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Three New Species of the Genus *Gammarus* (Crustacea, Amphipoda, Gammaridae) from Yunnan, China

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ABSTRACT—Three new species of the genus *Gammarus* are described from Lijiang, Yunnan Province, South China. *Gammarus elevatus* sp. nov. is characterized by mid-dorsal keel on pleonites 1-3 and compressed elevation on urosomites 1-2; *G. denticulatus* sp. nov. by many small spinules and setae on pleonites 1-3; *G. stagnarius* sp. nov. by lack of calceoli on antenna 2 and shorter inner ramus of uropod 3. These amphipods are compared with other known *Gammarus* species from China.

Key Words: amphipoda, *Gammarus*, taxonomy, Yunnan, China

INTRODUCTION

Lijiang lies in the northwest of Yunnan Province and on the south of Qinghai-Tibet Plateau. Todays Lijiang currently comprises two towns, two distinct parts divided by Lion Hill - the new town, which came into being 43 years ago, and the old town, an 865-year-old architectural gem. The old town is also called Dayan Town, which was put on the World Cultural Heritage List in 1997.

Lijiang got its name from the Lishui (now Jinsha, part of Yangtze) River, which flows through the town. The Lion Hill also helps block the icy wind from the northwest, which lend the region favorable climate and rich species, thus attracts many biologists. Only from 1981 to 1985 hundreds employee of Chinese Academy of Sciences, including geophysicists, geologists, geographers, biologists and agriculturalists, have made scientific expeditions in this area. The *Gammarus* specimens used in the present study are also obtained in these expeditions.

Gammarus is one of large epigean freshwater genera of amphipods in the world. Up to now, ten species have been reported from China, among which eight are endemic to this country: *G. gregoryi* Tattersall (1924), *G. nekkensis* Uchida (1935), *G. spinipalmus* Chen (1939), *G. taliensis* Shen (1954), *G. shanxiensis* Barnard and Dai (1988), *G. hongyuanensis* Barnard and Dai (1988), *G. lasaensis* Barnard and Dai (1988), *G. qiani* Hou and Li (2002). *G. lacustris* Sars (1869) and *G. suifunensis* Martynov (1925) are also known from adjacent regions in Asia (Barnard, 1983). Barnard & Dai (1988) and Karaman (1984, 1989, 1991) discussed relationships among these species of *Gammarus*, which helps us a lot to our present study on the systematics of Chinese freshwater Amphipoda. In the present paper three new species of the genus *Gammarus* from Lijiang, Yunnan Province, South China, are described. Detailed drawings of taxonomic characters are illustrated. A key to species of *Gammarus* and *Echinogammarus* from China is also presented.

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Key to the Species of *Gammarus* and *Echinogammarus* from China

1. Uropod 3 parviramus (*Echinogammarus*) 2
   Uropod 3 variramus to magniramus (*Gammarus*) 3
2. Dorsoposterior margin of pleonite 1 bearing only setae ..... *gregoryi*
   Dorsoposterior margin of pleonite 1 bearing both spines and setae ..... *suifunensis*
3. Body carinate ..... *elevatus*
   Body not carinate, urosomite occasionally with humps 4
4. Pleonites 1–3 with spines and setae on dorsal surface ..... *denticulatus*
   Pleonites 1–3 smooth or with several setae on dorsal surface only 5
5. Anterior margins of pereopods 5 to 7 with spines and long setae intermixed with them ..... *qiani*
   Anterior margins of pereopods 5 to 7 with spines only (if setae are present, they are always shorter than the spines) 6
6. Inner ramus of uropod 3 half as long as outer ramus, epimeron 2 with weak posteroventral tooth 7
   Inner ramus of urpod 3 two-thirds as long as outer ramus, epimeron 2 with strong posteroventral tooth 10

7. Setae on male antenna 2 and article 2 of pereopod 7 elongate..... *taliensis*
   Setae on male antenna 2 and article 2 of pereopod 7 short (ordinary)..... 8
8. Telson lacking basolateral spines, article 2 of pereopod 7 broad (*suifunensis* of Ueno, 1940a)..... *sp.*
   Telson with basolateral spines, article 2 of pereopod 7 narrow..... 9
9. Pereopod 3 with long curled setae on posterior margin ..... *nekkensis*
   Pereopod 3 with long straight setae on posterior margin ..... *hongyuanensis*
10. Calceoli absent on antenna 2, epimera 2 and 3 weakly pointed on posteroventral corner ..... *stagnarius*
    Calceoli present on antenna 2, epimera 2 and 3 pointed 11
11. Epimera 2 and 3 with sharper posteroventral corner, dactyli of pereopods slender..... *lacustris*
    Epimera 2 and 3 pointed (ordinary), dactyli of pereopods short 12
12. Telson with basolateral spines, posteroventral corner on article 2 of pereopod 7 with thick spinules 13
    Telson lacking basolateral spines, posteroventral corner on article 2 of pereopod 7 with thin setules or naked ..... *lasaensis*
13. One lateral seta of telson very long ..... *spinipalmus*
    No lateral seta of telson very long ..... *shanxiensis*

MATERIAL AND METHODS

Specimens were first examined under a dissecting microscope, and then under a compound microscope after slide mounted appendages were prepared. The drawings were made with the aid of a drawing tube mounted on an Olympus BH-2 compound microscope. For each species, several specimens of each sex were dissected and the appendages were mounted on slides according to the methods described by Holsinger (1967).

The materials examined are collected by Mr. Guoxiao Chen, and deposited in the Institute of Zoology, Chinese Academy of Sciences (IZCAS), Beijing, China.

DESCRIPTION

Gammarus denticulatus sp. nov .

(Figs. 1–6)

Material examined. Holotype: IZCAS-I-A0005, male, 12.5 mm; allotype: IZCAS-I-A0006, female, 10.6 mm; paratypes: 20 males, 14 females and 4 juveniles; collected from Baimalongtan Spring, Lijiang (26.8° N, 100.2° E), Yunnan Province; 2400 m altitude; 24 August 1981.

The Baimalongtan Spring lies in west of Dayan Town and south of Lion Hill. It's water surface is about $100m^2$, and $0.023m^3$ water is spouted out each second.

Diagnosis

Accessory flagellum of antenna 1 with 3 articles. Pereopods 3-4 densely setose with long straight setae on posterior margins. Pleonites 1-3 with a row of numerous spines accompanied by short setae on posterodorsal margins. All dactyli stout, nails short. Uropod 3, inner ramus about 70% of article 1 of outer ramus; all margins plumose-setose. Telson relatively short. Flagellum of antenna 2 of female with calceoli. Gnathopod 1 of female, propodus with 1 medial palmar spine. Oostegites long.

Description of male (holotype, IZCAS-I-A0005)

Body: Body medium in size. Pleonites 1–3 bearing numerous short spines accompanied by short setae on posterodorsal margins. Epimeral plates 1–3 with few short setae on posterolateral margins. Epimeral plate 1 weakly pointed on posteroventral corner, with 1 seta on anteroventral corner; epimeral plate 2, posterovental corner acute, bearing 2 spines on anteroventral corner; ventral margin of epimeral plate 3 wider than epimeral plate 2, posteroventrally acute, with 3 spines. Urosomites 1-3 poorly elevated, with 3 groups of 1–2 spines accompanied by 2-5 setae on dorsal margins.
Head: Lateral lobe truncate, inferior antennal sinus deep, eyes oval.
Antenna 1: Antenna 1 distinctly longer than antenna 2, peduncular articles 1–3 in length ratio 1 : 0.72 : 0.34, with a few distal setae; primary flagellum 31-articulate, accessory flagellum 3-articulate.
Antenna 2: Gland cone shorter than peduncular article 3; article 4 a little longer than article 5, both with 4–5 groups of short setae along anterior and posterior margins; flagellum 12-articulate, articles 2–7 with calceoli.
Upper lip: Convex, with minute setae.
Mandible: Incisor of left mandible 5-dentate, lacinia mobilis with 4 dentitions, spine row with 7 spinulate setae, molar triturative with 1 seta; article 2 of palp bearing 21 stiff setae, article 3 about 73% of article 2 in length, with 2 groups of A-setae on outer face, 4 B-setae on inner face, and about 30 D-setae and 6 E-setae. Right mandible, incisor 4-dentate, lacinia mobilis bifurcate.
Lower lip: Inner lobe lacking, apical margin with short spines.
Maxilla 1: Inner plate with 19 plumose setae, outer plate bearing 11 serrated spines, second article of left palp with 7 sharp spines accompanied by 4 stiff setae; second article of right palp bearing 7 blunt spines and 1 stiff seta.
Maxilla 2: Inner plate bearing 22 plumose setae on inner face, almost parallel to inner margin.
Maxilliped: Inner plate with 3 apical blunt spines; outer plate broad, bearing 16 medial spines and 5 apical pectinate setae; palp article 4 unguiform.
Coxal plates: Coxal plate 1 weakly dilated distally, bearing 1 seta on anterior and posterior corners respectively; coxal plates 2–3 subrectangular; coxal plate 4 excavate, longer than wide, with 1 seta on anterior corner and 3 short setae on posterior margin; anterior lobe of coxal plates 5–6 small, posterior margin of coxal plate 5 convex, posterior margin of coxal plate 6 nearly straight; coxal plate 7 with 2 setae on posterior margin.
Gnathopod 1: Setae on gnathopod 1 straight, basis with

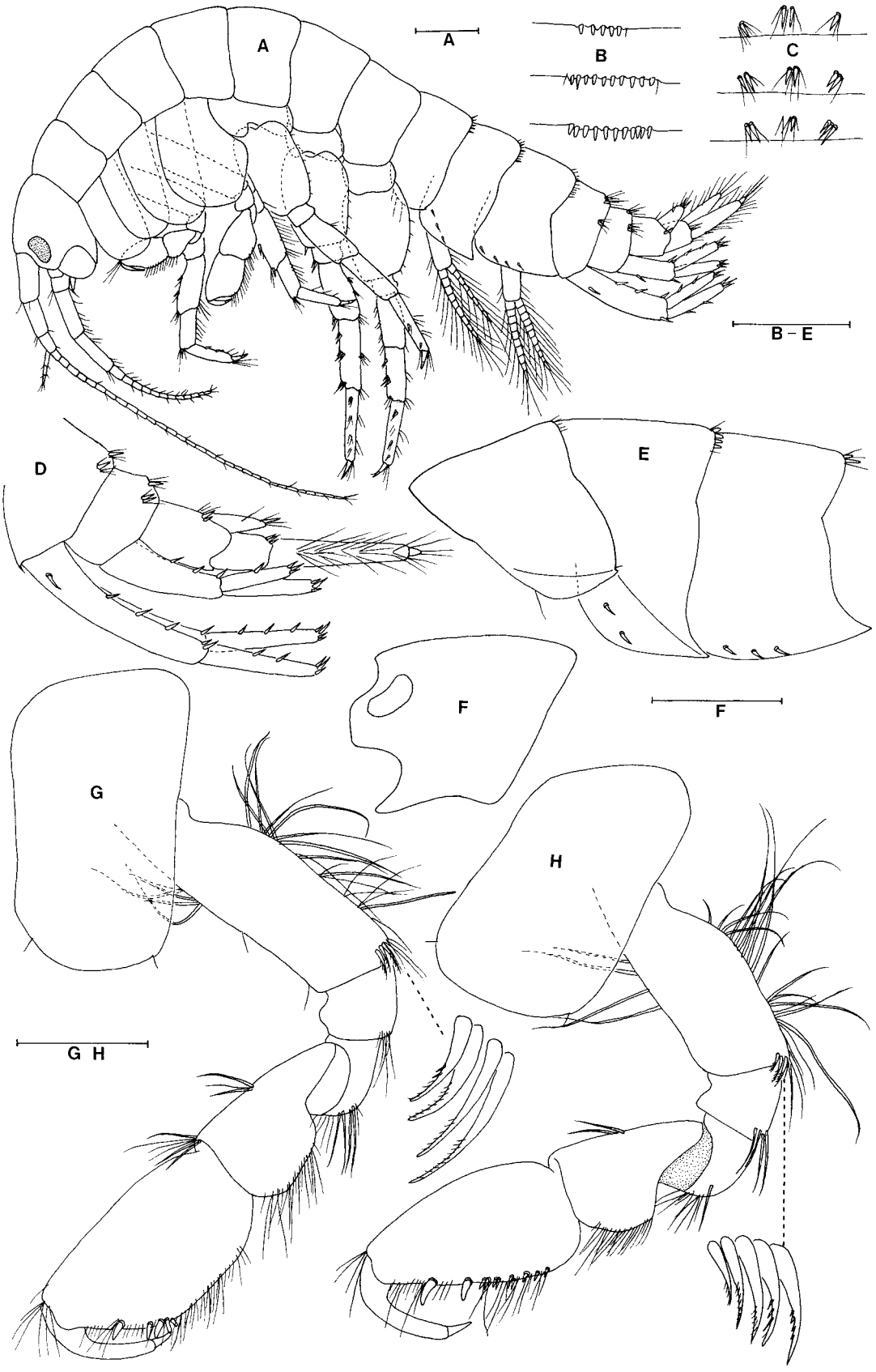

Fig. 1. *Gammarus denticulatus* sp. nov. allotype, female (A); holotype, male (B-H). A, body (lateral view); B, pleonites (dorsal view); C, urosomites (dorsal view); D, urosomites (lateral view); E, epimeral plates; F, head; G, gnathopod 2; H, gnathopod 1. Scales: A–H=1 mm.

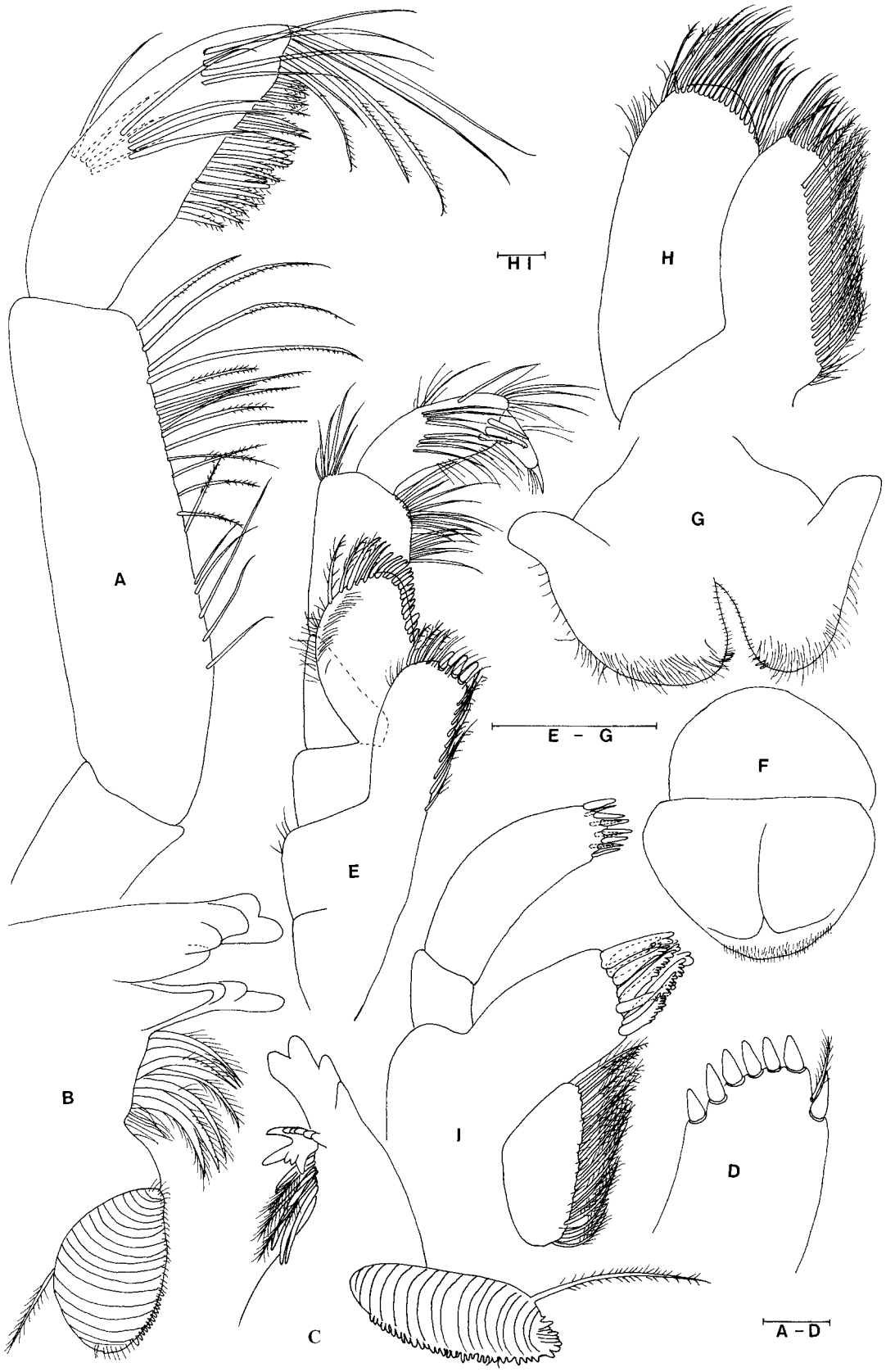

Fig. 2. *Gammarus denticulatus* sp. nov. holotype, male. A, palp of left mandible; B, left mandible; C, right mandible; D, palp of right maxilla 1; E, maxilliped; F, upper lip; G, lower lip; H, maxilla 2; I, left maxilla 1. Scales: A–D, H, I=0.1 mm; E–G=0.5 mm.

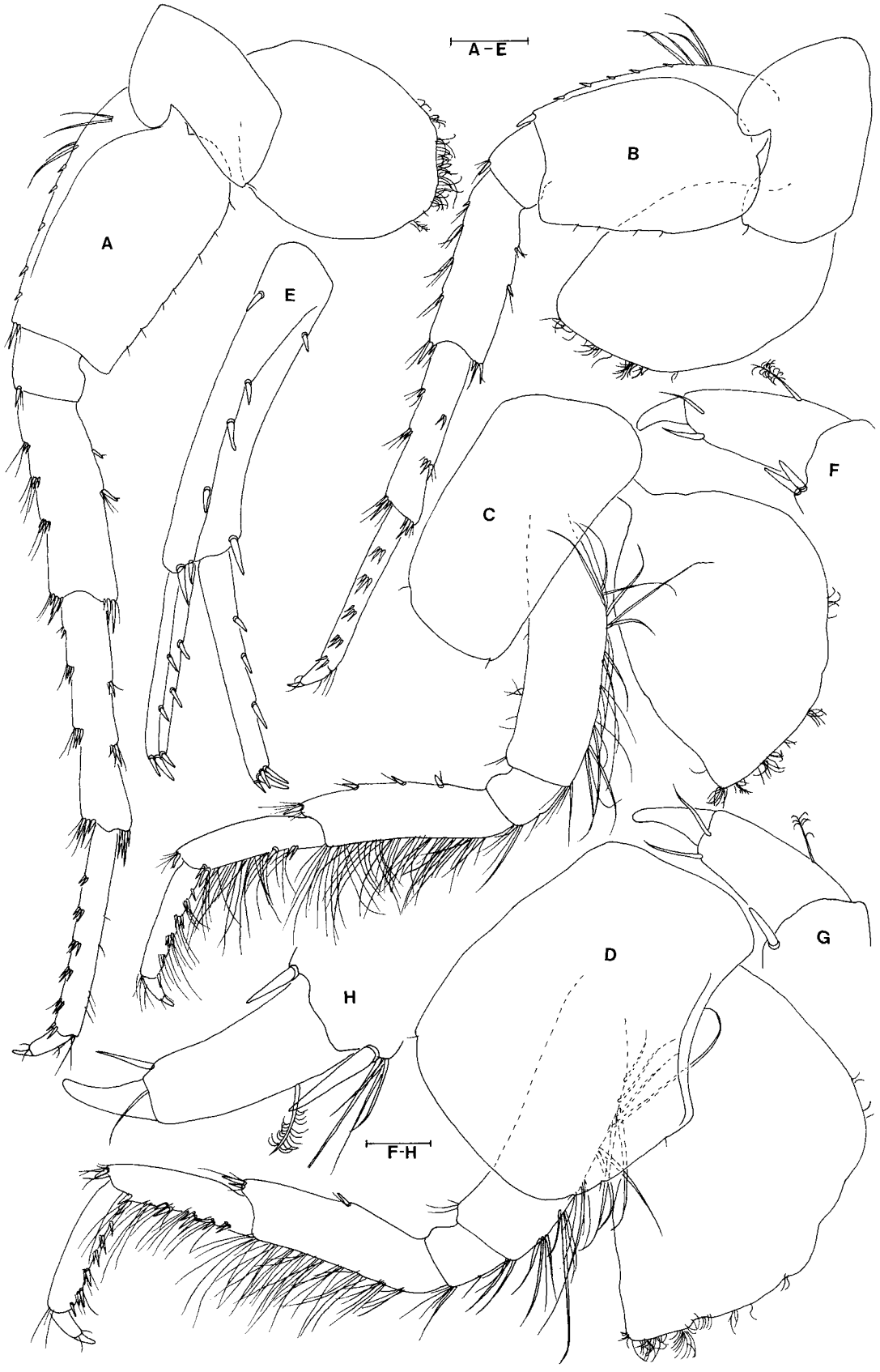

Fig. 3. *Gammarus denticulatus* sp. nov. holotype, male. A, pereopod 6; B, pereopod 5; C, pereopod 3; D, pereopod 4; E, uropod 1; F, dactylus of pereopod 3; G, dactylus of pereopod 4; H, dactylus of pereopod 6. Scales: A–E=0.5 mm; F–H=0.1 mm.

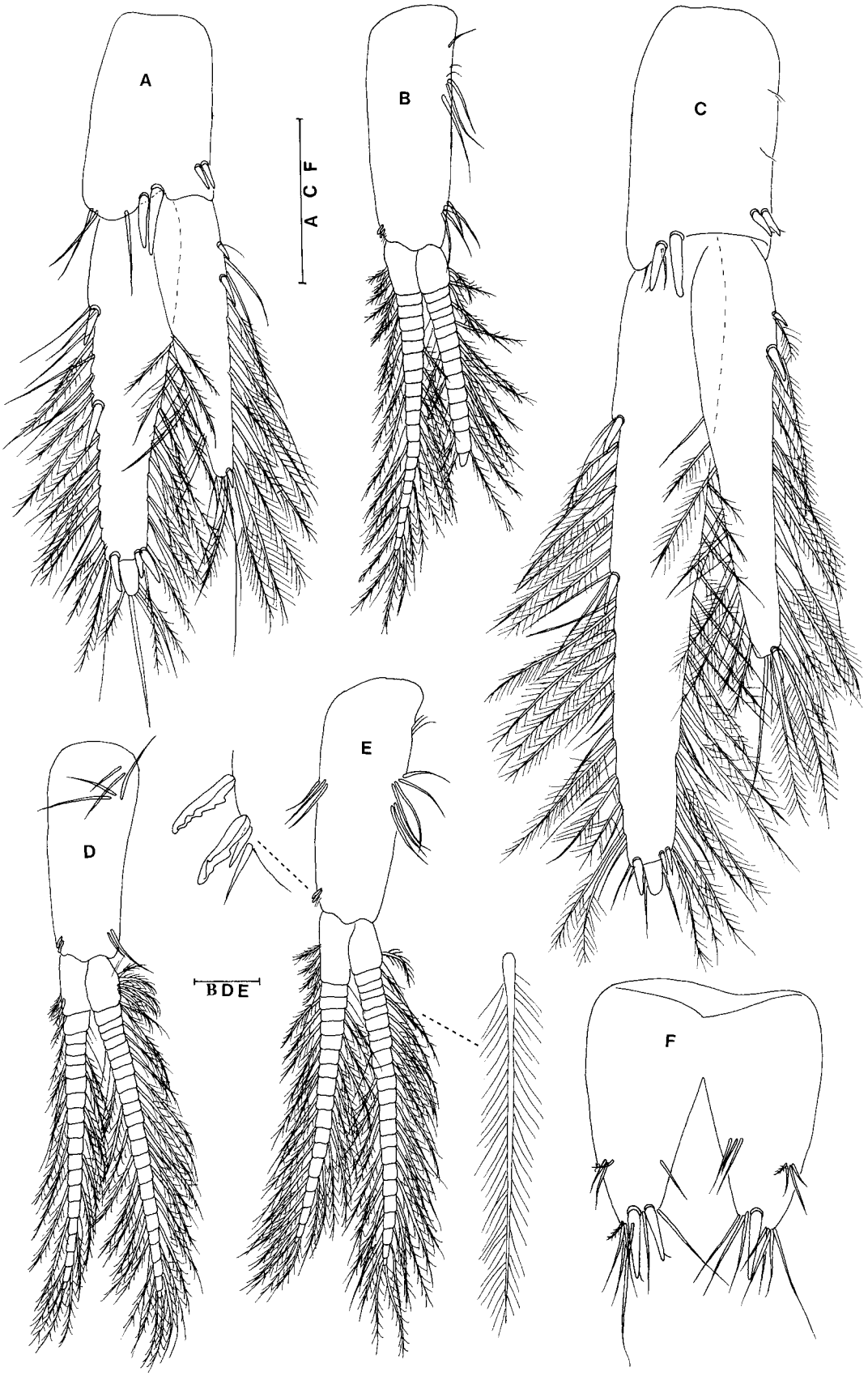

Fig. 4. *Gammarus denticulatus* sp. nov. allotype, female (A); holotype, male (B–F). A, uropod 3; B, pleopod 3; C, uropod 3; D, pleopod 1; E, pleopod 2; F, telson. Scales: A, C, F=0.5 mm; B, D, E=0.1 mm.

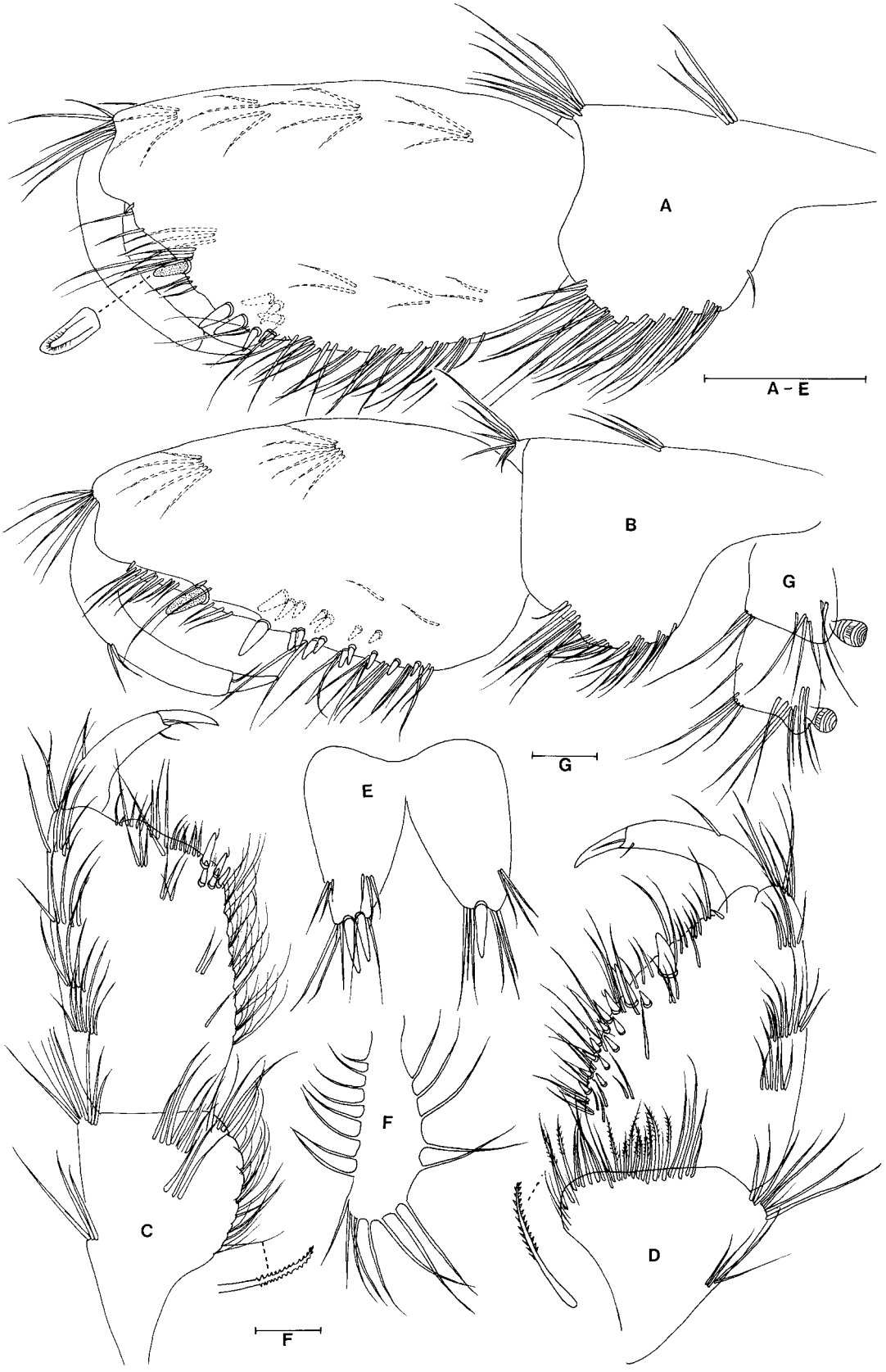

Fig. 5. *Gammarus denticulatus* sp. nov. allotype, female (C-G); holotype, male (A, B). A, propodus of gnathopod 2; B, propodus of gnathopod 1; C, propodus of gnathopod 2; D, propodus of gnathopod 1; E, telson; F, oostegite of pereopod 4; G, flagellum of antenna 2. Scales: A–F=0.5 mm.

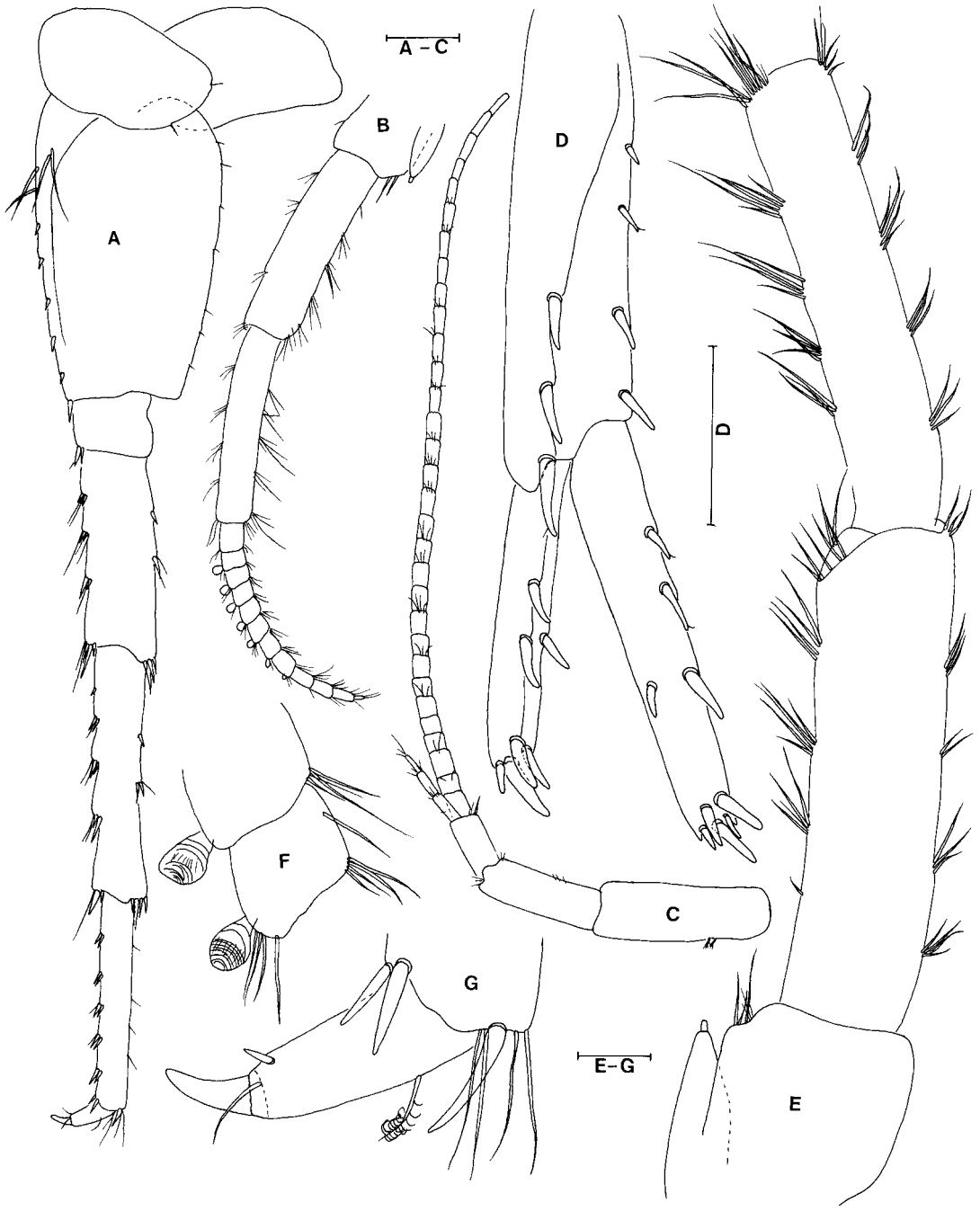

Fig. 6. *Gammarus denticulatus* sp. nov. holotype, male. A, pereopod 7; B, antenna 2; C, antenna 1; D, uropod 2; E, peduncular articles of antenna 2; F, flagellum of antenna 2; G, dactylus of pereopod 7. Scales: A–D=0.5 mm, E–G=0.1 mm.

long setae on posterior margin, bearing 5 spinulate setae distally; carpus shorter than propodus; propodus pyriform, palm oblique, bearing 1 medial spine and 10 spines on posterior margin, inner face with 7 short spines; dactylus bearing 2 setae on outer margin, nail short.

Gnathopod 2: Setae on gnathopod 2 straight, basis slender than that of gnathopod 1, bearing 4 spinulate setae distally; carpus parallel-sided, shorter than propodus; palm of propodus not very oblique, with 1 medial spine and 8 spines on posterior corner; nail of dactylus short.

Pereopod 3: Pereopod 3 slender, posterior margin densely furnished with long straight setae, propodus and carpus accompanied by several spines on posterior margins, dactylus stout, nail short.

Pereopod 4: Pereopod 4 shorter than pereopod 3, propodus to merus with fewer setae than those of pereopod 3.

Pereopods 5–7: Pereopods 6 and 7 longer than pereopod 5. Bases of pereopods 5–7 slender, anterior margin with some setae and 6 short spines; posterior margin with about 8 short setae; carpus and propodus with 3–5 groups of

spines accompanied by short setae on anterior margin; propodus with 6 groups of 2–3 spines on anterior margin, posterior margin with some setae; dactylus stout, with 1 plumose seta on outer margin and 2 stiff setae at joint of nail, nail short.

Gills: Coxal gills 2–6 sac-like, coxal gill 7 smallest.

Pleopods: Pleopods 1–3 subequal, peduncle with some setae, bearing 2 retinaculae accompanied by 1–2 setae; rami about 20-articulate, armed with plumose setae.

Uropod 1: Peduncle longer than rami, bearing 1 basofacial spine, outer and inner margins with 5 and 2 spines respectively; outer ramus shorter than inner ramus, bearing 2 spines on each side; inner ramus with 3 spines on outer margin.

Uropod 2: Peduncle with 3 and 4 spines on outer and inner margins respectively; outer ramus shorter than inner ramus, with 2 and 1 spines on outer and inner margins, respectively; inner ramus bearing 1 and 3 spines on inner and outer margins.

Uropod 3: Peduncle with 4 distal spines; inner ramus about 70% of article 1 of outer ramus in length, with 1 lateral and 1 distal spines; article 1 of outer ramus with 2 lateral and 3 distal spines, article 2 as long as adjacent spines; all margins plumose-setose.

Telson: Cleft deeply, as long as wide, each lobe with 1–2 distal spines accompanied by 6–7 setae, dorsal surface with 2 clusters of short setae.

Description of female (allotype, IZCAS-I-A0006)

Flagellum of antenna 2 with calceoli. Gnathopod 1, carpus short, triangular-shaped; propodus shorter than that of male, palm not oblique as that of male, bearing 1 submedial spine and 14 spines on posterior margin; dactylus with 1 seta on outer margin. Gnathopod 2, propodus subrectangular, palm transverse, with 5 spines on posterior corner; dactylus similar to that of gnathopod 1. Uropod 3, inner ramus about 82% of article 1 of outer ramus, both rami ornamented with plumose setae. Oostegites of pereopods 2–5 long, with many marginal setae.

Etymology

The specific name *denticulatus* alludes to the presence of numerous spines on dorsal margins of pleonites 1–3.

Remarks

The present new species belongs to *Gammarus pulex*-group defined by Karaman and Pinkster (1977a). This species is easily recognizable because of a row of spines and setae on pleonites and propodus of gnathopod 1 of female bearing a medial palmar spine.

The new species resembles *G. crenulatus* Karaman and Pinkster, 1977 in the armature on pleonites. But it can be distinguished from the latter by (1) the pleonites with numerous dentations accompanied by setae on dorsal posterior margin, while the latter with incisions, each incision bearing a long setule; (2) the primary flagellum of antenna 2 bearing calceoli in both sexes; (3) bases of pereopods 5-7 elongate, inner surface with few setae; (4) the propodus of gnathopod 1 of female with 1 medial palmar spine; and (5) oostegites long. Species with crenulated or setose pleonites in *Gammarus balcanicus*-group (Karaman and Pinkster, 1987), that is, *G. anatoliensis* Schellenberg, 1937, *G. pseudanatoliensis* Karaman and Pinkster, 1987, *G. abscisus* Karaman, 1973 and *G. accolae* Karaman, 1973, differ from the new species by poorly setose pereopods 3 and 4, and uropod 3.

G. denticulatus differs markedly from European *G. pulex*-group species in the following characters: inner plate of maxilla 2 with a vertical row of about 20 plumose setae on inner face (always oblique in European *G. pulex*-group), dactyls of gnathopods relatively long, coxal plates 5 and 6 with oblique, nearly straight lower and hind margins. These characters are mostly thought plesio-morphic.

***Gammarus stagnarius* sp. nov.**

(Figs. 7–11)

Material examined. Holotype: IZCAS-I-A0007, male, 11.6 mm; allotype: IZCAS-I-A0008**,** female, 7.1 mm; Dayan, Lijiang, Yunnan Province; 2400 m altitude; 25 August 1981. Paratypes: 13 males and 9 females, Baimalongtan Spring, Lijiang, Yunnan Province, 24 August, 1981.

Diagnosis

Antenna 2, calceoli lacking, peduncular articles 4-5 with short setae on anterior and posterior margins. Dactylus of gnathopod 1 stout and relatively short. Uropod 3, inner ramus about 68% of article 1 of outer ramus, all margins plumose-setose.

Description of male (holotype, IZCAS-I-A0007)

Body: Body medium-sized and slender. Epimeral plates 1–3 progressively acuminate on posteroventral corner, with 1–2 short setae on posterior margin. Epimeral plate 1 with 10 setae on anterior corner, epimeral plate 2 with 2 spines and 2 setae on ventral margin, epimeral plate 3 with 3 spines on anterior corner. Urosomites 1–3 flat, urosomites 1–2 with 4 groups of spines accompanied by setae on dorsal margin, urosomite 3 with 1 group of spines on each side and some setae on dorsomedial margin.

Head: Lateral lobe tranverse, eyes reniform, inferior antennal sinus deep.

Antenna 1: Peduncular articles 1–3 in length ratio 1 : 0.76 : 0.46, articles 2 and 3 with 2 and 1 setal group on posterior margin respectively; flagellum 23-articulate, accessory flagellum 3-articulate.

Antenna 2: Peduncular article 4 about as long as article 5, both with groups of short setae along anterior and posterior margins; flagellum 11-articulate, calceoli lacking.

Upper lip: Convex, with minute setae.

Mandible: Incisor of left mandible 5-dentate, lacinia mobilis with 4 dentitions, spine row bearing 8 pectinate setae, molar triturative with 1 seta; second article of palp with 14 stiff

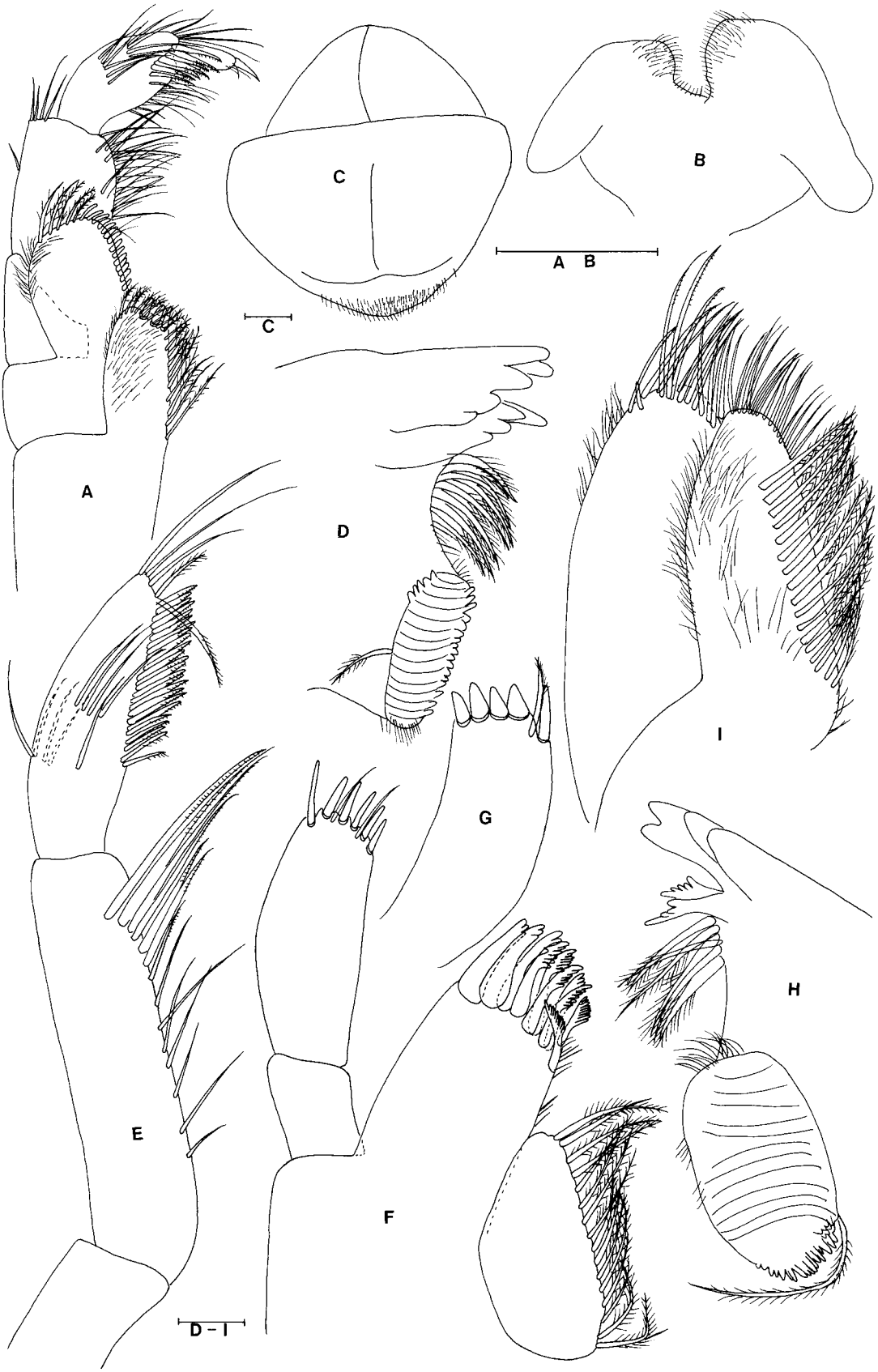

Fig. 7. *Gammarus stagnarius* sp. nov. holotype, male. A, maxilliped; B, lower lip; C, upper lip; D, left mandible; E, palp of left mandible; F, left maxilla 1; G, palp of right maxilla 1; H, right mandible; I, maxilla 2. Scales: A, B=0.5 mm; C–I=0.1 mm.

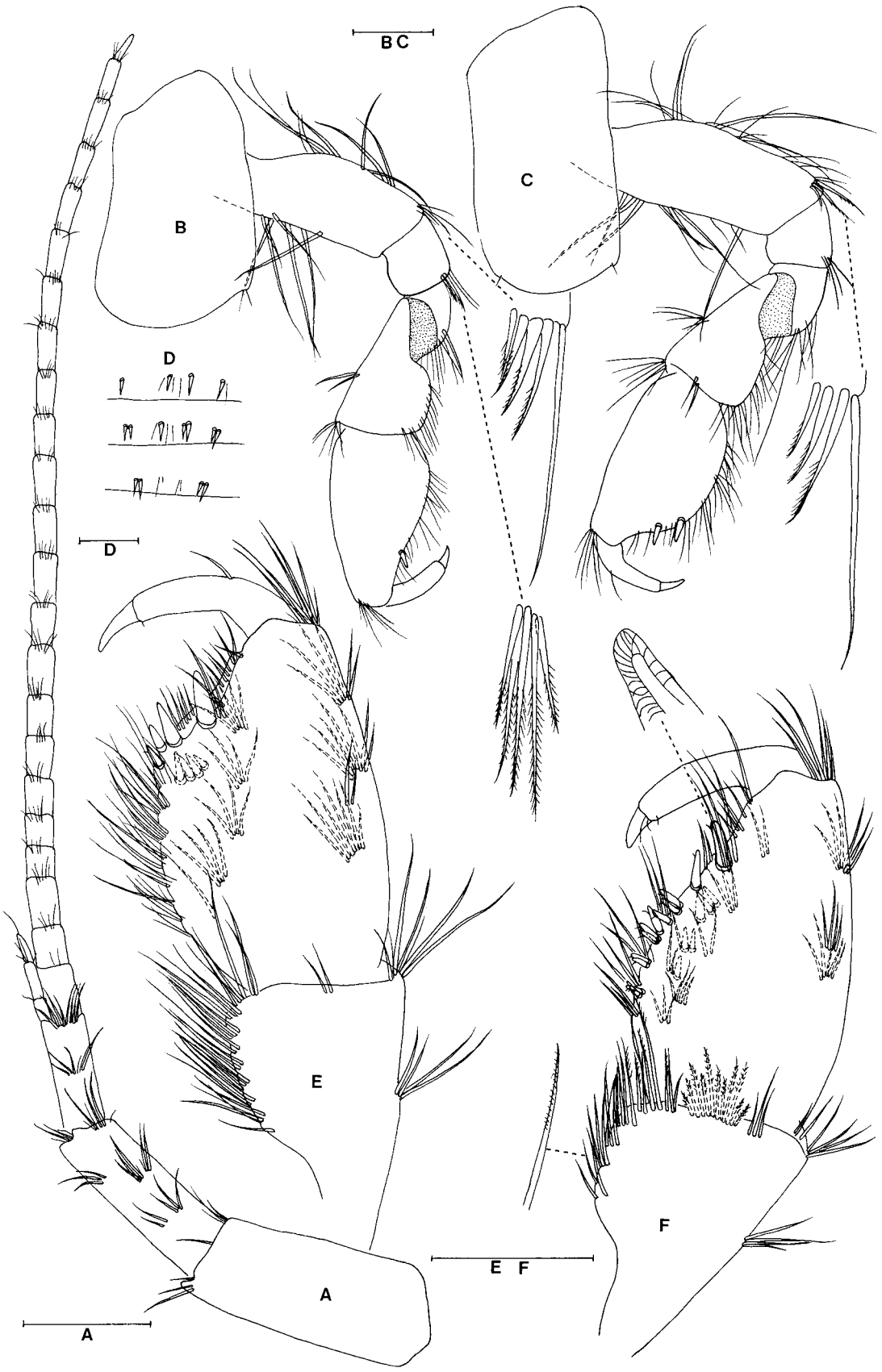

Fig. 8. *Gammarus stagnarius* sp. nov. holotype, male. A, antenna 1; B, gnathopod 1; C, gnathopod 2; D, urosomites 1–3 (dorsal view); E, propodus of gnathopod 2; F, propodus of gnathopod 1. Scales: A–F=0.5 mm.

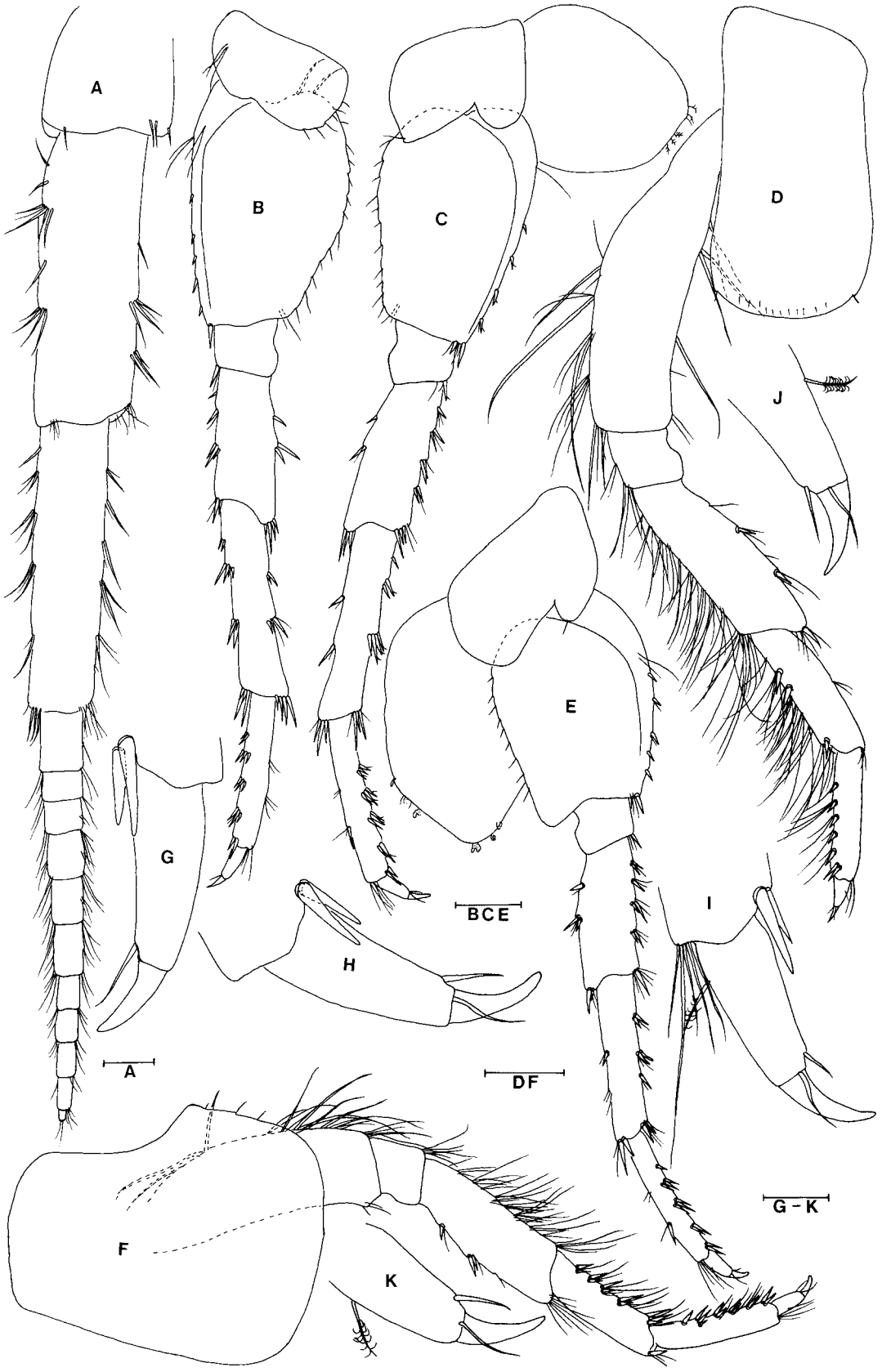

Fig. 9. *Gammarus stagnarius* sp. nov. holotype, male. A, antenna 2; B, pereopod 7; C, pereopod 5; D, pereopod 3; E, pereopod 5; F, pereopod 4; G, dactylus of pereopod 7; H, dactylus of pereopod 6; I, dactylus of pereopod 5; J, dactylus of pereopod 3; K, dactylus of pereopod 4. Scales: A–F=0.5 mm; G–K=0.1 mm.

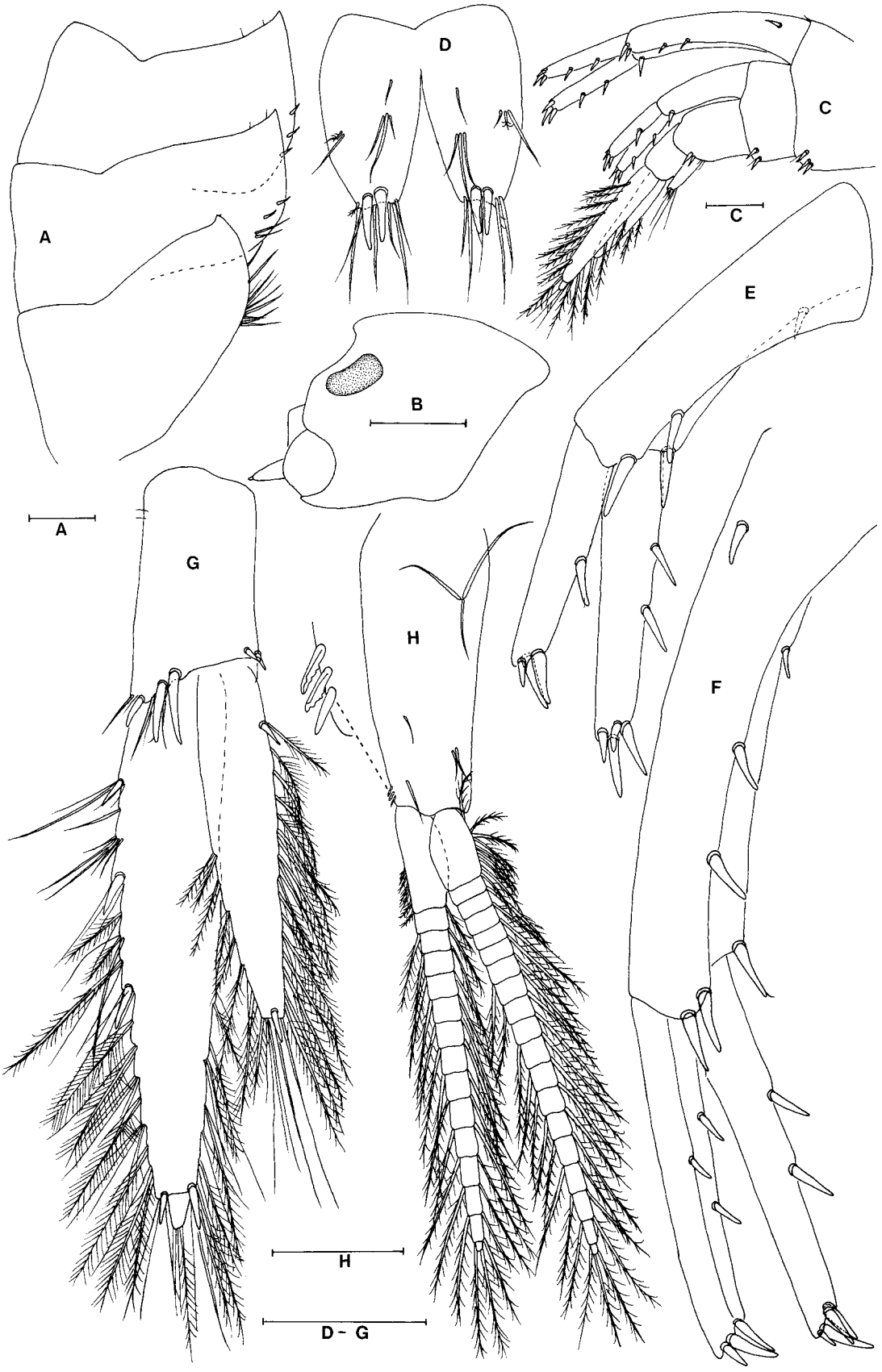

Fig. 10. *Gammarus stagnarius* sp. nov. holotype, male. A, epimeral plates 1–3; B, head; C, urosomites (lateral view); D, telson; E, uropod 2; F, uropod 1; G, uropod 3; H, pleopod 1. Scales: A–H=0.5 mm.

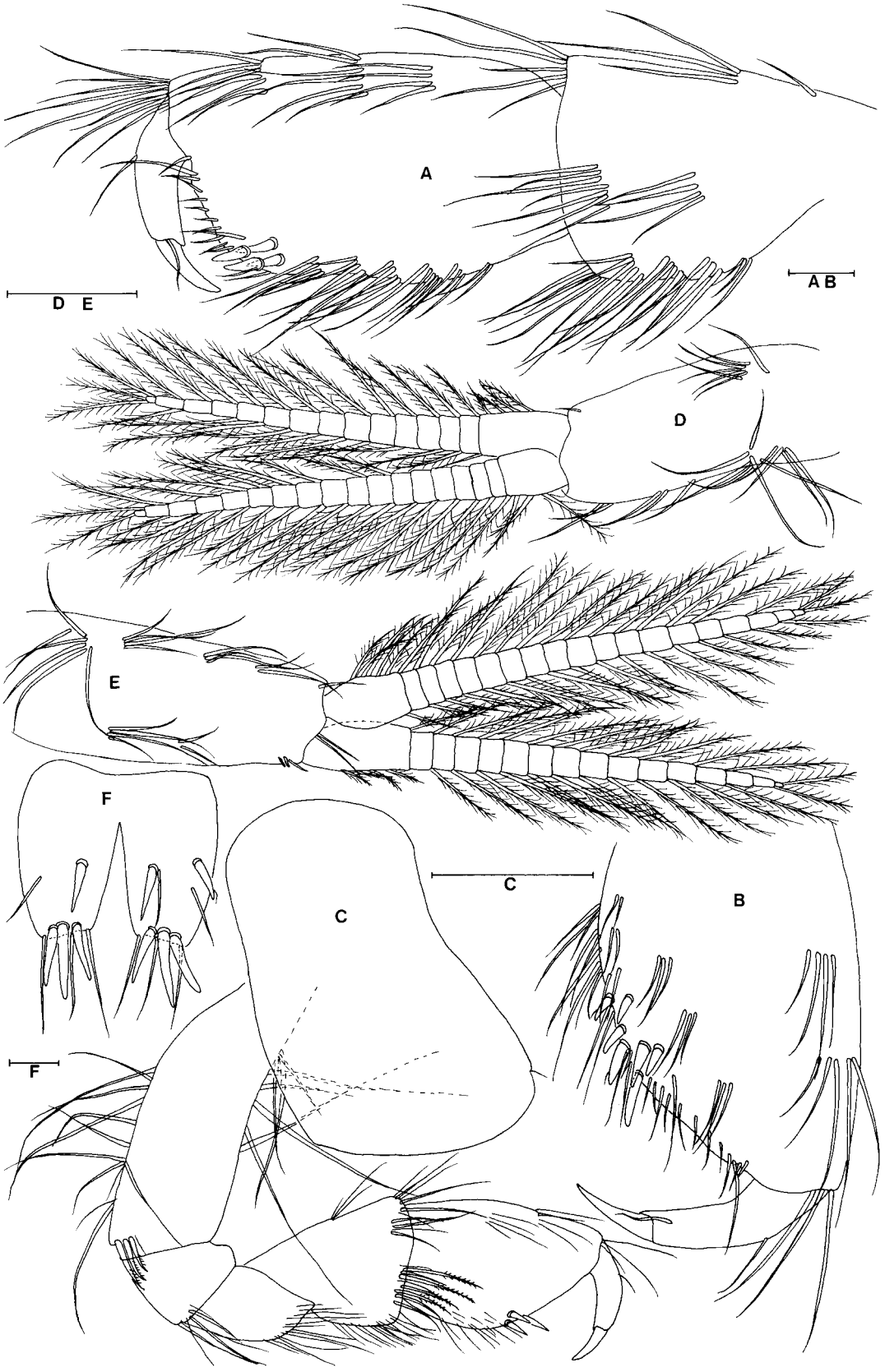

Fig. 11. *Gammarus stagnarius* sp. nov. allotype, female (A-C, F); holotype, male (D, E). A, propodus of gnathopod 2; B, propodus of gnathopod 1; C, gnathopod 1; D, pleopod 3; E, pleopod 2; F, telson. Scales: A, B, F=0.1 mm; C–E=0.5 mm.

setae, article 3 about 73% of article 2 in length, with 2 groups of A-setae, 4 B-setae, 25 D-setae and 4 E-setae. Right mandible, incisor 4-dentate, lacinia mobilis bifurcate.

Lower lip: Low lip lacking inner lobe.

Maxilla 1: Inner plate with 16 plumose setae, outer plate with 11 serrated spines, second article of left palp with 6 sharp spines accompanied by 2 stiff setae; second article of right palp with 5 blunt spines accompanied by 1 spinulate seta.

Maxilla 2: Inner plate shorter than outer plate, bearing 17 plumose setae on inner face.

Maxilliped: Inner plate with 3 apical spines; outer plate broad, with 15 slender spines on medial margin and 5 apical pectinate setae; palp article 4 unguiform, nail short.

Coxal plates: Coxal plate 1 weakly dilated distally, bearing 1 seta on posterior corner; coxal plates 2–3 subrectangular, with 1 seta on anterior corner and 1 seta on posterior corner; coxal plate 4 excavate, longer than wide, bearing 4 setae on posterior margin; coxal plates 5–6, anterior lobe small; coxal plate 7, anterior margin with 3 long setae, posterior margin with 5 setae.

Gnathopod 1: Basis with long setae on both margins, bearing 4 spinulate setae distally; carpus shorter than propodus; palm of propodus oblique, bearing 1 medial spine, with 11 spines on posterior margin and 6 spines on inner surface; dactylus stout, nail short.

Gnathopod 2: Setae on gnathopod 2 straight, carpus shorter than propodus, palm of propodus slant, bearing 1 medial blunt spine and 7 spines on posterior corner.

Pereopod 3: Slender, posterior margin of merus to carpus densely furnished with long straight setae, carpus and propodus accompanied by several spines on posterior margin, dactylus bearing 1 plumose seta on outer margin and 2 setae at joint of nail, nail shorter than basis of dactylus.

Pereopod 4: Pereopod 4 shorter than pereopod 3, setae of merus to propodus shorter and fewer, dactylus similar to that of pereopod 3.

Pereopods 5–7: Pereopod 5 shorter than pereopods 6 and 7. Anterior margin of bases of pereopods 5–7 weakly convex, with 1–4 long setae and about 5 short spines; posterior margin nearly straight in pereopod 5, weakly concave in pereopod 6, weakly expanded in pereopod 7, with about 12 short setae. Merus and carpus mainly with 4–5 groups of short spines accompanied by short setae; propodus with 5 groups of 2–3 spines on anterior margin and some setae on posterior margin. Dactylus slender, bearing 1 seta on outer margin and 1–2 setae at joint of nail, nail slender.

Gills: Gills on pereopods 2 to 7, sac-like.

Pleopods: Pleopods 1–3 similar to each other, peduncle with numerous setae, bearing 2 retinaculae accompanied by 1 seta; rami 15-articulate, armed with plumose setae.

Uropod 1: Peduncle longer than rami, bearing 1 basofacial spine, outer margin and inner margin with 4 and 2 spines respectively; both rami subequal in length, bearing 1-2 marginal spines.

Uropod 2: Peduncle with 2 spines on inner and outer margins, respectively; outer ramus shorter than inner ramus.

Uropod 3: Peduncle with 4 distal spines and some setae; inner ramus 68% of article 1 of outer ramus in length, with 1 lateral and 1 distal spine; article 1 of outer ramus with 3 lateral and 2 distal spines, article 2 short; all margins plumose-setose.

Telson: Telson wider than long, cleft deeply, each lobe with 2 distal spines accompanied by some setae, dorsal surface with some setae.

Description of female (allotype, IZCAS-I-A0008)

Gnathopod 1, coxal plate 1 dilated distally, palm of propodus not very oblique, with 7 spines on posterior corner. Gnathopod 2, carpus and propodus elongate, palm of propodus transverse, with 4 spines on posterior corner, dactylus stout.

Telson cleft deeply, each lobe with 3 distal spines and 1–2 dorsal spines.

Etymology

This species is named for the sampling locations in a stagnant pond.

Remarks

Gammarus stagnarius sp. nov. also belongs to *Gammarus pulex*-group. This taxon is similar to *G. lascustris*, but it differs from the latter by absence of calceoli on antenna 2, setose peduncle of antenna 1, epimeral plates not very acute, and relatively short inner ramus of uropod 3. *Gammarus stagnarius* sp. nov. can be clearly distinguished from other *Gammarus* species known from China by the absence of calceoli.

***Gammarus elevatus* sp. nov.**

(Fig. 12–16)

Material examined. Holotype: IZCAS-I-A0009**,** male, 16.6 mm; allotype: IZCAS-I-A0010, female, 11.1 mm; Dayan, Lijing, Yunnan Province; 2400 m altitude, 25 August, 1981. Paratype: one female, Baimalongtan Spring, Lijiang, Yunnan Province, 2400 m altitude, 24 August, 1981.

Diagnosis

Antenna 1 accessory flagellum 4-articulate. Coxal plate 3 weakly produced on posterodistal corner. Pereonite 7 and pleonites 1-3 dorsally elevated, epimeral plates 2 and 3 cuspate on posterodistal corners. Urosomites 1–3 elevated, with 3 clusters of dorsal spines or setae. Uropod 3 inner ramus more than 80% of article 1 of outer ramus, both rami densely armed with plumose setae. Telson cleft, each lobe with 1 distal spine accompanied by 7 setae.

Description of male (IZCAS-I-A0009)

Body: Body large, relatively stout. Body and Appandages attaching extraneous material, which may be parasitic epizoans. Pereonite 7 and pleonites 1–3 progressively elevated dorsally to keels. Pleonites 1–3 with a few short setae on

Fig. 12. *Gammarus elevatus* sp. nov. holotype, male. A, head; B, upper lip; C, left maxilla 1; D, palp of right maxilla 1; E, maxilliped; F, lower lip; G, left mandible; H, right mandible; I, maxilla 2; J, outer plate of left maxilla 1. Scales: A–I=0.5 mm; J=0.1 mm.

Fig. 13. *Gammarus elevatus* sp. nov. holotype, male. A, gnathopod 1; B, gnathopod 2; C, uropod 1; D, epimeral plates; E, propodus of gnathopod 1; F, propodus of gnathopod 2. Scales: A–F=0.5 mm.

Fig. 14. *Gammarus elevatus* sp. nov. holotype, male. A, pereopod 3; B, pereopod 4; C, pleopod 2; D, uropod 2; E, urosomites (lateral view); F, antenna 1; G, antenna 2; H, flagellum of antenna 2; I, dactylus of pereopod 4. Scales: A–G=0.5 mm; H, I=0.1 mm.

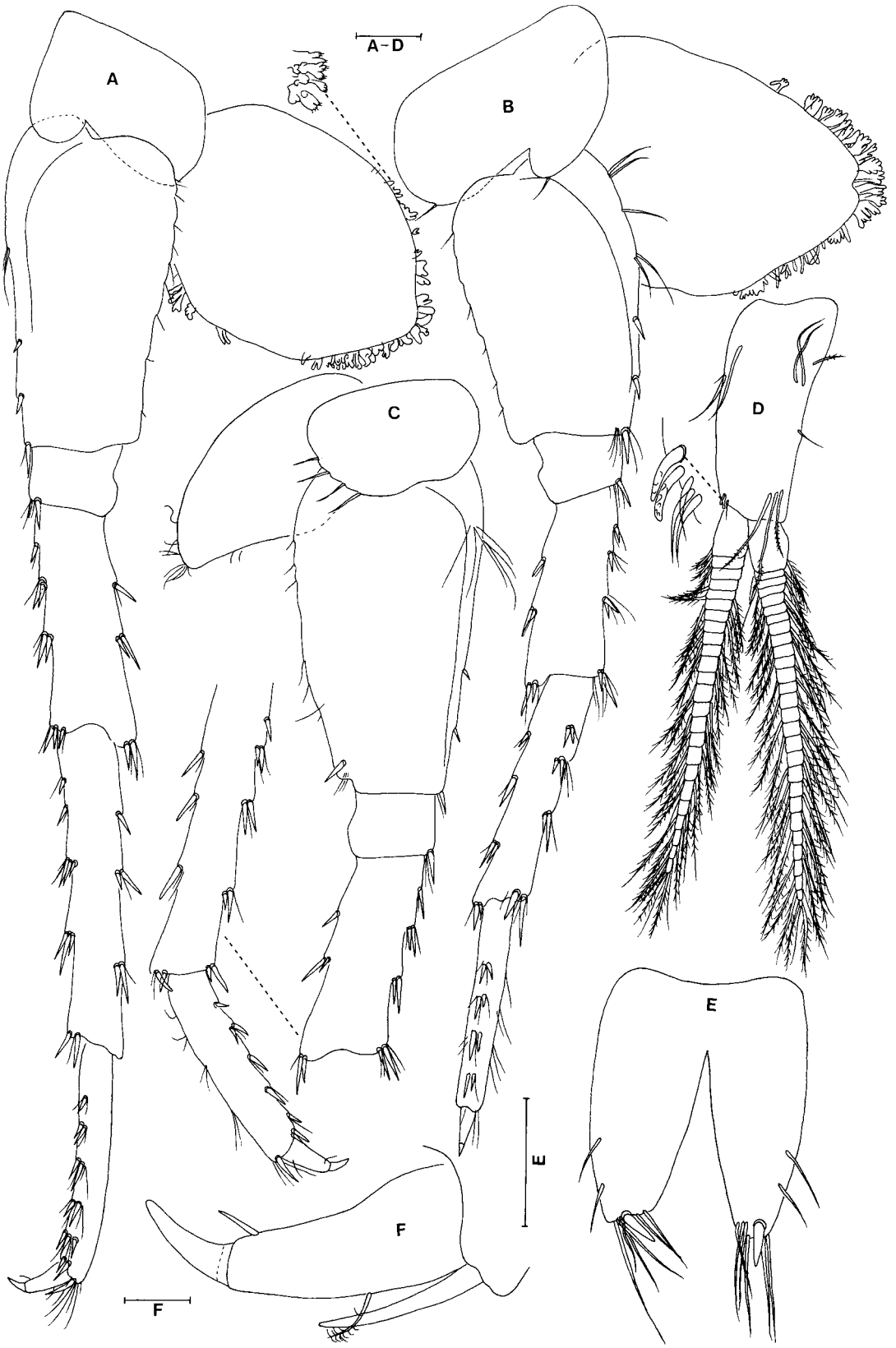

Fig. 15. *Gammarus elevatus* sp. nov. holotype, male. A, pereopod 6; B, pereopod 5; C, pereopod 7; D, pleopod 1; E, telson; F, dactylus of pereopod 6. Scales: A–E=0.5 mm; F=0.1 mm.

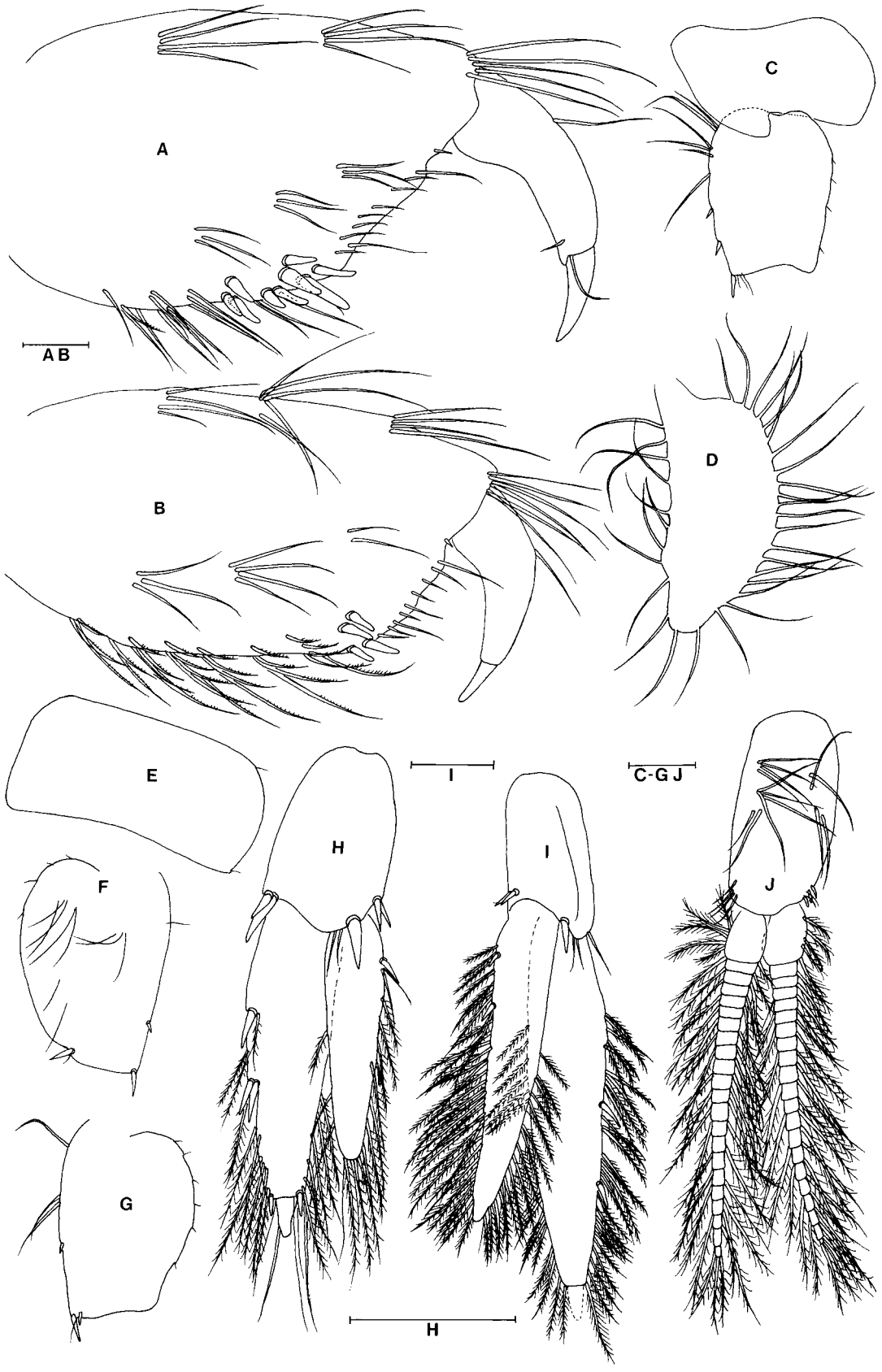

Fig. 16. *Gammarus elevatus* sp. nov. allotype, female (A–H); holotype, male (I, J). A, propodus of gnathopod 1; B, propodus of gnathopod 2; C, basis pereopod 5; D, oostegite of gnathopod 2; E, coxa 3; F, basis of pereopod 7; G, basis of pereopod 6; H, uropod 3; I, uropod 3; J, pleopod 3. Scales: A–J=0.5 mm.

dorsal margin. Epimeral plate 1 with 6 ventral setae on anterior corner. Epimeral plate 2 acute on posterior corner, with 5 long setae accompanied by 1 spine on ventral margin. Epimeral plate 3 not as acute as plate 2 on posterior corner, with 2 spines and 1 seta on ventral margin. Urosomites 1–3 with humps, bearing 1 cluster of spines and setae dorsally, 2 clusters of spines laterally.

Head: Eyes medium in size, elongate-oval. Lateral lobe gently truncate. Inferior antennal sinus deep.

Antenna 1: Peduncular articles 1–3 in length ratio 1 : 0.68 : 0.39, with some short setae; flagellum broken distally, accessory flagellum 4-articulate.

Antenna 2: Peduncular article 3 with distal short setae, article 4 about as long as article 5, bearing 3–4 groups of short setae along anterior and posterior margins; flagellum broken, calceoli present in proximal articles, setae short.

Upper lip: Subrounded, with minute setae.

Mandible: Incisor of left mandible 5-dentate, lacinia mobilis with 4 dentitions; article 2 of palp with 5 stiff setae, article 3 about 74% of article 2, with 2 groups of A-setae, 2 groups of B-setae, 22 D-setae and 5 E-setae. Right mandible, incisor 4-dentate, lacinia mobilis bifurcate, setae of article same as that of left mandible.

Lower lip: Lower lip lacking inner lobe.

Maxilla 1: Inner plate with 18 plumose setae, outer plate with 11 serrated spines, article 2 of left palp with 7 spines accompanied by 4 stiff setae; that of right palp with 5 blunt spines accompanied by 2 stiff setae.

Maxilla 2: Inner plate with a row of 21 setae on inner face.

Maxilliped: Inner plate with 3 blunt apical spines and 1 lateral spine, outer plate with 12 slender spines on medial margin and 5 apical pectinate setae.

Coxal plates: Coxal plate 1 weakly dilated distally, with 1 and 2 setae on anterior and posterior corner respectively; coxal plate 2 elongate; coxal plate 3 weakly produced on posterior corner; coxal plate 4 excavate; coxal plates 5–6, anterior lobe small, posterior lobe with 1 seta on posterior corner; coxal plate 7 with 4 setae on posterior margin.

Gnathopod 1: Basis short with long setae and 5 spinulate setae distally; carpus and propodus in length ratio 1 : 1.4; palm of propodus oblique, bearing 1 medial spine, 11 spines on posterior margin and 5 spines on inner face.

Gnathopod 2: Carpus parallel-sided; palm of propodus truncate, bearing 1 medial blunt spine, 4 and 3 spines on outer and inner surface respectively; dactylus with 1 seta on outer margin and 1 short seta at joint of nail.

Pereopod 3: Basis slender, with 4 spinulate setae distally; merus to propodus with long straight setae.

Pereopod 4: Pereopod 4 with fewer long straight setae on posterior margin than pereopod 3.

Pereopods 5–7: Pereopods 5–7 subequal in length. Anterior margin of basis with several long setae accompanied by 3-4 short spines; posterior margin nearly straight on pereopod 5, narrow on pereopods 6 and 7, with a row of ca. 10 short setae; inner surface of pereopod 7 with 1 spine and 2 short setae on posterodistal corner. Merus and carpus mainly with 3–4 groups of spines along anterior and posterior margin, accompanied by a few short setae on anterior margin. Propodus with about 5 groups of spines on anterior margin. Dactylus with 1 seta on outer margin and 1 short seta on inner margin.

Gills: Coxal gills of pereopods 2–7 sac-like.

Pleopods: Pleopods 1–3, peduncle armed with some setae, bearing 2 retinaculae accompanied by 3 setae; rami fringed with plumose setae.

Uropod 1: Peduncle with 1 basofacial spine, with 4 and 2 spines on outer and inner margins respectively; inner ramus with 2 spines on outer margin; outer ramus with 1 spine on each side.

Uropod 2: Peduncle with 3 spines on outer margin and 1 spine on inner margin; inner ramus with 2 spines on outer margin; outer ramus with 2 and 3 spines on outer and inner margins.

Uropod 3: Peduncle with short setae dorsally and several spines on distal margin; inner ramus about 83% of article 1 of outer ramus, with 2 marginal spines; article 1 of outer ramus with 2 marginal spines, article 2 missing; both rami armed with plumose setae.

Telson: Telson cleft, each lobe with 1 distal spine accompanied by 7 long setae and 2 facial setae.

Description of female (allotype, IZCAS-I-A0010)

Gnathopod 1, basis with long setae; palm of propodus slant, with 9 spines on posterior margin. Gnathopod 2, palm of propodus transverse, with 4 spines on posterior corner. Pereopod 3, coxal plate weakly produced on posterior corner, posterior margin with long straight setae. Bases of pereopods 5–7 shorter than those of male, posterior margin produced on pereopods 6 and 7; inner face of pereopod 7 with some setae and 1 spine on posterior corner. Uropod 3, inner ramus about 80% of article 1 of outer ramus; article 2 of outer ramus distinct; both rami ornamented with plumose setae. Oostegites of pereopods 2-5 with long marginal setae, progressively smaller.

Etymology

The specific name *elevatus* is derived from the mid-dorsal keels on pleonites 1–3.

Remarks

Gammarus elevatus sp. nov. belongs to the *Gammarus roeseli*-group (Karaman and Pinkster, 1977b). Dorsal surface of pereonite 7 and pleonites 1–3 with a rounded mid-dorsal keel, but not pointed into a spine-form process. Urosomites 1 and 2 with compressed elevation.

This new species is very close to *G. anodon* Stock, 1998. But differences can be found between *G. elevatus* and *G. anodon* in: (1) the presence of calceoli on antenna 2 in *G. elevatus*; (2) coxal plate 3 weakly produced on posterodistal corner in *G. elevatus*; (3) uropod 3 inner ramus more than three-fourths of article 1 of outer ramus, both rami densely armed with plumose setae in *G. elevatus* (outer

margin of outer ramus of uropod 3 with smooth setae in *G. anodon*).

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