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Original Article

# First report of the microgastropod *Ammonicera japonica* (Omalogyridae Habe, 1972) in Korea

Tsukasa Waki [a,b], Hee-Jung Lee [a], Sang-Rul Park [a], Jinsoon Park [c], Hyuck Joon Kwun [c], Kwang-Sik Choi [a,*]

[a] *School of Marine Biomedical Science (BK21 PLUS), Jeju National University, 102 Jejudaehakno, Jeju, 63243 South Korea*
[b] *Meguro Parasitological Museum, 4-1-1 Shimomeguro Meguro-ku, Tokyo, Japan*
[c] *Biodiversity Dynamics Team, National Marine Biodiversity Institute of Korea, 75, 101 Jangsan-ro, Janghang-eup, Seocheon-gun, Chungcheongnam-do, 325-902, South Korea*

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ABSTRACT

The intertidal zone of Jeju Island, Korea, is characterized by well-developed volcanic rocks with high wave action. During low tide, numerous small tidal pools are formed on the rocky intertidal zone, which provide shelter and habitats for benthic organisms. Previous investigation indicated that many species of micromolluscans inhabit the tidal pools; however, only a few studies have reported the ecology and identification of these microshells. In this study, we have identified a microgastropod, *Ammonicera japonica* Habe, 1972 (Omalogyridae), from a tidal pool on the southern coast of Jeju Island. Morphological identification of the species was based on scanning electron microscopy (SEM) of the protoconch and teleoconch. *A. japonica* was found to be associated with encrusting coralline algae distributed on the bottom of the tidal pools. This is the first report of *A. japonica* from Korea, and the specimen was registered at the National Marine Biodiversity Institute of Korea (MABIK MO00157413).



## Introduction

Microshells are the adult stage of small sized gastropods or bivalves with a shell length (i.e. the longest axis) smaller than a few millimeters (Sasaki 2000). Additionally, the early juvenile stage of large mollusk species is often called a microshell. In the coastal marine ecosystem, these micromollusks are often associated with benthic algal tufts, especially coralline algae, and they play a key role as secondary producers (Akioka et al 1999; Kelaher 2002; Olabarria 2002). In Korea, Min (2004) reported 247 species of micromollusks, mostly from coastal Jeju Island. Despite their abundance and ecological importance, few studies have reported the distribution pattern and life history of these micromollusks to date. According to Sasaki (2000), numerous species of microgastropods are associated with benthic macro-algae including coralline algae and large brown algae such as *Sargassum* spp.

Members of the Omalogyridae family are typical microgastropods, with a shell length of a few millimeters. Okutani (2000) reported approximately 40 species of these family members from Japanese waters and some of them are found within the benthic macro algae community, although their ecological role is still unknown. Within the Omalogyridae family, the genus *Ammonicera* is characterized by an ammonite-like shell, although the shell size is extremely small, with a shell length $< 2$ mm. In Japan, Okutani (2000) reported two species of *Ammonicera*, including *Ammonicera japonica* (Habe 1972) and *Ammonicera angulate* (Sleurs 1985).

In the present study we collected the first specimens of *A. japonica* associated with coralline algae in tidal pools on the south coast of Jeju Island, Korea. Accordingly, the present study first reports *A. japonica* in Korea.

## Materials and methods

In July 2015, we installed a 10 cm $\times$ 10-cm microquadrat in a tidal pool, to collect microgastropods associated with benthic algae (Figure 1). The sampling area was a rocky intertidal area on the south coast of Jeju Island, Korea. The removed algal tuft was identified as coralline algae, *Collallina pilulifera* and *Collallina officinalis*.

* Corresponding author. Tel.: +82 64754 3422; fax: +82 64756 3493.
*E-mail address:* skchoi@jejunu.ac.kr (K.-S. Choi).

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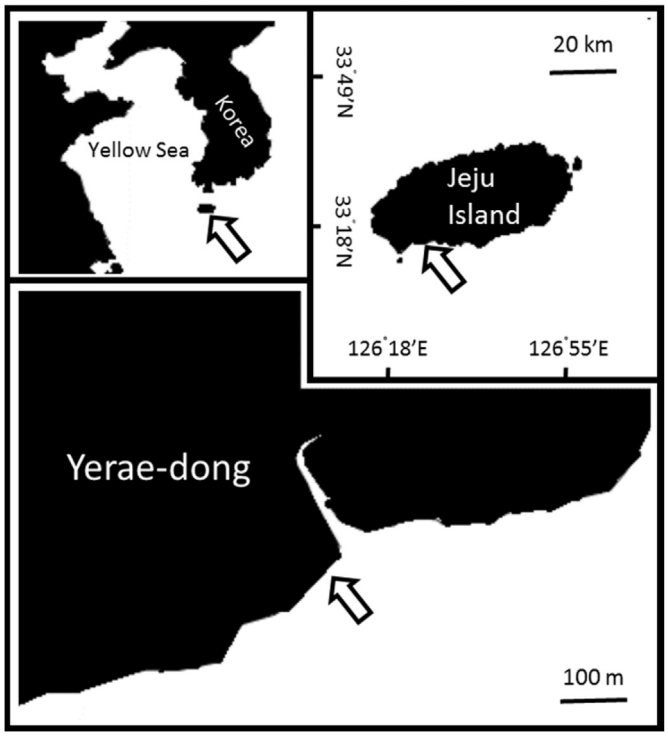


**Figure 1.** Sampling site of specimens of *Ammonicera japonica* Habe, 1972.

After transportation to the laboratory, the algae-microshell complexes were immersed in 70% ethanol for 15 minutes and sieved through a 2-cm mesh to isolate the associated microorganisms. Microscopic examination of the filtrate revealed numerous small organisms including several species of gastropods. A scanning electron microscope (SEM: Carl Zeiss AG - SUPRA 55VP) (ZEISS, Jena, Germany) was used to identify the microgastropods by examining the microstructure of the shell surface. The specimens were stored in 70% ethanol and registered at the National Marine Biodiversity Institute of Korea (MABIK MO00157413).

## Results and discussion

Numerous benthic organisms were found within the 10 mm × 10-mm microquadrat, mostly small molluscans. Based upon SEM photomicrographs, the microgastropods isolated from the quadrat were identified as *A. japonica* Habe (1972) (Figure 2), and this species is new to Korean waters. A total of 40 *A. japonica* were counted from the quadrat, suggesting that *A. japonica* is densely associated with the coralline algae, *C. pilulifera* and *C. officinalis* in the tidal pool. Of the 40 individuals, most of them were found to be live specimens, with the operculum. Malacological features of *A. japonica* can be summarized as follows:

Order Heterostropha Ponder and Warén, 1988
Family Omalogyridae G. O. Sars, 1878
Genus *Ammonicera* Vayssière, 1893

***Ammonicera japonica* (Habe, 1972)**
*Ammonicera japonica* Habe, 1972: 115, Figures 1–4 (type locality: Yamaguchi Pref., Japan); Okutani, 2000: 700–701, Figure Omaligyridae-1.

*Description.* Protoconch: 185 μm in shell diameter. Shell with two spiral ridges extending to the first three quarters of the whorl; transition to teleoconch indistinct (Figure 2B). Obsolete axial growth lines. Teleoconch: shell extremely small (476 μm in shell diameter), red-brown color, planispiral, opaque, translucent (Figure 2A). Obsolete axial growth lines between axial ribs.

The microstructure of the shell surface of *A. japonica* demonstrated in this study using SEM corresponds very well with the description of the shell surface by Habe (1972) and Okutani (2000). Bieler and Mikkelsen (1998) reported that the surface structure of the protoconch and teleoconch of *Ammonicera minortalis* is extremely similar to that of *A. japonica*, although *A. minortalis* is limited in distribution in the Atlantic Ocean (i.e. Florida coast). It is unlikely that the microgastropod identified in this study is *A. minortalis*, because this species has not been reported from the west Pacific region. Chernyshev (2003) reported a new species of *Ammonicera* from Korean water as *Ammonicera chosenica.* This species was discovered from the coastal East Sea, near Pohang, suggesting that *A. chosenica* distributes in rather cold water. *A. japonica* can be distinguished from *A. chosenica*, because *A. japonica* has two spiral ridges extending to the teleoconch, and large axial ribs on the teleoconch.

*Material examined.* A tidal pool in the south coast of Jeju Island, 33°14'23.42"N, 126°23'49.22"E. July 18, 2015, one adult (476 μm in shell diameter).

*Distribution.* From the Indian Ocean to Southern Hokkaido, Japan (West Pacific Ocean). *A. japonica* reported in this study was found from tufts of coralline algae. Several studies have reported that micromollusks use tufts of coralline algae as a shelter, which

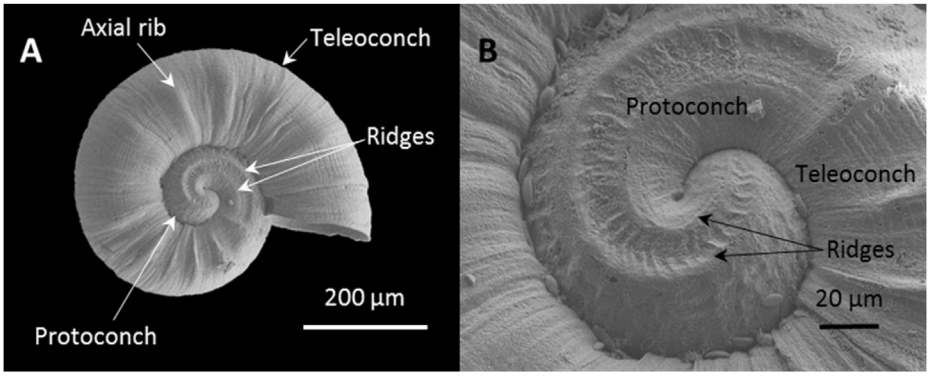


**Figure 2.** *Ammonicera japonica* shells by scanning electron microscopy. A, Apical view. Arrows represent axial ribs on the teleoconch and two ridges on the protoconch. B, Protoconch from apical view (detail of A). Arrows represent two ridges.

protects them from strong wave or water flow and predators (Uchiba et al 1982; Hayakawa et al 2013). Accordingly, we believe that *A. japonica* also utilizes the tufts of coralline algae, *C. pilulifera* and *C. officinalis,* as shelter for protection from predators and strong wave actions.

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