

A new species of the genus *Ameiropsis* Sars G.O., 1907 (Copepoda; Harpacticoida) from Korea

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The family Ameiridae Boeck, 1865 (Copepoda; Harpacticoida) consists of about 380 species in 47 genera, but only 10 species have been reported in Korea. A benthic ameirid species was collected from the East Sea of Korea. Specimens were identified as members of the genus *Ameiropsis* Sars G.O., 1907, and this is the first record of the genus *Ameiropsis* in the Pacific Ocean. *Ameiropsis gyeongjuensis* sp. nov. is morphologically similar to *A. mixta* Sars G.O., 1907 and *A. longicornis* Sars G.O., 1907 from Norway. However, the new species is clearly distinguishable from the others based on the following morphological characteristics: the proximal segment of antennary exopod with a bulge in the middle, and with one pinnate seta; the distal segment of antennary exopod with a thickened, blade-shaped outer seta; and female P5 baseopod with five setae and exopod with six setae. An identification key to species is provided for the 11 valid species of the genus *Ameiropsis*.

Keywords: benthic harpacticoid, copepod, Korea, meiofauna, taxonomy

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DOI:10.12651/JSR.2023.12.3.244

INTRODUCTION

The family Ameiridae Boeck, 1865 is large and diverse, with the two subfamilies, Ameirinae Monard, 1927 and Stenocopiinae Lang, 1944, comprising over 380 valid species in 47 genera (Walter and Boxshall, 2023). Despite the lack of information on males and the inaccuracy of morphological descriptions in many genera, which necessitates an overall revision of the family Ameiridae, the genus *Ameiropsis* Sars G.O., 1907 remains relatively concise and well-defined (Conroy-Dalton and Huys, 1996; Karanovic, 2006).

So far, only 10 ameirid species in four genera have been reported in Korea: *Ameira* Boeck, 1965 (three species: *A. kimchi* Karanovic and Cho, 2012; *A. parvula* (Claus, 1866); and *A. zahaae* Karanovic and Cho, 2012), *Nitokra* Boeck, 1865 (five species: *N. affinis californicus* Lang, 1965; *N. koreanus* Chang, 2007; *N. lacustris* (Schmankevitch, 1875); *N. pietschmanni* Chappuis, 1934; and *N. spinipes* Boeck, 1865), *Pseudameira* Sars G.O., 1911 (monospecific: *P. mago* Karanovic and Cho, 2012), and *Pseudoleptomesochra* Lang, 1965 (monospecific: *P. mannada* Karanovic and Cho, 2018) from brackish water and intertidal zone of Korea (Chang, 2007; Chang and Yoon, 2008; Karanovic and Cho, 2012; 2018). This new species,

Ameiropsis gyeongjuensis sp. nov. is the first report of the genus *Ameiropsis* in Korea.

Herein, I describe the new species with taxonomic descriptions of both sexes based on morphological features and provide a revised key to the 11 species of the genus *Ameiropsis*.

MATERIALS AND METHODS

Samples were collected from Bong-gil Beach, Gyeongju, Korea in January 2019. Specimens were sampled with a hand net, were fixed with 70% ethanol, and then stained with Rose Bengal. Meiofauna was extracted from sediments by Ludox isopycnic centrifugation (Burgess, 2001). Harpacticoids were sorted and enumerated under a Leica S APO dissecting microscope (Leica Microsystems, Wetzlar, Germany) and stored in 70% ethanol. Specimens were dissected in lactic acid, and the dissected parts were mounted on slides in lactophenol mounting medium, then covered by a cover glass.

Preparations were sealed with transparent nail varnish. All drawings were prepared using a drawing tube attached to an optical microscope (Leica DM 4000B). Specimens were deposited at the National Marine Biodiversity Insti-

tute of Korea (MABIK).

The descriptive terminology regarding the body and appendage morphology is adopted from Huys and Boxshall (1991). Abbreviations used in the text are: A1 for antennule; A2 for antenna; exp for exopod; enp for endopod; P1–P6 for the first to the sixth thoracopod; exp(enp)-1 (-2, -3) to denote the proximal (middle, distal) segment of a ramus; and ae for aesthetasc. Scale bars in figures are indicated in μm .

SYSTEMATICS

Order Harpacticoida Sars G.O., 1903

Family Ameiridae Boeck, 1865

Genus *Ameiropsis* Sars G.O., 1907

Ameiropsis gyeongjuensis sp. nov. (Figs. 1–9)

Material examined. Holotype 1♀ (MABIK CR00253740) dissected on 10 slides, and paratype 1♂ (MABIK CR00253741) dissected on 5 slides. All from the type locality, Bong-gil Beach, Gyeongju, Korea (35°44′21.1″N, 129°29′03.0″E), collected by H.W. Bang and H. Moon on 8 January 2019.

Etymology. The specific epithet, “*gyeongjuensis*” is based on the name of the location where the new species is found.

Description. Female. Total body (Fig. 1A, B) length from anterior margin of the rostrum to posterior margin of caudal rami 790 μm . Maximum width 195 μm measured at end of cephalothorax. Habitus semi-cylindrical, gradually tapering posteriorly, and prosome and urosome are not clearly distinguished.

Cephalothorax gradually tapering anteriorly, ornamented with sensilla as illustrated, and posterior margin with sensilla and plain hyaline frills. Rostrum (Figs. 1A, 2A) fused to cephalothorax, bell-shaped, blunt at tip, and with pair of sensilla near anterior margin. Pleural areas of cephalothorax not highly developed, so cephalic appendages are clearly exposed in lateral view (Fig. 2A). All pedigerous somites with plain hyaline frills.

Urosome (Figs. 1A, B, 3A) five-segmented, comprising P5-bearing somite, genital double-somite, and three free abdominal somites. Genital double-somite completely fused, subdivided by chitinous suture laterally, with paired laterodorsal rows of spinules, and with fine spinules on the posterior margin.

Genital apparatus (Fig. 3A) located near the anterior margin of the genital double-somite, with a small copulatory pore (arrowed in Fig. 3A), and two large seminal receptacles. P6 represented by a single symmetric plate bearing one bipinnate outer and one inner bare seta.

Anal somite (Figs. 1A, 3A) cleft medially, with a trans-

verse row of spinules on the ventral surface, and with coarse spinules on the posterior margin dorsally and ventrally; anal operculum flat with fine spinules.

Caudal rami (Figs. 1A, 3A) about as long as broad, each ramus with two dorsal and one lateroventral pore, and with seven setae: seta I and II bare; seta III bare, located near the distal corner; seta IV bipinnate and long; seta V unipinnate, longest; seta VI bare at an inner distal corner; seta VII articulated at base and bare.

Antennule (Fig. 4A), eight-segmented; segment-2 longest; segment-4 with one aesthetasc fused at base to a very long naked seta; segment-8 with an acrothek consisting of one apical aesthetasc fused basally to two apical setae; armature formula: 1-[1], 2-[9], 3-[8], 4-[4 + (1 + ae)], 5-[2], 6-[4], 7-[4], 8-[5 + (2 + ae)].

Antenna (Fig. 2B) composed of coxa, basis, two-segmented endopod, and two-segmented exopod. Coxa short and unarmed, with spinules on the anterior margin. Basis unarmed, with row of spinules and setules along abexopodal margin, basis and first endopodal segment partly fused. Exopod two-segmented; exp-1 large, with highly bulging outer margin, and with one biarticulated pinnate seta; exp-2 small, with one articulated pinnate and one broad, curved sabre-like seta apically. Endopod two-segmented; enp-1 about 2.5 times as long as wide, unarmed and unornamented; enp-2 with a transverse row of spinules close to an outer distal corner, with two pinnate spines and one small seta laterally, five geniculate and one unipinnate setae distally, and longest geniculate seta fused at the base with one smaller seta.

Labrum (Figs. 2A, 3B) large, protruding forward, and forms a beak-like structure.

Mandible (Fig. 2C, D). Coxal gnathobase well developed, with one unipinnate seta laterally and eight multicuspidate teeth. Basis with one unipinnate and one naked spine and one plumose seta, and with well-developed rami. Exopod with five plumose setae. Endopod with one inner plumose and five distal setae, of which three fused basally.

Maxillule (Fig. 5A). Praecoxal arthrite well-developed with two rows of spinules, with two setae on the anterior surface, one pinnate seta medially on the inner margin, and five elements around the distal margin. Coxal endite with one plumose and two bare setae. Basis with one spinulous and two bare setae apically. Endopod incorporated into the base, with one naked seta; exopod with two pinnate and one bare seta.

Maxilla (Fig. 5B). Syncoxa with two endites; proximal endite with two pinnate setae, distal endite broad with one strong unipinnate seta and one pectinate spine apically, and one naked seta subapically. Allobasis produced into a very strong spinulose claw, with one strong unipinnate spinulose spine. Endopod represented by minute segment, with three bare setae.

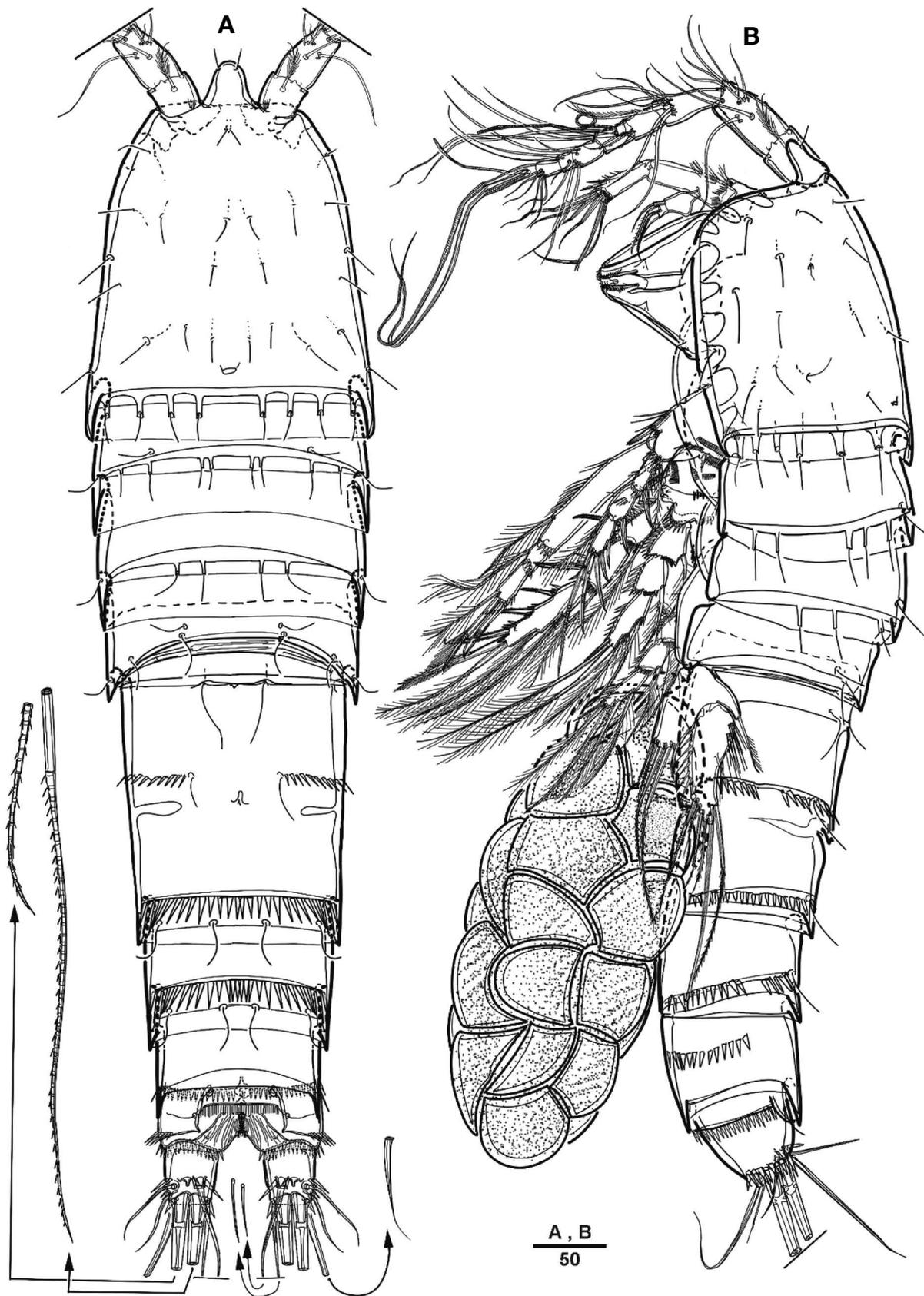


Fig. 1. *Ameiropsis gyeongjuensis* sp. nov. holotype female. A. habitus, dorsal; B. habitus, lateral. Scale bar in μm .

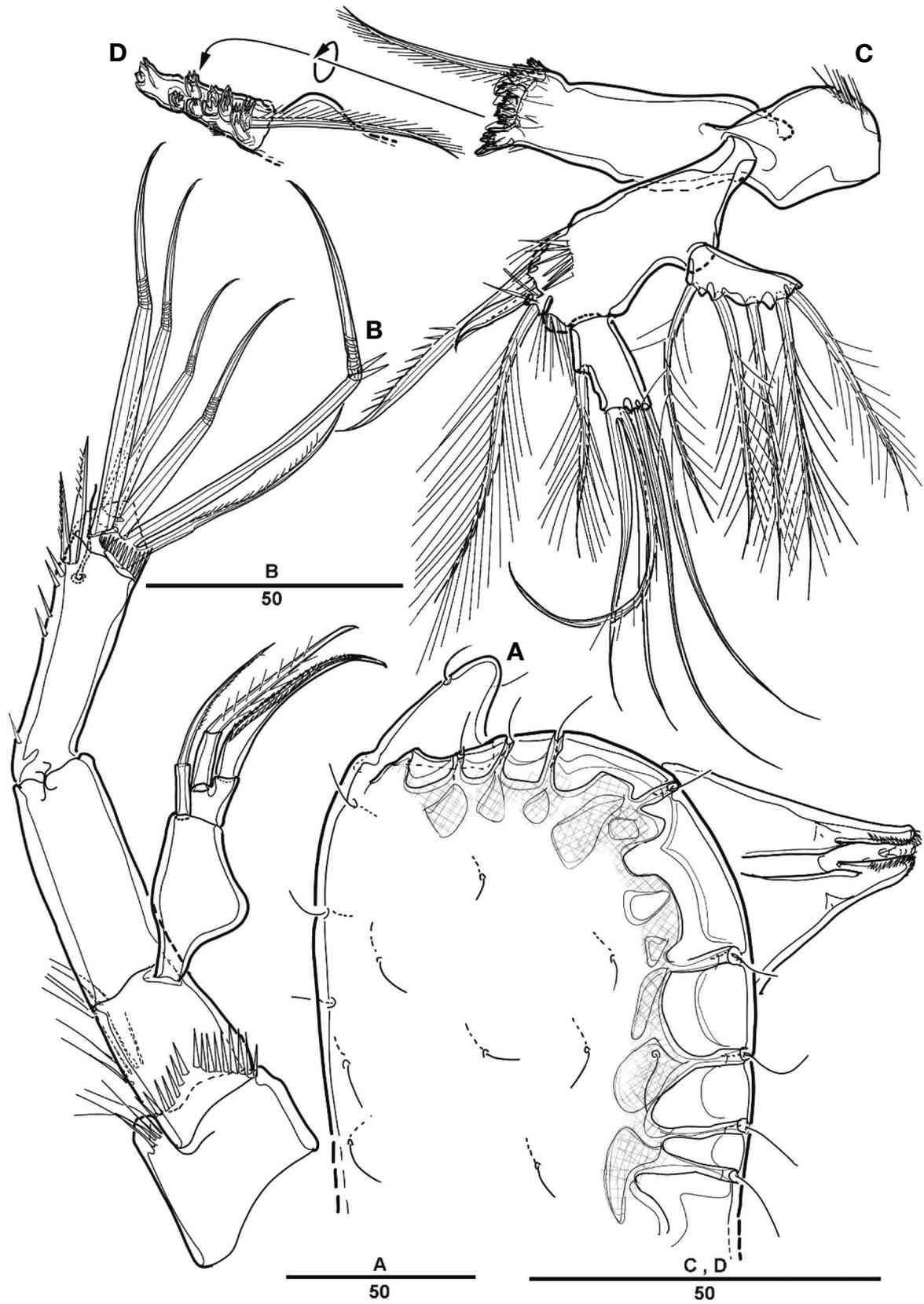


Fig. 2. *Ameiropsis gyeongjuensis* sp. nov. holotype female. A. cephalothorax, lateral; B. antenna; C. mandible; D. mandibular gnathobase. Scale bars in μm .

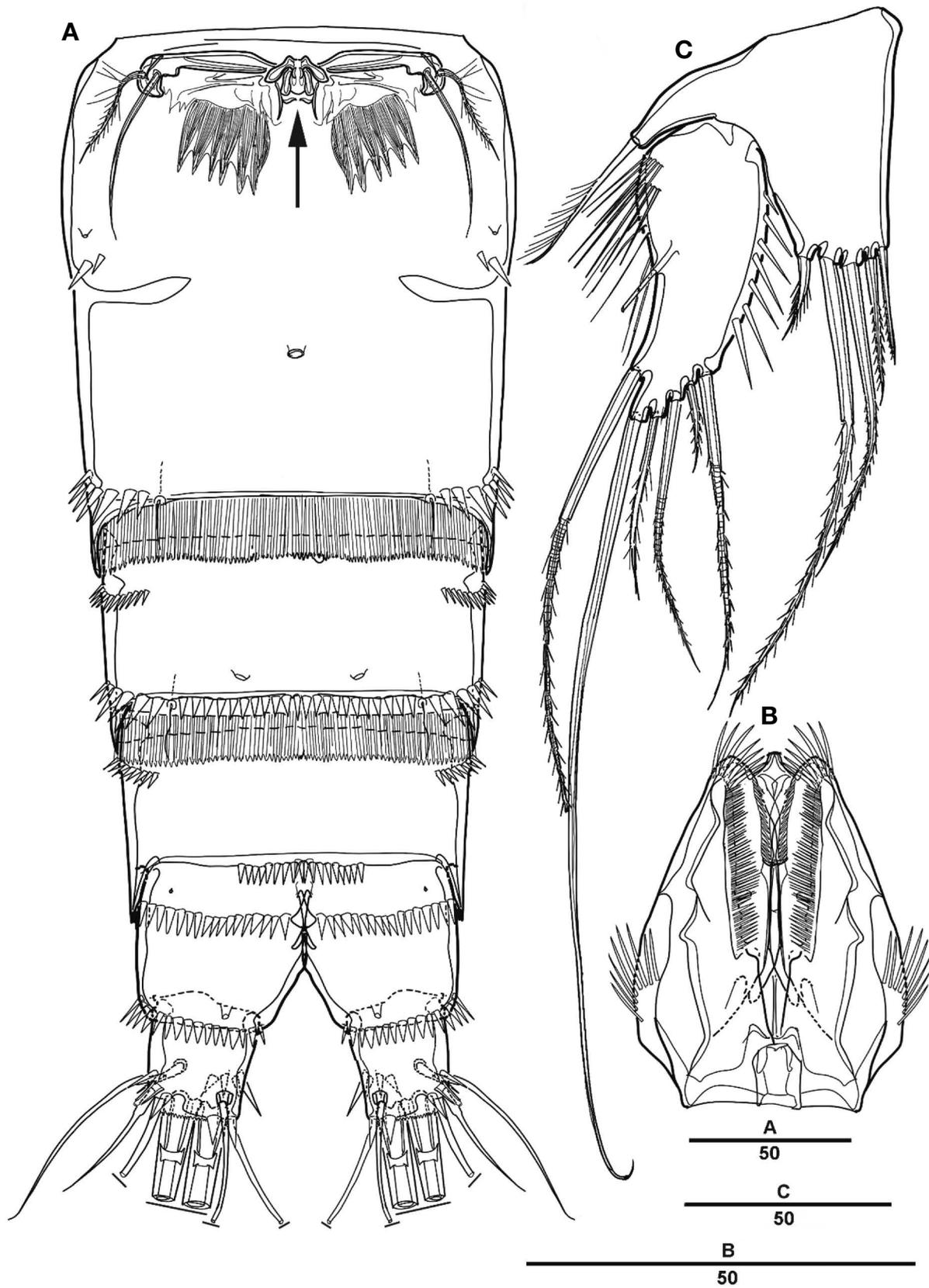


Fig. 3. *Ameiopsis gyeongjuensis* sp. nov. holotype female. A. urosome, ventral (arrow indicating copulatory pore); B. labrum, ventral; C. P5. Scale bars in μm .

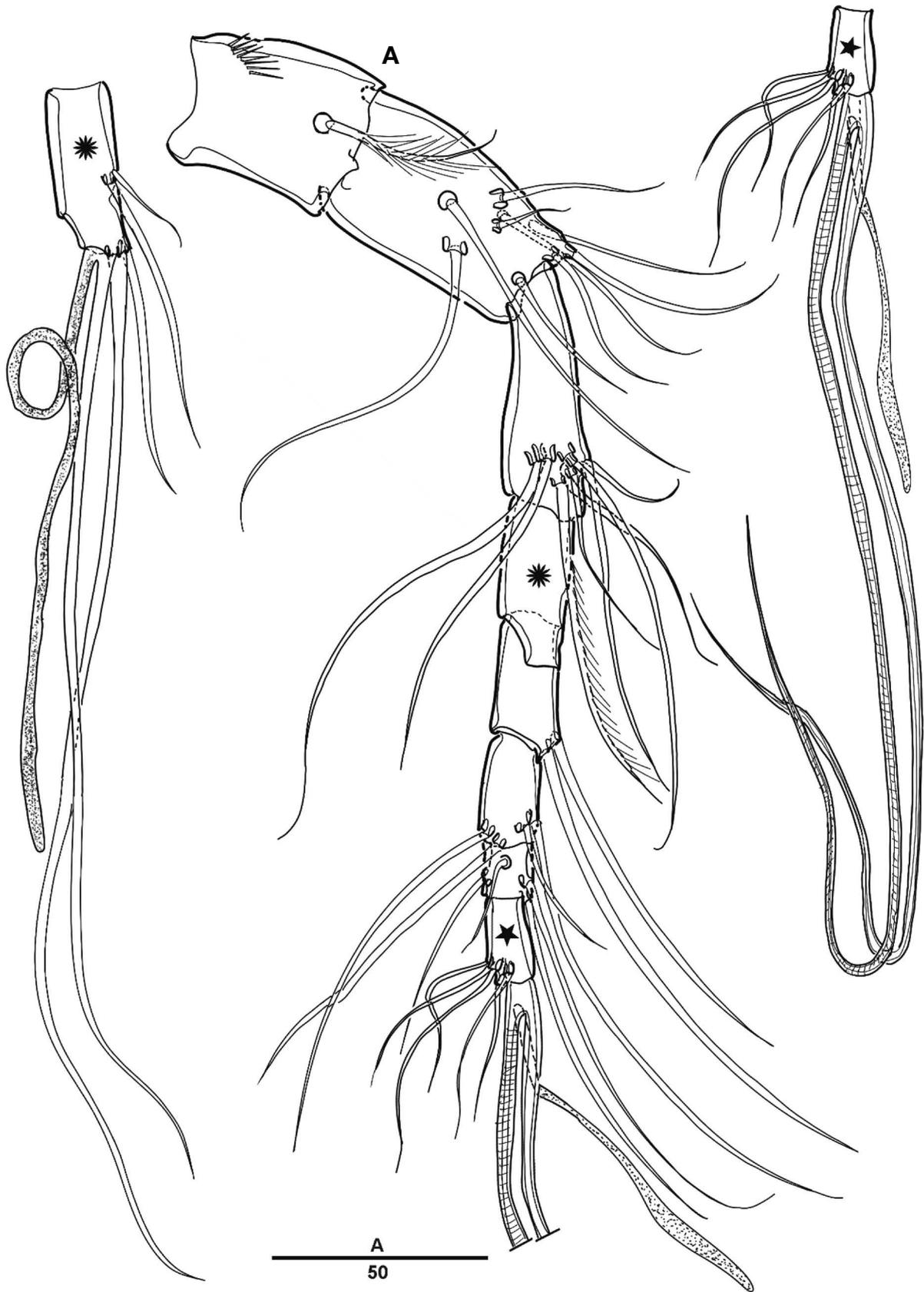


Fig. 4. *Ameiropsis gyeongjuensis* sp. nov. holotype female. A. antennule. Scale bar in μm .

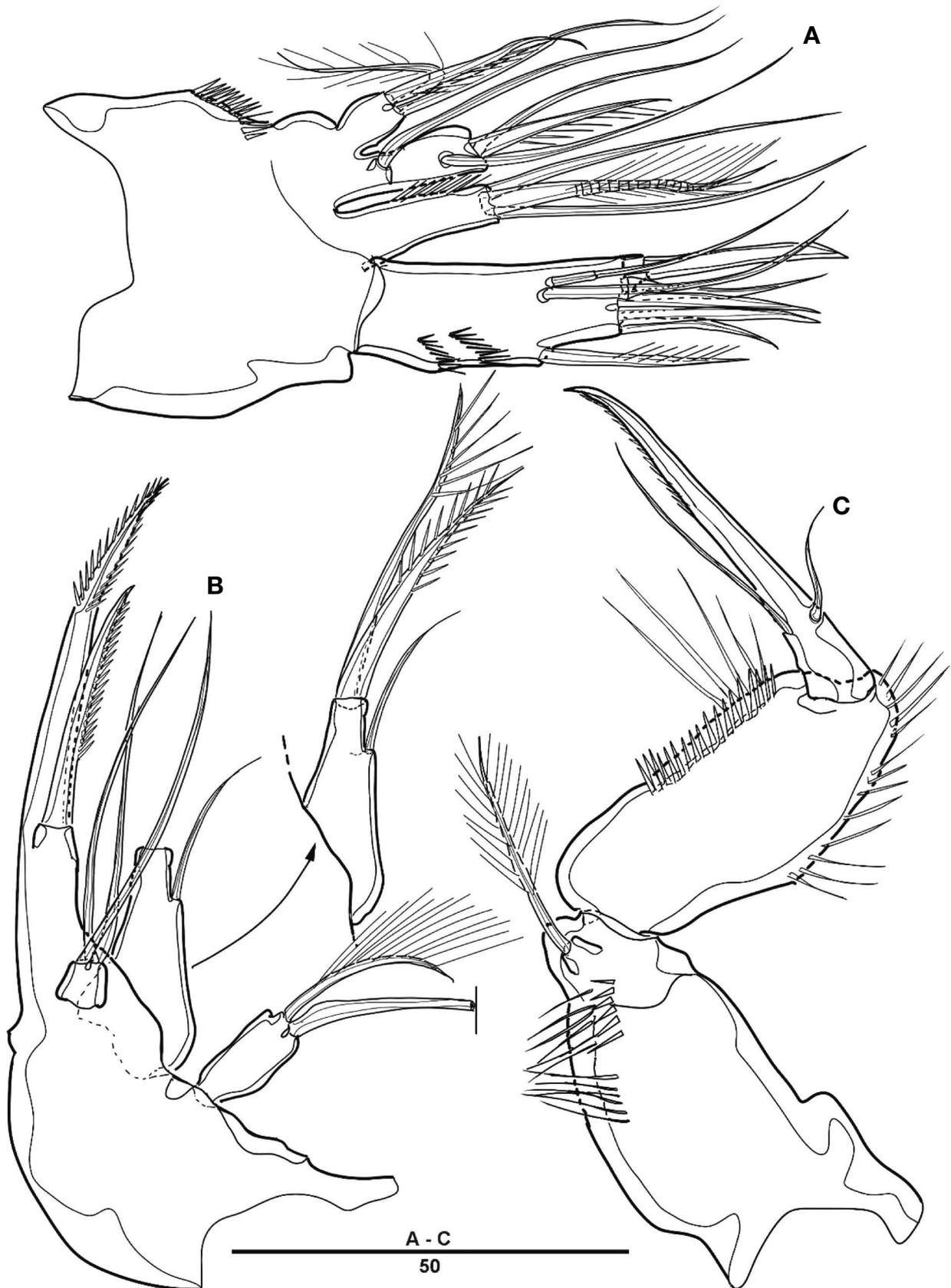


Fig. 5. *Ameiropsis gyeongjuensis* sp. nov. holotype female. A. maxillule; B. maxilla; C. maxilliped. Scale bar in μm .



Fig. 6. *Ameiropsis gyeongjuensis* sp. nov. holotype female. A. P1; B. P2. Scale bar in μm .

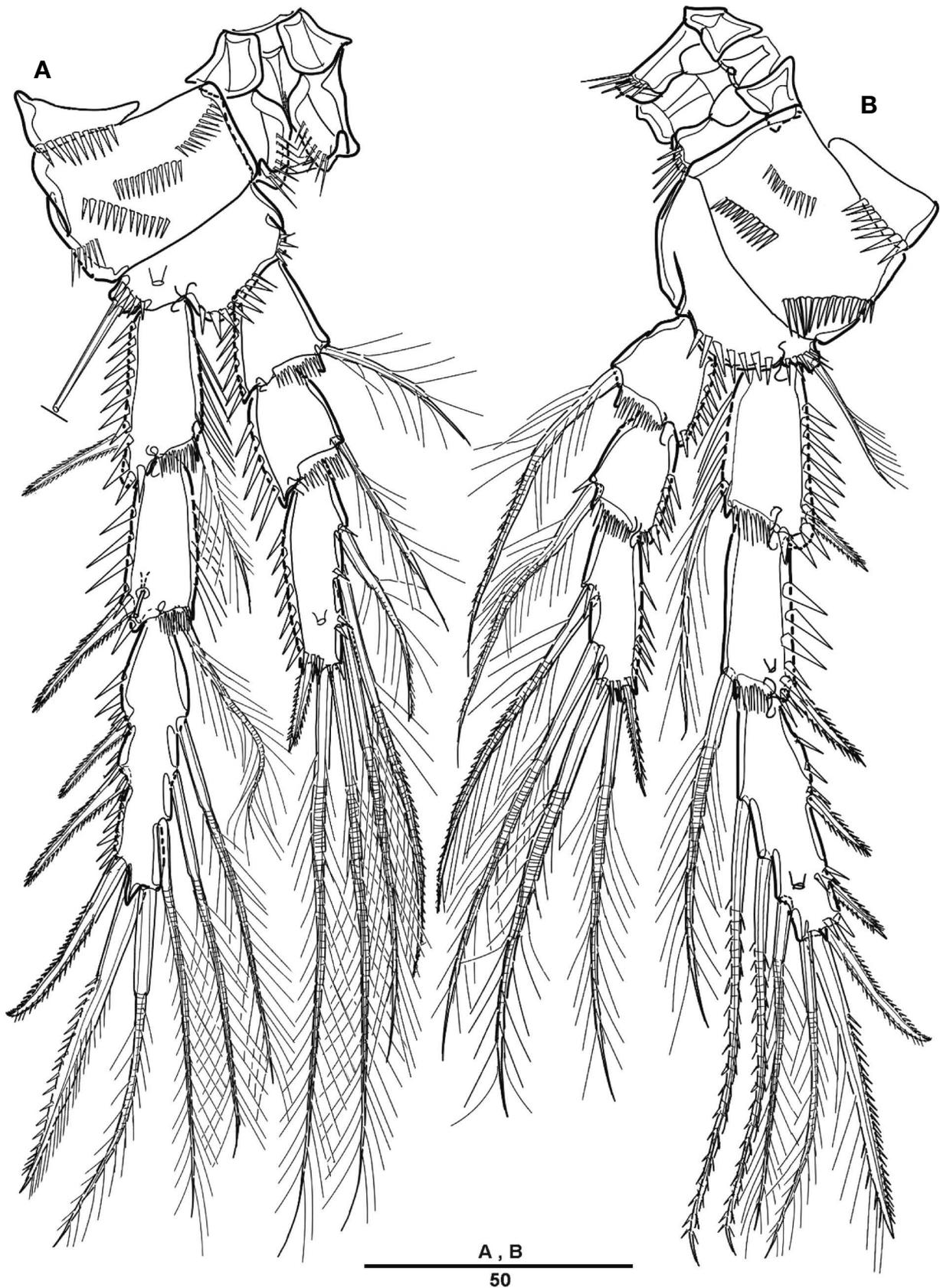


Fig. 7. *Ameiropsis gyeongjuensis* sp. nov. holotype female. A. P3; B. P4. Scale bar in μm .

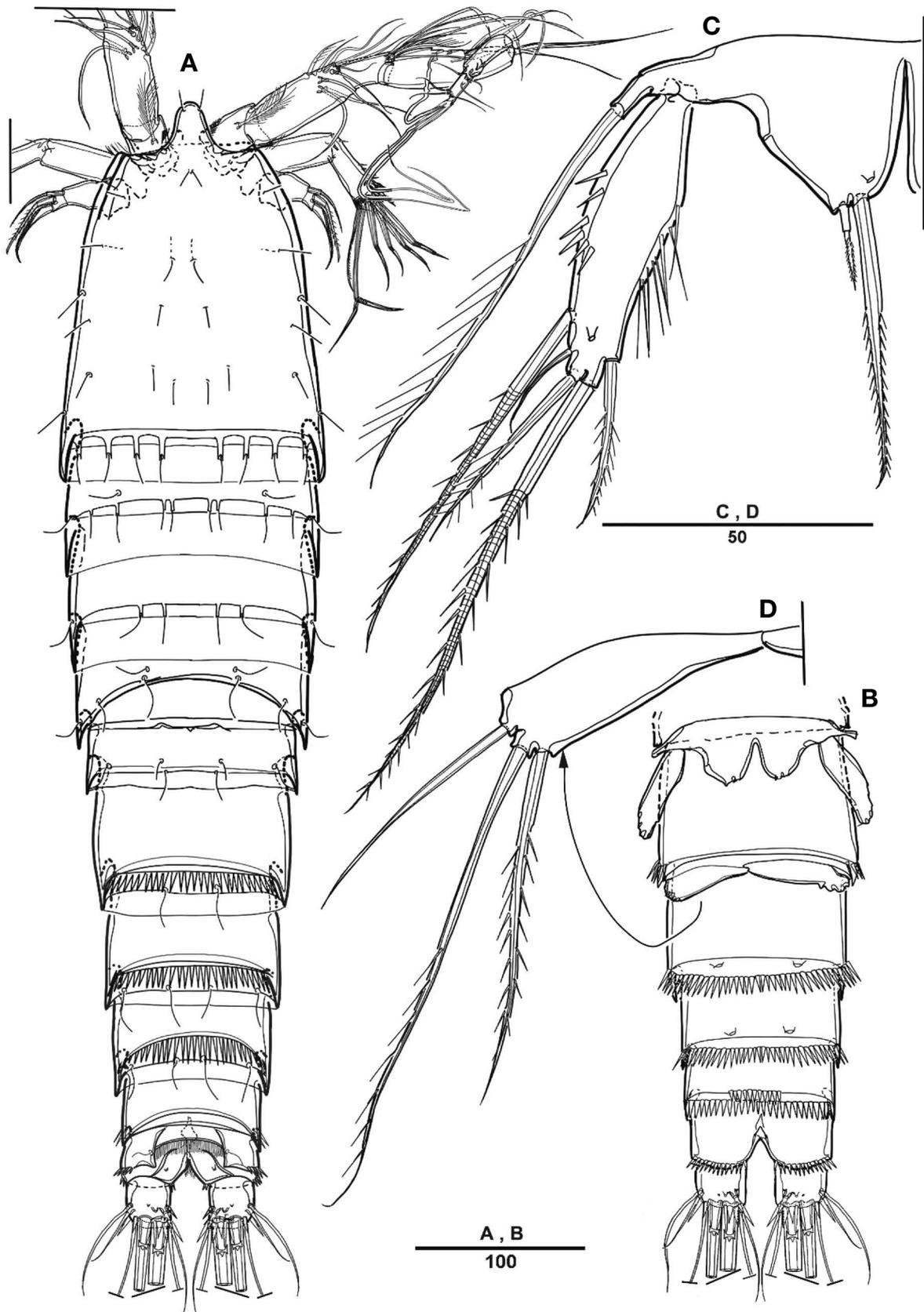


Fig. 8. *Ameiropsis gyongjuensis* sp. nov. paratype male. A. habitus, dorsal; B. urosome, ventral; C. P5; D. P6. Scale bars in μm .

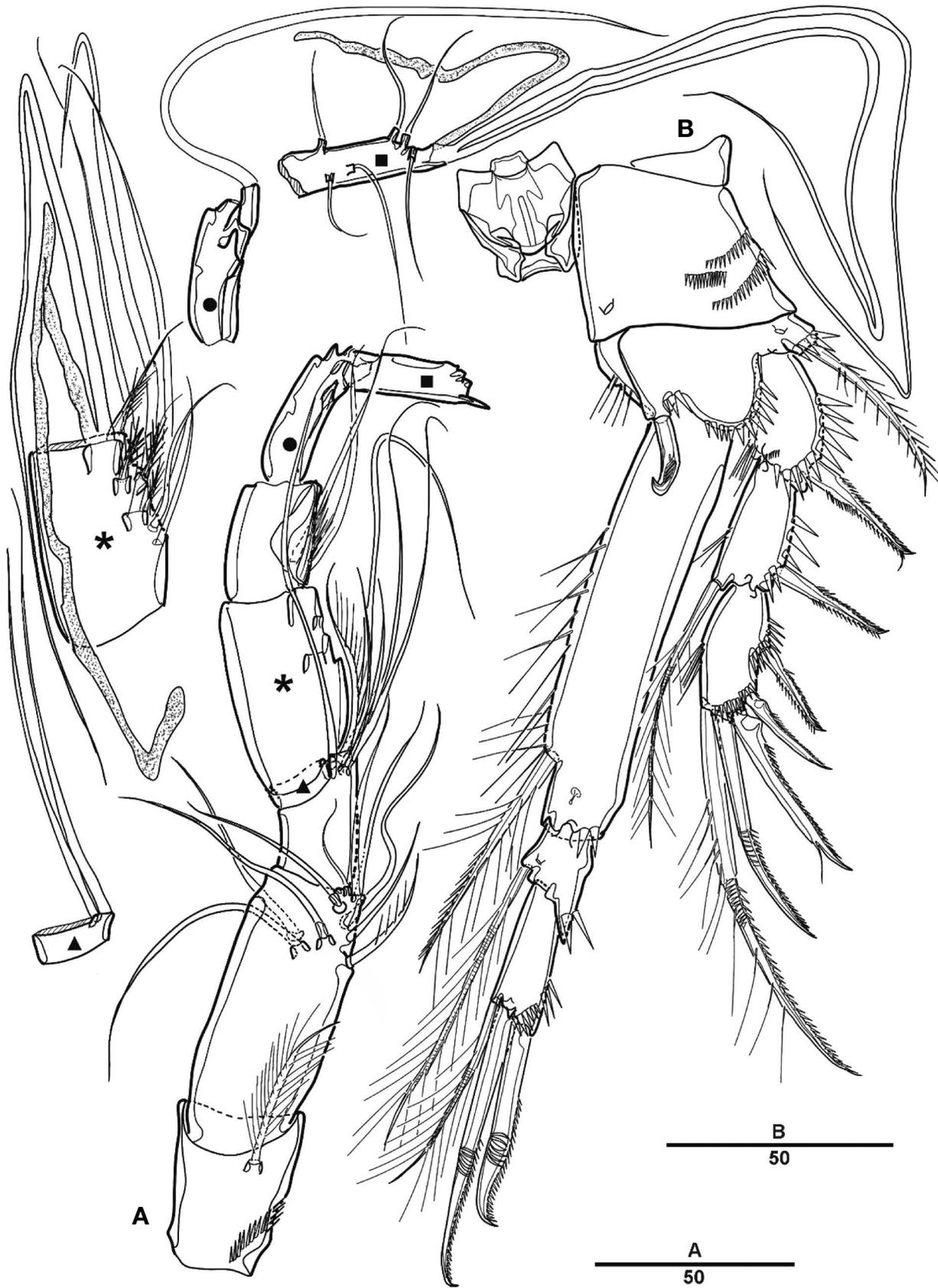


Fig. 9. *Ameiropsis gyongjuensis* sp. nov. paratype male. A. antennule; B. P1. Scale bars in μm .

Maxilliped (Fig. 5C). Syncoxa with inner rows of spinules, and one plumose seta. Basis about twice as long as wide, aetose, with rows of spinules on the inner margin, and with a row of spinules on the outer margin. Endopod represented by recurved claw, longer than basis, with two accessory setae near its base.

P1 (Fig. 6A). Intercoxal sclerite trapezoid, without ornamentation. Praecoxa small and triangular. Coxa ornamented with rows of spinules on the anterior surface. Basis with one strong pinnate seta on the outer corner, and one finely bipinnate spine on the inner distal margin; anterior surface with setules on the inner margin, and with spinules around the base of the inner and outer spine. Exopod three-segmented, all segments of about equal length; exp-1 with spinules along outer margin, and pinnate outer seta; exp-2 with spinules on outer margin, and with one outer spine and one plumose inner seta; exp-3 with two geniculate setae distally and three finely pinnate spines on outer margin. Endopod three-segmented; enp-1 elongate, extends well beyond the end of exopod, with setules along the inner margin and spinules along the distal margin, and with one plumose inner seta; end-2 smallest, with spinules on distal corner, and with one plumose seta on inner margin; enp-3 about twice as long as enp-2, with one plumose seta on inner distal margin, and two geniculate spines apically.

P2 (Fig. 6B). Intercoxal sclerite with a row of spinules on the anterior surface. Praecoxa small and triangular, with a row of spinules along the distal margin. Coxa rectangular, about 1.6 times as wide as long, with transverse rows of spinules on the anterior surface. Basis with one plumose seta on the outer distal corner, with a row of spinules on the inner distal margin, distal margin, and at the base of the outer spine, with a single pore on the anterior surface close to the outer seta. Exopod three-segmented; exp-1 with coarse spinules along outer margin and outer distal corner, with one inner plumose seta, and bipinnate outer spine; exp-2 with few outer spinules, with one plumose inner seta, and with one pinnate outer spine; exp-3 elongated, with two long plumose inner setae, one plumose seta and one bipinnate spine distally, and three serrate outer spines. Endopod three-segmented, all segments with outer spinules; enp-1 and enp-2 with plumose inner seta; enp-3 slightly elongated, with two inner pinnate setae, two long terminal setae, and one small spinulose outer spine.

P3 (Fig. 7A). Intercoxal sclerite, praecoxa, coxa, and basis as in P2. Rami three-segmented; exp-1 and exp-2 each with one inner plumose seta, and bipinnate outer spine, with coarse spinules along the outer margin; exp-3 elongated, with three plumose inner setae, one pinnate seta and one spine terminally, and three serrate outer spines. Endopod three-segmented; enp-1 and enp-2 with short

plumose inner seta; enp-3 with three inner plumose setae, two long distal bipinnate setae, and one small serrate outer spine.

P4 (Fig. 7B). Intercoxal sclerite, praecoxa, and coxa as in P2. Basis semicircular, with a row of spinules on the outer distal margin, and with one unipinnate outer seta. Exp-1 and exp-2 with spinules on the outer margin, a plumose inner seta, and one bipinnate outer spine; exp-3 with three pinnate inner setae, a plumose seta and a pinnate spine terminally, and three outer spines.

Armature formulae as follows:

	Exopod	Endopod
P1	0.1.023	1.1.021
P2	1.1.223	1.1.221
P3	1.1.323	1.1.321
P4	1.1.323	1.1.221

P5 (Fig. 3C). Endopodal with separate exopod and baseoendopod. Exopod elongated, about 2.5 times as long as broad, with inner spinules and long outer setules, with one anterior tube pore, and with six setae; outermost seta long and bipinnate, second outer very longest and naked, second inner short and pinnate. Baseoendopod with outer setophore carrying one unipinnate seta, endopodal lobe triangular, with five pinnate setae.

Male. Total body (Fig. 8A) length from anterior margin of the rostrum to posterior margin of caudal rami 670 μm . Maximum width 153 μm measured at end of cephalothorax. General ornamentation and sensilla pattern same as in female except genital double somite; sexual dimorphisms in A1, P1 basis, P5, and P6.

Urosome (Fig. 8B) six-segmented, comprising P5-bearing somite genital somite, and four abdominal somites. Genital and first free abdominal somite with posterior continuous row of spinules ventrally.

Antennule (Fig. 9A) eight-segmented, haplocer, with geniculation between segments-7 and -8, and aesthetasc on segments-5 and -8; segment-2 longest, with nine bare and on pinnate setae; segment-4 very short with two setae. Armature formula: 1-[1], 2-[10], 3-[7], 4-[2], 5-[9 + (1 + ae)], 6-[3], 7-[1], 8-[6 + (2 + ae)]. Apical acrothek consisting of short aesthetasc and two long naked setae.

P1 (Fig. 9B) inner basal spine modified into a hook-shaped element.

P5 (Fig. 8C) baseoendopods fused medially. Baseoendopod with outer setophore carrying a long unipinnate seta. Endopodal lobe not extending beyond the middle of exopod, with two pinnate setae. Exopod thinner than in female, about 3.5 times as long as wide, with five setae; second outer seta very short and bare.

P6 (Fig. 8D), asymmetrical, represented on both sides by a small plate, each plate with two pinnate and one naked seta.

DISCUSSION

According to Lang (1965), Petkovski (1976), and Boxshall and Halsey (2004), *Ameiropsis gyeongjuensis* sp. nov. belongs to the genus *Ameiropsis* Sars G.O., 1907 based on the following morphological characters: (1) first antennular segment not distinctly elongated, (2) antennary exopod two-segmented, (3) mandibular palp biramous, (4) maxilliped syncoxa with one seta, (5) P1–P4 with three-segmented rami, and (6) P1 enp-1 not prehensile.

The genus *Ameiropsis* was first diagnosed by Sars (1907) to accommodate three new species.

A. brevicornis Sars G.O., 1907, *A. longicornis* Sars G.O., 1907, and *A. mixta* Sars G.O., 1907 from off the coast of Norway. Subsequently, eight species were added to the genus, by Sars (1911: *A. abbreviata*, *A. angulifera*, and *A. nobilis*), Gurney (1927: *A. robinsoni*), Monard (1928: *A. ariana*), Apostolov (1973: *A. reducta*), Kunz (1975: *A. australis*), and Gee (2009: *A. martinis*). Moreover, *Ameiropsis minor* was first diagnosed by Sars (1920) as *Stenocopia minor* Sars G.O., 1920, but was transferred to *Ameiropsis* by Lang (1936).

Lang (1948) placed *Ameiropsis ariana* Monard, 1928 as *incertae sedis*, and later *A. ariana* transferred to the newly established genus *Ameiropsyllus* Bodin, 1977. Lang (1948) also considered *A. robinsoni* Gurney, 1927 a *species incertae sedis* in the genus because the mouse parts were not depicted in the original description and the middle segment lacks an inner seta in P1. However, subsequent authors such as Kunz (1975), Gee (2009), and Sönmez (2019) recognized *A. robinsoni* as a valid species of *Ameiropsis*, so this species remains controversial. Furthermore, Karanovic (2006) proposed a new genus *Biameiropsis* Karanovic, 2006 to accommodate *Ameiropsis abbreviata* Sars, 1911 and a new species, *Biameiropsis barrowensis* Karanovic, 2006. Consequently, the genus *Ameiropsis* now consists of 10 valid species: *A. angulifera* Sars G.O., 1911, *A. australis* Kunz, 1975, *A. brevicornis*, *A. longicornis*, *A. martinis* Gee, 2009, *A. minor* (Sars G.O., 1920), *A. mixta*, *A. nobilis* Sars G.O., 1911, *A. reducta* Apostolov, 1973, and *A. robinsoni*.

Ameiropsis gyeongjuensis sp. nov. has a morphological similarity to *A. mixta*, and *A. longicornis* according to three characters: P1 exp-2 with inner seta, P1 enp-1 extending well beyond the end of exp, and P2–P4 exp-1 with inner seta. However, *A. gyeongjuensis* sp. nov. can be distinguished from its congeners by a combination of characters including: (1) A2 exp-1 with a bulge in the middle, and with one pinnate seta; (2) A2 exp-2 with a thickened, blade-shaped outer seta; and (3) female P5 baseoendopod and exopod with five and six setae respectively.

These latter two species have only been reported mostly in Europe: *Ameiropsis mixta* was reported from southern

Norway (Sars, 1907), Ireland (Roe, 1957), Isles of Scilly (Wells, 1970), and the Gulf of Mexico (Plum *et al.*, 2015). *A. longicornis* was recorded previously in southern Norway (Sars, 1907; Por, 1964), Helgoland (Klie, 1950), Ireland (Roe, 1957), and Isles of Scilly (Wells, 1970). As with the above two species, the genus *Ameiropsis* is distributed in Europe except for *A. australis* from South Africa (Kunz, 1975). *A. gyeongjuensis* sp. nov. is the first species of the genus discovered in the Pacific and the Indian Ocean.

Revised key to the species of the genus *Ameiropsis* Sars G.O., 1907. (amended from Wells, 2007)

1. P1 exopod-2 with inner seta, and P1 exopod-3 with four setae *Ameiropsis minor*
 - P1 exopod-2 with inner seta, and P1 exopod-3 with five setae 2
 - P1 exopod-2 without inner seta, and P1 exopod-3 with five setae 8
2. P2–P4 endopod-1 and endopod-2 without inner seta *A. reducta*
 - P2–P4 endopod-1 and endopod-2 with inner seta 3
3. P1 endopod-1 extending far beyond the end of exopod 4
 - P1 endopod-1 extends to approximately the end of exopod 6
4. A2 exopod-2 with two simple setae, subequal in length *A. longicornis*
 - A2 exopod-2 with a bipinnate inner seta, and a strong blade-like outer seta 5
5. Female P5 with four setae on baseoendopod and five setae on exopod *A. mixta*
 - Female P5 with five setae on baseoendopod and six setae on exopod *A. gyeongjuensis* sp. nov.
6. P2–P4 exopod-1 without inner seta *A. angulifera*
 - P2–P4 exopod-1 with inner seta 7
7. Female P5 with five setae on baseoendopod *A. nobilis*
 - Female P5 with four setae on baseoendopod *A. brevicornis*
8. P2 exopod-3 with seven setae; P3 exopod-3 with eight setae; P2 and P3 endopod-3 with five setae; female P5 exopod with four setae *A. robinsoni*
 - P2 and P3 exopod-3 with six setae; P2 and P3 endopod-3 with four setae; female P5 exopod with five setae 9
9. P4 exopod-3 with seven setae *A. martinis*
 - P4 exopod-3 with eight setae *A. australis*

ACKNOWLEDGEMENTS

The author would like to thank Heejin Moon (Marine Art Platform, Korea) for her great help in drawing. I

would also like to sincerely thank the two anonymous reviewers and the editor for their reasonable criticisms that helped me improve the manuscript.

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Submitted: April 17, 2023

Revised: June 1, 2023

Accepted: June 12, 2023