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Two canthocamptid copepods of the genera *Itunella* and *Mesochra* (Harpacticoida, Canthocamptidae) from brackish waters in South Korea

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Two new harpacticoid species belonging to the family Canthocamptidae are described from brackish waters in South Korea: *Itunella arenaria* sp. nov. and *Mesochra bisetososa* sp. nov. The genus *Itunella* is first known from the Pacific. *Itunella arenaria* most resembles *I. muelleri* (Gagern) among three recognized congeners; however, it is characterized by the shape of the anal operculum with serrated projections beside it, and the armature of the endopods of legs 2–4 in the male. *Mesochra bisetososa* is closely related to two Asian allies, *M. quadrispinosa* from China and *M. hinumaensis* from Japan, but differs from them in the paucity of setae on the third endopodal segments of legs 2 and 3. Description and the taxonomic accounts of the two new species are presented with illustrations and scanning electron micrographs.

Keywords: brackish-water Copepoda; Canthocamptidae; Harpacticoida; *Itunella*; Korea; *Mesochra*; new species; taxonomy

Introduction

Taxonomic studies on the brackish-water harpacticoid copepods are rather scant in Korea. Chang and Kim (1991) first recorded a new species, *Harpacticella itoi* Chang and Kim, 1991, in the estuary of the river Tamjin on the middle of the southwestern coast of Korea. Song and Chang (1995) reported two tachidid species *Tachidius* (*Tachidius*) *discipes* Giesbrecht, 1881 and *T. (Neotachidius) triangularis* (Shen and Tai, 1963) from Jindo Island, southwestern coast of Korea. Huys et al. (2005) elevated the subgenus *Neotachidius* to genus level to designate two new species, *N. parvus* and *N. koreanus*, from Kwangyang Bay in the middle of the south coast of the Korean Peninsula. They also suggested that *N. triangularis sensu* Song and Chang, 1995 was at least partly based on *N. parvus*.

Recently, to attempt a comprehensive study of the brackish-water copepod fauna, the authors have examined the copepod specimens deposited in the specimen room of the Department of Biological Science, Daegu University. These have been collected from various brackish waters, including estuaries, coastal marshes and lagoons, in South Korea since 1988. As a result, they have reported *Mesochra alaskana* Wilson, 1958 and *M. suifunensis* Borutzky, 1952 (Lee and Chang 2003), *Onychocamptus vitiospinulosa* (Shen and Tai, 1963) and *O. mohammed* (Blanchard and Richard, 1891) (Lee and Chang 2005), three Cletodidae species, *Limnocletodes behningi* Borutzky, 1926, *L. angustodes* Shen and Tai, 1963 and *Kollerua longum*

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(Shen and Tai, 1979) (Lee and Chang 2007), and *Nitokra koreanus* Chang, 2007 and *Ameira parvula* (Claus, 1886) (Chang 2007).

In the present study, we describe two new brackish-water canthocamptids belonging to the genera *Itunella* and *Mesochra*.

Materials and methods

Material examined in the present study was collected from estuaries and a coastal well at five localities (Figure 1) in South Korea during the period from May 1996 to April 2007. Samples were obtained with a dipnet of 64- μ m mesh. Copepods were fixed and stored in 4% buffered formalin.

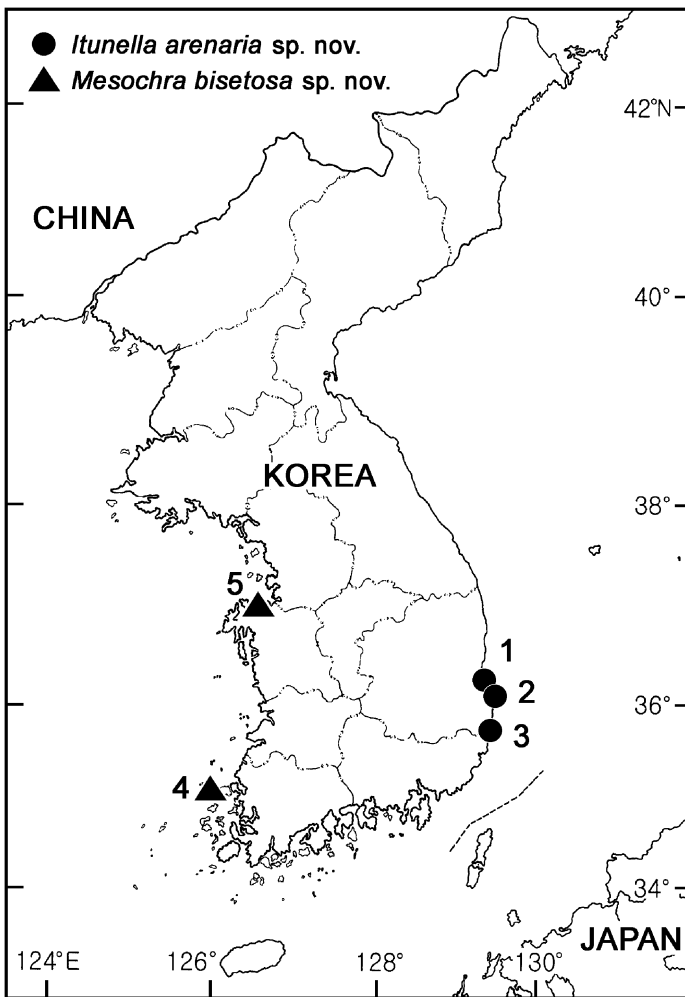


Figure 1. A map showing localities in South Korea. 1, Estuary of Seojeongricheon Stream, Wolpo; 2, Youngil Bay, Pohang; 3, estuary of Daejongcheon Stream, Gyeongju; 4, Jeonjangpo Beach, Imjado Island; 5, estuary of Maesancheon Stream, Dangjin.

Specimens were dissected and mounted in lactophenol on H-S slides (Shirayama et al. 1993), a recent variation of the Cobb slide, after treatment in a solution of 5% glycerin/95% ethyl alcohol for 1–2 days. Dissection was performed using two needles made from 0.25-mm diameter tungsten wire by electrolysis (Huys and Boxshall 1991). Mounted specimens were observed using a differential interference contrast microscope (Olympus BX-51) equipped with Nomarski optics. Measurements were taken with a digital camera for microscope (Cool SNAP 5.0M, Roper Scientific Co., USA) and calibration software QCAPTURE PRO (version 5.0, Media Cybernetics Inc., USA).

Materials for scanning electron microscopy were prefixed overnight at 4°C in 2.5% glutaraldehyde, followed by post-fixation in 2% cold osmium tetroxide. After dehydration through a graded series of ethanol (50–100% at 10% intervals) for 30 min each step, the material was critical point dried, and coated with gold–palladium in a high evaporator, and then examined with a scanning electron microscope (Hitachi S-4800) operated at 5 KV.

Type specimens are deposited in the Natural History Museum, London (NHM), the National Institute of Biological Resources (NIBR), Incheon, Korea, and the specimen room of the Department of Biological Science, Daegu University (DB), Korea.

Abbreviations used in the text and figure legends follow conventions frequently used in copepod taxonomy: A1, antennule; A2, antenna; P1–P5, legs (pereopods) 1–5; enp 1–3 or exp 1–3, the first to third endopodal or exopodal segments of each leg.

Systematic accounts

Family **CANTHOCAMPTIDAE** Sars, 1906

Genus *Itunella* Brady, 1896

Itunella arenaria sp. nov.

(Figures 2–6)

Type material

Holotype ♀ (DB20014), allotype ♂ (DB20015), dissected in lactophenol, estuary of Daejongcheon Stream, Gyeongju (35°44'37"N, 129°29'02"E), 15 May 1996 (*leg.* C.Y. Chang and H.S. Rho). Paratypes: three ♀♀, two ♂♂, collection details same as in holotype, including three undissected (♀, NHM reg. no. 2008. 960; ♂, NHM reg. no. 2008. 961; ♀, NIBRIV0000100514) and two dissected paratypes (♀, DB20016; ♂, DB20017).

Additional material examined

Two ♀♀, Wolpo Beach (estuary of Seojeonggricheon Stream), Pohang, 3 February 2007 (C.Y. Chang, J.M. Lee and S.W. Lee); eight ♀♀, five ♂♂, coastal well at Balsanri village, Youngil Bay, Pohang, 29 April 2007 (C.Y. Chang, J.M. Lee and H.J. Yoon); three ♀♀, estuary of Daejongcheon Stream, Gyeongju, 15 May 1996 (C.Y. Chang and H.S. Rho).

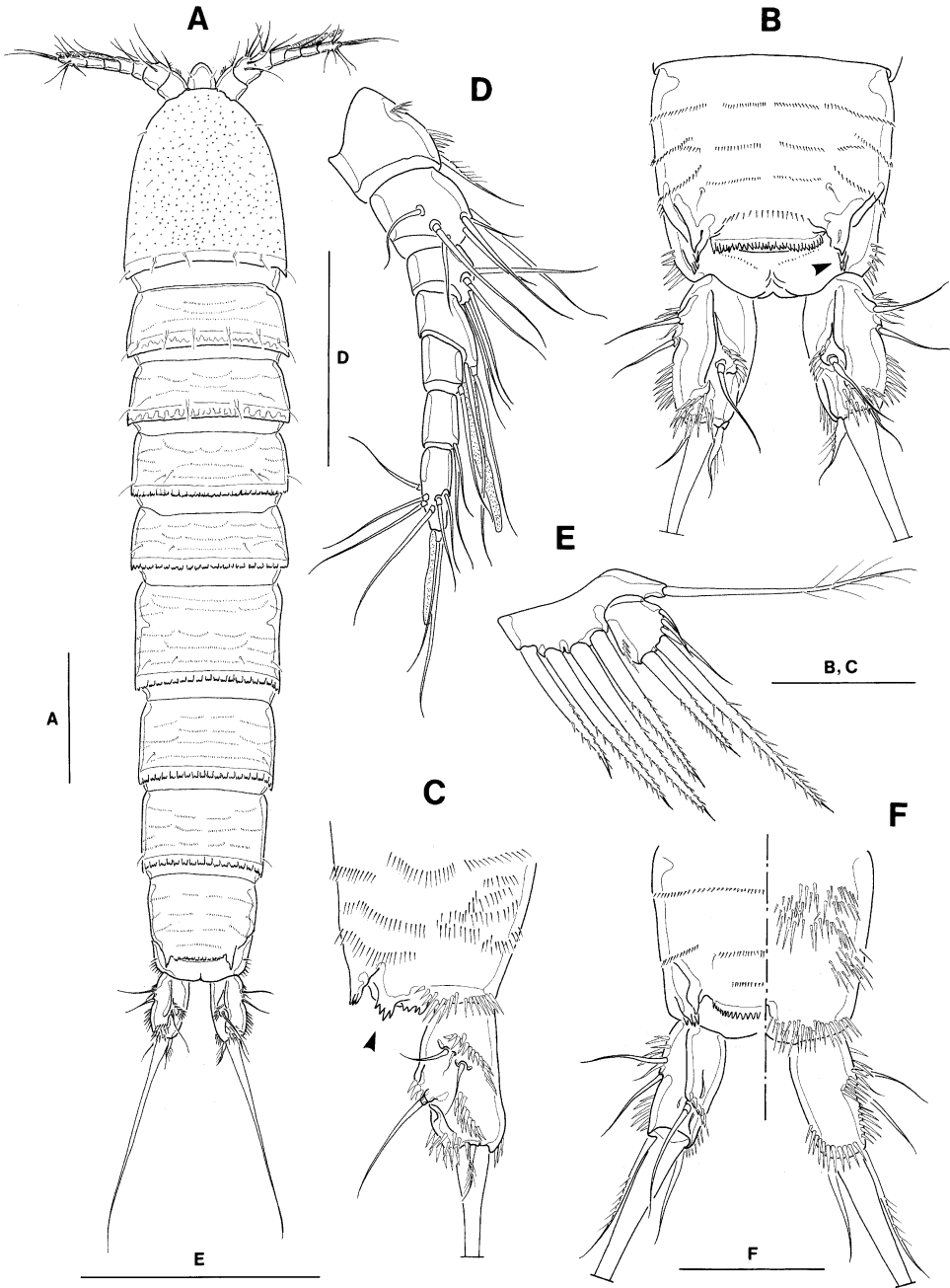


Figure 2. *Itunella arenaria* sp. nov. (A–E) Female: (A) habitus, dorsal; (B) anal somite and caudal rami, dorsal; (C) anal somite and caudal ramus, lateral; (D) A1; (E) P5. (F) Male: anal somite and caudal rami, dorsal (left side) and ventral (right side). Scale bars: 100 µm (A); 50 µm (B–F).

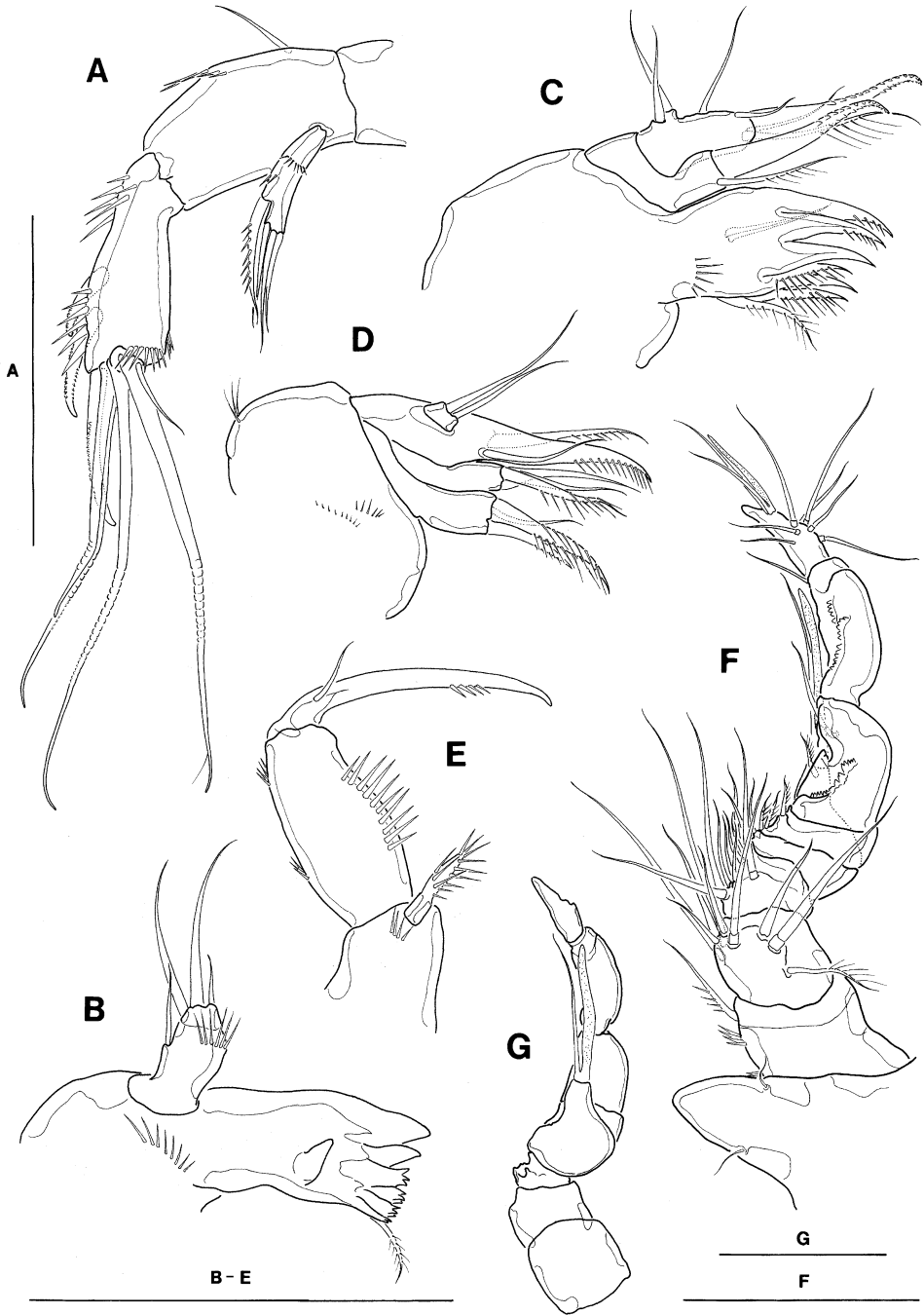


Figure 3. *Itunella arenaria* sp. nov. (A–E) Female: (A) A2; (B) mandible; (C) maxillule; (D) maxilla; (E) maxilliped. (F,G) Male: (F) rostrum and right A1, dorsal; (G) A1, ventral. Scale bars: 50 μ m.

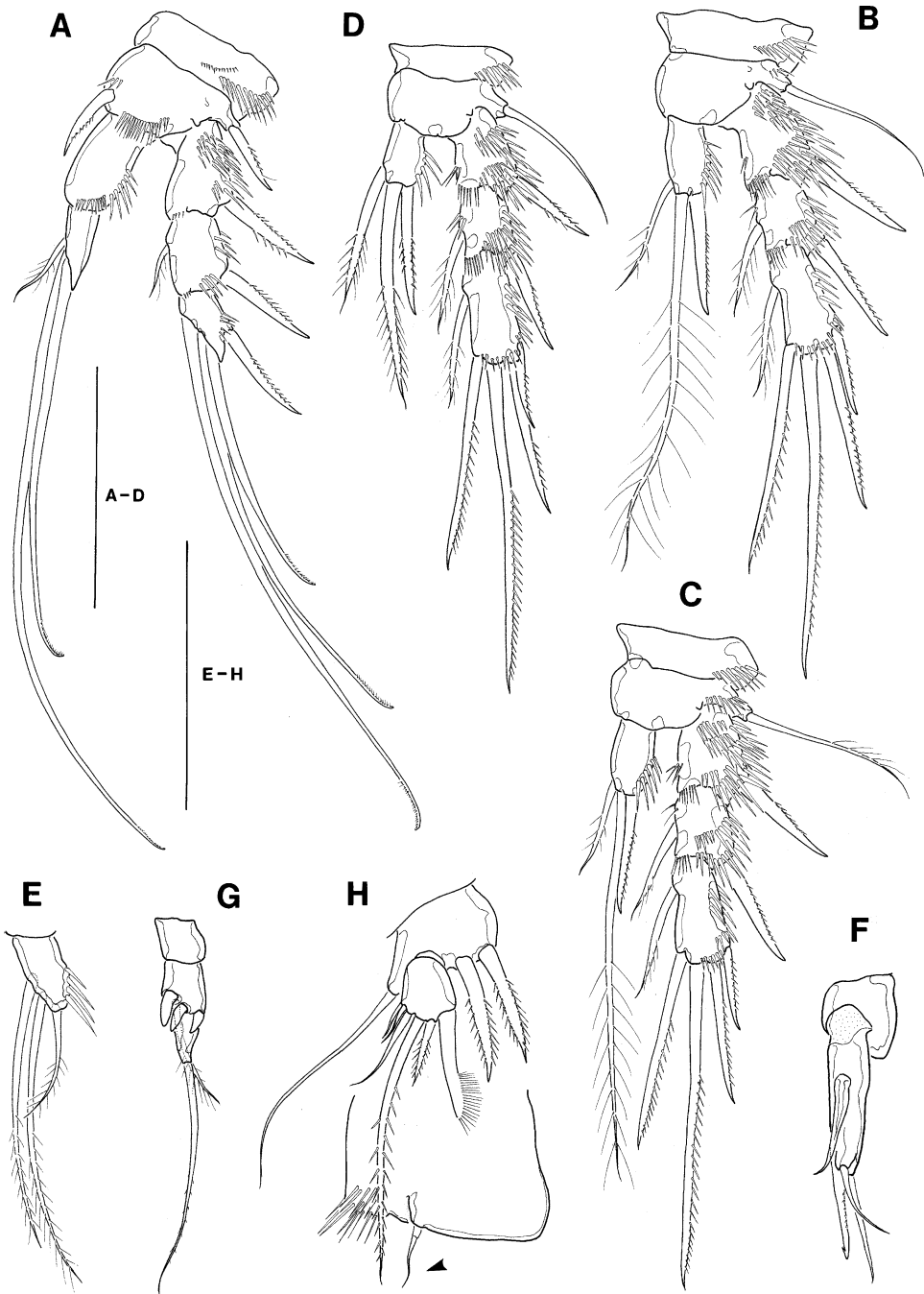


Figure 4. *Itunella arenaria* sp. nov. (A–D) Female P1–P4. (E–H) Male: (E–G) endopods of P2–P4; (H) P5 and P6 (arrow). Scale bars: 50 μm.

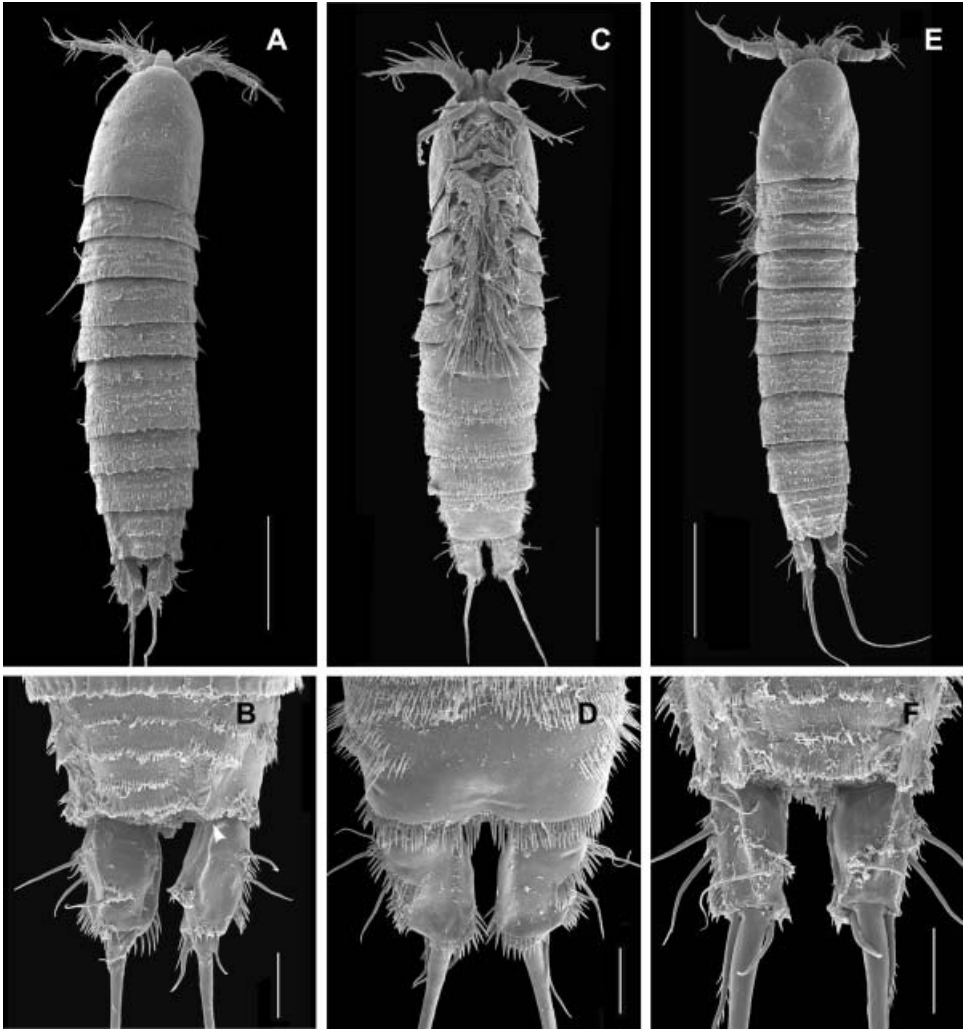


Figure 5. *Itunella arenaria* sp. nov., Scanning electron micrographs. (A–D) Female: (A) habitus, dorsal; (B) anal somite and caudal rami, dorsal; (C) habitus, ventral; (D) anal somite and caudal rami, ventral. (E,F) Male: (E) habitus, dorsal; (F) anal somite and caudal rami, dorsal. Scale bars: 100 μm (A,C,D); 20 μm (B,D,F).

Description

Female. Body (Figure 2A) slender, elongate, $460 \pm 30 \mu\text{m}$ ($n=9$) in length, cylindrical, tapering posteriorly from genital double-somite, without clear distinction between prosome and urosome. All prosomites and urosomites except cephalosome and anal somite ornamented with hyaline frill. Distolateral margin of each prosomite a little protruded. Rostrum protruding with round apex, bearing two sensillae, defined at base. Cephalothorax bell-shaped, a little shorter than sum of next three prosomites; numerous integumental pores dispersed throughout whole surface, with eight or nine short hairs scattered, as in Figure 2A; four to six papillary sensillae along posterior margin; integumental depression (nuchal organ)

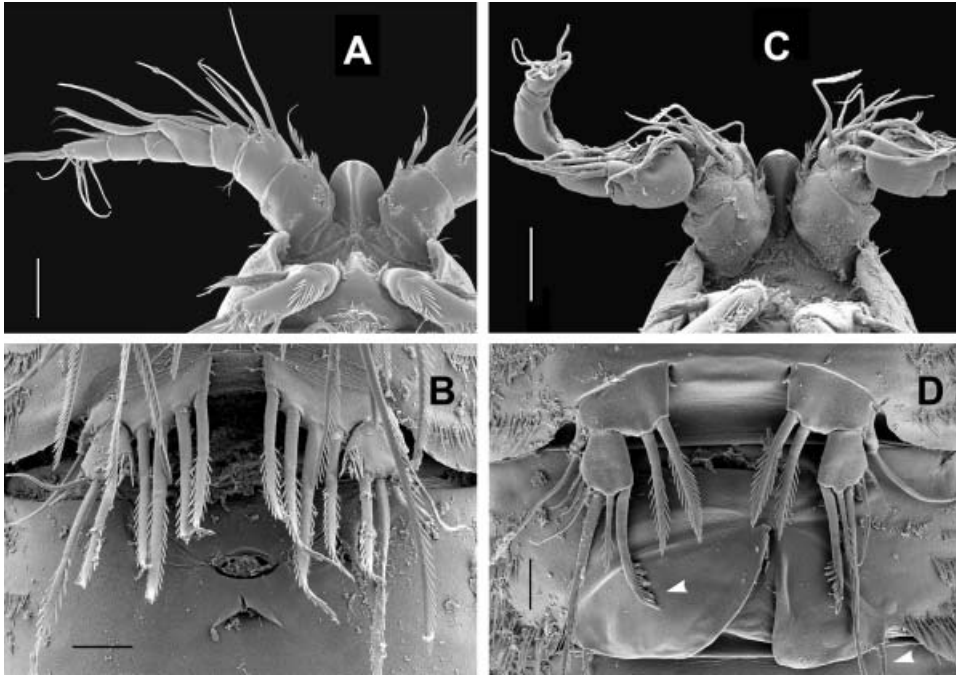


Figure 6. *Itunella arenaria* sp. nov., scanning electron micrographs. (A,B) Female: (A) rostrum and A1, ventral; (B) P5 and genital field, ventral. (C,D) Male: (C) rostrum and A1, ventral; (D) P5, P6 and genital field, ventral. Scale bars: 20 μ m.

not clear. Genital double-somite completely fused, with subcuticular ridge only laterally marking line of fusion. Genital apparatus comprising genital apertures medially fused to form a large elliptical gonopore (Figure 6B); median copulatory pore close to gonopore, partly covered with paired oblique opercula. Anal somite a little longer than preceding abdominal somites; anal operculum not convex, its posterior margin rather straight, serrated; both posterolateral sides of anal somite protruded as triangular projections, serrated longitudinally (Figures 2B,C and 5B, arrows).

Caudal rami ellipsoidal in dorsal view, 1.65–1.86 times (mean 1.76, $n=9$) longer than wide, a little divergent posteriorly. Dorsal keel apparent, running longitudinally nearly throughout dorsal surface. One oblique spinule row present dorsomedially; spinules patched at distal part of dorsal face (Figure 2B,C); two oblique spinule rows laterally (Figure 2C). Lateral caudal setae (caudal setae I and II) locating near proximal quarter of lateral margin; caudal setae II vestigial. Outer caudal seta (caudal seta III) slender, situated at proximal third of lateral margin of caudal rami. Outer terminal caudal seta (caudal seta IV) short, plumose, a little shorter than inner caudal seta (caudal seta VI). Inner terminal caudal seta (caudal seta V) bare, a little more than three times as long as caudal rami. Inner caudal seta (caudal seta VI) swollen at its base, with secondary setules inwardly. Dorsal caudal seta (caudal seta VII) situated a little posterior to middle of caudal ramus, between dorsal keel and medial spinule row.

A1 (Figure 2D) seven-segmented; segment 1 armed with spinules proximally and distally; segment 2 slightly swollen, with convex anterior margin; segment 4 bearing one long aesthetasc, its tip nearly reaching to the end of last segment; last segment with one aesthetasc apically. Setal formula: 1-[1 pinnate], 2-[7], 3-[5], 4-[2+aesthetasc], 5-[1], 6-[2], 7-[6+(2+aesthetasc)]. A2 (Figure 3A), allobasis bearing one naked seta proximally, with one spinule row near middle of medial margin; endopod bearing three outer or outer distal spines, four terminal geniculate setae and one small inner distal seta; exopod one-segmented, about 2.5–3 times longer than broad, with four setae in total. Mandible (Figure 3B) with well-developed coxal gnathobase bearing six teeth along distal margin and one seta at dorsal corner; palp one-segmented with both rami fused to basis, tapering distally, armed with four setae in total and one setule row inner distally. Maxillule (Figure 3C) with praecoxal arthrite bearing seven elements with two setae on frontal surface and one plumose seta posteriorly; coxal endite cylindrical, bearing one large spine with both margins serrated distally and one plumose seta proximally; exopod and endopod fused to basis, bearing in total six setae and one apical spine with two accessory setae at its distal third. Maxilla (Figure 3D) armed with two syncoxal endites, each endite bearing three setal elements; allobasis forming one strong pectinate claw, flanked by two setae; endopod represented by small protuberance bearing two long setae. Maxilliped (Figure 3E) subchelate; syncoxa protruded distomedially with one pinnate seta; basis pectinate with 10–12 spinules along inner margin; endopod represented by one strong and curved claw, bearing two minute setae proximally as accessory armature.

P1 (Figure 4A), exopod three-segmented; endopod two-segmented; endopod much shorter than exopod; coxa armed with one row of sharp spinules at outer distal corner, with one row of minute spinules medially; basis with one spiniform seta inner distally, its tip reaching to two-thirds of enp 1; enp 1 a little elongate, without inner seta; enp 2 with one plumose inner seta and two long terminally pinnate setae apically; exp 1 without inner seta; exp 2 with one short inner proximal seta; exp 3 with one outer spine and three long terminally pinnate setae. P2–P4 (Figure 4B–D), exopods three-segmented; endopods one-segmented; enp 1 small, bearing one spine and two setae, with spinules along lateral margin; exp 1 and exp 2 ornamented with two to four spinule rows near lateral margin of posterior face. Seta/spine armature of P1–P4 as follows (Arabic numerals representing setae, while Roman numerals indicating spines):

P1	basis I-I	exp I-0; I-1; I,1,2	enp 0-0; 0,1,2
P2	basis 1-0	exp I-0; I-1; II,1,2	enp I,1,1
P3	basis 1-0	exp I-0; I-1; II,1,2	enp I,1,1
P4	basis 1-0	exp I-0; I-1; II,1,2	enp I,1,1

P5 (Figure 2E) baseoendopod not protruded, bearing four spiniform setae; exopod nearly as long as wide, bearing two stout apical and three slender outer setae, with spinules inner distally.

Male. Body $378 \pm 20 \mu\text{m}$ ($n=5$) in length. Sexual dimorphism shown in caudal ramus, A1, endopods of P2–P4, P5 and P6. Caudal rami (Figure 2F) spindle-shaped; relatively a little longer than in female, 2.1 times as long as wide; lacking spinule patch posterior to dorsal caudal seta.

A1 (Figure 3F,G) subchirocerate, eight-segmented; geniculate between segments 6 and 7; segment 1 with one row of spinules and one pinnate seta; segment 2 with nine setae (eight naked and one plumose); segment 3 incompletely fused, with two or three surface sutures dorsally, bearing seven naked setae; segment 4 bulbous ventrally, with seven naked setae and one long aesthetasc; segment 5 narrow, with three pinnate and one naked setae; segment 6 enlarged, with one row of denticles on dorsal surface, bearing one pinnate and one naked setae; segment 7 elongate, with one naked seta and two rows of denticles on dorsal surface; last segment projected apically, with six bare setae and one distal trithec.

P2 endopod (Figure 4E) one-segmented, bearing three plumose setae inner distally with spinule row at outer distal margin. P3 endopod (Figure 4F) two-segmented; enp 1 lacking seta or spine; enp 2 elongate, outer distal margin attenuated into slender apophysis with its posterior margin minutely serrate, armed with one proximal and two distal setae. P4 endopod (Figure 4G) three-segmented; enp 1 without inner seta; enp 2 with one plumose seta and three tooth-like projections; enp 3 conical, with one long seta apically.

P5 (Figures 4H, 6D) baseoendopod bearing two setae, similar in lengths to each other; exopod with six setae in total, including one brush-like innermost seta (Figure 6D, left arrow). P6 represented by single seta on outer distal corner of genital operculum (Figures 4H, arrow; 6D, right arrow), with basal socket.

Variability

Individuals from the coastal wells in three localities in South Korea show some variation in two characters. Specimens from the type locality, estuary of Daejongcheon Stream, have the anal operculum with its posterior margin densely serrated (bearing more than 30 teeth), while the specimens from the coastal wells have the anal operculum with 18–20 sharp, triangular teeth, sometimes shown as spinules. Furthermore, in the individuals from the coastal wells, the spinule patch at the outer distal part of the dorsal face of the caudal ramus (cf. Figure 2B) is very weak or rather lacking as in male specimens (cf. Figure 2F). Other characters, including seta/spine armature of legs, are consistent throughout all the specimens examined. As the coastal well is exposed, and not deep (less than 1.5 m deep) there are no grounds for the specimens to be regarded as genuinely subterranean, with taxonomically significant diversification.

Etymology

The specific name (*arenaria*, Latin) means ‘of sand’ or ‘sandy’, taken from the main habitat (sand dunes of the estuaries), where the new species occurred.

Ecology

Collected from the sand dunes of the estuaries discharging into the southeastern coast of Korea and from a coastal well. This species is supposed to be a meiobenthic one inhabiting coarse to medium sand sediments around the estuary. It co-occurred with *Ameira parvula* (Claus, 1866), *Nitokra koreanus* Chang, 2007, and a tardigrade species, *Pseudobiotus granditintinus* (Chang and Rho, 1996).

Remarks

In the genus *Itunella* Brady, five species have been recorded so far: *I. tenuiremis* (Scott, 1893), *I. subsalsa* Brady, 1896, *I. muelleri* (Gagern, 1922), *I. bacescui* (Chappuis and Serban, 1953), and *I. intermedia* Apostolov, 1975. All of them were known from Europe. Among them, *I. subsalsa* was a junior synonym of *I. tenuiremis*, and *I. bacescui* was a junior synonym of *I. muelleri*, (Dussart and Defaye 1990; Bodin 1997). Therefore, only three species are currently recognized as valid.

Itunella arenaria n. sp. is characterized by the serrated projections beside the anal operculum with its convex posterior margin serrated as well as some different modification tendencies in the male endopodal armature. Based on the ellipsoidal shape of the caudal ramus in the female, as used in the key by Lang (1948), *I. arenaria* sp. nov. most resembles *I. muelleri*. However, *I. arenaria* differs from it by spine/seta armature on P4 and P5 in the male: the apical element on P4 enp 3 is a long seta in *I. arenaria*, but a stout, dagger-like projection in *I. muelleri*; and the P5 exopod is armed with six setae including a brush-like innermost seta in *I. arenaria*, while all the setae are normal in *I. muelleri*.

Itunella arenaria sp. nov. is also similar to *I. intermedia* in the appearance of the caudal ramus; however, *I. arenaria* is clearly distinguished from *I. intermedia* by the armature of the endopods of male P2–P4, and by the number and shape of the setae on P5 exopod:

- (1) P2 endopod bearing three setae in *I. arenaria* compared with four in *I. intermedia*;
- (2) P3 enp 2 bearing three setae in *I. arenaria* compared with only one in *I. intermedia*;
- (3) P4 endopod three-segmented with two setae and three projections in *I. arenaria* compared with one-segmented with two setae and serrated apical projection in *I. intermedia* (cf. Apostolov 1975, Figure 4j);
- (4) P5 exopod bearing six setae including a brush-like innermost seta in *I. arenaria*, while there are five normal setae in *I. intermedia*.

Finally, *I. arenaria* is easily distinguished from *I. tenuiremis* by the conspicuous anal operculum (compared with an inconspicuous or even absent anal operculum in *I. tenuiremis*), ellipsoidal caudal ramus in female (against rather oblong ramus in *I. tenuiremis*), and different armature of P2–P4 endopods in the male.

Genus *Mesochra* Boeck, 1864

Mesochra bisetosa sp. nov.

(Figures 7–10)

Type material

Holotype ♀ (DB20018), allotype ♂ (DB20019), dissected in lactophenol, mouth of streamlet, Imjado Island, Sinan (35°08'29"N, 126°08'23"E), 17 January 2006 (*leg.* H.W. Lim). Paratypes: three ♀♀, two ♂♂, collection details same as in holotype, including three undissected (♀, NHM reg. no. 2008. 962; ♂, NHM reg. no. 2008. 963; ♀, NIBRIV0000100515) and two dissected paratypes (♀, DB20020; ♂, DB20021).

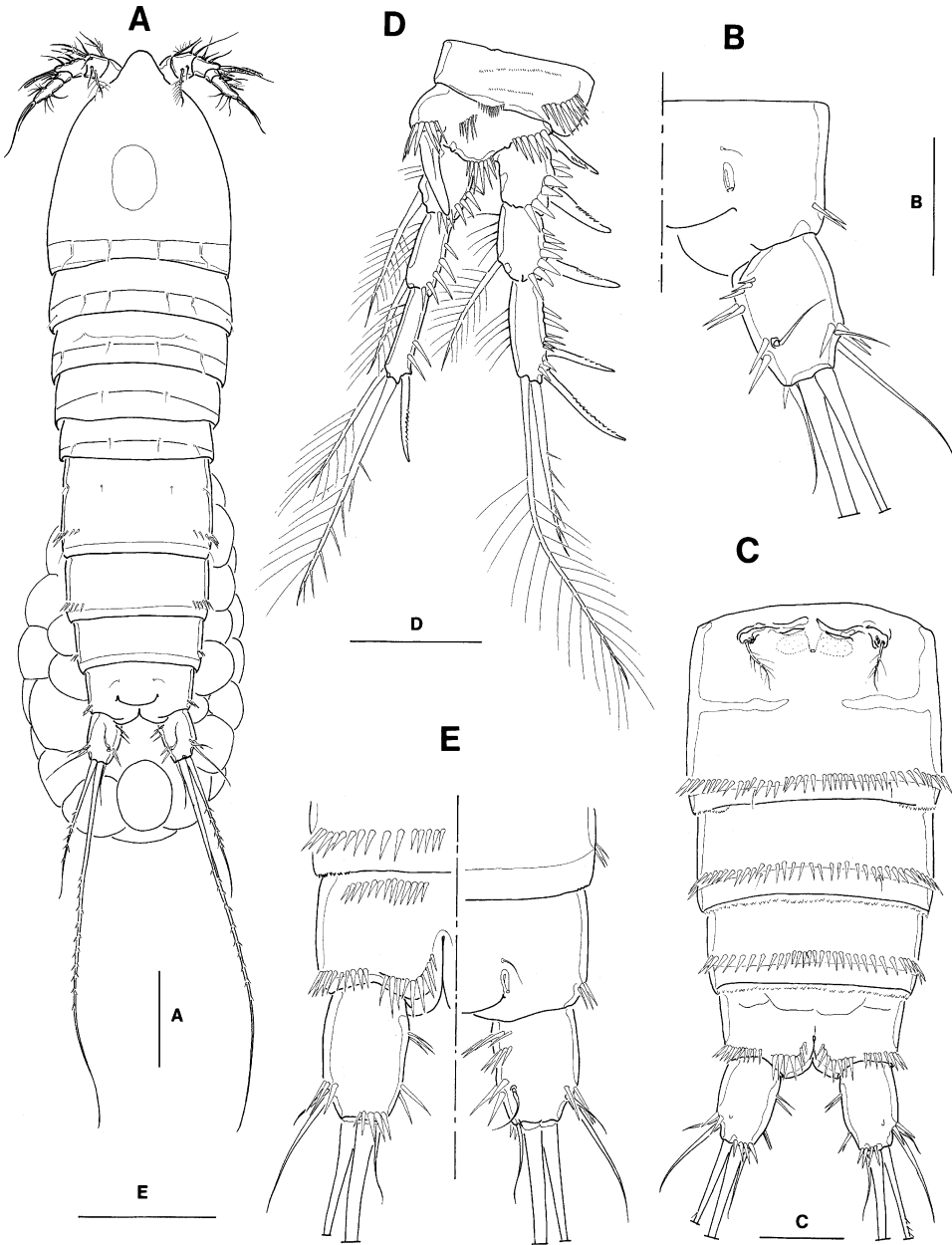


Figure 7. *Mesochra bisetosa* sp. nov. (A–D) Female: (A) habitus, dorsal; (B) right side of anal somite and caudal ramus, dorsal; (C) urosome, ventral; (D) P1. (E) Male: anal somite and caudal rami, ventral (left side) and dorsal (right side). Scale bars: 100 μ m (A); 50 μ m (B–E).

Additional material examined

Eight ♀♀, three ♂♂, mouth of streamlet, Imjado Island, Sinan, 17 January 2006 (H.W. Lim); five ♀♀, one ♂, estuary of Maesancheon Stream, Dangjin, 4 March 2007 (C.Y. Chang and J.M. Lee).

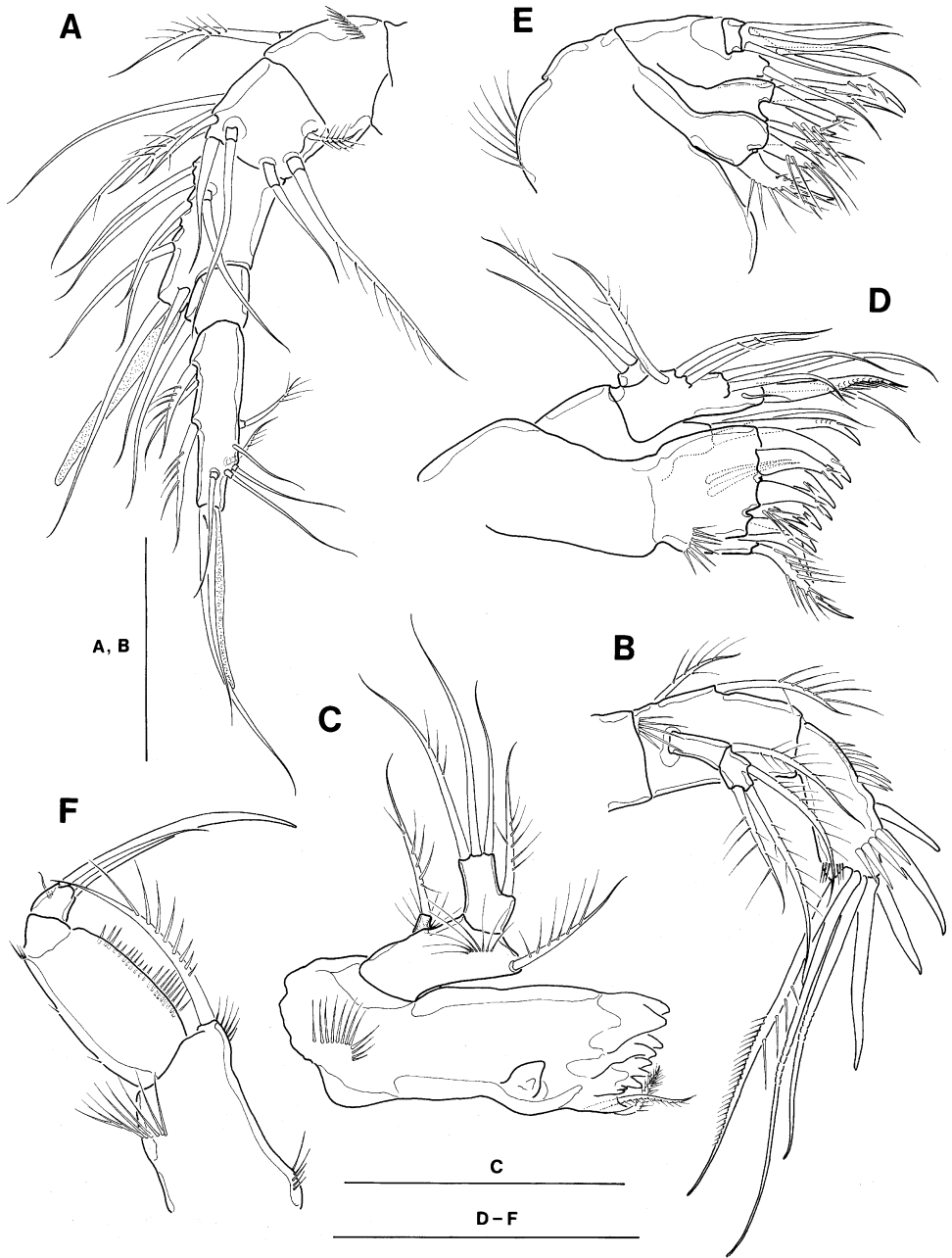


Figure 8. *Mesochra bisetosa* sp. nov., female. (A) A1; (B) A2; (C) mandible; (D) maxillule; (E) maxilla; (F) maxilliped. Scale bars: 50 μ m.

Description

Female. Body (Figure 7A) small, cylindrical, $740 \pm 30 \mu\text{m}$ ($n=9$) in length, tapering behind from border of cephalothorax. Rostrum large, broad, protruding anteroventrally, not defined from cephalic shield at base. Prosomites ornamented with

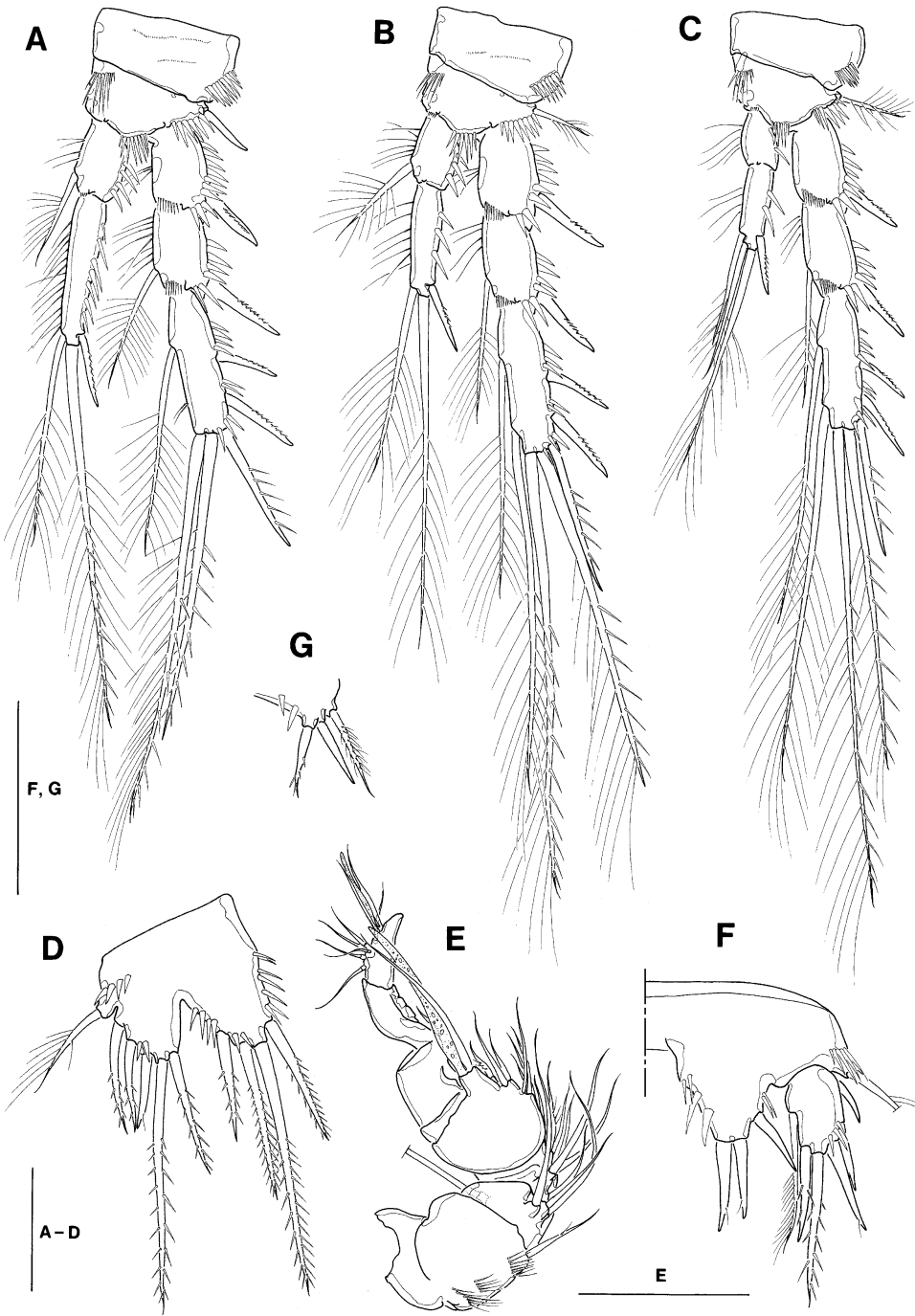


Figure 9. *Mesochra bisetosa* sp. nov. (A–D) Female P2–P5. (E–G) Male: (E) A1, ventral; (F) P5; (G) P6. Scale bars: 50 μ m.

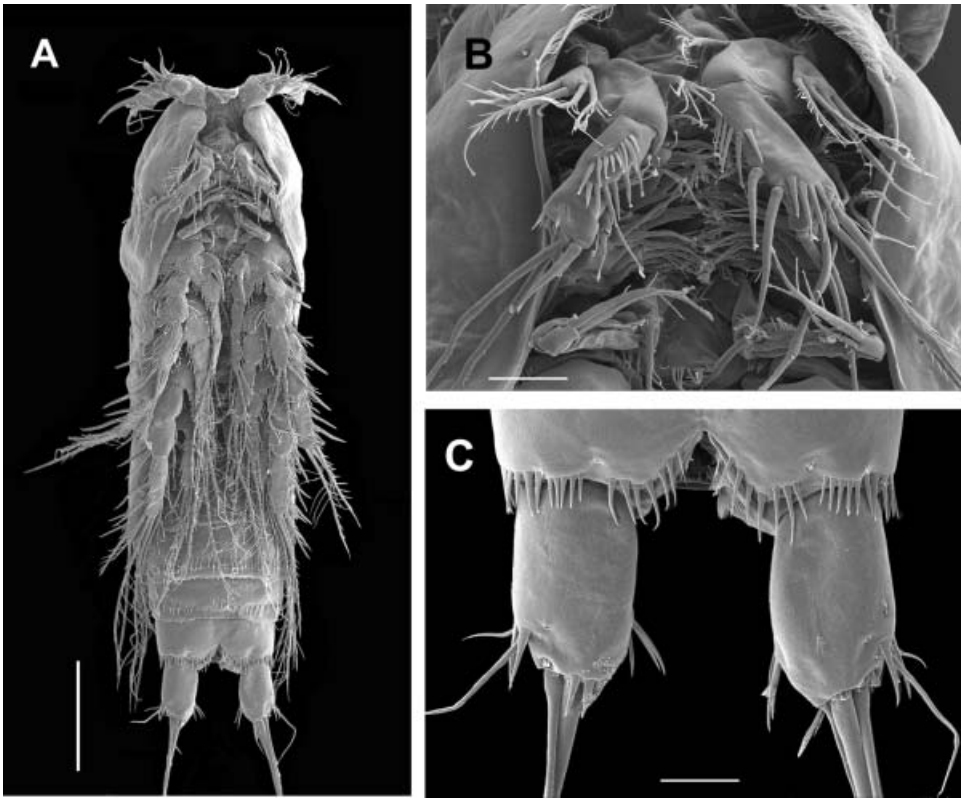


Figure 10. *Mesochra bisetosa* sp. nov., female, scanning electron micrographs. (A) Habitus, ventral; (B) mouthparts; (C) anal somite and caudal rami, ventral. Scale bars: 100 μm (A); 20 μm (B,C).

hyaline membrane and one or two pairs of sensillae along posterior margin dorsally. Cephalothorax a little longer than sum of next three prosomites, with large integumental depression (nuchal organ). Outer distal margin of each prosomite not strongly protruded. Urosomites armed with spinule row along posterior margin ventrally (Figure 7C) and dorsolaterally (Figure 7A). Genital double-somite with subcuticular ridge marking faint line of fusion (suture) in dorsolateral and ventral sides. Genital field (Figure 7C) with separate genital apertures, ending with vestigial P6, each bearing one plumose seta and two minute conical projections medially; copulatory pore situated medially, posterior to genital apertures. Anterior part of ventral surface of anal somite inconspicuous with internal cuticular thickenings (Figure 7C). Anal operculum convex with smooth posterior edge (Figure 7B).

Caudal rami cylindrical, 1.3–1.5 times longer than wide, narrowing a little posteriorly, much divergent from each other posteriorly (Figure 7B). Inner margin armed generally with two spinule rows at about the proximal quarter and distal third of the inner margin (sometimes with only one row distally); posterior margin with one transverse row of four or five spinules ventrally (Figure 7C). Lateral caudal setae

(caudal seta I and II) locating at distal quarter of lateral margin of caudal ramus, flanked with three or four spinules. Outer caudal seta (caudal seta III) lacking. Terminal caudal setae (caudal seta IV and V) well developed, pinnate; inner one about 2.3 times longer than outer one. Inner caudal seta (caudal seta VI) slender, naked, a little shorter than caudal ramus. Dorsal caudal seta (caudal seta VII) locating near inner margin of caudal ramus.

A1 short, five-segmented (Figure 8A); segment one with one row of spinules proximally; segment 3 with one long aesthetasc distally, its tip nearly reaching to distal end of A1; segment 4 small; segment 5 elongate (resulted from complete fusion of two distal segments), about 4.2 times longer than broad. Setal formula: 1-[1 pinnate], 2-[5 pinnate+4 naked], 3-[8 naked+aesthetasc], 4-[1 naked], 5-[4 pinnate+4 naked+trithek (2 naked+1 aesthetasc)]. A2 (Figure 8B) three-segmented, consisting of coxa, allobasis and free endopod; endopod bearing three subapical and four apical elements; exopod two-segmented, with four setae in total. Mandible (Figure 8C) armed with well-developed coxal gnathobase bearing several bicuspidate teeth along distal margin and two setae at dorsal corner; palp three-segmented; basis with one inner distal seta; exopod represented by a small segment bearing one seta; endopod well developed with one proximal and three distal setae. Maxillule (Figure 8D) with praecoxal arthrite bearing nine distal elements with two surface setae; coxa with cylindrical endite bearing two apical setae; endopod fused to basis, bearing nine setae in total; exopod represented by small protuberance with two setae. Maxilla (Figure 8E) armed with two syncoxal endites, each bearing three setiform elements; allobasis forming one strong pectinate claw, flanked by two proximal setae; endopod represented by protuberance bearing four bare setae. Maxilliped (Figure 8F) subchelate; syncoxa with one pinnate seta inner distally and group of eight setules outer distally; basis armed with a row of long setules along inner margin and five spinules on outer distal edge; endopod represented by one curved claw, bearing one long seta as accessory armature.

P1 (Figure 7D), endopod equal in length to exopod; inner distal seta of basis stout, spiniform, a little longer than enp 1; enp 1 not elongated, with one long seta inner distally; enp 2 and enp 3 a little longer than enp 1; enp 3 with one spine and two setae apically or subapically; exp 2 not elongated, with one inner seta; exp 3 with two outer spines and two apical setae.

P2–P4, endopods two-segmented, exopods three-segmented. P2 (Figure 9A), enp 1 with inner seta; enp 2 elongated with setules along inner margin and spinules along outer margin, armed with one outer spine, one apical and one inner distal setae (outer one about twice as long as inner one); exp 3 bearing three outer spines, two apical setae and one inner proximal seta. P3 (Figure 9B), enp 1 with inner seta; enp 2 bearing one outer spine, one apical and one inner distal setae. P4 (Figure 9C), enp 1 small, without inner seta; enp 2 bearing one outer spine, one apical and two inner distal setae with two spinules on outer margin.

Seta/spine armature of P1–P4 as follows (Arabic numerals represent setae, while Roman numerals indicate spines):

P1	basis I-I	exopod I-0; I-1; II,1,1	endopod 0-1; 0-1; I,1,1
P2	basis I-0	exopod I-0; I-1; III,2,1	endopod 0-1; I,1,1
P3	basis 1-0	exopod I-0; I-1; III,2,2	endopod 0-1; I,1,1
P4	basis 1-0	exopod I-0; I-1; III,2,2	endopod 0-0; I,1,2

P5 (Figure 9D) baseopod and exopod confluent proximally, each bearing four (excluding lateral seta) and five pinnate spiniform setae, respectively; both inner and outer margins of inner lobe of baseopod with spinule row, its tip slightly exceeding exopod; exopod triangular, slightly longer than wide, with longest apical setae flanking one inner and three outer setae.

Male. Body cylindrical, $680 \pm 20 \mu\text{m}$ ($n=4$) in length. General appearance and seta/spine arrangement similar to those of females. Anal somite with one transverse spinule row at anterior part of ventral surface (Figure 7E); internal cuticular thickening faint or unseen. Caudal rami sometimes showing asymmetrical spinule ornamentation on inner face (Figure 7E).

A1 (Figure 9E) subchirocerate, eight-segmented; segment 1 with three setule rows and one distal seta; segment 2 with nine naked setae; segment 3 incompletely fused, with two pinnate setae and seven naked setae; segment 4 bulbous, bearing seven naked and two short pinnate setae with one long naked seta and one aesthetasc distally; segment 5 narrow, with one pinnate and two naked setae anterodistally; segment 6 with two naked setae; segment 7 elongate and slightly curved with three cusps on anterior margin; segment 8 curved to claw-shape apically, with six naked setae and two basally fused elements (one aesthetasc and one naked seta) distally.

P5 (Figure 9F), both sides connected basally without distinct intercoxal sclerite; baseopod triangular, bearing three spiniform setae with a few spinules on inner and outer edges; exopod pyriform, with six setae in total, consisting of three outer spiniform setae, one longest pinnate apical seta, two inner setae. P6 (Figure 9G) represented by one small triangular plate bearing three setae with two spinules on inner edge.

Variability

Three of 13 females and two of four males examined show the variation at the inner margin of the caudal rami, that is, armed with only one spinule row distally (cf. Figure 10C), compared with the normal character state of two spinule rows at about the proximal quarter and distal third of the inner margin (cf. Figure 7C). Two females and one male show the asymmetrical arrangement of the spinulation, that is, two spinule rows on one side and three rows on the other side (cf. Figure 7E), or two rows on one side but only one row on the other side.

Etymology

The proposed specific name, *bisetosa*, alludes to the “two setae on distal endopodal segments of legs 2 and 3”, one of the characteristics differentiating it from the related species.

Ecology

The present species was collected from the mouths of streams discharging into the Yellow Sea, on the western coast of Korea. The bottom type in these localities is muddy sand. This species co-occurred with various brackish-water copepods: *Sinodiaptomus tenellus*, *Pseudodiaptomus inopinus* (Calanoida), *Nitokra koreanus*,

Tachidius parvus, *Schizopera neglecta*, *Limnocletodes behningi*, *Onychocamptus vitiospinulosa* (Harpacticoida), and *Halicyclops japonicus* (Cyclopoida).

Remarks

This species is apparently allied with two Far East Asian congeners, *M. quadrispinosa* recorded from brackish waters or freshwaters on the southern coasts of China (Shen and Tai 1965) and *M. hinumaensis* from a brackish-water lake in Ibaraki, northeastern Honshu, Japan (Kikuchi 1972). All three species are basically from brackish water, and do not show sexual dimorphism in P1–P4. Furthermore, they share short P1 enp 1, three outer spines on exp 3 of P2–P3, and five-segmented A1 with last segment resulting from the complete fusion of two distal segments.

However, *M. bisetosa* sp. nov. differs from the two related species by having only two setae on P2–P3 exp 3, as indicated in the specific name. Generally this species has one or two additional spinule row(s) along the inner face of the caudal ramus, compared with the other two species that have only one spinule row distally. Moreover, this species does not show the conspicuous internal cuticular thickening at the anterior part of the anal somite, which was mentioned as a “hyaline frill” by Kikuchi (1972) in the description of *M. hinumaensis*. *Mesochra bisetosa* is also distinguished from *M. quadrispinosa* by the number of setae on the P5 exopod in the female (five setae in *M. bisetosa*, four in *M. quadrispinosa*). The three species seem to have diversified recently in the Far East, and apparently form a species group that is clearly discernible from other congeners of the genus *Mesochra*.

A key to the species of the genus *Mesochra* from East Asia

- 1. P2–P3 exp 3 with two outer spines 2
- P2–P3 exp 3 with three outer spines 3
- 2. Female P5 exopod with four setae/spines *M. suifumensis* Borutsky
- Female P5 exopod with five setae/spines *M. prowazeki* Douwe
- 3. P1 enp 1 elongate, longer than or as long as exopod; sexually dimorphic in P3–P4 endopods 4
- P1 enp 1 much shorter than exopod; P3–P4 endopods similar in both sexes 5
- 4. Anal operculum lacking spinules on posterior border. *M. rapiens* (Schmeil)
- Anal operculum with spinules on posterior border . . . *M. alaskana* Wilson
- 5. P2–P3 enp 2 bearing two setae. *M. bisetosa* sp. nov.
- P2–P3 enp 2 bearing three setae. 6
- 6. P5 exopod in female bearing five setae; anal somite with well-developed cuticular thickening along anterior margin *M. hinumaensis* Kikuchi
- P5 exopod in female bearing four setae; anal somite without conspicuous cuticular thickening along anterior margin. . . *M. quadrispinosa* Shen and Tai

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