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ORIGINAL ARTICLE

First report of Hyssuridae (Isopoda: Anthuroidea) from Japan, with the description of a new *Kupellonura* species

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ABSTRACT

We describe *Kupellonura tamago* sp. nov., collected from the North Pacific off the southern coast of the Boso Peninsula, Japan, at a depth of 445–407 m. This is the first record of Hyssuridae not only for Japan but also for the Temperate Northern Pacific ecoregion. Female *K. tamago* closely resembles *Kupellonura gidgee* Poore and Lew Ton, 1988 and *Kupellonura indonesica* Annisaqois and Wägele, 2021 in the shape of the uropodal exopod but differs from them in having a broader uropodal exopod (length/width ratio 1.47), a broader uropodal endopod (length/width ratio 1.64), and the telson margins smooth. We transfer *Kupellonura flexibilis* (Pasternak, 1982), originally described in *Ananthura* Barnard, 1925 but provisionally transferred to *Kupellonura* Barnard, 1925, to *Anthelura* Norman and Stebbing, 1886 in Antheluridae, as *Anthelura flexibilis* (Pasternak, 1982) comb. nov.

KEYWORDS

Crustacea, Cymothoida, deep sea, new combination, taxonomy

INTRODUCTION

Species in the anthuroid isopod family Hyssuridae are distinguished from members in the other families by having (1) elongate pleonites 1–5, (2) similar, non-operculiform pleopods 1–5, and (3) the carpi of pereopods 2–3 strongly produced ventrodistally (Poore, 2001). This family currently comprises 41 species in six genera: *Belura* Poore and Lew Ton, 1988 (2 species); *Galziniella* Müller, 1991 (1 species); *Hyssura* Norman and Stebbing,

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1886 (7 species); *Kupellonura* Barnard, 1925 (18 species); *Neohyssura* Amar, 1953 (6 species); and *Xenanthura* Barnard, 1925 (7 species) (Poore and Bruce, 2012; Annisaqois and Wägele, 2021).

Kupellonura is the most species-rich hyssurid genus and differs from the other five genera by combining the following characters: (1) the uropodal exopod longer than wide, (2) the uropodal exopod and telson without cuticular spine, (3) the carpi of pereopods 4–7 trapezoidal, with 1 marginal spiniform seta, and (4) the pleopod 1 endopod longer and broader than the exopod (Poore, 2001). At present, *Kupellonura* species have been reported from the intertidal zone to 2,829 m depth, from all marine ecoregions except the Arctic, Temperate Northern Pacific, Tropical Eastern Pacific, and Temperate South America (Poore, 2001; Poore and Bruce, 2012; Annisaqois and Wägele, 2021; cf. Spalding *et al*., 2007) (but see the Remarks section for *Kupellonura* below).

Here we describe a new species of *Kupellonura* collected in the North Pacific off the southern coast of the Boso Peninsula, Japan, at a depth of 445–407 m. This is the first record of Hyssuridae not only for Japan but also for the Temperate Northern Pacific ecoregion. In addition, we transfer *Kupellonura flexibilis* (Pasternak, 1982) to the genus *Anthelura* Norman and Stebbing, 1886 in Antheluridae.

Material and Methods

Our specimen was collected in 2003 off the southern coast of Boso Peninsula, Japan, with a biological dredge having a 1 m opening, during cruise KT03-17 of RV "Tansei-maru", and fixed and preserved in 70 % ethanol. The methods used for dissection, preparation of slides, light microscopy, and drawing were as described by Shiraki *et al.* (2021). Body length was measured from the tip of the anterolateral lobe of the head to the tip of telson, and body width at the widest portion of pereonite 7. Measurements were made axially from digital images by using ImageJ (http://rsb.info.nih.gov/ij). We treated non-manca individuals without oostegites or appendix masculina as females lacking oostegites. The material examined is deposited in the collections of the Seto Marine Biological Laboratory (SMBL), Wakayama, Japan.

Systematics

Superfamily Anthuroidea Leach, 1814

Family Hyssuridae Wägele, 1981

Genus *Kupellonura* Barnard, 1925

Type species. Kupellonura mediterranea Barnard, 1925

Diagnosis. See Poore (2001).

Remarks. Kupellonura flexibilis was described from the Mediterranean as *Ananthura flexibilis* Pasternak, 1982. Negoescu (1984) provisionally transferred it to *Kupellonura*, but noted that this species does not show some of the features diagnostic for *Kupellonura*; its short pleonites 1–5 and the operculiform pleopod 1 contradict even the familial diagnosis of Hyssuridae. Here we transfer this species to *Anthelura* in Antheluridae as *Anthelura flexibilis* (Pasternak, 1982) comb. nov., based on the following features: (1) pleonites 1–5 free, (2) broad maxillipedal palp, (3) pereopods 4–7 carpi much longer than wide, and (4) pereopod 1 merus broader than the propodus (cf. Poore, 2001). This species differs from the sole congener *Anthelura elongata* Norman and Stebbing, 1886 in the number of articles in the antennal flagellum, which are eight in *A. flexibilis* but seven in *A. elongata* (see Pasternak, 1982; Negoescu, 1984; Poore, 2001). This changes the deepest record for *Kupellonura* to 1,141 m (Negoescu, 2006), reported for *Kupellonura cryosi* Negoescu, 2006.

Species composition. Eighteen species: *Kupellonura afareaitu* Müller, 1991; *Kupellonura biriwa* Poore and Lew Ton, 1988; *Kupellonura capensis* (Kensley, 1975); *Kupellonura caudoserrata* Negoescu, 1994; *K. cryosi*; *Kupellonura currawan* Poore and Lew Ton, 1988; *Kupellonura formosa* (Menzies and Frankenberg, 1966); *Kupellonura gidgee* Poore and Lew Ton, 1988; *Kupellonura imswe* (Kensley, 1982); *Kupellonura indonesica* Annisaqois and Wägele, 2021; *Kupellonura macaroni* Annisaqois and Wägele, 2021; *Kupellonura marrongie* Poore and Lew Ton, 1988; *Kupellonura mediterranea* Barnard, 1925 (type species); *Kupellonura proberti* Wägele, 1985; *Kupellonura racovitzai* George

and Negoescu, 1985; *Kupellonura serritelson* Wägele, 1981; *Kupellonura tamago* sp. nov.; and *Kupellonura werawera* Poore and Lew Ton, 1988.

Kupellonura tamago sp. nov.

[New Japanese name:
Tamago-haranaga-uminanafushi]
(Figs. 1–4)
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Etymology. The specific name is derived from the Japanese noun *tamago* ("egg"), referring to the oval shape of uropodal exopod.

Diagnosis. Eyes present. Telson margins smooth. Length of antennular flagellum article 2, 2.50 times width. Margins of uropodal endopod smooth, without serrations. Length of uropodal exopod 1.47 times width, oval, widest at proximal third; inner margin smooth, without serration or crenulation; outer margin not concave.

Type material. Holotype: female without oostegites (SMBL-V0638, 14 slides and 1 vial; body length 6.79 mm, body width 0.44 mm, head length 0.38 mm, head width 0.38 mm, eye length 0.04 mm); 34°57.091'N 140°07.774'E to 34°57.404'N 140°07.626'E, Stn. KG-4, off the southern coast of the Boso Peninsula, Japan, Northern Pacific, 445–407 m depth; 17 November 2003; collected by M. Shimomura.

Description of female holotype. Body length (Figs. 1, 2A–E) 15.31 times body width, slender, without dorsal pigmentation in fixed specimen. Head length (Fig. 2A) 1.00 times head width; rostrum protruding as much as anterolateral lobes; eyes dorsolateral, small; length ratio of eye to head, 0.04. Pereonites 1–7 (Fig. 2A–C) with length ratio 1.00:1.22:1.25:1.65:1.74:1.74:1.57. Pleonites 1–6 (Fig. 2D) articulated, with length ratio 1.00:1.04:0.99:0.93:1.08:0.93; combined length pleonites 1–6, 0.19 times body length; pleonites 1–4 with several lateral plumose setae. Telson (Fig. 4H) oval, margins smooth, with simple seta laterally and 16 distal simple setae.

Antennula (Fig. 2F) with three peduncular articles and four flagellar articles. Peduncular article 1 longest, with outer simple seta; article 2 with 2 outer distal plumose sensory setae, and 1 outer distal, 1 mid-dorsal, and 1 inner distal simple seta; article 3 with 5 distal simple setae. Flagellar article 1 with distal plumose sensory seta; article 2 length 2.50 times width, naked; article 3 naked; article 4 with 2 outer distal simple setae and prominent aesthetasc.

Figure 1. *Kupellonura tamago* sp. nov., holotype, female, lateral view of fixed specimen. Scale bar: 1 mm

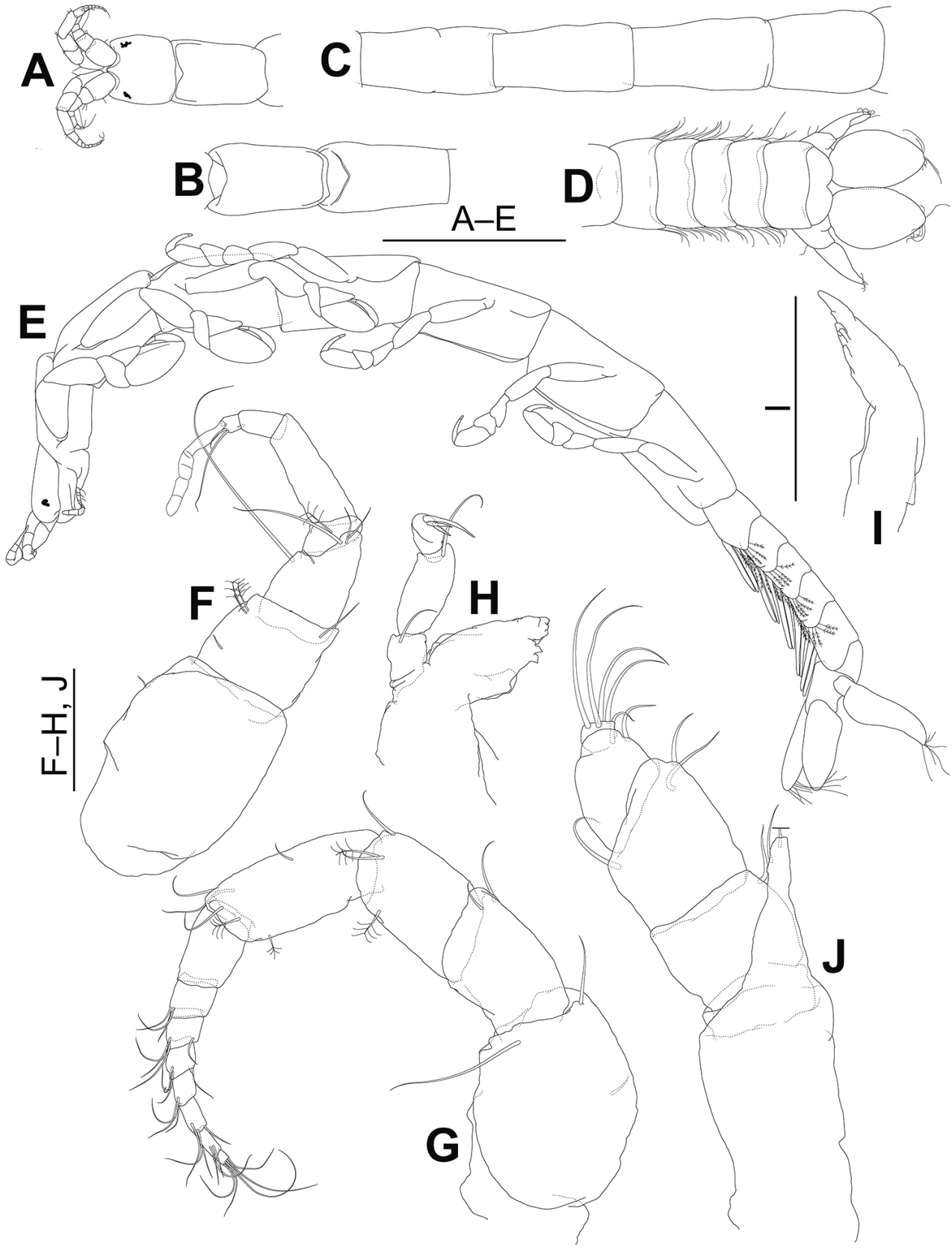

Figure 2. *Kupellonura tamago* sp. nov., holotype, female. **A–D**, dorsal view; **E**, lateral view. **A**, head and pereonite 1; **B**, pereonites 2 and 3; **C**, pereonites 4–7; **D**, pleon; **E**, body; **F**, left antennula; **G**, right antenna; **H**, right mandible; **I**, maxilla; **J**, left maxilliped. Scale bars: 1 mm (**A–E**); 100 µm (**F–J**).

Antenna (Fig. 2G) with 5 peduncular articles and 8 flagellar articles. Peduncular article 1 naked; article 2 with 2 distal and 1 inner middle simple seta; article 3 with 2 inner distal simple setae; article 4 with 1 outer and 1 distal plumose sensory seta and 2 distal simple setae; article 5 with one outer and 1 distal plumose sensory seta, and 1 inner middle and 3 distal simple setae. Flagellar articles 1–8 with 0, 3, 4, 4, 3, 4, 3, and 5 distal simple setae, respectively.

Mandible (Fig. 2H) with tri-articulate palp. Palp article 1 with distal simple seta; article 2 longest, with distal simple seta; article 3 with 3 distal spiniform setae. Incisor with 2 cusps; lamina dentata with 2 teeth, molar rounded.

Maxilla (Fig. 2I) with 1 strong and 5 smaller distal teeth.

Maxilliped (Fig. 2J) with 5-articulate palp. Palp article 1 naked; article 2 with inner distal simple seta; article 3 with 3 distal simple setae; article 4 with 2 distal simple setae; article 5 with 4 distal simple setae. Endite overreaching distal margin of palp article 2, with distal simple seta and distal seta (tip broken).

Pereopod 1 (Fig. 3A) subchelate, robust. Basis with ventrodistal simple seta. Ischium with 1 dorsal and 1 ventrodistal simple seta. Merus with 2 dorsodistal and 3 ventrodistal simple setae. Carpus triangular, not produced ventrodistally, with 1 ventroproximal and 1 ventrodistal transparent membrane-like process, and 2 ventral spiniform setae and 2 subdistal simple setae. Propodus broad, with inner spiniform seta, and 1 outer proximal, 3 dorsodistal, and 1 ventrodistal simple seta. Palm with 1 ventroproximal and 1 mid-ventral transparent membrane-like process, 2 ventral spiniform setae, and 2 ventro-subproximal and 3 ventro-subdistal simple setae. Dactylus with ventrodistal short spiniform seta and 1 mid-ventral, 5 subdistal, and 3 distal simple setae. Unguis naked, length nearly two-thirds dactylus length.

Pereopod 2 (Fig. 3B) subchelate, as robust as pereopod 1. Basis with dorsal plumose sensory seta, and 2 dorsal and 2 ventral simple setae. Ischium with ventrodistal simple seta. Merus with dorsodistal spiniform seta, and 1 dorsodistal and 3 ventrodistal simple setae. Carpus triangular, with ventrodistal prolongation, 1 ventroproximal and 1 ventrodistal transparent membrane-like process, 1 mid-ventral and 1 ventrodistal spiniform seta, and 1 outer and 3 ventral simple setae. Propodus with dorsal plumose sensory seta and 2 subproximal, 2 dorsal, and 3 dorsodistal simple setae. Palm with 1 ventroproximal, 1 mid-ventral, and 1 ventro-subdistal transparent membrane-like process, mid-ventral two-pronged spiniform seta, 1 ventro-subproximal and 1 ventro-subdistal spiniform seta, and 3 ventro-subdistal simple setae. Dactylus with 2 middle and 6 distal simple setae. Unguis naked, length nearly half dactylus length.

Pereopod 3 (Fig. 3C) subchelate, similar to pereopod 2 except in number of simple setae.

Pereopod 4 (Fig. 3D) with basis, ischium, merus similar to those of pereopod 3 but narrower and bearing different numbers of plumose sensory setae and simple setae. Carpus trapezoidal, with 4 small ventral processes, ventrodistal spiniform seta, dorsodistal plumose sensory seta, and 1 dorsodistal and 4 ventral simple setae. Propodus with dorsodistal plumose sensory seta and 2 dorsodistal simple setae. Palm with several small ventral processes, ventrodistal spiniform seta, and 1 inner and 4 ventrodistal simple setae. Dactylus narrow, with 1 ventro-subproximal, 1 dorso-subdistal, and 9 distal simple setae. Unguis naked, length nearly one-quarter dactylus length.

Pereopods 5–7 (Fig. 3E–G) similar to pereopod 4, except for number of plumose sensory setae and simple setae.

Pleopod 1 (Fig. 4A) protopod with 2 inner hooks and outer simple seta. Exopod not operculiform, length 1.82 times width, with 22 plumose setae (one broken). Endopod length 1.80 times width, 0.96 times exopod length, with 9 plumose setae. Protopod, exopod, and endopod partly covered with fine setae.

Pleopods 2–5 (Fig. 4B–E) similar to pleopod 1, except for number of plumose setae on endopod (9, 8, 9, 8 plumose setae on endopods 2–5, respectively).

Uropodal endopod (Fig. 4F) length 1.64 times width, with 3 distal plumose sensory setae and 34 simple setae. Exopod (Fig. 4G) oval, widest at proximal third, length 1.47 times width, with 15 simple setae (2 with tip broken); inner margin smooth, without serration or crenulation; outer margin not concave.

Remarks. The uropodal exopod in female *K. tamago* sp. nov. is widest at the proximal third; the inner margin is smooth, without serration or crenulation;

the outer margin is not concave. Females of *K. tamago* sp. nov. share these features with females of *K. gidgee* and *K. indonesica*, but differ from them as follows (character states in parentheses, *K. gidgee* and *K. indonesica*, respectively): uropodal exopod broader, with the length/width ratio 1.47 (2.1; 2.4); uropodal endopod broader, with the length/width ratio 1.64 (2.1; not mentioned); telson margins smooth (dentate distally; paired prominent dentations on distolateral margins) (Poore and Lew Ton, 1988; Annisaqois and Wägele, 2021).

The description of the tailfan of female *K. serritelson* is insufficient, but *K. tamago* sp. nov. differs from this species in having a more-elongate antennular flagellum article 2 (length 2.50 times the width in *K. tamago* sp. nov.; 1.44 times in *K. serritelson*), a more-elongate antennal peduncle article 5 (length 2.14 times the width in *K. tamago* sp. nov.; 1.56 times in *K. serritelson*), and the carpus of pereopod 1 lacking the ventrodistal prolongation present in pereopods 2 and 3 (ventrodistal prolongation present on the carpus of pereopod 1 in *K. serritelson*) (Wägele, 1981).

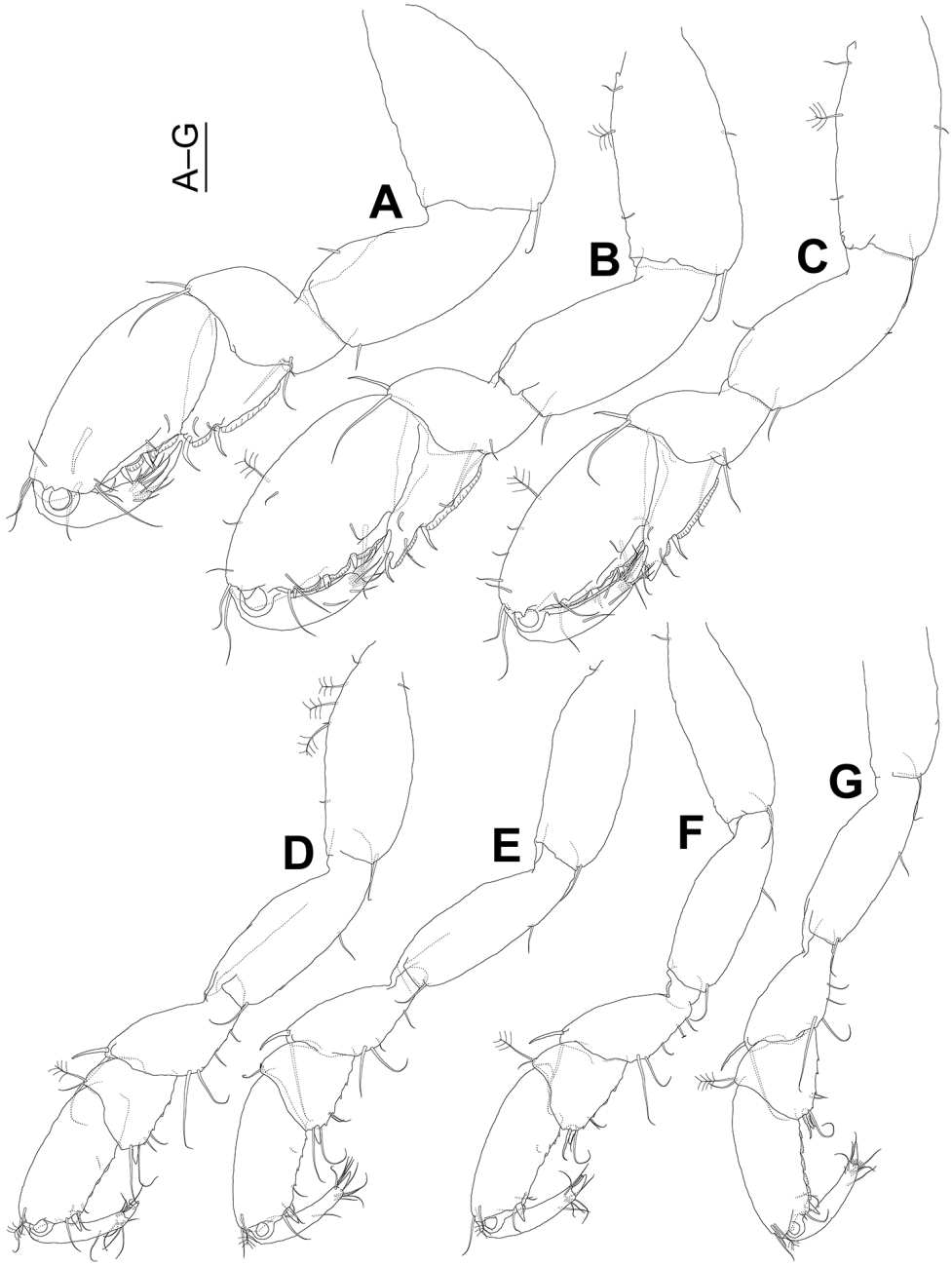

Figure 3. *Kupellonura tamago* sp. nov., holotype, female. **A–G**, left pereopods 1–7. Scale bar: 100 μm.

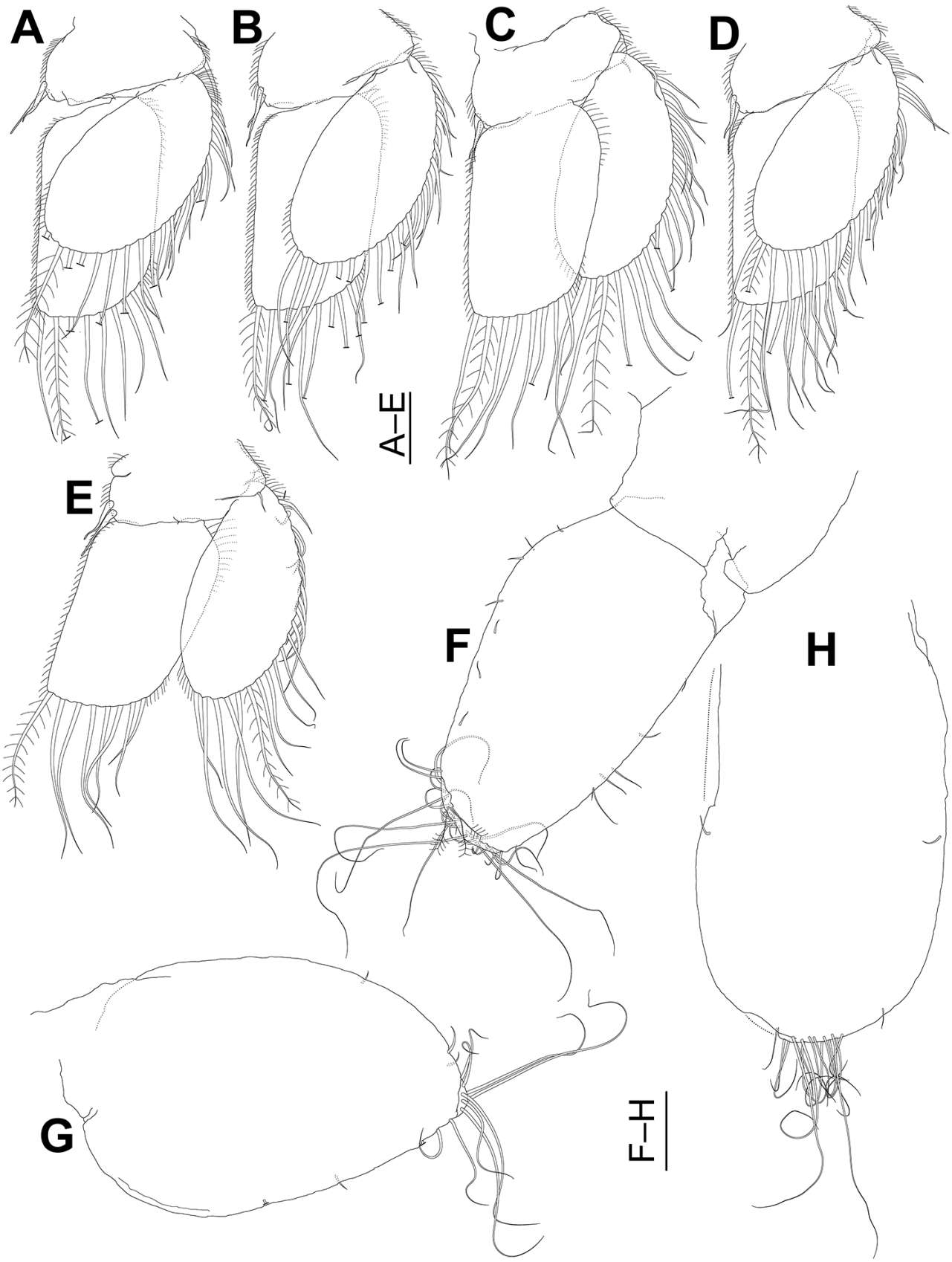

Figure 4. *Kupellonura tamago* sp. nov., female. **A**, **B**, **D**, **E**, left pleopods 1, 2, 4, and 5; **C**, right pleopod 3; **F**, left uropodal endopod; **G**, left uropodal exopod; **H**, telson. Scale bars: 100 μm.

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