

**Taxonomic Study of Marine Tardigrades from Korea**  
**II. Genus *Halechiniscus* (Heterotardigrada, Arthrotardigrada,**  
***Halechiniscidae*)**

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**ABSTRACT**

Two marine tardigrades belonging to the genus *Halechiniscus* Richters, *H. jejuensis* n. sp. and *H. remanei* Schulz are recorded from Jeju Island, Korea. *Halechiniscus jejuensis* n. sp. is distinguished from the congeners by the shape and position of lateral body processes, the shape of sensory papilla on leg IV, and the contour of head portion not clearly divided into two lobes. A revised key to the nine species of the genus *Halechiniscus* is prepared.

Key words: Taxonomy, marine Tardigrada, Heterotardigrada, Halechiniscidae, *Halechiniscus*, new species, Jeju Island, Korea

**INTRODUCTION**

Genus *Halechiniscus* Richters, 1908 is the type genus of the family Halechiniscidae Thulin, which is the most diverse family including eight subfamilies and 29 genera of the Arthrotardigrada (De Zio Grimaldi and Villora-Moreno, 1995). Nevertheless, in the genus *Halechiniscus*, only two species are recorded in the North Pacific: *H. remanei* Schulz, 1955 from California (Pollock, 1989) and from Tanabe Bay, southwest Honshu, Japan (Noda, 1985) and from Okinawa Is., Japan (Noda, 1994); *H. chafarinensis* De Zio Grimaldi and Moreno, 1995 from Wakayama-ken,

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southwest Honshu and Yaeyama Is., Okinawa, Japan (Noda, 1998).

The fauna of the Korean marine tardigrades has been poorly known so far. Chang and Rho (1997) first reported the marine tardigrades from Korean seashore and described two new *Batillipes* (*B. longispinosus*, *B. orientalis*). Rho *et al.* (1999) clarified the eight *Batillipes* species from Korea, including the two preceding species and a new species (*B. rotundiculus*). As one of the serial reports on the marine tardigrade fauna of Korea, we now deal with the two species belonging to the genus *Halechiniscus*.

## MATERIALS AND METHODS

Materials were collected from the washings of the upper 10 cm of sediments at the shallow sublittoral zone in Udo Islet off Jeju Island (=Cheju I.) in the time span of June, 1997–October, 1998. Samples were scooped into polyethylene vinyl bag by SCUBA diving, and in the field filtered through nylon net (67  $\mu\text{m}$  in pore diameter) after freshwater rinsing for less than a minute for osmotic shock, to be fixed with 5% buffered formalin.

Specimens were mounted in glycerin on H-S slide (Shirayama *et al.*, 1993), after placing in a solution of 5% glycerin in 95% ethyl alcohol for 1–2 days, and observed under a differential interference contrast microscope with Nomarski optics. All drawings and measurements were made using a camera lucida.

## TAXONOMIC ACCOUNTS

Order Arthrotardigrada Marcus, 1927 마디곰벌레목 (신칭)

Family Halechiniscidae Thulin, 1928 바다가시곰벌레과 (신칭)

Genus *Halechiniscus* Richters, 1908 바다가시곰벌레속 (신칭)

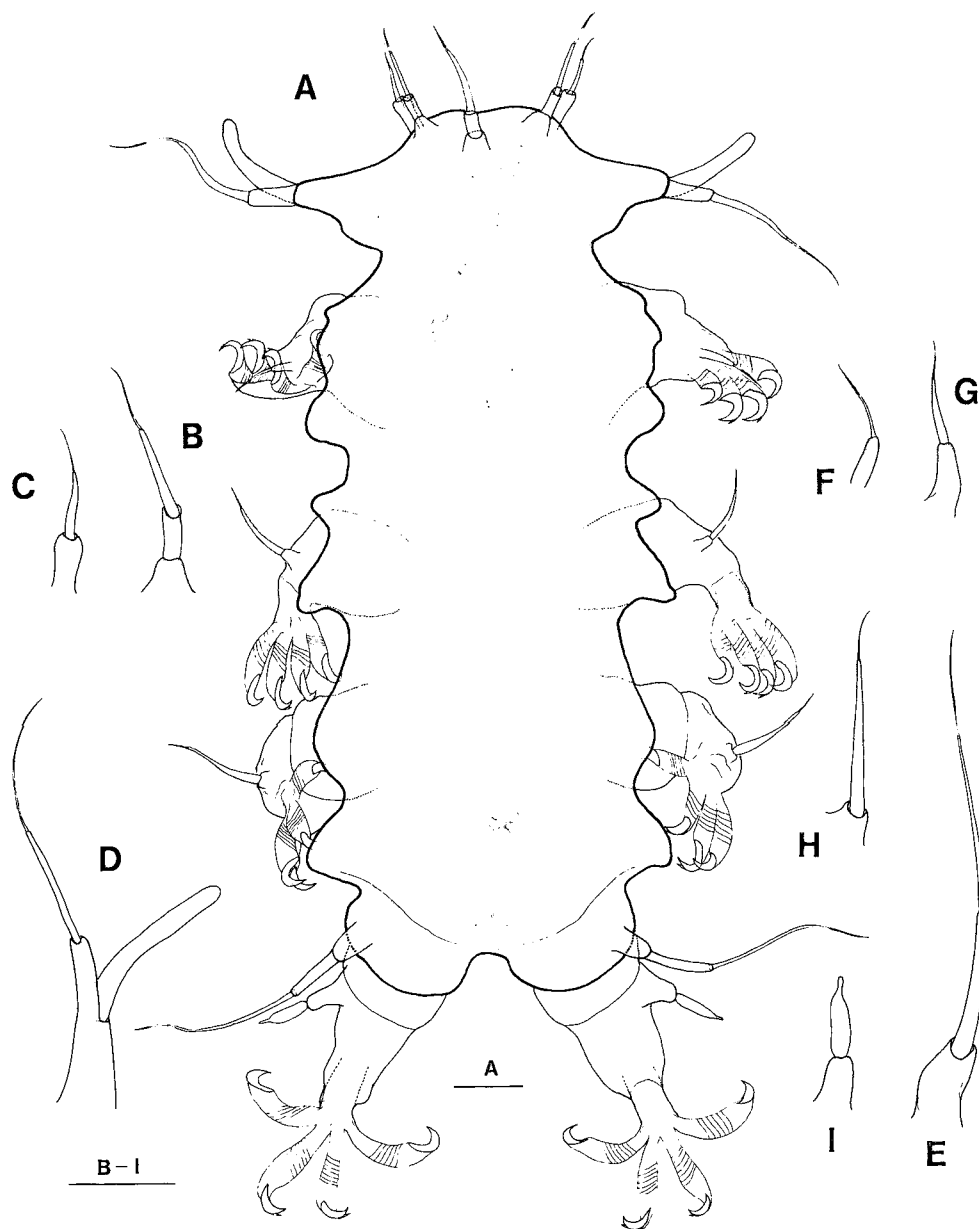
### 1. *Halechiniscus jejuensis* n. sp. 제주가시곰벌레 (신칭) (Figs. 1, 2)

**Material examined.** Two females and 1 male from submerged sand bottom (2–3 m deep) of Udo Islet, Jeju I. (37° 13'00"N, 126° 06'56"E), 9 Oct. 1998, H. S. Rho and J. W. Choi. One paratype (female) will be deposited in the Natural History Museum of Ewha Womans University. Holotypic female and allotype are kept in the collection of the authors.

**Diagnosis.** *Halechiniscus* with cephalic region not divided into dorsal and ventral lobes with cephalic cirri; internal cephalic cirri dorsal to external cirri; lateral cirrus (cirrus A) co-occurred with primary clava dorsally; bearing 6 pairs of lateral body expansions; caudal region smooth without any protrusion; sensory process on leg IV shaped as elongate papilla; internal claws with a small dorsal spur.

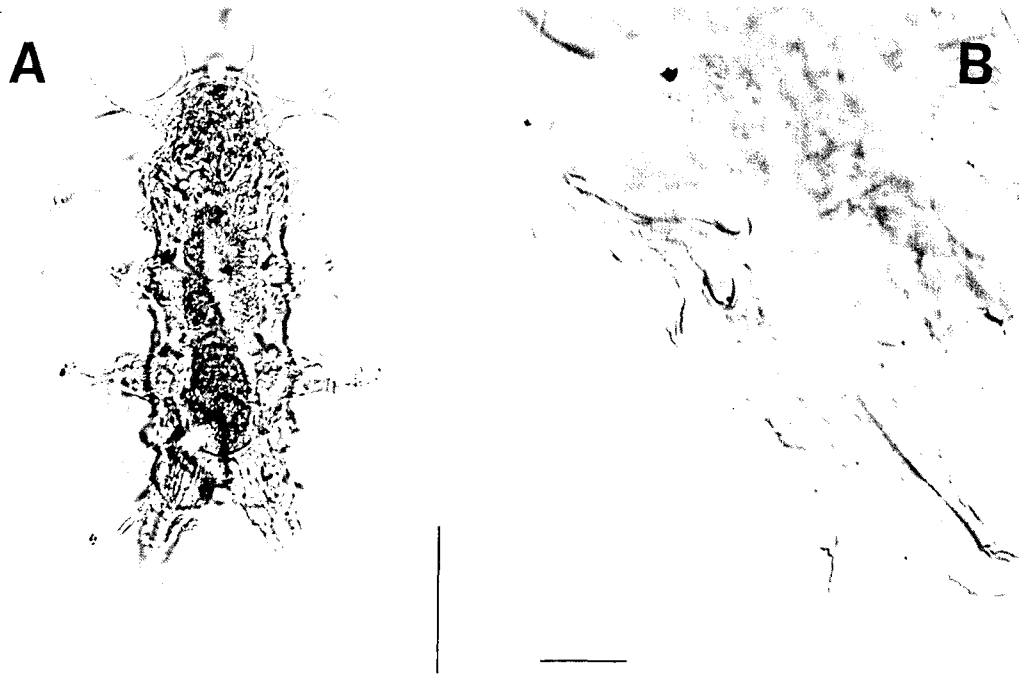
**Description.** Body 128.4  $\mu\text{m}$  long from frontal margin of head (excluding cephalic cirri) to posterior margin of trunk; broadest at the level of last lateral projection of 53.0  $\mu\text{m}$ . Body inapparently divided with metameric constrictions. Dorsal cuticle finely punctuated; caudal region appearing rather granulated.

Cephalic region not apparently divided into two lobes of dorsal portion and ventral one by a



**Fig. 1.** *Halechiniscus jejuensis* n. sp. A, habitus, dorsal view; B, internal cirrus; C, external cirrus; D, lateral cirrus and primary clava; E, cirrus E; F-I, sensory organs on legs I-IV. Scale bars = 10  $\mu$ m.

furrow. Frontal expansion of head flattened, with 1 median cirrus and 2 pairs of cirri submesially. All cephalic cirri organized according to the same pattern: scapus followed by flagellum sheathed with hairy distal portion. Median cirrus distinct, issuing from well-developed cirrophorus, and consisting of 5.0  $\mu$ m scapus and 20.3  $\mu$ m long flagellum (6.7  $\mu$ m unsheathed). Internal cirri much longer than outer cirri, locating dorsally; internal cirrus 20.0  $\mu$ m long with 4.8  $\mu$ m scapus and



**Fig. 2.** *Halechiniscus jejuensis* n. sp. A, habitus, dorsal view; B, leg III and proximal part of leg IV, ventral view. Scale bars: A = 50  $\mu\text{m}$ ; B = 10  $\mu\text{m}$ .

15.2  $\mu\text{m}$  flagellum (6.1  $\mu\text{m}$  unsheathed); external cirrus 14.4  $\mu\text{m}$  long with 5.2  $\mu\text{m}$  scapus and 13.2  $\mu\text{m}$  flagellum (4.4  $\mu\text{m}$  unsheathed).

Lateral sides of head swollen, forming large cirrophori; lateral cirrus (cirrus A) co-occurred with primary clava (the former dorsal to the latter), 33.9  $\mu\text{m}$  long with 7.4  $\mu\text{m}$  scapus and 26.5  $\mu\text{m}$  flagellum (15.2  $\mu\text{m}$  unsheathed). Primary clava club-shaped, a little less than 1/2 times as long as lateral cirrus (16.0  $\mu\text{m}$  long), with nearly uniform diameter along all its length.

Eye spot absent. Mouth opening surrounded by strong ring; pharyngeal apparatus consisting of a pharyngeal tube (22  $\mu\text{m}$  long), two stylets (14  $\mu\text{m}$  long) with their stylet supports, and spherical pharyngeal bulb (18  $\times$  16  $\mu\text{m}$ ). Buccal papilla or peribuccal kidney-shaped sensory areas not detected.

Bearing 6 pairs of lateral body expansions of various sizes, smaller ones alternating with larger ones; first two pairs on leg I, anterior one not conspicuously protruding with small projection anteriorly; third and fourth pairs on leg II, posterior pair wing-shaped with blunt ends; fifth and sixth pairs locating between leg III and leg IV, last one somewhat triangular and protruding most laterally. Caudal region concave mesially without conical protrusion.

Cirrus E situated at laterodistal corner of trunk, issuing from stout cirrophorus (7.4  $\mu\text{m}$  long); consisting of scapus-like structure (13.9  $\mu\text{m}$ ) and long slender flagellum (27.4  $\mu\text{m}$ ).

Legs, toes and claws with typical pattern of *Halechiniscus*: telescopic legs, wrinkled fingers with spiral folds; paired external claws simple (dorsal margin smooth without any spur or spinule),

while paired internal ones with a small dorsal spur. Legs I-III each furnished with a sensory spine, ending with hairy tip; lengths of sensory spines on legs I-III increasing posteriorly. Leg IV bearing a papillary process (7.8  $\mu\text{m}$  long) with blunt end, issuing from a stout, cylindrical cirrophorus-like protrusion (5.7  $\mu\text{m}$  long), constricted at base and distal part.

Female gonopore situated at the level of last body expansions; relatively large, 5.8  $\mu\text{m}$  in diameter, surrounded with 6 rosettes of small cuticular membrane. Distance between gonopore and three-pointed anus scar 7.8  $\mu\text{m}$ .

Allotypic male 134.6  $\mu\text{m}$  long, showing sexual dimorphism only by lack of rosette-shaped gonopore and by the short distance between gonopore and anus, 3.5  $\mu\text{m}$  long.

Occurred at the sublittoral coralline sands of Udo Islet off the east of Jeju I.

**Etymology.** The proposed specific name is taken from Jeju Island, the type locality.

**Remarks.** Genus *Halechiniscus* Richters comprises 8 species and 1 subspecies, of which the present new species shares the character combinations of the large cirrophori supporting cephalic cirri and the evident lateral body expansions with the congeners as follows: *H. tuleari*, *H. paratuleari*, *H. macrocephalus* and *H. chafarinensis*. However, this new species is clearly distinguished from them by the shapes and/or position of lateral body expansions, the contour of head portion not clearly divided into two lobes, and the shape of sensory papilla on leg IV.

## 2. *Halechiniscus remanei* Schulz, 1955 레마네가시곰벌레 (신칭) (Fig. 3)

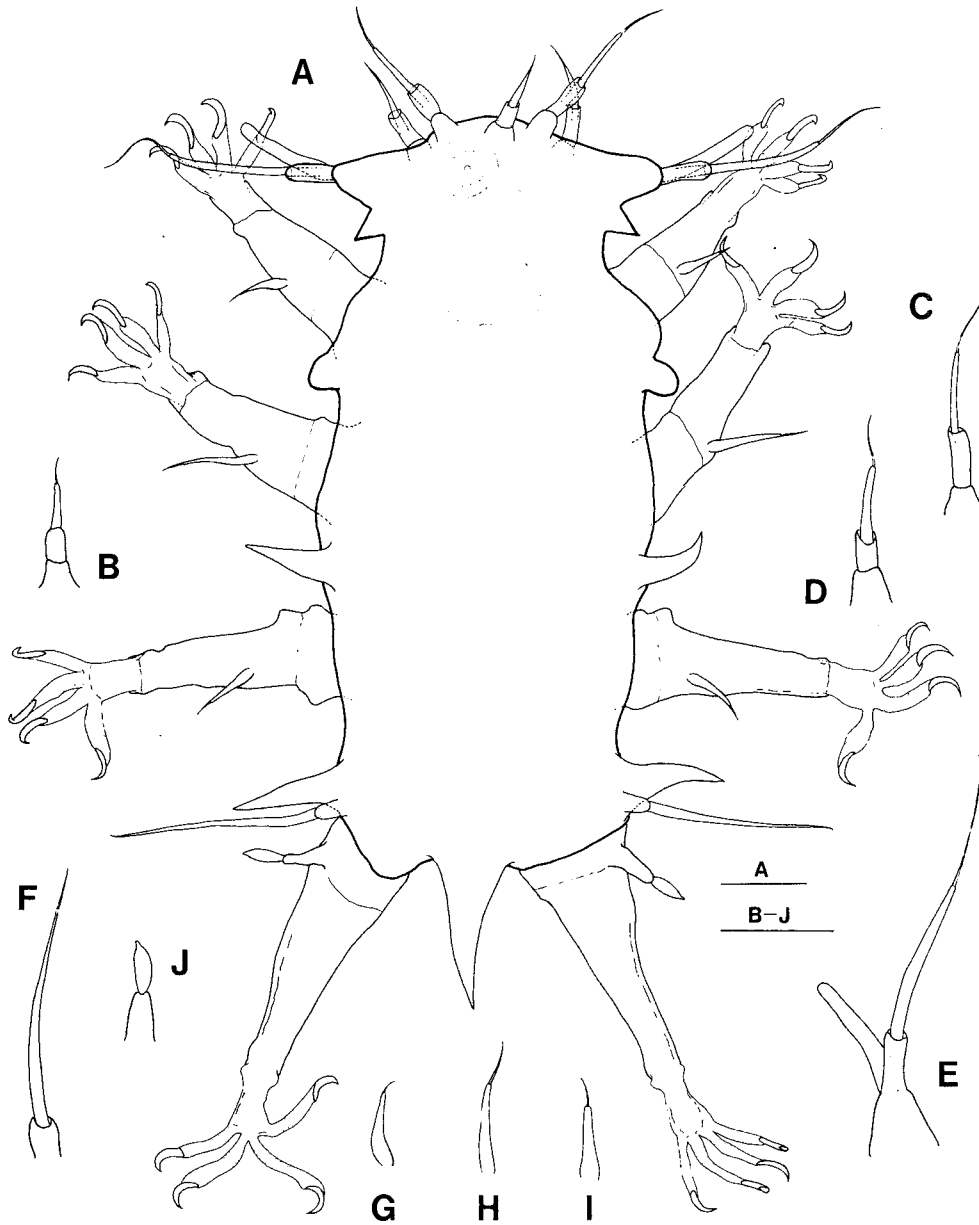
*Halechiniscus remanei* Schulz, 1955, p. 76, Taf. 21, Abb. 6-7; McGinty, 1969, p. 394, Fig. 1; Grimaldi de Zio *et al.*, 1979, p. 47, Fig. 5; Villora-Moreno and De Zio Grimaldi, 1996, p. 154.

*Halechiniscus remanei remanei*: Pollock, 1989, p. 183, Fig. 5; Renaud-Mornant, 1984, p. 986.

**Material examined.** 2 adult females and 2 juveniles from submerged sand bottom (2-3 m deep) of Udo Islet, Cheju I., 25 June 1997, H. S. Rho and J. W. Choi.

**Diagnosis.** Body minute, around 100  $\mu\text{m}$  long; head lobe undivided; bearing 4 pairs of lateral expansions; caudal protrusion triangular; bearing a sensory papilla on leg IV.

**Remarks.** As mentioned in Pollock (1989), only limited detailed descriptions with elaborate illustrations are available, although this species has been reported widely. Korean specimens are fitted well with the original description (Schulz, 1955) and other records reported thereafter, considering the characters as follows: (1) the arrangement of nine cephalic cirri, (2) the general appearance, location and size arrangement of four pairs of lateral body expansions, (3) a triangular caudal protrusion, the most diagnostic feature of this species, (4) the sensory spines on legs I-III, and sensory papilla on leg IV, (5) claws without spur. Especially, the detailed structure of cephalic cirri and leg IV papillae with constricted tip of our specimens are coincided with those of the Californian population (Pollock, 1989). Furthermore, the minute body size (about 102.6  $\mu\text{m}$  long including the caudal protrusion), the internal cirrus (16.8-18.7  $\mu\text{m}$  long) and lateral cirrus (24.1-25.8  $\mu\text{m}$  long) of our adult females are within the range of the morphometric distribution of *H. remanei* (see Pollock, 1989, Fig. 5). However, Korean specimens show some minor morphological discrepancies of the relatively round lateral expansion II, and the more projected lateral expansions III and IV and caudal protrusion in comparison with the figures available for this species (Schulz, 1955; McGinty, 1969; Grimaldi de Zio *et al.*, 1979).



**Fig. 3.** *Halechiniscus remanei* Schulz, 1955. A, habitus, dorsal view; B, median cirrus; C, internal cirrus; D, external cirrus; E, lateral cirrus and primary clava, dorsal view; F, cirrus E; G-J, sensory organs on legs I-IV. Scale bars = 10  $\mu$ m.

The present materials were collected (but not co-occurred) from the same locality of the sublittoral coralline sand bottom at Udo Islet off Jeju I. with *H. jejuensis*.

**Distribution.** Mediterranean (Italy), Eastern Atlantic (France), Australia, California, Japan, Korea.

A revised key to the species of the genus *Halechiniscus* Richters

1. There is a caudal protrusion of an obtuse spine ..... *H. remanei*  
    There is no caudal protrusion ..... 2
2. On leg IV exists a spine ..... 3  
    On leg IV exists a papilla ..... 4
3. Median cirrus present; claws without spurs ..... *H. perfectus*  
    Median cirrus absent; claws with spurs ..... *H. gutteli*
4. There are lateral conical expansions ..... 5  
    There are no lateral conical expansions ..... *H. greveni*
5. Head region divided into dorsal and ventral lobes ..... 6  
    Head region not divided into two lobes ..... *H. jejuensis* n. sp.
6. Claws without spurs ..... 7  
    Claws with spurs ..... 8
7. Head swollen; lateral expansion triangular ..... *H. macrocephalus*  
    Head not swollen; lateral expansion spinous ..... *H. paratuleari*
8. Cirrus E issuing from the last lateral expansion; external cephalic cirri situated dorsally .....  
    ..... *H. tuleari*  
    Cirrus E not issuing from the lateral expansion; external cephalic cirri situated ventrally .....  
    ..... *H. chafarinensis*

## ACKNOWLEDGEMENTS

We are grateful to Ms. Ji Min Lee for her support in making the picture plates, and to Mr. J. W. Choi for his help in collecting samples. This work was partly supported by grant No. KOSEF 2001-1-20100-003-2 from the Basic Research Program of the Korea Science and Engineering Foundation.

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RECEIVED: 20 March 2002

ACCEPTED: 8 April 2002

### 한국산 해양 완보류의 분류학적 연구

#### II. 바다가시곰벌레속 (이완보강, 마디곰벌레목, 바다가시곰벌레과)

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#### 요 약

바다가시곰벌레속 (*Halechiniscus*)에 속하는 해양완보류 2종 (*H. jejuensis*, *H. remanei*)을 보고한다. 신종인 제주가시곰벌레 (*H. jejuensis*)는 몸통 측돌기의 위치와 모양, 제4다리 기부에 난 유두형의 감각돌기의 모양, 그리고 머리의 전단부가 두 갈래로 갈라져 있지 않은 점에서 본 속의 다른 종들과 뚜렷이 구별된다. 지금까지 바다가시곰벌레속에 기록된 9종에 대한 종검색표를 새롭게 작성하였다.