

A New Species of *Cerapus* from Korea (Crustacea: Amphipoda: Ischyroceridae)

Byung-Jin Lim¹, Ja-Yang Park^{2,*} and Gi-Sik Min¹

¹Department of Biological Sciences, Inha University, Incheon 402-751, Korea

²Sanbon-dong, Gunpo-si, Gyeonggi-do 435-040, Korea

ABSTRACT

Cerapus longicervicum, a new species of ischyrocerid amphipods, was isolated from the vicinal sea of Deokjeokdo-Island, Incheon (South Korea). This species is characterized by a narrower coxal plate width of gnathopod 1 in male, which is 0.39 times as broad as pereonite 1, and antenna 2, which is longer than antenna 1. This paper also provides the partial sequence of the mitochondrial *cytochrome c oxidase* subunit I (CO1) of the new species, which was obtained from a specimen that was preserved in 4% formalin solution.

Key words: Amphipoda, *Cerapus longicervicum*, formalin, CO1, Korea

INTRODUCTION

The genus *Cerapus* Say, 1817 consists of 26 species worldwide and has been known to be a cosmopolitan amphipod genus. These species live in tubes that they build in sand, mud and debris. Such habitat has influences on the morphological characters as like small coxal plates and strong antennae. Until now, only a single species, *C. longirostris* Shen, 1936, has been recorded by Kim (1991) from Korea.

Recently, mitochondrial *cytochrome c oxidase* subunit I (CO1) was shown to have the potential to be used as a species diagnostic gene, with characteristics of low intraspecific variation and high inter specific variation in most animal phyla. We tried to obtain the CO1 sequence from the new species as this was postulated to be a useful voucher sequence in the future. The efficiency of CO1 as a species diagnostic gene has not yet been proved in ischyrocerid amphipods. This gene, however, has been well adopted for freshwater gammarid amphipods (Meyran and Taberlet, 1998). A specimen used in this molecular study was preserved in 4% formaldehyde-seawater solution about for 2 months.

The aim of this work was to describe a new species identified as *Cerapus longicervicum* and to provide, its sequencing data and other key information.

MATERIALS AND METHODS

Taxonomic processes

Samples were collected by sieving mud and sand sedi-

ments in the vicinity of the sea of Deokjeokdo-Island, Incheon and Gunsan harbor, Jeollabuk-do. Specimens were fixed in 4% formalin-seawater solution. About 2 months later, they were transferred into 70% ethanol. The left parts of their appendages were dissected in glycerol on a cavity slide glass under a stereomicroscope Leica MZ 16 and drawn using a drawing tube under the Olympus BX 51 microscope.

Sequencing processes

The specimen was directly fixed using 4% formalin-seawater solution. About 2 months later, it was transferred to 70% ethanol. For genomic DNA extraction, the specimen was washed twice with 1X phosphate buffered saline (PBS), and then genomic DNA was extracted with RED Extract-N-Amp Tissue PCR (polymerase chain reaction) kit (Sigma) according to the manufacturer's instructions. The target DNA segment of the CO1 was amplified by PCR, using universal primers of CO1, LCO1490 and HCO2198 (Folmer et al., 1994). PCR amplification was conducted under the following conditions: 3 min at 94°C, 40 cycles of 95°C for 15 s, 46°C for 30 s and 68°C for 1.5 min, with a final 68°C extension reaction for 7 min. The PCR products were gel-purified with a QIAquick[®] Gel Extraction Kit (Qiagen) and cloned with pGEM[®]-T Easy Vector and finally sequenced with an ABI PRISM[®] 3700 DNA Analyzer using a BigDye Terminator Cycle Sequencing Ready Reaction Kit (Applied Biosystems).

DESCRIPTION

Order Amphipoda Latreille, 1816

*To whom correspondence should be addressed

Tel: 82-11-1722-5909, Fax: 82-32-874-6737

E-mail: seodjup@sookmyung.ac.kr

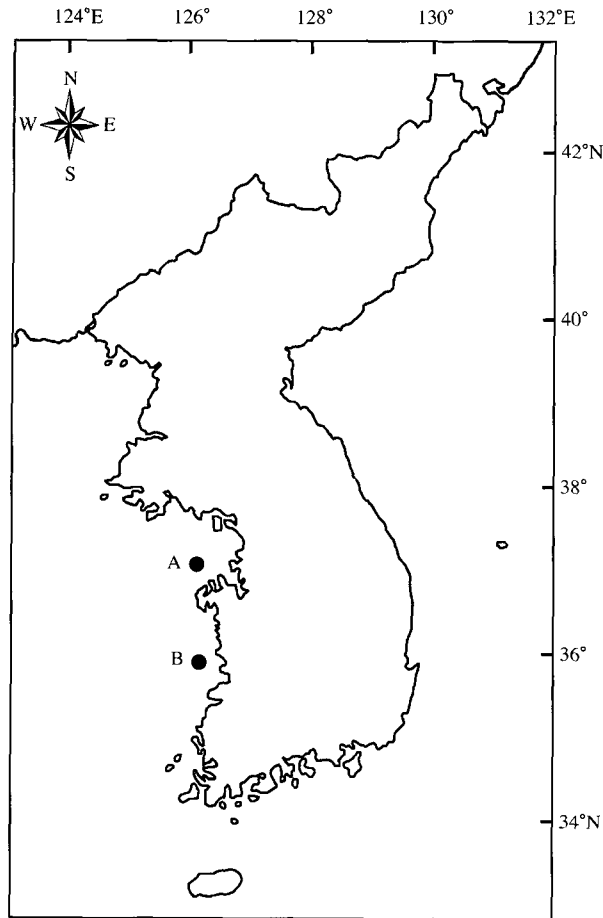


Fig. 1. Collection localities. A, Deokjeokdo-Island; B, Gunsan harbor.

Family Ischyroceridae Stebbing, 1899

***Cerapus longicervicum* n. sp. (Figs. 2-6)**

Material examined. Holotype male was collected from Deokjeokdo-Island, Incheon, on the 10th of March 2006. Paratypes (2♂♂, 2♀♀) were collected from Gunsan harbor, Jeollabuk-do, 17 October 2006. The holotype and 4 paratypes are deposited in the Department of Biological Sciences, Inha University.

Holotype male. Head, and rostrum short, apically acute with the rostrum reaching proximal 13.5% of first peduncular article of antenna 1. Pereonite 1-3 to head ratio 1.08 : 1.1 : 1.08.

Antenna 1 (Fig. 3B) long, 0.47 times as long as body, shorter than antenna 2, with simple setae on ventral margin and with a few setae on dorsal margin; first peduncular article the longest, second and third peduncular articles in same length; flagellum, long, 7-articulated; first article 0.34 times as long as flagellum; last article with 2 claws. Antenna 2

(Fig. 3A) long, slender, 1.32 times as long as antenna 1; fourth peduncular article the longest, with a row of simple setae along lateral line; fifth peduncular article with a row of simple setae along lateral line; flagellum long, 6-articulated; first article 0.34 times as long as flagellum; second to fifth articles sub-equal, at each with a small claw-like seta; last article with 2 claws.

Mandible (Fig. 3C) with pars incisiva bearing 7 teeth; lacinia mobilis with 6 teeth; 5 strong serrated setae; palp 3-articulated, long, slender, third peduncular article slightly longer than second one. Outer plate of maxilla 1 (Fig. 3E) with 8 terminal spines; palp 2-articulated with oblique row of 6 simple setae sub-distally and 8 terminal spines. Outer plate of maxilla 2 (Fig. 3D) longer than inner one with fine serrated setae on both. Inner plate of maxilliped (Figs. 3F, G) with 3 short thick spines distomedially and fine serrated setae along distal margin; outer plate ovate, medially with 6 tooth-like spines and 3 long spines along distal margin; palp 4-articulate, densely setose.

Gnathopod 1 (Fig. 4A) subchelate; coxa ovate; merus with a tuft of setae distally; carpus with lobe on ventral margin; propodus slightly longer than broad, palm oblique without spine; dactylus with inner margin serrated irregularly, with two setae on inner distal margin. Gnathopod 2 (Fig. 4C) carpochelate; basis slightly slender, 2.3 times longer than broad; carpus enlarged, 2 times longer than broad, palmar margin with sparse setae; dactylus long, thin, with sparse setae along inner margin.

Basis of pereopod 3 (Fig. 4B) long, about 2 times as long as broad, with setae on anterior margin; ischium long, 2.55 times as long as broad, without seta; merus long, 1.9 times as long as broad with anterodistal and posterodistal corner bearing setae; propodus 1.4 times as long as broad; dactylus simple. Pereopod 4 (Fig. 4D) similar to pereopod 3; basis, 2.6 times as long as broad, with setae on anterior margin; ischium 1.65 times as long as broad; merus 2.2 times as long as broad. Coxal plate of pereopod 5 (Fig. 4E) large, anterior edge long, corners rounded, posterior short; dorsal lobes of merus with 6 short simple setae and 6 fine serrated setae distally, and ventral lobes with 3 setae and 1 long fine serrated seta; carpus, distal margin covered in short spines and 1 long simple seta distally; dactylus unciniate. Pereopod 6 (Fig. 4F) with densely setose distally on dorsal margin of merus and carpus; dactylus unciniate. Pereopod 7 (Fig. 5E) longer than other pereopods; merus with long simple setae along dorsal and ventral edge; carpus with long simple setae distally on dorsal and ventral margin; dactylus unciniate.

Pleopods 1 to 3 (Figs. 5B, C, D) decreasing in size. Ramus of pleopod 1 sub-equal in length; inner ramus with 9 articles; outer ramus with 3 articles. Pleopod 2 and 3 biramous; outer ramus 2.5 times length of inner one.

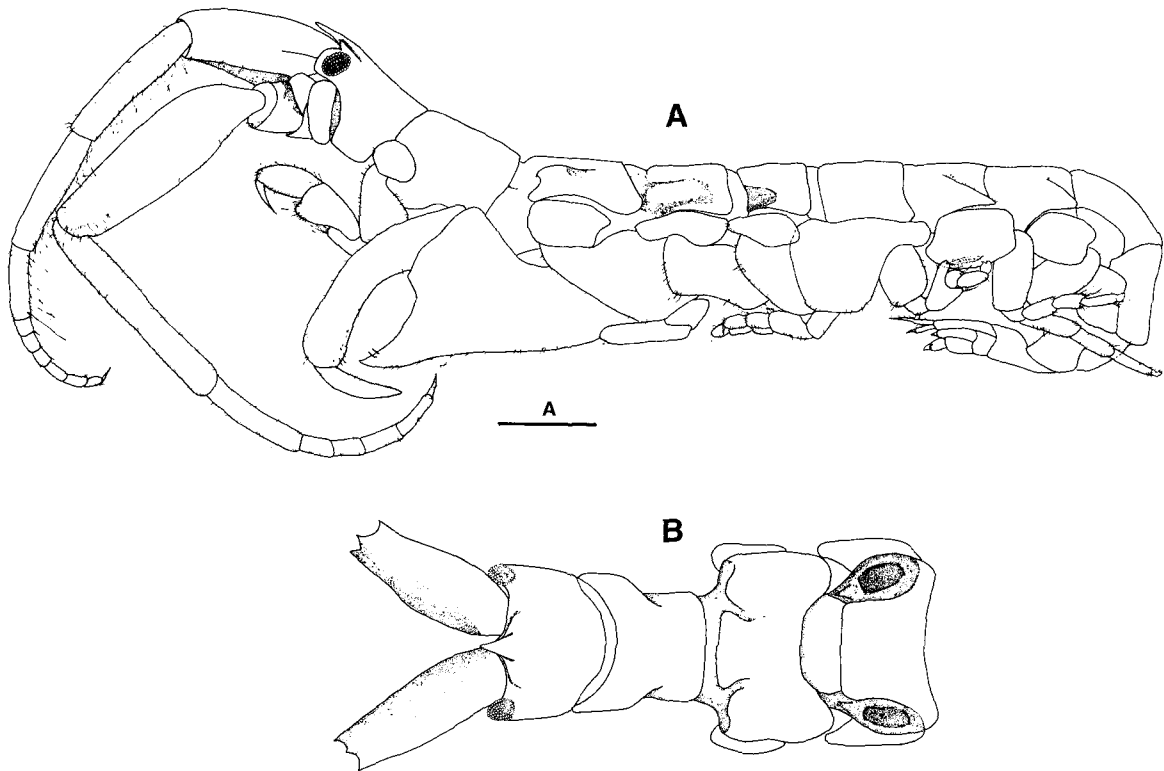


Fig. 2. *Cerapus longicervicum* n. sp., holotype male. A, habitus; B, dorsal view. Scale bar=1 mm (A).

Urosomites (Fig. 5A) separate. Uropod 1, biramous; peduncle 3.7 times as long as wide, with 8 simple setae along anterior margin; outer ramus 0.72 times length of peduncle, lateral margin with serrated, one large spine distally; inner ramus 0.5 times length of outer, one large spine distally. Uropod 2, uniramous; peduncle 4 times as long as wide; ramus with 4 small spines on lateral surface and a terminal seta. Uropod 3, uniramous; peduncle, stout, twice as long as broad, with 3 setae distally; ramus small, biuncinate. Telson, bilobed, each lobe with 2 rows of about 9 recurved spines and a small apical plumose seta.

Female. Similar to male except for the following factors. Pereonite 1-4 (Figs. 6A, B) to head length ratio 0.22 : 0.44 : 0.6 : 0.9. Antenna 1 (Fig. 6D) slightly shorter than antenna 2 (Fig. 6E). Fourth and fifth peduncular article of antenna 2 with setae on ventral margin. Gnathopod 2 (Fig. 6C) subchelate (not carpochelate); carpus, about 1.6 times as long as wide; propodus 1.85 times as long as wide.

Habitat. Mixed sediments with coarse sand and fine mud.

Molecular data. The GenBank accession number of the partial CO1 sequence was EF998852.

Etymology. The name *longicervicum* is a combination of Latin words *longus* (=long) and *cervix* (=neck) because the first pereonite looks like a 'long-neck' in dorsal view.

REMARKS

In most species of the genus *Cerapus*, antenna 1 and antenna 2 are similar in length. However, in *C. longicervicum*, antenna 2 appeared to be 1.32 times longer than antenna 1. It was also characterized by an extremely narrow, coxal plate of gnathopod 1 0.39 times narrower than that of pereonite 1. These characteristics distinguish all the species of *Cerapus longicervicum* from their congeners except for *C. benthophilus*, which has a larger size and 9 segments of antennal flagella (Thomas and Heard, 1979). Both species are almost similar in body length.

C. longicervicum differs from *C. benthophilus* in the following characteristics: the fourth peduncular article of antenna 2 is longer than fifth one and the former has a seta on lateral line, while that of *C. benthophilus* is absent; carpus of gnathopod 1 without setae on mid-dorsal margin (present in *C. benthophilus*); gnathopod 2 does not have long simple setae proximally on anterodorsal margin (present in *C. benthophilus*); outer ramus of pleopod 2 is about 2.54 times longer than the inner one (about 1.3 times in *C. benthophilus*).

C. longicervicum is distinguished from *C. longirostris* by

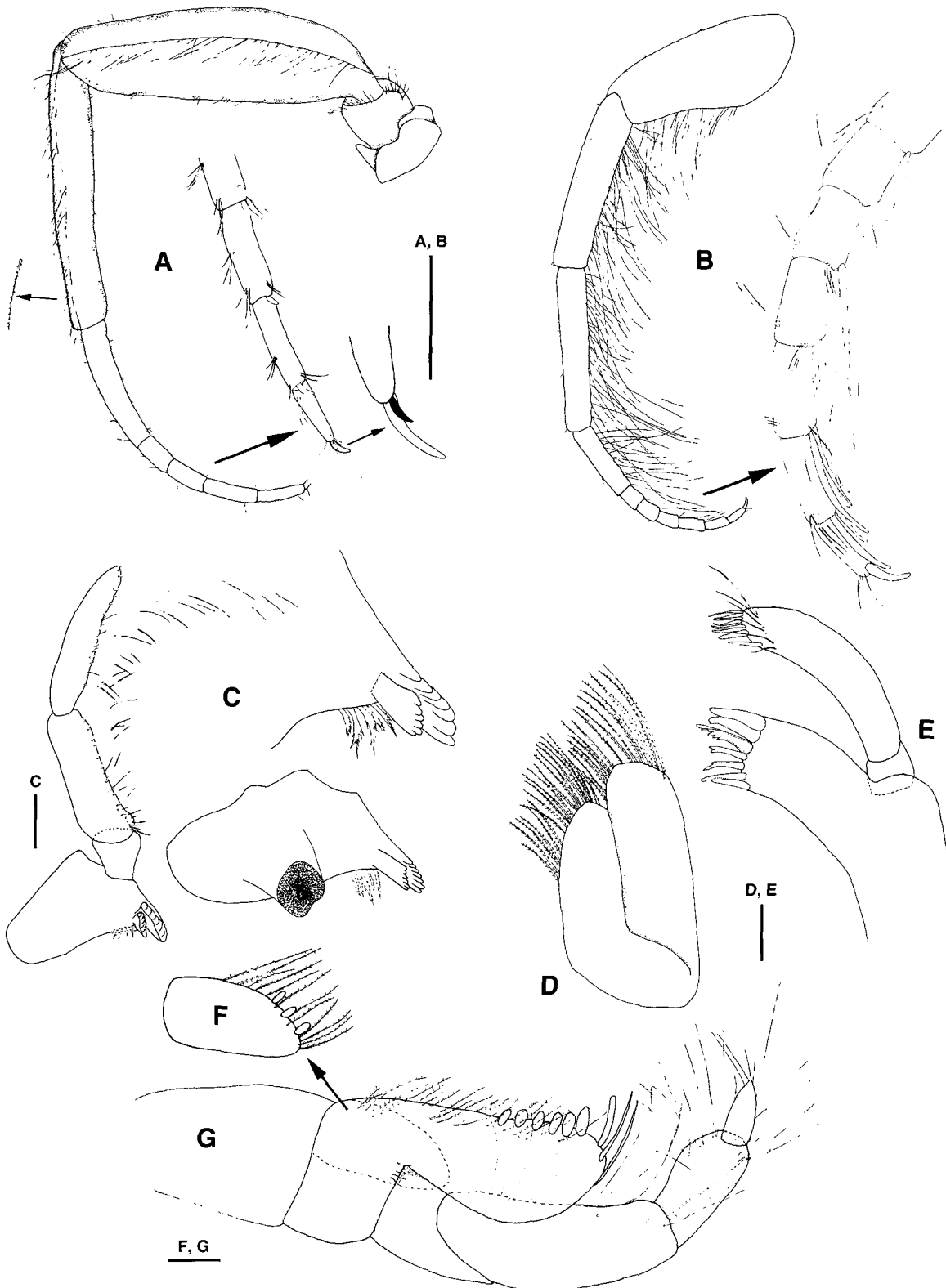


Fig. 3. *Cerapus longicervicum* n. sp., holotype male. A, antenna 2; B, antenna 1; C, mandible; D, maxilla 2; E, maxilla 1 (inner plate detected and omitted); F, inner plate of maxilliped; G, maxilliped. Scale bars=1 mm (A, B); 0.2 mm (C); 0.1 mm (D, E); 0.1 mm (F, G).

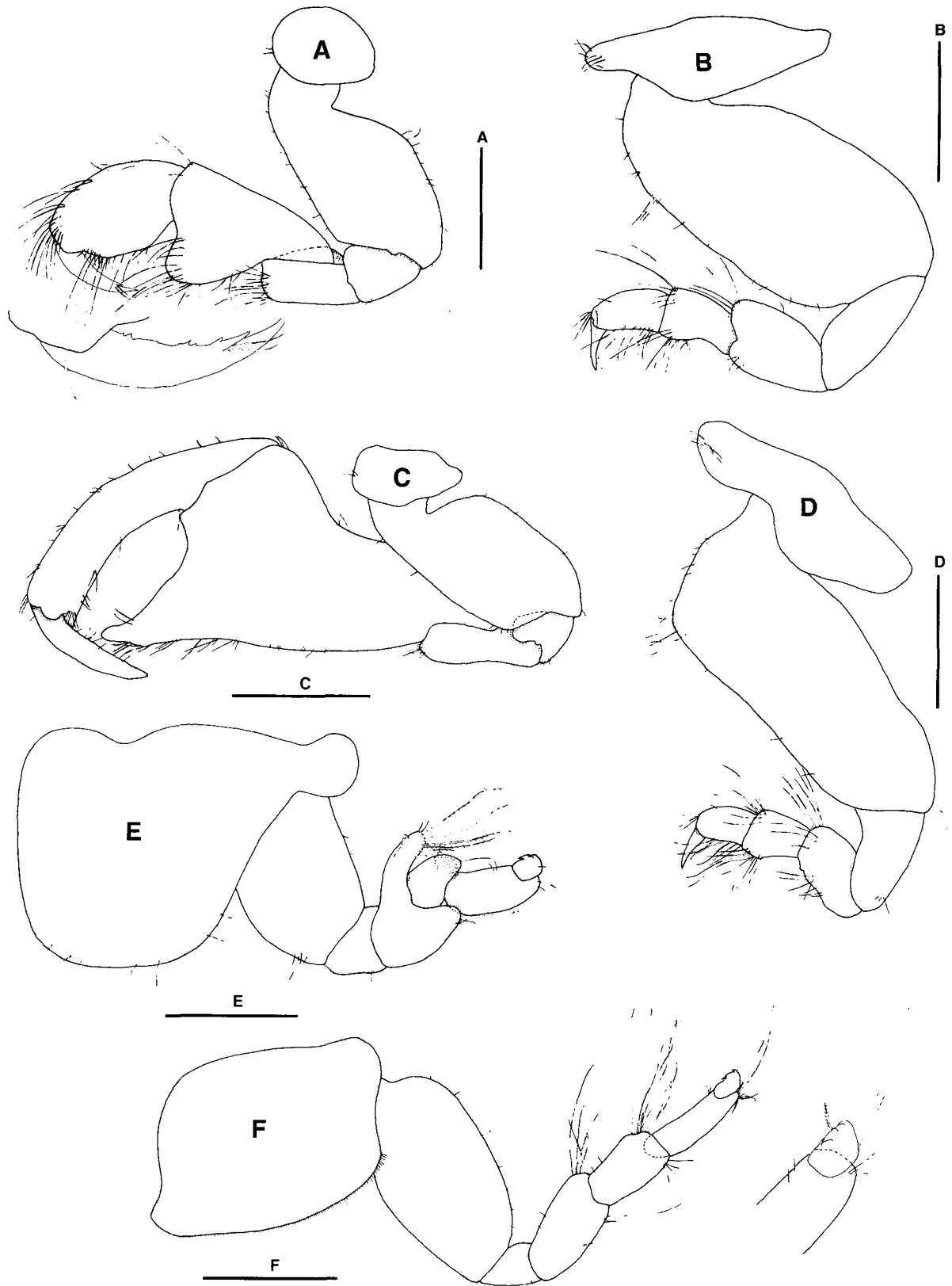


Fig. 4. *Cerapus longicervicum* n. sp., holotype male. A, gnathopod 1; B, pereopod 3; C, gnathopod 2; D, pereopod 4; E, pereopod 5; F, pereopod 6. Scale bars=0.5 mm (A, B); 1 mm (C); 0.5 mm (D-F).

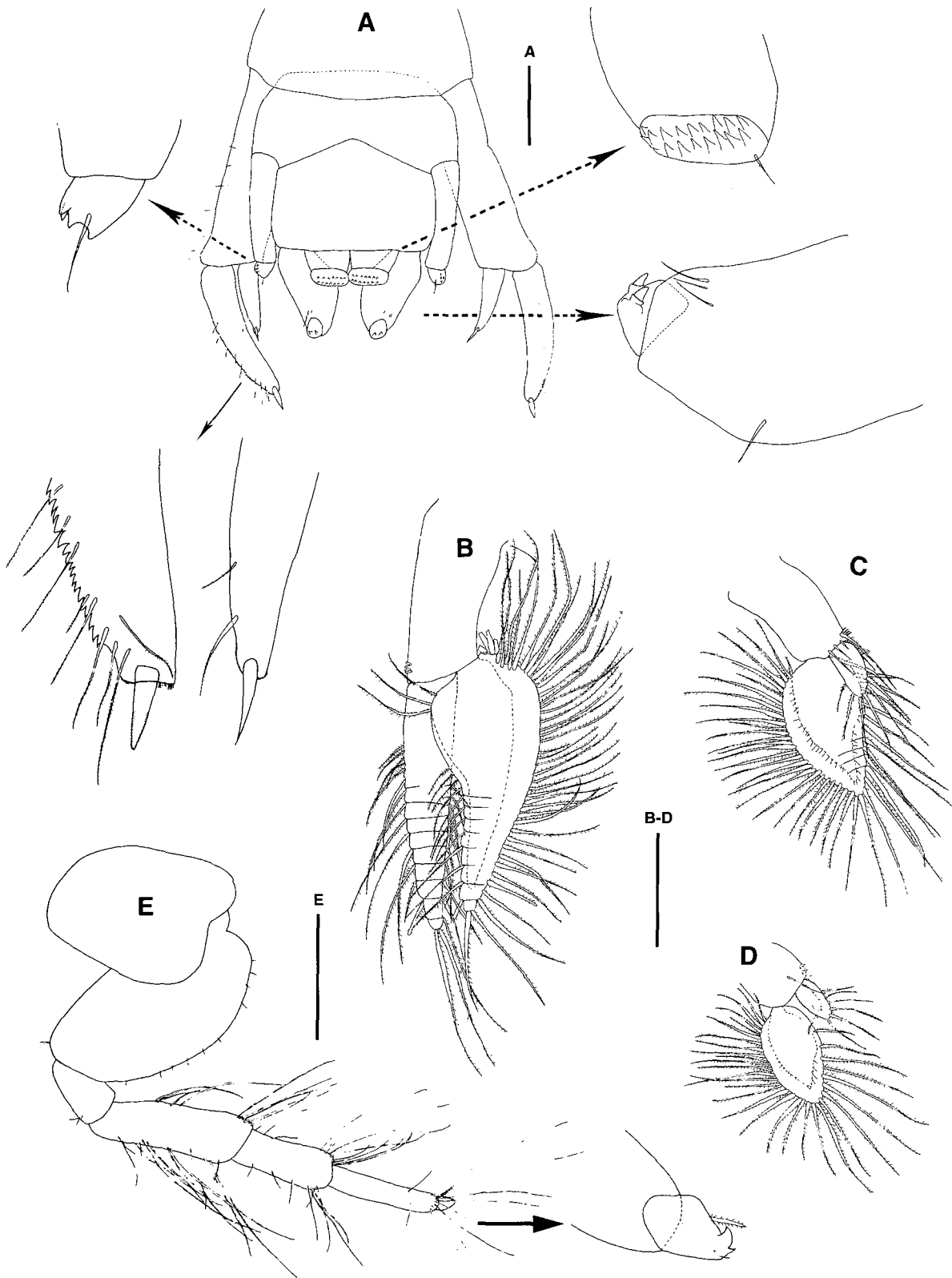


Fig. 5. *Cerapus longicervicum* n. sp., holotype male. A, urosomites and telson; B, pleopod 1; C, pleopod 2; D, pleopod 3; E, pereopod 7. Scale bars=0.5 mm (A-E).

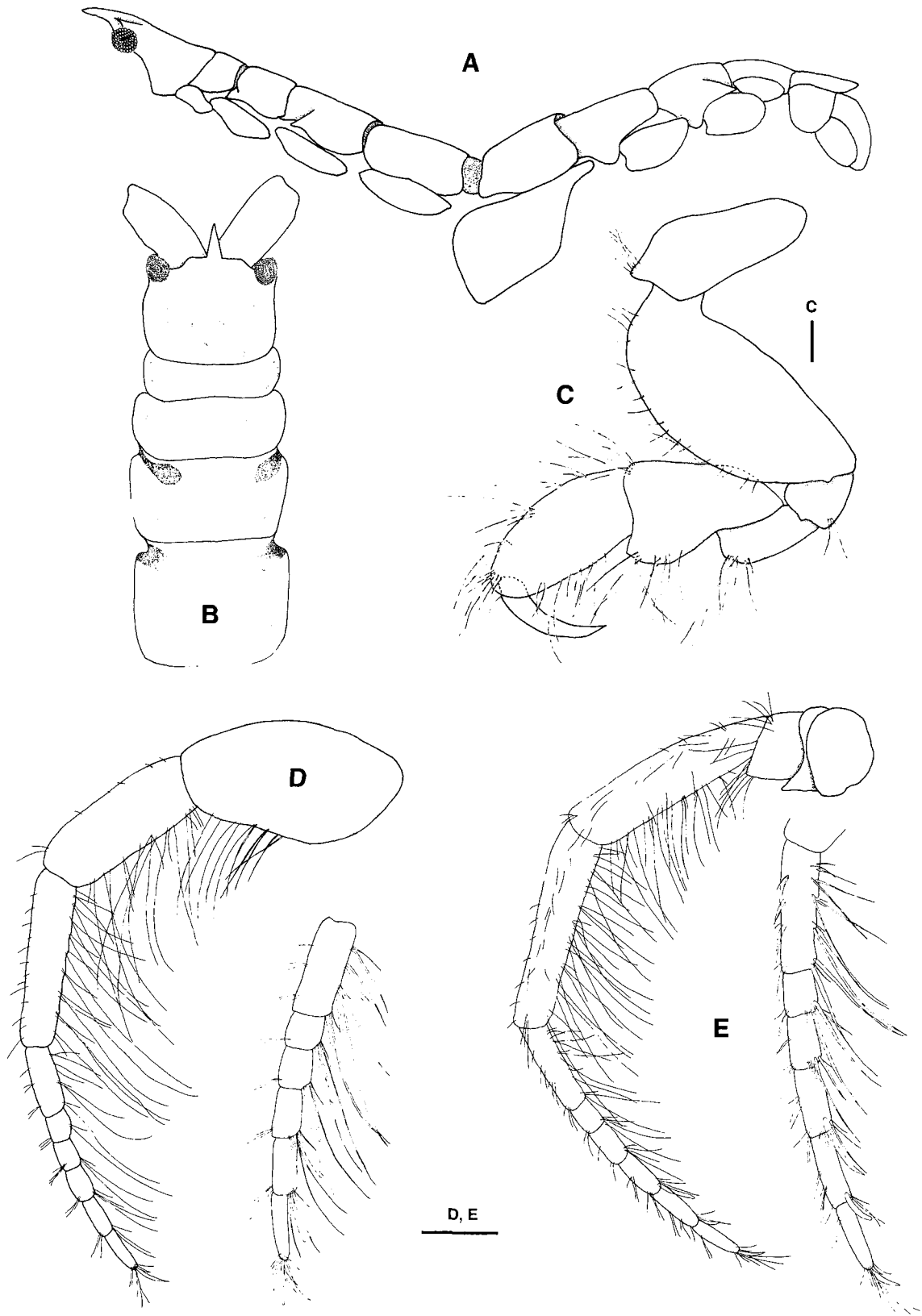


Fig. 6. *Cerapus longicervicum* n. sp., paratype female. A, lateral view; B, dorsal view; C, gnathopod 2; D, antenna 1; E, antenna 2. Scale bars=0.1 mm (C); 0.2 mm (D, E).

the features: rostrum short (13.5% of the first peduncular article of antenna 1); posterior part of pereonite 1 constricted; antenna 2, 1.32 times longer than antenna 1; entire articles of antenna 2 with sparse setae on ventral margin and fifth peduncular article with setae along the lateral line; cephalothorax, pereonites 1, 2 and 3 sub-equal; coxal plate of gnathopod 1, 0.39 times as broad as pereonites 1.

Key to Korean species of *Cerapus*

1. Antenna 2 sub-equal to antenna 1; posterior part of pereonite 1 not constricted *C. longirostris*
2. Antenna 2 about 1.3 times longer than antenna 1; posterior part of pereonite 1 constricted *C. longicervicum*

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