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A New Freshwater Species of the Genus *Jesogammarus* (Crustacea: Amphipoda: Anisogammaridae) from Northern Japan

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ABSTRACT—A new species of anisogammarid amphipod, *Jesogammarus* (*Jesogammarus*) *mikadoi* sp. nov., is described from freshwater habitats in northern Honshu, Japan. The species is distinguished from its congeners by having dorsal setae on pereonites 5–7 and pleonites 1–3.

Key words: new species, Anisogammaridae, *Jesogammarus*, taxonomy, Japan

INTRODUCTION

The genus *Jesogammarus* in the sense of Morino (1985) is known from parts of the northwestern Pacific rim, including Japan, Korea, and China (Morino, 1994). To date, 13 species in two subgenera have been recognized, occurring in cold freshwaters and brackish habitats. In 1988 one of the authors (HM) was entrusted by a colleague with the identification of a few specimens of freshwater amphipod collected from a spring stream in Akita Prefecture. They proved to belong to a previously unknown species of the subgenus *Jesogammarus* (*Jesogammarus*) characterized by elongate dorsal setae on the pleonites and some pereonites. Although no congeneric species has this characteristic, the paucity of material and relatively small body size precluded an immediate description. During the past 10 years, thanks to donations from colleagues and a collection made by the first author (KT), a significant number of specimens sharing this trait has been accumulated and they are here-with described as a new species.

MATERIALS AND METHODS

The specimens were collected by scooping with a fine-mesh hand-net, and then fixed in 70% ethanol at the site. The body length from the base of the first antenna to the base of the telson was measured to the nearest 0.1 mm after straightening out each animal. The sex of each individual was determined by the presence of oostegites in females and genital papillae in males. Appendages

were dissected and embedded in gum-chloral medium on glass slides. The type materials are deposited in the National Science Museum, Tokyo (NSMT) and the collection of the Department of Biology, Faculty of Science, Ibaraki University.

TAXONOMY

Jesogammarus (*Jesogammarus*) *mikadoi* sp. nov.

[Japanese name: Mikado-yokoebi, new]

(Figs. 1–5)

Type series

Niteko-shimizu spring (39°25'N, 140°33'E), Rokugo town, Senboku county, Akita Prefecture (type locality), collected by K. Tomikawa: holotype, NSMT–Cr. 2779 (male, 12.6 mm, 14 Nov. 2001, 7 slides and ethanol vial); paratypes, NSMT–Cr. 2780 (allotype, ovigerous female, 9.7 mm, 8 Nov. 2001, 4 slides and ethanol vial), NSMT–Cr. 2781 (male, 12.2 mm, 8 Nov. 2001, 7 slides and ethanol vial), NSMT–Cr. 2782 (male, 11.3 mm, 8 Nov. 2001, 8 slides), NSMT–Cr. 2783 (male, 11.9 mm, 14 Nov. 2001, 7 slides and ethanol vial), NSMT–Cr. 2784 (male, 11.1 mm, 8 Nov. 2001, 8 slides), NSMT–Cr. 2785 (male, 11.2 mm, 8 Nov. 2001, 8 slides), NSMT–Cr. 2786 (male, 13.8 mm, 8 Nov. 2001, 8 slides), NSMT–Cr. 2787 (male, 13.0 mm, 8 Nov. 2001, 8 slides), NSMT–Cr. 2788 (male, 13.9 mm, 14 Nov. 2001, 1 slide and ethanol vial), NSMT–Cr. 2789 (male, 13.6 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2790 (male, 12.9 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2791 (male, 10.9 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2792 (male, 11.9 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2793 (male, 11.1 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2794 (10.1 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2795 (male, 9.8

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mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2796 (female, 9.5 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2797 (ovigerous female, 9.6 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2798 (ovigerous female, 9.8 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2799 (female, 8.0 mm, 8 Nov. 2001, in ethanol), NSMT–Cr. 2800 (female, 7.1 mm, 8 Nov. 2001, in ethanol).

Edurikofujine (39°18'21"N, 141°3'1"E), Kitakami city, Iwate Prefecture, collected by K. Tomikawa: paratypes, NSMT–Cr. 2899 (male, 11.6 mm, 14 Nov. 2001, 4 slides and ethanol vial), NSMT–Cr. 2900 (male 12.6 mm, 14 Nov. 2001, 4 slides and ethanol vial), NSMT–Cr. 2901 (ovigerous female, 8.6 mm, 14 Nov. 2001, 1 slide and ethanol vial), NSMT–Cr. 2902 (male 10.3 mm, 14 Nov. 2001, 3 slides and ethanol vial), NSMT–Cr. 2903 (male 12.3 mm, 14 Nov. 2001, 1 slide and ethanol vial).

Paratypes deposited in the collection of Ibaraki University: male 11.1 mm (slide mount), female 9.1 mm (slide mount), Sennan village, Senboku county, Akita Prefecture, date unknown, collected by K. Aoya; male 12.0 mm (slide mount), female 9.0 mm (slide mount), Kakunodate town, Senboku county, Akita Prefecture, 14 Jul. 1992, collected by Sh. Komatsu.

Other material

Several specimens from the following localities were

also examined: Ooshizunuma Pond, Senhata town, Senboku county, Akita Prefecture, 24 Jun. 1998, collected by N. Yasuno; Kumahara River, Takko town, Sannohe county, Aomori Prefecture, 8 Oct. 1990, collected by K. Kuribayashi.

Diagnosis

Pereonites 5–7 each with pair of elongate posterodorsal setae marginally. Pleonites 1–3 with many elongate posterodorsal setae marginally and submarginally. Peduncular articles 4 and 5 of antenna 2 each with 2 or 3 clusters of short setae on posterior margin. Article 1 of mandibular palp unarmed. Outer ramus of uropod 3 lanceolate; inner ramus 19–23% as long as outer ramus; inner margin of outer ramus with 4–8 plumose setae; longest distal spine on proximal article of outer ramus 86–100% as long as terminal article. Telson wider than long.

Description of male (holotype, NSMT–Cr. 2779)

Body (Fig. 1 of paratype, NSMT–Cr. 2788): rather compressed.

Head as long as deep. Eye small, subreniform.

Antenna 1 (Fig. 2A): 63% of body length; length ratio of peduncular articles 1–3 = 1 : 0.75 : 0.43; peduncular article 1 lacking posterodistal spine, posterior margin with 2 setae and pair of setae; article 2, posterior margin with 2 clusters

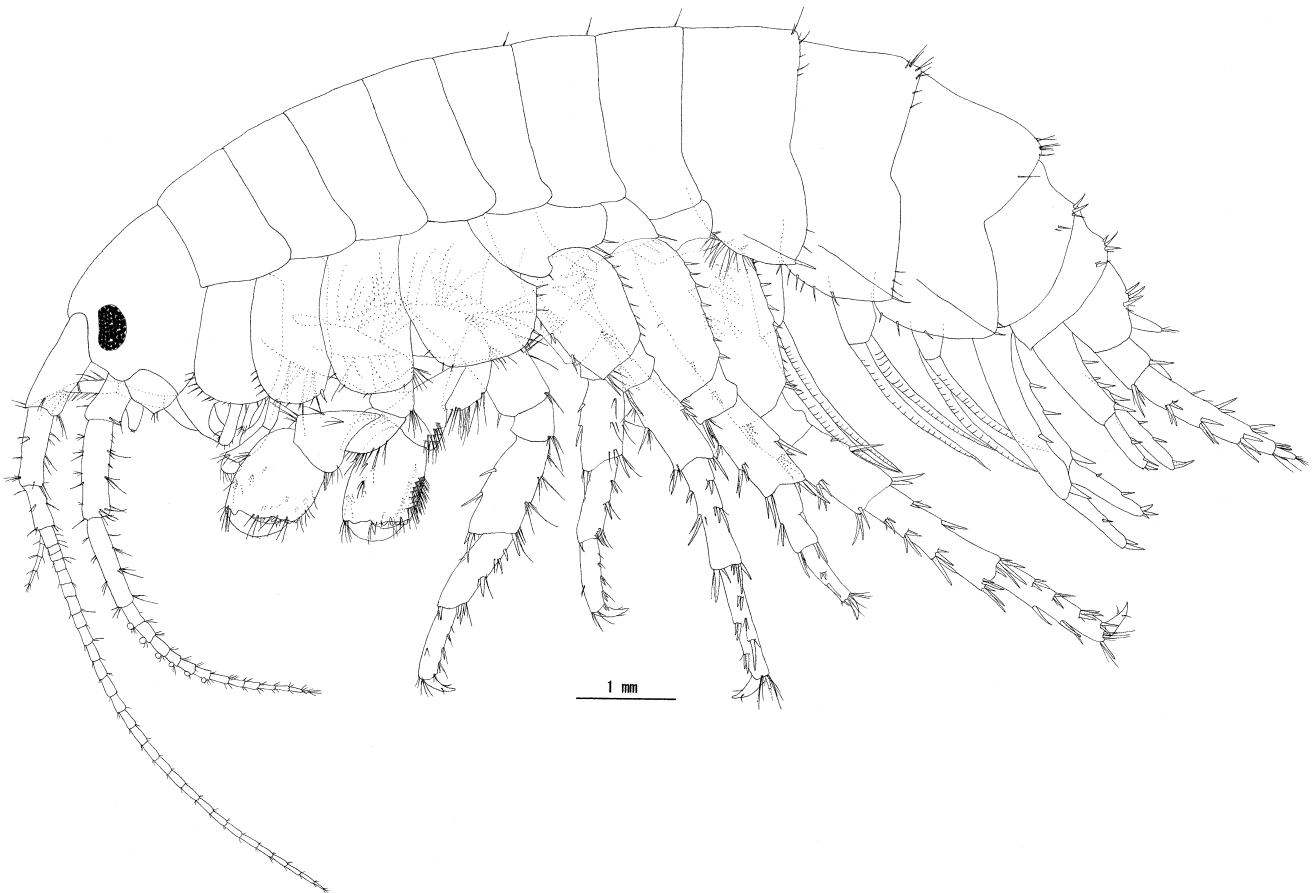


Fig. 1. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Male, paratype (NSMT–Cr. 2788).

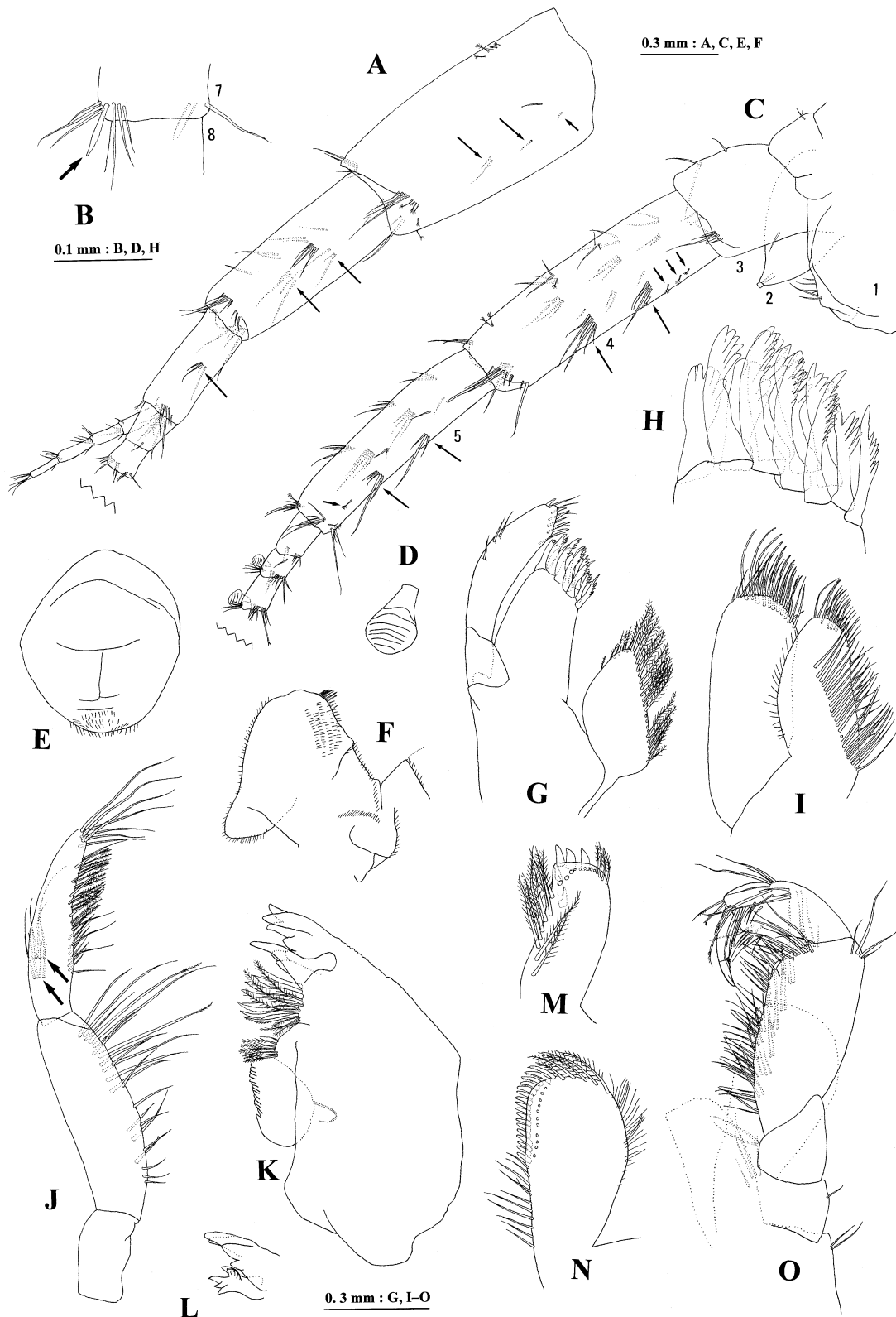


Fig. 2. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Male, holotype (NSMT–Cr. 2779). A: left antenna 1 (posteromarginal setae indicated by arrows); B: aesthetascs of flagellar article 7 of left antenna 1 (7 and 8: flagellar articles 7 and 8, aesthetascs indicated by arrow); C: left antenna 2 (1, 2, 3, 4, and 5: peduncular articles 1–5, posteromarginal setae indicated by arrows); D: calceolus on flagellar article 2 of left antenna 2; E: upper lip; F: lower lip; G: left maxilla 1; H: distal spines on outer plate of left maxilla 1; I: left maxilla 2; J: palp of left mandible (A-setae indicated by arrows); K: left mandible (with palp removed); L: incisor and lacinia mobilis of right mandible; M: inner plate of right maxilliped; N: outer plate of right maxilliped; O: palp of right maxilliped.

of setae; article 3, posterior margin with pair of setae; flagellum 27-articulated; articles 2–22 of flagellum with aesthetascs (Fig. 2B); accessory flagellum 5-articulated.

Antenna 2 (Fig. 2C): 69% as long as antenna 1; length ratio of peduncular articles 4–5 = 1 : 0.87; peduncular article 4, posterior margin with 2 clusters of setae and 3 plumose setae; article 5, posterior margin with 2 clusters of setae and plumose seta; flagellum 13-articulated, articles 2–9 with cup-calceoli (Fig. 2D).

Upper lip (Fig. 2E): convex, with minute setae.

Mandible (Fig. 2J–L): left and right incisors 5- and 4-dentate, respectively; left lacinia mobilis 4-dentate, right lacinia mobilis 2-edged; article 1 of palp unarmed; article 2 with 9 marginal and 14 submarginal setae; article 3 90% as long as article 2, with 2 clusters of A-setae.

Lower lip (Fig. 2F): inner lobes laterally fused.

Left maxilla 1 (Fig. 2G, H): article 2 of palp with 3 setae on outer margin, and with 5 spines and 6 setae apically; outer plate with 11 serrated spines apically; inner plate with 21 plumose setae medially.

Right maxilla 1: article 2 of palp with 3 setae on outer margin, and with 7 spines and 6 setae apically; outer plate with 11 serrated spines apically; inner plate with 22 plumose setae medially.

Left maxilla 2 (Fig. 2I): inner plate with 23 facial setae.

Maxilliped (Fig. 2M–O): inner plate 88% as long as outer plate; outer plate 83% as long as article 2 of palp, with a few of its medial marginal spines pectinate; inner margin of palp article 2 with numerous setae.

Gnathopod 1 (Fig. 3A): coxa weakly expanded distally, lower and anterodistal margins setose, posterodistal corner with stiff seta, posteroproximal margin setose; basis, posterior and anterior margins setose; propodus, palmar margin (Fig. 3C) lined with 6 inner and 11 outer striated peg-spines, anterior margin with 3 setal clusters; dactylus (Fig. 3B) with posterior accessory blade longer than nail, accessory blade basally elevated.

Gnathopod 2 (Fig. 3D): coxa (Fig. 3E), lower and anterodistal margins setose, posteroproximal margin setose, posterodistal corner with stiff seta; basis, posterior and anterior margins setose; propodus more slender than that of gnathopod 1, palmar margin of propodus (Fig. 3G) with 7 inner and 6 outer striated peg-spines, and with 2 pectinate stiff setae inner distally; dactylus (Fig. 3F) with posterior accessory blade longer than nail, accessory blade basally elevated.

Pereopod 3: coxa (Fig. 4A), anterodistal margin with 3 setae, posterodistal margin with 2 stiff setae and 2 setae, posteroproximal margin setose; basis, posterior and anterior margins setose; length ratio of merus–propodus = 1 : 1 : 0.8;

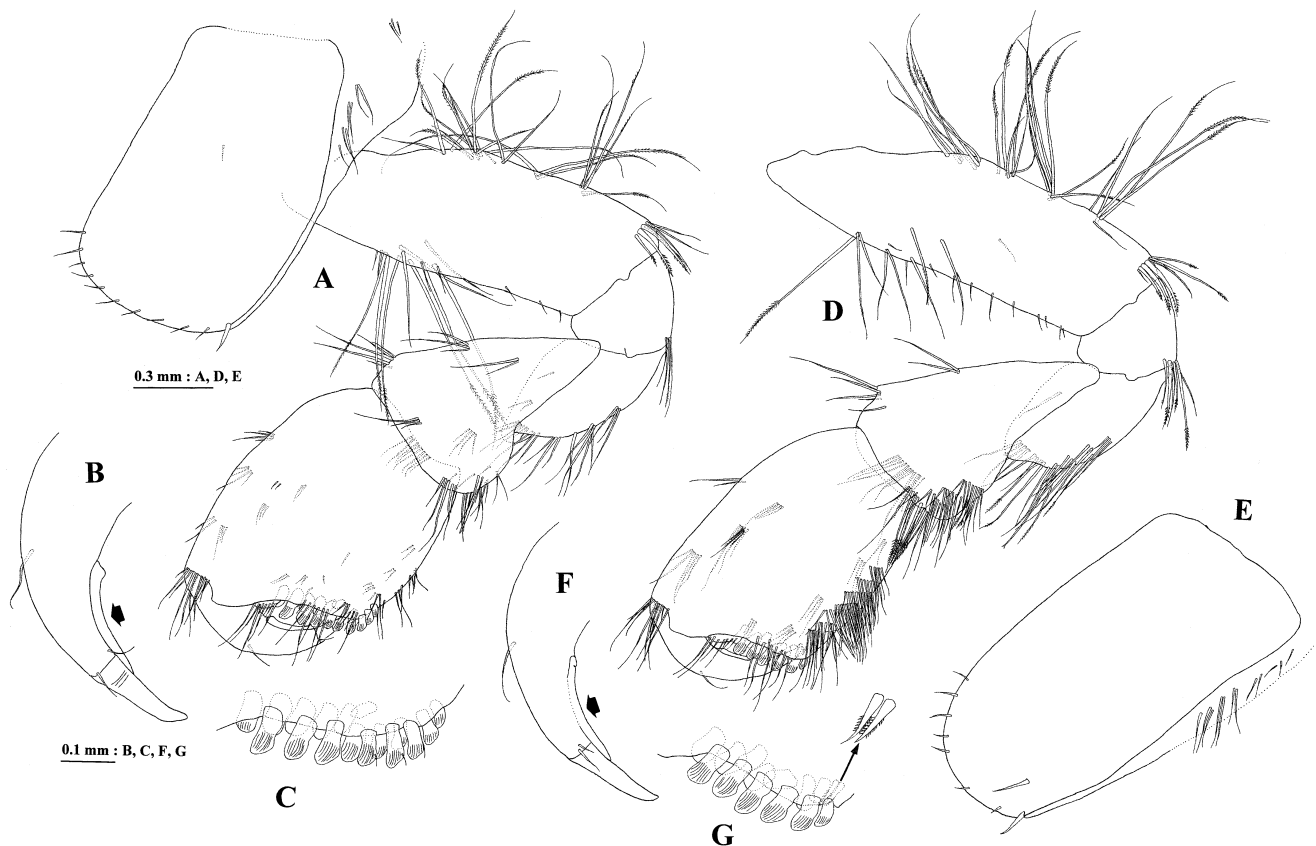


Fig. 3. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Male, holotype (NSMT–Cr. 2779). A: gnathopod 1; B: dactylus of gnathopod 1 (accessory blade indicated by arrow); C: palm of gnathopod 1 (setae omitted); D: gnathopod 2 (with coxa removed); E: coxa 2; F: dactylus of gnathopod 2 (accessory blade indicated by arrow); G: palm of gnathopod 2 (setae omitted).

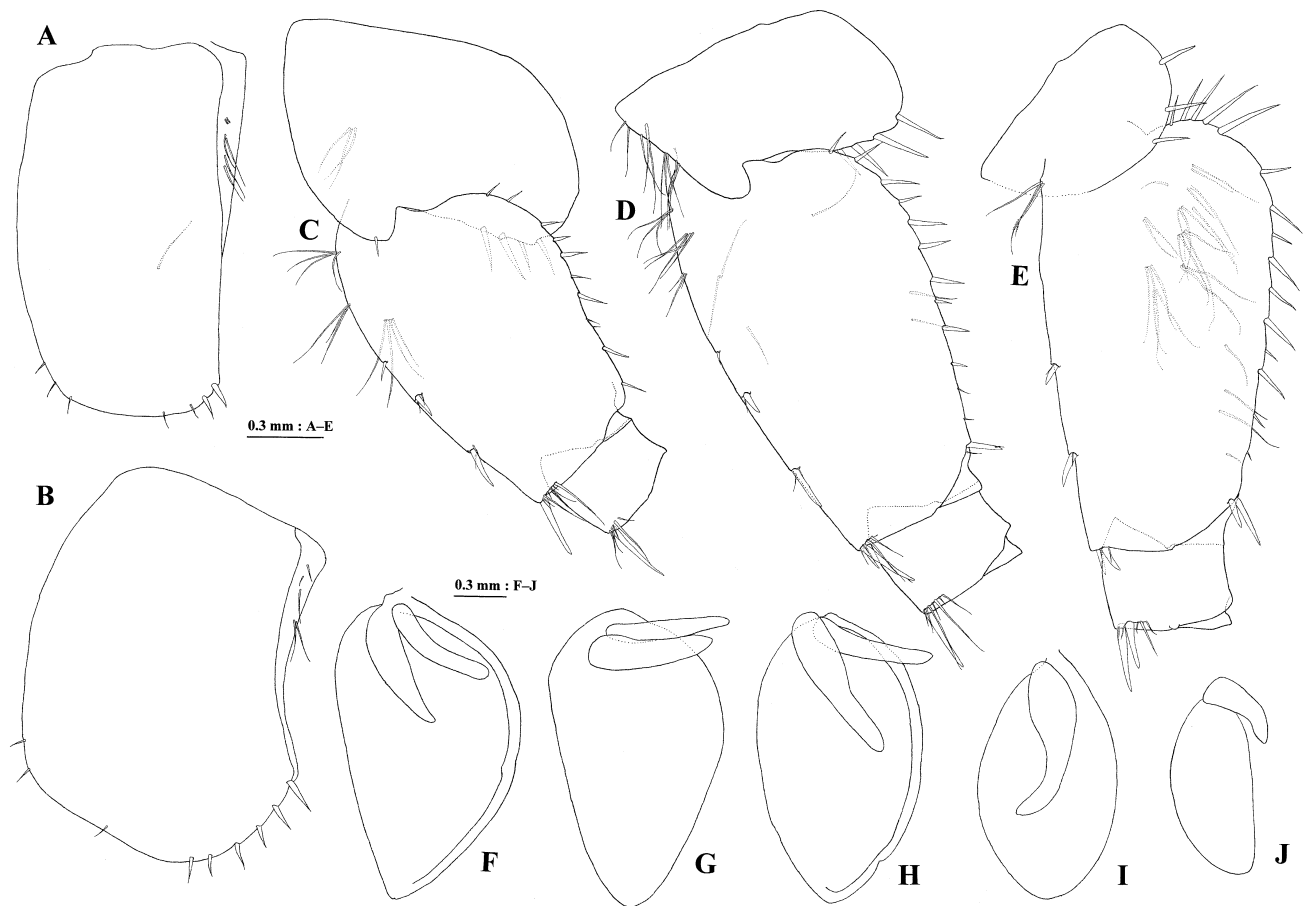


Fig. 4. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Male, holotype (NSMT–Cr. 2779). A and B: coxae 3 and 4; C–E: coxa–ischium of pereopods 5, 6, and 7; F–J: coxal gills of pereopods 3, 4, 5, 6, and 7.

merus and carpus with anterodistal spines.

Pereopod 4: coxa (Fig. 4B) with wide posterior concavity, posterior margin almost vertical, anterodistal margin with 2 setae, lower margin with seta, posterodistal margin with 6 stiff setae, posteroproximal margin setose; basis, posterior and anterior margins setose; length ratio of merus–propodus = 1 : 1 : 0.9; merus and carpus with anterodistal spines.

Pereopod 5 (Fig. 4C): coxa with 1 distal seta on anterior lobe, lower margin of posterior lobe with 4 stiff setae; basis with clusters of setae on anteroproximal margin, anterodistal margin spinose, posterior margin with stiff setae and short setae, and inner face with cluster of setae anteriorly; margins of merus–propodus spinose and weakly setose.

Pereopod 6 (Fig. 4D): coxa with no distal seta on anterior lobe, lower margin of posterior lobe with 4 stiff setae; basis with anterior margin proximally setose, distally spinose, posterior margin with stiff setae and short setae, and inner face with cluster of setae and 4 widely scattered setae; margins of merus–propodus spinose and weakly setose.

Pereopod 7 (Fig. 4E): coxa with 3 stiff setae on posterior margin; basis with stiff setae and short setae on posterior margin, anterior margin spinose distally with cluster of setae proximally, inner surface with 8 clusters of setae and 6 setae.

Coxal gills of pereopods 3–4 (Fig. 4F–G) subequal to bases of pereopods 3 and 4 in length, anterior accessory lobe of each gill subequal to posterior one, and subequal to half length of main lobe, respectively. Gill of pereopod 5 (Fig. 4H) longer than basis. Gill of pereopod 6 (Fig. 4I) shorter than basis; accessory lobe longer than half length of main lobe. Gill of pereopod 7 (Fig. 4J) longer than half length of basis; accessory lobe subequal to half length of main lobe. Gill of gnathopod 2 missing due to manipulation.

Pereonites 5–7: posterodorsal margins (Fig. 5A–C) each with pair of long setae.

Pleonites 1–3: posterodorsal margins (Fig. 5D–F) with 7 marginal setae, 11 marginal and 2 submarginal setae, and 9 marginal and 5 submarginal setae, respectively.

Epimeral plates (Fig. 5G–I) each posterior margin with 2–4 setae and posterodistal corner with stiff seta. Plates 1–3 not pointed posterodistally. Plate 1 (Fig. 5G): anterior margin setose. Plate 2 (Fig. 5H): anterior margin with setae, ventral margin with 2 marginal and 2 submarginal stiff setae. Plate 3 (Fig. 5I): anterior and ventral margins with 4 stiff setae.

Pleopods: peduncles, outer margin setose, inner margin with a few setae, front and back faces with setae; coupling spines paired; inner basal margin of inner ramus of

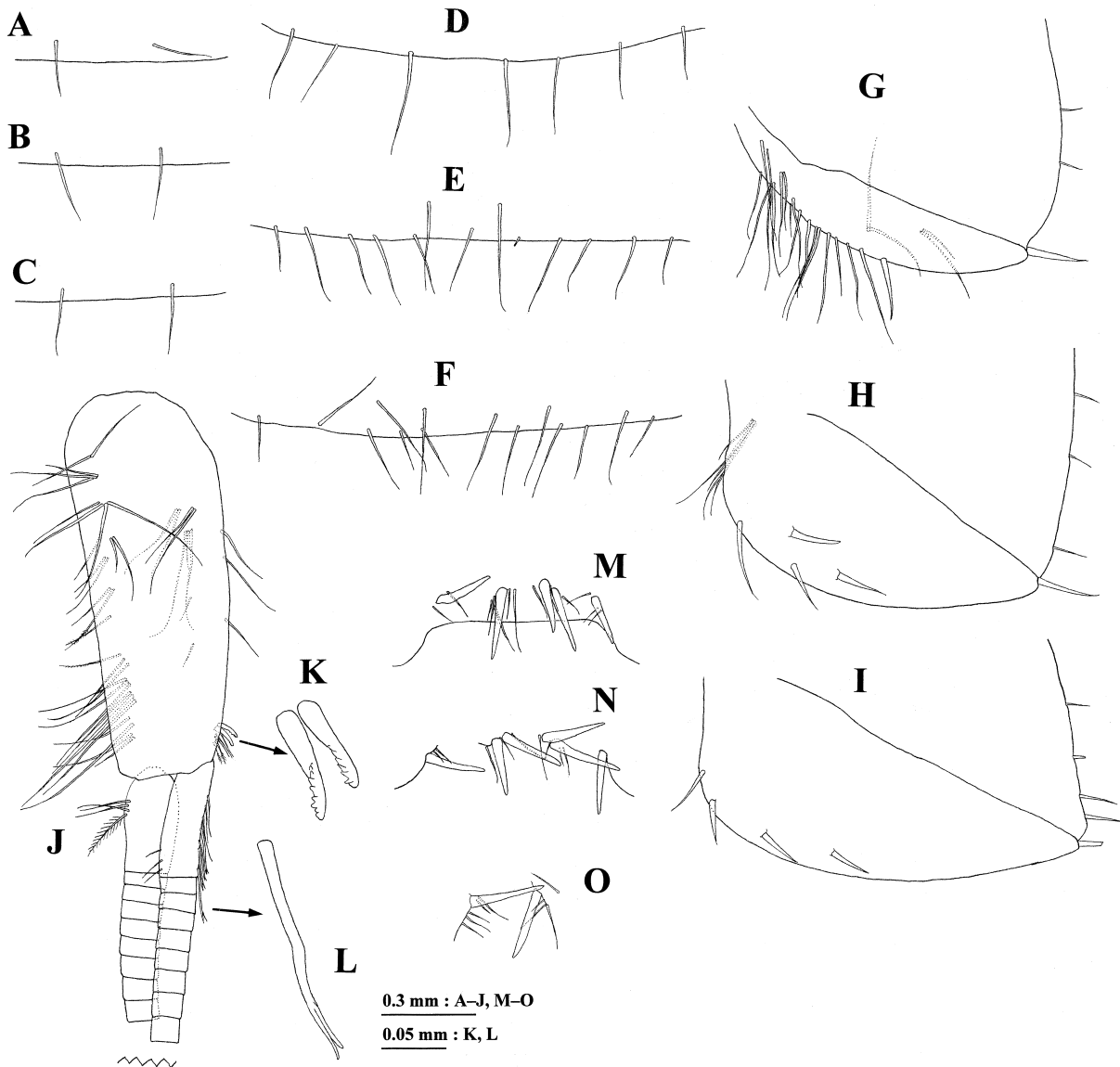


Fig. 5. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Male, holotype (NSMT-Cr. 2779). A–C: dorsal margins of pereonites 5, 6, and 7; D–F: dorsal margins of pleonites 1, 2, and 3; G–I: epimeral plate 1, 2, and 3; J: left pleopod 1 (plumose setae on rami omitted); K: coupling spines of left pleopod 1; L: clothes-pin spine of left pleopod 1; M–O: dorsal margins of urosomites 1, 2, and 3.

pleopods 1, 2, and 3 with 4, 3, and 3 clothes-pin spines, respectively. Pleopod 1 (Fig. 5J–L): outer ramus 23-, inner ramus 18-articulated. Pleopod 2: outer ramus 22-, inner ramus 18-articulated. Pleopod 3: outer ramus 21-, inner ramus 16-articulated.

Urosomites 1 and 2 (Fig. 5M, N) each bearing pair of dorsomarginal lateral spines and pair of medial spine-clusters with interspersed setae. Urosomite 3 (Fig. 5O) with pair of dorsomarginal lateral spines with interspersed setae.

Uropod 1 (Fig. 6A): outer ramus 61% and inner ramus 67% as long as peduncle, latter with marginal spines and basofacial spine; outer ramus with 2 outer and 1 inner marginal spines; inner ramus with 2 outer and 2 inner marginal spines. Uropod 2 (Fig. 6B): outer ramus 64% and inner ramus 89% as long as peduncle, latter with marginal spines;

outer ramus with outer marginal spine; inner ramus with 1 outer and 2 inner marginal spines. Uropod 3 (Fig. 6C, E): outer margin of outer ramus with 4 pairs of spines and a few simple setae, inner margin with cluster of spines, pair of spines, single spine, and 7 plumose setae; longest distal spine on proximal article of outer ramus as long as terminal article; terminal article distinct, 17% as long as proximal article; inner ramus 19% as long as outer ramus, with apical and lateral simple setae, distolateral plumose seta, and lateral spine.

Telson (Fig. 6D): length 84% of basal maximum width, with apical and distolateral spines and setae, medially cleft 72% of way to base.

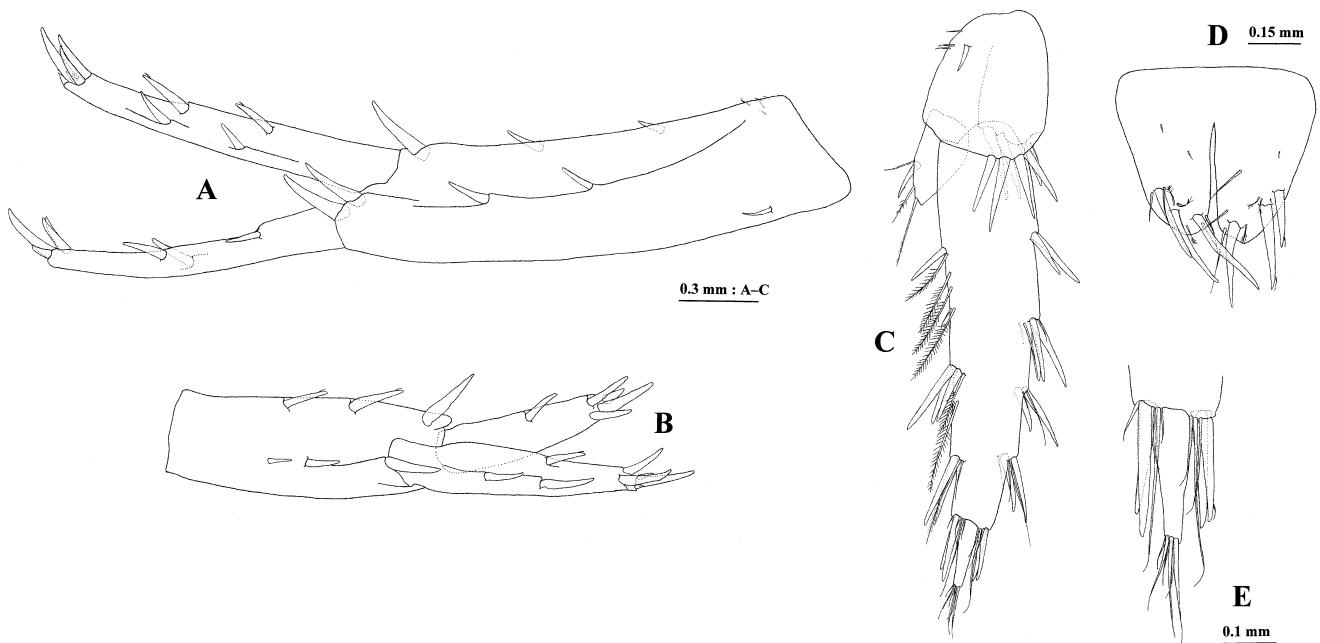


Fig. 6. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Male, holotype (NSMT–Cr. 2779). A: right uropod 1; B: right uropod 2; C: left uropod 3; D: telson (dorsal view); E: distal part of outer ramus of left uropod 3.

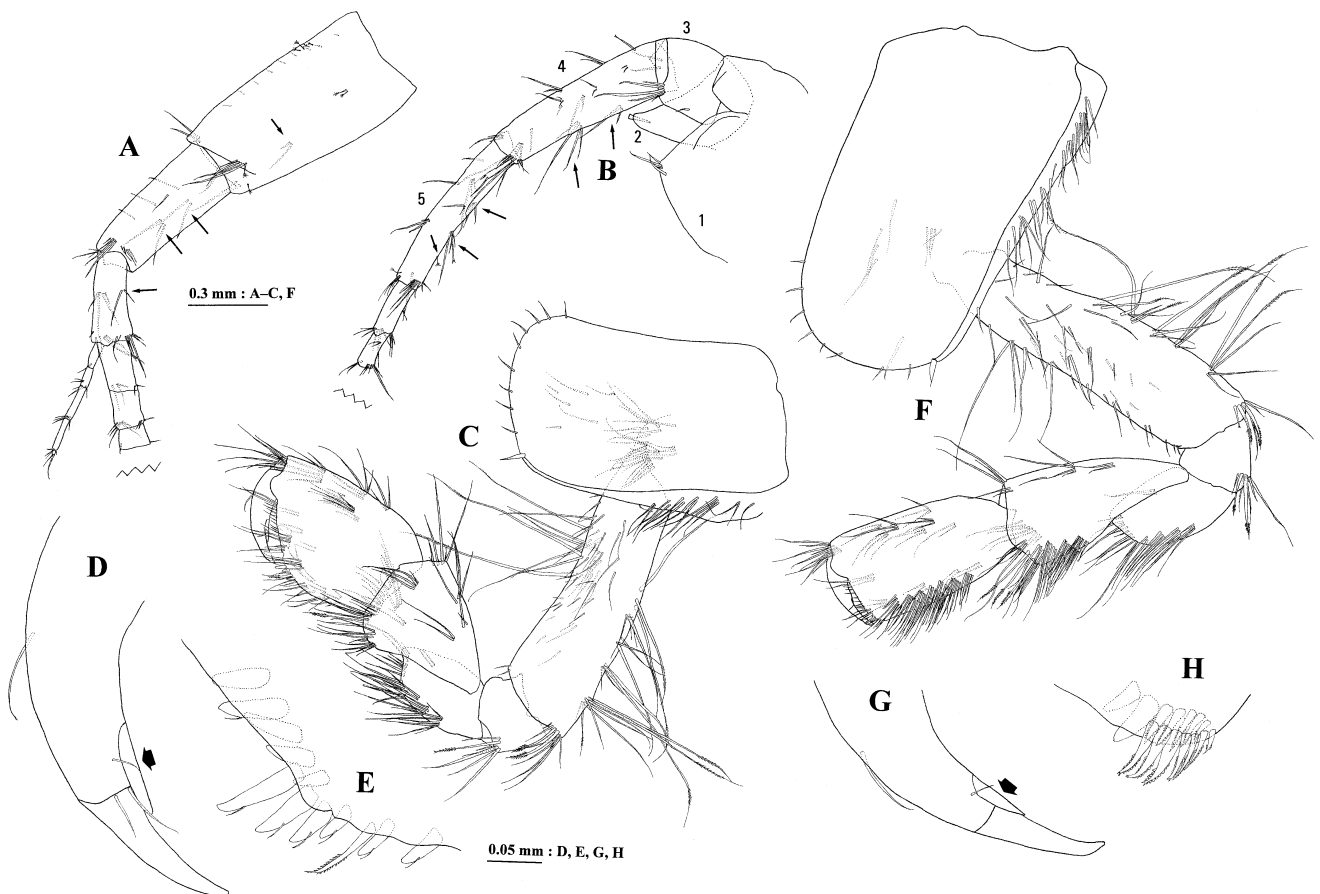


Fig. 7. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Female, allotype (NSMT–Cr. 2780). A: left antenna 1 (posteromarginal setae indicated by arrows); B: left antenna 2 (1, 2, 3, 4, and 5: peduncular articles 1–5, posteromarginal setae indicated by arrows); C: gnathopod 1; D: dactylus of gnathopod 1 (accessory blade indicated by arrow); E: palm of gnathopod 1 (setae omitted); F: gnathopod 2; G: dactylus of gnathopod 2 (accessory blade indicated by arrow); H: palm of gnathopod 2 (setae omitted).

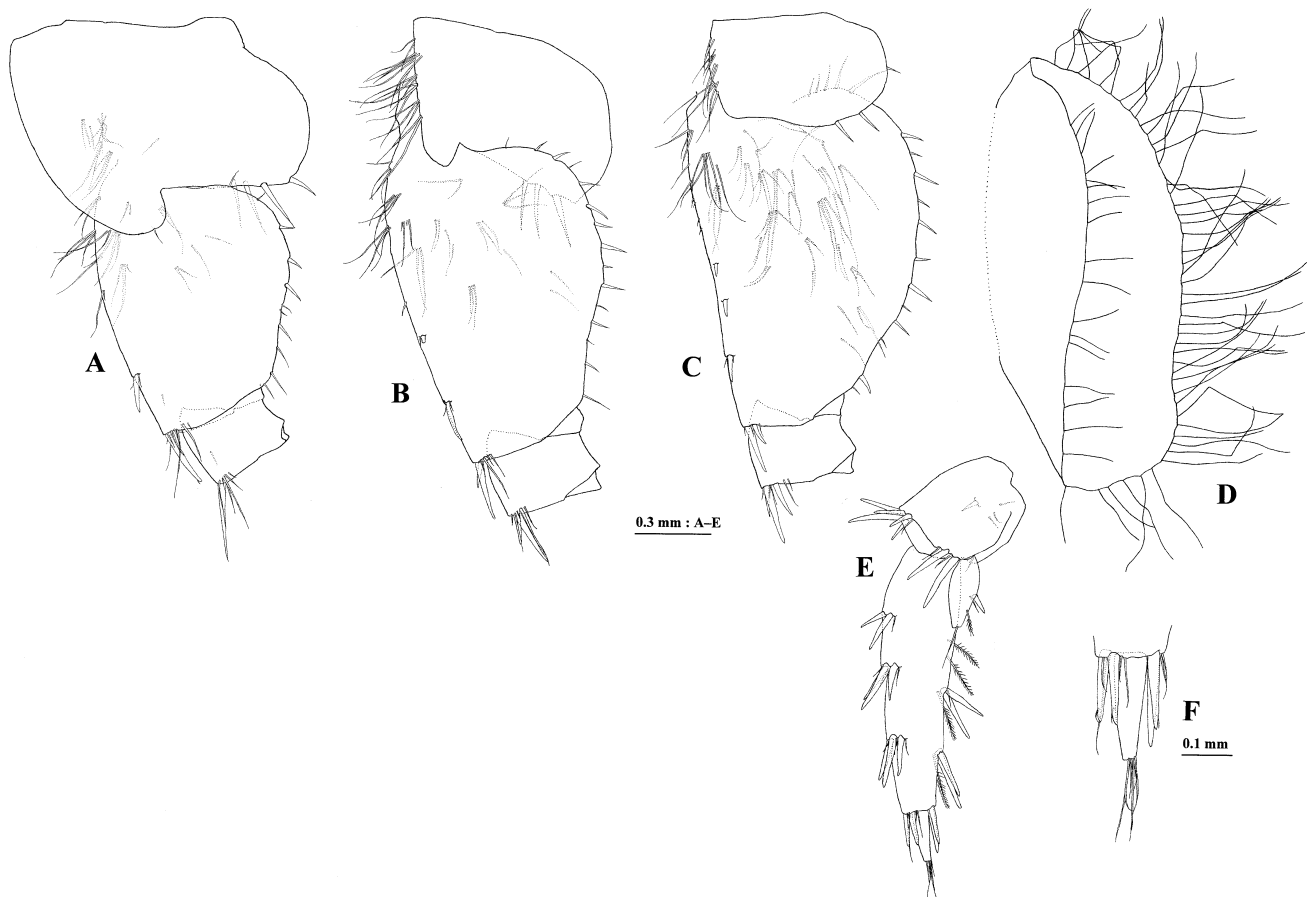


Fig. 8. *Jesogammarus (Jesogammarus) mikadoi* sp. nov. Rokugo, Akita Pref., Japan. Female, allotype (NSMT–Cr. 2780). A–C: coxa–ischium of pereopods 5, 6, and 7; D: oostegite of gnathopod 2 (folded); E: left uropod 3; F: distal part of outer ramus of left uropod 3.

Female (allotype, NSMT–Cr. 2780)

Antenna 1 (Fig. 7A): length ratio of peduncular articles 1–3 = 1 : 0.70 : 0.45; peduncular article 1 lacking posterodistal spine, posterior margin with pair of setae; article 2, posterior margin with pair of setae and cluster of setae; article 3, posterior margin with pair of setae; flagellum 26-articulated; articles 3–21 of flagellum with aesthetascs; accessory flagellum 5-articulated.

Antenna 2 (Fig. 7B): length ratio of peduncular articles 4–5 = 1 : 0.92; peduncular article 4, posterior margin with pair of setae and cluster of setae; article 5, posterior margin with 2 clusters of setae and plumose seta; flagellum 13-articulated.

Gnathopod 1 (Fig. 7C): coxa, posteroproximal margin setose; basis with numerous facial setae; palmar margin of propodus (Fig. 7E), inner distal part with 11 simple spines and pectinate stiff seta; dactylus (Fig. 7D) with posterior accessory blade shorter than nail, accessory blade not elevated basally.

Gnathopod 2 (Fig. 7F): coxa, posteroproximal margin setose; basis with numerous facial setae; carpus and propodus slender, propodus parallel-sided, its palmar margin (Fig. 7H) with 7 pectinate stiff setae on outer distal part, and 2 simple spines and 5 pectinate stiff setae on inner distal part;

dactylus (Fig. 7G) with posterior accessory blade shorter than nail, accessory blade not elevated basally.

Oostegites on gnathopod 2 to pereopod 5; oostegite of gnathopod 2 (Fig. 8D) large and broad, fringed with numerous setae.

Bases of pereopods 5–7 (Fig. 8A–C) more expanded posteroproximally than those of male.

Uropod 3 (Fig. 8E, F): outer margin of outer ramus with pair of spines, 2 clusters of spines, and a few simple setae; inner margin with 2 pairs of spines, simple seta, and 4 plumose setae; longest distal spine on proximal article of outer ramus 86% as long as terminal article; terminal article of outer ramus 19% as long as proximal article; inner ramus 23% as long as outer ramus.

Egg number: 29.

Variation

Some specimens from Kitakami (Iwate Pref.) and Kakunodate and Senhata (Akita Pref.) bear posterodistal spine on peduncular article 1 of antenna 1. Specimens from Kakunodate exhibit a more setose (26–27 setae) inner plate on maxilla 1, a relatively shorter inner ramus of uropod 3 (17% as long as outer ramus in male), and a longer telson (93–95% as long as wide).

Remarks

Jesogammarus (Jesogammarus) mikadoi sp. nov. is readily distinguishable from its congeners by the elongate dorsal setae not only on pleonites 1–3 but also on pereonites 5–7 (Morino, 1984, 1985, 1986, 1993; Lee and Seo, 1990, 1992; Tomikawa and Morino, 2003). The present new species is similar to *J. (J.) paucisetulosus* Morino, 1984 and *J. (J.) fujinoi* Tomikawa et Morino, 2003 in having pleonites that lack spines. Further distinguishing characters from *J. (J.) paucisetulosus* and *J. (J.) fujinoi* are as follows: from *J. (J.) paucisetulosus* (the character states of which are shown in parentheses), only a few short posteromarginal setal clusters present on each peduncular article of antennae 1 and 2 (many long setal clusters: more than 4) and 4–8 plumose setae on the outer ramus of uropod 3 of the male (fewer than 3); from *J. (J.) fujinoi* (the character states of which are shown in parentheses), absence of spines on the proximal part of article 2 of the mandibular palp (presence), separated medial spine clusters of urosomites 1 and 2 (closely set), presence of 1 marginal spine on the outer ramus of uropod 2 (no spine), longest distal spine on proximal article of outer ramus of uropod 3 longer than 80% of terminal article (shorter than 60%), telson with distolateral spines (lacking spines), and distal setae of telson shorter than distal spines (longer).

Etymology

The species name is derived from the Japanese word “Mikado”, which means “the Emperor”. In 1881, the Emperor Meiji visited Akita Prefecture and appreciated the waters of the type locality.

Distribution

The new species has been collected from springs and spring brooklets, or ponds with springs, in Akita, Aomori, and Iwate Prefectures, northern Japan.

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REFERENCES

- Lee KS, Seo IS (1990) One new species of freshwater *Jesogammarus* (Crustacea, Amphipoda, Anisogammaridae) from South Korea. Korean J Syst Zool 6: 251–260
- Lee KS, Seo IS (1992) One new species of freshwater *Jesogammarus* (Crustacea, Amphipoda, Anisogammaridae) from South Korea. Korean J Zool 35: 344–349
- Morino H (1984) On a new freshwater species of Anisogammaridae (Gammaroidea: Amphipoda) from central Japan. Publ Itako Hydrobiol Stn 1: 17–23
- Morino H (1985) Revisional studies on *Jesogammarus–Annanogammarus* group (Amphipoda: Gammaroidea) with descriptions of four new species from Japan. Publ Itako Hydrobiol Stn 2: 9–55
- Morino H (1986) A new species of the subgenus *Annanogammarus* (Amphipoda: Anisogammaridae) from Lake Suwa, Japan. Publ Itako Hydrobiol Stn 3: 1–11
- Morino H (1993) A new species of the genus *Jesogammarus* (Amphipoda: Anisogammaridae) from brackish waters of Japan. Publ Itako Hydrobiol Stn 6: 9–16
- Morino H (1994) The phylogeny of *Jesogammarus* species (Amphipoda: Anisogammaridae) and life history features of two species endemic to Lake Biwa, Japan. Arch Hydrobiol Beih Ergebn Limnol 44: 257–266
- Tomikawa K, Morino H (2003) Two new freshwater species of the genus *Jesogammarus* (Crustacea: Amphipoda: Anisogammaridae) from northern Japan. Zool Sci 20: 229–241

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