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A new record of *Acanthogorgia* species (Octocorallia: Alcyonacea: Holaxonia: Acanthogorgiidae) from Korea

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In 2017, during a survey of the anthozoan fauna in the Hallyeohaesang National Park in the South Sea, several *Acanthogorgia* specimens were collected from the subtidal zone. Through taxonomic analysis, one species, *Acanthogorgia densiflora* Kükenthal & Gorzawsky, 1908, was found to be previously unreported from Korea, and was, therefore, newly added to the list of Korean anthozoan fauna. This species is distributed on the slopes of the rocky substratum between depths of 14 and 24 m. Including the findings from this study, ten species of the genus *Acanthogorgia* have thus been reported from the Korean waters until now.

Keywords: *Acanthogorgia*, Acanthogorgiidae, Alcyonacea, Holaxonia, Octocorallia

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Introduction

The genus *Acanthogorgia*, comprising of Acanthogorgiidae having a spiny crown composed of protruding spindles around the polyp head, was established by Gray (1857) with the type species *Acanthogorgia hirsuta* Gray, 1857. In 1908, Kükenthal distinguished the genus *Acalycigorgia*, comprising of Acanthogorgiidae without a spiny crown, from *Acanthogorgia* (Kükenthal and Gorzawsky, 1908a; 1908b). However, in 1999, Grasshoff treated *Acalycigorgia* as a junior synonym of *Acanthogorgia*, and therefore, *Acanthogorgia* includes species belonging to the genus *Acalycigorgia*. And also, the phylogenetic relationship between *Acanthogorgia* and *Acalycigorgia* based on mitochondrial datasets of ND2 and msh1 was paraphyletic (Kong, 2011). Till date, the genus *Acanthogorgia* includes 64 valid species (WoRMS Editorial Board, 2018), and among them nine species have been reported from the Korean waters until now (Rho and Song, 1976). These species inhabit at depths of 10-30 m off the southern coastal regions of Korea, including the South Sea and the Jeju-do waters. In the present taxonomic study conducted on *Acanthogorgia* in the Hallyeohaesang National Park in the South Sea, one previously unrecorded species, *Acanthogorgia densiflora* Kükenthal & Gorzawsky, 1908, has been newly added to the octocorallian fauna of Korea.

Materials and Methods

Specimens examined in this study were collected with a dive knife from the southern coastal regions of Korea, between depths of 14 and 24 m, by SCUBA diving in 2017. After collection, all living specimen were transferred into seawater in plastic containers, and then anesthetized with menthol powder for 6 h. Anesthetized specimens were fixed and preserved in 99% alcohol (v/v).

For identification, the morphological characteristics, such as the colonial branching form, the size of each part of the colony, polyps, and sclerites, and the types of sclerites in the polyps and coenenchyme of each specimen was examined under either a stereomicroscope (SteREO Discovery. V8; Carl Zeiss, Jena, Germany) or a light microscope (CX23; Olympus Corporation, Tokyo, Japan), as suitable. To examine the sclerites, small sections of tissues from the tentacles, polyp wall, and coenenchyme were dissolved in a 50% (v/v) diluted solution of kitchen chlorine bleach for a few minutes, until the sclerites were exposed. After complete dissolution of the tissues, the kitchen chlorine bleach solution was removed using filter papers, and then the sclerites were washed with distilled water twice under the stereomicroscope. For obtaining Scanning Electron Microscope (SEM) images, the washed sclerites were placed

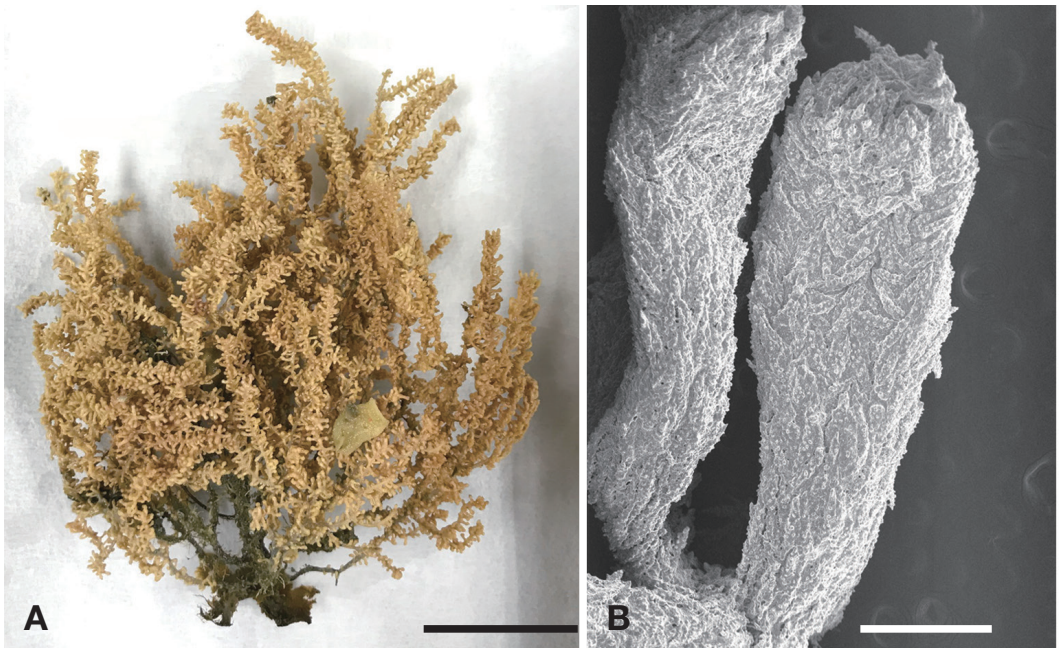


Fig. 1. Colony and polyps of *Acanthogorgia densiflora*. A, colony in alcohol; B, SEM image of polyps. Scale bars: A = 5 cm, B = 0.5 mm.

on the double-sided carbon conductive tabs using a single-hair brush. The SEM images were taken with Mini-SEM (SNE 3200M; SEC Co. Ltd., Suwon, Korea) at the Marine Bryozoans Resources Bank of Korea (MBRBK), Woosuk University, Jincheon.

Definition and terminology of the colony growth forms and sclerites was based on "Illustrated trilingual glossary of morphological and anatomical terms applied to Octocorallia" (Bayer *et al*., 1983).

Systematic Accounts

Phylum Cnidaria Verrill, 1865
Class Anthozoa Ehrenberg, 1834
Subclass Octocorallia Haeckel, 1866
Order Alcyonacea Lamouroux, 1812
Suborder Holaxonia Studer, 1887
Family Acanthogorgiidae Gray, 1859
Genus *Acanthogorgia* Gray, 1857

Diagnosis. Colony flabellate or bush-like with slender branches. Coenenchyme layer of branches very thin. Polyps monomorphic, non-retractile, cylindrical, and taller than wide. Warty spindles arranged in eight chevron rows along polyp walls. Spindles straight, bent, and sometimes bifurcated. In many species, spiny crown formed by prominent spindles around polyp head. Tentacles covered with small, flat sclerites. Coenenchyme sclerites warty spindles and radiates.

***Acanthogorgia densiflora* Kükenthal & Gorzawsky, 1908 빽빽가시산호 (신칭) (Fig. 1-3)**

Acalycigorgia densiflora Kükenthal & Gorzawsky, 1908a: 630; 1908b; 44-46, text-figs. 42. Utinomi, 1965 (listed only): 249. Iwase, 1992: 108, text-figs, 4-70B, pl. 23, fig. 5. Imahara, 1996; 29 (listed only). Iwase & Matsumoto, 2006: 82 (listed only). Matsumoto *et al*., 2007: 239 (listed only).

Acanthogorgia densiflora: Imahara *et al*., 2014: 224, text-figs. 139-140.

Materials examined. Korea: 1 colony, Gyeongsangnam-do, Geoje-si, Nambu-myeon, Angyeongseom Bukye-odo (34° 41.0077″ N, 128°46.5569″ E), 25 July 2017, Hwang SJ, Jung KJ, 14-24 m depth by SCUBA diving; 1 colony, Gyeongsangnam-do, Tongyeong-si, Hansan-myeon, Maejuk-ri, Eoyudo (34° 39.3458″ N, 128° 34.3335″ E), 27 July 2017, Hwang SJ, Jung KJ, 16-17 m depth by SCUBA diving.

Description. Colony bush like with short stem, not branched in complete one plane, formed by up to four levels of branching (Fig. 1A). Usually first and second branches make acute angles with main and first branches, respectively. Branches not anastomosing, but sometimes terminal branches anastomosed. Colony 16-16.5 cm in height, 15-16 cm in width. Polyps cylindrical, non-retractile, densely covering entire surfaces of branches, slightly arranged in whorl pattern with 24 polyps in branches of 0.5 cm length and three-four polyps on tip of branches. Polyp about 2.22-3.45 mm in length,

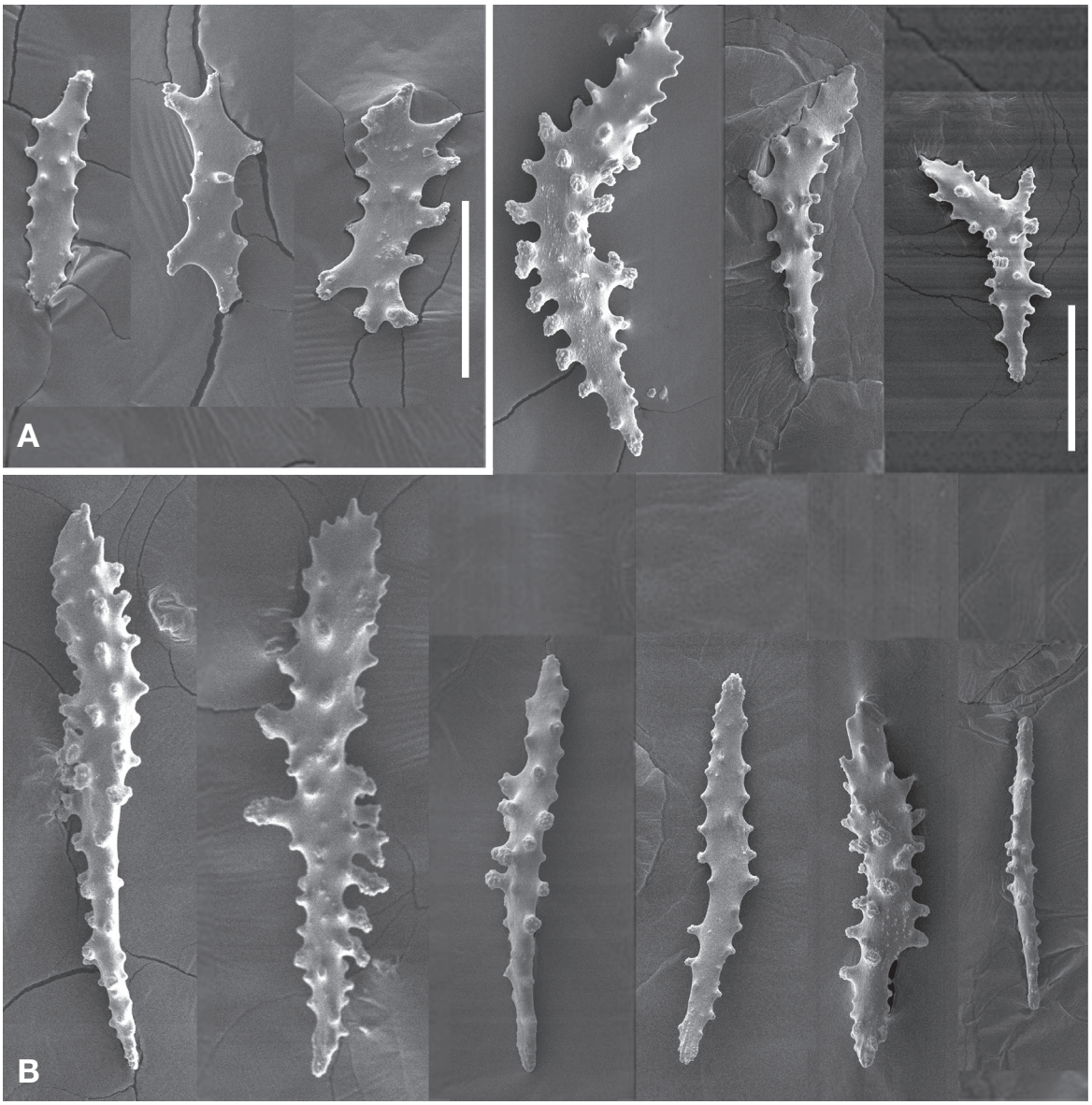


Fig. 2. Sclerites of *Acanthogorgia densiflora*. A, plates in tentacles; B, spindles in polyp wall. Scale bars = 0.1 mm.

with widths of 0.52-0.82 mm at top, 0.44-0.66 mm at middle, and 0.42-0.98 mm at base. Coenenchyme layer of branches very thin, revealing black axis. Spiny crown around polyp head absent (Fig. 1B). Spindles compactly arranged in eight chevron rows along polyp walls, sometimes intersecting. Spindles straight, bent, and sometimes bifurcated. Spindles moderately or strongly warty; sometimes one side of spindles without warts and flattened, varying in size (Fig. 2B). Straight spindles 0.16-0.35 mm, bent spindles 0.23-0.40 mm, sometimes up to 0.60 mm, and bifurcated spindles 0.21-0.27 mm in length. Tentacular sclerites small plates or scales, 0.10-0.14 mm in length and 0.04-0.06 mm in width (Fig. 2A). Coenenchyme sclerites warty spindles and radiates (Fig. 3A, B). Spindles predominant, mainly straight, sometimes bent or bifurcated, and 0.14-0.30 mm in length. Radiates smaller than spindles, 0.05-0.15 mm in length and 0.04-0.15 mm in width.

When alive, polyps and coenenchyme purple, axis of branches and main stem black. Upon preservation in alcohol, polyps and coenenchyme rendered colorless.

Habitat. This species inhabits the rocky slopes at depths between 14 and 24 m, and have bryozoans attached to their branches.

Remarks. This species was characterized by the absence of a spiny crown, and bush-like branching without

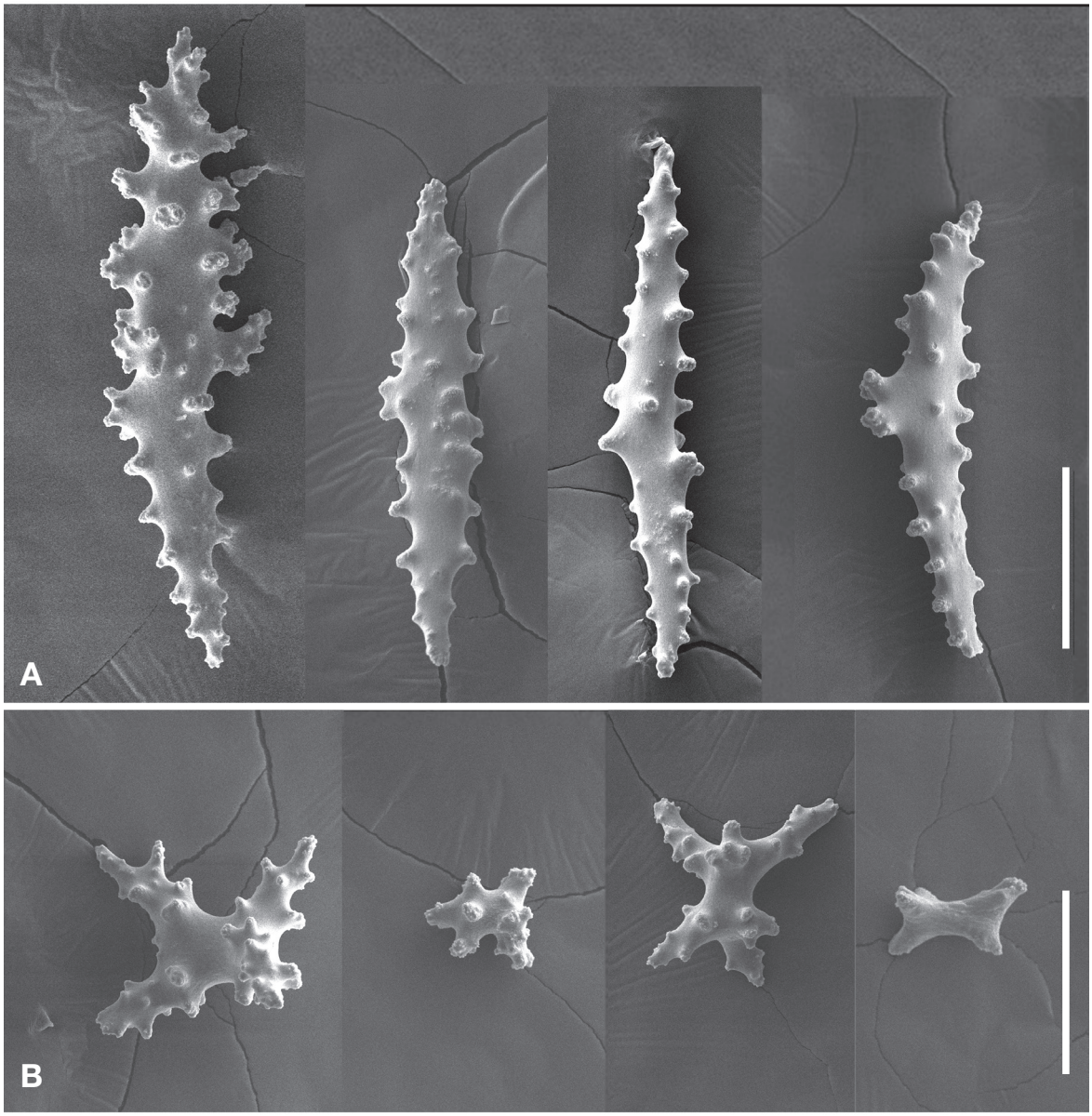


Fig. 3. Sclerites of *Acanthogorgia densiflora*. A, spindles in coenenchyme; B, radiates in coenenchyme. Scale bars = 0.1 mm.

anastomosis, similar to that of *Acanthogorgia irregularis*. However, this species was distinguished from the other species by the size of its polyp. The polyps are less than 2 mm long in *A. irregularis*, but about 3 mm long in *A. densiflora*. And also, spindles of polyp wall are up to 0.60 mm in *A. densiflora*, but less than 0.40 mm long in *A. irregularis*. The descriptions of our studied specimens are in considerable agreement with the original description by Kükenthal and Gorzawsky (1908b), but is slightly different from the description previously recorded by Iwase (1992), in being purple instead of yellow when alive. Also, our specimens had less sclerites in the tentacles than the specimens recorded by Imahara (2014).

Distribution. Pacific Ocean: Korea (South Sea: Hallyeohaesang National Park), Japan (Sagami Bay, Kii Peninsula).

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