

A Newly Recorded Basket Star of Genus *Gorgonocephalus* (Ophiuroidea: Euryalida: Gorgonocephalidae) from Korea

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Abstract - Some euryalid specimens were collected with fishing nets from Mipo, Gyung-sangnam-do and Aewol, Jeju-do Island, Korea. They were identified as *Gorgonocephalus eucnemis* (Müller & Troschel, 1842), belonging to family Gorgonocephalidae of order Euryalida, which was new to the Korean fauna. Their molecular analyses were done with newly intended COI primers of mitochondrial cytochrome oxidase I (COI) gene for the accurate molecular identification. The Korean *G. eucnemis* was coincident with this NCBI species as a result of Blast analysis, which showed the 99% similarity. In the current study, three *Gorgonocephalus* species have been reported from Korea.

Key words: *Gorgonocephalus eucnemis*, basket star, morphology, molecular analysis, Korea

INTRODUCTION

Family Gorgonocephalidae including 34 genera is the largest one of three families belonging to order Euryalida (Okanishi and Fujita 2013) and its four genera, *Astroboa*, *Astrocladus*, *Astrodendrum* and *Gorgonocephalus*, have been reported in Korean fauna (Shin 2013). Almost all *Gorgonocephalus* species distribute exclusively in deep water and are of worldwide distribution (Perseke *et al.* 2008). This genus has special features that are the presence of arm spines before first arm fork of arms, disc and arm covered with small stumps or tubercles, disc often naked interradially (Baker 1980) and the presence of a row of marginal plates on interbrachial outer margin (Matsumoto 1917). Only two, *G. dolichodactylus* Döderlein, 1911 and *G. tuberosus* Döderlein, 1902, of ten *Gorgonocephalus* species have been reported in Korea (Shin and Rho 1996; Shin 2013).

MATERIALS AND METHODS

Basket stars were collected at a depth of 100~150 m deep by fishing nets from Mipo, Korea Strait and Aewol, Jeju-do Island, Korea on June 1983 and January 2013, respectively. The specimens were preserved in 95% ethyl alcohol and identified on the basis of morphological characteristics and molecular analyses. The important morphological characteristics were photographed using digital camera (D7000, Nikon Co., Tokyo, Japan), stereo-microscopy (Nikon SMZ1000), and scanning electron microscopy (JSM-6510, JEOL Ltd., Tokyo, Japan). Molecular analyses were based on mitochondrial cytochrome oxidase I (COI) sequences using newly intended primers (F-TGRGTCYGGVACMRYDGGACHGC and R-GGRTCHCCKCCHCCHGWDGGRTC) for the accurate molecular identification and the comparison of other Korean *Gorgonocephalus* species. DNA was extracted from the gonads using DNeasy Tissue and Blood Kits (Qiagen, Hilden, Germany), and PCR analyses were conducted according to Lee and Shin (2011) with minor revision. All PCR products were purified with a QIAquick PCR purification Kit (Qiagen) and sequenced with an automated sequencer

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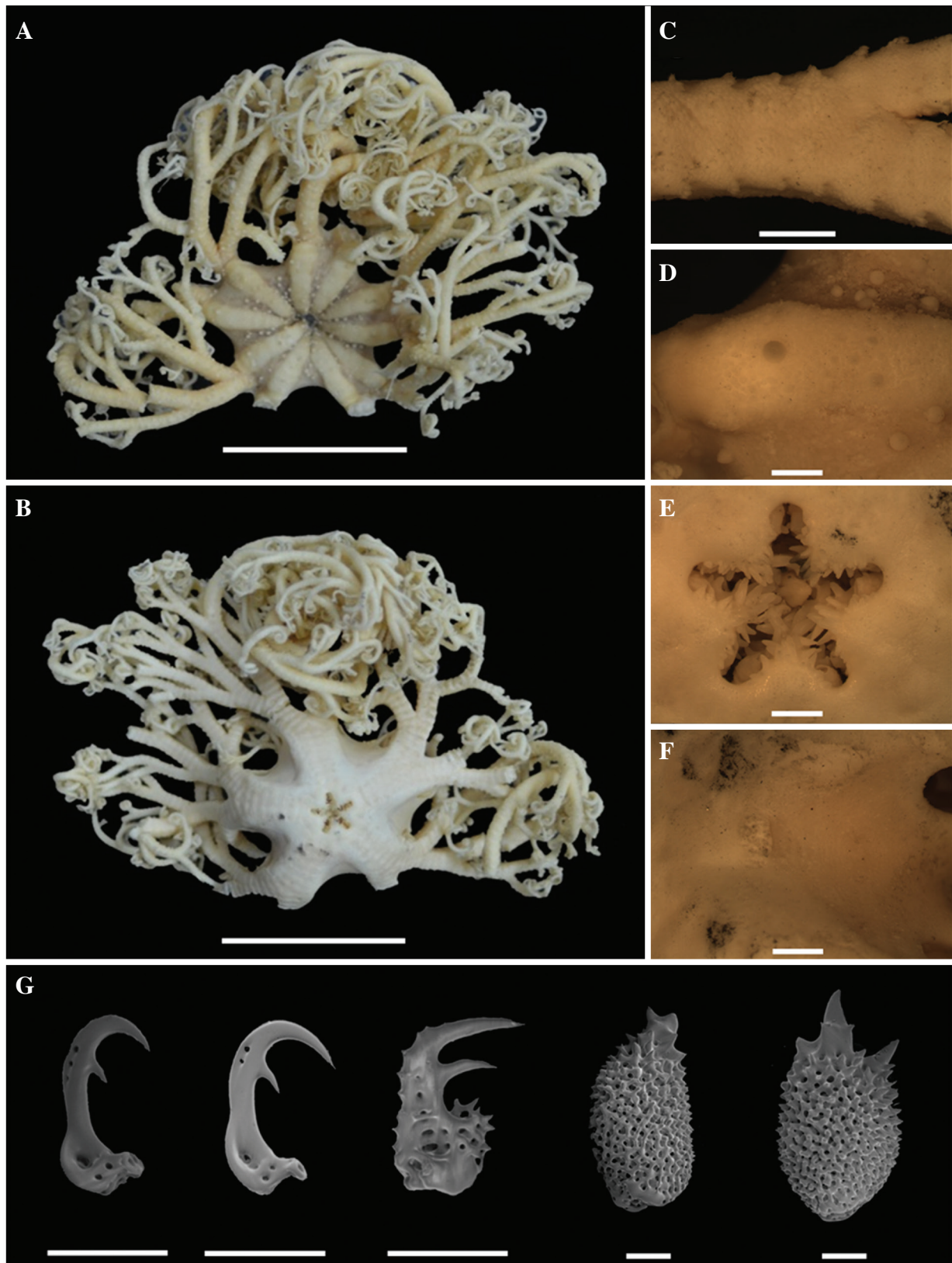


Fig. 1. *Gorgonocephalus eucnemis*. A. dorsal side; B. ventral side; C. ventral side of arm; D. a part of radial shield; E. oral part; F. madreporite; G. arm spines. Scale bars: A, B = 4 cm, C-F = 2 mm, G = 20 μ m.

ABI 3100 (Perkin Eimer, Foster City, CA, USA). The sequence data obtained were conducted by Blast (Basic Local Alignment Search Tool) analysis. They were identified as *Gorgonocephalus eucnemis* (Müller & Troschel, 1842), which was firstly reported in the Korean fauna.

SYSTEMATIC ACCOUNTS

Class Ophiuroidea Gray, 1840

Order Euryalida Lamarck, 1816

Family Gorgonocephalidae Ljungman, 1867

Genus *Gorgonocephalus* Leach, 1815

***Gorgonocephalus eucnemis* (Müller & Troschel, 1842)**

진삼천발이 (신칭) (Fig. 1A-G)

Astrophyton eucnemis Müller & Troschel, 1842: 123.

Astrophyton caryi: Lyman, 1865: 184.

Astrophyton stimpsoni Verrill, 1869: 388.

Gorgonocephalus stimpsoni: Lyman, 1882: 264.

Gorgonocephalus caryi: Lyman, 1882: 264; Clark, 1911: 287; Matsumoto, 1917: 71-73.

Gorgonocephalus japonicus Döderlein, 1902: 322; 1911: 31, Pl. I, figs. 1-3, Pl. VII, figs. 1-2c.

Gorgonocephalus eucnemis Döderlein, 1900: 226, pl. 10, figs. 1-4; May, 1924: 270; Mortensen, 1927: 163; Hendler, 1996: 113-179; Hansson, 2001: 336-351; Pérezrul *et al.*, 2014: 1-3; Stöhr, 2015: 124969.

Material examined: 1 specimen, Mipo, Gyungsangnam-do, 5 Jun. 1983, Shin; 1 specimen, Aewol, Jeju Island, 9 Jan. 2013, Shin and Kim, at 100~150 m deep by fishing net.

Description: Disk with thin plates, covered with many small granules. Especially radial shields and dorsal side of arms densely covered with diverse size of granules. Radial shields have almost same length and widely concave features tapering towards center of disk. One madreporite formed semicircular peak on inner corner of interbranchial area of ventral side of disk. Genital slits rather wide, beginning at distal portion of interbranchial area. Four or five arm spines between arm segments existed on ventral side of arm. Arm spines short, cylindrical, with many small pores, mostly becoming hooks with two pointed tips near end of arm. Oral parts consisted of sharp spine-form teeth.

Size: R = 4.0 cm, r = 2.0 cm, R/r = 2.0.

Color: Color in 95% ethanol was light brown.

Habitat: *Gorgonocephalus* individuals live gregariously in rocky habitats, clinging to corals and sponges, or to one another, forming a dense network with their dendritic arms (Mortensen 1927).

Distribution: Korea (Korea Strait, Jeju Island), Japan (Sagami Sea, Suruga gulf, Eastern Sea, East Sea), Sakhalin, Okhotsk Sea, East Siberian Sea, Laptev Sea, Chukchi Sea, Beaufort Sea, Bering Sea, Gulf of Saint Lawrence, California (Monterey Bay), Mexico (Guadalupe Island).

Deposition: These specimens were deposited in the Marine Echinoderm Resource Bank of Korea (MEBRK), Sahn-yook University, Seoul, Korea.

Remarks: Most species of genus *Gorgonocephalus* distribute from the Atlantic Ocean to the Arctic Ocean in deep water (Anisimova and Cochrane 2003). This species is a boreal species usually found in the Arctic and North Pacific Oceans (Pérezrul *et al.* 2014). In case of our specimens, they were collected at 100~150 m deep in Mipo of the Korea Strait and Aewol of Jeju island which are affected by warm current. The molecular analysis was done with newly intended COI primers of the mitochondrial COI gene for the accurate molecular identification. The sequence obtained was 569 bp in length (Genbank accession No. KR919684) and showed 99% similarity to this NCBI species as the result of Blast analysis. Therefore Korean *G. eucnemis* was coincident with this NCBI species and was an unrecorded species in Korea on the basis of morphological characteristics and the molecular analysis. As a result, three *Gorgonocephalus* species including *G. dolichodactylus*, *G. tuberosus* and this species are recorded in the Korean fauna.

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