 times longer than carpus and 3.70 times longer than maximal width, subcylindrical, obliquely articulated with ischium; ventral surface with row of minute spinules in proximal 0.20. Ischium with setae on ventral surface.

Second pereopod (Fig. 4C) slender, overreaching scaphocerite by length of chela and half of carpus. Chela small with subcylindrical palm; dactylus 0.50–0.60 times as long as palm, with 2 terminal claws; fixed finger with 1 terminal claw; cutting

edges of dactylus and fixed finger entire. Carpus 3.90 times longer than chela, composed of 7 articles, with articles in following ratios from proximal end 1.00: 0.80: 1.40: 1.00: 0.80: 0.50: 0.90. Merus 0.60 times as long as carpus. Ischium 1.10 times longer than merus, subproximally with few stout setae on ventral margin.

Ambulatory pereopods long and slender. Third pereopod (Fig. 4D) overreaching scaphocerite by length of dactylus and half of propodus; dactylus (Fig. 4E) compressed laterally, about 3.80 times longer than deep and 0.17 times as long as propodus, with 5 or 6 accessory spinules on flexor margin; propodus 15.00–16.00 times longer than deep, with 2 rows of spinules on flexor surface; carpus 0.40 times as long as propodus, unarmed; merus 7.90 times longer than deep, with 2 or 3 lateral spines in distal 0.30–0.40; ischium about half length of merus, unarmed. Fourth pereopods (Fig. 4F, G) similar to third pereopod, overreaching scaphocerite by length of dactylus and 0.30–0.40 of propodus; merus with 1–3 lateral spines in distal 0.25–0.30. Fifth pereopod generally similar to third; merus unarmed or armed subdistally with 1 lateral spine.

First pleopod with endopod shorter than exopod, elongate subtriangular, with minute spiniform setae on mesial and lateral margins and few long setae apically.

Uropod (Figs. 1, 2D) with protopodite gradually tapering in acute posterolateral tooth; both rami slightly overreaching pos-

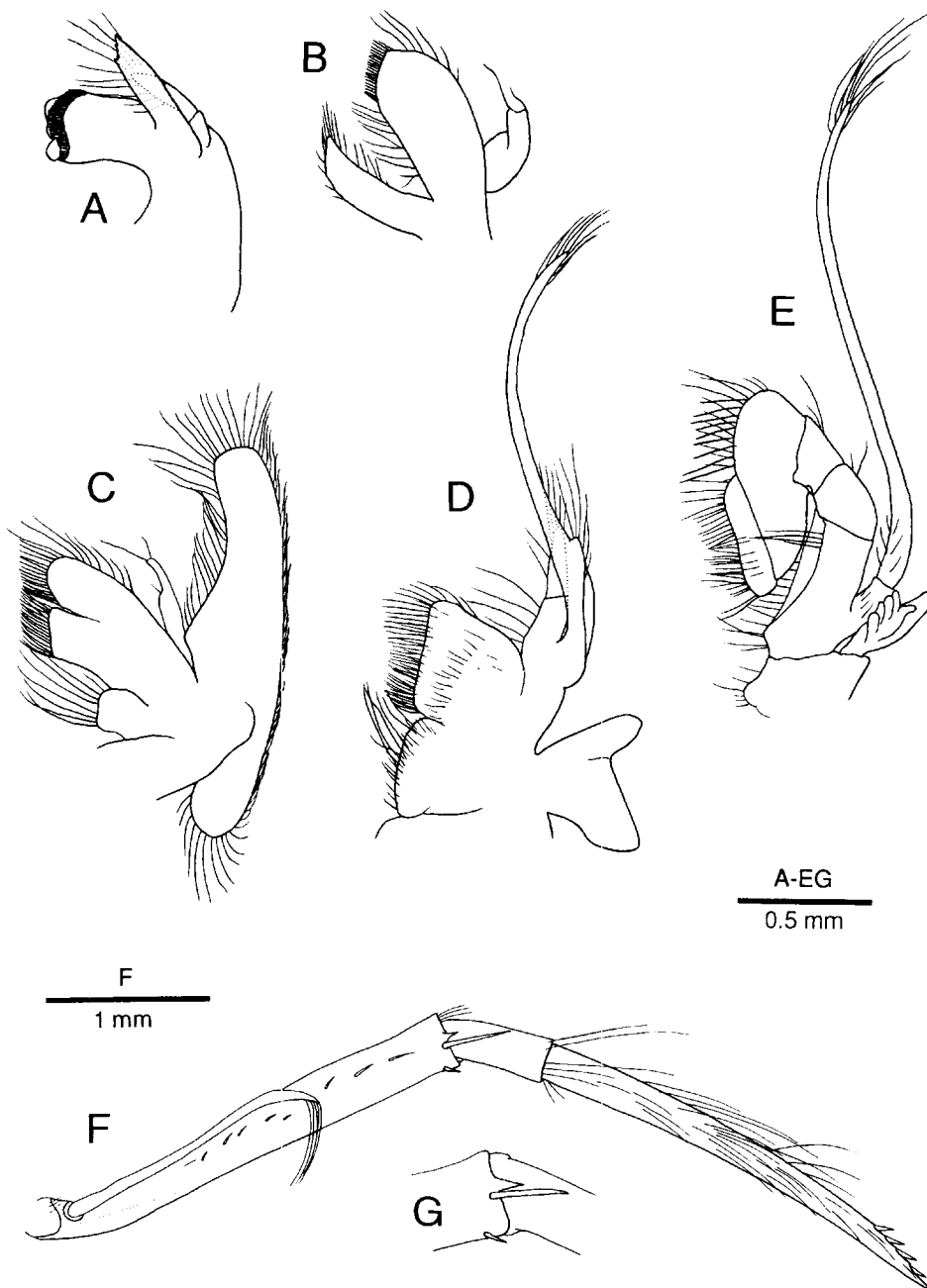


Fig. 3. *Eualus horii*, new species. Holotype female (cl 3.0 mm), Toyama Bay, Sea of Japan, NFU 530-2-2297. Mouthparts: A, left mandible, external; B, left maxillule, external; C, left maxilla, external; D, left first maxilliped, external; E, left second maxilliped, external; F, right third maxilliped, lateral; G, same, distal part of antepenultimate segment, lateral.

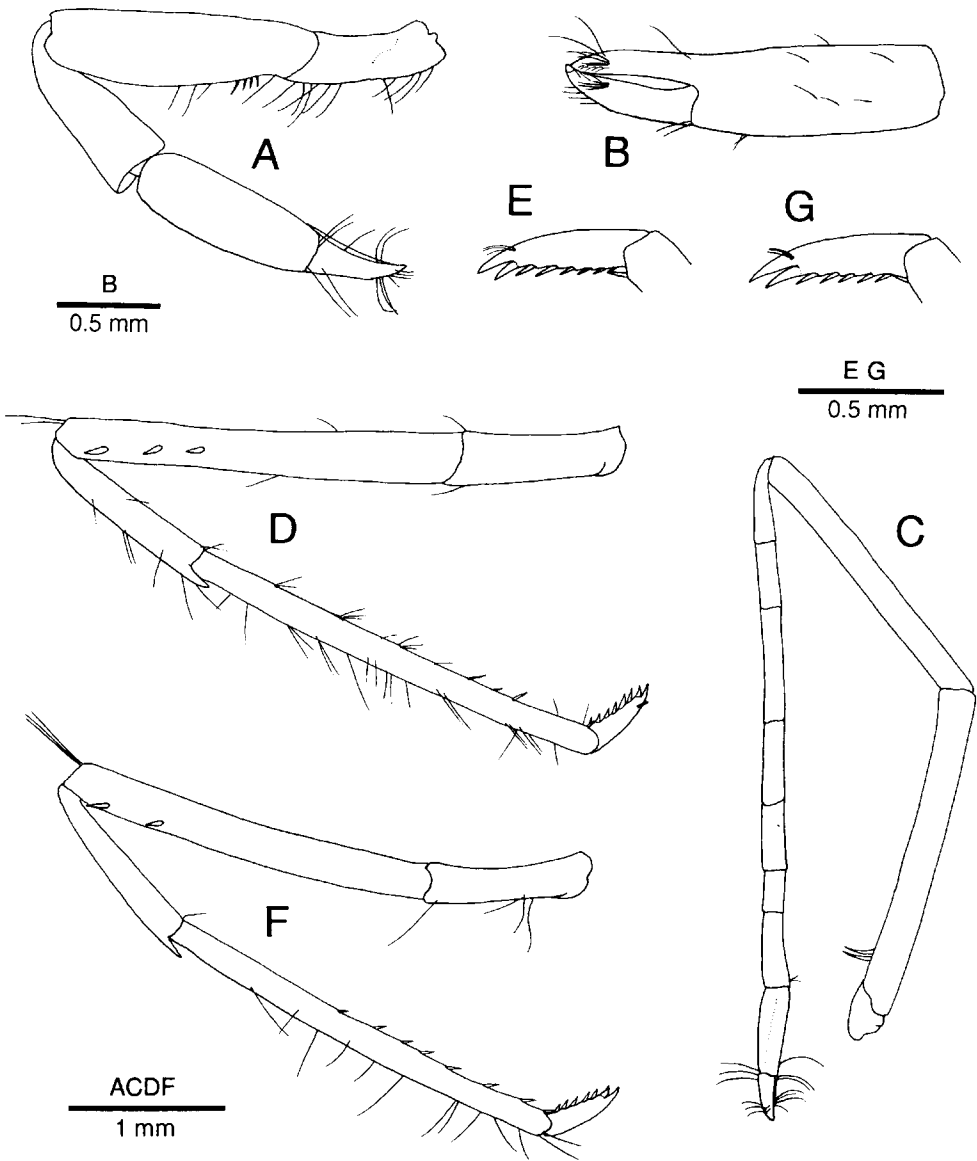


Fig. 4. *Eualus horii*, new species. *Eualus horii*, new species. Holotype female (cl 3.0 mm), Toyama Bay, Sea of Japan, NFU 530-2-2297. Left pereopods: A, first pereopod, lateral; B, chela of first pereopod, extensor; C, second pereopod, lateral; D, third pereopod, lateral; E, dactylus of third pereopod, lateral; F, fourth pereopod, lateral; G, dactylus of fourth pereopod, lateral.

terior margin of telson; exopod with lateral margin nearly straight, with acute postero-lateral tooth accompanied mesially by long movable spine.

Eggs oblong, width-length ranging from 0.50–0.60 to 0.70–0.90 mm, about 40–70 in number.

Differences in male.—Generally similar

to females. Rostrum (Fig. 5A) with less developed ventral blade. Dorsal flagellum of antennule (Fig. 5A) slightly longer than in females, 0.75 times as long as carapace; ventral flagellum (Fig. 5A) longer than in females. First pleopod with endopod (Fig. 5B) elongate subtriangular, with some setae on lateral margin; appendix interna termi-

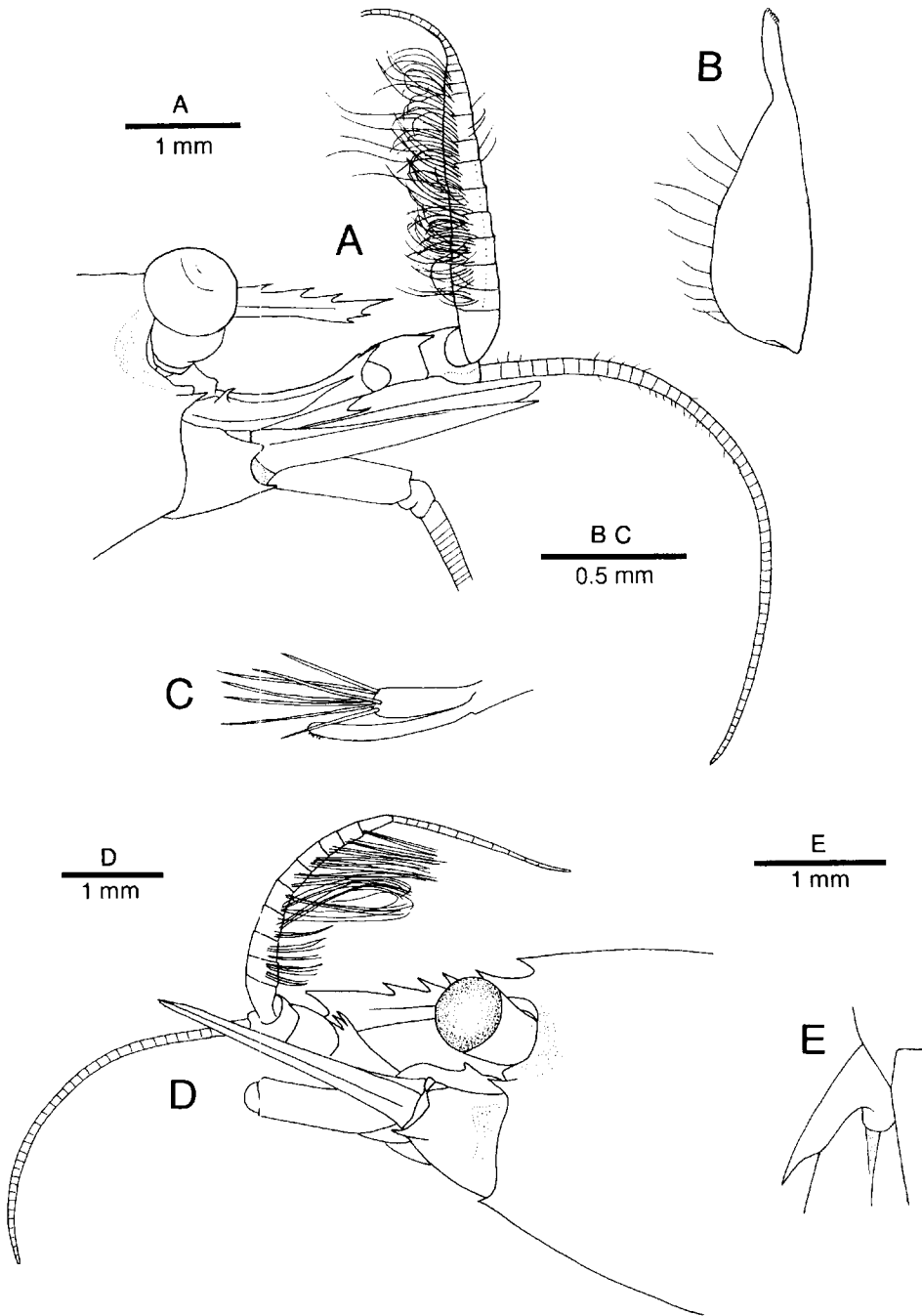


Fig. 5. A–C, *Eualus horii*, new species, paratype male (cl 3.2 mm), Toyama Bay, Sea of Japan, NFU 530–2–601; D, E, *Eualus lineatus* Wicksten & Butler, 1983, female (cl 3.5 mm), San Juan Island, Washington State, G. C. Jensen's private collection. A, anterior right part of carapace and cephalic appendages, lateral (antennal flagellum partially omitted); B, endopod of left first pleopod, ventral; C, appendix masculina and appendix interna of left second maxilliped, mesial; D, anterior left part of carapace and cephalic appendages, lateral (antennal flagellum missing); E, protopod of left uropod, dorsal (setae omitted).

nal, elongate, about half length of endopod. Second pleopod with appendix masculina (Fig. 5C) about 0.60 length of appendix interna, bearing about 7 long setae.

Color.—Unknown.

Distribution.—So far known only from Toyama Bay, Sea of Japan, at depths of 80–160 m.

Etymology.—This new species is dedicated to Mr. Naojiro Horii, Port of Nagoya Public Aquarium, who collected the specimens of this interesting shrimp. He donated many shrimps from Toyama Bay to the junior author when he worked at Uozu Aquarium. The name is considered as a noun in apposition.

Remarks.—This new species exhibits sexual dimorphism in the development of the antennular flagella: in males, both flagella are more elongate than in females (Figs. 2A, 5A).

Eualus horii belongs to a group of species having epipods on the first to third pereopods. The possession of a small but distinct subproximal spine on the lateral margin of the antennular stylocerite in the new species is remarkable, although little attention has been paid previously to the presence or absence of that spine. Within *Eualus*, the presence of the mentioned spine is so far known with certainty only in the northeastern Pacific species *E. lineatus* (see Jensen & Johnson 1999). In order to evaluate the significance of the presence of this spine in identifying the species of the genus, we examined specimens of six previously known species of *Eualus* from the northwestern Pacific (see Appendix) characterized by having epipods on the first to third pereopods (Hayashi 1993), and found that none have a subproximal spine on the antennular stylocerite.

Eualus horii is very similar to *E. lineatus*. In order to ascertain differences between the two species, the specimens of the new species were compared with three specimens of *E. lineatus* from the Washington State, USA (see Appendix). In *E. horii*, the basal segment of the antennular pedun-

cle is armed usually with only one, rather than two to four dorsodistal spines. In the holotype of *E. horii*, the right basal segment has two closely set dorsodistal spines, but this condition is attributable to an abnormality. In the three specimens of *E. lineatus*, the dorsodistal spines are separated by a distinct space. The subproximal spine on the antennular stylocerite is relatively larger and more strongly curved in *E. horii* than in *E. lineatus* (cf. Figs. 2A, 5A, D). The protopod of the uropod tapers gradually in *E. horii* (Fig. 2D), but it tapers rather abruptly in *E. lineatus* (Fig. 5E). The number of lateral spines on the merus of the third pereopod may further serve to differentiate the two species, though there is overlap. In the new species, there are two or three lateral spines on the merus of the third pereopod, while in *E. lineatus*, there are one or two (usually one) lateral spines on the mentioned segment (cf. Jensen & Johnson 1999).

Acknowledgments

We greatly appreciate Mr. Naojiro Horii, who collected these valuable specimens and donated them to National Fisheries University, on which the present paper is based. Thanks are extended to Dr. Gregory C. Jensen for making available specimens of *E. lineatus* in his private collection for comparison. We also thank two anonymous reviewers, and Dr. R. Lemaitre for comments to improve the manuscript.

Literature Cited

- Chace, F. A. Jr. 1997. The caridean shrimps (Crustacea: Decapoda) of the Albatross Philippine Expedition, 1907–191, part 7: Families Atyidae, Eugonatonotidae, Rhynchocinetidae, Bathypalaemonellidae, Processidae, and Hippolytidae.—Smithsonian Contributions to Zoology 587:1–106.
- Hayashi, K. 1993. Prawns, shrimps and lobsters from Japan (72). Family Hippolytidae—Genus *Eualus*.—Aquabiology 15:241–244, 311–314, 390–393 (in Japanese).
- Jensen, G. C., & R. C. Johnson, 1999. Reinstatement and further description of *Eualus subtilis* Car-

- vacho & Olson, and comparison with *E. lineatus* Wicksten & Butler (Crustacea: Decapoda: Hippolytidae).—Proceedings of the Biological Society of Washington 112:133–140.
- Kobjakova, Z. I. 1955.—[New species of Crustacea Decapoda from southern part of Kurile-Sakhalin region].—Trudy Zoologicheskogo Instituta Akademii Nauk SSSR 18:235–242 (in Russian).
- Krøyer, H. 1841. Udsigt over de nordiske arter af slægten *Hippolyte*.—Naturhistorisk Tidsskrift 3:570–579.
- Noël, P. 1978. *Eualus drachi* nov. sp. (Crustacea, Caridea, Hippolytidae) des côtes française de la Méditerranée.—Archives de Zoologie Expérimentale et Générale, Paris 119:21–38.
- Stimpson, W. 1860. Crustacea Macrura. Prodomus descriptionis animalium evertibratorum, quae in expeditione ad oceanum Pacificum septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit, part VIII.—[Reprint from] Proceedings of the Academy of Natural Sciences of Philadelphia 1860:91–116.
- Thallwitz, J. 1891. Decapoden-Studien, insbesondere basirt auf A. B. Meyer's Sammlungen im Ostindischen Archipel, nebst einer Aufzählung der Decapoden und Stomatopoden des Dresdener Museums.—Abhandlungen und Berichte des Königlichen Zoologischen und Anthropologisch-Ethnographischen Museums zu Dresden 1890–1891:1–55, pl. 1.
- Wicksten, M. K., & T. H. Butler. 1983. Description of *Eualus lineatus* new species, with a redescription of *Heptacarpus herdmanni* (Walker) (Caridea: Hippolytidae).—Proceedings of the Biological Society of Washington 96:1–6.
- Yokoya, Y. 1933. On the distribution of decapod Crustacea inhabiting the continental shelf around Japan, chiefly based upon the materials collected by S.S. "Soyo-maru" during the year 1923–1930.—Journal of the College of Agriculture of the Tokyo Imperial University: 12:1–236.

Appendix

List of comparative material

- Eualus butychevae* Kobjakova, 1955: Tomioka Bay, Amakusa Islands, Kyushu, 21 Apr 1964, coll. T. Kikuchi, 1 male (cl 1.8 mm), holotype of *Eualus kikuchii* Miyake & Hayashi, 1967, KMNH (formerly deposited in Zoological Laboratory, Faculty of Agriculture, Kyushu University (under ZLKU 8072).
- Eualus gracilirostris* (Stimpson, 1860): Nemuro Bay, eastern Hokkaido, 43°21.4'N, 145°29.5'E, 15 m, 15 Sept 1995, beam trawl, RV "Tansei-maru", KT95-13, stn 9, coll. T. Komai, 2 females (cl 2.6, 2.9 mm), CBM-ZC 2435.
- Eualus leptognathus* (Stimpson, 1860): Miyako Bay, Iwate Prefecture, 1–2 m, 12 Aug 1994, trap, coll. T. Komai, 3 females (cl 2.8–3.6 mm), CBM-ZC 960.
- Eualus lineatus* Wicksten & Butler, 1983: San Juan Island, Washington State, USA, 8 Jan 1980, dredged by RV Hydah, coll. G. C. Jensen, 1 male (cl 2.8 mm), 1 female (cl 3.5 mm), G. C. Jensen's private collection; Burrows Channel, Anacortes, Washington State, 12 m, 12 Jun 1997, coll. G. C. Jensen, 1 female (cl 3.2 mm), G. C. Jensen private collection.
- Eualus macilentus* (Krøyer, 1841): Baffin Bay, W of Greenland, 69°27.8'N, 58°33.4'E, 254 m, 27 Aug 1991, 1 male (cl 12.5 mm), 1 female (cl 13.4 mm), HUMZ-C 1293.
- Eualus pusiolus* (Krøyer, 1841): W of Paramushir Island, North Kurile Islands, 100–120 m, 22 July 1997, scalopp seine, coll. T. Komai & Y. M. Yakovlev, 1 female (cl 3.6 mm), CBM-ZC 4976.
- Eualus spathulirostris* (Yokoya, 1933): off Usujiri, southern Hokkaido, 60 m, 28 May 1993, dredge, coll. F. Muto, 1 ovig. female (cl 5.4 mm), CBM-ZC 80.