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A New Species of the Genus *Bryocamptus* (Copepoda, Harpacticoida, Canthocamptidae) from Alpine Wetlands at Jeju Island, Korea

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ABSTRACT

Material of a *Bryocamptus* species, formerly reported as *B. umiatensis* Wilson, 1958 from Sakhalin and South Korea, is here recognized as a distinct new species. Specimens of both sexes were recently obtained from an alpine wetland, Sumeunmulbaengdui, located in the Hallasan National Park, Korea, and newly registered as a Ramsar Wetland in 2015. The new species, *B. jejuensis* n. sp., differs from the type population of *B. umiatensis* from Alaska by the smooth margin of the anal operculum in both sexes, the peculiarly modified terminal seta on the distal endopodal segment of the male leg 3, the sword-like spinous seta on the distal endopodal segment of the male leg 4, and the presence of a setule row on the inner distal margin of the caudal rami in the female. Both sexes of the new species are described in detail with particular reference to the male characters. A revised key to the seven species of the genus *Bryocamptus* Chappuis, 1929 occurring in Korean waters is provided.

Keywords: *Bryocamptus umiatensis*, freshwater Copepoda, Mt. Hallasan, Ramsar, wetland, taxonomy

INTRODUCTION

Jeju Island, the largest island in South Korea, is dominated by Mt. Hallasan, a 1,950 m high shield volcano and the highest mountain in the country. As the island mainly consists of basaltic and trachytic lava deposits, and rain water readily percolates through the underlying volcaniclastic layers, natural surface water bodies are not common on the island (Smith et al., 2014). A few mountain wetlands exist between the secondary (parasitic) cones (called 'oreum' in the local Jeju dialect) on the flank of the volcano. Recently an alpine wetland, Sumeunmulbaengdui, was reported from the northwestern hillside of Mt. Hallasan near the 1,100-Highland, at a height of 980 m above sea level between Samhyeonjesaet oreum (1,114 m), Noro oreum (1,070 m), and Salpin oreum (1,076 m). Sumeunmulbaengdui was registered as a Ramsar Wetland in 2015 and is the largest alpine wetland in South Korea, having an area of 43,602 m^2 and a circumference of about 2,474 m (Ko et al., 2014). On 11 Sep 2010, the junior author (C.Y.C.) participated in a preliminary investigation of the wetland sponsored by the National Institute of Biological Resources, Korea, and obtained a large amount of small aquatic invertebrates, including copepod specimens.

Among the copepods obtained, the most noticeable and dominant species was a harpacticoid species belonging to the genus *Bryocamptus* Chappuis, 1929. The harpacticoid specimens were found to be identical to material previously collected in 1988 from the nearby 1,100-Highland wetland, at about 5 km from Sumeunmulbaengdui, and which was subsequently identified as '*B. umiatensis*' by Lee and Chang (2006).

Bryocamptus umiatensis Wilson, 1958 is a rare, boreal species, originally described from females and males collected on the Arctic slope of Alaska by Wilson (1958). The only other record from outside the type region is that by Ishida and Kobayashi (1992) who reported a single female from the Russian island Sakhalin. However, since Wilson's (1958) concise description was completely lacking in illustrations, the authenticity of the Russian record has yet to be

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confirmed. Similarly, although our female specimens from the 1,100-Highland wetland (Lee and Chang, 2006) agreed well with the female from Sakhalin, it was impossible to unequivocally corroborate their conspecificity with *B. umiatensis* since the single male specimen mounted on a slide had already partly disintegrated, hampering observation of the relevant sexually dimorphic characters.

Several specimens of both sexes of '*B. umiatensis*' were obtained from the Sumeunmulbaengdui wetland. Examination showed that both females and males differed consistently from the original description in a number of characters, while the females from Sakhalin and Jeju Island showed complete concordance, indicating that the Asian specimens should be treated as a new species, distinct from *B. umiatensis*. A detailed illustrated description of both sexes is provided herein, with particular reference to male characteristics. In addition, we provide a revised key to the seven species of the genus *Bryocamptus* Chappuis, 1929, that have so far been reported from Korea.

MATERIALS AND METHODS

Copepods were collected from an alpine wetland on Mt. Hallasan, Sumeunmulbaengdui (33°21′25−28″N, 126°27′43−57″E, 980 m altitude; about 90 cm in depth at its deepest point) (Fig. 1).

Collections were made with a hand net and a dipnet, both with a mesh size of 64 μm. Samples were fixed in the field by immediately adding about 10% solution of formalin (equivalent of a 4% solution of formaldehyde in water by weight). In the laboratory, specimens were sorted from the samples under a zoom-stereomicroscope (Leica M165C, Wetzlar, Germany) at high magnifications (20−120×) with a micropipette, and transferred to about 80% ethanol to which glycerine was added for long-term preservation.

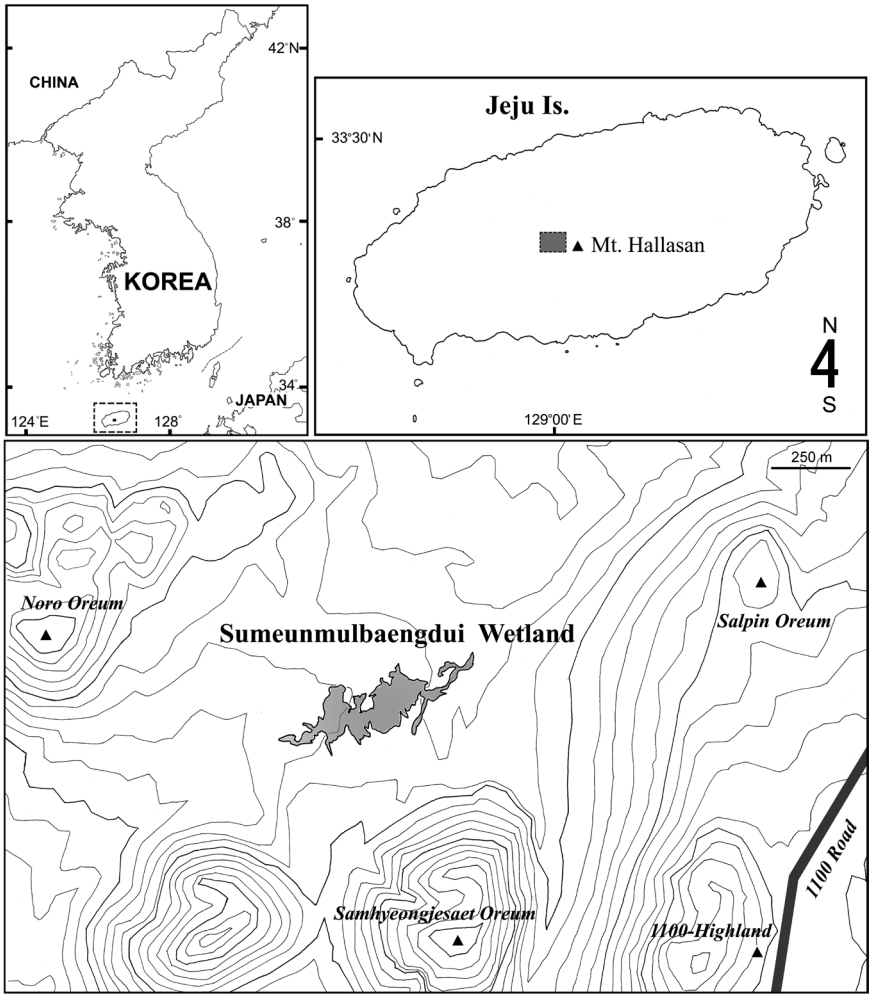

Fig. 1. Location of Sumeunmulbaengdui Wetland.

Methods for dissection and double-coverglass preparation using H-S slides followed those in the latest paper of the junior author (Chang, 2012). Drawings and measurements were made at 630× or 1,000× magnification using a drawing tube mounted on a differential interference contrast microscope with Normaski optics (Leica DM2500).

Holotype specimen is deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea, and paratype specimens are kept temporarily in the collection of the junior author (C.Y.C.) at the Department of Biological Science, Daegu University (DB), Korea.

The descriptive terminology follows Huys and Boxshall (1991). Abbreviations used in the text and figure legends are as follows: enp-1 to enp-3 or exp-1 to exp-3, the first to third endopodal or exopodal segments of each leg.

SYSTEMATIC ACCOUNTS

Order Harpacticoida Sars, 1903
Family Canthocamptidae Brady, 1880
Genus *Bryocamptus* Chappuis, 1929

***Bryocamptus jejuensis* n. sp. (Figs. 2–5)**

Non *Bryocamptus umiatensis* Wilson, 1958: Ishida and Kobayashi, 1992: 205, figs. 1–7; Lee and Chang, 2006: 203, figs. 7, 8; Chang, 2009: 316, figs. 158, 159; 2010: 188, figs. 98, 99.

Type locality. Sumeunmulbaengdui wetland (33°21′27″N, 126°27′53″E; at 980 m altitude), Mt. Hallasan, Jeju Island, South Korea.

Material examined. Holotype ♂ (NIBRIV0000552737), undissected, ethanol-preserved, from Sumeunmulbaengdui, 11 Sep 2010 (coll. C.Y. Chang). Paratypes: 2♀♀ (DB20056, 20057), 2♂♂ (DB20058, 20059), dissected on slides; 4♀♀ (DB20060), 2♂♂ (DB20061), ethanol-preserved, collection details same as for the holotype.

Additional material: 1♀, 1♂, dissected on slides, from 1100-Highland, 13 February 1988 (coll. C.Y. Chang).

Description. Male: Body (Fig. 2A) cylindrical; body length ranging from 536 to 583 μm (mean 564 μm, n = 6; holotype 570 μm), excluding caudal setae. Prosome about 1.2 times longer than urosome, slightly narrowing posteriorly. Rostrum weakly developed, blunt, slightly protruding anteriorly, with 2 dorsal sensilla subdistally; not defined at its base. Cephalothorax with scattered sensilla, with peanut-shaped integumental window mid-dorsally. Free prosomites with 1 pair of sensilla dorsolaterally, and transverse row of long sensilla along posterior margin of each somite. Urosomites (excluding fifth pedigerous somite) with dorsolateral spinules along posterior margin. Genital somite and remaining urosomites with well-developed continuous row of strong spinules laterally and ventrally along posterior margin (Fig. 2A, B). Spermatophore (Fig. 2A, B) elongate, ellipsoidal (143 × 45 μm), with coiled basal neck.

Anal somite (Fig. 2B, C) with smooth dorsal surface, except for paired sensilla anterior to anal operculum; armed with transverse rows of strong spinules laterally and ventrally along posterior margin of somite. Anal operculum convex with smooth posterior margin (Fig. 2C, arrow).

Caudal rami (Fig. 2A–C) subparallel, truncate, 1.3–1.4 times longer than wide in ventral view, with smooth inner margin; ventral surface with 1 oblique row of 3 sharp spinules near outer margin at bases of setae II–III, and 2 strong spinules ventromedially, at base of inner terminal caudal seta (seta V); armed with 7 setae. Seta I short, arising slightly ventral to seta II (Fig. 2C). Seta II relatively long, naked, located near middle of outer margin of ramus. Seta III naked and slender, situated at outer distal corner of ramus, not flanked by dorsal spinules at its base. Seta IV pinnate, with fracture plane in basal part, slightly shorter than half the length of seta V (Fig. 2A). Seta V pinnate between anterior quarter and anterior two-thirds, slightly less than half the body length. Seta VI short, naked and slender, slightly longer than ramus. Seta VII situated anterior to seta V, naked, with basal socket, about twice longer than ramus.

Antennule (Fig. 3A, B) subchirocerate, about two-thirds as long as cephalothorax, 10-segmented; geniculation located between segments 7 and 8; anterior margin of segment 1 with 4 spinules proximally and 1 long pinnate seta distally; segment 2 with membranous insert dorsally, bearing 9 slender naked setae; segments 3–4 relatively short, with 8 and 2 setae, respectively; segment 5 bulbous, bearing 1 long aesthetasc distally, its tip nearly reaching to distal end of penultimate segment and its base fused to seta of approximately the same length; segment 6 with 2 minute setae proximally; segments 7 and 8 with spiniform projections (modified armature elements) on anterior margin; segment 9 small, bearing 1 slender seta distally; segment 10 armed with 6 posterior, 1 anterior and 2 apical setae (the latter fused at base to aesthetasc). Armature formula: 1-[1 pinnate], 2-[9], 3-[6 + 2 pinnate], 4-[1 + 1 pinnate], 5-[3 + 1 spine + (1 + aesthetasc)], 6-[2], 7-[2 + 2 modified], 8-[2 modified], 9-[1], 10-[7 + (2 + aesthetasc)].

Antenna (Fig. 3C), coxa small, with spinules at outer distal corner; allobasis 1.7–1.8 times as long as wide, with 2 pinnate setae on abexopodal margin; free endopodal segment armed with 2 lateral spines and 6 distal elements, comprising 2 unipinnate spines and 3 geniculate setae, the outermost of which being fused at the base to a minute seta; exopod 2-segmented, comprising cylindrical exp-1 with 1 inner

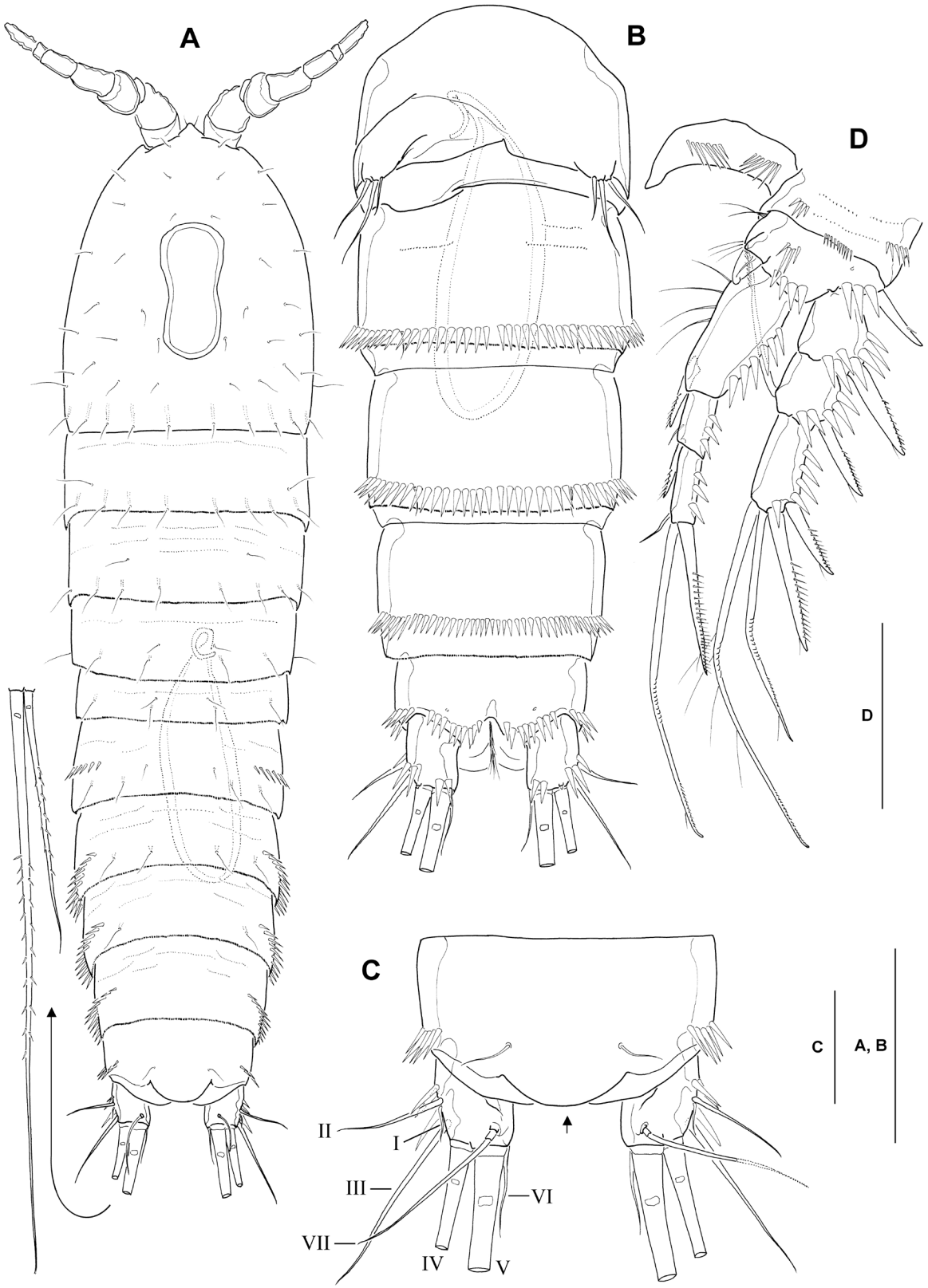

Fig. 2. *Bryocamptus jejuensis*, male. A, Habitus, dorsal; B, Urosome (excluding leg 5-bearing somite), ventral; C, Anal somite (anal operculum arrowed) and caudal rami, dorsal; D, Leg 1, anterior. Scale bars: A = 0.1 mm, B–D = 0.05 mm.

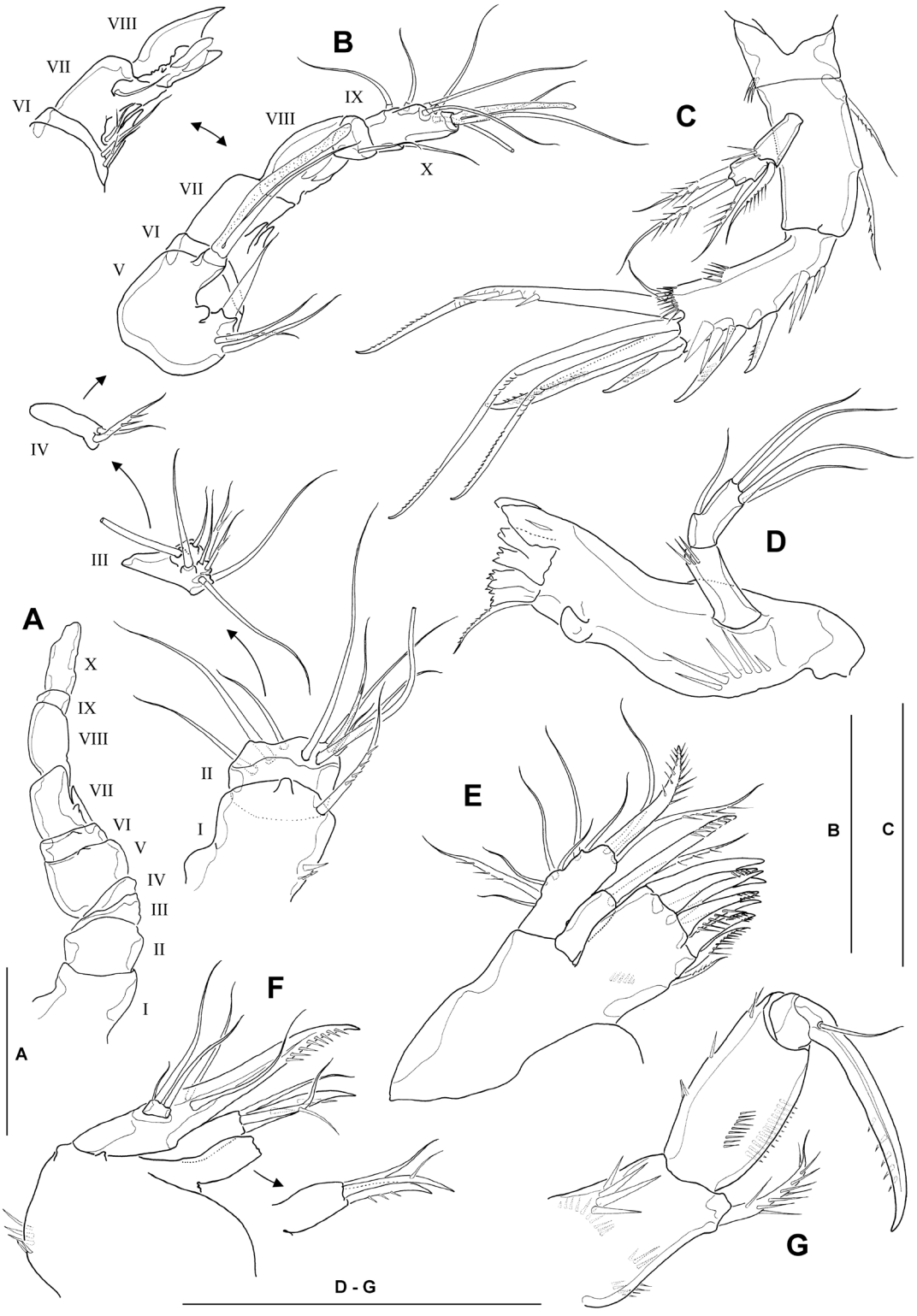

Fig. 3. *Bryocamptus jejuensis*, male. A, Antennular segmentation; B, Antennule shown disarticulated to reveal detailed armature on individual segments; C, Antenna; D, Mandible; E, Maxillule; F, Maxilla (inset showing armature of proximal endite of syncoxa); G, maxilliped. Scale bars: A–G = 0.05 mm.

distal pinnate seta and exp-2 with 1 inner and 2 apical pinnate setae.

Mandible (Fig. 3D), with well-developed coxal gnathobase bearing 5−6 bicuspidate and multicuspidate teeth and 1 pinnate seta along distal margin; with strong spinules near base of palp; palp well-developed, comprising basis and endopod; basis cylindrical, with setules near inner distal corner; endopod about 2.4 times as long as broad, with 1 lateral and 4 apical naked setae.

Maxillule (Fig. 3E) with praecoxal arthrite bearing 7 unguiform elements and 1 pinnate seta around distal margin, and 1 pinnate seta on distal inner margin; coxal arthrite with cylindrical endite bearing 1 pinnate spine and 1 slender seta apically; exopod and endopod completely fused to basis, bearing 1 pinnate and 6 naked setae laterally, and 1 bipinnate spine, 1 pinnate seta and 1 naked seta apically; origin (exopodal, endopodal or basal) of lateral setae indeterminable.

Maxilla (Fig. 3F) armed with 2 syncoxal endites, each bearing 1 unguiform spine and 2 setal elements; allobasis produced into strong unipinnate claw, flanked by 1 anterior and 1 posterior naked seta proximally; endopod a minute segment bearing 1 short and 2 well-developed naked setae distally.

Maxilliped (Fig. 3G) subchelate; syncoxa armed with 1 stout bipinnate seta at inner distal corner, surface with 4 spinular rows; basis about 1.8 times longer than wide, with longitudinal row of spinules on both anterior and posterior surfaces near medial margin; spinule row on posterior surface consisting of 12−14 spinules; few spinules present along outer margin; endopod bearing 1 strong, curved claw with 1 minute accessory seta arising from its base.

Leg 1 (Fig. 2D) with 3-segmented rami; all segments with strong spinules along outer margin. Intercoxal sclerite with paired spinule rows consisting of 7 sharp spinules each on anterior surface. Coxa with 2 groups of spinules near medial margin and lateral margin, respectively, about 12 fine setules in middle of posterior margin, and 2 transverse rows of minute spinules. Inner distal element of basis represented by stout short spine with blunt tip slightly recurved outwardly, not reaching to proximal quarter of enp-1. Enp-1 about 2.1 times as long as wide, reaching just beyond posterior margin of exp-2, with short, pinnate seta near inner distal corner; enp-2 with stout, pinnate seta near inner distal corner; enp-3 with 1 short inner seta subdistally, and 1 unipinnate spine and 1 long geniculate seta distally. Exp-1 with stout outer spine; exp-2 not elongate, with dorsally recurved inner distal seta, serrated in distal third; exp-3 with 2 outer spines and 2 apical geniculate setae.

Legs 2−4 (Fig. 4A−C) with small enp-1, each bearing inner distal seta; exp-1 lacking inner seta. Leg 2 (Fig. 4A), anterior surface of intercoxal sclerite with pair of sharp, incisor-like spinules near concave free margin; basis with strong, naked, outer spine; enp-2 elongate, about 2.8 times as long as broad, with distinct notch along distal outer margin, bearing 2 pinnate setae on inner margin and 2 plumose apical setae, of which outer one about 1.5 times as long as inner one, and ornamented with secondary spinule row; exp-3 with 3 spines along outer margin, one spine and one seta apically (both with mixed ornamentation as figured) and 1 pectinate seta along inner margin. Leg 3 (Fig. 4B), intercoxal sclerite with paired spinous processes on concave free margin; enp-2 short, inner distal margin produced into spinous apophysis, proximal part broad and hollow inside, narrowing posteriorly to form minute barb, reaching almost to end of modified spine of enp-3; enp-3 pyriform, apex with long, strongly pinnate seta and long modified spine, shown as ribbon-like process, with a long, narrow incision or groove as figured; exp-3 armed with 3 spines along outer margin, 2 setae apically (both with mixed ornamentation as figured) and 2 pectinate setae along inner margin. Leg 4 (Fig. 4C), enp-2 bearing 1 outer distal spine, 2 apical plumose setae (inner one about 3 times as long as outer one), and 1 inner distal spinous seta with curved serrated inner margin in distal third; seta/spine armature of exopod same as in leg 3.

Leg 5 (Fig. 4D), baseoendopod with weakly produced endopodal lobe, reaching to just beyond middle of inner margin of exopod, bearing 1 short outer and 1 stout inner setae, flanking 1 membranous tube-pore (Fig. 4D, arrow); exopod slightly wider than long, L/W about 0.9, bearing 6 setae in total, comprising (from inner to outer) distally plumose seta, short bipinnate inner distal seta, long bipinnate apical seta, slender, naked outer seta, bipinnate outer seta, and minute, naked, outer seta.

Female: Body (Fig. 5A) cylindrical, slightly tapering posteriorly; body length ranging from 664 to 710 μm (mean 683 μm, n = 6). Genital double-somite completely fused both dorsally and ventrally (Fig. 5A, C), without trace of subdivision by subcuticular chitinous rib; paired transverse rows of 7−8 spinules situated posterior to leg 6; copulatory pore located on ventral midline, immediately posterior to genital apertures; pair of long sensilla present near posterior margin of genital double-somite. Third (antepenultimate) urosomite with dorsolateral and ventrolateral spinules along posterior margin; fourth (penultimate) urosomite with continuous ventral spinule row (Fig. 5C). Anal somite (Fig. 5B, C) nearly same as in male, including smooth posterior margin of anal operculum.

Caudal rami (Fig. 5B) slightly longer than in male, 1.3−1.4 times as long as wide in ventral view; setular tuft present along distal inner margin of ramus (arrowed in Fig. 5B; absent in male).

Seta/spine armature of legs 1−4 as follows (as for figures

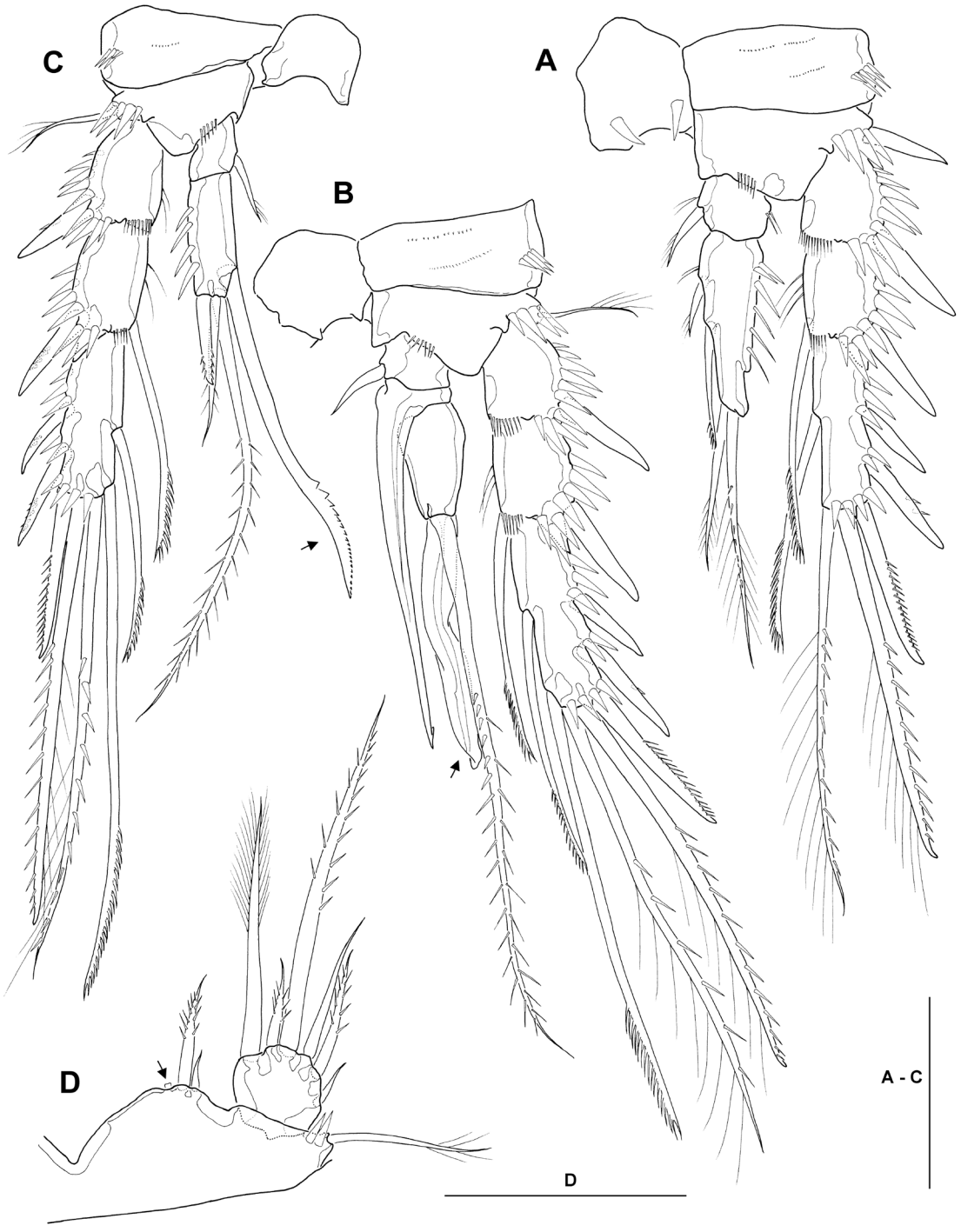

Fig. 4. *Bryocamptus jejuensis*, male. A, Leg 2, anterior; B, Leg 3, anterior; C, Leg 4, anterior; D, Leg 5 (arrow indicating tube pore). Scale bars: A–D = 0.05 mm.

of female legs 1−4, see Lee and Chang, 2006):

Leg 1	basis I-I	exp I-0; I-1; II,2,0	enp 0-1; 0-1; I,1,1
Leg 2	basis I-0	exp I-0; I-1; III,2,1	enp 0-1; 0-1; I,2,1
Leg 3	basis 1-0	exp I-0; I-1; III,2,2	enp 0-1; 0-1; I,2,2
Leg 4	basis 1-0	exp I-0; I-1; III,2,2	enp 0-1; I,2,2

Leg 2, enp-3 with long apical plumose seta, about 2.3

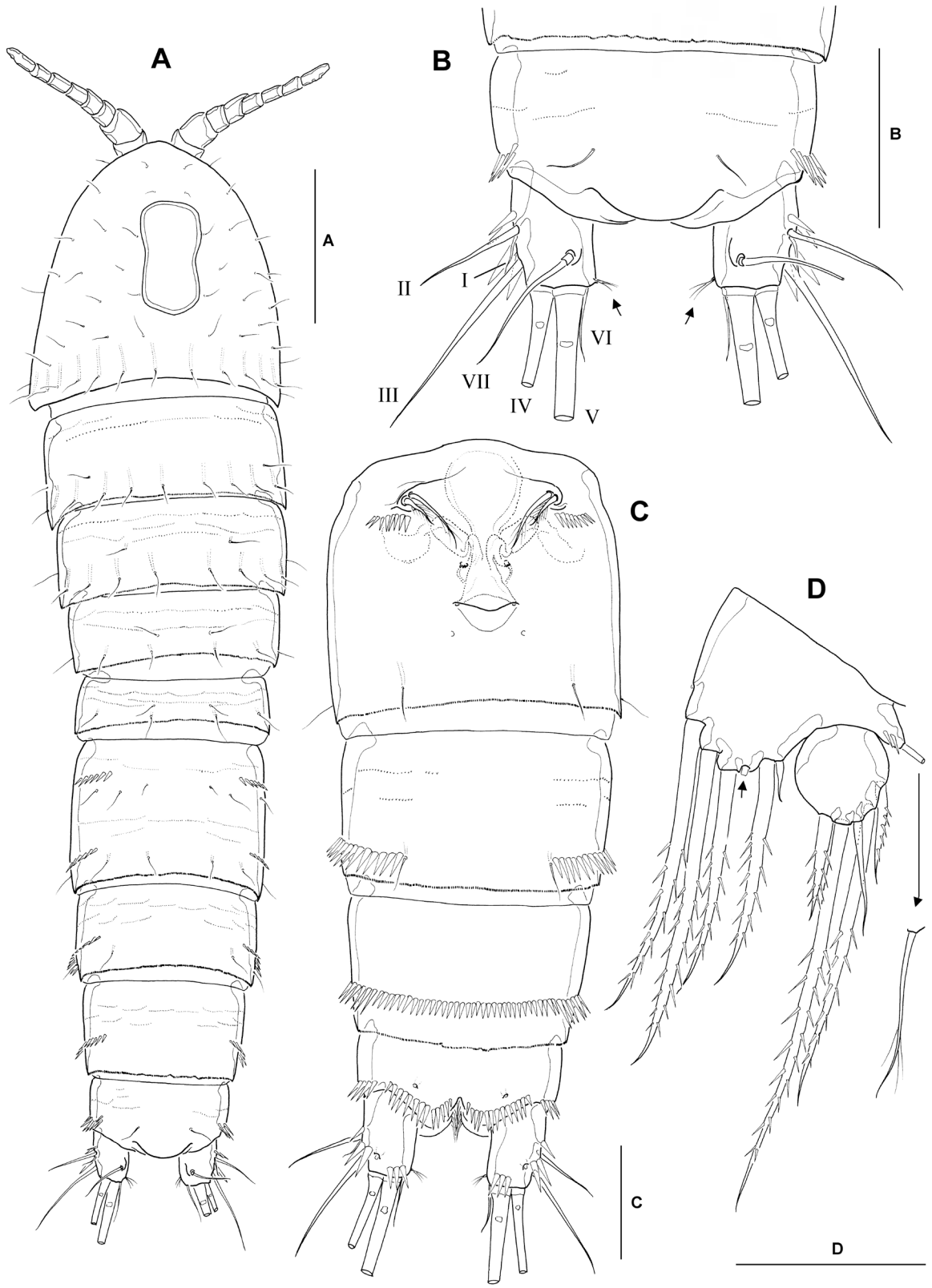

Fig. 5. *Bryocamptus jejuensis*, female. A, Habitus, dorsal; B, Anal somite and caudal rami (arrows indicating setular tuft), dorsal; C, Urosome (excluding leg 5-bearing somite), ventral; D, Leg 5 (arrow indicating tube pore). Scale bars: A = 0.1 mm, B–D = 0.05 mm.

times as long as adjacent subapical seta. Leg 3, enp-3 with 2 equally long apical setae. Leg 4, enp-3 bearing 5 elements in total, comprising 1 subapical spine, 1 short, pinnate outer distal, 1 elongate, plumose inner distal, and 2 inner pinnate setae.

Leg 5 (Fig. 5D), baseoendopod with well developed endopodal lobe, reaching slightly beyond middle of exopod, with 4 stout spiniform, bipinnate setae, flanked by 1 minute, naked outermost seta, remaining prominent gap between inner third and fourth pinnate setae (arrowed in Fig. 5D); exopod nearly circular, with naked inner margin, bearing 5 setae in total, comprising 1 short bipinnate innermost seta, 1 longest, apical, bipinnate seta, 1 slender, naked, subapical seta, and 2 bipinnate outer setae.

Remarks. Four subgenera are currently recognized in the genus *Bryocamptus* Chappuis, 1929: *Bryocamptus* Chappuis, 1929, *Arcticocamptus* Chappuis, 1929, *Echinocamptus* Chappuis, 1929 and *Rheocamptus* Borutzky, 1952 (see Walter and Gaviria-Melo, 2015 for details of subgeneric classification). Of the four subgenera, the present new species should be allocated to the nominotypical subgenus *Bryocamptus* based on the endopodal segmentation of the swimming legs in the female, being 3-segmented in leg 1 and 3-segmented in legs 2−4. The subgenus *Bryocamptus* currently accommodates 38 nominal species and subspecies (Walter and Gaviria-Melo, 2015; Pesce, 2016).

Among the other members of the subgenus *B. jejuensis* n. sp. resembles *B.* (*B.*) *newyorkensis* (Chappuis, 1926), *B.* (*B.*) *tarnogradskyi* Borutzky, 1934 and *B.* (*B.*) *umiatensis* Wilson, 1958 in showing a reduction in the number of endopodal setae of leg 5 in the female, being armed with only 4 or 5 well-developed pinnate setae, or occasionally, with 4 pinnate setae accompanied by 1 vestigial, slender seta.

Bryocamptus jejuensis n. sp. is most similar to *B. umiatensis* in sharing an identical arrangement of the endopodal setae on the female leg 5. In both species the endopodal lobe bears a vestigial seta at the outer corner in addition to 4 well-developed pinnate setae along the distal and inner margins. The spacing between the 4 pinnate setae is unequal, showing a prominent gap with a marginal tube-pore (arrowed in Fig. 5D) between the two distal ones. This unusual setal arrangement is the primary reason why the Asian specimens collected from Sakhalin and Mt. Hallasan, Jeju Island, Korea were previously regarded as conspecific with the Alaskan *B. umiatensis*, in spite of a remarkable difference in the morphology of the anal operculum, having a smooth posterior margin in both sexes (Ishida and Kobayashi, 1992; Lee and Chang, 2006). According to Wilson (1958) the anal operculum in *B. umiatensis* has 3−5 widely spaced spinules in the female and 8 in the male. Moreover, both species share a strikingly modified seta on leg 3 enp-3 in male (cf. Fig. 4B, arrow). According to Wilson's (1958) original description of *B. umiatensis*, the peculiarly modified seta is "about as long as endopod, stout at base and divided into two apical processes by an incision that extends from apex to about the middle". The modified element in the male Korean specimens of *B. jejuensis* n. sp. has a similar appearance but is much longer (about 1.5 times longer than endopod).

In *B.* (*B.*) *jejuensis* n. sp., another strikingly modified spinous seta on enp-2 of male leg 4 is especially noteworthy (cf. Fig. 4C, arrow). The modified element assumes a unique shape of a sword-like spinous process, usually curved and bearing serrations along the distal third of the inner margin. Wilson's (1958) original description of *B. umiatensis* simply mentioned "apical segment [of leg 4 endopod] with 4 setae," which could mean that the inner distal seta is not as strongly modified as in *B. jejuensis* n. sp. However, it cannot be ruled out that Wilson made an oversight since viewing such setae from the wrong angle can result in observational errors. The caudal ramus in *B. jejuensis* n. sp. shows strong ventral spinules in both sexes and a setule tuft on the inner margin in the female (cf. Fig. 5B, arrow), both of which were not mentioned in the original description of *B. umiatensis*. Especially, as the latter character is regarded as an important character in the classification of canthocamptid harpacticoids, it could not have been ignored by Wilson if it had been present in *B. umiatensis*. In conclusion, the identical seta/spine armature of legs 2−4 in the female, the shared unusual arrangement of the endopodal setae of the female leg 5 accompanied by a reduction in the number of setae, the similar preference for small lentic waters in the boreal region, and zoogeographical connection between the Far East and neighboring Alaska, collectively indicate that the present new species is closely related to *B. umiatensis*. However, the former evidently differs from the latter by the smooth anal operculum, the strongly modified spinous seta on enp-2 of the male leg 4, and setular ornamentation on the inner surface of the female caudal ramus. There is no doubt that the single female from Sakhalin, identified as *B. umiatensis* by Ishida and Kobayashi (1992), is conspecific with *B. jejuensis* n. sp. since the authors' illustrations show complete concordance with the above-mentioned characteristics of the new species.

Bryocamptus jejuensis n. sp. is similar to *B. newyorkensis*, a rare, Nearctic boreal species (as for its geographical distribution, see Bruno et al., 2002, pp. 850−851), in sharing 5 endopodal setae on the female leg 5 and a smooth anal operculum. However, based on the detailed, recent redescription by Bruno et al. (2002), *B. newyorkensis* is easily distinguished from *B. jejuensis* by the well-developed outermost endopodal seta on the female leg 5, the lack of the inner seta on enp-1 of male legs 3−4, the absence of an inner distal spinous seta on enp-2 of the male leg 4, and the presence of

two normally plumose apical setae on enp-3 of male leg 3. In addition, the baseoendopod of the male leg 5 bears two well-developed setae in *B. newyorkensis*, while the outer seta is very short in *B. jejuensis*. It should be noted here that the medial tube-pore (arrowed in Fig. 4D) was erroneously illustrated as the proximal part of a broken seta in our previous paper (see Lee and Chang, 2006, Fig. 8F).

Wilson (1958) remarked that *B. umiatensis* "has the caudal ramus and leg 5 of the female similar to those of *B. tarnogradskyi*, from the Caucasus Mountains". However, *B. tarnogradskyi* is easily discernible from *B. jejuensis* by the following combination of characters: (1) *B. tarnogradskyi* has only four well-developed setae on baseoendopod of female leg 5, lacking the vestigial outermost seta, and its exopod is armed with two spinules on the inner margin (versus smooth in *B. jejuensis*); (2) the anal operculum bears 7−8 long denticles in both sexes (versus smooth in *B. jejuensis* in both sexes); (3) the penultimate urosomite of both sexes bears paired lateral spinule rows near the posterior margin but lacks spinules on the midventral surface (although Borutzky (1934) did not illustrate ventral views of the urosome), while the male has paired additional spinule rows dorsally (versus the spinules being arranged in a continuous row all around the somite except dorsally in both sexes of *B. jejuensis*); (4) in the male of *B. tarnogradskyi*, the apical seta on enp-3 of leg 3 and the inner distal seta on enp-2 of leg 4 are both unmodified and have retained their normal plumose armature (versus the setae are extremely modified into unusual spinous processes in *B. jejuensis*) (see Borutzky, 1934, 1952).

Lee and Chang (2006) reported five species of the genus *Bryocamptus* from Korea: *B. zschokkei caucasicus* (Borutzky, 1930), *B. nivalis* (Willey, 1925), *B. pacificus* Ishida, 1992, *B. vejdovskyi* (Mrázek, 1893) and '*B. umiatensis*' (now corrected as a distinct new species, *B. jejuensis*). Chang (2009) added *B. minutus* (Claus, 1863), formerly reported from a limestone cave in South Korea by Miura (1969), and provided a key to the six species. Furthermore, Lee and Lee (2010) described a cavernicolous species, *B. cheongokensis* Lee and Lee, 2010. A revised key to the seven species of the genus *Bryocamptus* hitherto known from South Korea is provided below.

1. Leg 1 endopod 2-segmented; anal operculum with 3−5 stout spinules ····· *B.* (*Rheocamptus*) *zschokkei caucasicus*
− Leg 1 endopod 3-segmented; anal operculum smooth or with more than 10 spinules along posterior margin ····· 2
2. Legs 2−3 with 2-segmented endopod ····· 3
− Legs 2−3 with 3-segmented endopod ····· 5
3. Anal operculum smooth; female leg 4 enp-2 with 2 inner setae; male leg 3 enp-1 with inner seta ····· 4
− Anal operculum setulose; female leg 4 enp-2 with 1 inner seta; male leg 3 enp-1 lacking inner seta ····· *B.* (*Echinocamptus*) *cheongokensis*
4. Inner distal edge of caudal rami with more than 6−8 spinules; both apical setae of legs 2−3 enp-2 very long (outer seta about 3/4 times as long as inner seta) ····· *B.* (*E.*) *nivalis*
− Inner distal edge of caudal rami with 2−3 spinules; outer apical setae of legs 2−3 enp-2 short (outer seta about half the inner seta) ····· *B.* (*E.*) *pacificus*
5. Female leg 5 baseoendopod with 6 well-developed setae; anal operculum with spinules along posterior margin ··· 6
− Female leg 5 baseoendopod with 4 pinnate and 1 vestigial setae; anal operculum with smooth posterior margin ····· *B.* (*Bryocamptus*) *jejuensis* n. sp.
6. Outer terminal caudal seta (seta IV) diminished into a small process ····· *B.* (*B.*) *vejdovskyi*
− Outer terminal caudal seta (seta IV) normal ····· *B.* (*B.*) *minutus*

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