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Two New Species of the Genus *Mycale* (*Naviculina*) (Poecilosclerida: Mycalidae) from Ulleungdo Island, Korea

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A study on marine sponges was conducted by SCUBA diving at Ulleungdo Island, Korea, from July 2001 to August 2003. Two species, *Mycale* (*Naviculina*) *ulleugensis* and *Mycale* (*N.*) *neunggulensis*, are new to science. *Mycale* (*N.*) *ulleugensis* n. sp. seems close to *M. chungae* based on the shape of spicules, but differs in the size of megascleres and sigmas, *Mycale* (*N.*) *neunggulensis* n. sp. seems close to *M. flagellifer* Vacelet and Vasseur in the type and size of spicules, but differs in the shape of naviculichela. Naviculichela I of *M. flagellifer* has a spine on the upper part of the felix.

The genus *Mycale* of the family Mycalidae is a very large group of poecilosclerid sponges as over 150 species have been recorded from around the world (Hadju, 1995; Sim and Lee, 2001). This genus is characterized by megascleres and palmate anisochelae; other microscleres include toxas, rhaphides, microxeas and palmate anisochelae (van Soest, 1984). The genus *Mycale* is subdivided into 11 subgenera: *Mycale*, *Aegogropila*, *Anomomyclae*, *Arenochalina*, *Carmia*, *Grapelia*, *Naviculina*, *Oxymycale*, *Paresperella*, *Rhaphidotheca* and *Zygomycale* (Hooper and van Soest, 2002). The subgenus *Naviculina* Gray (1867) has reticulated tangential ectosomal megasclere bundles and naviculichelae (Hooper and van Soest, 2002; Hajdu, 1999). The shape of naviculichelae is distinguished from anisochelae of the other subgenera of *Mycale*. Both frontal alae of naviculina are complete or near fusion, the falx is markedly expanded along the shaft, and the lateral alae of the head are projected backward and upward (Hooper and van Soest, 2002). Hajdu (1999) recognized five species worldwide; *M*. (*N*.) *cliftoni* Gray (1867), *M*. (*N*.) *obscura* Carter (1882), *M.* (*N*.) *diastrophochela* Lévi (1969), *M.* (*N*.) *cleistochela* Vacelet and Vasseur (1971) and *M*. (*N*.) *peculiaris* Pulitzer-Finali (1996). Lerner and Hajdu (2002) added two species, *M*. (*N*.) *arcuiris* and *M*. (*N*.) *purpurata.* Additionally, he transferred *M*. (*A*.) *hentscheli* Sim and Lee to *M*. (*N*.) *chungae.* Six species of *Mycale* were already reported from Korean waters (Kim et al., 1968; Rho et al., 1969; Rho and Yang, 1983; Sim and Bae, 1987; Sim and Lee, 2001). Only one species, *M*. (*N*.) *chungae* Lerner & Hajdu (2002), belongs to the subgenus *Naviculina*.

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All of the sponge materials observed in this study were collected from Ulleungdo Island, Korea from July 2001 to August 2003 by SCUBA diving. Specimens were fixed immediately in 70-90% mechanol or absolute alcohol. Specimens were studied by light microscopy (Zeiss Axioskop II) and by scanning electron microscopy (Hitachi S-3000N). For SEM of the spicules and skeletons, the procedure of Rützler (1978) was followed. Holotypes are deposited in the Natural History Museum, Hannam University (HUNHM), Daejeon, Korea.

Results

Phylum Porifera Grant, 1836
Class Demospongia Sollas, 1885
Order Poecilosclerida Topsent, 1928
Suborder Mycalina Hajdu et al., 1994
Family Mycalidae Lundbeck, 1905

Mycale (*Naviculina*) *ulleungensis* n. sp.
(Fig. 1A-H)

Type specimens: Holotype (Por. 45). Haengnam lighthouse, 31 July 2001, SCUBA, 30 m deep, K. J. Lee, deposited in the (HUNHM), Daejeon, Korea. Paratypes. Por. 44-1, collected with holotype. Por. 44-2, Gadubong, 19 June 2002, SCUBA, 25 m deep, K. J. Lee. Por. 44-3, Daepungryeong, 24 Oct. 2001, SCUBA, 25 m deep, K. J. Lee. Por. 44-4, Daepungryeong, 18 June 2002, SCUBA, 25 m deep, K. J. Lee. Por. 44-5, Ssangjungcho, 27 Aug. 2003, SCUBA, 30 m deep, K. J. Lee, deposited in the Department of Biological Sciences, Hannam University, Daejeon, Korea.

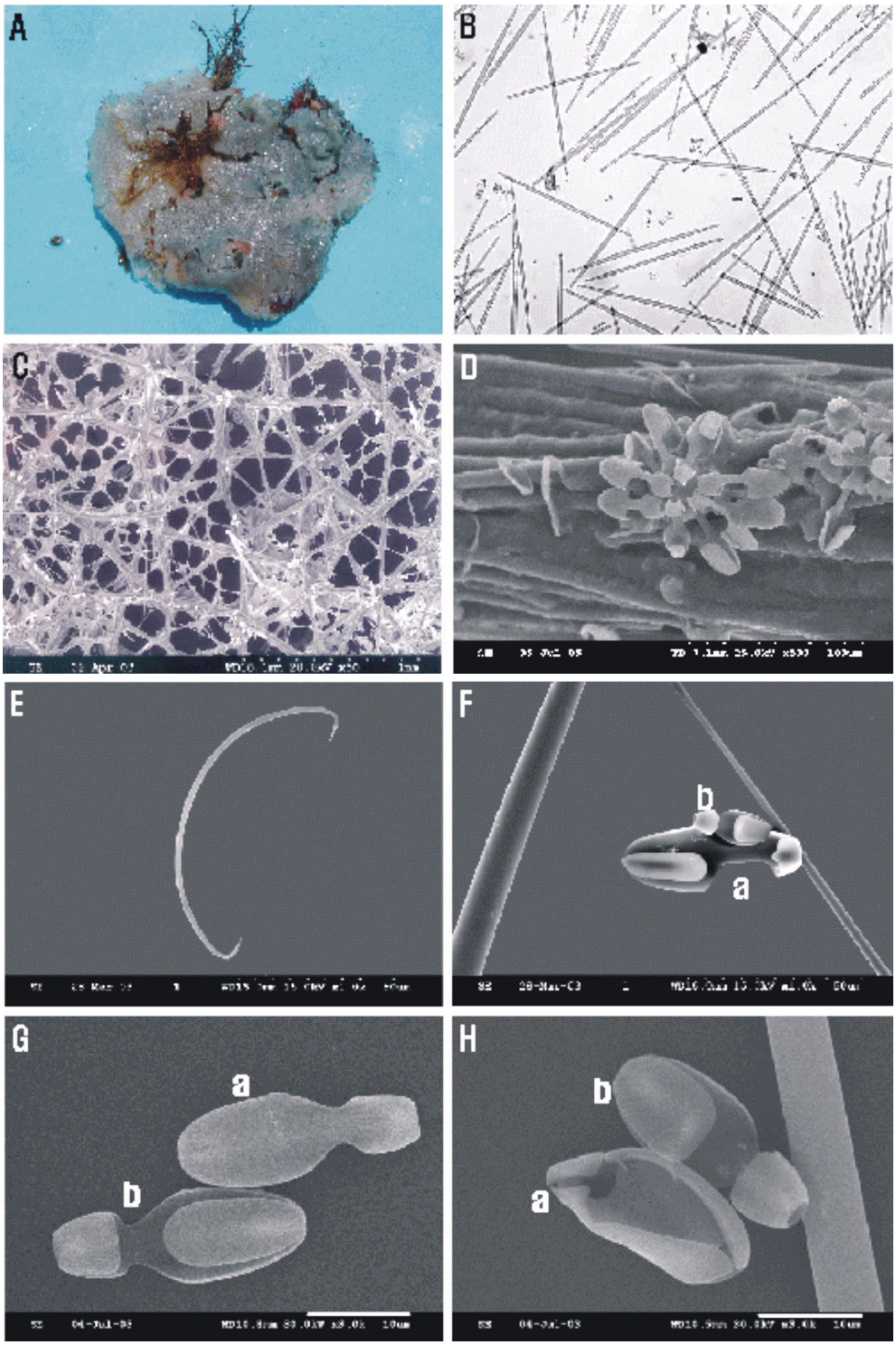

Fig. 1. *Mycale* (*Naviculina*) *ulleungensis* n. sp.. A, Entire specimen. B, Megascleres, subtylostyles. C, Ectosomal skeleton. D, Rosettes in the ectosome. E, Large sigma. F, a, large anisochela; b, small anisochela. G, a, rear view of small anisochelae; b, frontal view of small anisochelae. H, a, naviculichelae; b, small anisochela. Scale bars = 2 cm (A), 200 μm (B), 1 mm (C), 100 μm (D), 50 μm (E, F), and 10 μm (G, H).

Description

Holotype thickly encrusting on rocky substrate. Size up to 8×6 cm wide and 2 cm thick. Surface smooth and covered with thin membrane. Membrane easily separated from sponge. Oscules 3-5 mm in diameter, irregularly

Table 1. Spicule dimensions of *Mycale* (*Naviculina*) *ulleungensis* n. sp. and *M.* (*N.*) *chungae*

Species	Mycalostyles (length/thickness, μm)	Anisochelae (μm)	Naviculichelae (μm)	Sigma 1 (μm)	Sigma 2 (μm)
M ulleungensis	380-480/5-10	I, 50 II, 25-30	25-30	65-80	
M. chungae	I, 300-460/6-10 II, 250-350/1-3	I, 35-40 II, 20-25 III, 15-20	15-25		15-25

distributed on surface. Texture soft and fragile. Color in life blue purple-like sapphire on surface and pale yellow underneath. Preserved sponges changed to white.

Skeleton. Ectosomal skeleton, tangential reticulation of mycalostyles in bundles (2-8 spicules across). Choanosomal skeleton, thick tracks of megascleres (50-300 μm in diameter) loosely arranged. Spicule tracks generally poor in spongin, but very tightly attached to each other.

Spicules. Megascleres, mycalostyles, with sharp-pointed end and oval-swelled head. Microscleres dispersed in all of sponge mesohyl. Height of large anisochela 4 of 5 times of foot. Large anisochelae make rosettes of 10-15 large anisochelae. Rosettes appearing on surface of spicule bundles. Width of head alae of small anisochelae almost the same between front and back. Size of naviculichela similar to small anisochelae. Thin frontal alae of naviculichela reaching the foot. Sigmas very thin and elongated (Table 1).

Etymology

This species is named after its type locality, Ulleungdo Island, Korea.

Remarks

This new species seems close to *Mycale* (*Naviculina*) *chungae* based on the shape of spicules (Table 1). However, it is different in the size of megascleres and sigmas.

Mycale (*Naviculina*) *neunggulensis* n. sp.
(Fig. 2A-H)

Type specimens

Holotype (Por. 46). Neunggul, 2 Aug. 2001, SCUBA, 40 m deep, K. J. Lee, deposited in the HUNHM, Daejeon, Korea. Paratypes. Por. 45-1, collected with Holotype. Por. 45-2, Jukdo, 19 June 2002, SCUBA, 40 m deep, K. J. Lee. Por. 45-3, Ilsunam, 18 June 2002, SCUBA, 30 m, K. J. Lee, deposited in the Department of Biological Sciences, Hannam University, Daejeon, Korea.

Description

Holotype irregular massive and lobate. Size up to 9×5 cm wide and 6 cm thick. Surface covered with thin membrane and wrinkled. Oscules 5-6 mm in diameter, scattered on surface. Texture soft, overripe and fragile. Color pale yellow in life.

Skeleton. Ectosomal skeleton consisting of reticulate mycalostyles in bundles (3-5 spicules across) with net-form. Choanosomal skeleton with thick tracks of megascleres.

Spicules. Megascleres, mycalostyles, smooth, straight or slightly bent with oval heads, points taper down. Microscleres dispersed through sponge mesohyl. Width of head alae of anisochelae almost the same between front and back. About 20-25 anisochelae from rosettes. Rosettes appearing under dermal membrane. Naviculichela abundant in ectosome. Thin frontal alae of naviculichela reaching to foot. Large and small sigmas with sharp endings (Table 2).

Etymology

This species is named after its type locality, Neunggul, Ulleungdo Island, Korea.

Remarks

This new species seems close to *M.* (*N.*) *flagellifer* Vacelet & Vasseur (1971) (in Lerner and Hajdu, 2002) based on the type and size of spicules (Table 2). However,

Table 2. Spicule dimensions of *Mycale* (*Naviculina*) *neunggulensis* n. sp. and *M.* (*N.*) *flagellifer*

Species	Mycalostyles (length/thickness, μm)	Anisochelae (μm)	Naviculichelae (μm)	Sigma 1 (μm)	Sigma 2 (μm)
M neunggulensis	430-600/5-15	30-40	20-25	50-70	20-25
M. flagellifer	480-640/5-18	42-50	I, 20-30 II, 12-18	65-75	15-20

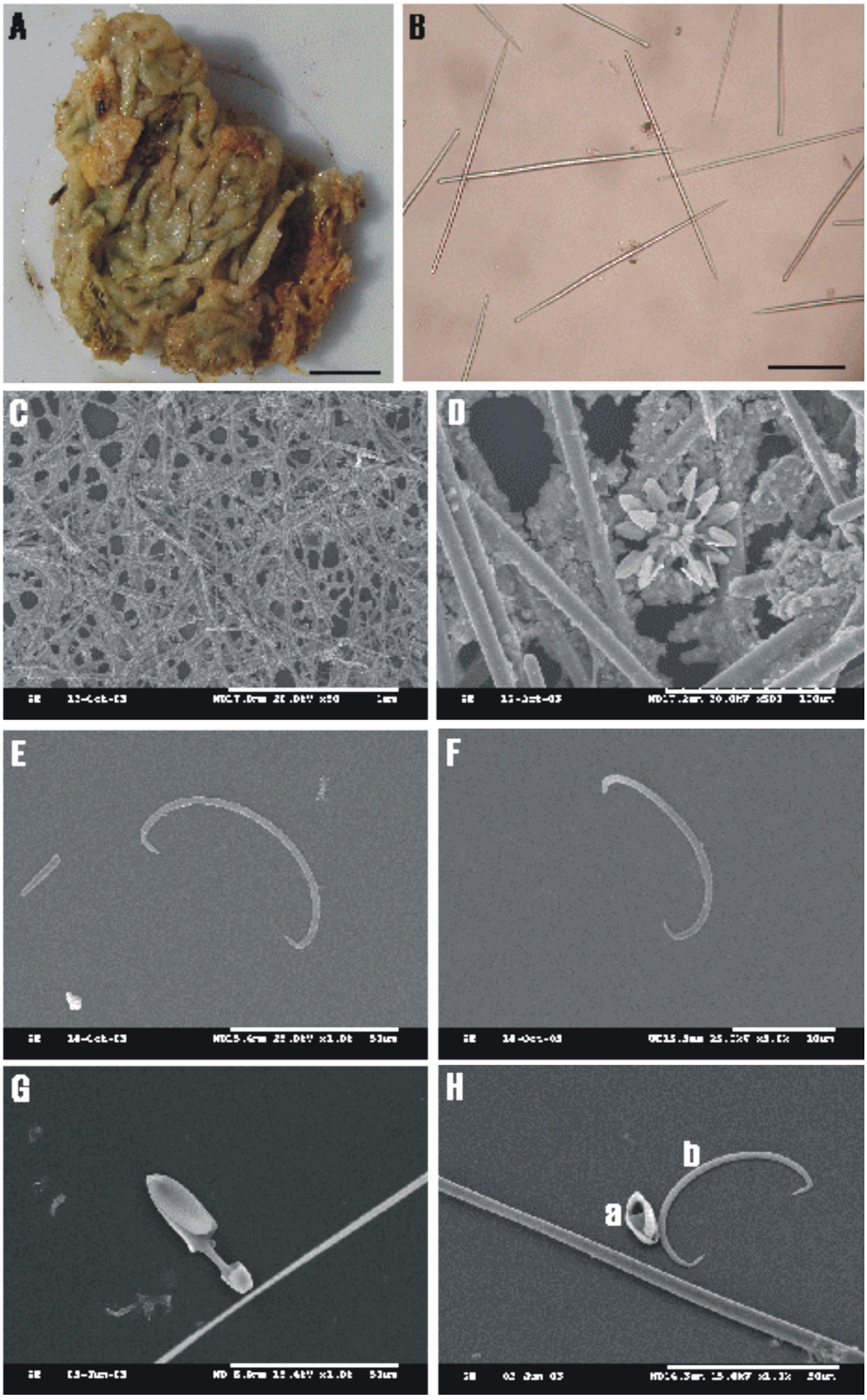

Fig. 2. *Mycale* (*Naviculina*) *neunggulensis* n. sp.. A, Entire specimen. B, Megascleres, subtylostyles. C, Ectosomal skeleton. D, Rosettes in the ectosome. E, Large sigma. F, Small sigma. G, Anisochela. H, a, naviculichela; b, large sigma. Scale bars = 2 cm (A), 200 μm (B), 1 mm (C), 100 μm (D), 50 μm (E, G, H), and 10 μm (F).

it is different in the shape of naviculichelae. Naviculichela I of *M*. (*N*.) *flagellifer* has a spine on upper part of the falx (Hooper and van Soest, 2002).

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