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Five new species of genus *Hyattella* (Dictyoceratida: Spongiidae) from Korea

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Five new species of the genus *Hyattella* (Dictyoceratida: Spongiidae) were collected from Jejudo and Gageodo, Korea: *Hy. gukheulensis* n. sp., *Hy. regularis* n. sp., *Hy. lenis* n. sp., *Hy. membrana* n. sp., and *Hy. asper* n. sp. *Hyattella gukheulensis* n. sp. is similar to *Hy. munseomensis* Sim *et al*., 2015 in shape, but differs in skeletal structure. *Hyattella regularis* n. sp. is close to *Hy. bakusi* Sim *et al*., 2015 but differs in regular secondary fibres at the surface membrane. *Hyattella lenis* n. sp. is unique by having numerous windings at the surface. *Hyattella membrana* n. sp. is similar to *Hy. bakusi* Sim *et al*., 2015 in shape, but differs in surface and skeletal fibres. *Hyattella asper* n. sp. is close to *Hy. lendenfeldi* Sim and Lee, 2014 in skeletal fibres, but differs in thin secondary fibres. This new species has numerous dense cored primary fibres.

Keywords: Dictyoceratida, *Hyattella*, Korea, new species, Spongiidae

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Introduction

The genus *Hyattella* in family Spongiidae was erected by Von Lendenfeld, 1888. This genus is characterized by a cavernous sponge body, and numerous cored primary fibres in the skeletal structure (Cook and Bergquist, 2001; Hooper and Van Soest, 2002). Several authors reported and described genus *Hyattella* (Willson, 1902; Dendy, 1905; De Laubenfels, 1936; 1948; 1954; Wiedenmayer, 1977; Van Soest, 1978; Bergquist, 1980; Hooper and Van Soest, 2002; Sim and Lee, 2014; Sim *et al*., 2015; Varsha *et al*., 2020). To date, 29 species of the genus *Hyattella* have been reported worldwide (Van Soest *et al*., 2014). Among them, there are nine species from Korean waters (Sim and Lee, 2014; Sim *et al*., 2015).

Materials and Methods

Specimens were collected from depth of 5–25 m at Jejudo and Gageodo by SCUBA diving, during the period 1999–2008. All specimens were fixed in 95% or absolute ethanol. Identification was made on the basis of external features of the sponges, including growth form and skeletal structure.

This procedure followed methods described in Sim and Lee, 2002. Sponges were examined under stereomicroscope (Stemi SV 6, Carl Zeiss) and light microscope (Axioscop II, Carl Zeiss). The voucher specimens examined in this study were deposited at the National Institute of Biological Resources (NIBR), Incheon, Korea.

Systematic Accounts

Phylum Porifera Grant, 1836
Class Demospongiae Sollas, 1885
Order Dictyoceratida Minchin, 1900
Family Spongiidae Gray, 1867
Genus *Hyattella* Lendenfeld, 1888

1. *Hyattella gukheulensis* n. sp. (Fig. 1)
국흘히아텔라해면

Type specimen. Holotype (NIBRIV0000895360), Korea: Gukheuldo, Gageodo Island, Heuksan-myeon, Shinan-gun, Jeollanam-do, 21 September 2008, collected by H. S. Kim, SCUBA diving, depth 20 m, deposited in NIBR.
LSID urn:lsid:zoobank.org:act: 85EBE34D-6A16-42B3-A207-D1AD566763EB

Description. Thickly encrusting sponge. Size up to 13 × 9 × 3.5 cm. Surface smooth with shallow cavities covered

with thick membrane. Oscules with large opening, 0.5−1 cm in diameter at sponge surface. Color in life, purple at surface and yellowish beige inside. Texture very firm and compressible.
Skeleton: Primary fibres, 30−50 μm in diameter, usually rare at surface and choanosome. Secondary fibres, 20−35−40 μm in diameter, arranged irregularly. Thin secondary fibres, 10 μm in diameter on surface membrane.
Etymology. The species name, *gukheulensis*, is named after type locality Gukheuldo, Gageodo, Jeollanam-do.
Remarks. This new species is similar to *Hyattella munseomensis* Sim *et al*., 2015 in shape, but differs in skeletal structure. Primary fibres are very rare throughout the sponge body and surface membrane has thin secondary fibres.

2. *Hyattella regularis* n. sp. (Fig. 2) 정형히아텔라해면

Type specimen. Holotype (NIBRIV0000895361), Korea: Gukheuldo, Gageodo Island, Heuksan-myeon, Shinan-gun, Jeollanam-do, 21 September 2008, collected by H. S. Kim, SCUBA diving, depth 20 m, deposited in NIBR.
LSID urn:lsid:zoobank.org:act:94DEE649-E4AB-4FFD-A8A2-0F9699D18EB7
Description. Thickly encrusting sponge. Size up to 13 × 11 × 5.5 cm. Surface rough with small round swelling covered with thick membrane. Oscules rare, 1 cm in diameter, open at tip of protruding structure. Color in life, yellowish purple. Texture firm and compressible.
Skeleton: Primary fibres, connected with long conules at surface, 40−70 μm in diameter, abundant throughout sponge body. Secondary fibres, regular mesh, 40−50 μm in diameter. Thin and thick regular polygonal network at surface membrane, 5−10 μm in diameter (Fig. 2H).
Etymology. The species name, *regularis*, is named after the regular shape of secondary fibres at the sponge surface membrane.
Remarks. This new species is similar to *Hy. bakusi* Sim *et al*., 2015 in shape, but differs in regular secondary fibres mesh at the surface.

3. *Hyattella lenis* n. sp. (Fig. 3) 매끈이히아텔라해면

Type specimen. Holotype (NIBRIV0000895362), Korea: Geomeunyeo, Gageodo Island, Heuksan-myeon, Shinan-gun, Jeollanam-do, 21 September 2008, collected by H. S. Kim, SCUBA diving, depth 20 m, deposited in NIBR.
LSID urn:lsid:zoobank.org:act:C40CCAD5-45F9-4A75-B471-38B1922F93B9
Description. Thickly encrusting sponge. Size up to 11 × 10 × 5.5 cm. Surface smooth with numerous deep furrows and short conules, covered with thick collagenous membrane. Oscules, 0.3−1 cm in diameter, open at sponge surface. Color in life, purplish ivory. Texture firm and compressible and lacunose.
Skeleton: Primary fibres rarely cored with detritus, 40−50 μm in diameter spread throughout the sponge body (Fig. 3E, G). Thick and thin secondary fibres, 15−30 μm in diameter arranged irregularly with large mesh at surface. Thick secondary fibres, 45−50 μm in diameter at choanosome.
Etymology. The species name, *lenis*, is named after the shape of the smooth surface.
Remarks. The shape of the surface in this new species is very unique with numerous deep furrows at the smooth surface. Primary fibres which are rarely cored with sands are abundant throughout the sponge body.

4. *Hyattella membrana* n. sp. (Fig. 4) 막히아텔라해면

Type specimen. Holotype (NIBRIV0000895368), Korea: Chujado, Chuja-myeon, Jeju-si, Jeju-do, 27 August 2002, collected by H. S. Kim, SCUBA diving, depth 13 m, deposited in NIBR.
LSID urn:lsid:zoobank.org:act:7BB77BA2-53A6-42E0-8983-EF1108CF1C41
Description. Thickly encrusting sponge. Size up to 14 × 9.5 × 2.3 cm. Surface smooth with shallow elevated tubes, covered with thick collagenous membrane and numerous sharp conules. Large and small oscules, 2−4 mm in diameter, open at tip of sallow tubes. Color in life, purple and ivory. Texture firm and compressible.
Skeleton: Primary fibres cored with sands, 50−75 μm in diameter at surface conules distributed throughout sponge body. Secondary fibres loose, thick and thin, 20−40 μm in diameter with no regular mesh.
Etymology. The species name, *membrana*, is named after a surface with heavy collagenous membrane.
Remarks. This new species is similar to *Hyattella bakusi* Sim *et al*., 2015 in shape, but differs by having a heavy collagenous membrane at the surface (Fig. 4C).

5. *Hyattella asper* n. sp. (Figs. 5, 6) 거친히아텔라해면

Type specimen. Holotype (NIBRIV0000895369), Korea: Dueokyeo, Gageodo Island, Heuksan-myeon, Shinan-gun, Jeollanam-do, 11 Jun 1999, collected by SCUBA diving, depth 27 m, deposited in NIBR.
LSID urn:lsid:zoobank.org:act:75D69D2D-168F-4965-BBF0-D50BB883E0B8
Description. Thickly encrusting, looks like bryozoan animal. Size up to 22 × 4 × 8 cm. Surface rough with sharp long conules. Color in life, ivory. Texture soft and compressible.
Skeleton: Numerous dense primary fibres, straight long lines cored with sands, 60−75 μm in diameter, occur throughout sponge body. Secondary fibres, 30−50 μm in diameter, arranged irregularly with loose mesh. Some part

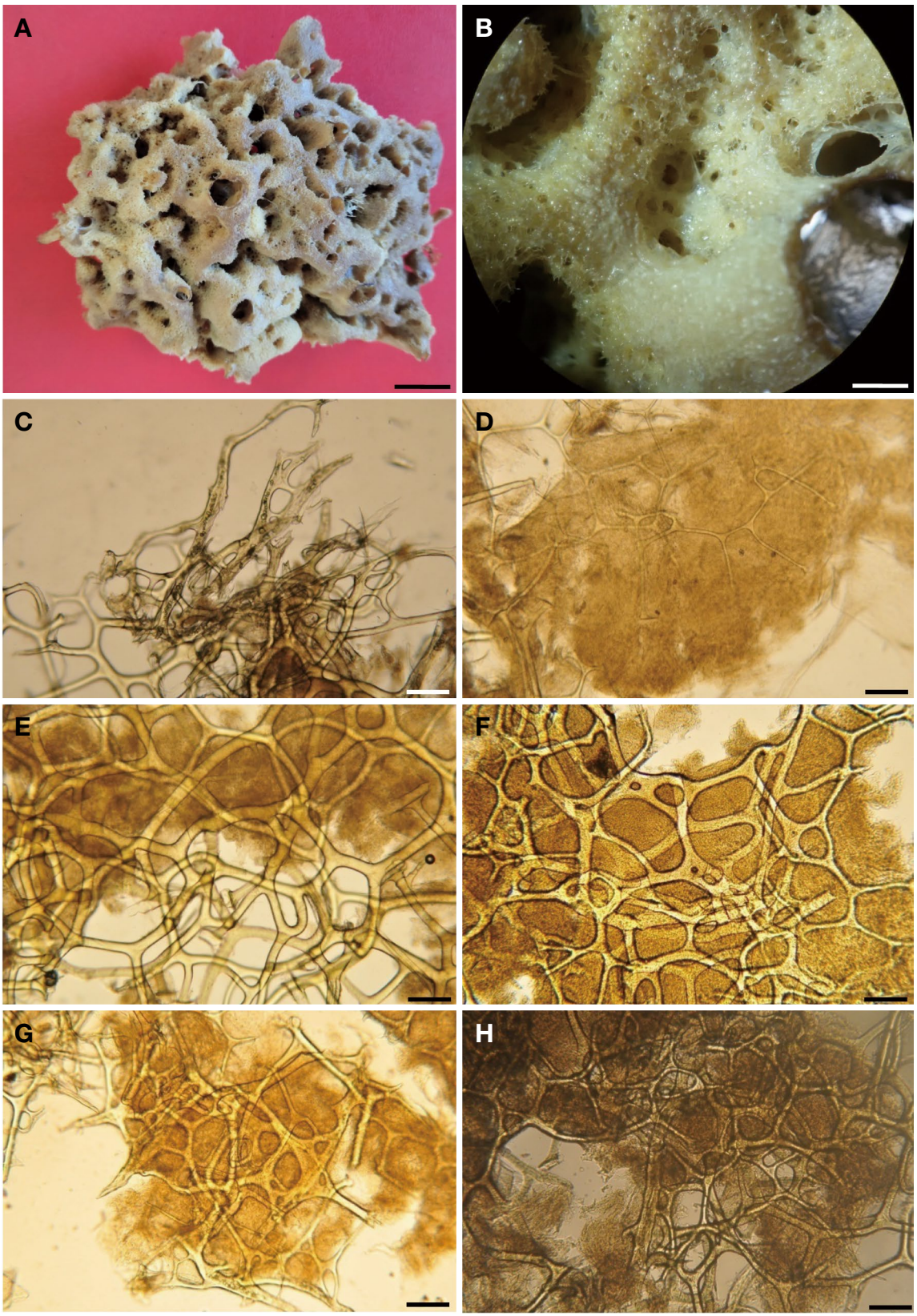

Fig. 1. *Hyattella gukheulensis* n. sp. A, external morphology; B, surface under the dissecting microscope; C, cored primary fibres near surface; D, thin secondary fibres with surface membrane; E, F, regular meshes of secondary fibres in choanosome; G, H, skeletal structure near surface. Scale bars: A = 1 cm, B = 1 mm, C–H = 100 μm.

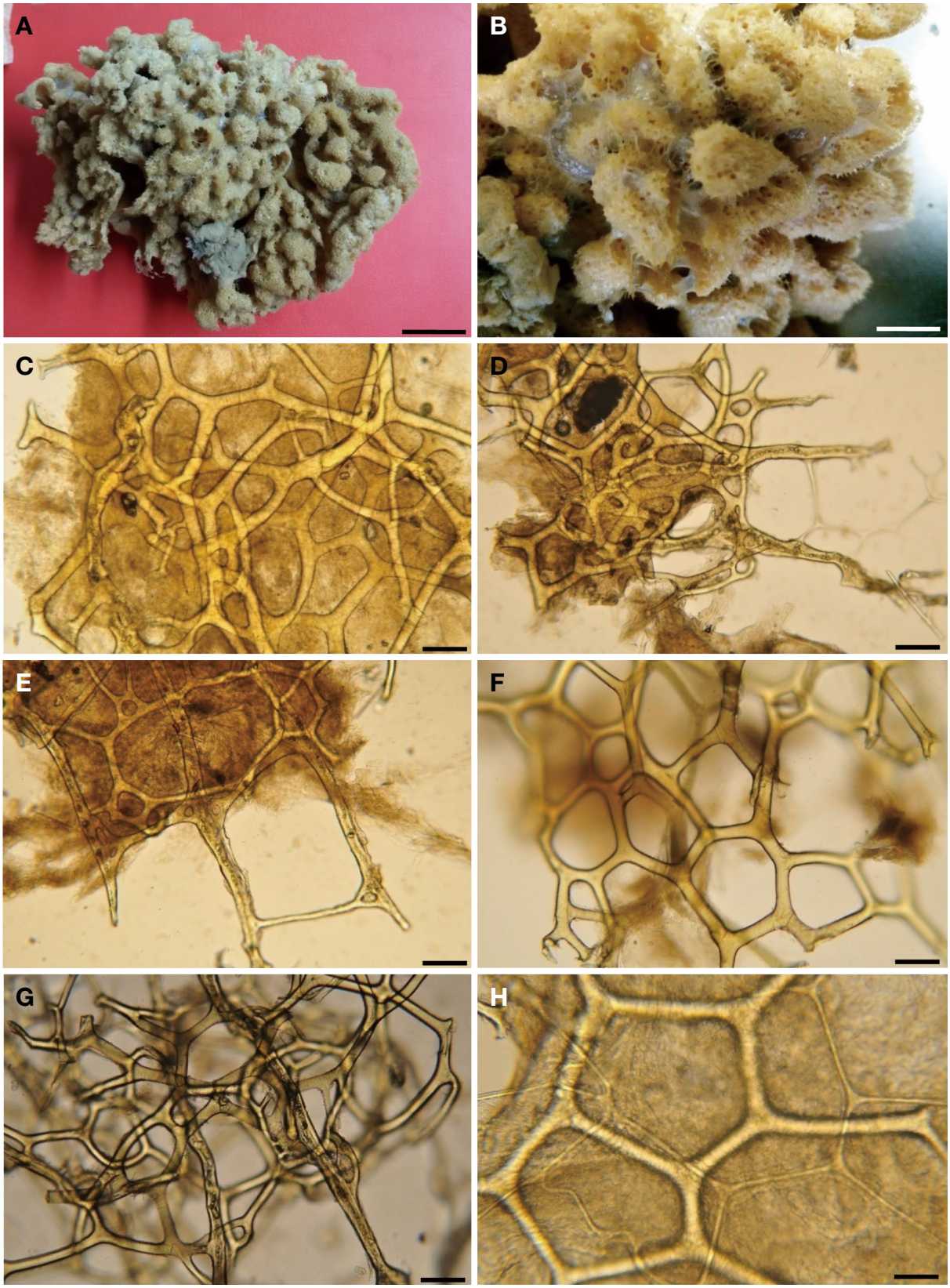

Fig. 2. *Hyattella regularis* n. sp. A, external morphology; B, surface close up; C, skeletal structure; D, E, primary fibres near conules; F, regular secondary fibres; G, primary fibres at choanosome; H, thin secondary fibres with surface membrane. Scale bars: A = 1 cm, B = 5 mm, C–G = 100 μm, H = 50 μm.

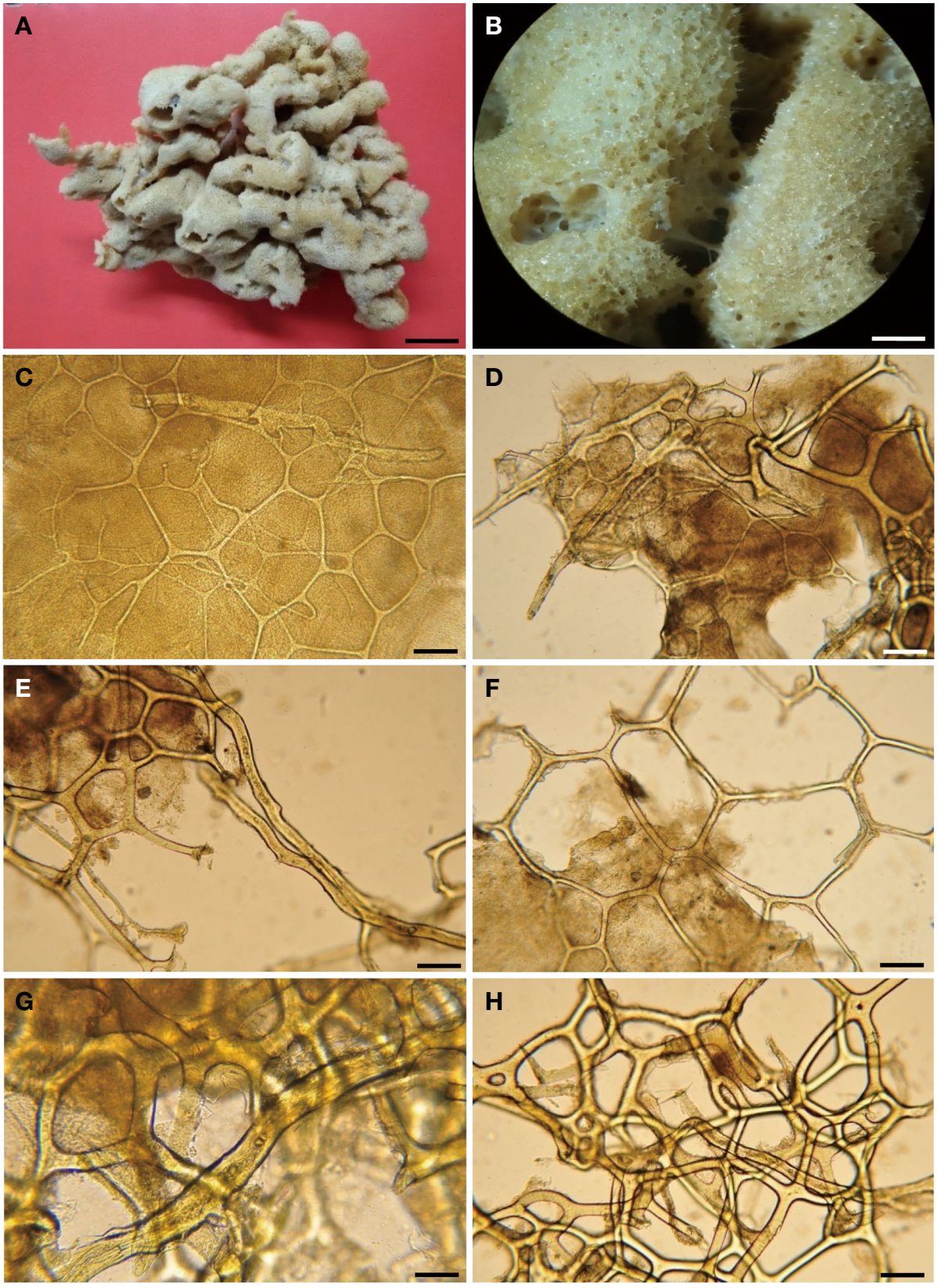

Fig. 3. *Hyattella lenis* n. sp. A, external morphology; B, surface under the dissecting microscope; C, thin secondary fibres with membrane; D, primary fibres near conules; E, primary fibres; F, thin secondary fibres; G, primary fibres close up; H, primary fibres at choanosome. Scale bars: A = 1 cm, B = 1 mm, C–F, H = 100 µm, G = 50 µm.

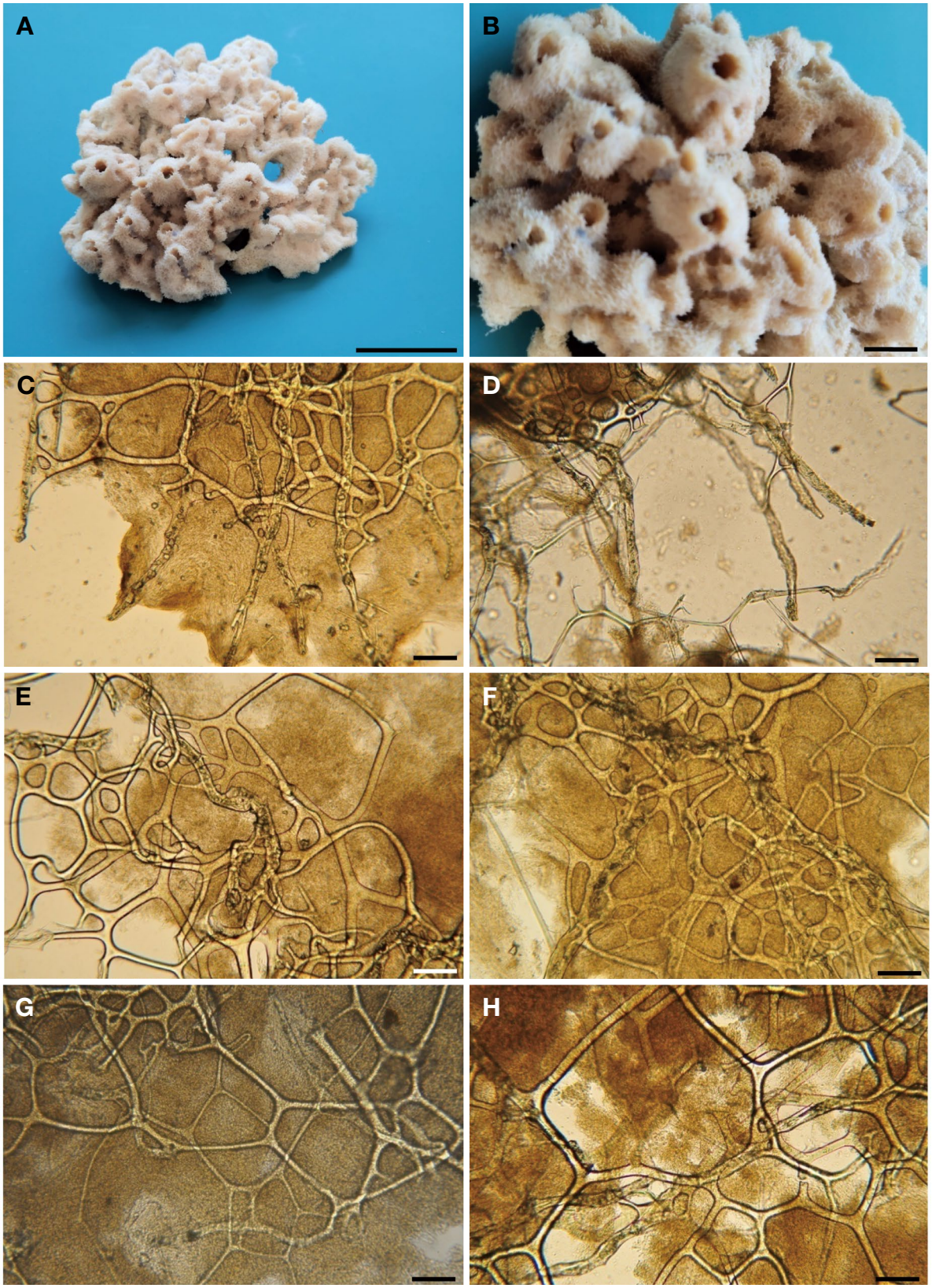

Fig. 4. *Hyattella membrana* n. sp. A, external morphology; B, surface close up; C, D, primary fibres near conules; E, F, primary fibres at choanosome; G, thin and thick secondary fibres at the surface; H, regular mesh secondary fibres. Scale bars: A = 1 cm, B = 1 mm, C–H = 100 μm.

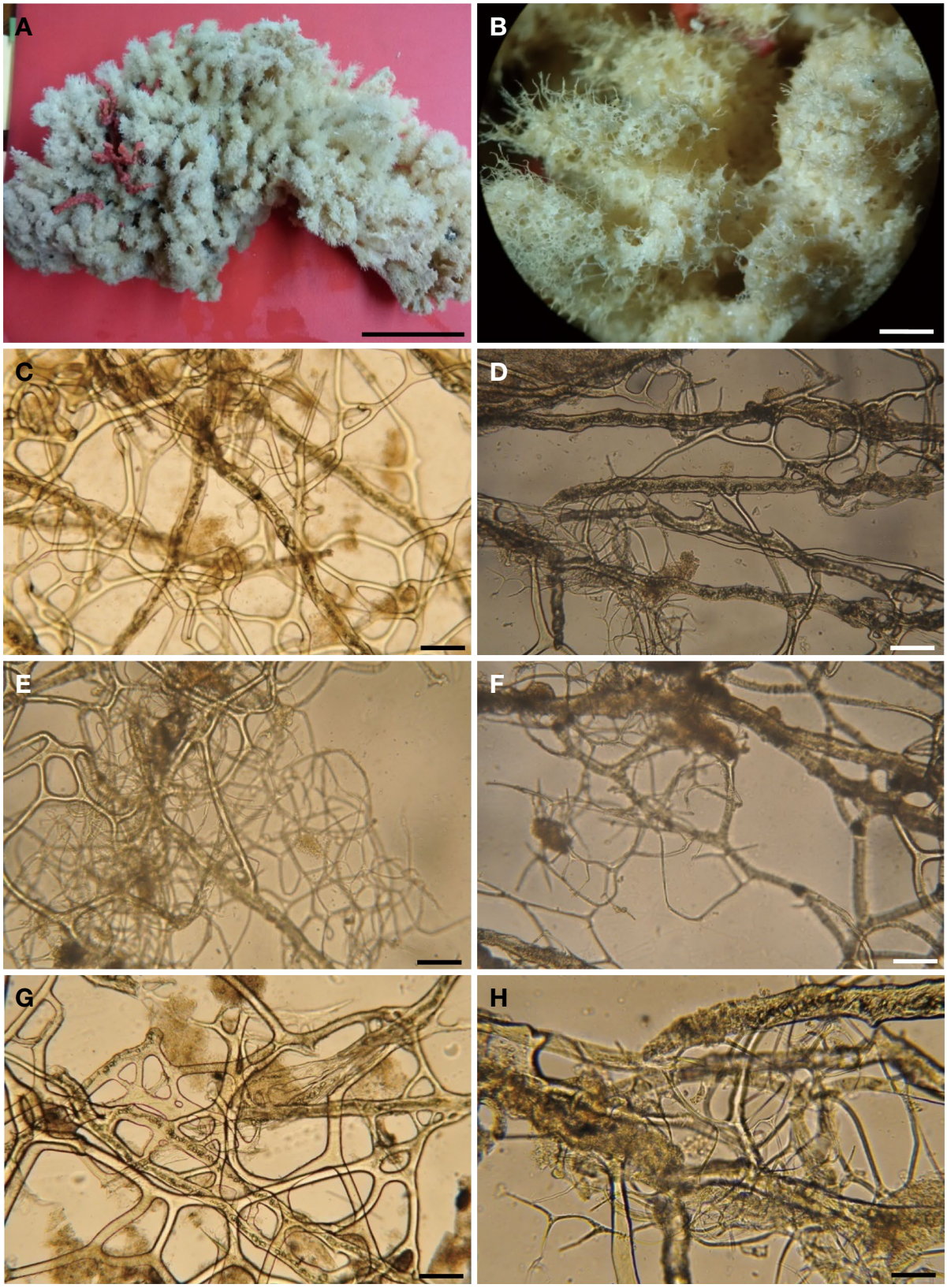

Fig. 5. *Hyattella asper* n. sp. A, external morphology; B, surface under the dissecting microscope; C, D, skeletal structure; E, F, separated thin secondary fibres; G, numerous primary fibres; H, skeletal structure. Scale bars: A = 1 cm, B = 1 mm, C–G = 100 μm, H = 50 μm.



Fig. 6. *Hyattella asper* n. sp. A, sand cored primary fibres; B, thin secondary fibres from primary fibres. Scale bars: A, B = 50 μm.

of surface has hair-like thin secondary fibres, 5−10 μm in diameter. These hair-like fibres which separated from primary fibres, are not easy to locate (Fig. 5E, F, H).

Etymology. The species name, *asper*, is named after the shape of rough surface of sponge.

Remarks. This new species is similar to *Hyattella lendenfeldi* Sim and Lee, 2014 in skeletal fibres, but differs in thin secondary fibres. Thin secondary fibres are not easy to locate, because they separated from skeletal fibres (Fig. 5E). Secondary fibres are loosely arranged.

Discussion

The genus *Hyattella* is characterized by a cavernous sponge body and numerous cored primary fibres in the skeletal structure (Cook and Bergquist, 2001). Sometimes this genus can be mistaken for genus *Hippospongia* because of the lacunose body in both genera. The only distinction is the cored primary fibres which could be numerous or rare. Bergquist (1980) remarks on two genera indicating that *Hippospongia* species have frequently been confused with those which are here assigned *Hyattella*. The latter has coarse texture and abundant primary fibres, the former is elastic and compressible with almost no primary fibres. The primary fibres in *Hyattella* can be found easily at the surface near conules, but the cored primary fibres at the choanosome are not easy to find in some areas. However, it is often difficult to identify the species because the arrangement of fibre skeletal structure of inner layer is similar. For this reason, fibre skeletal structure of the surface and subsurface should be examined in detail. In this study, we observed conules, the end of primary fibre protruding to the surface, in detail, and skeletal structure distributed in the choanosomal membrane area, the thickness of the fibres and the presence or absence of thin secondary and tertiary fibres were focused on.

The Indian species (Varsha *et al*., 2020), *Hy. repandus*, *Hy. macrophylla*, and *Hy. foliate*, differ from these new species in a texture that is difficult to separate. *Hyattella oblongus* similar with new species in appearance, but it has thin primary and secondary fibres. *Hyattella vedalainensis* and *Hy. diffusa* has very different appearance from Korean species.

Conflicts of Interest

The author of this paper has no affiliation with any interests and is solely responsible for the paper.

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