

Munnidae from Japan (Crustacea: Isopoda: Asellota)

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Abstract Six species of *Munna* including two new to science and a species of *Uromunna* in Munnidae (Isopoda, Asellota) are reported from Japanese waters. *Munna bispina* sp. nov. is distinctive in having a pair of marked long robust sensory setae on frontal margin of the head, a long robust sensory seta on anterior margin of the eyestalk, and very long and slender antenna 2. *Munna japonica* sp. nov. lacks conspicuous dorsal and lateral setae both on pereon and pleon as in *M. limicola* G. O. Sars, 1866, *M. subneglecta* Gurjanova, 1936, *M. tenuipes* Kussakin, 1962, *M. chilensis* Menzies, 1962, *M. lundae* Menzies, 1962 and *M. hovelli* Poore, 1984, but distinguished from them in having the character combination of the pereopod 1 without sexual dimorphism, the pleopod 1 with a pair of distolaterally directed, long projections, and big pear-shaped pleotelson. *Munna avatshensis* Gurjanova, 1936, previously reported from the east coasts of Russia, were recorded from Japan for the first time. *Munna stephensi* Gurjanova, 1933, *M. tenuipes* Kussakin, 1962 and *Uromunna serricauda* Müller, 1992 were redescribed in detail based on the Japanese materials newly collected.

Key words: new species, *Munna*, *Uromunna*, Munnidae, Asellota, Isopoda, Japan

Introduction

Munnidae is a large family in the suborder Asellota including 99 species in six genera known from marine, brackish and fresh water habitats (Wilson, 1980; Poore, 1984; Müller, 1990). Among them, 23 species belonging to two genera are known from the northwestern Pacific: 22 species of *Munna* from Far East Russia (Gurjanova, 1933, 1936; Kussakin, 1962, 1972, 1974; Kussakin and Mezhev, 1979) and *Uromunna serricauda* Müller, 1992 from Malaysia (Müller, 1992). From Japanese waters, some munnids were reported being identified at generic or family levels (Kikuchi, 1968; Gamô *et al.*, 1980; Nunomura, 1987, 1995). Only three taxa identified at species level were recently recorded as new to Japan from Otsuchi Bay, Iwate Prefecture (Shimomura *et al.*, 2001). These are *Munna stephensi* Gurjanova, 1933, *M. tenuipes* Kussakin, 1962 and *Uromunna serricauda* Müller, 1992. Under such circumstances, this paper describes two new species and redescribes four species belonging to the two genera based on the specimens collected along the Japanese coasts as a result of our comprehensive taxonomic study of Japanese munnids.

Materials and Methods

All the materials were collected at forty-nine sites on the coasts of Japan, from Hokkaido, the northernmost locality, to Okinawa, the southernmost one. Intertidal seaweeds, seagrasses and stones were collected by hands. From the subtidal zones, bottom sediments including shells, stones and sands were obtained by snorkeling and SCUBA or by a Smith-McIntyre grab, a sledge net, a plankton net and a dredge. The specimens retained were fixed with 5% neutralized formalin solution diluted with seawater and preserved in 70% ethanol. Each individual was dissected and prepared for observation using a light microscope equipped with Nomarski differential interference contrast (Shimomura and Mawatari, 1999). Table 1 shows abbreviations of sampling data used for the designation of specimens in "Material Examined". Total length as indicated in "Material Examined" was measured from the tip of the head to the end of the pleotelson.

Table 1. Abbreviations of sampling data used for the designation of specimens in the text.

Abbreviation	Locality	Depth	Gear*	Date**	Collector
ABA	Abashiri, Hokkaido	0.3 m		17 Apr 1998	MS
RUM	Rumoi, Hokkaido	0.5 m		12 Jun 1998	MS
NOS	Nossapu-misaki, Nemuro, Hokkaido	0.5 m		12 Jul 1998	MS
OSH1	Oshoro, Hokkaido	0.5 m		20 Aug 1997	MS
OSH2	Oshoro, Hokkaido	0.5 m		23 Aug 1997	MS
OSH3	Oshoro, Hokkaido	0.5 m		25 Feb 1998	MS
OSH4	Oshoro, Hokkaido	2 m	snorkeling	21 Jul 1998	MS
OSH5	Oshoro, Hokkaido	0.5 m		29 Jul 1998	G. Takaku
IWA	Iwanai, Hokkaido	0.3 m		22 Nov 1997	MS
CHI1	Chikko, Otaru, Hokkaido	0.5 m		3 Jun 1997	T. Kato
CHI2	Chikko, Otaru, Hokkaido	0.5 m		24 Oct 1997	MS
CHI3	Chikko, Otaru, Hokkaido	0.5 m		27 May 1998	MS
LAA1	Lake Akkeshi, Hokkaido	4 m	dredge	7 Nov 1997	MS
LAA2	Lake Akkeshi, Hokkaido	4 m	dredge	15 Apr 1998	MS
LAA3	Lake Akkeshi, Hokkaido	4 m	dredge	9 Jul 1998	MS
NAA1	Nakanose, Akkeshi, Hokkaido	7 m	dredge	3 Jul 1997	MS
NAA2	Nakanose, Akkeshi, Hokkaido	7 m	dredge	15 Apr 1998	MS
NAA3	Nakanose, Akkeshi, Hokkaido	7 m	dredge	8 Jul 1998	MS
NAA4	Nakanose, Akkeshi, Hokkaido	7 m	dredge	14 Jun 1999	T. Kato
AIA1	Aininkappu, Akkeshi, Hokkaido	0.5 m		16 Apr 1998	MS
AIA2	Aininkappu, Akkeshi, Hokkaido	0.5 m		16 Jun 1999	T. Kato
DAA	Daikoku Island, Akkeshi, Hokkaido	0.5 m		11 Jul 1998	MS
MUR1	Muroran, Hokkaido	0.3 m		28 Apr 1998	MS
MUR2	Muroran, Hokkaido	0.5 m		28 Apr 1998	MS
ERM	Erimo, Hokkaido	0.5 m		25 May 1997	Y. Takashima
TAM	Tamagawa, Noda, Iwate	0.3 m		24 May 1998	MS
OTS1	Otsuchi, Iwate	45.3 m	SM	25 May 1998	MS
OTS2	Otsuchi, Iwate	46.5 m	SM	25 May 1998	MS
OTS3	Otsuchi, Iwate	45 m	SM	10 Aug 1998	MS
OAR	Oarai, Ibaraki	0.5 m		8 Dec 1998	MS
KOM	Kominato, Chiba	0.5 m		23 Jun 1997	T. Kato
MIS	Misaki, Miura, Kanagawa	1 m	snorkeling	25 May 2000	T. Iseto
MIH	Miho, Shimizu, Shizuoka	0.5 m	plankton net	26 Jun 1988	N. Saito
ATA1	Atami, Shizuoka	0.5 m		17 Oct 1997	MS
ATA2	Atami, Shizuoka	0.5 m		5 Apr 1998	MS
SHM	Shimoda, Shizuoka	0.5 m		6 Apr 1998	MS
TAN1	Tanigawa, Misaki, Osaka	7 m	SCUBA	9 Jul 1988	H. Ariyama
TAN2	Tanigawa, Misaki, Osaka	2 m	snorkeling	9 Apr 1996	H. Ariyama
USH	Ushimado, Okayama	0.5 m		15 Oct 1997	MS
MUK1	Mukaishima, Hiroshima	10 m	SM	20 Jun 1997	MS
MUK2	Mukaishima, Hiroshima	0.5 m		21 Jun 1997	MS
MUK3	Mukaishima, Hiroshima	0.5 m		22 Jun 1997	MS
MUK4	Mukaishima, Hiroshima	0.5 m		23 Jun 1997	MS
YUR	Yura, Wakayama	1 m	snorkeling	19 Mar 1988	H. Ariyama
SHR1	Shirahama, Wakayama	10 m	SM	17 Nov 1997	MS
SHR2	Shirahama, Wakayama	0.5 m		14 Mar 1998	MS
KUS	Kushimoto, Wakayama	5 m	snorkeling	31 Jul 1989	H. Ariyama
KUB	Kubotsu, Tosashimizu, Kochi	0.5 m		14 May 1998	MS
NAG	Nagannu Island, Okinawa	52 m	sledge net	28 May 2000	MS

* In "Gear" column, blank shows shore collecting by hand and SM means Smith-McIntyre grab.

** MS in "Collector" column is Michitaka Shimomura.

The type series are deposited in the Zoological Museum, Division of Biological Sciences, Graduate School of Science, Hokkaido University (ZIHU).

Taxonomy

Family Munnidae G. O. Sars, 1899

Genus *Munna* Krøyer, 1839

Munna bispina sp. nov.

(Figs. 1-2)

Material Examined

Holotype, 1 ovig. female, 1.6 mm (ZIHU-01987), sand, NAG, 26°14.50'N, 127°32.00'E, TR/V "Toyoshio-maru".

Description

Female: Body (Fig. 1A) about 1.9 times as long as maximum width. Head about 2.9 times as broad as long, broader than pereonite 1, with 2 dorsal long robust setae; frontal margin of head nearly straight, with a pair of marked long robust sensory setae; labrum surpassing head anteriorly; posterior margin of head convex between eyestalks. Preocular lobes narrow, without setae. Eyestalks long and slender, each with 1 dorsal seta and 1 long robust sensory seta on plinth-like short projection. Pereonites 1-7 laterally rounded: pereonite 1 with 2 dorsal and 2 lateral robust setae; pereonite 2 with 2 dorsal robust, 4 lateral robust and 2 fine setae; pereonite 3 with 2 dorsal robust, 2 lateral robust and 2 lateral fine setae; pereonite 4 with 2 posterolateral long robust setae; pereonites 5 and 6 with some fine setae laterally; pereonite 7 without setae. Pereonite 1 short; pereonite 2 about twice as long as pereonite 1; pereonite 3 longest; pereonite 4 slightly shorter than pereonite 2; pereonites 5 and 6 subequal in length; pereonite 7 about twice as long as pereonite 6. Pereonites 1 to 3 increasing in width; pereonite 4 slightly narrower than pereonite 3; pereonites 5 to 7 decreasing in width. Coxal plates dorsally visible on all pereonites, each with 1 or 2 lateral robust sensory setae. Pleonite narrow, slightly longer than pereonite 7, without dorsal setae. Pleotelson about 1.2 times as long as broad, anteriorly widest, with 3 lateral robust sensory setae and some lateral fine setae, and with a pair of setal fossae dorsally. Uropod (Fig. 1B) uniramous, with 2 simple and 5 filoplume-like setae.

Antenna 1 (Fig. 1C) with 4-articulate peduncle and 3-articulate flagellum. Peduncular article 1 longest, with 3 lateral simple setae and 2 distal filoplume-like setae; article 2 narrower than article 1, with 2 simple setae and 5 filoplume-like setae; article 3 narrow, without setae; article 4 shorter than article 3, with 2 distal setae. Flagellar article 1 about 3.8 times as long as peduncular article 4, with 2 distal setae; article 2 shorter than article 1, apically with 1 simple seta and 1 aesthetasc; article 3 minute, apically bearing 1 aesthetasc and 4 simple setae.

Antenna 2 (Fig. 1D) very long, slender, with peduncle composed of 6 articles: article 1 not visible dorsally; article 2 with 2 lateral setae; article 3 slightly shorter than article 2, with 1 lateral seta; article 4 as long as article 3, with 1 distolateral seta; article 5 slender, with 2 mesial and 2 lateral long setae; article 6 longest, with 21 mesial, 15 lateral, 1 ventral and 2 dorsal simple setae and 2 lateral filoplume-like setae. Flagellum composed of 12 articles, shorter than peduncular article 6, each with some setae.

Left mandible (Fig. 1E) consisting of palp, incisor and molar processes, lacinia mobilis and spine row. Palp 3-articulated: article 1 with 1 distomesial setae; article 2 without setae; article 3 as long as article 1, apically with 1 short simple and 2 plumose setae, and with 14 setulated scales. Incisor with 5 cusps; lacinia mobilis with 3 teeth; spine row with 4 spines; molar process stout, bearing 3 apical setae. Right mandible (Fig. 1F) lacking lacinia mobilis. Palp 3-articulated: article 1 with 1 distomesial seta; article 2 with 2 setulated scales; article 3 as long as article 1, with 1 short

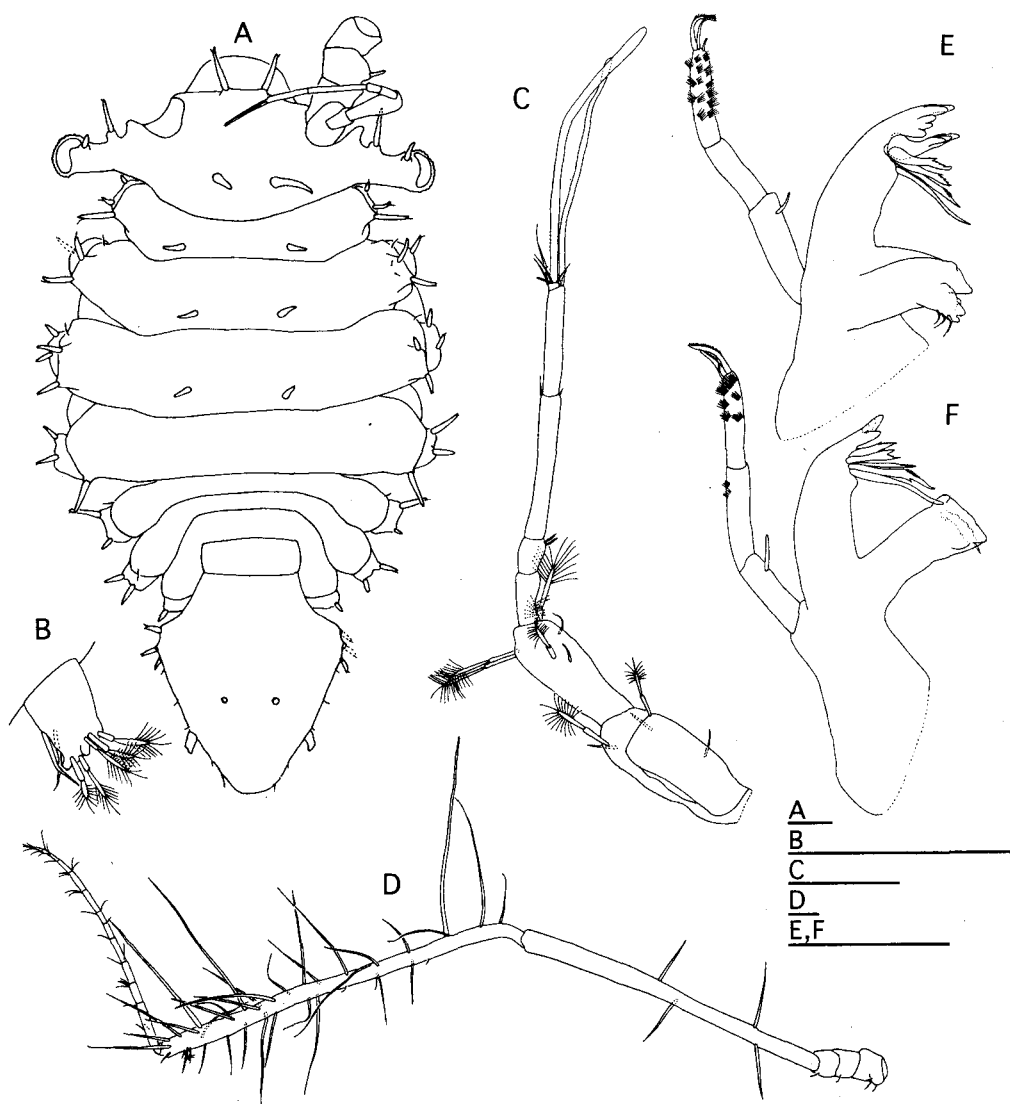


Fig. 1. *Munna bispina* sp. nov. A-F, holotype female: A, habitus; B, uropod; C, antenna 1; D, antenna 2; E, left mandible; F, right mandible. Scales=0.1 mm.

simple and 2 plumose setae, and with 7 setulated scales. Incisor with 3 cusps; spine row with 5 spines; molar process stout, bearing 1 apical seta.

Maxilla 1 (Fig. 2A) with inner lobe bearing 4 apical robust, 4 lateral fine and 2 ventral fine setae; outer lobe with 9 apical robust and 4 mesial fine setae. Maxilla 2 (Fig. 2B) with inner lobe with 3 apical robust, 6 mesial robust, and 7 mesial fine and 9 dorsal fine setae; outer 2 lobes each with 4 apical robust setae.

Maxilliped (Fig. 2C) with palp composed of 5 articles; article 1 narrower than article 2, with 1 mesial seta; article 2 trapezoidal, about 1.8 times as long as article 1, with 2 lateral and 2 mesial setae; article 3 shorter than article 2, with 2 lateral and 3 mesial setae; article 4 as long as article 3, with 2 distoventral long and 1 lateral setae; article 5 narrowest, slightly shorter than article 4, with 2 subapical and 2 apical setae; endite moderately broad, bearing 2 ventral simple, some dorsal

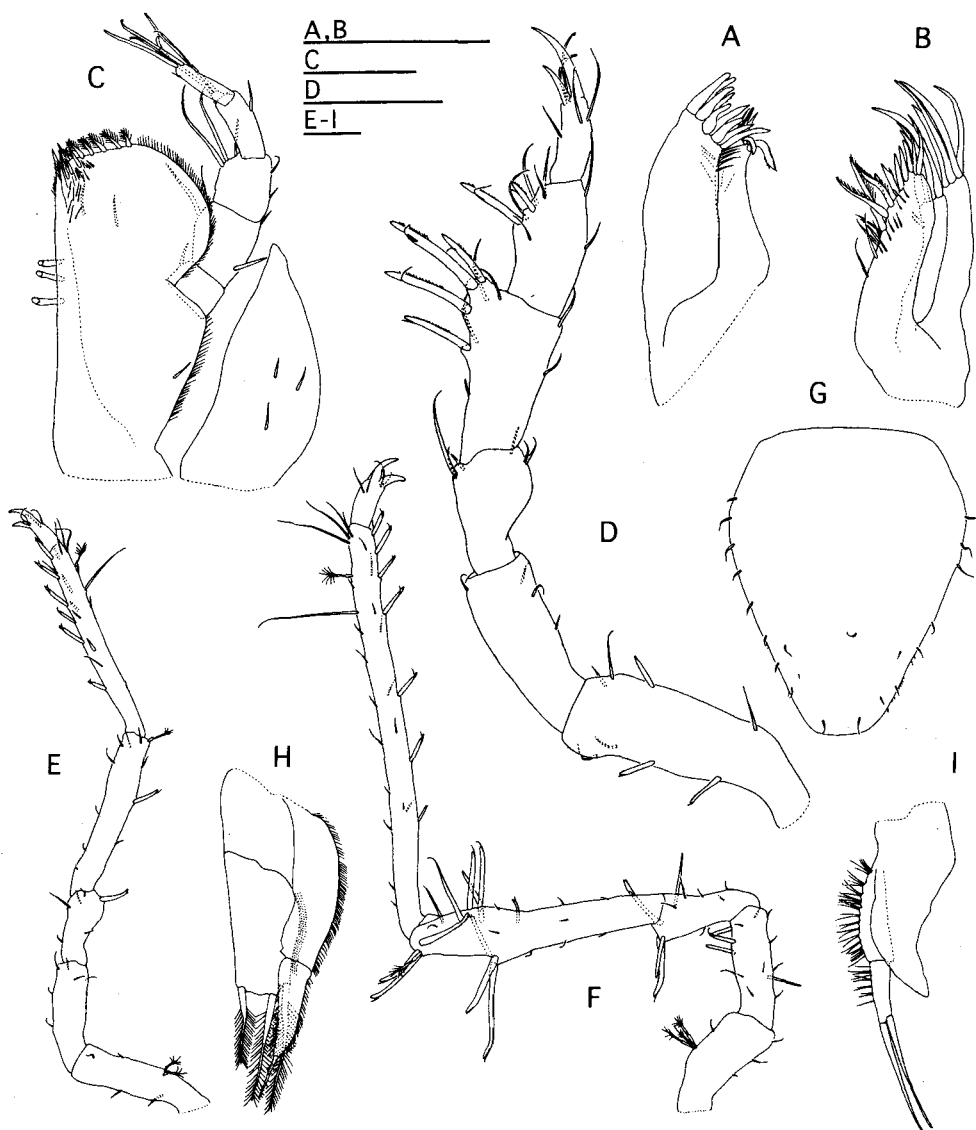


Fig. 2. *Munna bispina* sp. nov. A-I, holotype female: A, maxilla 1; B, maxilla 2; C, maxilliped; D, pereopod 1; E, pereopod 2; F, pereopod 7; G, operculum, H, pleopod 3; I, pleopod 4. Scales=0.1 mm.

simple and 6 distal pectinate setae, with many short setae laterally and 3 coupling hooks mesially; epipod lanceolate, narrower than endite, tapering to pointed apex with 3 dorsal setae.

Pereopod 1 (Fig. 2D) shorter than pereopods 2-7: basis longest article, with 3 ventral, 3 dorsal and 2 lateral setae; ischium narrower than basis, bearing 1 distoventral, 2 dorsal and 1 lateral setae; merus trapezoidal, ventrodistally with 1 long and 2 short setae, dorsodistally with 3 setae; carpus broadest, long, ventrally with 4 long robust sensory and 1 simple setae, with 2 ventrolateral, 1 distomesial and 2 dorsal simple setae; propodus ovate, ventrally with 4 simple and 2 robust sensory setae, with 1 mesial and 2 dorsal simple setae; dactylus longer than propodus, narrowest of all articles, with 1 ventral, 2 distolateral and 2 mesial setae, 1 long curved unguis, and 1 short acute accessory spine.

Pereopods 2 to 7 increasing in length posteriorly. Pereopod 2 (Fig. 2E) long and slender: basis with 2 ventral, 1 dorsal, 1 mesial simple setae and 2 dorsal filoplume-like setae; ischium shorter than basis, with 3 ventral, 1 dorsal, 1 mesial and 1 lateral setae; merus trapezoidal, dorsodistally with 1 long robust sensory seta, and with 2 ventral, 2 mesial and 1 lateral simple setae; carpus about 1.2 times as long as basis, dorsally with 2 simple, 1 robust sensory and 1 filoplume-like setae, and with 5 ventral, 1 lateral and 1 distomesial simple setae; propodus longest article, about 1.2 times as long as carpus, dorsally with 5 simple and 1 filoplume-like setae, and with 6 ventral robust sensory setae and 1 ventral, 4 mesial and 3 lateral simple setae; dactylus the narrowest article; with 2 lateral and 3 distomesial setae, 1 curved unguis, and 1 minute accessory spine. Pereopod 7 (Fig. 2F) long and slender: basis with 3 ventral, 1 dorsal simple setae and 3 dorsal filoplume-like setae; ischium as long as basis, ventrally with 1 long and 4 short simple setae, dorsally with 3 long robust and 1 simple setae, and with 3 mesial and 1 lateral simple setae; merus trapezoidal, dorsally with 2 long robust sensory and 1 short simple setae, and with 2 lateral long robust sensory and 2 mesial short setae; carpus about 1.5 times as long as basis, ventrally with 2 long robust sensory and 4 simple setae, dorsally with 4 long robust sensory, 1 filoplume-like and 3 short simple setae, and with 3 mesial short simple setae and 2 mesial, 1 lateral long robust sensory setae; propodus longest article, about 1.7 times as long as carpus, ventrally with 7 robust sensory and 1 simple setae, dorsally with 1 filoplume-like seta and 4 long, 10 short simple setae, and with 4 mesial and 4 lateral short simple setae; dactylus the narrowest article; with 2 mesial and 2 lateral setae, 1 curved unguis, and 1 minute accessory spine.

Operculum (Fig. 2G) pear-shaped, about 1.3 times as long as broad, with some ventral, 16 lateral and 2 subapical and some fine lateral setae. Pleopod 3 (Fig. 2H): endopod bearing 3 stout, plumose setae distally; exopod composed of 2 articles, narrower than endopod, laterally with many fine setae; article 2 bearing apical long setae. Pleopod 4 (Fig. 2I): exopod narrow, distally with 2 long simple setae, laterally with many long setae; endopod moderately narrow, tapering to pointed apex, without setae.

Male: Unknown.

Remarks

The following features displayed by the new species indicate that it belongs to *Munna*: pereon dorsally setose, last article of antenna 1 minute, antenna 1 with two aesthetascs, and mandibular palp reaching apex of incisor.

The robust sensory setae on frontal margin of head and on lateral margin of pleotelson link the new species to *Munna stephensi* Gurjanova, 1936 from Bering Sea (type locality) and California (Menzies, 1952) and *M. gallardoi* Winkler, 1992 from Magellan Strait (type locality). The present new species is, however, distinguished from *Munna stephensi* by the following features (those of *M. stephensi* in parentheses): long and slender eyestalks (short and stout); a pair of dorsal robust setae on pereonites 1–3 (many fine setae); nearly straight frontal margin of head (concave); a pair of long robust sensory setae on frontal margin of head (some short setae); some long robust sensory setae laterally on pereonites 1–4 (no long robust sensory setae); a long robust sensory seta on anterior margin of eyestalk (without setae); very long and slender antenna 2 (moderately short and stout); anteriorly widest pleotelson (widest at middle); narrow pereopods 2–7 (robust); about 1.3 times as long as broad operculum (about 1.1 times as long as broad). *Munna gallardoi* differs from the new species in having short stout antenna 2, four short robust sensory setae on the frontal margin of head, short and stout eyestalks, pereonites 1–4 each with some dorsal short setae, pleotelson with 6 pairs of robust sensory setae laterally, robust pereopods 2–7, and operculum with some robust sensory setae ventrally.

Table 2 summarizes some diagnostic characters to distinguish between the five species of *Munna* from Japan.

Etymology: The specific name refers to a pair of setae on the frontal margin of head.

Table 2. Features separating the five species of *Munna* known from Japan.

species	frontal margin of head	setae on frontal margin of head	robust sensory setae on lateral margin of pleotelson	sexual dimorphism of pereopod 1	projections of male pleopod 1
<i>M. bispina</i> sp. nov.	nearly straight	2 long robust sensory setae	3 pairs	unknown	unknown
<i>M. japonica</i> sp. nov.	nearly straight	some short fine simple setae	absent	absent	long and stout distolaterally directed
<i>M. avatshensis</i> Gurjanova, 1936	nearly straight	many long fine simple setae	6-11 pairs	present	long and slender distolaterally directed
<i>M. stephensi</i> Gurjanova, 1933	concave	2 short sensory robust and some short fine simple setae	1-4 pairs	present	short and slender laterally directed
<i>M. tenuipes</i> Kussakin, 1962	nearly straight	many long fine simple setae	absent	absent	long and stout laterally directed

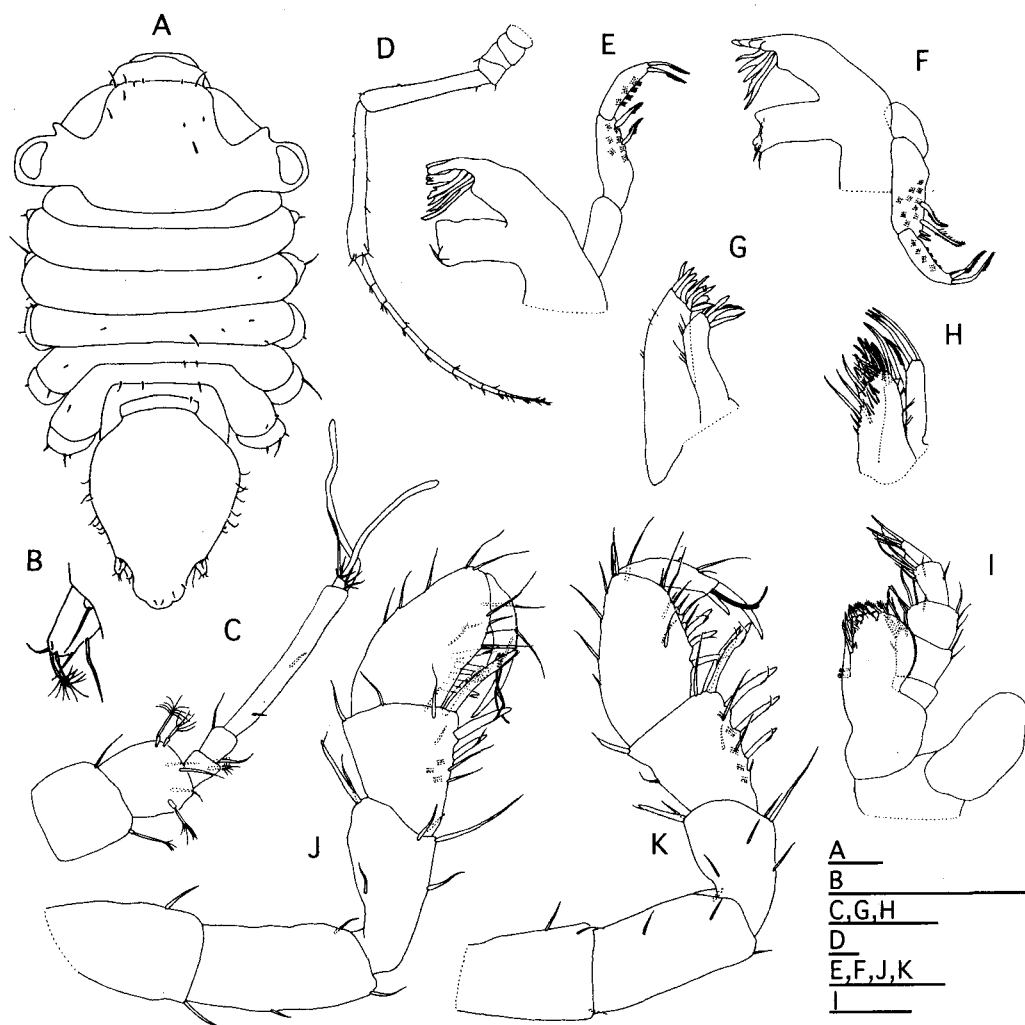


Fig. 3. *Munna japonica* sp. nov. A-J, holotype male; K, paratype female (ZIHU-01989): A, habitus; B, uropod; C, antenna 1; D, antenna 2; E, left mandible; F, right mandible; G, maxilla 1; H, maxilla 2; I, maxilliped; J, pereopod 1; K, pereopod 1. Scales=0.1 mm.

Distribution in Japan: Okinawa (type locality).

***Munna japonica* sp. nov.**

(Figs. 3-4)

Material Examined

Holotype, 1 male, 1.1 mm (ZIHU-01988), on seaweeds, MUK2; paratypes, 1 ovig. female, 1.3 mm (ZIHU-01989), data same as the holotype; 1 male, 1.1 mm (ZIHU-01990), 1 ovig. female, 1.1 mm (ZIHU-01991), 4 non-ovig. females, 1.0-1.4 mm (ZIHU-01992-5), on seaweeds, MUK4. Additional specimens: 3 males, 0.8-1.4 mm, 9 non-ovig. females, 1.0-1.4 mm, on seaweeds, OSH3; 1 ovig. female, 1.4 mm, on seaweeds, OSH4; 1 male, 0.8 mm, 1 non-ovig. female, 1.0 mm, on sponges, CHI3; 6 males, 0.6-1.0 mm, 9 ovig. females, 1.0-1.4 mm, 2 non-ovig. females, 0.8 mm, 1.0 mm, on seaweeds, IWA; 1 male, 0.9 mm, 1 non-ovig. female, 1.6 mm, on seaweeds, MUR2; 1 male,

0.8 mm, 1 non-ovig. female, 1.0 mm, on seaweeds, OAR; 1 male, 0.8 mm, on seaweeds, KOM; 1 male, 1.1 mm, 1 ovig. female, 1.4 mm, sand and seaweeds, MIH; 3 ovig. females, 1.0–1.5 mm, on seaweeds, ATA1; 1 male, 1.0 mm, on stones, SHM; 3 ovig. females, 1.1–1.2 mm, on seaweeds, ATA2; 55 males, 0.8–1.5 mm, 18 ovig. females, 1.2–1.7 mm, 38 non-ovig. females, 0.9–1.9 mm, on *Amphiroa zonata*, YUR; 2 males, 0.8 mm, 1.2 mm, 3 ovig. females, 1.1–1.3 mm, 1 non-ovig. female, 1.4 mm, on *Eckloniopsis radicata*, KUS; 1 male, 0.9 mm, on seaweeds, SHR2; 5 males, 1.2–1.4 mm, 12 ovig. females, 1.3–2.0 mm, 13 non-ovig. females, 1.1–1.8 mm, on bryozoans, TAN1; 1 male, 1.2 mm, 2 non-ovig. females, 0.7 mm, 1.2 mm, on *Gelidium amansii*, TAN2; 1 ovig. female, 1.3 mm, on sponges, USH; 1 non-ovig. female, 1.2 mm, on stones, KUB.

Description

Male: Body (Fig. 3A) about 1.9 times as long as maximum width. Head about twice as broad as long, broader than pereonite 1, with some dorsal short setae; frontal margin of head nearly straight, with some short fine simple setae; labrum surpassing head anteriorly; posterior margin of head convex between eyestalks. Preocular lobes narrow, without setae. Eyestalks short and stout. Pereonites 1–7 laterally rounded: pereonites 1 and 2, without setae; pereonites 3–7 with some setae. Pereonite 1 short; pereonite 2 about 2.8 times as long as pereonite 1; pereonite 3 as long as pereonite 2; pereonite 4 shorter than pereonite 2; pereonites 5 and 6 subequal in length; pereonite 7 shortest. Pereonite 1 slightly shorter than pereonite 2; pereonites 2 and 3 subequal in width; pereonite 4 slightly narrower than pereonite 3; pereonites 5 as broad as pereonite 4; pereonite 6 slightly narrower than pereonite 5; pereonite 7 narrow. Coxal plates dorsally visible on pereonites 2–6, each with some lateral fine setae. Pleonite narrow, as long as pereonite 7, without dorsal setae. Pleotelson pear-shaped, about 1.3 times as long as broad, laterally with many forward-curved fine setae, subapically with some fine setae. Uropod (Fig. 1B) biramous: dorsal ramous minute, bearing single long setae apically; ventral ramous cylindrical, with 3 simple and 2 filoplume-like setae.

Antenna 1 (Fig. 3C) with 4-articulate peduncle and 2-articulate flagellum. Peduncular article 1 broadest, with 1 distomesial simple and 1 distolateral filoplume-like setae; article 2 slightly narrower than article 1, with 3 simple and 3 filoplume-like setae; article 3 narrow, laterally with 1 simple and 1 filoplume-like setae; article 4 as long as article 3, with 1 distomesial simple seta. Flagellar article 1 about 5.6 times as long as peduncular article 4, apically with 2 simple seta and 1 aesthetasc, with 1 ventral and 1 dorsal simple setae; article 2 minute, apically bearing 1 aesthetasc and 5 simple setae.

Antenna 2 (Fig. 3D) moderately short, with peduncle composed of 6 articles: articles 1 and 2 without setae; article 3 as broad as article 2, with 1 distomesial seta; article 4 with 1 distolateral seta; article 5 slightly narrower than article 4, with 2 mesial and 1 lateral short setae; article 6 longest, with 2 mesial, 2 lateral and 3 distal setae. Flagellum composed of 9 articles, longer than peduncular article 6, each with some setae.

Left mandible (Fig. 3E) consisting of palp, incisor and molar processes, lacinia mobilis and spine row. Palp 3-articulated: article 1 without setae; article 2 with 2 lateral pectinate setae and 7 setulated scales; article 3 narrow, apically with 2 pectinate setae, with 7 setulated scales. Incisor with 2 cusps; lacinia mobilis with 4 teeth; spine row with 4 spines; molar process stout, bearing 1 apical setae. Right mandible (Fig. 3F) lacking lacinia mobilis. Palp 3-articulated: article 1 without setae; article 2 with 2 short simple and 2 pectinate setae, and 10 setulated scales; article 3 narrow, with 1 short simple and 2 plumose setae, and 8 setulated scales. Incisor with 4 cusps; spine row with 5 spines; molar process stout, bearing 2 apical setae.

Maxilla 1 (Fig. 3G) with inner lobe bearing 4 apical robust and 6 lateral fine setae; outer lobe apically with 9 robust setae, laterally with 4 fine setae. Maxilla 2 (Fig. 3H) with inner lobe with 6 apical robust, 4 mesial robust and 2 lateral fine setae; outer 2 lobes each with 4 apical robust setae.

Maxilliped (Fig. 3I) with palp composed of 5 articles; article 1 narrower than article 2, without setae; article 2 trapezoidal, about twice as long as article 1, with 2 lateral and 7 mesial setae; article

3 as long as article 2, with 3 lateral and 5 mesial setae; article 4 as long as article 3, with 1 ventral, 1 lateral and 4 mesial setae; article 5 narrowest, shorter than article 4, with 1 subapical and 3 apical setae; endite moderately narrow, bearing some dorsal simple and 6 distal pectinate setae, with many short setae laterally and 2 coupling hooks mesially; epipod ovate, slightly narrower than endite, with rounded apex.

Pereopod 1 (Fig. 3J) shorter than pereopods 2-7: basis shorter than ischium, with 1 distoventral and 1 dorsal setae; ischium slightly narrower than basis, bearing 2 ventral and 1 dorsal setae; merus trapezoidal, ventrally with 1 long and 1 short setae, dorsally with 1 robust sensory and 1 simple setae, and with 2 lateral and 1 mesial simple setae; carpus broadest, moderately short, ventrally with 4 robust sensory and 2 simple setae, with 2 distolateral, 2 mesial and 1 dorsal simple setae, and with 3 mesial setulated scales; propodus ovate, as long as ischium, with 5 ventral, 5 dorsal and 3 mesial simple setae, mesially with 4 robust sensory setae; dactylus shorter than propodus, narrowest of all articles, with 2 lateral and 2 mesial setae, 1 long curved unguis, and 1 short acute accessory spine.

Pereopods 2 to 7 increasing in length posteriorly. Pereopod 2 (Fig. 4A) moderately short and robust: basis with 1 distoventral seta; ischium longer than basis, with 3 ventral, 1 dorsal 2 mesial setae; merus trapezoidal, dorsodistally with 1 long robust sensory and 1 simple setae, and with 3 ventral and 1 lateral simple setae; carpus about 1.8 times as long as basis, dorsally with 3 simple and 1 robust sensory setae, ventrally with 3 simple and 2 robust sensory setae, distally with 1 simple and 3 robust sensory setae; propodus longest article, about 1.1 times as long as carpus, ventrally with 2 simple and 5 robust sensory setae, dorsally with 16 simple, 1 robust sensory and 1 filoplume-like setae, and with 8 lateral simple setae; dactylus the narrowest article; with 1 dorsal, 2 lateral and 1 mesial setae, 1 curved unguis, and 1 minute accessory spine. Pereopod 7 (Fig. 4B) moderately short and slender: basis with 1 distoventral and 1 distodorsal simple setae; ischium about 1.4 times as long as basis, with 4 ventral and 1 dorsal simple setae; merus trapezoidal, dorsally with 1 long robust sensory and 1 simple setae; carpus about 2.9 times as long as basis, ventrally with 5 robust sensory and 2 simple setae, dorsally with 2 robust sensory and 7 simple setae, and with 2 lateral and 6 distal long setae; propodus longest article, about 1.5 times as long as carpus, with 7 ventral robust, 27 dorsal and 5 lateral setae; dactylus the narrowest article; with 1 dorsal and 1 lateral setae, 1

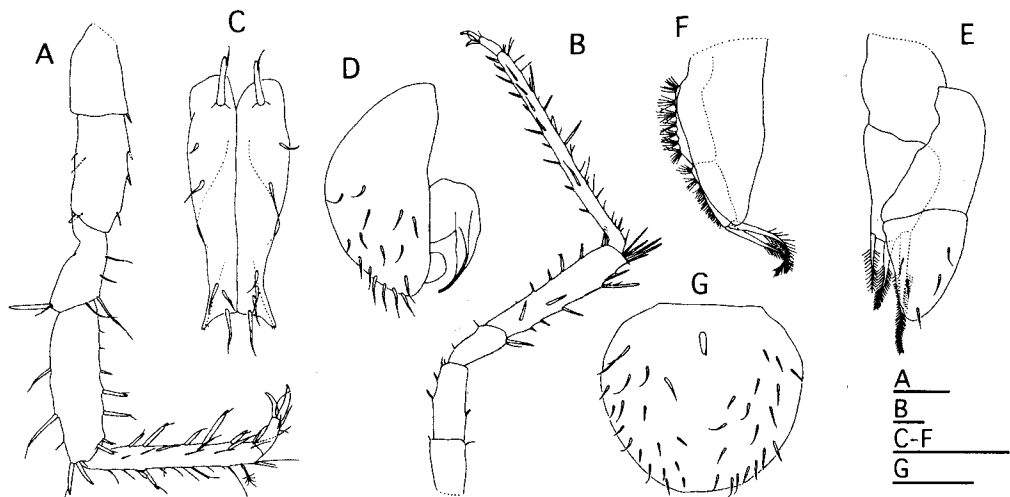


Fig. 4. *Munna japonica* sp. nov. A, C-F, holotype male; B, G, paratype female (ZIHU-01989): A, pereopod 2; B, pereopod 7; C, pleopod 1; D, pleopod 2; E, pleopod 3; F, pleopod 4; G, operculum. Scales=0.1 mm.

curved unguis, and 1 minute accessory spine.

Pleopod 1 (Fig. 4C) with a pair of distolaterally directed, long, stout projections, with 2 anteroventral robust sensory setae or not, and with 9 ventral and 2 posterodistal simple setae. Pleopod 2 (Fig. 4D) with broad protopod: protopod semicircular, lateral margin convex, bearing 12 ventral and 4 lateral setae; endopod with short, stout second article; exopod short. Pleopod 3 (Fig. 4E): endopod bearing 3 stout, plumose setae distally; exopod composed of 2 articles, broader than endopod; article 2 bearing 2 dorsal setae. Pleopod 4 (Fig. 4F): exopod narrow, distally with 2 long plumose setae, laterally with many long fine setae; endopod ovate and broad, without setae.

Female: Similar to male in morphology of all pereonal appendages. Body about 1.6 times as long as maximum width. Pereopod 1 (Fig. 3K) shorter than pereopods 2-7: basis shorter than ischium, with 1 distoventral and 2 dorsal setae; ischium slightly narrower than basis, bearing 1 ventral, 1 mesial and 2 lateral setae; merus trapezoidal, ventrally with 1 long and 2 short setae, dorsally with 1 robust sensory and 1 simple setae, and with 2 lateral simple setae; carpus broadest, moderately short, ventrally with 5 robust sensory and 2 simple setae, dorsally with 1 robust sensory and 1 simple setae, and with 1 mesial and 2 lateral simple setae, 5 mesial setulated scales; propodus ovate, as long as ischium, with 7 ventral, 6 dorsal, 3 mesial and 1 lateral simple setae, and with 3 robust sensory setae ventrally; dactylus shorter than propodus, narrowest of all articles, with 2 lateral setae, 1 long curved unguis, and 1 short acute accessory spine. Operculum (Fig. 4G) circular, as long as broad, ventrally with 1 robust sensory and 37 simple setae.

Remarks

The present new species is assigned to *Munna*, having the character combination of dorsally setose pereon, minute last article of antenna 2, two aesthetascs of antenna 2, mandibular palp reaching apex of incisor.

Munna japonica sp. nov. is similar to *M. limicola* G. O. Sars, 1866, *M. subneglecta* Gurjanova, 1936, *M. tenuipes* Kussakin, 1962, *M. chilensis* Menzies, 1962, *M. lundae* Menzies, 1962 and *M. hovelli* Poore, 1984 in having pereon and pleon both without any marked dorsal and lateral setae. *Munna japonica* sp. nov. is distinguished from *M. hovelli* by the following features (those of *M. hovelli* in parentheses): distolateral projection of pleopod 1 is long (moderately short), pleotelson is big and pear-shaped (small and globose), maxillipedal epipod is ovate (subtriangular), exopod of pleopod 4 reaches the apex of endopod (not reach), and flagellum of antenna 2 has 9 articles (12 articles). *Munna japonica* is distinguished from *M. limicola*, *M. tenuipes*, *M. chilensis* and *M. lundae* in having pleopod 1 with a pair of distolaterally directed, long, stout projections in male. *Munna subneglecta* differs from the new species in having male robust pereopod 1, posteriorly convex male pleopod 1, moderately broad epipod of maxilliped, and apically acute uropod.

Etymology: The specific name refers to Japan.

Distribution in Japan: Hiroshima (type locality), Hokkaido, Ibaraki, Chiba, Shizuoka, Wakayama, Osaka, Okayama, Kochi.

***Munna avatshensis* Gurjanova, 1936**

(Figs. 5-6)

Munna avatshensis Gurjanova, 1936a: 252-254, fig. 2; Gurjanova, 1936b: 52-53; Gurjanova, 1950: 283; Kussakin, 1962: 78, fig. 4; Wolff, 1962: 255; Kussakin and Mezhev, 1979: 171; Mezhev, 1981: 23; Kussakin, 1988: 282-284, figs. 233, 234.

Material Examined

2 ovig. females, 2.9 mm, 3.3 mm (ZIHU-01998), mudstone, NAA1; 3 males, 2.1, 2.8 mm, 2.8 mm (ZIHU-01999), 9 ovig. females, 2.1 mm-2.9 mm, mudstone, NAA2; 1 ovig. female, 2.9 mm, mudstone, NAA3; 1 ovig. female, 3.0 mm, mudstone, NAA4.

Description

Female: Body (Fig. 5A) about 1.8 times as long as maximum width. Head about 2.7 times as broad as long, broader than pereonite 1, dorsally with some short and 11 long setae; frontal margin of head nearly straight, with many long fine simple setae; labrum surpassing head anteriorly;

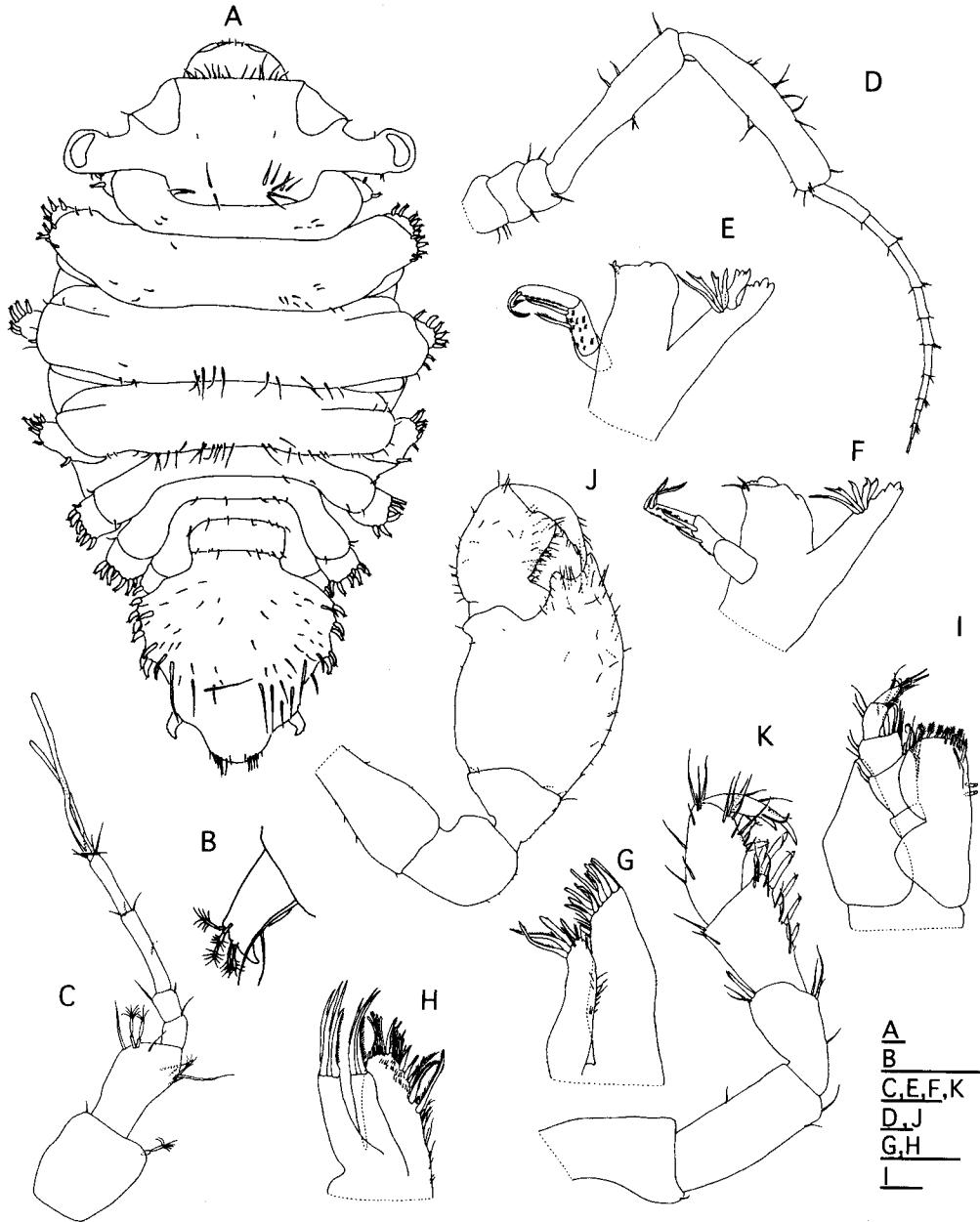


Fig. 5. *Munna avatshensis* Gurjanova, 1936. A-I, K, female (ZIHU-01998); J, male (ZIHU-01999): A, habitus; B, uropod; C, antenna 1; D, antenna 2; E, left mandible; F, right mandible; G, maxilla 1; H, maxilla 2; I, maxilliped; J, pereopod 1; K, pereopod 1. Scales=0.1 mm.

posterior margin of head convex between eyestalks. Preocular lobes narrow, each with 1 fine setae. Eyestalks long and slender. Pereonites 1-7 laterally rounded: pereonite 1 with some short dorsal setae; pereonite 2 with some dorsal and short lateral robust sensory setae; pereonite 3 with some long and short dorsal setae, lateral short robust sensory setae; pereonite 4 with some short and long dorsal setae; pereonites 5-7 with some short dorsal setae. Pereonite 1 short; pereonite 2 about 2.3 times as long as pereonite 1; pereonite 3 slightly longer than pereonite 2; pereonite 4 slightly shorter than pereonite 3; pereonites 5 about half as long as pereonite 4; pereonite 6 slightly shorter than pereonite 5; pereonite 7 as long as pereonite 6. Pereonites 1 to 3 increasing in width; pereonite 4 narrower than pereonite 3; pereonites 5 to 7 decreasing in width. Coxal plates dorsally visible on all pereonites, each with 2-7 short robust sensory setae. Pleonite narrow, slightly longer than pereonite 7, with some short dorsal setae. Pleotelson pentagonal, about 1.1 times as long as broad, dorsally with many short and long simple setae, laterally with 6-11 backward-curved robust sensory setae. Uropod (Fig. 5B) uniramous, proximally with 1 long seta, with 1 mesial simple and 5 filoplume-like setae.

Antenna 1 (Fig. 5C) with 4-articulate peduncle and 3-articulate flagellum. Peduncular article 1 broadest, with 1 distomesial simple and 1 distolateral filoplume-like setae; article 2 narrower than article 1, with 6 simple and 3 filoplume-like setae; article 3 narrow, with 1 distolateral simple seta; article 4 as long as article 3, with 1 distomesial and 1 distolateral simple setae. Flagellar article 1 about 3 times as long as peduncular article 4, with 1 ventral and 3 distal simple setae; article 2 shorter than article 1, with 3 short setae and 1 aesthetasc; article 2 minute, apically bearing 1 aesthetasc and 4 simple setae.

Antenna 2 (Fig. 5D) moderately short, robust, with peduncle composed of 6 articles: article 1 not visible dorsally; article 2 with 3 lateral setae; article 3 as broad as article 2, with 1 distolateral seta; article 4 with 2 mesial and 1 lateral setae; article 5 slightly slender than article 4, with 3 mesial and 3 lateral setae; article 6 as long as article 5, with 9 mesial, 5 lateral and 2 distal setae. Flagellum composed of 10 articles, longer than peduncular article 6, each with some setae.

Left mandible (Fig. 5E) consisting of palp, incisor and molar processes, lacinia mobilis and spine row. Palp 3-articulated: article 1 without setae; article 2 with 2 lateral pectinate setae and 14 setulated scales; article 3 narrow, apically with 2 pectinate setae, and with 7 setulated scales. Incisor with 5 cusps; lacinia mobilis with 4 teeth; spine row with 4 spines; molar process stout, bearing 1 apical seta. Right mandible (Fig. 5F) lacking lacinia mobilis. Palp 3-articulated: article 1 without setae; article 2 with 2 pectinate setae and 4 setulated scales; article 3 narrow, with 1 short simple and 2 plumose setae, 8 setulated scales. Incisor with 4 cusps; spine row with 5 spines; molar process stout, bearing 2 apical setae.

Maxilla 1 (Fig. 5G) with inner lobe bearing 4 apical robust setae and 7 apical, some lateral fine setae; outer lobe apically with 12 robust setae. Maxilla 2 (Fig. 5H) with inner lobe bearing 7 apical robust and 12 mesial robust setae, with some lateral and many ventral fine setae; outer 2 lobes each with 4 apical robust setae.

Maxilliped (Fig. 5I) with palp composed of 5 articles; article 1 narrower than article 2, without setae; article 2 trapezoidal, about twice as long as article 1, with 2 lateral and 7 mesial setae; article 3 shorter than article 2, with 3 lateral and 7 mesial setae; article 4 as long as article 3, with 3 ventral, 3 lateral and 5 mesial setae; article 5 narrowest, shorter than article 4, with 2 subapical and 3 apical setae; endite moderately narrow, bearing some dorsal simple setae and 2 long dorsal, 6 distal pectinate setae, with 2 coupling hooks mesially; epipod trapezoidal, slightly broader than endite, with rounded apex.

Pereopod 1 (Fig. 5K) shorter than pereopods 2-7: basis shorter than ischium, with 1 dorsoventral seta; ischium slightly narrower than basis, bearing 2 ventral and 1 dorsal setae; merus trapezoidal, ventrally with 2 long and 2 short setae, dorsally with 1 robust sensory and 2 simple setae; carpus broadest, moderately short, ventrally with 7 robust sensory and 8 simple setae, dorsally with 3 simple setae; propodus ovate, as long as ischium, ventrally with 2 robust sensory and 6

simple setae, and with 7 dorsal and 2 lateral simple setae; dactylus shorter than propodus, narrowest of all articles, with 1 ventral, 2 dorsal, 1 mesial and 1 lateral setae, 1 long curved unguis, and 1 short acute accessory spine.

Pereopods 2 to 7 increasing in length posteriorly. Pereopod 2 (Fig. 6A) moderately short and robust: basis with 2 ventral and 6 dorsal setae; ischium longer than basis, with 5 ventral and 1 dorsal setae; merus trapezoidal, dorsodistally with 1 long robust sensory and 3 simple setae; carpus about 1.9 times as long as basis, dorsally with 5 simple and 3 robust sensory setae, ventrally with 2 simple and 5 robust sensory setae; propodus longest article, about 1.3 times as long as carpus, ventrally with 4 simple and 12 robust sensory setae, dorsally with 22 simple, 1 robust sensory and 1 filoplume-like setae; dactylus the narrowest article; with 2 lateral and 2 mesial setae, 1 curved unguis, and 1 minute accessory spine. Pereopod 7 (Fig. 6B) moderately short and robust: basis dorsally with 2 filoplume-like setae, and with 2 ventral and 2 dorsal simple setae; ischium about 1.5 times as long as basis, with 3 ventral simple setae; merus trapezoidal, with 2 long dorsal robust sensory and 3 simple setae; carpus robust, about 2.8 times as long as basis, ventrally with 3 robust sensory and 3 simple setae, dorsally with 8 robust sensory and 3 simple setae; propodus longest article, about 1.3 times as long as carpus, ventrally with 10 robust sensory and 4 simple setae, dorsally with 4 robust sensory, 16 simple and 1 filoplume-like setae; dactylus the narrowest article; with 2 lateral setae, 1 curved unguis, and 1 minute accessory spine.

Operculum (Fig. 6G) circular, as long as broad, ventrally with 7 robust sensory setae, and with many marginal and submarginal short simple setae. Pleopod 3 (Fig. 6E): endopod bearing 3 stout plumose setae distally; exopod composed of 2 articles, as broad as endopod; article 2 bearing 9 simple setae distally. Pleopod 4 (Fig. 6F): exopod moderately stout, distally with 2 long plumose setae, laterally with many fine setae; endopod broad, inward-curved, without setae.

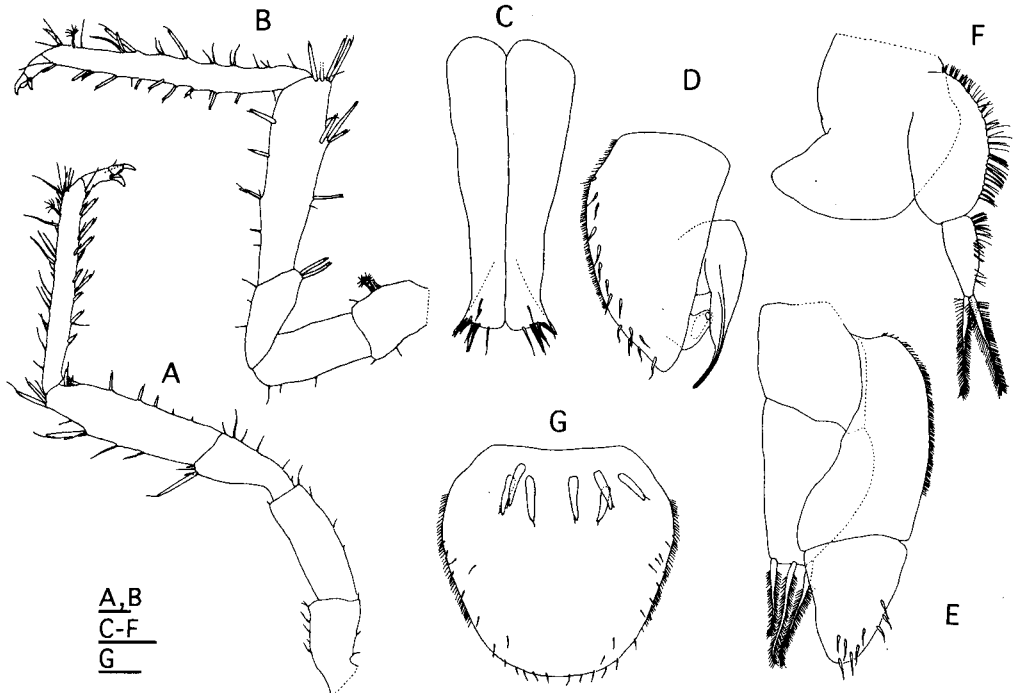


Fig. 6. *Munna avatshensis* Gurjanova, 1936. A, B, E-G, female (ZIHU-01998); C, D, male (ZIHU-01999): A, pereopod 2; B, pereopod 7; C, pleopod 1; D, pleopod 2; E, pleopod 3; F, pleopod 4; G, operculum. Scales=0.1 mm.

Male: Similar to female in morphology of all pereonal appendages except for pereopod 1. Body about 2.2 times as long as maximum width. Pereopod 1 (Fig. 5J) robust, shorter than pereopods 2-7: basis shorter than ischium, with 4 ventral and 3 dorsal short setae; ischium robust and short, shorter than basis, bearing 4 ventral short setae; merus triangulate, with 6 ventral and 4 distal short setae; carpus broadest and longest, armed with 2 blunt teeth ventrodistally, with many short simple setae; propodus deeply concave on ventral margin, with many short simple setae, without sensory setae; dactylus shorter than propodus, narrowest of all articles, with 4 ventral, 3 dorsal and 2 lateral setae, 1 long curved unguis, and 1 short acute accessory spine. Pleopod 1 (Fig. 6C) with a pair of distolaterally directed, long, slender projections, with some subapical and 16 distal simple setae. Pleopod 2 (Fig. 6D) with broad protopod: protopod semicircular, lateral margin convex, bearing 11 submarginal and 4 lateral simple setae, many lateral fine setae; endopod with short and stout second article; exopod short.

Remarks

The present specimens show the character states identical with the original description of *Munna avatshensis* Gurjanova, 1936 from Kamchatka as follows: backwards-curved robust sensory setae on lateral margin of pleotelson, pentagonal pleotelson, lateral robust sensory setae on coxal plates, nearly straight anterior margin of head, and robust carpus having two blunt teeth on ventral margin in male pereopod 1. A marked difference between the present material and the original is the presence of fine simple setae on the anterior margin of head: many fine simple setae in Japanese specimens, but none in the original. Some minor differences between Japanese and the original materials are as follows: the former has robust and short ischium of male pereopod 1, some subapical setae on pleopod 1, and dorsally visible coxal plates of pereonite 1, while the latter has moderately narrow and long ischium of male pereopod 1, pleopod 1 lacking subapical setae and dorsally invisible coxal plates of pereonite 1. Since the features described by the original description are insufficient to distinguish the species between congeners, this study newly covered additional ten characters, namely antenna 2, left and right mandibles, maxillae 1 and 2, maxilliped, pereopod 2, pleopods 3 and 4, and operculum. Combination of these characters contributes to separate the species from all the congeners.

Distribution in Japan: Hokkaido.

Munna stephenseni Gurjanova, 1933

(Figs. 7-8)

Munna stephenseni Gurjanova, 1933: 88, 91, fig. 15; Gurjanova, 1936b: 50-51, fig. 16; Menzies, 1952: 124-128, figs. 49-51; Wolff, 1962: 252; Kussakin, 1979: 121; Kussakin, 1988: 277-279, figs. 227-230; Shimomura *et al.*, 2001: 3.

Munna (Neomunna) stephenseni: Menzies, 1962: 36; Kussakin, 1962: 73-75, fig. 1; Schultz, 1969: 297, fig. 472; Kussakin, 1972: 169; Kussakin, 1974: 261, fig. 28; Kussakin, 1975: 67; Kussakin and Mezhov, 1979: 171; Mezhov, 1981: 22-23.

Munna kroyeri: Fee, 1926: 22; Hatch, 1947: 174, pl. 4, figs. 45-47.

Material Examined

1 ovig. female, 3.0 mm, on sponges, ERM; 2 ovig. females, 2.2 mm, 2.3 mm, on seagrasses, CHI1; 1 male, 2.1 mm (ZIHU-02000), 1 ovig. female, 2.8 mm (ZIHU-02001), mudstone, NAA1; 1 male, 1.7 mm, under stones, AIA1; 1 male, 1.6 mm, 2 ovig. females, 1 non-ovig. female, 1.6 mm, 2.5 mm, 2.6 mm, under stones, ABA; 3 males, 1.6 mm, 2.5 mm, 2.5 mm (ZIHU-02002), 10 ovig. females, 1.7-2.7 mm, under stones, MUR1; 1 non-ovig. female, 1.5 mm, under stones, TAM; 2 males, 0.7 mm, 1.7 mm, 6 ovig. females, 1.6-1.9 mm, 1 non-ovig. female, 1.3 mm, under stones, RUM; 1 male, 2.1 mm, 3 ovig. females, 1.2-2.1 mm, 2 non-ovig. females, 1.3 mm, 1.4 mm, mudstone, NAA3; 8 males,

1.0–1.5 mm, 4 ovig. females, 1.6–2.8 mm, 4 non-ovig. females, 1.0–1.9 mm, under stones, DAA; 1 non-ovig. female, 1.4 mm, under stones, NOS; 1 non-ovig. female, 0.9 mm, sand and mud, OTS3; 1 male, 1.7 mm, under stones, AIA2.

Description

Female: Body (Fig. 7A) about twice as long as maximum width. Head about 2.4 times as broad as long, broader than pereonite 1, dorsally with some long setae; frontal margin of head

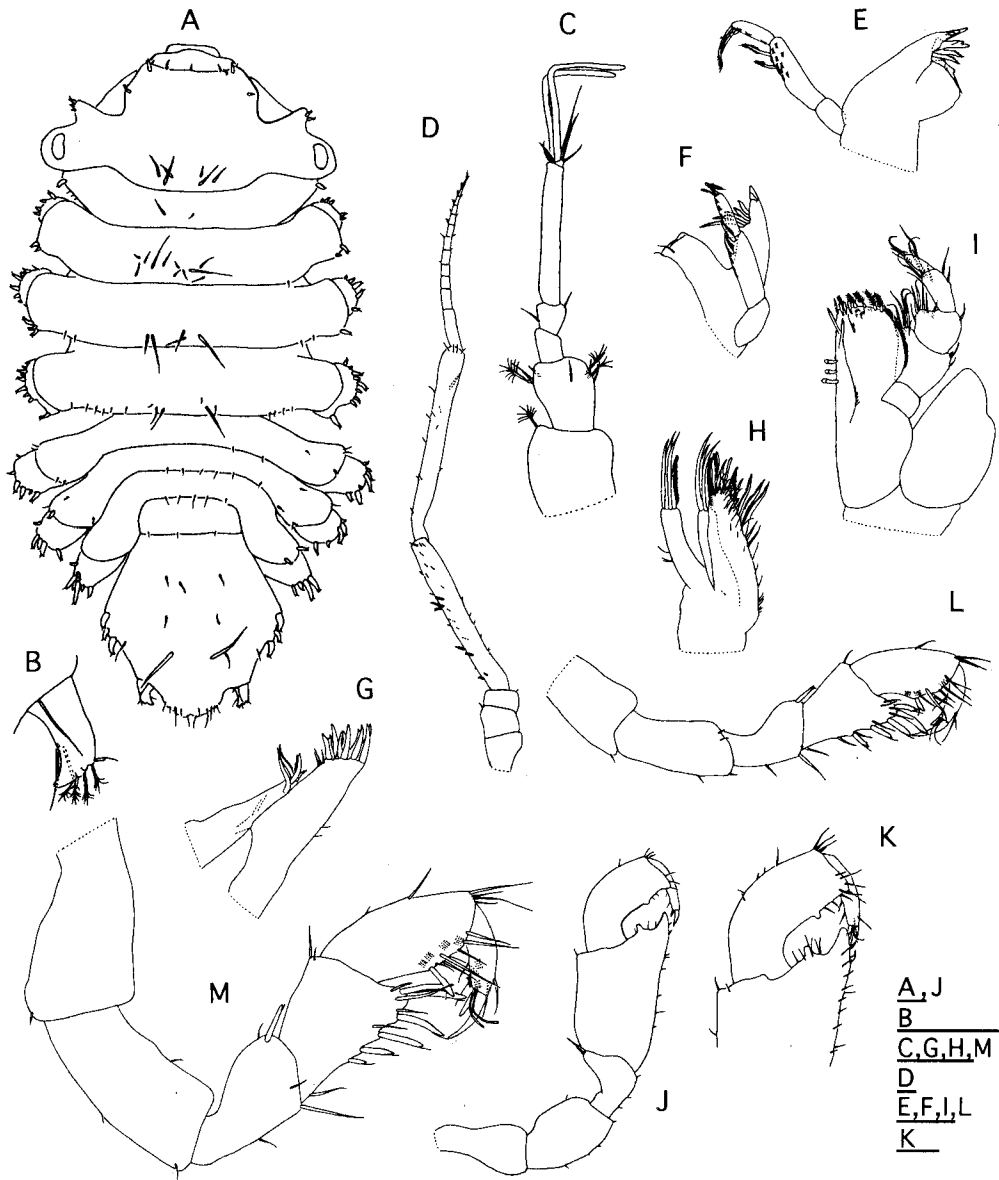


Fig. 7. *Munna stephenseni* Gurjanova, 1933. A, B, M, female (ZIHU-02001); C, E–I, L, male (ZIHU-02000); D, J, K, male (ZIHU-02002): A, habitus; B, uropod; C, antenna 1; D, antenna 2; E, left mandible; F, right mandible; G, maxilla 1; H, maxilla 2; I, maxilliped; J, K, mature male pereopod 1; L, juvenile male pereopod 1; M, pereopod 1. Scales=0.1 mm.

concave, with 2 short sensory robust and some short fine simple setae; labrum surpassing head anteriorly; posterior margin of head convex between eyestalks. Preocular lobes moderately stout, each with 2 or 3 robust sensory setae. Eyestalks short and stout. Pereonites 1-7 laterally rounded: pereonite 1 laterally with 2 lateral robust sensory and some fine setae, and with 2 dorsal simple setae; pereonite 2 with 11 dorsal and 4 posterolateral robust sensory setae; pereonite 3 dorsally with 5 long and some short dorsal setae, and with 4 robust sensory setae; pereonite 4 with 16 dorsal simple setae; pereonites 5-7 with some short dorsal and some lateral robust sensory setae. Pereonite 1 short; pereonite 2 about 1.6 times as long as pereonite 1; pereonite 3 slightly longer than pereonite 2; pereonite 4 slightly longer than pereonite 3; pereonites 5 about half as long as pereonite 4; pereonite 6 slightly shorter than pereonite 5; pereonite 7 as long as pereonite 6. Pereonites 1 to 3 increasing in width; pereonite 4 slightly narrower than pereonite 3; pereonite 5 broader than pereonite 4; pereonite 6 slightly narrower than pereonite 5; pereonite 7 narrowest. Coxal plates dorsally visible on pereonites 2-7, each with 4-9 short robust sensory setae. Pleonite narrow, slightly longer than pereonite 7, with some short dorsal setae. Pleotelson heptagonal, about as long as broad, dorsally with 2 long and some short simple setae, laterally with 1-4 pairs of backward-curved short robust sensory setae, and with 8 distal short setae. Uropod (Fig. 7B) uniramous, inward-curved, proximally with 1 long seta, and with 1 mesial, 1 ventral simple setae and 5 filoplume-like setae.

Antenna 1 (Fig. 7C) with 4-articulate peduncle and 2-articulate flagellum. Peduncular article 1 broadest, with 1 distolateral filoplume-like seta; article 2 narrower than article 1, with 3 simple and 5 filoplume-like setae; article 3 narrow, without setae; article 4 as long as article 3, with 1 distolateral simple seta. Flagellar article 1 about 4.8 times as long as peduncular article 4, with 2 short setae and 1 aesthetasc; article 2 minute, apically bearing 1 aesthetasc and 3 simple setae.

Antenna 2 (Fig. 7D) moderately short, robust, with peduncle composed of 6 articles: article 1 not visible dorsally; article 2 without setae; article 3 as broad as article 2, with 1 distomesial seta; article 4 with 1 lateral seta; article 5 slightly broader than article 4, with many short simple and 6 robust sensory setae; article 6 slightly longer than article 5, with 3 ventral, 2 dorsal, 5 mesial, 1 lateral and 4 distal short setae. Flagellum composed of 11 articles, slightly shorter than peduncular article 6, each with some setae.

Left mandible (Fig. 7E) consisting of palp, incisor and molar processes, lacinia mobilis and spine row. Palp 3-articulated: article 1 without setae; article 2 with 2 lateral pectinate setae and 10 setulated scales; article 3 narrow, apically with 2 pectinate and 1 simple setae, and with 3 setulated scales. Incisor with 4 cusps; lacinia mobilis with 4 teeth; spine row with 3 spines; molar process stout. Right mandible (Fig. 7F) lacking lacinia mobilis. Palp 3-articulated: article 1 without setae; article 2 with 2 pectinate setae; article 3 narrow, with 2 plumose setae and 3 setulated scales. Incisor with 3 cusps; spine row with 5 spines; molar process stout, bearing 2 apical setae.

Maxilla 1 (Fig. 7G) with inner lobe bearing 4 apical robust and 4 dorsal fine setae; outer lobe apically with 11 robust and 2 lateral fine setae. Maxilla 2 (Fig. 7H) with inner lobe with 7 apical robust and 5 mesial robust setae, and with 13 lateral and many ventral fine setae; outer 2 lobes each with 4 apical robust setae.

Maxilliped (Fig. 7I) with palp composed of 5 articles; article 1 narrower than article 2, without setae; article 2 trapezoidal, about 1.8 times as long as article 1, with 3 lateral and 6 mesial setae; article 3 shorter than article 2, with 1 lateral and 6 mesial setae; article 4 as long as article 3, with 3 ventral, 2 lateral and 3 mesial setae; article 5 narrowest, shorter than article 4, with 1 lateral and 2 apical setae; endite moderately narrow, bearing some dorsal simple setae and 2 long dorsal, 3 subdistal, 7 distal pectinate setae, and with 3 coupling hooks mesially; epipod ovate, broader than endite, with rounded apex.

Pereopod 1 (Fig. 7M) shorter than pereopods 2-7; basis shorter than ischium, with 1 dorsoventral seta; ischium slightly narrower than basis, bearing 2 ventral and 1 dorsal setae; merus trapezoidal, ventrally with 1 long and 1 short setae, dorsally with 1 robust sensory and 1 simple

setae, and with 1 distolateral simple seta; carpus broadest, moderately short, ventrally with 6 robust sensory and 5 simple setae, dorsally with 2 simple setae; propodus ovate, shorter than ischium, ventrally with 1 robust sensory and 7 simple setae, and with 6 dorsal simple setae and 4 mesial setulated scales; dactylus shorter than propodus, narrowest of all articles, with 1 ventral, 1 dorsal, 1 mesial and 2 lateral setae and 2 mesial setulated scales, 1 long curved unguis, and 1 short acute accessory spine.

Pereopods 2 to 7 increasing in length posteriorly. Pereopod 2 (Fig. 8A) short and robust: basis with 1 dorsal seta; ischium longer than basis, with 2 ventral setae; merus trapezoidal, dorsally with 1 long robust sensory and 1 simple setae, and with 4 ventral simple setae; carpus about 1.8 times as long as basis, dorsally with 5 simple and 5 robust sensory setae, ventrally with 1 robust sensory seta; propodus longest article, about 1.2 times as long as carpus, ventrally with 4 simple and 8 robust sensory setae, dorsally with 11 simple setae; dactylus the narrowest article; with 1 lateral and 1 mesial setae, 1 curved unguis, and 1 minute accessory spine. Pereopod 7 (Fig. 8B) short and robust: basis with 1 ventral and 3 dorsal setae; ischium about 1.2 times as long as basis, ventrally with 3 simple and 2 robust sensory setae, and with 1 mesial and 1 lateral simple setae; merus trapezoidal, with 2 long dorsal robust sensory, 3 ventral simple and 1 distolateral long robust setae; carpus robust, about 2.6 times as long as basis, dorsally with 7 robust sensory and 4 simple setae, and with 1 ventral, 8 lateral and 1 distomesial robust sensory setae; propodus longest article, about 1.5 times as long as carpus, ventrally with 9 robust sensory and 2 simple setae, dorsally with 3 robust sensory, 13 simple and 1 filoplume-like setae, and with 1 mesial and 6 lateral setae; dactylus the narrowest article; with 1 dorsal, 1 mesial and 1 lateral setae, 1 curved unguis, and 1 minute accessory spine.

Operculum (Fig. 8G) ovate, about 1.1 times as long as broad, with many lateral short and 5 apical simple setae. Pleopod 3 (Fig. 8E): endopod bearing 3 stout, plumose setae distally; exopod

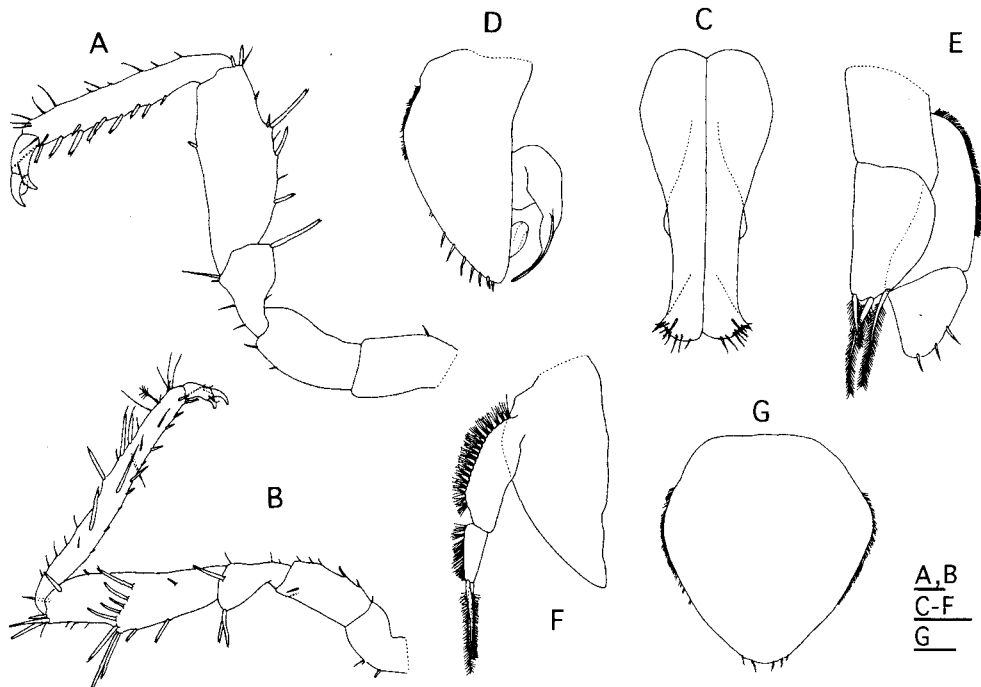


Fig. 8. *Munna stephenseni* Gurjanova, 1933. A-F, male (ZIHU-02002); G, female (ZIHU-02001): A, pereopod 2; B, pereopod 7; C, pleopod 1; D, pleopod 2; E, pleopod 3; F, pleopod 4; G, operculum. Scales=0.1 mm.

composed of 2 articles, as broad as endopod; article 2 bearing 3 simple setae distally. Pleopod 4 (Fig. 8F): exopod narrow, distally with 2 long plumose setae, laterally with many long fine setae; endopod broad, without setae.

Male: Similar to female in morphology of all pereonal appendages except for pereopod 1. Body about 1.9 times as long as maximum width. Mature pereopod 1 (Figs 7J, K) robust, shorter than pereopods 2-7: basis as long as ischium, without setae; ischium broader than basis, bearing 4 ventral and 1 dorsal short setae; merus trapezoidal, with 3 ventral short, 1 dorsal long and 1 dorsal short setae; carpus robust, broadest and longest, armed with 2 conspicuous teeth distally, with many short ventral and some short dorsal simple setae; propodus deeply concave on ventral margin, with short blunt teeth mesially, with 4 short ventral, 5 short dorsal and 5 distal short setae, without sensory setae; dactylus shorter than propodus, narrowest of all articles, with 2 ventral, 1 dorsal, 1 mesial and 1 lateral setae, 1 short curved unguis, and 1 minute acute accessory spine. Juvenile pereopod 1 (Fig. 7L) shorter than pereopods 2-7: basis shorter than ischium, with 1 distoventral seta; ischium slightly narrower than basis, bearing 2 ventral and 2 distal setae; merus trapezoidal, ventrally with 1 long and 1 short setae, dorsally with 1 robust sensory seta; carpus broadest, moderately short, ventrally with 5 robust sensory and 8 simple setae, and with 1 distodorsal simple seta; propodus ovate, shorter than ischium, ventrally with 1 robust sensory and 7 simple setae, and with 4 dorsal simple setae and 3 mesial setulated scales; dactylus shorter than propodus, narrowest of all articles, with 1 ventral, 2 dorsal and 2 lateral setae, 1 long curved unguis, and 1 short acute accessory spine. Pleopod 1 (Fig. 8C) with a pair of laterally directed, short, slender projections, with 2 subdistal and 16 distal simple setae. Pleopod 2 (Fig. 8D) with broad protopod: protopod tapering to rounded apex, lateral margin convex, bearing many lateral short fine and 7 lateral long setae; endopod with short and stout second article; exopod short.

Remarks

The Japanese material was identified with *Munna stephensi* Gurjanova, 1933 by the presence of the following features: backwards-curved robust sensory setae on lateral margin of pleotelson, heptagonal-shaped pleotelson, concave anterior margin of head, and two conspicuous teeth on robust carpus in mature male pereopod 1, all of which were redescribed and illustrated by Menzies (1952) based on the material from California. A marked difference between the Japanese and California materials is the number of robust sensory setae on the lateral margin of pleotelson: 1-4 pairs in the former, while 2-3 pairs in the latter. Some minor differences were shown between the present and Menzies' specimens as follows (those of Menzies' specimen in parentheses): 6 robust sensory setae on ventral margin of carpus of female pereopod 1 (4 robust sensory setae), some dorsal long or short setae on head and pereonites (without setae), and many lateral setae on coxal plates (some lateral setae). Additional four characters, such as, epipod of maxilliped, pleopod 4, pereopod 2 and operculum, were newly described with illustrations.

Munna stephensi resembles *M. modesta* Kussakin, 1962: both species has 4 pairs of robust setae on the lateral margin of pleotelson. However, *Munna stephensi* is distinguishable from *M. modesta* in having the head with convex anterior margin.

Distribution in Japan: Hokkaido, Iwate.

***Munna tenuipes* Kussakin, 1962**

(Figs. 9-10)

Munna (Munna) tenuipes Kussakin, 1962: 95-98, figs 21-22; Kussakin and Mezhev, 1979: 184.
Munna tenuipes: Kussakin, 1979: 121; Kussakin, 1988: 269-272, figs. 219-220; Shimomura *et al.*, 2001: 3.

Material Examined

2 males, 1.1 mm (ZIHU-02004), 1.2 mm (ZIHU-02003), 6 males, 0.8–1.4 mm, 2 ovig. females, 1.4 mm (ZIHU-02005), 1.7 mm (ZIHU-02006), 5 ovig. females, 1.1–1.7 mm, 14 non-ovig. females, 0.8–2.1 mm, mud and dead oyster shells, LAA1; 1 male, 1.8 mm, 1 ovig. female, 1 non-ovig. female, 2.1 mm, mud and dead oyster shells, LAA2; 3 ovig. females, 1.5–1.6 mm, 4 non-ovig. females, 0.6–1.5 mm, sand and mud, OTS1; 1 male, 1.1 mm, 1 non-ovig. female, 1.8 mm, mud and dead oyster shells, LAA3; 4 non-ovig. females, 1.6–2.9 mm, under stones, DAA.

Description

Male: Body (Fig. 9A) about 1.8 times as long as maximum width. Head about 2.5 times as broad as long, broader than pereonite 1, with some dorsal short setae; frontal margin of head nearly straight, with many long fine simple setae; labrum surpassing head anteriorly; posterior margin of head convex between eyestalks. Preocular lobes moderately robust, without setae. Eyestalks short and stout. Pereonites 1–7 laterally rounded: pereonite 1 without setae; pereonites 2–7 with some fine short setae. Pereonite 1 short; pereonite 2 about 1.2 times as long as pereonite 1; pereonite 3 longest; pereonite 4 shorter than pereonite 2; pereonites 5 and 6 subequal in length; pereonite 7 shortest. Pereonite 1 narrower than pereonite 2; pereonites 2–4 subequal in width; pereonite 5 slightly narrower than pereonite 4; pereonite 6 narrower than pereonite 5; pereonite 7 narrow. Coxal plates dorsally visible on pereonites 2–6, each with some lateral fine setae. Pleonite narrow, as long as pereonite 7, with some setae. Pleotelson pear-shaped, about 1.1 times as long as broad, laterally with many forward-curved fine setae, with some dorsal setae. Uropod (Fig. 9B) biramous: dorsal ramous minute, bearing single long setae apically; ventral ramous cylindrical, with 3 simple and 6 filoplume-like setae.

Antenna 1 (Fig. 9C) with 4-articulate peduncle and 3-articulate flagellum. Peduncular article 1 broadest, distolaterally with 1 simple and 1 filoplume-like setae, and with 1 distomesial simple seta; article 2 slightly narrower than article 1, with 6 simple and 1 filoplume-like setae; article 3 narrow, with 2 simple setae; article 4 as long as article 3, with 1 distomesial and 2 distolateral setae. Flagellar article 1 about 3 times as long as peduncular article 4, with 2 distal setae; article 2 shorter than article 1, distally with 1 simple seta and 1 aesthetasc; article 3 minute, apically bearing 1 aesthetasc and 3 simple setae.

Antenna 2 (Fig. 9D) long and slender, with peduncle composed of 6 articles: articles 1 not visible dorsally; article 2 with 2 lateral setae; article 3 slightly narrower than article 2, with 5 distal setae; article 4 as broad as article 3, with 4 distal setae; article 5 slightly narrower than article 4, with 5 mesial, 5 lateral, 1 dorsal and 5 ventral short setae; article 6 longest, with many short setae. Flagellum composed of 26 articles, longer than peduncular article 6, each with some setae.

Left mandible (Fig. 9E) consisting of palp, incisor and molar processes, lacinia mobilis and spine row. Palp 3-articulated: article 1 with 3 simple setae; article 2 with 2 lateral pectinate setae and 5 setulated scales; article 3 narrow, apically with 2 pectinate setae, and with 14 setulated scales. Incisor with 4 cusps; lacinia mobilis with 4 teeth; spine row with 4 spines; molar process stout, bearing 2 apical setae. Right mandible (Fig. 9F) lacking lacinia mobilis. Palp 3-articulated: article 1 with 3 simple setae; article 2 with 2 pectinate setae and 9 setulated scales; article 3 narrow, with 1 short simple and 2 plumose setae, 27 setulated scales. Incisor with 4 cusps; spine row with 5 spines; molar process stout, bearing 1 long seta and 3 short robust setae apically.

Maxilla 1 (Fig. 9G) with inner lobe bearing 4 apical robust and 5 lateral fine setae; outer lobe apically with 11 robust setae, mesially with 4 fine setae. Maxilla 2 (Fig. 9H) with inner lobe with 9 apical, 5 mesial robust setae and many fine setae; outer 2 lobes each with 4 apical robust and some fine setae.

Maxilliped (Fig. 9I) with palp composed of 5 articles; article 1 narrower than article 2, with 1 mesial seta; article 2 trapezoidal, about 2.6 times as long as article 1, with 2 lateral and 4 mesial setae; article 3 shorter than article 2, with 1 distoventral, 3 lateral and 3 mesial setae; article 4 as

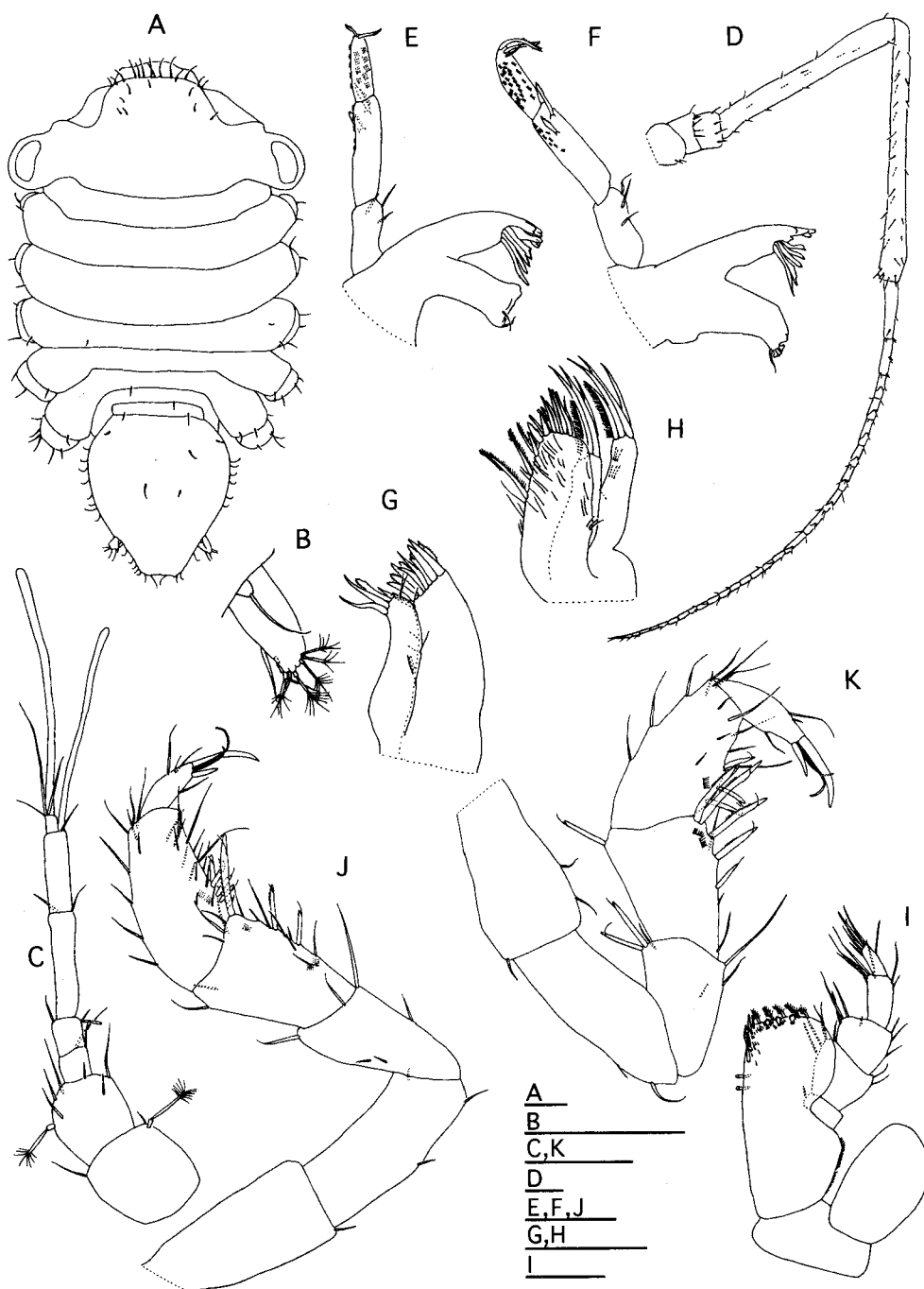


Fig. 9. *Munna tenuipes* Kussakin, 1962. A, D-I, male (ZIHU-02003); B, female (ZIHU-02005); C, J, male (ZIHU-02004); K, female (ZIHU-02006): A, habitus; B, uropod; C, antenna 1; D, antenna 2; E, left mandible; F, right mandible; G, maxilla 1; H, maxilla 2; I, maxilliped; J, pereopod 1; K, pereopod 1. Scales=0.1 mm.

long as article 3, with 1 ventral, 2 lateral and 4 mesial setae; article 5 narrowest, shorter than article 4, with 1 lateral, 2 subapical and 3 apical setae; endite moderately narrow, bearing many dorsal short fine, 3 fan-shaped subdistal setae and 3 dorsal long, 6 distal pectinate setae, with many short setae laterally and 2 coupling hooks mesially; epipod ovate, narrower than endite, with rounded apex.

Pereopod 1 (Fig. 9J) shorter than pereopods 2-7: basis shorter than ischium, with 1 distoventral seta; ischium narrower than basis, bearing 2 ventral and 1 distomesial setae; merus trapezoidal, ventrally with 1 long and 1 short setae, dorsally with 2 robust sensory and 1 simple setae, and with 1 mesial simple seta; carpus broadest, moderately long, ventrally with 3 robust sensory and 6 simple setae, with 2 distomesial, 3 distolateral, 1 dorsal and 2 lateral simple setae, and with 3 mesial setulated scales; propodus ovate, as long as ischium, ventrally with 5 robust sensory and 5 simple setae, and with 7 dorsal, 5 mesial and 6 lateral simple setae; dactylus shorter than propodus, narrowest of all articles, with 2 lateral, 2 mesial and 1 dorsal setae, 1 long curved unguis, and 1 short acute accessory spine.

Pereopods 2 to 7 increasing in length posteriorly. Pereopod 2 (Fig. 10A) long and slender: basis without setae; ischium longer than basis, with 3 ventral, 2 mesial and 3 lateral setae; merus trapezoidal, dorsodistally with 1 long robust sensory and 1 simple setae, with 1 ventral, 1 mesial and 4 lateral simple setae; carpus about 2.3 times as long as basis, dorsally with 6 simple and 2 robust sensory setae, ventrally with 2 simple and 4 robust sensory setae; propodus longest article, about 1.1 times as long as carpus, ventrally with 5 simple and 8 robust sensory setae, dorsally with 7 simple, 2 robust sensory and 1 filoplume-like setae, and with 5 mesial and 4 lateral simple setae; dactylus the narrowest article; with 2 lateral and 2 mesial setae, 1 curved unguis, and 1 minute accessory spine. Pereopod 7 (Fig. 10B) long and slender: basis with 1 distoventral and 2 dorsal simple setae; ischium about 1.8 times as long as basis, with 2 ventral and 1 lateral simple setae; merus trapezoidal,

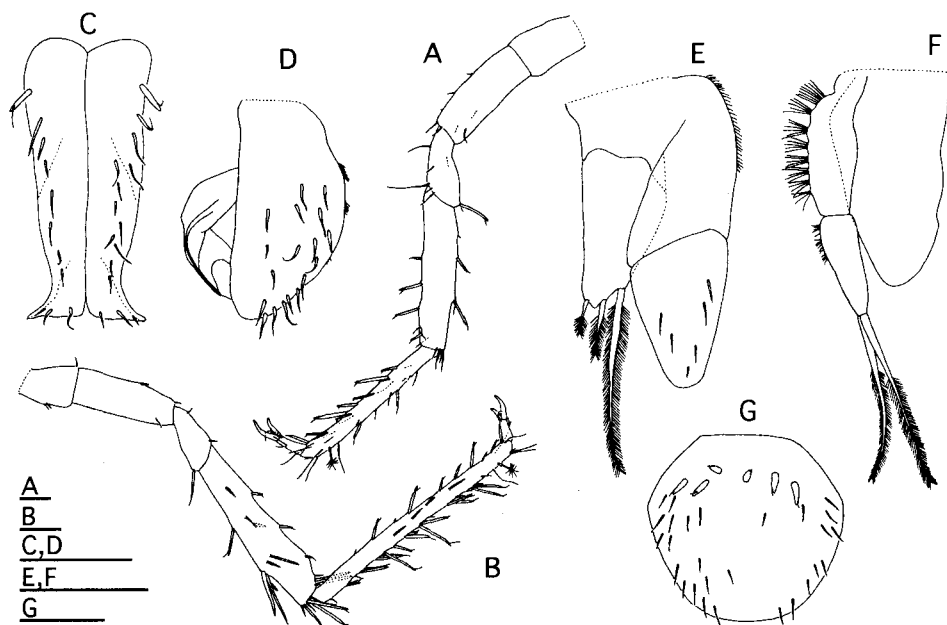


Fig. 10. *Munna tenuipes* Kussakin, 1962. A-E, male (ZIHU-02004); F, male (ZIHU-02003); G, female (ZIHU-02006): A, pereopod 2; B, pereopod 7; C, pleopod 1; D, pleopod 2; E, pleopod 3; F, pleopod 4; G, operculum. Scales=0.1 mm.

with 1 long dorsal robust sensory and 2 ventral simple setae; carpus about 3.2 times as long as basis, ventrally with 2 long and 4 short robust sensory setae, dorsally with 7 robust sensory and 3 simple setae, and with 1 mesial and 4 lateral setae; propodus longest article, about 4.7 times as long as carpus, ventrally with 7 robust sensory and 4 simple setae, dorsally with 17 robust sensory, 9 simple and 1 filoplume-like setae, and with 1 distomesial and 4 lateral setae; dactylus the narrowest article; with 2 dorsal and 1 lateral setae, 1 curved unguis, and 1 minute accessory spine.

Pleopod 1 (Fig. 10C) with a pair of laterally directed, long, stout projections, anterolaterally with 2 robust sensory setae, with 18 ventral and 6 posterodistal simple setae. Pleopod 2 (Fig. 10D) with broad protopod: protopod semicircular, lateral margin convex, bearing 13 ventral, 5 posterolateral long and some short fine setae; endopod with short, stout second article; exopod short. Pleopod 3 (Fig. 10E): endopod bearing 3 stout, plumose setae distally; exopod composed of 2 articles, broader than endopod; article 2 bearing 6 dorsal setae. Pleopod 4 (Fig. 10F): exopod narrow, distally with 2 long plumose setae, laterally with many long fine setae; endopod ovate and broad, without setae.

Female: Similar to male in morphology of all pereopodal appendages. Body about 1.6 times as long as maximum width. Pereopod 1 (Fig. 9K) shorter than pereopods 2-7: basis shorter than ischium, with 1 distoventral and 2 dorsal setae; ischium narrower than basis, bearing 2 ventral setae; merus trapezoidal, ventrally with 1 long and 1 short setae, dorsally with 2 robust sensory and 1 simple setae, and with 1 lateral simple seta; carpus broadest, moderately long, ventrally with 5 robust sensory setae and 2 simple setae, with 1 dorsal robust sensory seta and 2 lateral setulated scales; propodus ovate, as long as ischium, with 3 ventral, 4 dorsal, 5 mesial and 2 distolateral simple setae, ventrally with 3 robust sensory setae; dactylus shorter than propodus, narrowest of all articles, with 1 ventral, 2 dorsal and 2 lateral setae, 1 long curved unguis, and 1 short acute accessory spine. Operculum (Fig. 10G) circular, slightly broader than long, ventrally with 6 robust sensory and 27 simple setae.

Remarks

The present specimens were identified with *Munna tenuipes* Kussakin, 1962 from Okhotsk Sea in the following features: 1) body lacks conspicuous dorsal and lateral setae; 2) carpus of pereopod 1 is moderately long; 3) antenna 2 and pereopods 2-7 are long and slender; 4) pleotelson is unarmed with marked dorsal and lateral robust sensory setae.

The male pleopod 1 is identical in shape with that of holotype. Although the male pleopod 1 of the Japanese specimens is identical in shape with that of the type material, its chaetotaxy differs between the two: the former possesses a pair of anterolateral robust sensory setae and many ventral simple setae, while the latter has several ventral simple setae and no robust sensory setae. Some minor differences between the Japanese and type materials were newly discovered as follows (those of original in parentheses): many setulated scales on articles 2 and 3 of mandibular palp (without scales), 3 setae on article 1 of mandibular palp (1 seta), many articles of flagellum of antenna 2 (moderately little), and broad peduncular articles 1 and 2 of antenna 1 (moderately slender). Based on the Japanese specimens, additional nine characters, namely, right mandible, maxillae 1 and 2, female pereopod 1, epipod of maxilliped, pereopod 2, pleopods 3 and 4 and operculum, were newly described with illustrations.

Distribution in Japan: Hokkaido, Iwate.

Genus *Uromunna* Menzies, 1962

Uromunna serricauda Müller, 1992

(Figs. 11-12)

Uromunna serricauda Müller, 1992: 220-225; Shimomura *et al.*, 2001: 3.

Material Examined

1 male, 0.8 mm (ZIHU-02009), 1 ovig. female, 1.0 mm (ZIHU-02010), 9 non-ovig females, 0.8–1.0 mm, on seaweeds, OSH1; 10 males, 0.5–1.0 mm, 13 ovig. females, 0.8–1.0 mm, 16 non-ovig. females, 0.8–1.0 mm, on seaweeds, OSH2; 1 male, 0.6 mm, on seaweeds, CHI2; 1 ovig. female, 1.0 mm, on seagrasses, OSH5; 1 ovig. female, 1.0 mm, 4 non-ovig. females, 0.5–1.0 mm, on stones, OAR; 1 ovig. female, 0.8 mm, 1 female, 0.6 mm, on stones, MIS; 2 ovig. females, 0.9 mm, 1.0 mm, sand and seaweeds, MIH; 3 males, 0.6–0.8 mm, 6 ovig. females, 0.8–1.0 mm, 5 non-ovig. females, 0.5–1.0 mm, on seaweeds, SHM; 1 male, 0.9 mm (ZIHU-02011), 5 males, 0.5–1.1 mm, 7 ovig. females, 0.9–1.2 mm, 10 non-ovig. females, 0.4–1.2 mm, sand, SHR1; 1 male, 0.8 mm (ZIHU-02007), 1 ovig. female, 1.0 mm (ZIHU-02008), sand, MUK1; 15 males, 0.5–1.0 mm, 20 ovig. females, 0.8–1.4 mm, 15 non-ovig. females, 0.5–1.2 mm, on seaweeds, MUK2; 1 ovig. female, 0.8 mm, on seaweeds, MUK3; 1 male, 0.9 mm, sand, OTS2; 1 ovig. female, 1.0 mm, sand and mud, OTS1.

Description

Male: Body (Fig. 11A) about 1.9 times as long as maximum width. Head about 1.9 times as broad as long, slightly broader than pereonite 1; frontal margin of head nearly straight, with some short simple setae; labrum surpassing head anteriorly; posterior margin of head convex between eyestalks. Preocular lobes narrow, without setae. Eyestalks short and stout. Pereonites 1–7 laterally rounded, each with some lateral setae. Pereonite 1 short; pereonite 2 slightly longer than pereonite 1; pereonite 3 about 1.6 times as long as pereonite 2; pereonite 4 as long as pereonite 3; pereonites 5 to 7 increasing in length. Pereonites 1 and 2 subequal in width; pereonite 3 slightly broader than pereonite 2; pereonite 4 widest; pereonites 5 to 7 decreasing in width. Coxal plates dorsally visible on pereonites 2–7, each with some lateral fine setae. Pleonite narrow, shorter than pereonite 7, without dorsal setae. Pleotelson ovate, about 1.3 times as long as broad, with some dorsal, lateral fine setae and 3 pairs of lateral short teeth. Uropod (Fig. 11C) biramous: dorsal ramous minute, bearing single long seta apically; ventral ramous cylindrical, with 2 simple and 2 filoplume-like setae.

Antenna 1 (Fig. 11D) with 4-articulate peduncle and 2-articulate flagellum. Peduncular article 1 as broad as article 2, with 1 distolateral filoplume-like seta; article 2 longest, with 5 simple and 1 filoplume-like setae; article 3 narrow, without setae; article 4 slightly shorter than article 3, with 1 distomesial simple seta. Flagellar article 1 2.1 times as long as peduncular article 4, without setae; article 2 shorter than article 1, apically bearing 1 aesthetasc and 5 simple setae.

Antenna 2 (Fig. 11E) moderately short, with peduncle composed of 6 articles: article 1 not visible dorsally; article 2 without setae; article 3 as broad as article 2, with 1 distomesial seta; article 4 with 1 distomesial and 1 lateral setae; article 5 narrower than article 4, with 1 mesial, 2 lateral and 1 distodorsal short setae; article 6 longest, with 2 distomesial, 2 lateral and 6 dorsal setae. Flagellum composed of 11 articles, longer than peduncular article 6, each with some setae.

Left mandible (Fig. 11F) consisting of palp, incisor and molar processes, lacinia mobilis and spine row: 1 simple seta arising from its base. Palp 3-articulated: article 1 with 1 mesial seta; article 2 without setae; article 3 minute, apically with 2 pectinate setae. Incisor with 2 cusps; lacinia mobilis with 4 teeth; spine row with 3 spines; molar process stout, without setae. Right mandible (Fig. 11G) lacking lacinia mobilis: 1 simple seta arising from its base. Palp 3-articulated: article 1 with 1 mesial setae; article 2 without setae; article 3 minute, apically with 2 pectinate setae. Incisor with 2 cusps; spine row with 4 spines; molar process stout, without setae.

Maxilla 1 (Fig. 11H) with inner lobe bearing 4 apical robust and 6 lateral fine setae; outer lobe apically with 11 robust setae. Maxilla 2 (Fig. 11I) with inner lobe with 5 apical and 4 mesial robust setae; outer 2 lobes each with 4 apical robust setae.

Maxilliped (Fig. 11J) with palp composed of 5 articles; article 1 narrower than article 2, without setae; article 2 trapezoidal, about 1.5 times as long as article 1, with 1 lateral and 2 mesial

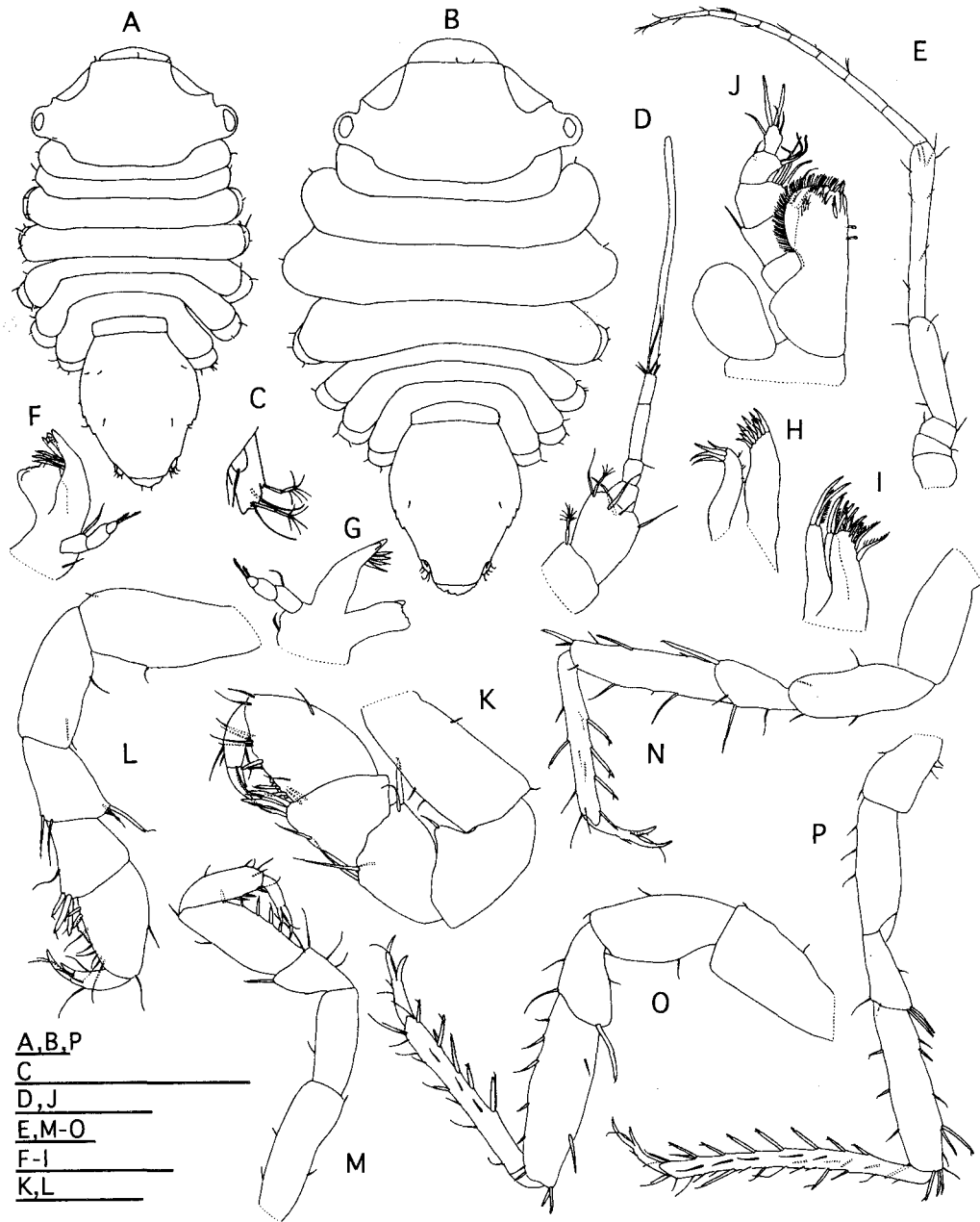


Fig. 11. *Uromunna serricauda* Müller, 1992. A, C-H, K, male (ZIHU-02009); B, L, female (ZIHU-02010); I, M, O, P, male (ZIHU-02007); J, male (ZIHU-02011); N, female (ZIHU-02008): A, male habitus; B, female habitus; C uropod; D, antenna 1; E, antenna 2; F, left mandible; G, right mandible; H, maxilla 1; I, maxilla 2; J, maxilliped; K, pereopod 1; L, pereopod 1; M, pereopod 2; N, pereopod 2; O, pereopod 3; P, pereopod 7. Scales=0.1 mm.

setae; article 3 as long as article 2, with 3 mesial setae; article 4 shorter than article 3, with 1 lateral and 2 mesial setae; article 5 narrowest, shorter than article 4, with 1 lateral, 1 mesial and 3 apical setae; endite moderately narrow, bearing many dorsal short fine, 1 subdistal fan-shaped setae and

2 subdistal, 2 distal pectinate setae, with many lateral and distal short setae, 2 mesial coupling hooks; epipod ovate, narrower than endite, with rounded apex.

Pereopod 1 (Fig. 11K) shorter than pereopods 2-7: basis longest, with 2 ventral and 2 dorsal setae; ischium shorter than basis, bearing 1 dorsal seta; merus shorter than ischium, dorsally with 1 robust sensory and 1 simple setae, and with 2 ventral long and 1 lateral setae; carpus broadest, short, ventrally with 3 robust sensory setae and 1 simple seta, and with 2 lateral simple setae; propodus ovate, shorter than ischium, ventrally with 3 robust sensory, 5 simple setae and 1 short scale, and with 3 dorsal and 1 mesial simple setae; dactylus shorter than propodus, narrowest of all articles, with 1 ventral, 2 dorsal, 1 lateral and 1 mesial setae, 1 long curved unguis, and 1 short acute accessory spine.

Pereopods 2 to 7 increasing in length posteriorly. Pereopod 2 (Fig. 11M) short and robust: basis longest article, with 2 ventral and 2 dorsal setae; ischium shorter than basis, with 1 ventral seta; merus trapezoidal, with 4 simple and 1 long distodorsal robust sensory setae; carpus short and stout, shorter than basis, with 5 ventral robust sensory and 2 simple setae; propodus short and stout, shorter than carpus, ventrally with 1 simple and 3 robust sensory setae, with 4 dorsal and 1 lateral simple setae; dactylus the narrowest article; with 1 mesial seta, 1 curved unguis, and 1 minute accessory spine. Pereopod 3 (Fig. 11O) moderately long: basis with 2 ventral simple setae; ischium as long as basis, with 2 ventral and 1 dorsal simple setae; merus trapezoidal, dorsally with 1 robust sensory and 1 simple setae, and with 2 ventral simple setae; carpus about long and stout, about 1.2 times as long as basis, ventrally with 5 robust sensory and 2 simple setae, and with 2 distodorsal, 1 lateral robust sensory setae and 1 lateral simple seta; propodus longest article, slender, about 1.3 times as long as carpus, ventrally with 6 robust sensory and 1 simple setae, dorsally with 1 robust sensory and 8 simple setae, and with 1 lateral robust sensory and 2 lateral simple setae; dactylus the narrowest article; with 2 dorsal and 1 lateral setae, 1 curved unguis, and 1 minute accessory spine. Pereopod 7 (Fig. 11P) long and slender: basis short, with 2 ventral and 3 dorsal simple setae; ischium about 1.5 times as long as basis, with 3 ventral simple setae; merus trapezoidal, dorsally with 2 long robust sensory and 1 simple setae, and with 1 distoventral and 1 distomesial simple setae; carpus about 1.9 times as long as basis, dorsally with 6 robust sensory and 4 simple setae, and with 4 ventral robust sensory setae; propodus longest article, slender, about 1.6 times as long as carpus, ventrally with 8 robust sensory and 2 simple setae, dorsally with 3 robust sensory and 12 simple setae, and with 5 lateral and 4 mesial simple setae; dactylus the narrowest article; with 1 dorsal, 1 mesial and 1 lateral setae, 1 curved unguis, and 1 minute accessory spine.

Pleopod 1 (Fig. 12A) without posterolateral projections, tapering to apex, with 4 mesiolateral

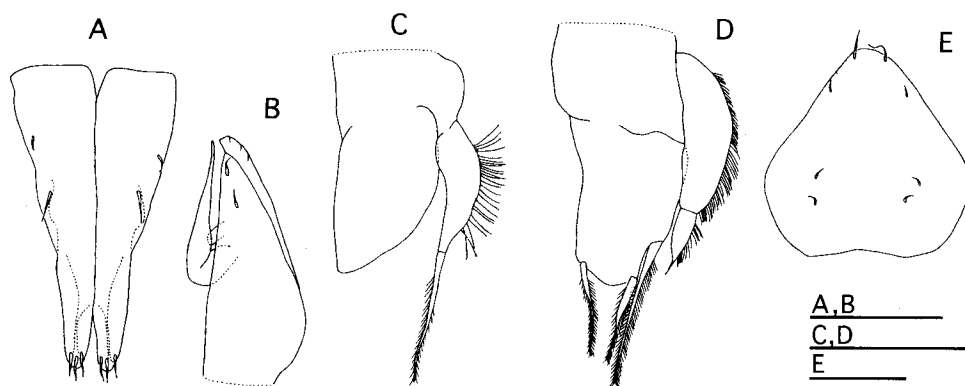


Fig. 12. *Uromunna serricauda* Müller, 1992. A, C, D, male (ZIHU-02009); B, male (ZIHU-02007); A, pleopod 1; B, pleopod 2; C, pleopod 3; D, pleopod 4; E, operculum. Scales=0.1 mm.

and 6 subapical simple setae. Pleopod 2 (Fig. 12B): protopod broad and lanceolate, lateral margin convex, bearing 1 subapical and 1 ventral simple setae, laterally with broad fringe; endopod with short and slender second article; exopod narrow. Pleopod 3 (Fig. 12D): endopod bearing 3 stout, plumose setae distally; exopod composed of 2 articles, narrower than endopod, laterally with many fine setae; article 2 narrow, with pointed apex. Pleopod 4 (Fig. 12C): exopod narrow, distally with 1 long plumose seta, laterally with many long fine setae; endopod ovate and broad, without setae.

Female: Similar to male in morphology of all pereoneal appendages except for pereopod 2. Body (Fig. 11B) about 1.6 times as long as maximum width. Pereonite 1 short; pereonite 2 about 2.6 times as long as pereonite 1; pereonite 3 about 1.2 times as long as pereonite 2; pereonite 4 shorter than pereonite 3; pereonites 5 to 7 increasing in length. Pereonites 1 narrow; pereonite 2 broader than pereonite 1; pereonite 3 widest; pereonite 4 narrower than pereonite 5; pereonites 5 to 7 decreasing in width. Pereopod 1 (Fig. 11L) shorter than pereopods 2-7: basis longer than ischium, with 1 distoventral and 1 dorsal setae; ischium shorter than basis, bearing 2 dorsal and 1 lateral setae; merus trapezoidal, dorsally with 1 robust sensory and 2 simple setae, and with 2 long ventral simple setae; carpus broadest, short, ventrally with 3 robust sensory and 1 simple setae; propodus ovate, shorter than ischium, with 2 dorsal simple setae, ventrally with 2 robust sensory and 6 simple setae, 1 broad fringe; dactylus shorter than propodus, narrowest of all articles, with 1 ventral, 1 dorsal, 1 mesial and 2 lateral setae, 1 long curved unguis, and 1 short acute accessory spine. Pereopod 2 (Fig. 11N) long and slender: basis short, without setae; ischium about 1.1 times as long as basis, with 2 ventral, 1 dorsal and 1 mesial simple setae; merus trapezoidal, dorsally with 1 long robust sensory seta, and with 1 distoventral long, 1 ventral short and 1 distolateral simple setae; carpus about 1.2 times as long as basis, dorsally with 2 robust sensory and 3 simple setae, ventrally with 2 long and 2 short setae; propodus longest article, slender, about 1.1 times as long as carpus, ventrally with 4 robust sensory setae, dorsally with 1 robust sensory and 3 simple setae, and with 1 lateral and 4 mesial simple setae; dactylus the narrowest article; with 1 dorsal, 1 mesial and 1 lateral setae, 1 curved unguis, and 1 minute accessory spine. Operculum (Fig. 12E) pentagonal-shaped, as long as broad, with 6 ventral and 2 subapical setae.

Remarks

Features from which the present specimens were identified with *Uromunna serricauda* Müller, 1992 from Malaysia were as follows: presence of lateral teeth on pleotelson, 3 pairs of apical setae of pleopod 1, and minute dorsal ramus of uropod, all of which were originally listed as the diagnostic characters of the species with illustrations (Müller, 1992). Some minor differences were found between the present and type specimens as follows (those of type specimens in parentheses): dorsally invisible coxal plates of female pereonites 2 and 3 (dorsally visible), 4 ventral setae on male pleopod 1 (without ventral setae), 6 ventral and 2 apical setae on operculum (4 ventral and 2 apical setae), narrow article 2 of exopod of pleopod 3 (broad) and broad endopod of pleopod 4 (narrow).

Distribution in Japan: Hokkaido, Iwate, Ibaraki, Kanagawa, Shizuoka, Wakayama, Hiroshima.

Acknowledgements

We thank captain and the crew of Toyoshio-maru, Hiroshima University for their kind cooperation on collecting specimens. Many thanks are given to Dr. H. Ariyama, Osaka Prefectural Fisheries Experimental Station, Mr. T. Iseto, University of the Ryukyus, Mr. N. Saito, Suido-sha Co. Ltd., and Dr. G. Takaku, Mr. T. Kato and Dr. Y. Takashima, Hokkaido University for providing samples. Sincere thanks are offered to Dr. S. Ohtsuka of Hiroshima University, Miss H. Ikezawa of Ibaraki Nature Museum and Dr. N. Kaneko of the National Institute of Advanced Industrial Science and Technology, for their kind assistance in our field work. We wish to thank the staffs of the Akkeshi Marine Biological Station and Oshoro Marine Biological Station, Hokkaido University, the Mukaishima Marine Biological Station, Hiroshima University and the Otsuchi Marine Research Center, The University of Tokyo, and the Seto Marine Biological

Laboratory, Kyoto University, for providing facilities. Thanks are also due to two anonymous referees for their valuable comments in this manuscript. This work partly was supported by the Sasakawa Scientific Research Grant from The Japan Science Society.

References

- Fee, A. R. 1926. The Isopoda of Departure Bay and vicinity, with descriptions of new species, variations and color notes. Contributions to Canadian Biology and Fisheries, 3 (1/8): 15-34.
- Gamô, S., Sugiura, Y., Takeda, M., Minegishi, H. and Irimura, S. 1980. Notes on some invertebrates (hydromedusae, turbellarians, decapod and some lower crustaceans, and ophiuroids) from Otsuchi Bay and its vicinity. Otsuchi Marine Research Center Report, 6: 25-32 (In Japanese).
- Gurjanova, E. F. 1933. Contributions to the Isopoda-Fauna of the Pacific. Gnathiidea and Asellota. Issledovaniia Morei SSSR, 19: 79-91 (In Russian).
- Gurjanova, E. F. 1936a. Beiträge zur Kenntnis der Isopodenfauna des Pazifischen Ozeans. IV. Neue Isopodenarten aus dem Japanischen und Bering-meer. Zoologischer Anzeiger, 114(9/10): 250-265.
- Gurjanova, E. F. 1936b. Crustaceans. Isopoda des mers Orientals. Faune de L'URSS., 7(3): 1-279 (In Russian with German summary).
- Gurjanova, E. F. 1950. K faune ravnogich rakov (Isopoda) Tichogo okeana V. Isopod po sboram Kamchatskoi morskoi stasii Gosudarsevnenogo gidrologischskogo in-ta. Akademiya Nauk SSSR. Zoologicheskii Instituta, Issledovaniia dal Nevostochnykh Morei SSSR, 2: 281- 292 (In Russian).
- Hatch, M. H. 1947. The Chelifera and Isopoda of Washington and adjacent regions. University of Washington Publications in Biology, 10 (5): 155-274.
- Kikuchi, T. 1968 Faunal list of the *Zostera marina* belt in Tomioka Bay, Amakusa, Kyushu. Publications of Amakusa Marine Biological Laboratory, 1 (2): 163-192.
- Kussakin, O. G. 1962. On the fauna of Munnidae (Isopoda, Asellota) from the Far-Eastern seas of the USSR. Trudy Zoologicheskogo Instituta Akademii Nauk USSR, 30: 66-109 (In Russian).
- Kussakin, O. G. 1972. Isopoda from the coastal zone of the Kurile Islands. II. Some data on the Munnidae mainly from the middle Kuriles. Crustaceana, Supplement, 3: 165-177.
- Kussakin, O. G. 1974. Fauna and Ecology of isopods (Crustacea) from the intertidal zone of the Kurile Islands. Transactions of the Academy of Science of the USSR, Far East Center, Institute of Marine Biology, 1: 227-275 (In Russian with English summary).
- Kussakin, O. G. 1975. A list of the macrofauna in the intertidal zone of the Kurile Islands, with remarks on zoogeographical structure of the region. Publications of the Seto Marine Biological laboratory, 22(1/4): 47-74.
- Kussakin, O. G. 1979. On the isopod crustaceans (Isopoda) of the Sea of Okhotsk. Investigations of Pelagic and Bottom Organisms from, the Far- Eastern Seas. Transactions, Akademiya Nauk CCCP, Dal'nevostochnyi Nauchyi Tsentr. Far East Science Center, Vladivostok, 15: 106-122 (In Russian).
- Kussakin, O. G. and Mezhev, B. V. 1979. Isopod Crustacea of the sublittoral and the upper bathyal zone of the Kurile Islands. In: Kussakin, O. G. (ed.), Biology of the Shelf of the Kurile Islands. Academy of Sciences, USSR, Far East Center, pp. 125-199 (In Russian).
- Kussakin, O. G. 1988. Marine and brackish-water Crustacea (Isopoda) of cold and temperate waters of northern hemisphere. Vol. 3, Suborder Asellota Part 1. Opredeliti Faune S. S. R. Academy of Science, U. S. S. R., Leningrad, 152: 1-500.
- Menzies, R. J. 1952. Some marine asellote isopods from Northern California, with descriptions of nine new species. Proceedings of the United States National Museum, 102 (3293): 117-159.
- Menzies, R. J. 1962. The zoogeography, ecology, and systematics of the Chilean marine isopods. Lunds Universitets Arsskrift, N. F., 2 (57): 1-162.
- Mezhov, B. V. 1981. Isopoda. Benthos of the Submarine mountains Marcus-Necker and adjacent Pacific regions. Academy of Sciences of the U. S. S. R., P. P. Shirshov Institute of Oceanology, 4-29 (In Russian).
- Müller, H.-G. 1990. Two new species and a new genus of coral-reef-inhabiting Munnidae from Bora Bora and Moorea, Society Islands (Crustacea: Isopoda). Revue Suisse de Zoologie, 97 (2): 361-371.
- Müller, H.-G. 1992. *Uromunna serricauda*, a new species of asellote isopod crustacean from a coral reef

- in the Tioman Archipelago. *Zoologischer Anzeiger*, 229 (5/6): 219-226.
- Nunomura, N. 1987. Marine Isopod Crustaceans recorded from Otsuchi Bay and the adjacent Sanriku Coast. *Otsuchi Marine Research Center Report*, 13: 1-5 (In Japanese).
- Nunomura, N. 1995. Isopoda. In: Nishimura S. (ed.) *Guide to Seashore Animals of Japan with Color Pictures and Keys II*, pp. 205-233.
- Poore, G. C. B. 1984. Redefinition of *Munna* and *Uromunna* (Crustacea: Isopoda: Munnidae), with descriptions of five species from coastal Victoria. *Proceedings of the Royal Society of Victoria*, 96: 61-81.
- Sars, G. O. 1866. Beretning om en i Sommeren 1865 foretagen zoologisk Reise ved Kysterne af Christianias og Christianssands Stifter. *Christiania*, 47 pp.
- Shimomura, M. and Mawatari, S. F. 1999. *Paramunna rhipis*, a new species of asellote isopod (Paramunnidae) from Japan. *Crustacean Research*, 28: 153-159.
- Shimomura, M., Kato, T. and Kajihara, H. 2001. Records of some marine invertebrates (nemerteans, asellotes and phyllodocids) from the coast around Otsuchi Bay. *Otsuchi Marine Science*, 26 (in press).
- Schultz, G. A. 1969. How to know the marine isopod crustaceans. Wm. C. Brown Company Publishers, pp. 359.
- Wilson, G. D. F. 1980. New insights into the colonization of the deep sea: Systematics and zoogeography of the Munnidae and Pleurogoniidae comb. nov. (Isopoda; Janiroidea). *Journal of Natural History*, 14: 215-236.
- Winkler, H. 1992. On two Magellanic; a new species of *Munna* and *Uromunna nana* (Nordenstam, 1933) (Crustacea: Isopoda: Asellota). *Journal of Natural History*, 26: 311-326.
- Wolff, T. 1962. The systematics and biology of bathyal and abyssal Isopoda Asellota. *Galathea Report*, 6: 1-320.