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Short communication

A New Record of the Cosmopolitan Species *Caprella mutica* (Crustacea: Amphipoda: Caprellidae) from Korean Waters, with Comparison to *Caprella acanthogaster*

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ABSTRACT

A newly recorded species *Caprella mutica* Schurin, 1935 belonging to the family Caprellidae Leach, 1814 was collected from the East Sea, Korea. *Caprella mutica* is native to the north-east Asia but is a well-known cosmopolitan and invasive species in many areas. This species is morphologically highly similar to *C. acanthogaster* Mayer, 1890. However, it is distinguished from a combination of the characteristics of the head, pereonites 1–2, and gnathopod 2. In this study, the Korean *C. mutica* is fully illustrated based on the mature specimens and compared to *C. acanthogaster*.

Keywords: Amphipoda, Caprellidae, *Caprella mutica*, new record species, Korea

INTRODUCTION

The genus *Caprella* Lamarck, 1801 is one of the 95 genera belonging to the family Caprellidae Leach, 1814 and contains 184 species (Horton et al., 2020). This genus is characterized with (1) biarticulate flagellum in the antenna 2; (2) mandibular palp absent; (3) pereonites 3–4 with gills; (4) pereopods 3–4 absent; and (5) abdomen with a pair of appendages and a pair of lobes in the male (McCain, 1968; Arimoto, 1976). Among them, *Caprella mutica* was first described as a type locality in Peter the Great Bay by Schurin (1935). After, Vassilenko (1967, 1974) and Arimoto (1976) dealt with this species more specifically. This species has a wide range of distribution globally and is well-known as a cosmopolitan and invasive species by navigation development, indigenous to north-east Asia (Schurin, 1935; Willis et al., 2004; Cook et al., 2007; Ashton et al., 2007, 2008; Frey et al., 2009; Schückel et al., 2010; Boos et al., 2011; Almón et al., 2014; Peters and Robinson, 2017). It is associated with macro-algae in shallow water (Fedotov, 1991; Ashton et al., 2007). Additionally, *C. mutica* is known predominantly as a detritivore (Guerra-García and De Figueroa, 2009) capable of swaying their bodies through the water using a setose antennae to filter particles from the water column (Nauwelaerts et al., 2007). However, *C. mutica* have been confused morphologically with *C. acanthogaster* Mayer, 1890 because they have mixed characteristics. *Caprella acanthogaster* was newly recorded in Korean waters with a brief description by Kim and Lee (1978). Thus, we suggest illustrations of *C. mutica* and *C. acanthogaster*, and compare the two species through their morphological characteristics in this paper. Specimens were collected by SCUBA diving and light trapping from the shallow and subtidal waters in Korea (Fig. 1) and were deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea and the Marine Amphipod Resources Bank of Korea (DARBK), Dankook University, Cheonan, Korea.

SYSTEMATIC ACCOUNTS

Order Amphipoda Latreille, 1816
Family Caprellidae Leach, 1814
Genus *Caprella* Lamarck, 1801

[1]**Caprella acanthogaster* Mayer, 1890 (Figs. 2A, 3)

Caprella acanthogaster Mayer, 1890: 80, Pl. 7, figs. 52, 53;

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1903: 78, Pl. 3, fig. 3; Vassilenko, 1974: 204, figs. 120, 121; Arimoto, 1976: 169, figs. 91, 92; Martin, 1977: 154, fig. 3; Kim and Lee, 1978: 2, fig. 2; Guerra-García and Takeuchi, 2004: 996, figs. 21–26; Vassilenko, 2006: 110, Pl. 16; Lee and Hong, 2011: 14, fig. 3.

Material examined. 3♂♂, Korea: Jeollanam-do: Jangheung-gun, Hoejin-myeon, Duksan-ri, Noryeoksin Port, 34°26′40.5″ N, 126°57′53.2″E, 15 Sep 2015, Kim SH, Heo JH; 1♂, Gyeongsangbuk-do: Uljin-gun, Pyeonghae-eup, Hupo-ri, 36°43′15.25″N, 129°43′09.38″E, 14 Aug 2018, Kim YH, Lee SG; 3♂♂, Pohang-si, Nam-gu, Guryongpo-eup, Janggil-ri, 35°56′58.65″N, 129°32′48.66″E, 5 Mar 2019, Lee SG; 3♂♂, Uljin-gun, Pyeonghae-eup, Jiksan-ri, 36°43′24.32″N, 129°28′35.51″E, 6 Mar 2019, Lee SG.

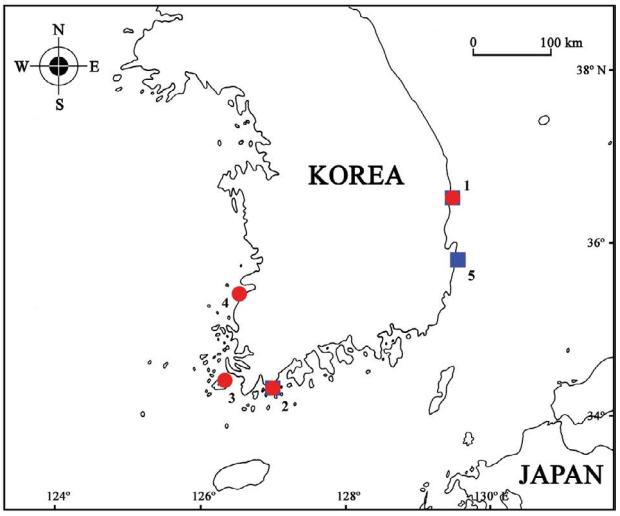

Fig. 1. Collecting sites of *Caprella mutica* (●) and *Caprella acanthogaster* (■) in this study. 1, Jiksan-ri, Uljin-gun; 2, Noryeoksin Port, Jangheung-gun; 3, Jimak-ri, Jindo-gun; 4, Daejukdo Island, Gochang-gun; 5, Janggil-ri, Pohang-si, Korea.

Description. Male (DARBK-203): Body (Figs. 2A, 3A) long and slender, 15.3 mm long, covered with tiny tubercles. Head unarmed, except a pair of tiny tubercles in middorsally. Eye small and round. Pereonite 1 elongate and fused with head, 0.80 times shorter than pereonite 2; pereonite 2 longest, with several spines posterodistally; pereonite 3 slightly longer than pereonite 4, with dorsal and lateral spines, elongated gills; pereonite 5 subequal to pereopod 4, with dorsal and lateral spines; pereonites 6–7 short, with dorsal spines; length ratio of pereonites 2–7 = 1.00 : 0.70 : 0.65 : 0.60 : 0.27 : 0.31.

Antenna 1 (Fig. 3B) 0.73 × body length; peduncular articles 1–3 thick, with sparse short setae and covered with tiny tubercles; peduncular article 3 slightly widening distally; length ratio of peduncular articles 1–3 = 1.00 : 1.71 : 1.43; flagellum slender, 21-articulate, 0.54 × peduncle, eac h article with 1 aesthetasc ventrodistally.

Antenna 2 (Fig. 3C) setose, much shorter than antenna 1, not reaching the distal end of peduncular article 2 of antenna 1; peduncular articles 4–5 and flagellum article 1 with many long swimming setae ventrally; length ratio of peduncular articles 3–5 = 1.00 : 3.66 : 3.90; flagellum biarticulate, 0.84 × peduncular article 5.

Gnathopod 1 (Fig. 3D) small, basis expanded posteriorly, with anterodistal process; merus subequal to ischium, with simple setae distally; carpus short, subtriangular, with expending rounded lobe and long simple setae ventrodistally;

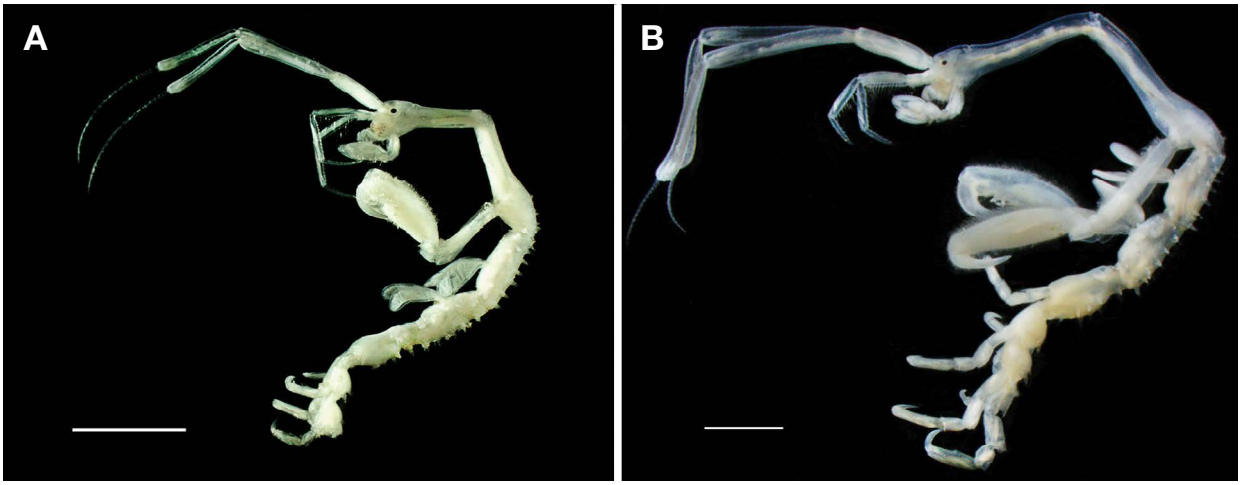

Fig. 2. *Caprella acanthogaster* Mayer, 1890 (A) and *Caprella mutica* Schurin, 1935 (B). A, Mature male, 15.1 mm, habitus; B, Mature male, 19.1 mm, habitus. Scale bars: A = 3.0 mm, B = 2.0 mm.

Korean name: [1*]가시투성바다대벌레

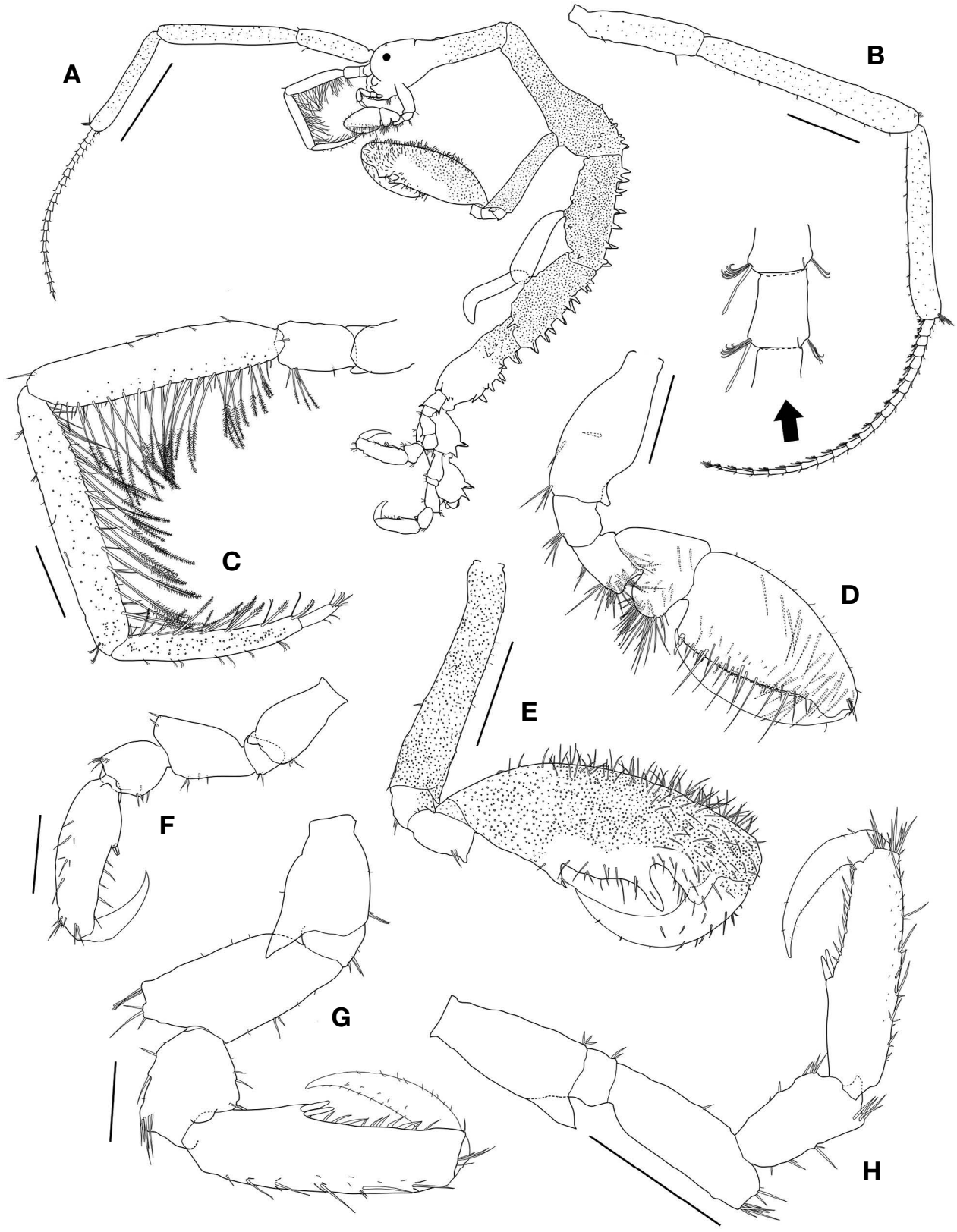

Fig. 3. *Caprella acanthogaster* Mayer, 1890, mature male, 15.1 mm. A, Habitus; B, Antenna 1; C, Antenna 2; D, Gnathopod 1; E, Gnathopod 2; F, Pereopod 5; G, Pereopod 6; H, Pereopod 7. Scale bars: A=2.0 mm, B, E, H=1.0 mm, C, D, F, G=0.4 mm.

propodus subtriangular, narrowing distally, palm slightly convex, with unequal setae, proximal projection conspicuously provided; dactylus falcate, slightly exceeding palm; length ratio of 6 articles = 1.00 : 0.31 : 0.35 : 0.53 : 1.39 : 1.37.

Gnathopod 2 (Fig. 3E) attached to rather distoventral portion of pereonite 2, long and slender, covered with tiny tubercles; basis, ischium, merus with process on each distal portion, propodus elongate, nearly as long as basis, width 0.50 × length, covered with unequal setae, palm with triangular projection near distal margin, poison tooth situated nearly triangular projection, and a grasping spine; dactylus falcate, strongly curved; length ratio of 6 articles = 1.00 : 0.14 : 0.28 : 0.09 : 1.42 : 0.89.

Pereopod 5 (Fig. 3F) regenerated form; basis with small triangular process posterodistally; ischium short; merus expanded posteriorly with simple setae; carpus with simple setae on both margins; propodus longest, with long simple setae posteriorly, distal margin with long setae, palm definded by a pair of grasping spines midanteriorly; dactylus falcate, slightly exceeding grasping spines; length ratio of 6 articles = 1.00 : 0.18 : 0.89 : 0.62 : 1.85 : 1.15.

Pereopod 6 (Fig. 3G) similar to pereopod 5, but merus more stout and elongated than that of pereopod 5; length ratio of 6 articles = 1.00 : 0.29 : 1.17 : 0.66 : 2.29 : 1.69.

Pereopod 7 (Fig. 3H) similar to pereopod 5, but merus narrower and more elongated than that of pereopod 5; length ratio of 6 articles = 1.00 : 0.24 : 1.18 : 0.90 : 1.69 : 1.30.

Distribution. North-Pacific Ocean (Mayer, 1890; Vassilenko, 1974; Arimoto, 1976), South America (Martin, 1977).

[1]**Caprella mutica* Schurin, 1935 (Figs. 2B, 4)

Caprella mutica Schurin, 1935: 198, fig. 1; Vassilenko, 1974: 201, figs. 118, 119; Arimoto, 1976: 111, fig. 59; Faasse, 2005: 22, figs. 1–3; Turcotte and Sainte-Marie, 2009: 1, fig. 1; Boos et al., 2011: 129, fig. 2; Daneliya and Laakkonen, 2012: 1, figs. 2, 3.

Material examined. 1♂, Korea: Jeollanam-do: Jindo-gun, Gogun-myeon, Jimak-ri, 34°28′19.36″N, 126°21′48.27″E, 1 Jul 2004, Kim YH, Yu CJ; 1♂, Jeollabuk-do: Gochang-gun, Simwon-myeon, Mandol-ri , Daejuk-do Island, 35°32′17.4″N, 126°29′00.8″E, 26 Jun 2014, Hong SS, Kim SH; 1♂, Jeollanam-do: Jangheung-gun, Hoejin-myeon, Duksan-ri, Noryeoksin Port, 34°26′40.5″N, 126°57′53.2″E, 15 Sep 2015, Kim SH, Heo JH; 1♂, Gyeongsangbuk-do: Uljin-gun, Pyeonghaeeup, Jiksan-ri, 36°43′24.32″N, 129°28′35.51″E, 6 Mar 2019, Lee SG.

Description. Male (cat no. NIBRIV0000865950): Body (Figs. 2B, 4A) long and slender, 17.7 mm long. Head smooth without process. Eye small and round. Pereonite 1 elongate and fused with head 0.86 times shorter than pereonite 2; pereonite 2 longest, covered with numerous hair, with a pair of small spines posterodistally; pereonite 3 slightly longer than pereonite 4, with dorsal and lateral spines and elongated gills; pereonite 5 subequal to pereonite 3, narrowed both lateral margins, with dorsal and lateral spines; pereonites 6–7 short, with dorsal spines; length ratio of pereonites 2–7 = 1.00 : 0.51 : 0.46 : 0.51 : 0.22 : 0.22.

Antenna 1 (Fig. 4B) 0.81 × body length; peduncular articles 1–3 thick, with rare short setae; peduncular article 3 slightly widening distally; length ratio of peduncular articles 1–3 = 1.00 : 2.14 : 1.64; flagellum slender, 19-articulate, 0.35 × peduncle, each article with 1 aesthetasc ventrodistally.

Antenna 2 (Fig. 4C) setose, much shorter than antenna 1, not reaching the distal end of peduncular article 2 of antenna 1; peduncular articles 4–5 and flagellum article 1 with many long swimming setae ventrally; length ratio of peduncular articles 3–5 = 1.00 : 4.07 : 4.44; flagellum biarticulate, 0.65 × peduncular article 5.

Gnathopod 1 (Fig. 4D) small, basis expanded posteriorly, with anterodistal process; merus subequal to ischium, with simple setae distally; carpus short, subtriangular, with expending rounded lobe and long simple setae ventrodistally; propodus subtriangular, narrowing distally, palm slightly convex, with unequal setae, proximal projection conspicuously provided; dactylus falcate, slightly exceeding palm; length ratio of 6 articles = 1.00 : 0.38 : 0.38 : 0.58 : 1.08 : 1.12.

Gnathopod 2 (Fig. 4E) attached to rather distoventral portion of pereonite 2, long and slender, covered with dense hair; basis, ischium, merus with process on each distal portion, propodus elongate, nearly as long as basis, width 0.30 × length, palm with triangular projection near distal margin, poison tooth situated nearly triangular projection, with a grasping spine, unequal simple setae on palmar margin; dactylus falcate, strongly curved; length ratio of 6 articles = 1.00 : 0.13 : 0.25 : 0.03 : 1.20 : 0.71.

Pereopod 5 (Fig. 4F) stout; basis with large triangular process posterodistally; ischium short; merus expanded posteriorly with simple setae; propodus longest, with long simple setae posteriorly, palm defined by a pair of grasping spines midanteriorly; dactylus falcate, slightly exceeding grasping spines; length ratio of 6 articles = 1.00 : 0.39 : 1.18 : 1.08 : 2.50 : 2.09.

Pereopod 6 (Fig. 4G) similar to pereopod 5, but merus more elongated than that of pereopod 5; length ratio of 6 articles = 1.00 : 0.57 : 1.70 : 1.35 : 2.85 : 2.38.

Pereopod 7 (Fig. 4H) regenerated form; similar to pereopod 5, but basis elongated; length ratio of 6 articles = 1.00 : 0.18 : 0.59 : 0.44 : 1.08 : 0.90.

Korean name: [1]*털손가시투성바다대벌레(신칭)

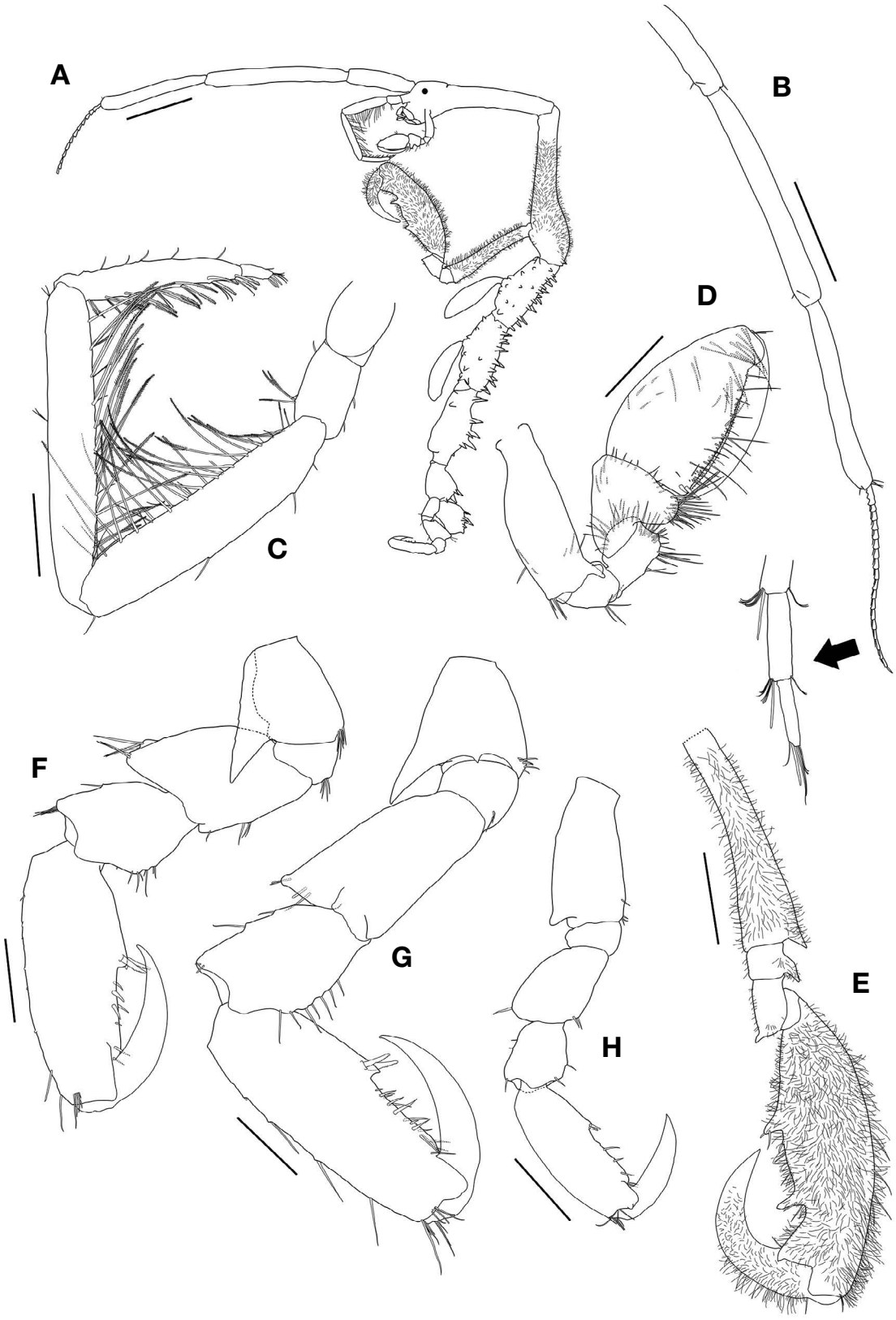

Fig. 4. *Caprella mutica* Schurin, 1935, mature male, 17.7 mm. A, Habitus; B, Antenna 1; C, Antenna 2; D, Gnathopod 1; E, Gnathopod 2; F, Pereopod 5; G, Pereopod 6; H, Pereopod 7. Scale bars: A, B=2.0 mm, C, D, F–H=0.4 mm, E=1.0 mm.

Distribution. North-East Asia, Pacific and Atlantic Ocean of North America, Europe, New Zealand (reviewed in Ashton et al., 2007), South Africa (Peters and Robinson, 2017).

Remarks. *Caprella mutica* is markedly similar to *C. acanthogaster* and the congeneric characteristics are as follow: (1) antenna 1, peduncular article elongate and peduncular article 3 slightly widening distally; (2) antenna 2, peduncular articles 4−5 and flagellum article 1 with many long swimming setae; (3) gnathopod 2 elongated, with poison tooth and a grasping spine; (4) pereonites 3−4 with elongated gills; (5) pereopods 5−7, basis with triangular process posterodistally (Arimoto, 1976; Faasse, 2005; Turcotte and Sainte-Marie, 2009). However, *C. mutica* is distinguished from *C. acanthogaster* by the following characteristics: (1) head without tiny tubercle (vs. with a pair of tubercles in *C. acanthogaster*); (2) pereonite 2 with a pair of spines posterodorsally in mature male (vs. with several spines posterodistally in *C. acanthogaster*); (3) pereonite 2 and gnathopod 2 covered with dense hair (vs. covered with sparsely setae or absent in *C. acanthogaster*). These differences are corresponded well with the paper in which Faasse (2005) compared the two species. Also, Arimoto (1976) described these two species, but the figure of *C. acanthogaster* appear to be mixed characteristics with *C. mutica*. Additionally, Vassilenko (2006) and Daneliya and Laakkonen (2012) mentioned the common characteristics of the *C. mutica*. However, our specimens differ from the specimens described previously, because dense hair on the pereonite 1 is not apparent. It may be considered a local variation in this species. Also, *C. mutica* resembles *C. eximia* Mayer, 1890 in having spines on pereonites. However, *C. mutica* is easily distinguished by lateral spines of pereonites 3−7, setose pereonite 2 and gnathopod 2. Our specimens are in good agreement with the characteristics of the *C. mutica*, as described by previous authors.

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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REFERENCES

Almón B, Pérez J, Bañón R, Trigo J, 2014. First record of *Caprella mutica* from the Iberian Peninsula: expansion southwards in European waters. Marine Biodiversity Records, 7:e30. https://doi.org/10.1017/S1755267214000335

Arimoto I, 1976. Taxonomic studies of caprellids (Crustacea, Amphipoda, Caprellidae) found in the Japanese and adjacent waters. Special Publications from the Seto Marine Biological Laboratory, 3:1-229. https://doi.org/10.5134/176456

Ashton GV, Stevens MI, Hart MC, Green DH, Burrows MT, Cook EJ, Willis KJ, 2008. Mitochondrial DNA reveals multiple Northern Hemisphere introductions of *Caprella mutica* (Crustacea, Amphipoda). Molecular Ecology, 17:1293-1303. https://doi.org/10.1111/j.1365-294X.2007.03668.x

Ashton GV, Willis KJ, Cook EJ, Burrows M, 2007. Distribution of the introduced amphipod, *Caprella mutica* Schurin, 1935 (Amphipoda: Caprellida: Caprellidae) on the west coast of Scotland and a review of its global distribution. Hydrobiologia, 590:31-41. https://doi.org/10.1007/s10750-007-0754-y

Boos K, Ashton GV, Cook EJ, 2011. The Japanese skeleton shrimp *Caprella mutica* (Crustacea, Amphipoda): a global invader of coastal waters. In: In the wrong place-alien marine crustaceans: distribution, biology and impacts (Ed., Galil BS). Springer, Dordrecht, pp. 129-156.

Cook EJ, Jahnke M, Kerckhof F, Minchin D, Faasse M, Boos K, Ashton G, 2007. European expansion of the introduced amphipod *Caprella mutica* Schurin 1935. Aquatic Invasion, 2:411-421. https://doi.org/10.3391/ai.2007.2.4.11

Daneliya ME, Laakkonen H, 2012. The Japanese skeleton shrimp *Caprella mutica* (Amphipoda: Caprellidae) in Sweden (Eastern Skagerrak). Marine Biodiversity Records, 5:e36. https://doi.org/10.1017/S1755267212000243

Faasse MA, 2005. Notes on diagnostic characters and morphological variability of *Caprella mutica* Schurin, 1935 in the Netherlands (Crustacea: Amphipoda: Caprellidea). Het Zeepaard, 65:22-28.

Fedotov PA, 1991. Population and production biology of amphipod *Caprella mutica* in Possjet Bay, Sea of Japan. Biol Morya, 4:53-60.

Frey MA, Gartner HN, Murray CC, Therriault TW, 2009. First confirmed records of the non-native amphipod *Caprella mutica* (Schurin 1935) along the coast of British Columbia, Canada, and the potential for secondary spread via hull fouling. Aquatic Invasions, 4:495-499. https://doi.org/10.3391/ai.2009.4.3.10

Guerra-García JM, De Figueroa JMT, 2009. What do caprellids (Crustacea: Amphipoda) feed on? Marine Biology, 156:1881-1890.

Guerra-García JM, Takeuchi I, 2004. The Caprellidea (Crustacea: Amphipoda) from Tasmania. Journal of Natural History, 38:967-1044. https://doi.org/10.1080/0022293021000054497

Horton T, Lowry J, De Broyer C, Bellan-Santini D, Coleman CO, Corbari L, Costello MJ, Daneliya M, Dauvin JC, Fišer C, Gasca R, Grabowski M, Guerra-García JM, Hendrycks E, Hughes L, Jaume D, Jazdzewski K, Kim YH, King R, Krapp-Schickel T, LeCroy S, Lörz AN, Mamos T, Senna AR, Serejo C, Sket B, Souza-Filho JF, Tandberg AH, Thomas JD, Thurston M, Vader W, Väinölä R, Vonk R, White K, Zeidler W, 2020. World Amphipoda Database. *Caprella* Lamarck, 1801 [Internet]. World Register of Marine Species, Accessed 4 Feb 2020, <http://www.marinespecies.org/aphia.php?p=taxdetails&id=101430>.

Kim HS, Lee KS, 1978. Systematic study of Amphipoda (Crustacea) in Korea. III. Four unrecorded caprellids (Caprellidae) from South Korea. Korean Journal of Zoology, 21:1-7.

Lee KS, Hong SS, 2011. Invertebrate Fauna of Korea, Skeleton shrimps. National Institute of Biological Resources, Incheon, Republic of Korea, 21:30-33.

Martin DM, 1977. A survey of the family Caprellidae (Crustacea, Amphipoda) from selected sites along the northern California coast. Bulletin of the Southern California Academy of Sciences, 76:146-167.

Mayer P, 1890. Die Caprelliden des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. Eine Monographie. Nachtrag zur Monographie derselben. Fauna und Flora des Golfes von Veapel, 17:1-55. https://doi.org/10.5962/bhl.title.7084

Mayer P, 1903. Die Caprellidae der Siboga-Expedition. Siboga-Expeditie, Monograph, 34:1-160.

McCain JC, 1968. The Capreillidae (Crustacea: Amphipoda) of the Western North Atlantic. Bulletin of the United States National Museum, 278:1-147. https://doi.org/10.5479/si.03629236.278

Nauwelaerts S, Michel K, Stamhuis E, Boos K, 2007. Is the Japanese skeleton shrimp *Caprella mutica* a filter feeder? II. Mechanics. Comparative Biochemistry and Physiology - Part A Molecular & Integrative Physiology, 146:S126. https://doi.org/10.1016/j.cbpa.2007.01.237

Peters K, Robinson TB, 2017. First record of the marine alien amphipod *Caprella mutica* (Schurin, 1935) in South Africa. BioInvasions Records, 6:61-66. https://doi.org/10.3391/bir.2017.6.1.10

Schückel U, Schückel S, Beck M, Liebezeit G, 2010. New range expansion of *Caprella mutica* Schurin, 1935 (Malacostraca: Caprellidae) to the German coast, North Sea. Aquatic Invasions, 5:S85-S89. https://doi.org/10.3391/ai.2010.5.S1.018

Schurin A, 1935. Zur Fauna der Caprelliden der Bucht Peters des Grossen (Japanisches Meer). Zoologischer Anzeiger, 122:198-203.

Turcotte C, Sainte-Marie B, 2009. Biological synopsis of the Japanese skeleton shrimp (*Caprella mutica*). Canadian Manuscript Report of Fisheries and Aquatic Sciences, 2903:1-26.

Vassilenko SV, 1967. Fauna of Caprellidae (Amphipoda) of the Possjet Bay (Sea of Japan) and some data on their ecology. Issledovanija Fauny Morei (Explorations of the fauna of the seas of the USSR), Biotzenozy Zalika Possjet Japanskovo Morja, 5:196-229.

Vassilenko SV, 1974. Kaprellidy (morskie kozochki) morei SSSR i sopredelnykh vod [The Caprellids of the seas of the USSR and adjacent waters]. Nauka, Leningrad, pp. 1-287.

Vassilenko SV, 2006. Caprellids. In: Biota of the Russian waters of the Sea of Japan, Vol. 4 (Ed., Adrianov AV). Dalnauka, Vladivostok, pp. 1-200.

Willis KJ, Cook EJ, Lozano-Fernandez M, Takeuchi I, 2004. First record of the alien caprellid amphipod, *Caprella mutica*, for the UK. Journal of the Marine Biological Association of the United Kingdom, 84:1027-1028. https://doi.org/10.1017/S0025315404010355h

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