

New species of *Hornera* (Bryozoa, Cyclostomata) from Jeju Island (Korea)

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The first occurrence of the genus *Hornera* (Bryozoa, Cyclostomata) is reported from waters around Jeju Island, Korean Peninsula. *Hornera jeongsangi* n. sp. differs from all known species of the genus *Hornera* in having very prominent spiny protrusions around the autozooidal apertures, which are not arranged in fascicles, the gonozooidal oeciopore facing frontally and nonporous zooidal walls around the oeciopore.

Keywords: Bryozoa, *Hornera*, Jeju Island, new species

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INTRODUCTION

There have been few descriptions of Cyclostomatous bryozoans (class Stenolaemata) on or near the Korean peninsula, and only three species have been reported to date (Seo, 2011). These species belong to three different suborders: *Tubulipora pulchra* (suborder Tubuliporina), *Crisia eburneodenticulata* (suborder Articulina) and *Disporella novaehollandiae* (suborder Rectangulata). This is the first report of a species from the suborder Cancellata.

The genus *Hornera* is characterized by dendroid, erect, non-jointed colonies with free walled autozooids and a free walled gonozooid. The main generic features are the presence of longitudinal folds and furrows and conspicuous large kenozooids on frontal side of branches where all zooid apertures open, and folds, furrows and kenozooids only on the abfrontal side of the colony (Hayward and Ryland, 1985). *Hornera* has also a unique skeletal organization and microstructure. The calcitic interior walls have a laminated structure, but lack the division into three layers (an inner, primary layer flanked on both sides by a secondary layer) ubiquitous in other cyclostomes. Moreover, the c-axes of the crystallites are oriented perpendicular to the wall structure in *Hornera*, and are therefore more similar to calcification of extinct trepostome bryozoans than of modern cyclostome bryozoans (Taylor and Jones, 1993).

Hornera is both a highly diversified and widely distributed fossil and recent genus. *Hornera* occurs in more than 547 geographical locations (based on 1134 entries on the GBIF portal – <https://demo.gbif.org/species/1004317> – 12 June 2017). The genus contains more than 84 species (<http://www.bryozoa.net/cyclostomata/horneridae/hornera.html> – 12 June 2017), of which at least 47 are extant (World register of marine species – <http://www.marinespecies.org> – 12 June 2017).

All the material collected and studied here belongs to one species of *Hornera*, *Hornera jeongsangi* n. sp., which is described below.

MATERIALS AND METHODS

Four specimens of *Hornera* were found in the collection of Marine Bryozoans Resources Bank of Korea (MBRBK), Woosuk University in Jincheon. These colonies were collected during SCUBA diving expeditions near Jeju Island from 2010 to 2013. The first colony was collected near Udo Island (Korean name: Udo-myeon, Jeju-si, Jeju-do) at a depth of 14-15 m, the second colony near Biyangdo Island (Korean name: Hyeopjae-ri, Hallim-eup, Jeju-si, Jeju-do), 20-25 m depth, the third near Munseom Island (Korean name: Seogwi-dong, Seogwipo-si, Jeju-do), 20-30 m depth, and the fourth near Marado Island (Korean name: Daejeong-eup, Seo-



Fig. 1. A map of Jeju-do (Jeju Island) with detailed position of collection sites of samples studied samples. 1. Udo Island. 2. Munseom Island. 3. Marado Island. 4. Biyangdo Island.

gwipo-si, Jeju-do), 20-30 m depth (Fig. 1). All specimens were growing on rock.

The specimens were ultrasonically cleaned prior to observation with a stereomicroscope. One colony was bleached for two hours before SEM study. The SEM images were made on a portable SEM (Sec SNE 3200M) at Woosuk University. Measurements were made using the software incorporated into the SEM Sec SNE 3200M. The holotype is deposited in the Marine Bryozoans Resources Bank of Korea (MBRBK), Woosuk University in Jincheon.

TAXONOMY

Phylum Bryozoa Ehrenberg, 1831
 Class Stenolaemata Borg, 1926
 Order Cyclostomata Busk, 1852
 Suborder Cancellata Gregory, 1896
 Family Horneridae Smitt, 1867
 Genus *Hornera* Lamouroux, 1821

Generic diagnosis: Colony erect, branching, thickened by continued budding of autozooids and secondary calcification. Apertures all opening on one, well-defined, frontal side. The surface of the frontal side is formed by

autozooidal tubes with circular, terminal apertures, and many kenozooids (sometimes called cancelli or vacuoles) between them. The abfrontal side is formed by kenozooids only. Gonozooid large, always situated on the abfrontal side of the colony, deeply immersed (according to Hayward and Ryland 1985, modified by Zágoršek, 2010).

Hornera jeongsangi n. sp. (Fig. 2)

Material examined.

Holotype (MBRBKSP037) Marado Island, collected at depth 20-30 m, 14 Nov. 2010 by J.E. Seo, B.S. Min and H.J. Yang.

Paratype (MBRBKSP038), Udo Island, collected at depth 14-15 m, 15 Mar. 2013 by B.S. Min and H.J. Yang.

Other materials: Marine Bryozoans Resources Bank of Korea (MBRBK) Collection—specimens from Biyangdo Island and Munseom Island, collected at depth 20-30 m, 25 Sep. 2011 by J.E. Seo, B.S. Min and H.J. Yang.

Diagnosis. Autozooids in three to five longitudinal rows, with five to seven kenozooids opening around aperture. Autozooidal apertures circular, not in fascicles, peristome with 5-9 prominent spiny protrusions. Gonozooid large, deeply immersed, longitudinally oval, with oval oeciopore facing frontally. Gonozooidal wall around

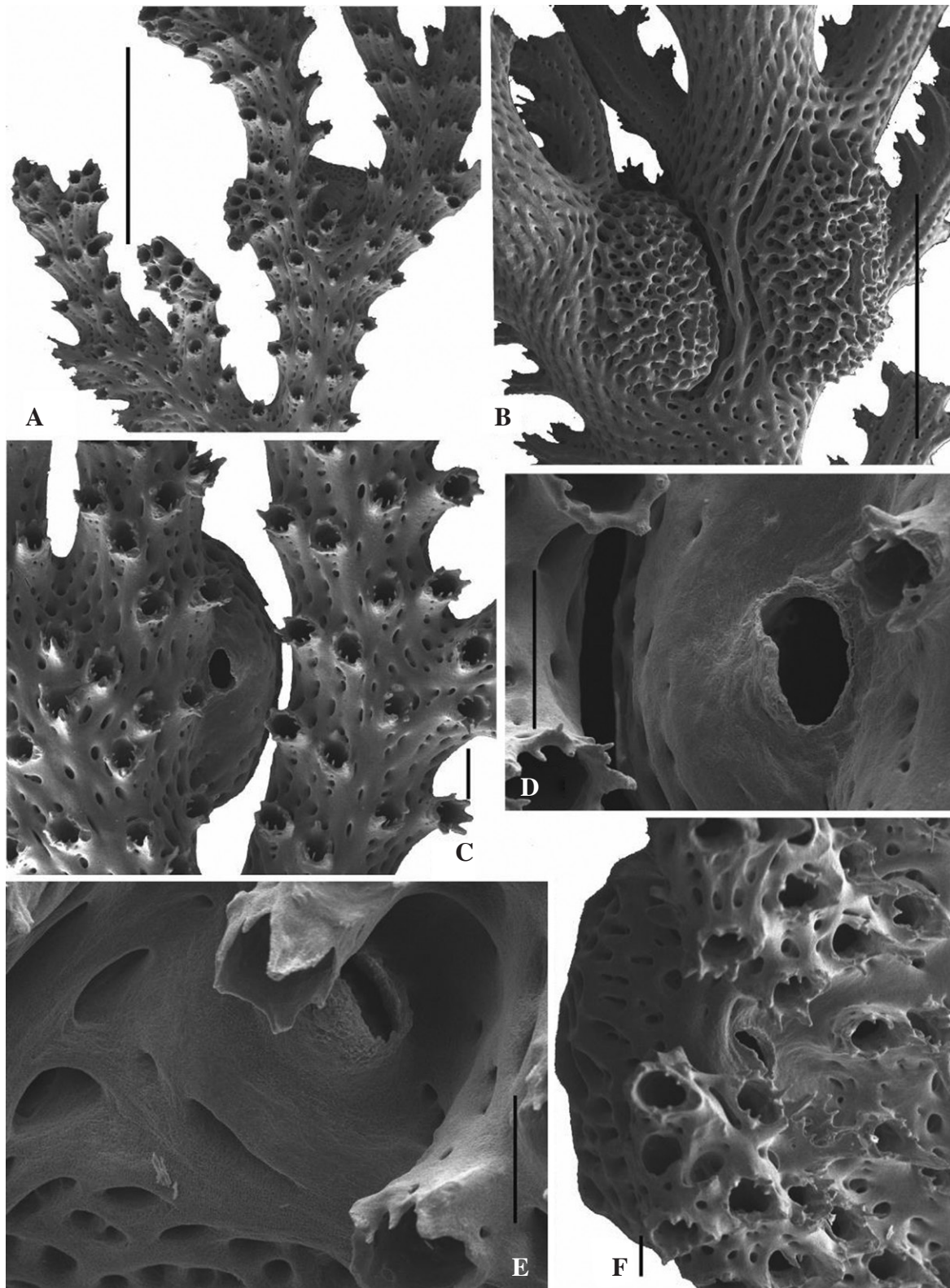


Fig. 2. *Hornear jeongsangi* n. sp. A. general view of frontal side of the colony showing the arrangement of the autozooidal tubes and position of the gonozooid. B. general view of dorsal side of the colony showing the arrangement of gonozooids and the frontal walls of gonozooids. C. detail of the gonozooid from frontal view showing the position of oeciopore. D. detail of oeciopore, showing the nonporous part around the opening. E. detail of oeciopore, showing the sizes of the pores around the oeciopore and on gonozooid frontal wall. F. lateral view showing the size of the gonozooid and position of oeciopore. Scale bars: A, B = 1 mm. C-F = 100 μ m.

oeciopore smooth, perforated only by minute pores.

Description.

Colonies erect, branching, up to 30 mm in height, with enlarged proximal portion attached to hard substratum (rock). Secondary calcification slightly developed on proximal part of colony. Branches cylindrical, up to 3 mm thick, numerous, situated close together and budded alternately from central branch (Fig. 2A). Branches divide dichotomously at interval of 1-2 mm, anastomoses not observed. Cross section of branches circular with one autozooidal tube in centre and six to eight around central one.

Apertures of autozooids face outwards away from axis of colony. Autozooid arranged in alternating longitudinal rows, with up to four series at growing tips, increasing slightly distally by lateral division of zooid rows to 5-6 maximally (Fig. 2C). Frontal surface with longitudinal folds and furrows and conspicuous large kenozooids. Five to seven circular to slightly oval small kenozooids situated alongside of each autozooidal tube, forming prominent longitudinal ridges among them (Fig. 2C).

Autozooidal tubes slightly curved laterally from branch axis and having long peristomes with apertures not arranged in rows (fascicles). Peristomes situated on margin of colony usually longer than those situated on central part of branch (Fig. 2C). Apertures bearing numerous, very prominent, spiny protrusions; unequal in size (Fig. 2E, F). Some protrusions about 63 μm long, some much shorter, only about 26 μm long. Number of protrusions per aperture five to nine. Some of protrusions radiate inwards towards orifice centre (Fig. 2F). Protrusions most developed on outer zooids, and a pair of especially long ones often produced by lateral margin of peristome. Autozooids apertures in centre of a branch often having largest spine developed at middle of proximal border of aperture. This suboral spiny protrusion sometimes as long as peristome.

Abfrontal surface of colony formed by longitudinal series of kenozooids and ridges among them (Fig. 2B). Sizes of abfrontal kenozooids vary, but always smaller than those on the frontal side.

Gonozooid globular, quite small, conspicuous, extending width of branch, but usually not exceeding width of branch (Fig. 2B). Gonozooidal calcification rugose, densely perforated by reticulate pores, no regularities (such as ridges or quincuncial arrangement of pores) observed (Fig. 2B). Oeciopore broadly flared, oval, and situated laterally on edge of chamber, facing frontally, very close to branch margin (Fig. 2C, F). Gonozooidal wall around oeciopore smooth, perforated only by minute pores (Fig. 2D, E).

Measurements. (in micrometers = μm ; () = average) width of branches before bifurcation, 406-480 (458); width of branches after bifurcation, 275-362 (317);

length of autozooid, 154-217 (187); width of autozooid, 82-105 (93); diameter of aperture, 55-87 (68); length of frontal kenozooid, 12-27 (20); width of frontal kenozooid, 10-17 (13); length of gonozooid, 1009-1228 (1085); width of gonozooid, 562-1010 (786); length of long spiny protrusions, 53-105 (74); length of short spiny protrusions, 10-17 (12); length of oeciopore, 122-136 (126); width of oeciopore, 52-61 (58).

Etymology. The specific name is in honor of Jeong Sang Seo, the founder of Woosuk University.

Remarks. Three other species of *Hornera* bearing characteristic spiny protrusions on apertures are *Hornera pectinata* Busk, 1861, *Hornera spinigera* Kirkpatrick, 1888 and *Hornera pinnata* Canu and Bassler, 1929.

Busk (1861) described *Hornera pectinata* from Madeira and listed characteristic features such as its small size and the "pectinate" border of the apertures (which according to Busk's illustrations are best understood as having spiny protrusions around the apertures). His illustrations show a colony with sparsely distributed branches, irregularly arranged apertures with short spiny protrusions, few kenozooids adjacent to autozooidal tubes on the frontal side of the branch, features which distinguish this species from *H. jeongsangi* n. sp. Moreover, Busk (1861) did not describe or illustrate any gonozoecia so comparison of this important feature is not possible.

Kirkpatrick (1888) described *Hornera spinigera* from Mauritius and distinguished it from *Hornera pectinata* Busk, 1861 in its having much smaller apertures which are, in contrast to those of *H. pectinata*, arranged in fascicles. According to his description, the apertures of *H. spinigera* are so regularly arranged, that it could be misinterpreted to be *Idmonea*. This arrangement of apertures was not observed in *H. jeongsangi* n. sp. According to Kirkpatrick's illustration (Kirkpatrick, 1888: pl. 10, fig. 1) colony branching is also much less dense than that of *H. jeongsangi* n. sp. and it has much smaller apertures (because Kirkpatrick, 1888 did not provide the exact measurements of the apertures, we estimated the diameters of apertures relative to the width of the branch). Moreover, the number of kenozooids on the frontal side of the branch seems very sparse, in contrast to the density of kenozooids in *H. jeongsangi* n. sp. Kirkpatrick (1888) did not describe or illustrate any gonozooid, so again comparison of this important feature is not possible.

Canu and Bassler (1929) described a new species (*H. pinnata*) from the Philippines and separated it from *Hornera spinigera* Kirkpatrick 1888 on the basis of having peristomes equal in length (rather than the lateral peristomes being longer as in *H. spinigera*), the absence of long peristomial spines, the regular arrangement of the alternate series and the presence of shorter "pinnules"

(the spiny protrusions). This species thus differs from *H. jeongsangi* n. sp. in having less prominent spiny protrusions. It also has a large gonozooid with a median ridge and circular oeciopore. Moreover, the lateral peristomes in *H. jeongsangi* n. sp. are long, whereas those of *H. pinnata* are short.

Harmer (1915) described *Hornera spinigera* Kirkpatrick, 1888 from Siboga Expedition (Indonesia) material. This species has usually only two, rarely three, longitudinal series of apertures, arranged in fascicles as described by Kirkpatrick (1888). The colony has branches developed more sparsely and the presence of kenozooids is not as dense as in *H. jeongsangi* n. sp. Harmer (1915) illustrated and described gonozooids very similar to those of *H. jeongsangi* n. sp. mainly because of the arrangement of the oeciopore, which opens toward the frontal side of the colony. However, he also described sharp spines developed on the frontal surfaces of the autozooid, principally on the ridges and also on the abfrontal surfaces of the branches, where the spines may be numerous, but are shorter and conical. Such spines have not been found in *H. jeongsangi* n. sp. Despite these differences, the specimens described by Harmer (1915) seem the most similar and even may represent same species. While revision of hornerids are beyond the scope of this paper, we decline to synonymize these specimens.

Another similar species is *Pseudoidmonea spinigera* (Kirkpatrick, 1888) described by Brood (1976) as having a similar position of the gonozooid and similar arrangement of the spiny protrusions around the aperture. It differs mainly in having less prominent spiny protrusions and smaller gonozooids that open on back side of the colony branch.

Characteristic features of the new species are the very prominent spiny protrusions around autozooidal apertures, which are not in fascicles, globular gonozooid with a chaotically, densely perforated wall with an oeciopore observable from the frontal side of the colony. The gonozooidal wall around the oeciopore is smooth, only perforated by minute pores, which may indicate the mixed free walled and fixed walled gonozooid. These features, together with the densely perforated abfrontal side and presence of spines only around aperture separate the described specimens from all known hornerids taxa.

Brood (1979) later established a new genus, *Spiniornera*, with type species *Hornera spinigera* Kirkpatrick, 1888, to accommodate the hornerids with spiny protrusions around apertures. However, as his description of this new genus omitted any discussion of gonozooids and synonymised *Hornera pinnata* Canu and Bassler, 1929

with *H. spinigera* Kirkpatrick, 1888 without any thorough explanation, the status of this genus is uncertain. Therefore, we placed the new species in the *Hornera*, pending a detailed revision of the Horneridae, which is outside the scope of this paper.

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