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Short communication

An Unrecorded Species of the Genus *Isobactrus* (Acari, Halacaridae) Inhabiting Marine Plastic Debris from Jeju Island, Korea

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ABSTRACT

We discovered a halacarid mite species, *Isobactrus tuberculatus* Abé, 1996, inhabiting marine plastic debris on the coast of Jeju Island, Korea. The key characteristics of these Korean specimens were consistent with those in the original description of specimens from Hokkaido, Japan, including the presence of tuberculate membranous cuticles between the anterior and posterior dorsal plates, fusion of the posterior epimeral plates I and II, tibia II with a bipectinate seta, tibiae III and IV each with five setae, and a pair of subgenital setae in females. However, two small morphological differences were noted: the distance between the anterior and posterior dorsal plates was shorter than that in Japanese specimens, and the location of dorsal seta-2 was closer to the anterior dorsal plate in Korean specimens. We herein provide detailed illustrations of *I. tuberculatus*, based on the Korean specimens, with a brief taxonomic comment on the similarities among allied congeneric species. The genus *Isobactrus* is first reported in Korea.

Keywords: *Isobactrus tuberculatus*, marine, meiofauna, mite, northwest Pacific

INTRODUCTION

Marine plastic debris (MPD) poses a significant environmental challenge and endangers the status of marine biodiversity (Deudero and Alomar, 2015). In particular, MPD has become a medium for the migration of alien species, making it a critical issue (Han et al., 2023). The components of MPD serve as it serves as provisional rafts that provide habitats for various marine invertebrates and create new ecosystems (Haram et al., 2021). Although some studies have focused on macroinvertebrates attached to MPD (Han et al., 2023), research on the entanglement of meiobenthic invertebrates with MPD remains lacking.

We discovered several halacarid specimens on floating MPD that had washed up on the west coast of Jeju Island in Korea. Among them, a halacarid mite has been identified as *Isobactrus tuberculatus* Abé, 1996. Thirty species in the genus *Isobactrus* Newell, 1947 have been recorded (WoRMS, 2023), including eight species from the northwestern Pacific described in the 1990s: *I. luxtoni* Bartsch, 1992 and *I. obesus* Bartsch, 1992 from Hong Kong (Bartsch, 1992); *I. dentatus* Abé, 1996, *I. gryposetus* Abé, 1996, *I. hamatus* Abé, 1996, *I. latistriatus* Abé, 1996, and *I. tuberculatus* Abé, 1996 from Hokkaido, Japan (Abé, 1996b); and *I. ponapensis* Abé, 1996 from Micronesia (Abé, 1996a). Therefore, both genus and species are newly reported in Korea.

Materials were taken from floating MPD at Yongsu port on the west coast of Jeju Island, Korea. Samples were collected by washing the surface of the MPD using a compression sprayer with tap water, then filtering the water through a 64 μm diameter nylon net and fixing it with 90% ethanol on site. The detailed methods of micro-slide preparation, measurements, and drawing are followed by Lee et al. (2023). The scale bars in the figures indicate measurements in micrometers.

Voucher specimens are deposited in the Honam National Institute of Biological Resources (HNIBR), Mokpo, Korea.

Terminology and abbreviations used in the text and figures are followed by Bartsch (2010): AD, anterior dorsal plate;

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AE, anterior epimeral plate (AEI and AEII, first and second anterior epimeral plates); aes-1 and aes-2, ventral setae attributed to anterior epimeral plate I and II, respectively; aes-v, setae in anterior portion of ventral idiosoma; ds, dorsal setae on idiosoma (ds-1 to ds-5, first to fifth dorsal setae on idiosoma); glp, gland pore (glp-1 to glp-4, first to fourth gland pores on idiosoma); OC, ocular plate(s); P, palp (P-1 to P-4, first to fourth palpal segments); pas, parambulacral setae; PD, posterior dorsal plate; PE, posterior epimeral plate (PEI and PEII, first and second posterior epimeral plates); pes-1 and pes-2, ventral setae attributed to posterior epimeral plates I and II, respectively; pes-d, dorsal (dorsolateral) seta on posterior epimeral plate; pgs, perigenital setae; sgs, subgenital setae.

SYSTEMATIC ACCOUNTS

Subclass Acari Leach, 1817
Order Trombidiformes Reuter, 1909
Suborder Prostigmata Kramer, 1877
Superfamily Halacaroidea Cunliffe, 1954
Family Halacaridae Murray, 1877
[1]*Genus *Isobactrus* Newell, 1947

[2]****Isobactrus tuberculatus*** **Abé, 1996 (Figs. 1, 2)**

Isobactrus tuberculatus Abé, 1996b: 89, figs. 19–23; 1998: 123.

Material examined. Korea: 2♀♀ (HNIBRIV2420, HNIBRIV7534) mounted each on a slide, Jeju-si, Hangyeong-myeon, Yongsu-ri, Yongsu port, 33°19′23″N, 126°09′55″E, 17 Mar 2022, Kim SL, Kang SM and Han GH *leg*.

Description of female. Idiosoma (Fig. 1A) 350–365 μm long, 230–238 μm wide. All dorsal plates (Fig. 1A) well-developed and separate each other by membranous cuticle; ornamented with polygonal panels on surfaces (Fig. 1A, C). Dorsal membranous cuticle tuberculate (Fig. 1D), gradually weakening towards lateral sides; distance of membranous cuticle between AD and PD about 0.14 times as long as AD.

AD (Fig. 1A) large, gradually narrowing towards anterior end and truncated posteriorly, 139–144 μm long (about 0.40 times as long as idiosoma), 133–138 μm wide, slightly longer than wide (length-to-width ratio 1.05); with pair of glp-1 located at anterior 23% of AD and pair of faint areolae medio-posteriorly.

OC (Fig. 1A) rhombus-shaped; 63–66 μm long (about 0.18 times as long as idiosoma), 53–55 μm wide, slightly longer than wide (length-to-width ratio 1.19); with 1 cornea positioned at anterior corner; with 2 pairs of glp, glp-2 situated laterally behind cornea, and glp-3 near posteromedial margin.

PD (Fig. 1A) large, 191–199 μm long (0.55 times as long as idiosoma), 161–167 μm wide (0.70 times as wide as idiosoma), length-to-width ratio 1.19; anterior margin convex, and distal half gradually narrowing towards posterior end; with a pair of glp-4 located at posterior 22% of PD.

Five pairs of dorsal setae (Fig. 1A) very short, except for ds-3; ds-1 located at anterior 45% of AD; ds-2 on membranous cuticle between AD and OC, more adjacent to posterior corner of AD; ds-3 long filiform, 21 μm long, about 5 times as long as others, and positioned on membranous cuticle between AD and PD; 2 pairs of ds (ds-4 and ds-5) issued at anterior 39% and 73% of PD, respectively.

Ventral epimeral plates (Fig. 1B) reduced and each exhibiting only coxal area; all ventral surfaces covered with striated membranous cuticle, except for AE, PE, and genital and anal sclerites; posterior margin of camerostome (Fig. 1B) rounded, slightly reaching beyond aes-1. AEI larger than AEII (Fig. 1B); 3 pairs of anterior epimeral setae (aes-1, aes-2, and aes-v) placed on ventral membranous cuticle. PE consisting of unseparated PEI and PEII, with 3 pairs of setae (pes-d, pes-1, and pes-2) situated on striated membranous cuticle, except for pes-d; pes-d slightly short than pes-1 and pes-2 (Fig. 1A, B).

Genital foramen (Fig. 1B, G) 70–73 μm long, 46–48 μm wide, covered with pair of genital sclerites; situated between PEII and anterior anal foramen and surrounded by 3 pairs of pgs; all pgs placed on membranous cuticle, foremost pgs located far beyond genital sclerites, at level of posterior end of PEI, second one at anterior 33% of genital foramen, and last pgs at posterior corner of genital foramen; with 3 pairs of genital acetabula, consisting of short and two large genital acetabula, and last genital acetabulum far from others (Fig. 1G). Genital sclerites (Fig. 1G) with pair of sgs situated at anterior 22%. Ovipositor (Fig. 1H) short, with 11 genital spines comprising of 4 spines at anterior and 7 at posterior part; all genital spines with trifid tips, except for 4 spines in posterior region, which with quadrifid tips. Anal foramen ventrodistally, without adanal setae.

Gnathosoma (Fig. 1E) almost concealed beneath anterior idiosoma in dorsal view; 50–53 μm long (0.15 times as long as idiosoma), 61–64 μm wide (0.17 times as wide as idiosoma), length-to-width ratio 0.82. Rostrum 20 μm long, shorter than gnathosomal base, occupying 40% gnathosoma length; with 2 pairs of rostral setae laterally, proximal seta slightly longer than distal one, located at anterior 50% and 75% of rostrum, respectively. Palp (Fig. 1F) short, comprising of 4 segments; P-1 and P-3 without process; P-2 with 1 subdistal seta; P-4 conical, with 1 tiny, 1 spatulate, and 2 filiform setae.

Korean name: [1]*곱추짠물응애속(신칭), [2]*결절곱추짠물응애(신칭)

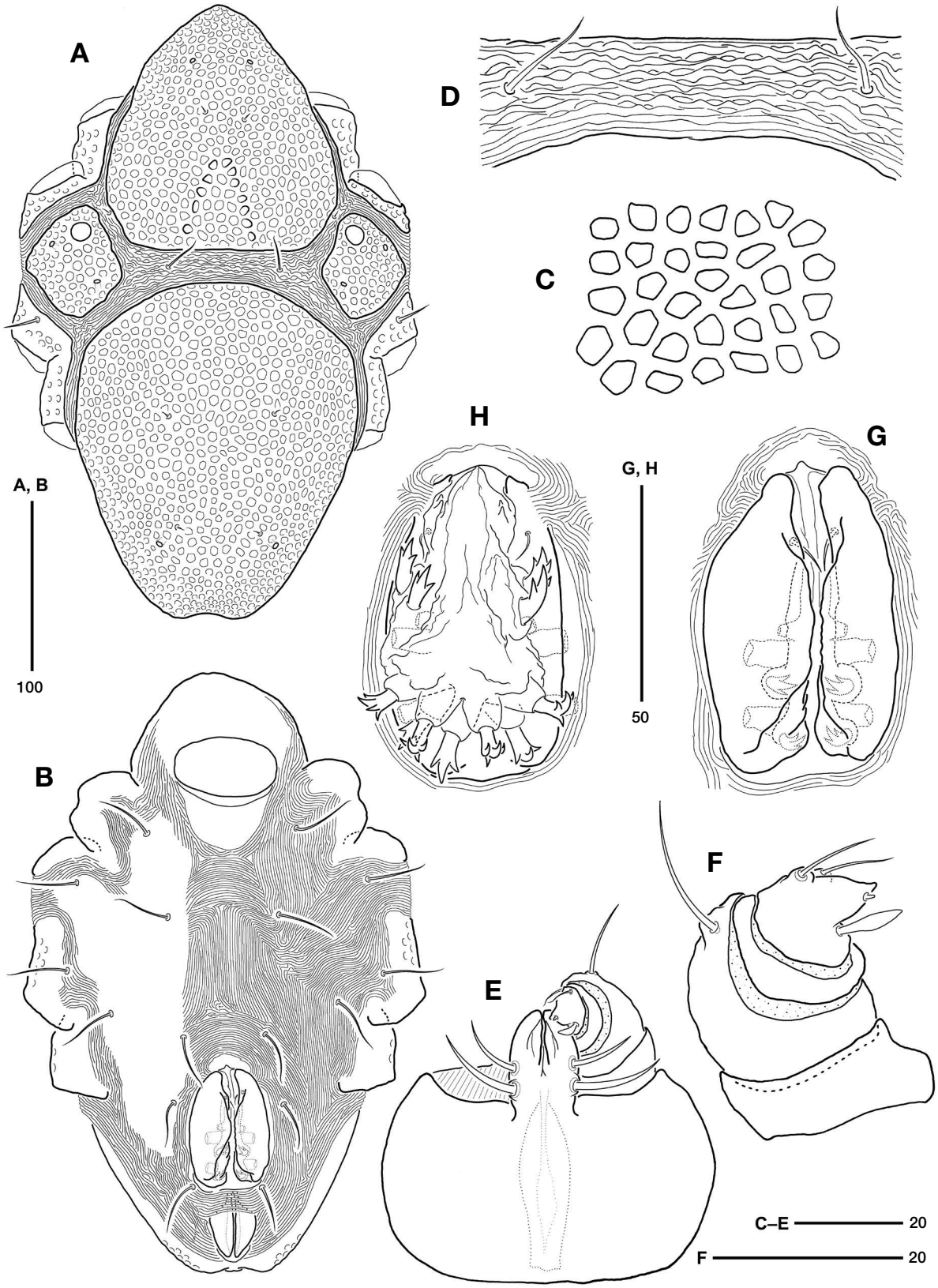

Fig. 1. *Isobactrus tuberculatus* Abé, female. A, Idiosoma, dorsal; B, Idiosoma, ventral; C, Polygonal panels on the surface of PD; D, Membranous cuticle between AD and PD; E, Gnathosoma, ventral; F, Palp, lateral; G, Genital foramen; H, Ovipositor.

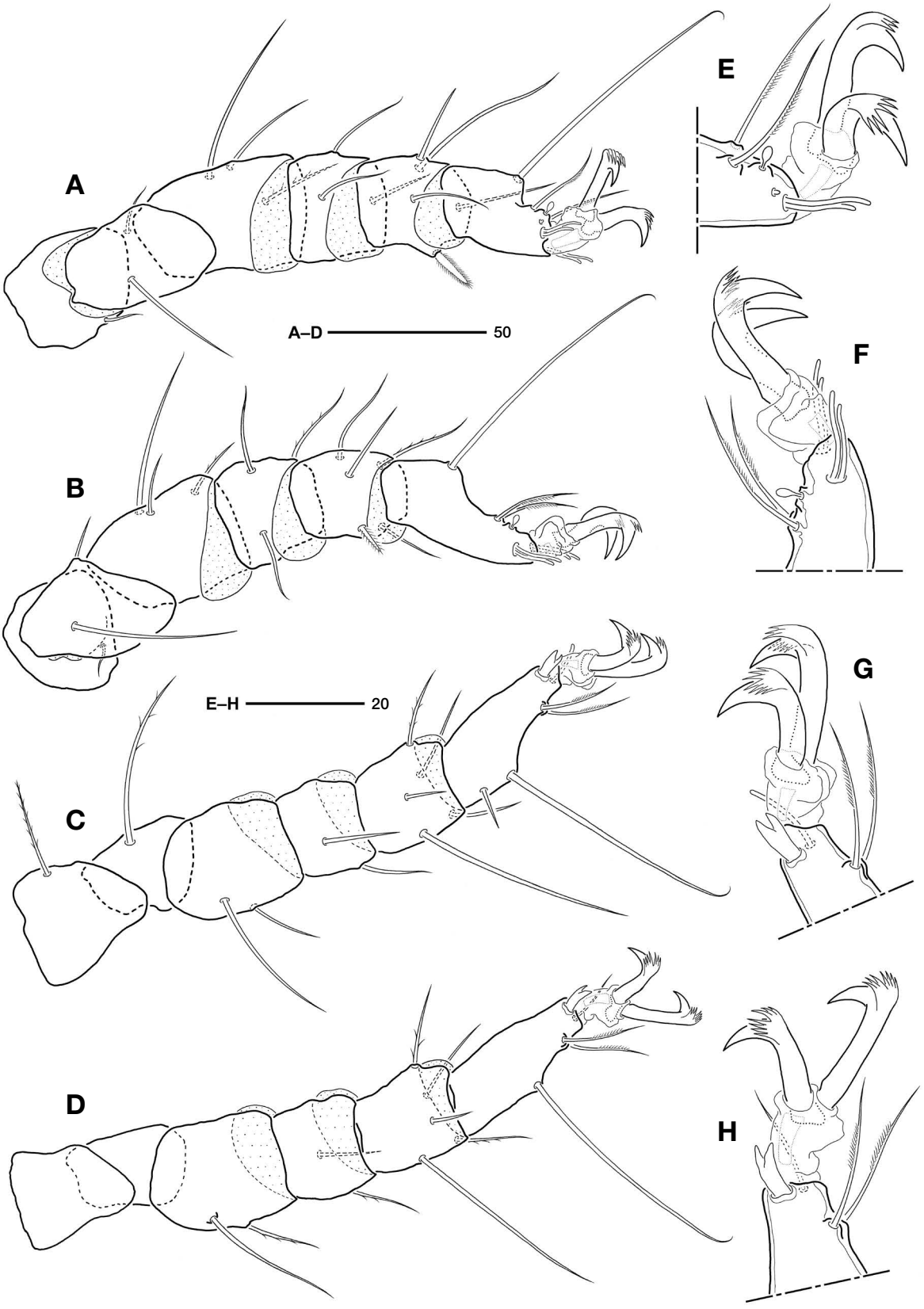

Fig. 2. *Isobactrus tuberculatus* Abé, female. A–D, Legs I–IV, lateral; E–H, Tarsi I–IV, lateral.

Chaetotaxy of legs (Fig. 2) as follows: trochanters 1-1-1-0; basifemora 2-2-1-0; telofemora 3-3-2-2; genua 3-3-2-2; tibiae 5-5-5-5; tarsi (excluding pas and famulus) 4-4-4-3. Tibiae I and II each with 1 bipectinate spiniform seta ventromedially and ventrolaterally; single spiniform seta on tibia I stronger than tibia II. Tarsi I–IV with 1 long basal and 2 distal fossary setae, except for tarsus III with 1 dorsoproximal seta additionally; all distal fossary setae with setules ventromedially; tarsus I (Fig. 2A, E) with 1 claviform solenidion, 1 short famulus, and a pair of doublet eupathid pas; tarsus II (Fig. 2B, F) with 1 claviform solenidion, and a pair of doublet eupathid pas; tarsus III (Fig. 2C, G) with 1 eupathid and 1 bifurcate pas; tarsus IV (Fig. 2D, H) with 1 filiform and 1 bifurcate pas. All tarsi with a pair of lateral claws bearing 6–8 accessory processes, and without medial claws.

Distribution. Japan (Abé, 1996b), Korea.

Remarks. *Isobactrus tuberculatus* Abé, 1996 was first described from green algae on gravels at a depth of 0.1 m in Shizunai on the coast of Hokkaido, Japan (Abé, 1996b). This species is characterized by the presence of tuberculate membranous cuticles between the AD and PD, fused PEI and PEII forming PE, tibia II carrying one bipectinate seta, and tibiae III and IV each bearing five setae.

Isobactrus tuberculatus, as indicated by its epithet, is distinctively characterized by the dorsal tuberculate membranous cuticle between the AD and PD. This characteristic is shared with five species within the genus *Isobactrus* (Abé, 1998), including *I. tuberculatus*; *I. asper* Bartsch, 1977 from Galapagos (Bartsch, 1977), *I. calderensis* Newell, 1984 and *I. microdens* Newell, 1984 from Chile (Newell, 1984), and *I. luxtoni* Bartsch, 1992 from Hong Kong (Bartsch, 1992). However, *I. tuberculatus* is differentiated from the four abovementioned species by having a dorsal seta-3, measuring approximately five times longer than others (versus all short dorsal setae in four species), fused PEI and PEII forming the PE (versus completely separated PEI and PEII in the other four species), and the pes-1 situated on the membranous cuticle instead of the posterior epimeral plate (versus the pes-1 situated on the posterior epimeral plate in the other four species). Moreover, *I. calderensis* possesses four pairs of perigenital setae and three setae on tarsus III (versus three pairs of perigenital setae and four setae on tarsus III in *I. tuberculatus*), and *I. microdens* has four pairs of posterior epimeral setae (versus three pairs in *I. tuberculatus*). Additionally, *I. asper* and *I. luxtoni* exhibit two pairs of subgenital setae (versus the single pair of subgenital setae in *I. tuberculatus*).

The Korean speciemens' chatacteristics of *I. tuberculatus* were consistent with the original description in Japan (Abé, 1996b) except for two minor discrepancies. First, the distance between AD and PD (approximately 14% of the length of the AD) was shorter than that in the Japanese specimens (approximately 50% of the length of the AD). Second, the position of ds-2 was closer to the AD than to the OC in the Korean specimens, whereas it was closer to the OC in the Japanese specimens.

Members of *Isobactrus* have been found to inhabit various environments, including algae, mussels, barnacles, and coarse sandy sediment in intertidal zones of both marine and brackish waters (Bartsch, 2006). Among them, *I. hutchinsoni* Newell, 1947 has even been discovered in habitats approaching freshwater, with salinities as low as 0.5‰, in a bay near a small river in Hamilton, U.S.A. (Bartsch, 1979). Abé (1996b) also collected *I. tuberculatus* from semi-closed shores near the river mouth in a wide salinity range (approximately 3–32‰) and assumed that the organism would be tolerant to oligo- and mesohaline brackish water. The Korean specimen of *I. tuberculatus*, however, was unexpectedly discovered on the surface of floating MPD in a port on the west coast of Jeju Island.

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CONFLICTS OF INTEREST

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

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