

Invertebrate Fauna of Korea

Volume 2, Number 1

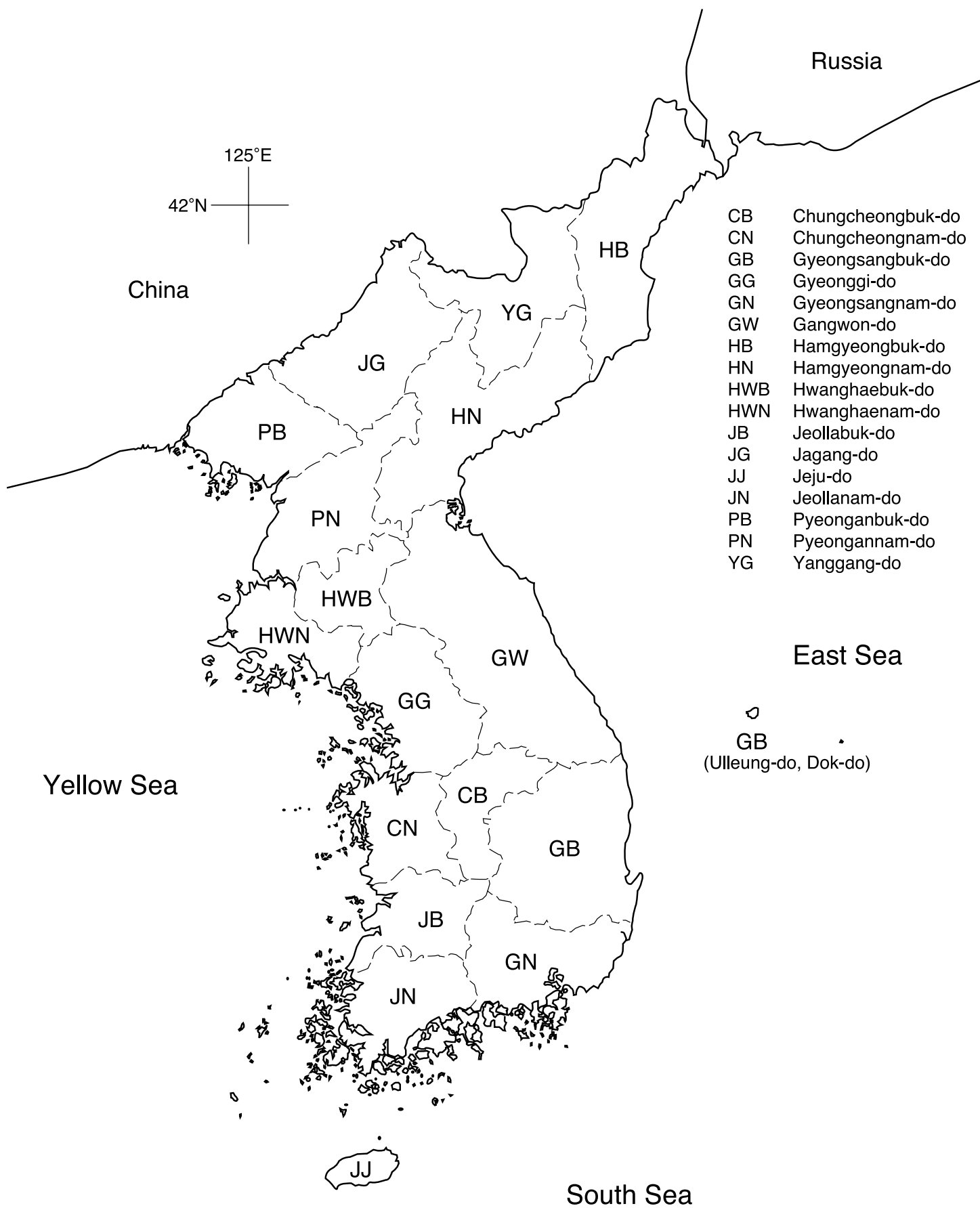
Dictyoceratid sponges I

Porifera: Demospongiae: Dictyoceratida: Irciniidae



Flora and Fauna of Korea

National Institute of Biological Resources
Ministry of Environment



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Dictyoceratid sponges I

Porifera: Demospongiae: Dictyoceratida: Irciniidae

Chung Ja Sim and Kyung Jin Lee¹

Hannam University

¹National Institute of Biological Resources



The Flora and Fauna of Korea logo was designed to represent six major target groups of the project including vertebrates, invertebrates, insects, algae, fungi, and bacteria.

PREFACE

Biological resources include all organisms and their genetic characteristics. Conservation and utilization of these resources have the capacity to improve human life and to enhance the world. Therefore it is required that the practical and potential values of these organisms are conserved and used wisely. The first step towards this goal is to document our biological diversity and to investigate them in detail. Biological resources increase the competitiveness of a nation through their use as fundamental resources for making highly valued products, such as new lines of cultivar, materials, and drugs.

Many countries in the world are responsible for preserving their biodiversity and using the sustainable ways. The Ministry of Environment (MOE) of Korea has established “CBD-CHM Korea” to share of information of biodiversity.

Each nation in the world is investigating and clearing information of native species within its territory. The National Institute of Biological Resources (NIBR) of MOE has published the ‘Flora and Fauna of Korea’ since 2009 to manage biological resources in comprehensive ways and to enhance national competitiveness by building up the foundation for the sovereignty rights over biological resources. Professional research groups, consisting of professors and other taxonomic experts, have systematically examined 15,545 species of vascular plants, animals and other organisms over the past 10 years and have published their findings in 191 volumes in Korean and 196 volumes in English, and two volumes of monographs covering 216 species of invertebrates. This year, 21 volumes of the Flora and Fauna of Korea in both Korean and English versions including 704 species of vascular plants, invertebrates and insects are additionally published.

The NIBR will continue to publish and research of flora and fauna of Korea that contribute conservation and sustainable use of biological resources. Finally, I would like to express my sincere appreciation to authors who made efforts in writing the manuscripts of *the Flora and Fauna of Korea*.

Prof. Dr. Yeon Jae Bae
President
National Institute of Biological Resources

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LIST OF TAXA

Phylum Porifera Grant, 1836

Class Demospongiae Sollas, 1885

Subclass Ceractinomorpha Lévi, 1953

Order Dictyoceratida Minchin, 1900

Family Irciniidae Gray, 1867

Genus *Bergquistia* Sim and Lee, 2002

Bergquistia baculus Sim, Lee and Kim, 2017

Bergquistia coreana Sim and Lee, 2002

Bergquistia latus Sim, Lee and Kim, 2017

Bergquistia ramus Sim, Lee and Kim, 2017

Bergquistia textura Sim, Lee and Kim, 2017

Bergquistia udoensis Sim, Lee and Kim, 2017

Genus *Ircinia* Nardo, 1833

Ircinia bakusi Sim, Lee and Kim, 2016

Ircinia bergquistia Sim, Lee and Kim, 2016

Ircinia canus Sim, Lee and Kim, 2017

Ircinia gapaensis Sim, Lee and Kim, 2016

Ircinia globulosa Sim, Lee and Kim, 2016

Ircinia incrustans Sim, Lee and Kim, 2016

Ircinia jejuensis Sim, Lee and Kim, 2016

Ircinia lacuna Sim, Lee and Kim, 2017

Ircinia lapillus Sim, Lee and Kim, 2016

Ircinia munsumensis Sim, Lee and Kim, 2016

Ircinia mureungensis Sim, Lee and Kim, 2016

Ircinia radícula Sim, Lee and Kim, 2017

Ircinia tunica Sim, Lee and Kim, 2017

Genus *Psammocinia* Lendenfeld, 1889

Psammocinia aspera Sim, Lee and Kim, 2017

Psammocinia bergquistae Sim and Lee, 2001

Psammocinia chupoensis (Sim, Lee and Kim, 2017)

Psammocinia conulosa Lee and Sim, 2004

Psammocinia foraminis Sim, Lee and Kim, 2017

Psammocinia gageoensis Sim and Lee, 2001
Psammocinia hwasunensis Sim, Lee and Kim, 2017
Psammocinia jejuensis Sim, 1998
Psammocinia lobatus Sim and Lee, 2002
Psammocinia mammiformis Sim, 1998
Psammocinia massa Kim, Lee and Sim, 2018
Psammocinia morum Sim, Lee and Kim, 2017
Psammocinia mosulpia Sim, 1998
Psammocinia palma Sim, Lee and Kim, 2017
Psammocinia rana Kim, Lee and Sim, 2018
Psammocinia rubra Sim and Lee, 2002
Psammocinia samyangensis Sim and Lee, 1998
Psammocinia scopulus Sim, Lee and Kim, 2017
Psammocinia ulleungensis Lee and Sim, 2004
Psammocinia vermis Kim, Lee and Sim, 2018
Psammocinia wandoensis Sim and Lee, 1998

Genus *Sarcotragus* Schmidt, 1862

Sarcotragus chagwiensis Sim, Lee and Kim, 2016
Sarcotragus dentilus Sim, Lee and Kim, 2016
Sarcotragus gapaensis Sim and Lee, 2000
Sarcotragus geomunensis Sim, Lee and Kim, 2016
Sarcotragus levis Sim, Lee and Kim, 2017
Sarcotragus mamillus Sim, Lee and Kim, 2016
Sarcotragus maraensis Sim and Lee, 2000
Sarcotragus mureungensis Sim, Lee and Kim, 2016
Sarcotragus purpureus Sim, Lee and Kim, 2016
Sarcotragus rutzleri Sim, Lee and Kim, 2017
Sarcotragus scalaris Sim, Lee and Kim, 2016
Sarcotragus schmidtii Sim, Lee and Kim, 2016
Sarcotragus seogwiensis Sim, Lee and Kim, 2016
Sarcotragus sucinum Sim, Lee and Kim, 2016

INTRODUCTION

The family Irciniidae, of the order Dictyoceratida in the subclass keratosa of the Demosponian Porifera are easily identified by the presence of very fine collagenous filaments with terminal knob, which supplement the fibre skeleton. Irciniid sponges are massive, or occasionally spread encrusting sponges, which display a wide range of forms, including low and pad-like, large and cushion-like, lobate and digitate. The sponge surface is usually conulose, with organized sand armour. Genera of the Irciniidae possess pithed and concentrically laminate, primary and secondary fibres. Primary fibres may often incorporate a core of foreign material, and can form complex, often massive fascicles. Secondary fibres are usually uncored, though foreign inclusions may occur in some species. The family Irciniidae consists of four genera, with approximately 124 species which are reported worldwide. Bergquist (1995) assigned the filamentose three genera, *Psammocinia*, *Ircinia* and *Sarcotragus* in the family Irciniidae. Later genus *Bergquistia* was established by Sim and Lee (2002). 21 species of *Psammocinia*, 13 species of *Ircinia*, 14 species of *Sarcotragus* and six species of *Bergquistia* have been reported from Korea (Sim, 1998; Sim and Lee, 1998, 2000, 2001, 2002a, b; Lee and Sim, 2004; Sim et al., 2016a, b; Sim et al., 2017a, b; Sim et al., 2018). This monograph aims to clarify the fauna of family Irciniidae, 54 species are described here.

MATERIALS AND METHODS

Sponge collections were made from Jejudo Island, Ulleungdo Island, Gageodo Island, and Geomundo Island, Korea. They were collected from depth of 15–30 m using SCUBA diving during the period of 1988–2015. Collected specimens preserved in 95% ethyl alcohol, were identified based on their morphological characteristics. The external feature of sponges was observed with a stereo microscope (Stemi DV4, Carl Zeiss, Göttingen, Germany). The skeletal fibres were studied under a light microscope (Primo Star, Carl Zeiss, Göttingen, Germany with Nikon Digital Camera D.5000). All specimens were deposited in the Natural History Museum, Hannam University, Daejeon and the National Institute of Biological Resources, Incheon, Korea. The classification system is based on Hooper and Soest (2002). Characteristics of family Irciniidae are shown in (Figs. 1–4).

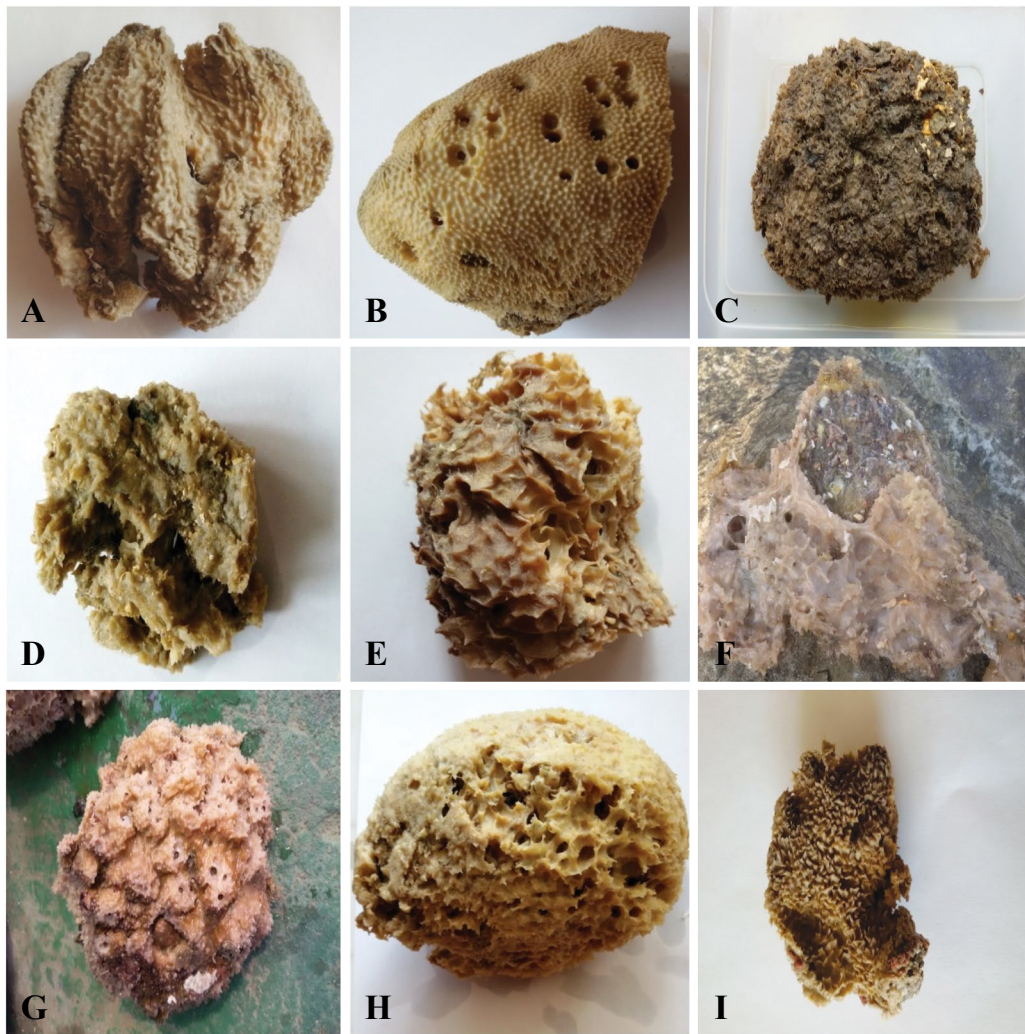


Fig. 1. External morphology. A. lobate sponge; B, C. round massive; D. irregular mass; E. irregular massive with sharp conules; F. encrusting sponge; G. thick encrusting; H. round sponge with rough surface; I. small piece of sponge with dense conules.

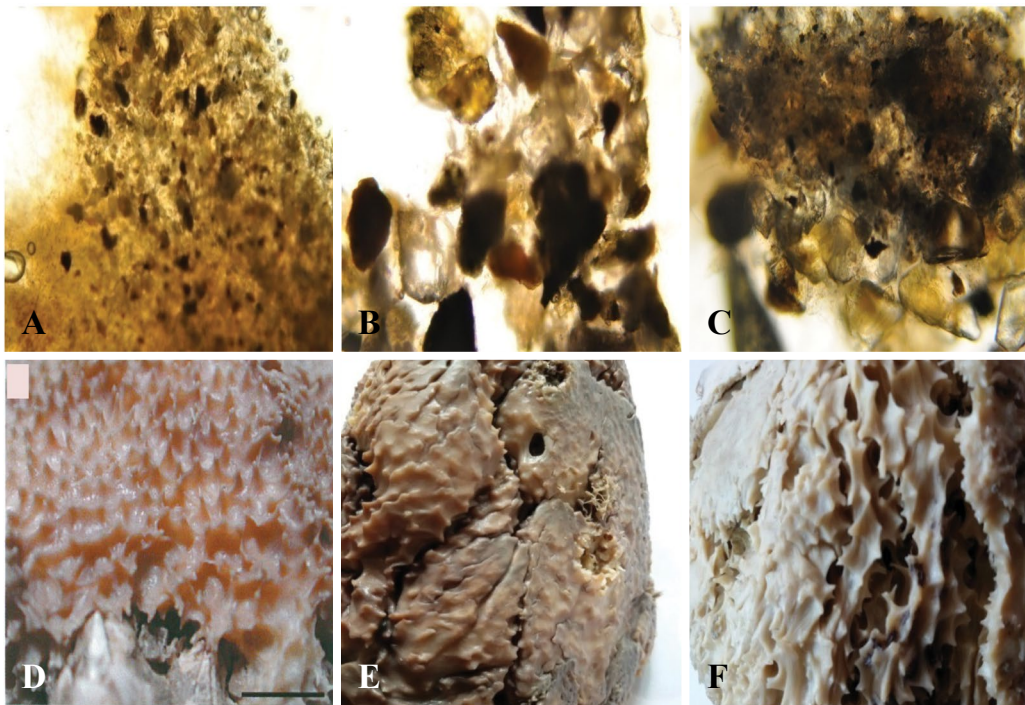


Fig. 2. Sand crust (A–C) and conules (D–F) on the surface. A. small sand crust; B. sand crust with large sands; C. small and large two layers sand crust; D. low sharp conules; E. round conules; F. teeth like conules.

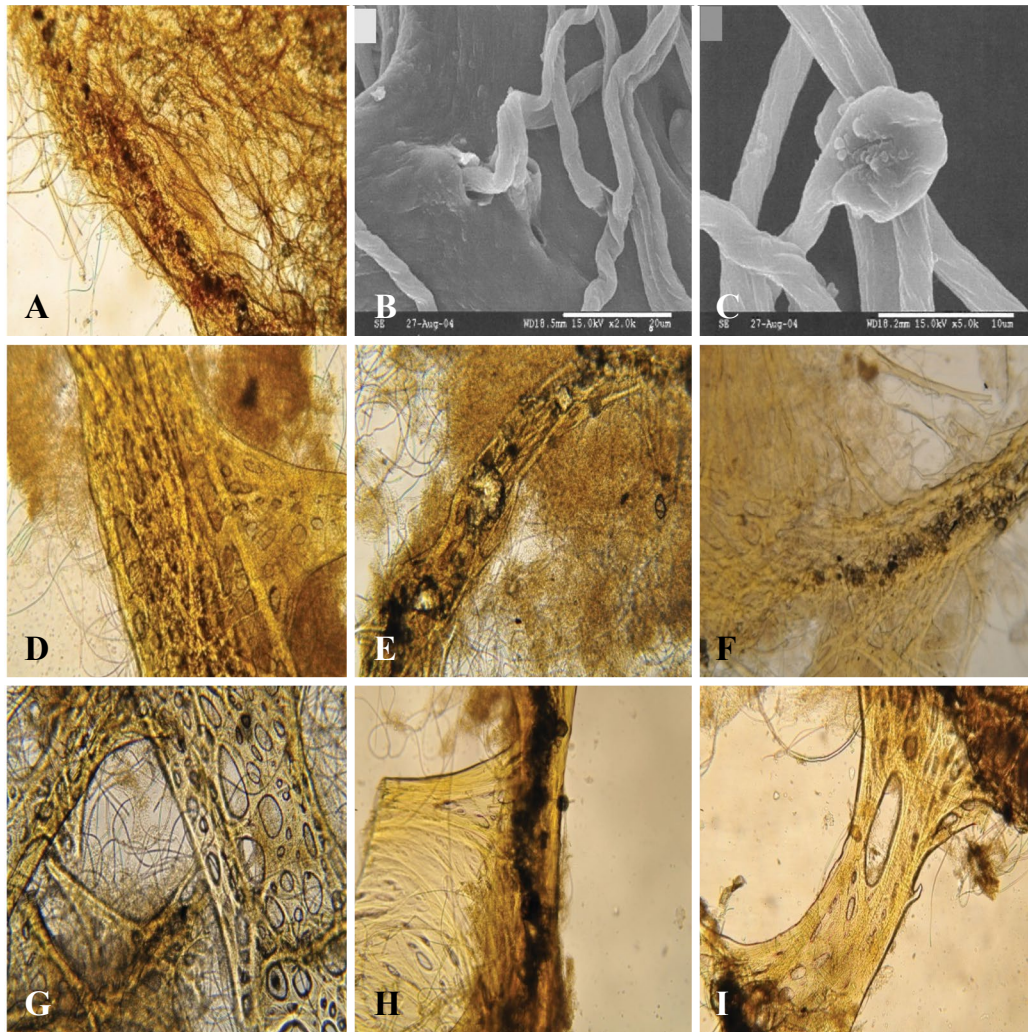


Fig. 3. Skeletal structure (A–C. filament; D–I. fibre). A. filaments support the fibres; B. filaments emerge from fibre; C. round terminal knob; D. cylindrical mesh net (fasciculated primary fibre); E. cored primary fibres; F. massive primary fibres; G. secondary web with many perforations; H. wide plastic-like secondary fibres; I. bridged secondary fibres.

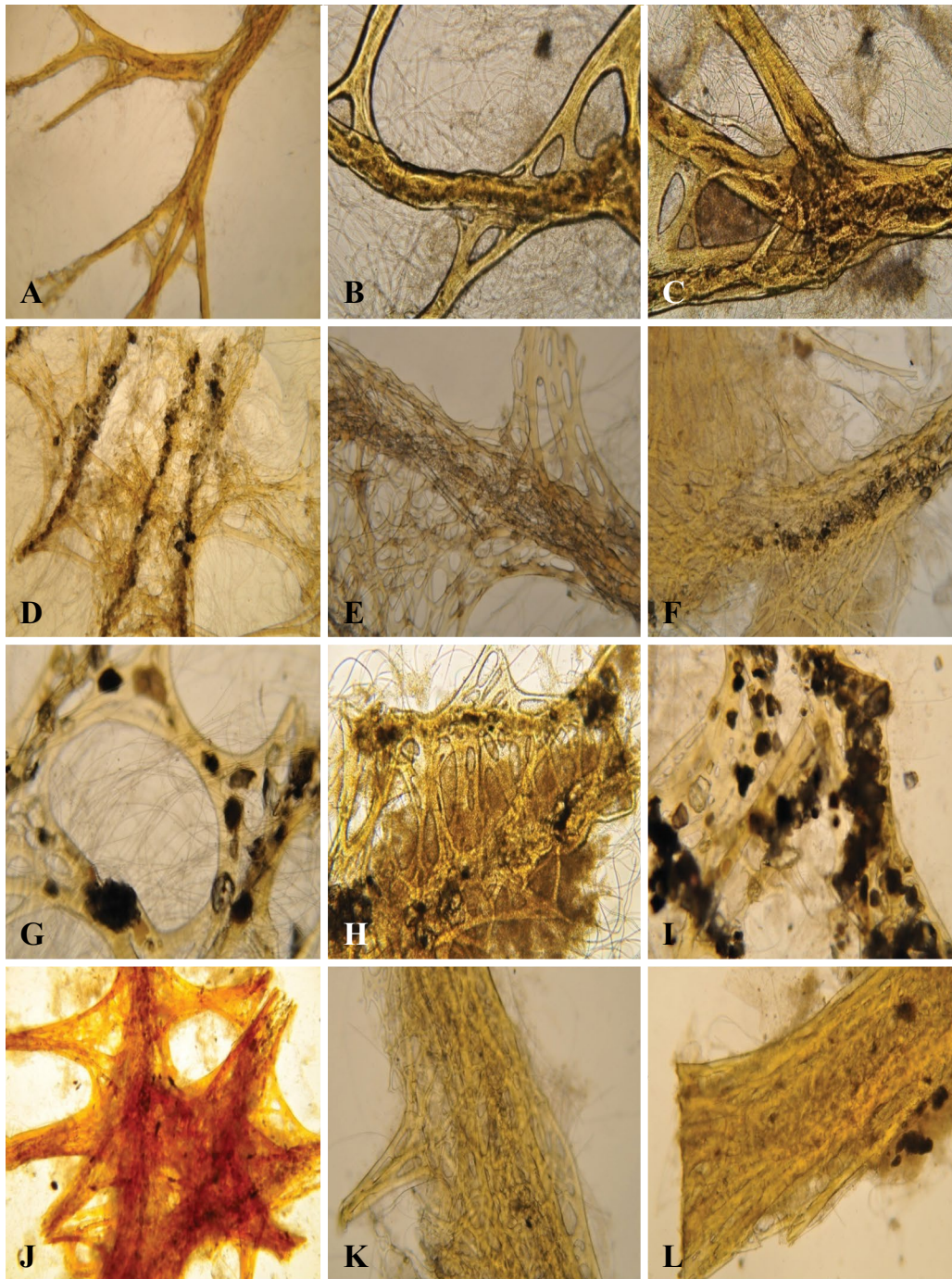


Fig. 4. Skeletal structure (A–C. genus *Bergquistia*; D–F. genus *Ircinia*; G–I. genus *Psammocinia*; J–L. genus *Sarcotragus*). A. primary fibres divided into two braches; B. primary and secondary fibres with small and large perforations; C. primary fibres with several branches; D. cored primary fibres with secondary web; E. uncored primary and secondary fibres; F. massive primary fascicles; G. cored primary and secondary fibres; H. secondary web between cored primary fibres; I. all cored fibres; J. large skeletal structure; K. cylindrical Primary fibre; L. plate-like primary fibre.

TAXONOMIC NOTES

Phylum Porifera Grant, 1836
Hae-myeon-dong-mul-mun (해면동물문)

Class Demospongiae Sollas, 1885
Bo-tong-hae-myeon-gang (보통해면강)

Subclass Ceractinomorpha Lévi, 1953
Il-chook-hae-myeon-a-gang (일축해면아강)

Order Dictyoceratida Minchin, 1900
Mang-gak-hae-myeon-mok (망각해면목)

In Ceractinomorpha, a spongin fibres skeleton is always present and constructed on an anastomosing plan. The skeleton does not arise from a continuous spreading basal plate. Elements of the fibres skeleton are organized as a hierarchy of primary, secondary, and sometimes tertiary fibres. Fibre construction is either homogeneous or pitched/laminated.

Key to families

1. Fine collagenous filaments present in addition to the fibres skeleton Irciniidae
— Lacking filaments 2
2. Fibres concentrically laminated with laminae clearly defined 3
— Fibres homogeneous, without marked laminations Spongiidae
3. Choanocyte chambers small, spherical (diplodal) Thorectidae
— Choanocyte chambers large, oval (eurypylous) Dysideidae

Family Irciniidae Gray, 1867

Ga-neun-sil-hae-myeon-gwa (가는실해면과)

Irciniids are readily identified by the presence of very fine collagenous filaments with beaded ends in the mesohyl, which supplement the fibres skeleton.

GENERA 4 (4 in Korea), **SPECIES** 124 (51 in Korea)

DISTRIBUTION: From temperate to subtropical regions.

Key to genera of family Irciniidae

1. Dermis unarmoured (although surface may be covered with sparse sands) 2
 - Dermis armoured (with a thick crustose layer of foreign debris) *Psammocinia*
2. Primary fibres form massive fascicles, which are often cored with foreign debris *Ircinia*
 - Primary fibres fascicular, uncored 3
3. Simple primary fibres divided into two or several branches *Bergquistia*
 - Primary fibres not divided into two branches *Sarcotragus*

Genus *Bergquistia* Sim and Lee, 2002

Ber-qui-s-t-hae-myeon-sok (버퀴스트해면속)

Characteristics of this genus are simple primary fibres fascicles which divided into two or several branches, secondary fibres are simple and rarely web type. Filaments of this genus are much thinner than other genus of Irciniid sponges. Sometimes simple and thick primary fibres are made of fascicles which look like wood bark with many openings, but they are not cylindrical meshed network.

Type species: *Bergquistia coreana* Sim and Lee, 2002.

SPECIES 6 (6 in Korea).

Key to species of Korean *Bergquistia* (Characteristics are illustrated in Figs. 5–10)

1. Skeletal fibres near surface arranged irregularly 2
 - Skeletal fibres near surface arranged regularly 4
2. Secondary fibres web-type between primary fibres *Bergquistia textura*
 - Secondary fibres simple bridge type 3

- 3. Secondary fibres mostly broad branches *Bergquistia latus*
- Secondary fibres very thin branches with perforation *Bergquistia udoensis*
- 4. Primary fibres divided into two branches *Bergquistia coreana*
- Primary fibres not divided into two branches 5
- 5. Primary fibres not divided into branches *Bergquistia baculus*
- Primary fibres divided into several branches *Bergquistia ramus*

1. *Bergquistia baculus* Sim, Lee and Kim, 2017 (Fig. 5)

Ji-pang-i-ber-qui-s-t-hae-myeon (지팡이버퀴스트해면)

Bergquistia baculus Sim et al., 2017b, pp. 143, 144, figs. 8, 9.

Description. Thick encrusting mass sponge, size up to $8 \times 5 \times 2$ cm. Winding surface covered by filamentous membrane with thick strong collagen and sharp conules. Oscules, rare, 1.5 mm in diameter. Color in life dark beige. Texture firm and compressible.

Skeleton: Primary fibres without branches, 150–300 μm in diameter, simple long line, rarely connected with secondary fibres and covered with some filaments. Secondary fibres, 50–150 μm in diameter, rarely branched off from primary fibres, and broad plate-like secondary web located at choanosome. Filaments, 1–2.5 μm in diameter, terminal knobs not clear.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Songaksan, 21.x.1998.

REMARKS: Primary fibres of this species are not branched except near conules. Secondary fibres are very rare, but if present are web type, very broad plate-like shape (Fig. 5G), and only located at choanosome.

2. *Bergquistia coreana* Sim and Lee, 2002 (Fig. 6)

Han-guk-ber-qui-s-t-hae-myeon (한국버퀴스트해면)

Bergquistia coreana Sim and Lee, 2002b, p. 285, fig. 1.

Description. Irregular mass sponge, size up to $4.5 \times 3 \times 3$ cm. Surface smooth and covered by distinct sharp conules. Oscules, 1–5 mm in diameter, irregularly scattered on surface, color in life beige, change to

brown in alcohol. Texture firm and compressible.

Skeleton: Primary fibres, slightly fasciculated, 200–400 μm in diameter, lack any coring material, and divided into two branches. Simple and rare secondary fibres, 50–100 μm in diameter, clear of debris. Primary and secondary fibres skeleton supplemented by dense aggregation of fine filaments, 0.7–2.5 μm in diameter, emerged from hole in fibres. Terminal knobs, 3–5 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Hyungjeseom, 21.x.1998.

3. *Bergquistia latus* Sim, Lee and Kim, 2017 (Fig. 7)

Neolb-eun-ber-qui-s-t-hae-myeon (넓은버퀴스트해면)

Bergquistia latus Sim et al., 2017b, pp. 140, 141, figs. 5, 6.

Description. Thickly encrusting mass sponge, size up to $12 \times 7 \times 3$ cm. Surface covered by shrap conules. Filamentous membrane contains irregular skeletal fibres. Oscules, very small and rare. Color in life grey and pale brown. Texture firm and compressible.

Skeleton: Simple fasciculated primary fibres, 150–200–400 μm in diameter. Secondary fibres, thick and smooth, 50–200 μm . Broad branched secondary fibres, 400 μm in diameter, no fascicles are appeared at choanosome. Filaments, 1–3 μm in diameter, terminal knobs, 3–5 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Jeju-si, Bakmiyeoksum, 22.viii.2000.

REMARKS: This species has bridged type secondary fibres with very broad ending, and no secondary web. Broad ending of secondary fibres is not root-like, thus can be easily parted from primary fibres.

4. *Bergquistia ramus* Sim, Lee and Kim, 2017 (Fig. 8)

Ga-gi-ber-qui-s-t-hae-myeon (가지버퀴스트해면)

Bergquistia ramus Sim et al., 2017b, pp. 144–146, figs. 10, 11.

Description. Round mass sponge, size up to $7 \times 5 \times 3.5$ cm. Surface covered by distinct sharp conules and strong collagen filamentous membrane. Oscules, 1–4 mm in diameter. Color in life dark beige. Texture firm and compressible.

Skeleton: Long primary fibres, 200–500 μm in diameter, simple twisted or entwined pattern fascicles. Several primary fibres binded with thick fascicles at base. Long nuddle-like, branched primary fibres are similar to secondary fibres. Secondary fibres, 100–250 μm in diameter, short bridged pattern. Thin filaments, 0.3–1 μm in diameter, terminal knobs very rare, 3–4 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Hyungjesum, 2.x.1998.

REMARKS: This species is very unique, thick primary fibres divided into several thin primary fibres (Fig. 8D). End of primary fibres are divided into three branches near conules (Fig. 8F).

5. *Bergquistia textura* Sim, Lee and Kim, 2017 (Fig. 9)

Geu-mul-ber-qui-s-t-hae-myeon (그물버퀴스트해면)

Bergquistia textura Sim et al., 2017b, pp. 139, 141, fig. 4.

Description. Irregular mass sponge, size up to $14 \times 7 \times 6$ cm, surface, strong collagenous filamentous membrane, covered with low distinct conules. Skeletal fibres irregularly attached to filamentous membrane near surface. Oscules, 1–5 mm in diameter, rare, only at the side surface. Color in life ivory and pale grey. Texture elastic and compressible.

Skeleton: Simple fasciculated primary fibres, 150–300–700 μm in diameter, secondary fibres, thin plate-like with large and small perforations, 50–200 μm in diameter. Secondary web distinct at the end of conules. Filaments, sometimes divided into two branches, 1–2 μm in diameter, terminal knobs, very indistinct, 3 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Munseom, 21.x.2002.

REMARKS: This species has very irregularly arranged skeletal structure (Fig. 9C), whereas primary fibres of *Bergquistia coreana* divided into two branches. Secondary fibres web between primary fibres are well developed near conules (Fig. 9G), whereas in most species of genus *Bergquistia*, secondary fibres are not well developed.

6. *Bergquistia udoensis* Sim, Lee and Kim, 2017 (Fig. 10)

U-do-ber-qui-s-t-hae-myeon (우도버퀴스트해면)

Bergquistia udoensis Sim et al., 2017b, pp. 141–144, fig. 7.

Description. Thickly encrusting small sponge, size up to $5.5 \times 4 \times 2$ cm. Surface with distinct dense and sharp conules, no oscules. Numerous thin skeletal fibres observed near surface. Color in life ivory, changed to dark brown in alcohol. Texture very hard.

Skeleton: Primary fibres, 200–300 μm in diameter, very thick and rough. Secondary fibres, 80–100 μm in diameter, with diverse sized opening near primary fibres. Filaments, 1–2.5 μm in diameter, terminal knobs, very rare 4 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Jeju-si, Udo, 15.iii.2013.

REMARKS: This species has very sharp and dense conules on the surface, and texture is very hard. The end points of secondary fibres always have diverse sized opening in contrast to web type (Fig. 10C, G).

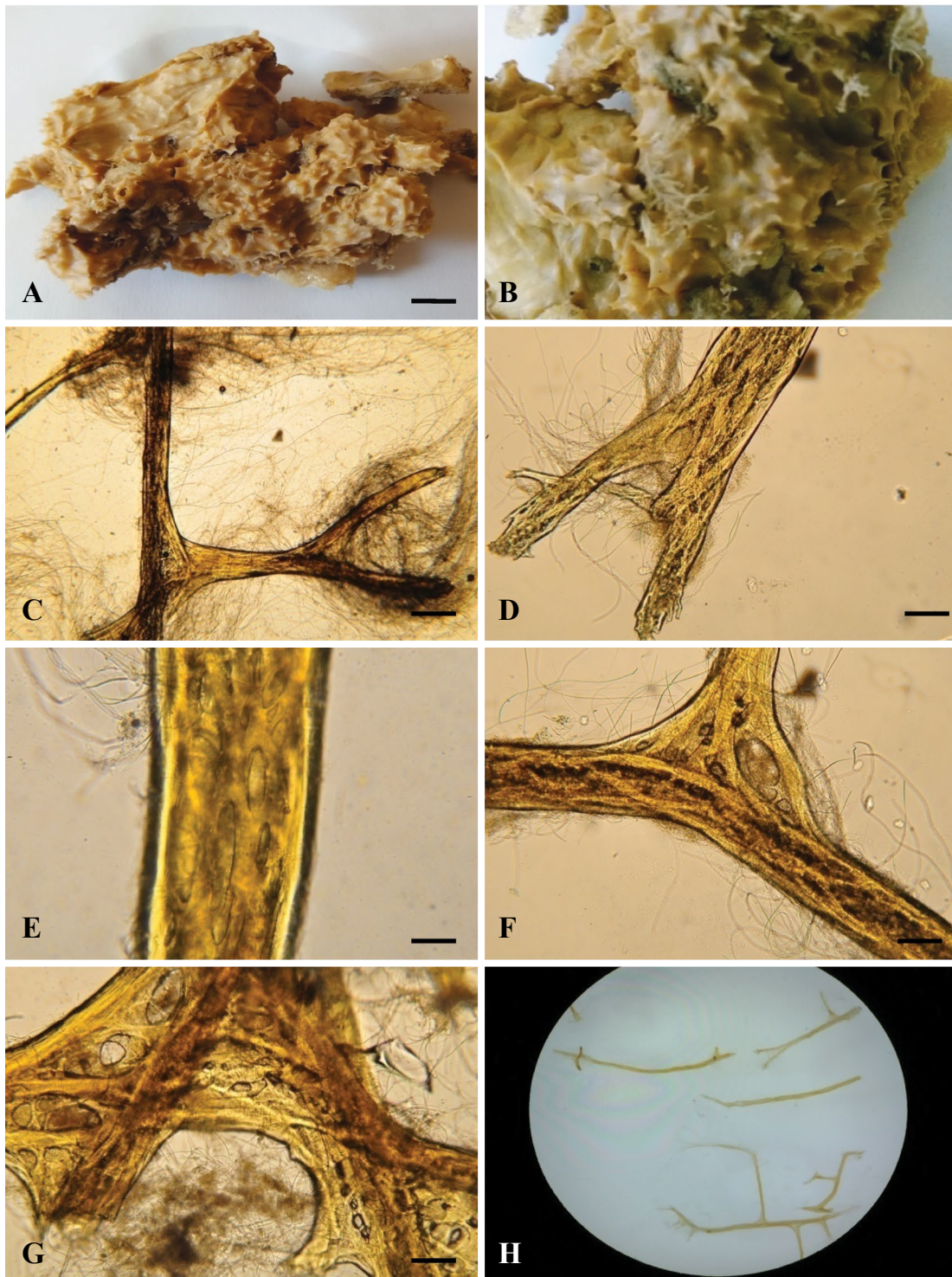


Fig. 5. *Bergquistia baculus* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. primary fascicles near conules; E. close up view of primary fibres with opening; F. primary fibres with secondary fibres extending; G. primary fibres with secondary web at the chanosome; H. skeletal structure under dissecting microscope. Scale bars: A = 2 cm, C = 200 μm , D, F, G = 100 μm , E = 50 μm .

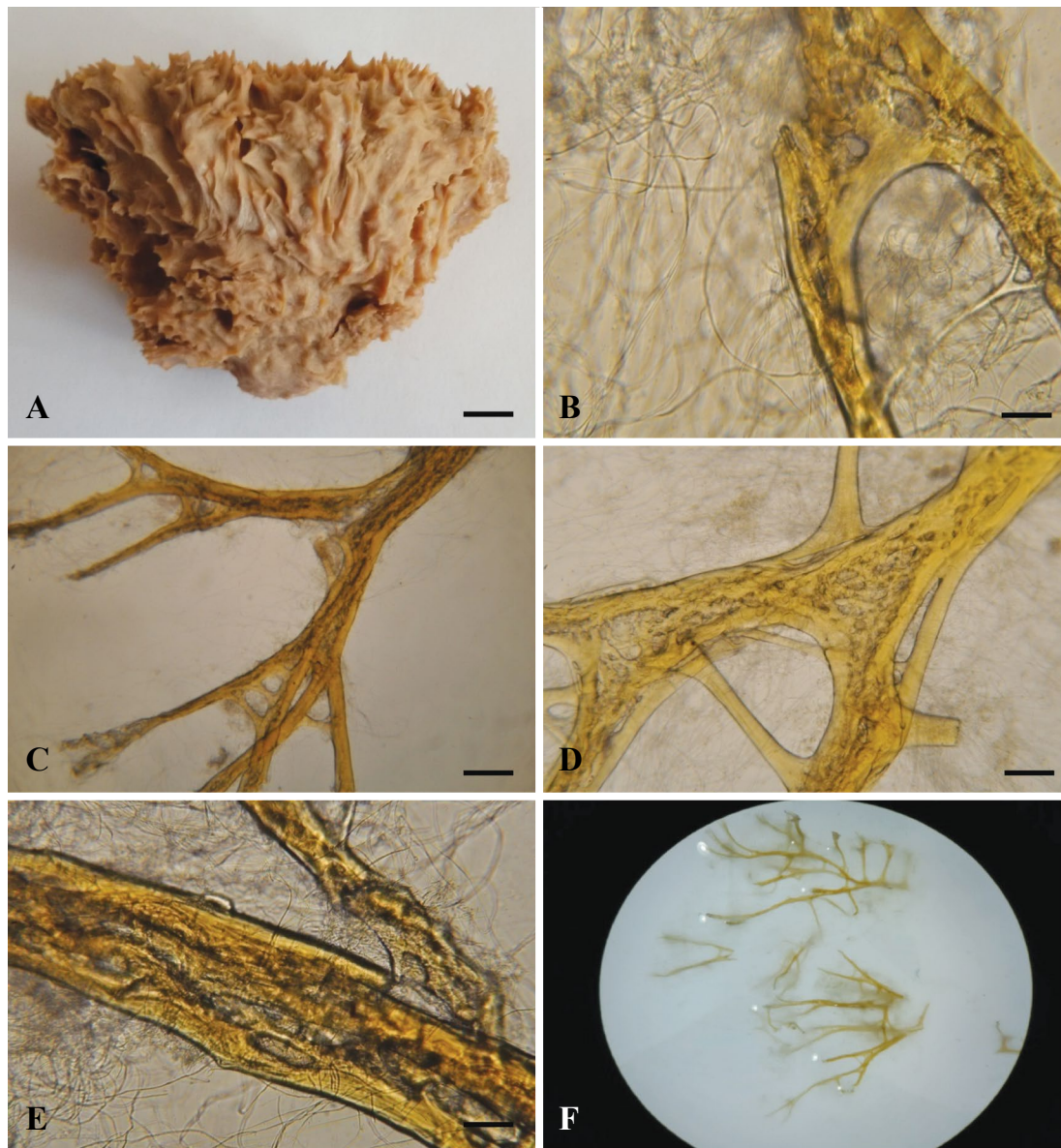


Fig. 6. *Bergquistia coreana* Sim and Lee. A. external morphology; B. primary fibres near canals; C. primary fibres divided into two branches; D. primary fibres with simple connected secondary fibres; E. thick primary fibres with irregular opening; F. skeletal structure under dissecting microscope. Scale bars: A, C, D = 100 μm , B, E = 50 μm .

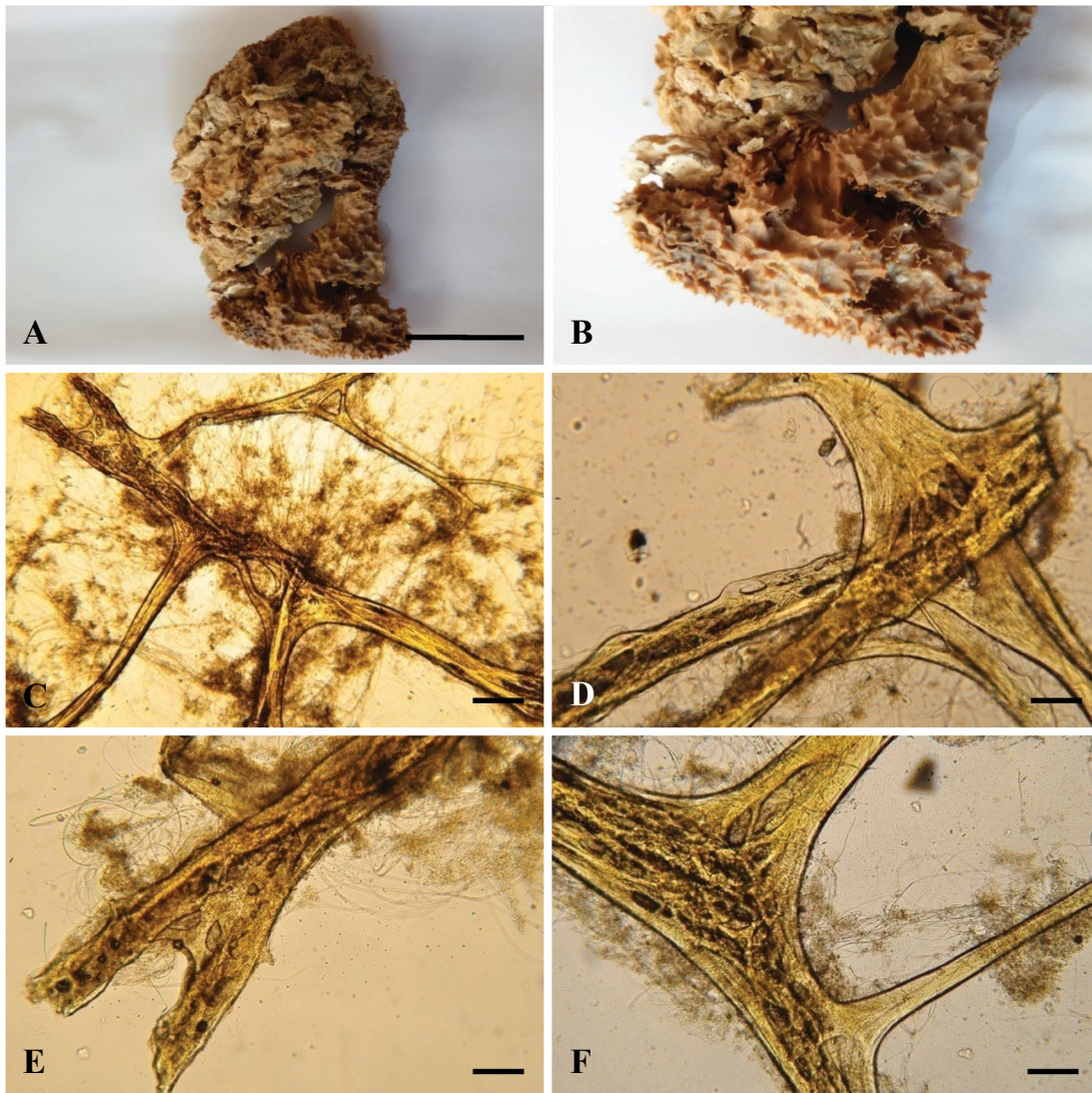


Fig. 7. *Bergquistia latus* Sim, Lee and Kim. A. external morphology; B. surface close up; C. surface skeletal structure; D. chanosome broad secondary fibres; E. primary fibres near conules; F. primary fibres and secondary branches. Scale bars: A = 2 cm, C = 200 μm , D–F = 100 μm .

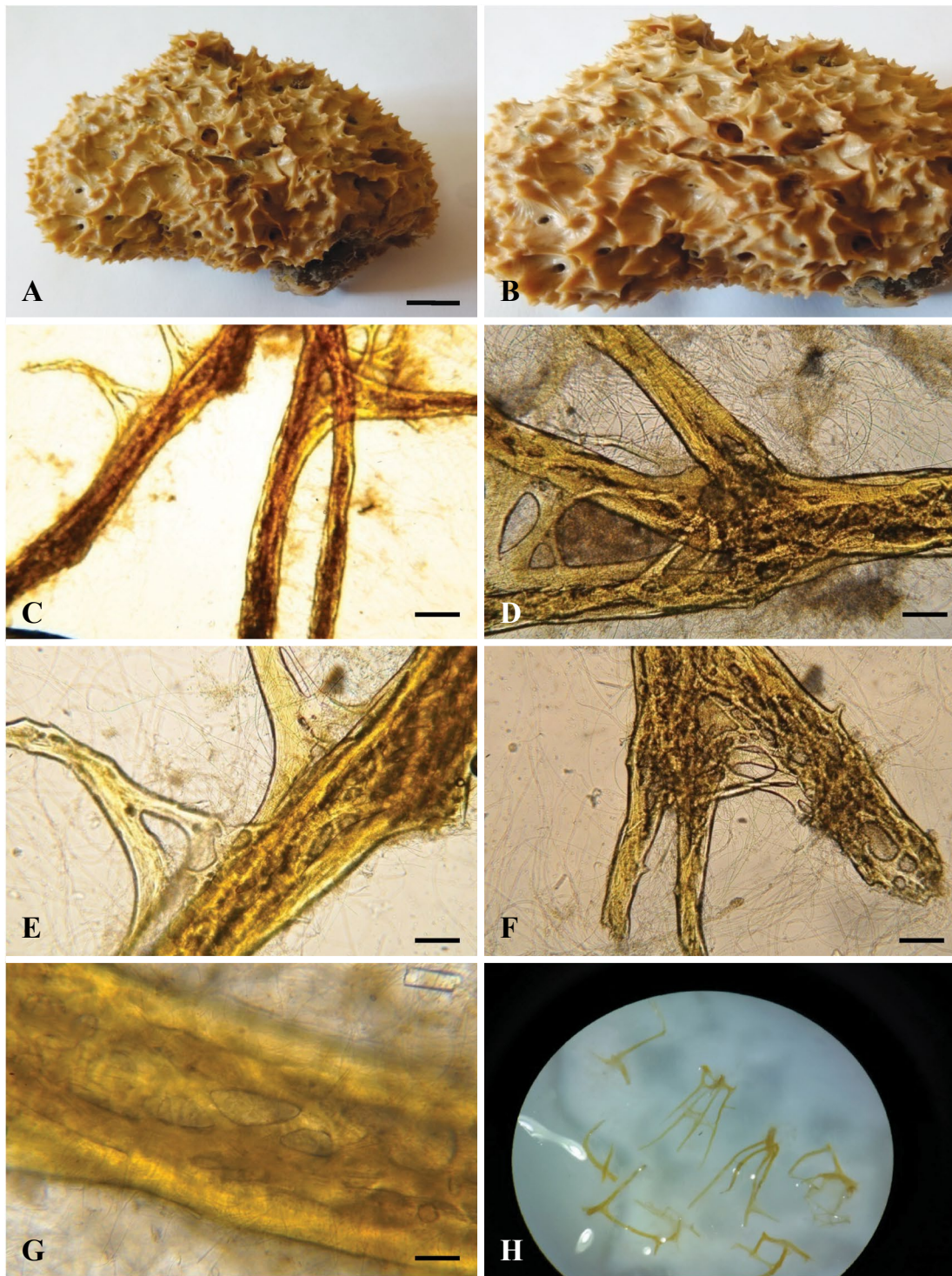


Fig. 8. *Bergquistia ramus* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. primary fibres divided into three branches; E. primary and secondary fibres; F. three branched primary fibres near conules; G. close up view of primary fascicles with opening; H. skeletal structure under dissecting microscope. Scale bars: A = 2 cm, C = 200 μ m, D–F = 100 μ m, G = 50 μ m.

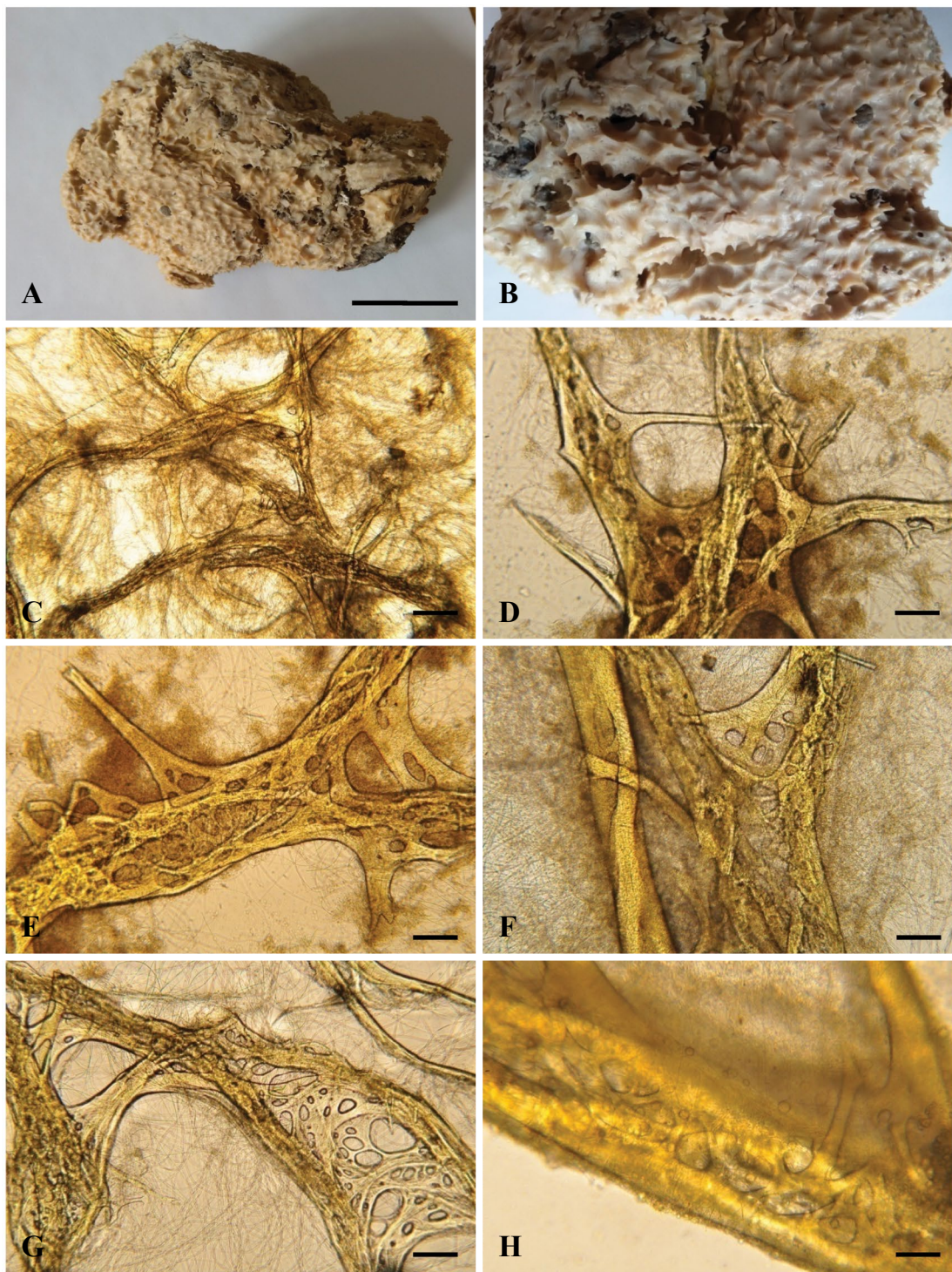


Fig. 9. *Bergquistia textura* Sim, Lee and Kim. A. external morphology; B. surface close up; C. surface skeletal structure; D. primary and secondary fibres; E. primary fibres with bridged secondary fibres; F. primary fibres with secondary web; G. secondary web between primary fibres; H. close up view of primary fascicles. Scale bars: A = 2 cm, C = 200 μ m, D–G = 100 μ m, H = 50 μ m.

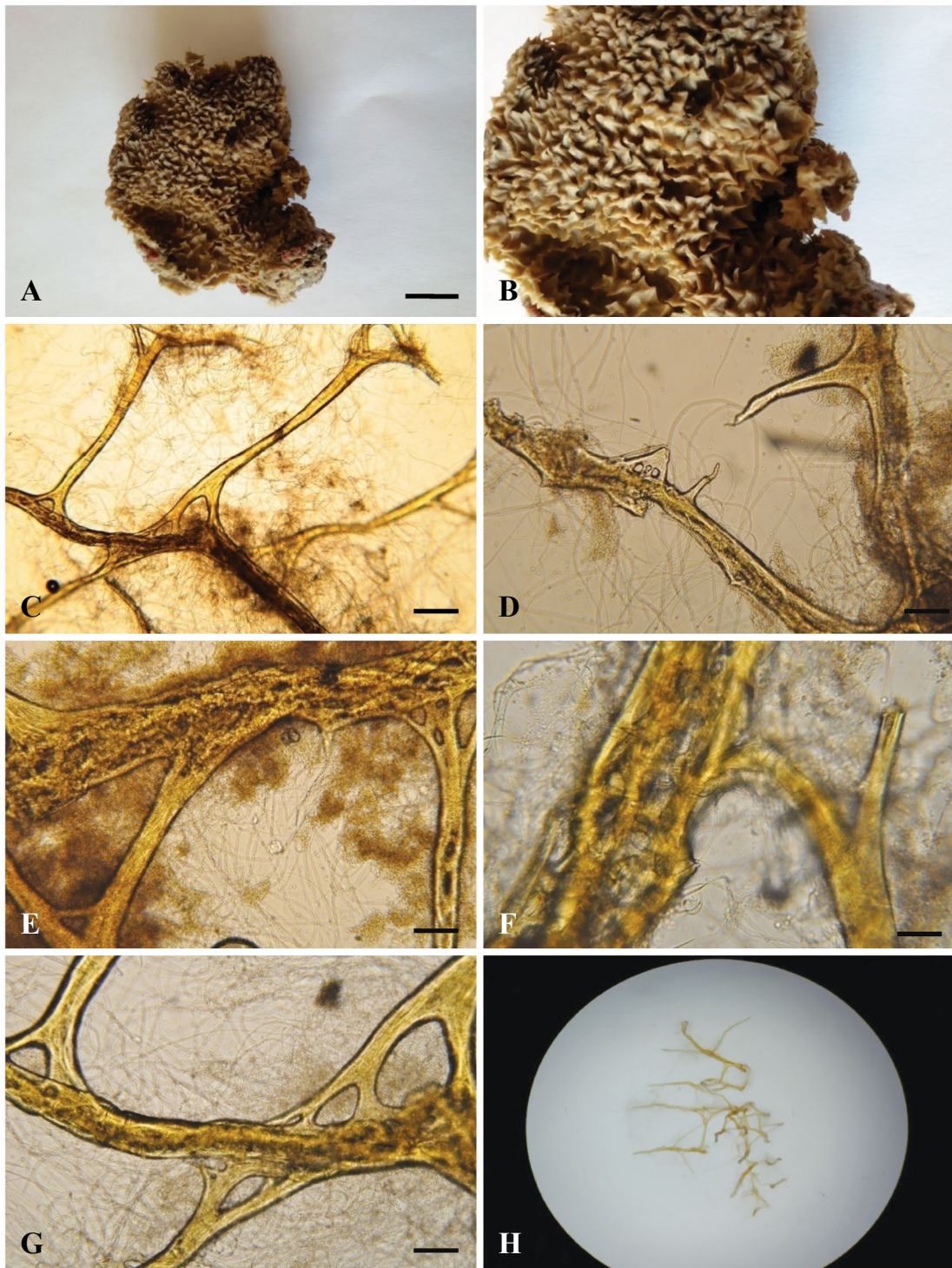


Fig. 10. *Bergquistia udoensis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. primary fibres near conules; E. primary and secondary fibres; F. close up view of primary fascicles with deep gap; G. secondary branch with small and large openings; H. skeletal structure under dissecting microscope. Scale bars: A = 2 cm, C = 200 μm, D, E, G = 100 μm, F = 50 μm.

Genus *Ircinia* Nardo, 1833

Ga-neun-sil-hae-myeon-sok (가는실해면속)

In skeleton of *Ircinia* species, primary fibres are cored with foreign debris, and form massive fascicles. Secondary fibres are simple and uncored. Although the consistency of these sponges is soft to firm, though they are extremely tough, and are difficult to cut or tear.

Type species: *Spongia fasciculata* Pallas, 1766.

SPECIES 62 (13 in Korea).

Key to species of Korean *Ircinia* (Characteristics are illustrated in Figs. 11–23)

1. Primary fibres cored with foreign debris.....2
 - Primary fibres slightly cored or uncored with foreign debris.....8
2. Surface with thin filamentous membrane.....3
 - Surface with thick filamentous membrane.....7
3. Primary fibres at conules cored with small and large sands.....4
 - Primary fibres at base of sponge cored with small and large sands *I. jejuensis*
4. Primary fibres cored with pebble-like large sands *I. lapillus*
 - Primary fibres cored with small sands.....5
5. All fibres with numerous perforations..... *I. gapaensis*
 - All fibres with rare perforations6
6. Root-like branched secondary fibres *I. globulosa*
 - Fasciculated branched secondary fibres *I. bakusi*
7. Thin encrusting sponge, choanosomal skeletal fibres, loosely arranged network..... *I. incrustans*
 - Round mass sponge, choanosomal skeletal fibres, thick and dense bundles *I. munsumensis*
8. Primary fibres slightly cored9
 - Primary fibres uncored 11
9. Surface with no hole..... 10
 - Surface with numerous holes..... *I. lacuna*
10. Sponge mammilate form *I. radícula*
 - Flabbily large round mass sponge *I. mureungensis*
11. Surface conules distinct..... *I. bergquistia*
 - Surface conules not distinct..... 12
12. Whole surface covered with colonial tuncates *I. tunica*
 - Surface partly covered with other animals *I. canus*

7. *Ircinia bakusi* Sim, Lee and Kim, 2016 (Fig. 11)

Ba-ku-s-ga-neun-sil-hae-myeon (바쿠스가는실해면)

Ircinia bakusi Sim et al., 2016b, pp. 486, 487, fig. 6.

Description. Round mass sponge, size up to $13 \times 9 \times 6$ cm. Surface, numerous mammilate form with low conules, sharp conules on side of sponge. Oscules, 2–4 mm in diameter, open on top of mammilate. Color in life pinkish brown. Texture soft and compressible. Choanosome lacunose.

Skeleton: Primary fibres, 100–150 to 250–270 μm in diameter, cored with small sands. Secondary fibres, 400–1000 μm in diameter, perforated with large space, and root-like or branch type secondary web, 100–300 μm in diameter. Choanosome skeletal structure, is simpler than surface structure. Filaments, 3–5 μm in diameter, terminal knobs, 10–15 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 17.viii.2015.

8. *Ircinia bergquistia* Sim, Lee and Kim, 2016 (Fig. 12)

Ber-qui-s-t-ga-neun-sil-hae-myeon (버퀴스트가는실해면)

Ircinia bergquistia Sim et al., 2016b, pp. 492, 493, fig. 12.

Description. Sponge irregular, thick, encrusting, size up to $8 \times 9 \times 4$ cm. Surface covered by conules, filamentous membrane mixed with pigments, and spicules. Oscules, 4–5 mm in diameter, rarely opened on sponge surface. Color in life, blackish gray on upper surface, pale brown near base of sponge. Texture soft and compressible.

Skeleton: Fasciculated primary fibres near surface, 700–1100 μm in diameter, very loose and not cored. Branched secondary fibres fasciculated, 300–400 μm in diameter. Filaments, 3–6 μm in diameter, terminal knobs, 10–15 μm in diameter.

HABITAT: Depth of 15–20 m, marine.

DISTRIBUTION: Korea (Jeju Island).

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 26.vi.2016.

REMARKS: In this sponge, primary and secondary fibres are free from foreign debris.

9. *Ircinia canus* Sim, Lee and Kim, 2017 (Fig. 13)

Hoe-sak-ga-neun-sil-hae-myeon (회색가는실해면)

Ircinia canus Sim et al., 2017, pp. 101, fig. 7.

Description. Irregular mass sponge, size up to $10 \times 7 \times 3.3$ cm. Surface has low sharp conules and covered with numerous other fauna. Oscules rare, 1–3 mm in diameter. A barnacle observed in each oscules. Color in life, gray. Texture, soft and compressible.

Skeleton: Primary fibres, 150–250 μm in diameter, cored with sands and spicules. Secondary fibres with mesh type web, or some complicated branch pattern, 150 μm in diameter (Fig. 13D, G). Filaments, 5–8 μm in diameter, with terminal knobs, 12–15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea (Jejudo Island).

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 17.viii.2015.

10. *Ircinia gapaensis* Sim, Lee and Kim, 2016 (Fig. 14)

Ga-pa- ga-neun-sil-hae-myeon (가파가는실해면)

Ircinia gapaensis Sim et al., 2016b, p. 484, figs. 3, 4.

Description. A mass, round sponge, size up to $9 \times 8 \times 4$ cm. Surface, low mammilate form with conules. Oscules, 2–4 mm in diameter, opened at the end of mammilated conules. Color in life grayish beige. Texture very soft and compressible.

Skeleton: Primary fibres near surface, 300–400 μm in diameter, cored with sparse small sands. Two kinds of secondary fibres at conules, 200–500 μm in diameter, bridged branch type and V shaped secondary web. Secondary web with irregularly arranged mesh net. Primary fibres in choanosome, 300–500 μm in diameter, cored with sands and secondary fibres, 250–400 μm in diameter. Primary and secondary fibres with numerous perforations, loose network and amber color. Filaments, 3–5 μm in diameter, terminal knobs, 15 μm in diameter.

HABITAT: Depth of 15–18 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Gapado, 29.ix.2014.

11. *Ircinia globulosa* Sim, Lee and Kim, 2016 (Fig. 15)

Dung-geun-ga-neun-sil-hae-myeon (둥근가는실해면)

Ircinia globulosa Sim et al., 2016b, p. 484, fig. 2.

Description. Round mass sponge, attached to shell of mollusc, size up to $8 \times 5 \times 3.3$ cm. Surface, honey comb pattern with row conules. Several oscules, 2–4 mm in diameter, opened on side of sponge. Color yellowish gray in life. Texture soft and compressible.

Skeleton: Primary fibres, 450–750 μm in diameter, cored with large sands and broken spicules. Two kinds of secondary fibres, secondary web with large irregular mesh net, 400–500 μm in diameter, and some branch pattern with root-like diverging secondary fibres, 500 μm in diameter. Filaments with two categories in size, 2 and 8 μm in diameter, terminal knobs, 10–15 μm in diameter.

HABITAT: Depth of 25 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Munseom, 15.viii.2015.

12. *Ircinia incrustans* Sim, Lee and Kim, 2016 (Fig. 16)

Deop-gae-ga-neun-sil-hae-myeon (뿔개가는실해면)

Ircinia incrustans Sim et al., 2016b, p. 484, fig. 1.

Description. Thin encrusting sponge, size up to 14×5 cm wide 0.5 cm thick, attached to shell of oyster. Surface smooth, and covered with thick collagenous filaments membrane. Conules, rare and low, but easily discerned on side of sponge. Several oscules, 2–8 mm in diameter, opened through out sponge surface. Color pale grey in life turns to dirty gray in alcohol. Texture firm.

Skeleton: Primary fibres, 150–450 μm in diameter, some thin primary fibres near membrane, cored with sands and broken spicules. Choanosome primary fibres mostly not cored and uncured primary fibres not easily distinguished from secondary fibres. Branched secondary fibres, 250–500 μm in diameter. Filaments, 6–7 μm in diameter, terminal knobs, 13–15 μm in diameter.

HABITAT: Depth of 25 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Munseom, 15.viii.2015.

13. *Ircinia jejuensis* Sim, Lee and Kim, 2016 (Fig. 17)

Je-ju-ga-neun-sil-hae-myeon (제주가는실해면)

Ircinia jejuensis Sim et al., 2016b, pp. 488, 491, figs. 9, 10.

Description. Large round mass sponge, size up to $22 \times 16 \times 7$ cm. Surface with low branched conules covered with filamentous membrane. Oscules, 1–5 mm in diameter, opened on sponge surface. Color in life dark gray. Texture soft and compressible. Choanosome lacunose.

Skeleton: Primary fibres, 150–300 to 650–700 μm in diameter. Primary fibres near surface conules slightly cored with spicules. Primary fibres at base of sponge cored with large sands, 150–300 μm in diameter, and small sands, below 50 μm in diameter. In secondary fibres, net-like secondary web in conules, 650 μm in diameter, loosely arranged, and simple bridged secondary fibres, 250–350 μm in diameter, with root-like extensions. Filaments, 3–5 μm in diameter, terminal knobs, 10 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 17.viii.2015.

REMARKS: This species is distinguished from other *Ircinia* species by primary fibres at base of sponge cored with large and small sands (Fig. 17F).

14. *Ircinia lacuna* Sim, Lee and Kim, 2017 (Fig. 18)

Gu-meong-ga-neun-sil-hae-myeon (구멍가는실해면)

Ircinia lacuna Sim et al., 2017b, p. 101, fig. 8.

Description. Thick encrusting, massive sponge, size up to $9 \times 6 \times 4$ cm. Surface with low conules. Large oscules, 1–5 mm in diameter, opened on sponge surface. Color in life beige. Texture, firm and compressible.

Skeleton: Primary fibres cored with sands, 200 μm in diameter. Most primary fibres in choanosome no

cored with sands, and not easily to separatable from secondary fibres (Fig. 18E). Bridged type secondary fibres, 70 μm in diameter. Secondary web with numerous large spaces between adjacent primary fibres. Filaments, 5–7 μm in diameter, with terminal knob, 10–13 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea (Jejudo Island).

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 17.viii.2015.

15. *Ircinia lapillus* Sim, Lee and Kim, 2016 (Fig. 19)

Jo-yak-dol-ga-neun-sil-hae-myeon (조약돌가는실해면)

Ircinia lapillus Sim et al., 2016b, pp. 484–486, fig. 5.

Description. Thick irregular mass sponge, size up to $8 \times 8 \times 3.5$ cm. Surface, covered with filamentous membrane. Conules round, but sharply branched on side of sponge. Oscules, 3 mm in diameter, opened on top of sponge. Color in life yellowish brown. Texture soft and compressible.

Skeleton: Primary fibres, 200–400 μm in diameter, cored with very large sands, and have loose fascicles. Two types of secondary fibres, secondary web, with large perforations, 800–1,100 μm in diameter, and branch type, 250–400 μm in diameter. Filaments, 5–8 μm in diameter, terminal knobs, 15 μm in diameter.

HABITAT: Depth of 25 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Munseom, 15.viii.2015.

16. *Ircinia munsumensis* Sim, Lee and Kim, 2016 (Fig. 20)

Mun-seom-ga-neun-sil-hae-myeon (문섬가는실해면)

Ircinia munsumensis Sim et al., 2016b, pp. 487, 488, figs. 7, 8.

Description. Thick mass sponge, size up to $7 \times 7 \times 5$ cm. Surface with low round conules covered with thick collagenous membrane. Membrane not easily separatable from sponge body. Large holes located on top of sponge. Several oscules, 1–5 mm in diameter, opened on sponge surface. Color in life pinkish brown.

Texture elastic and compressible.

Skeleton: Primary fibres, 200–400 µm in diameter, cored with sand and broken spicules near surface, but uncored in some parts of sponge. Choanosomal primary fibres cored irregularly with foreign debris. Two kinds of secondary fibres near surface, irregularly arranged secondary fibres, 700–1000 µm in diameter, and very simply fasciculated branched secondary fibres, 150–400 µm in diameter. Choanosomal secondary fibres very thick. Filaments, two categories in size, 4 and 8 µm in diameter, terminal knobs, 10–15 µm in diameter.

HABITAT: Depth of 25 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Munseom, 15.viii.2015.

17. *Ircinia mureungensis* Sim, Lee and Kim, 2016 (Fig. 21)

Mu-reung-ga-neun-sil-hae-myeon (무릉가는실해면)

Ircinia mureungensis Sim et al., 2016b, pp. 491, 492, fig. 11.

Description. Large irregular mass sponge, size up to 21 × 20 × 8 cm. Surface with very low branched conules, covered with thin filamentous membrane which mixed with spicules. Oscules, 3–8 mm in diameter, spread all over sponge surface. Color in life dirty gray. Texture very soft and compressible. Sponge unstable with flexible nature. Choanosome lacunose.

Skeleton: Primary fibres, 150–300 µm in diameter, usually slightly cored. Primary fibres at the end of conules, 800 µm in diameter. Two types of secondary fibres, secondary mesh net, 500–1,500 µm in diameter, loosely arranged, and simple bridged types rare, 250–350 µm in diameter. Filaments, 5 µm in diameter, terminal knobs, 12–15 µm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 17.viii.2015.

REMARKS: This species easily changed in shape because of very flabby texture. Primary fibres slightly cored with foreign materials.

18. *Ircinia radicula* Sim, Lee and Kim, 2017 (Fig. 22)

Bang-sa-ga-neun-sil-hae-myeon (방사가는실해면)

Ircinia radicula Sim et al., 2017a, pp. 107, 109, fig. 11.

Description. Thick mass sponge, size up to $7 \times 7 \times 9$ cm. Surface with filamentous membrane, distinct conules, and sand patch but not sand crust. Oscules, 3–5 mm in diameter, opened at protruding mammilated conules. Color in life dark grey. Texture, firm and compressible.

Skeleton: Primary fibres fascicles, over 1,000 μm in diameter, very complex massive fibres that radially arranged. Primary fibres of near surface with sand patches. Secondary fibres irregular branch type like roots, and wide fibres like plates, 200–450 μm in diameter (Fig. 22H), bridged secondary fibres, 100 μm in diameter. Filaments, 5–7 μm in diameter, terminal knobs, 10–15 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Shinan-gun, Gageodo, Duokyeo, 20.vii.2007.

REMARKS: This species sparsely covered with sands over sponge surface. Massive primary fibres very complex, and radially arranged with sand patches near surface conules (Fig. 22D).

19. *Ircinia tunica* Sim, Lee and Kim, 2017 (Fig. 23)

Meong-ge-ga-neun-sil-hae-myeon (멍게가는실해면)

Ircinia tunica Sim et al., 2017a, p. 101, fig. 9.

Description. Thick round massive sponge, size up to $14 \times 12 \times 4$ cm. Surface with indistinct conules, almost covered with colonial tunicates, and thick collagenous filamentous membrane. Oscules, rare, 5 mm in diameter. Color in life grayish beige. Texture, very soft and compressible.

Skeleton: Cylindrical primary fibres, 200–400 μm in diameter. Secondary fibres, 70–500 μm in diameter, branch type and fascicles. Filaments, 3–7 μm in diameter, terminal knobs, 10 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 17.viii.2015.

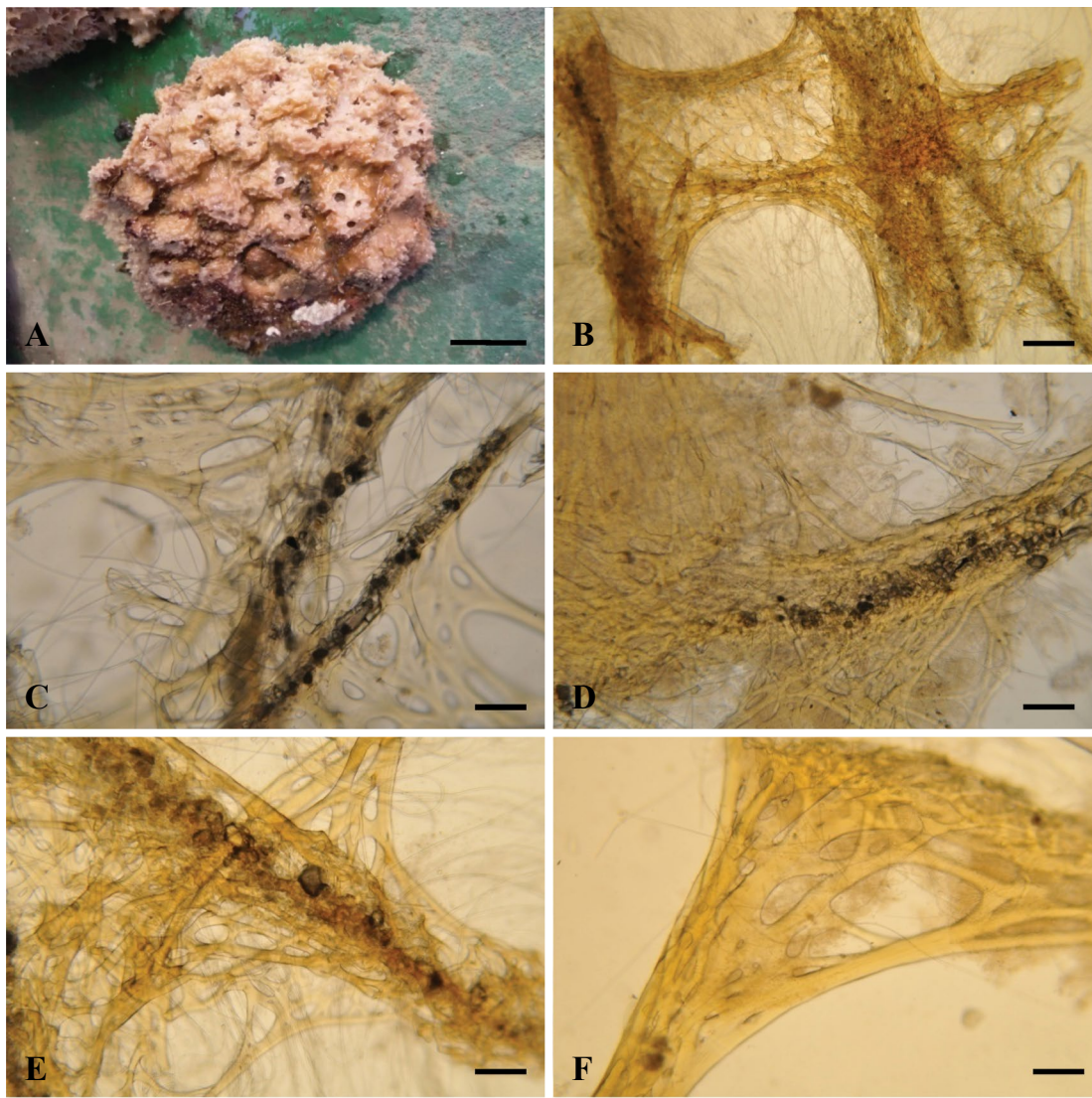


Fig. 11. *Ircinia bakusi* Sim, Lee and Kim. A. external morphology; B. subdermal skeletal structure; C. cored primary fibres near surface; D. choanosome skeletal structure; E. primary and secondary fibres; F. branched secondary fibres. Scale bars: A = 3 cm, B = 200 μ m, C–F = 100 μ m.

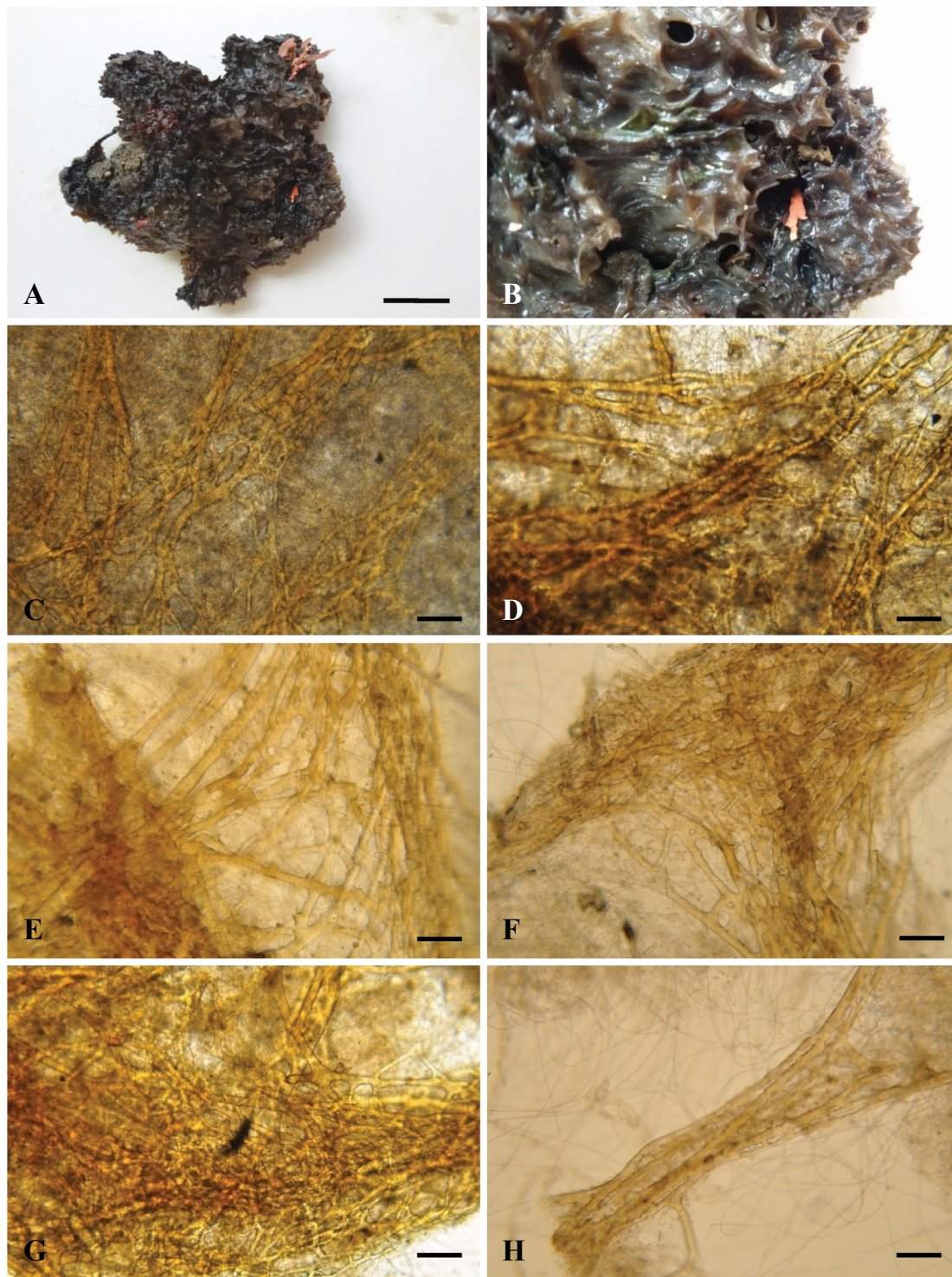


Fig. 12. *Ircinia bergquistia* Sim, Lee and Kim. A. external morphology; B. surface close up; C, D. surface membrane with fibres; E, F. skeletal structure near surface; G. primary fibres; H. branched secondary fibres. Scale bars: A = 2 cm, C-H = 100 μ m.

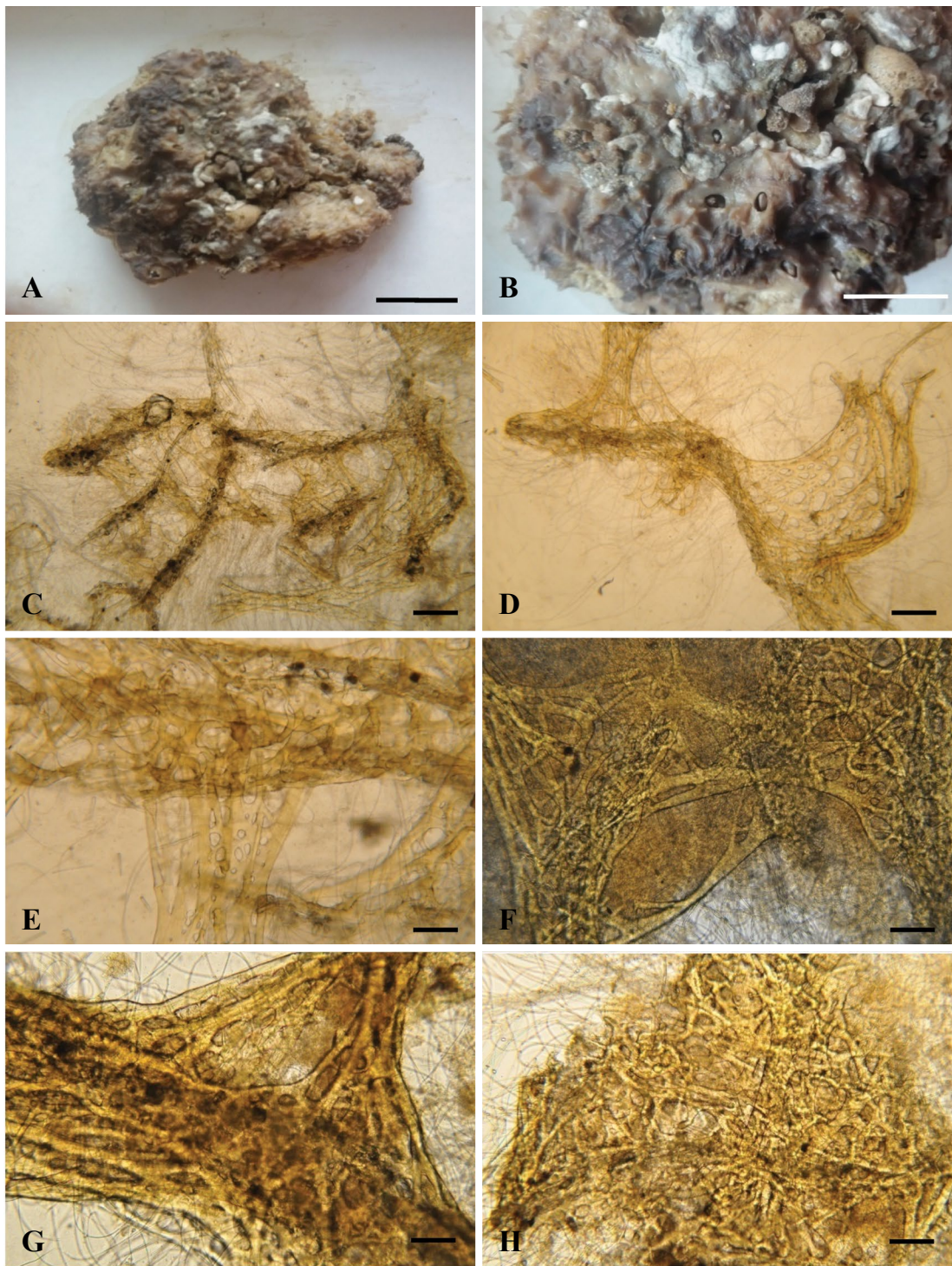


Fig. 13. *Ircinia canus* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure at surface conules; D. subdermal skeletal structure; E. secondary fibres network; F, G. primary and secondary fibres; H. fibres with surface membrane. Scale bars: A = 2 cm, B = 1 cm, C, D = 200 μ m, E–H = 100 μ m.

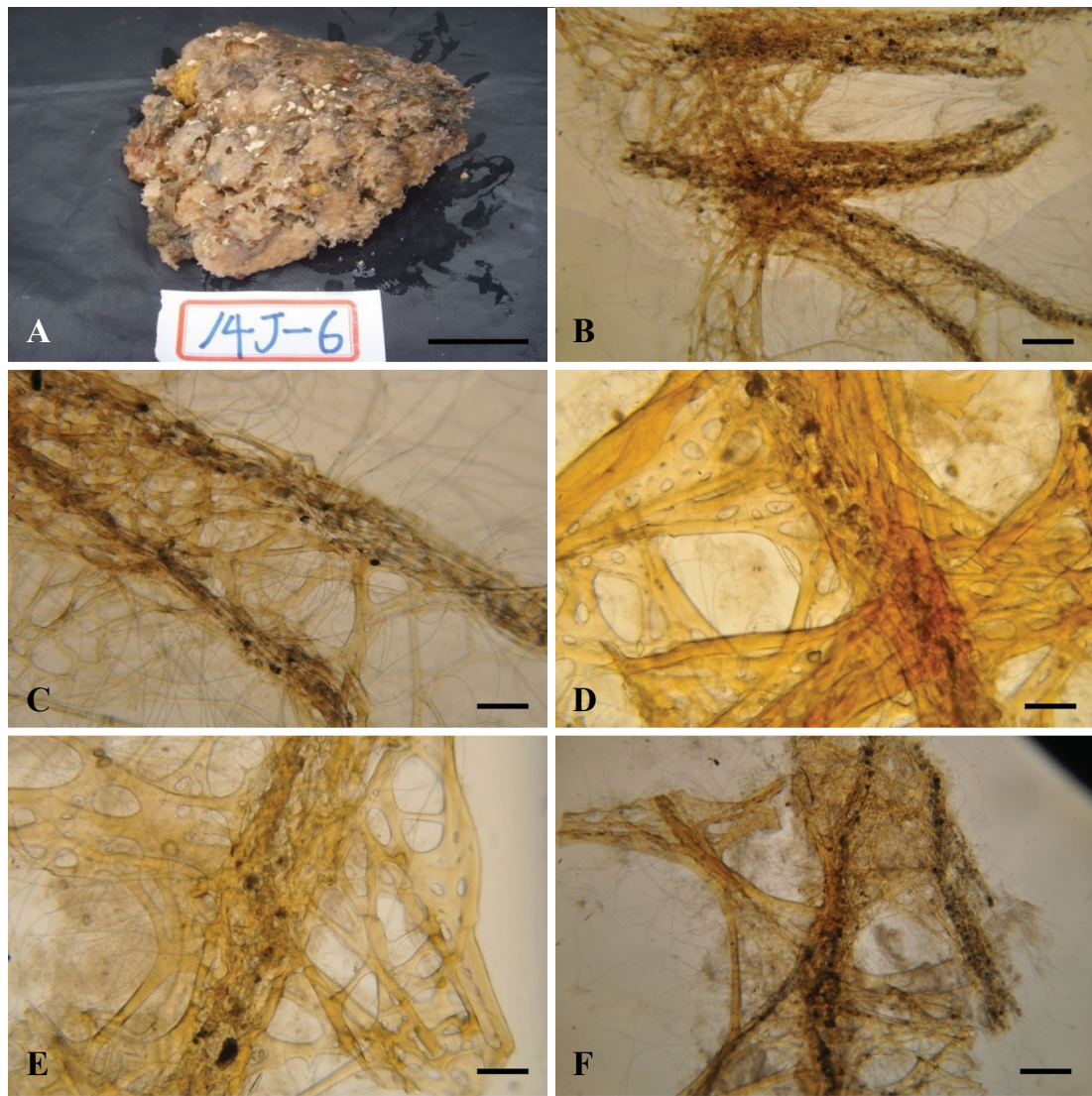


Fig. 14. *Ircinia gapaensis* Sim, Lee and Kim. A. external morphology; B, C. skeletal structure at surface conules; D–F. subdermal skeletal structure. Scale bars: A = 2 cm, B, F = 200 μ m, C–E = 100 μ m.

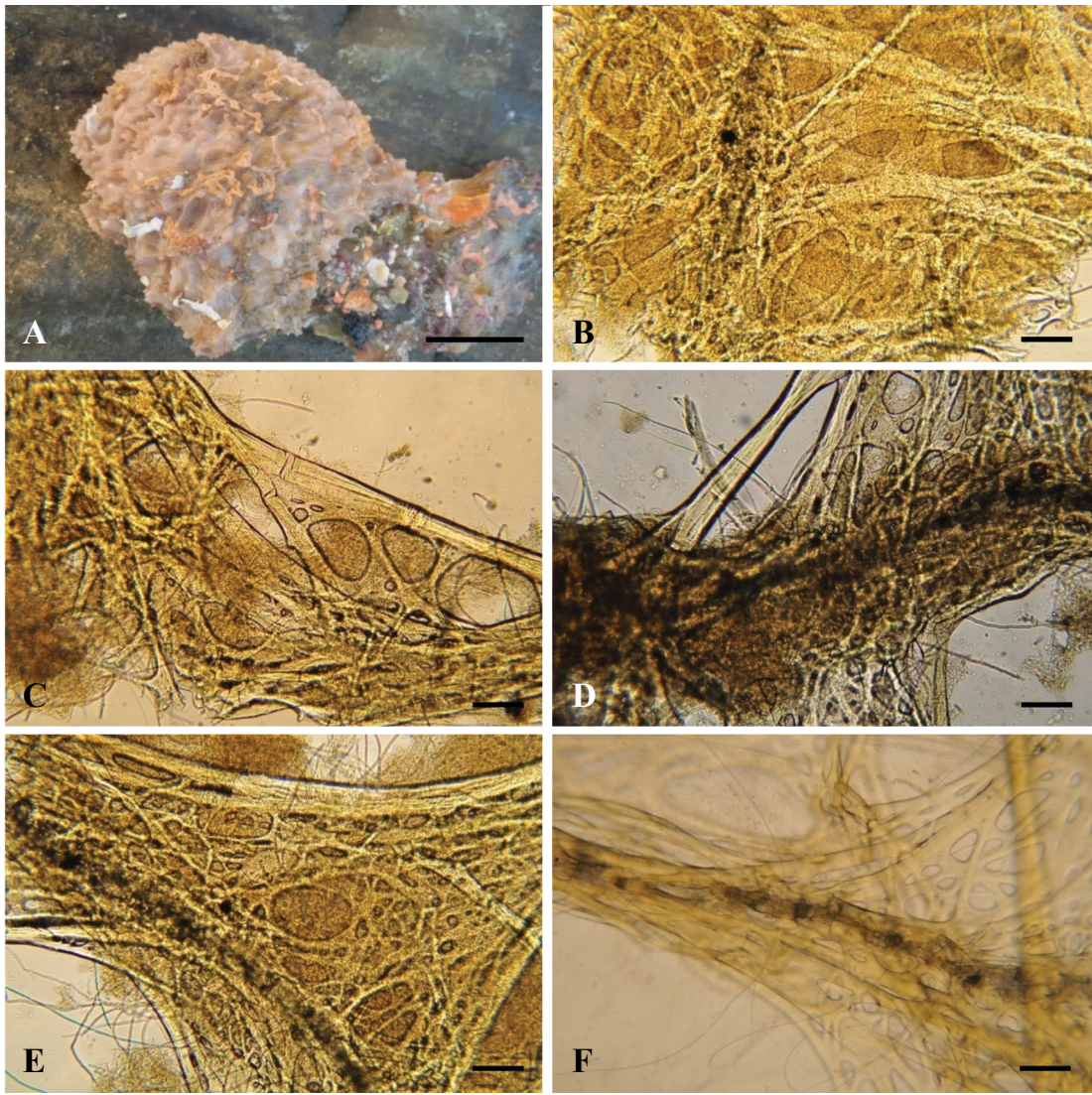


Fig. 15. *Ircinia globulosa* Sim, Lee and Kim. A. external morphology; B. surface skeletal structure; C. perforated secondary fibres; D, E. cored primary fibres and secondary web; F. choanosome skeletal structure. Scale bars: A = 2 cm, B = 200 μ m, C–F = 100 μ m.

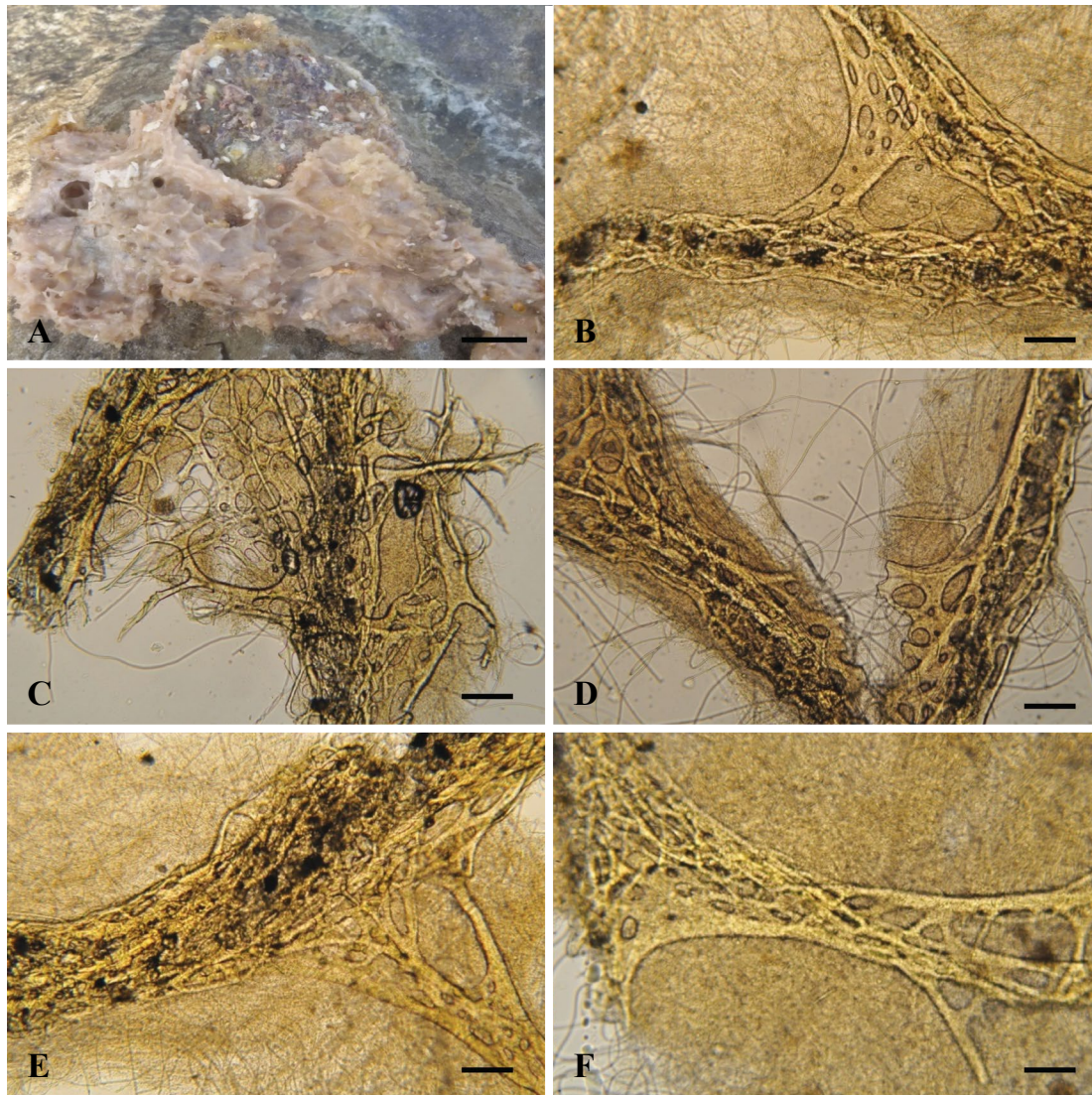


Fig. 16. *Ircinia incrustans* Sim, Lee and Kim. A. external morphology; B. filamentous membrane with surface skeletal structure; C. skeletal structure at conules; D. uncured primary fibres; E. light cored primary fibres; F. bridged secondary fibres. Scale bars: A = 2 cm, B-F = 100 µm.

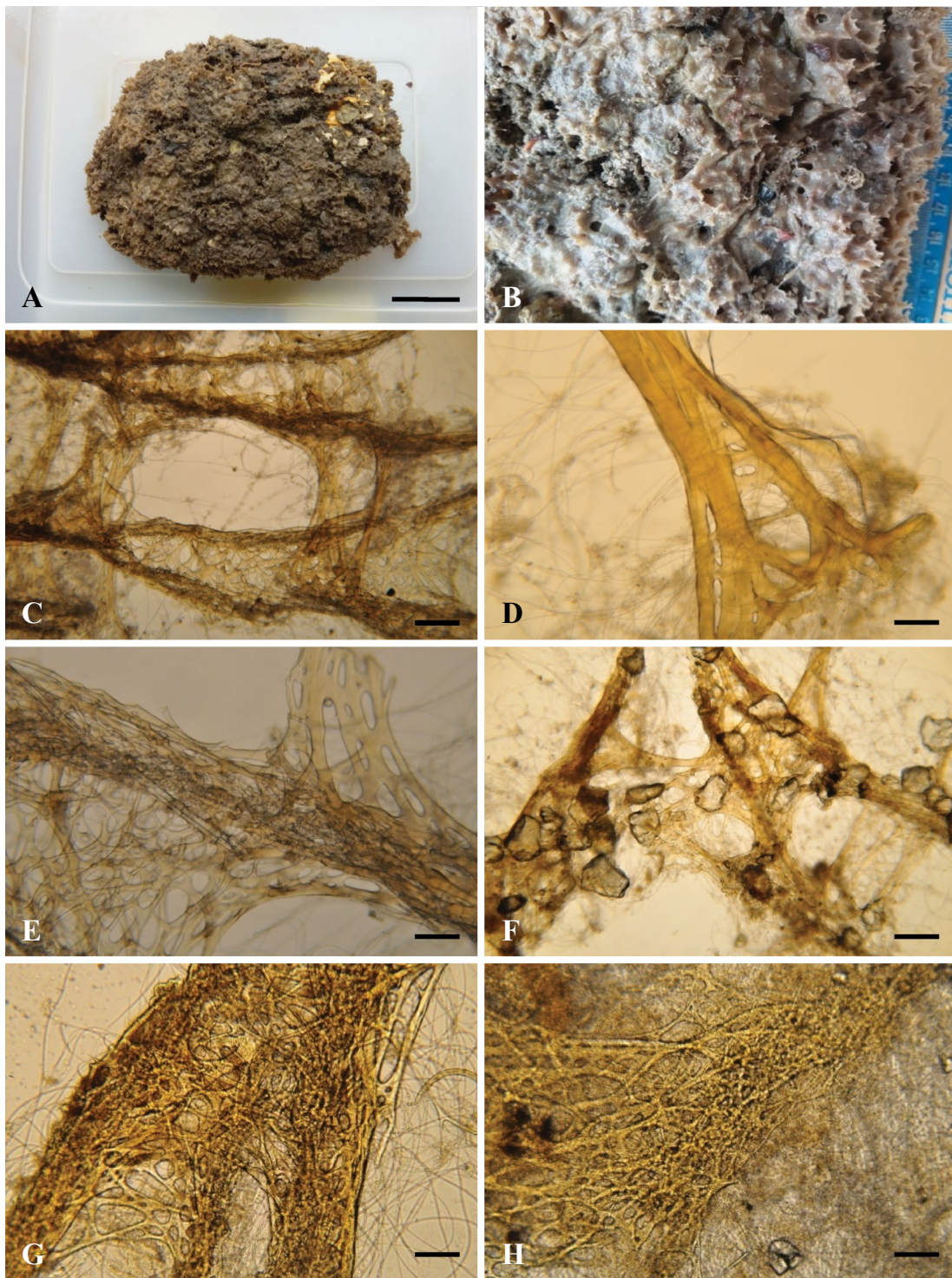


Fig. 17. *Ircinia jejuensis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure near surface; D. basal part of secondary fibre branch; E. uncored primary fibres and secondary fibres; F. primary fibres cored with large and small sands at base of sponge; G. primary and secondary fibres at surface membrane; H. primary fibres at conules. Scale bars: A = 4 cm, C = 200 μ m, D–F = 100 μ m.

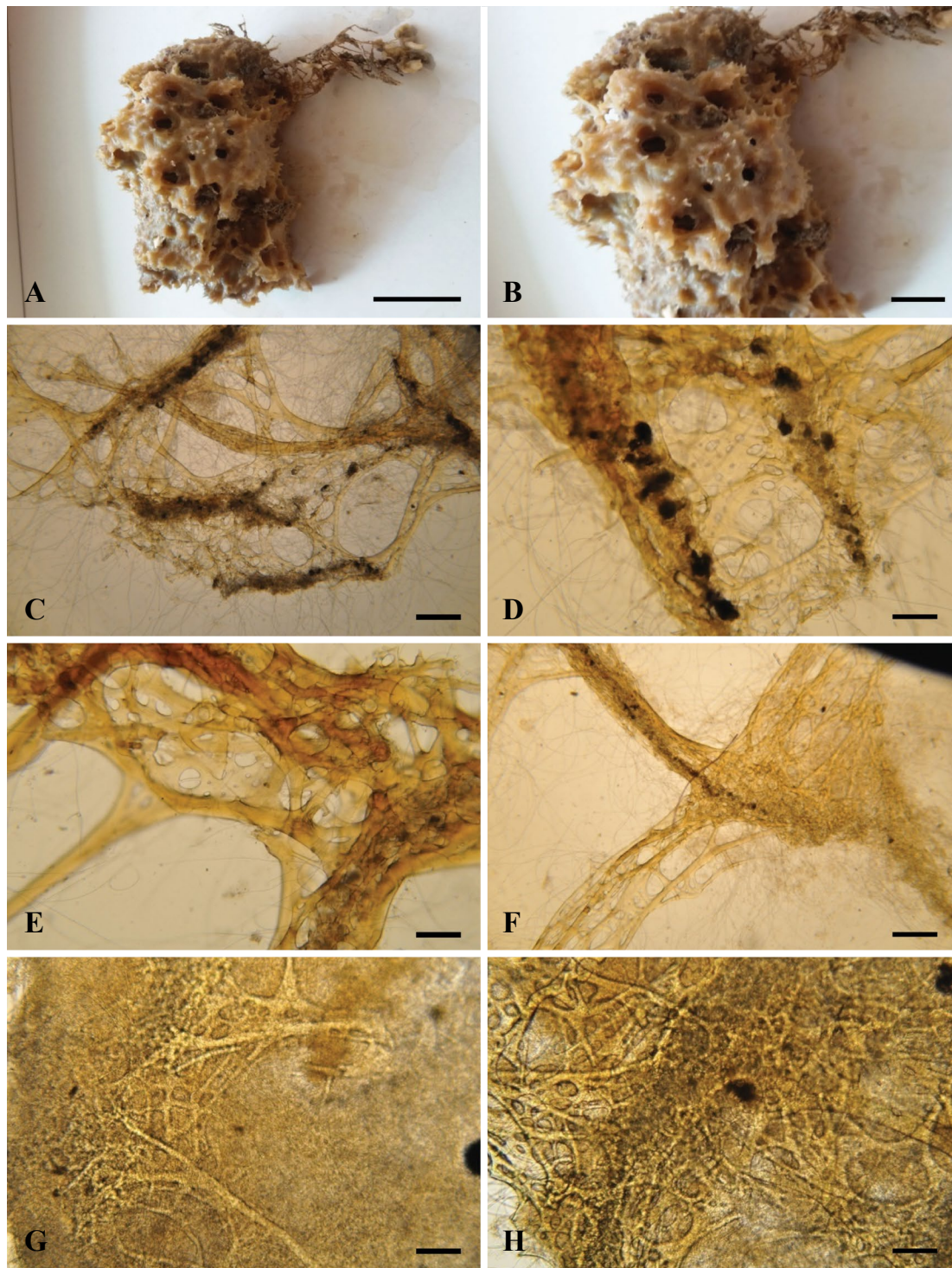


Fig. 18. *Ircinia lacuna* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. cored primary fibres near surface; E. uncored primary fibres; F. secondary web; G, H. fibres with surface membrane. Scale bars: A = 4 cm, B = 1 cm, C = 200 μ m, D–H = 100 μ m.

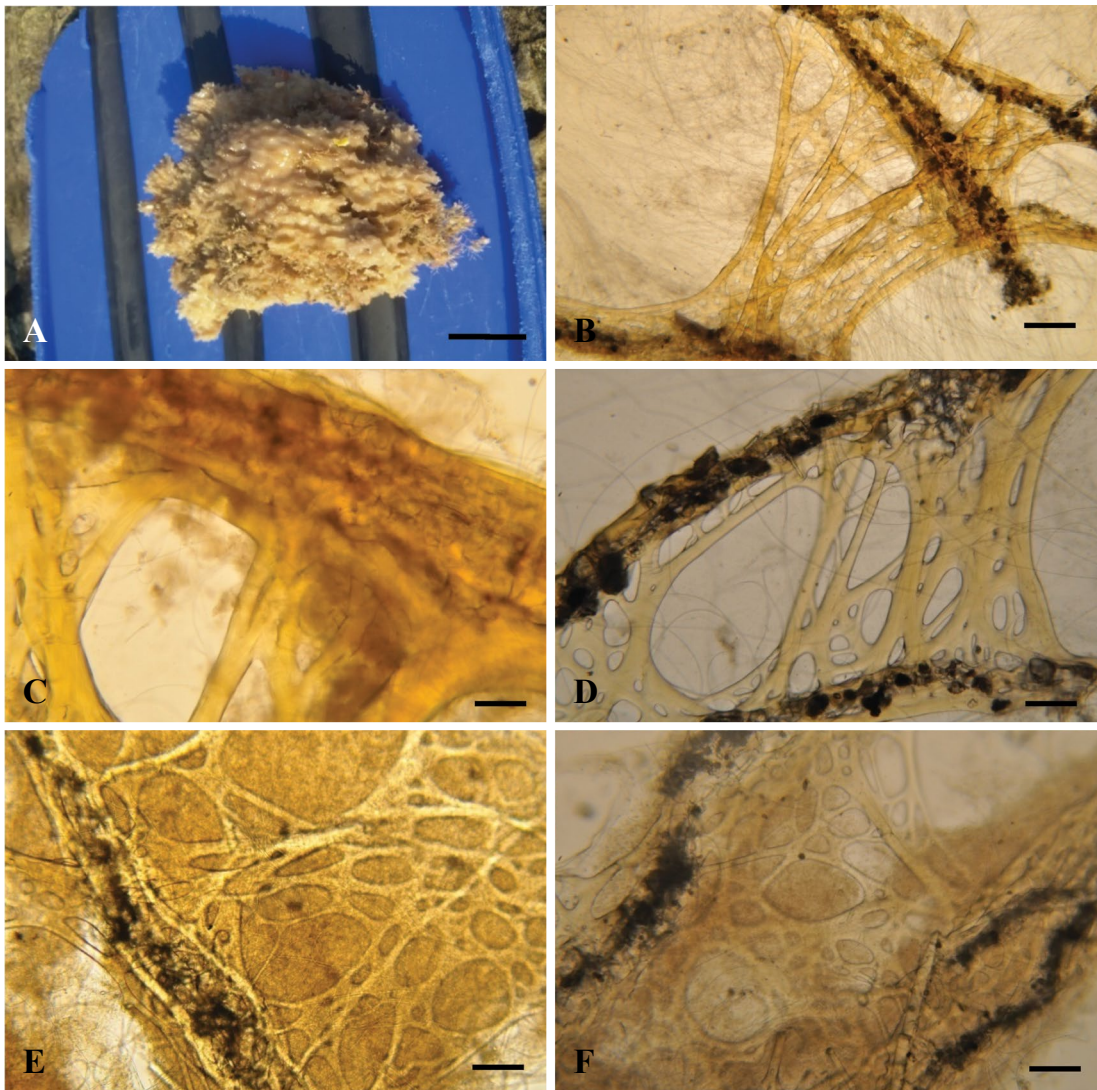


Fig. 19. *Ircinia lapillus* Sim, Lee and Kim. A. external morphology; B. skeletal structure at conules; C. choanosome thick skeletal structure; D. cored primary and secondary web; E. skeletal structure with membrane; F. skeletal structure near surface. Scale bars: A = 2 cm, B = 200 μm , C–F = 100 μm .

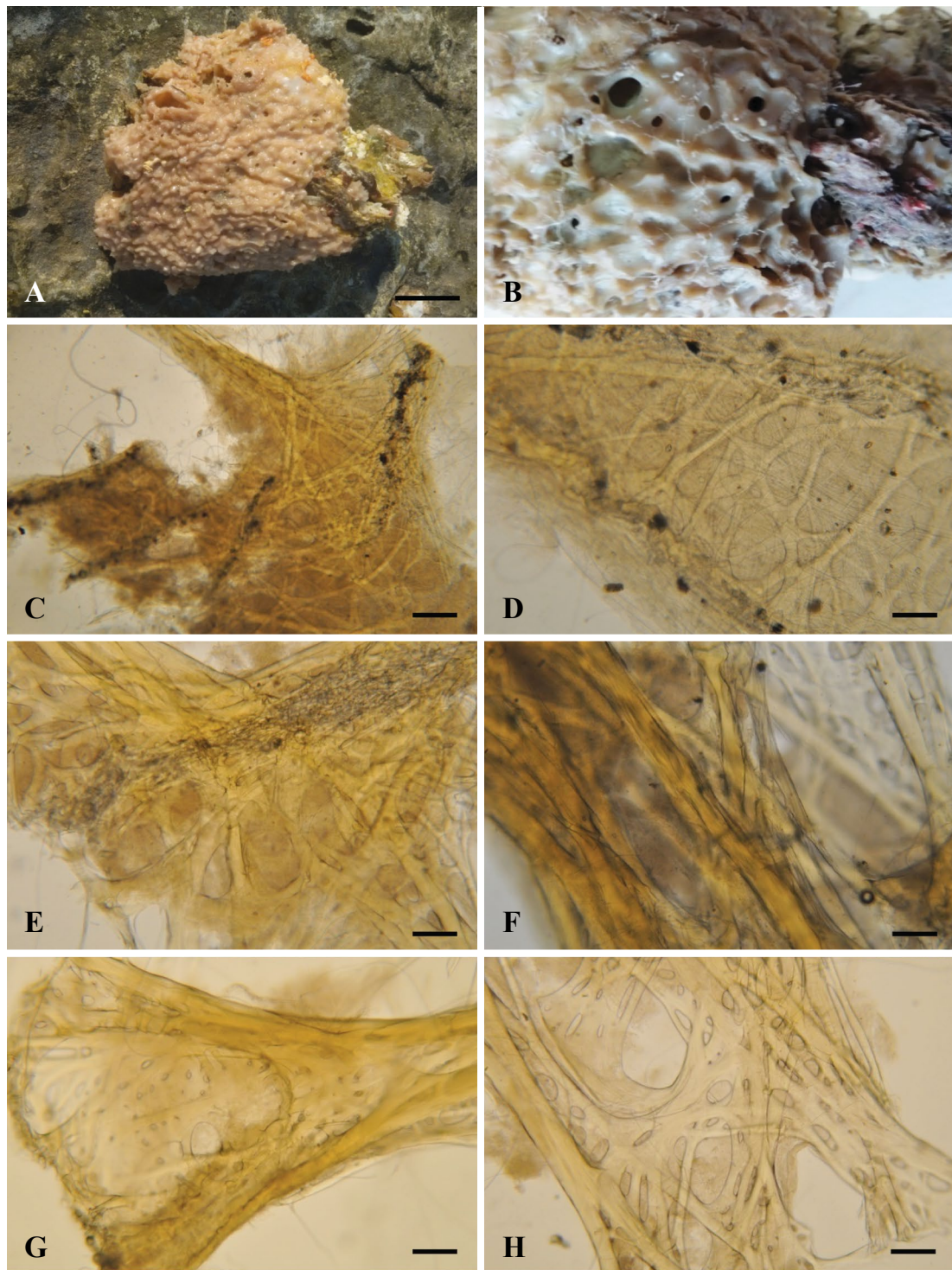


Fig. 20. *Ircinia munsumensis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure near surface; D. secondary web between cored primary fibres; E. choanosome skeletal structure; F. choanosome thick secondary fibres; G. branched secondary fibres; H. secondary web. Scale bars: A = 2 cm, C = 200 μ m, D–H = 100 μ m.

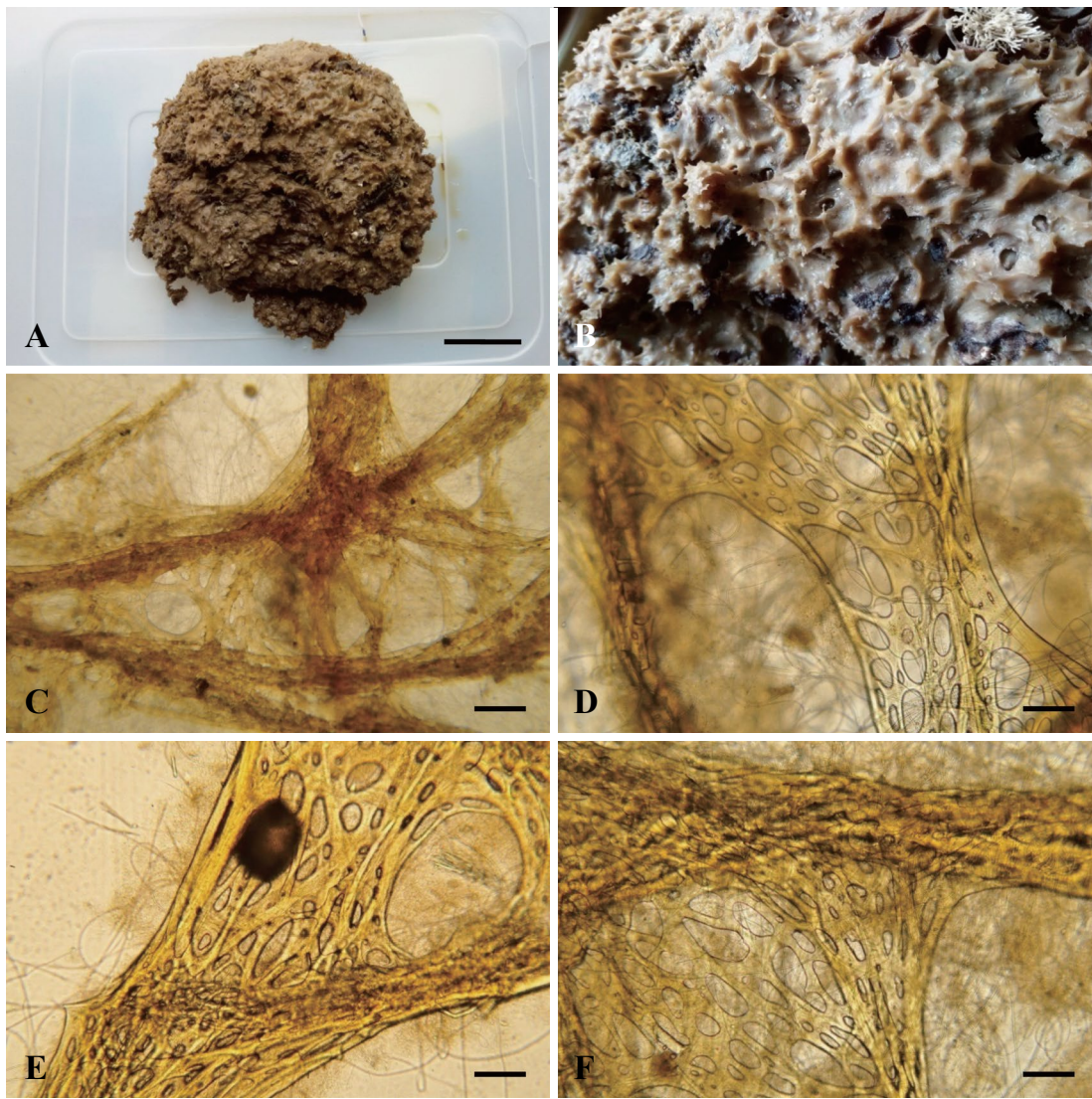


Fig. 21. *Ircinia mureungensis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. subdermal skeletal structure; D. secondary web with membrane; E, F. skeletal structure. Scale bars: A = 6 cm, C = 200 μm , D–F = 100 μm .

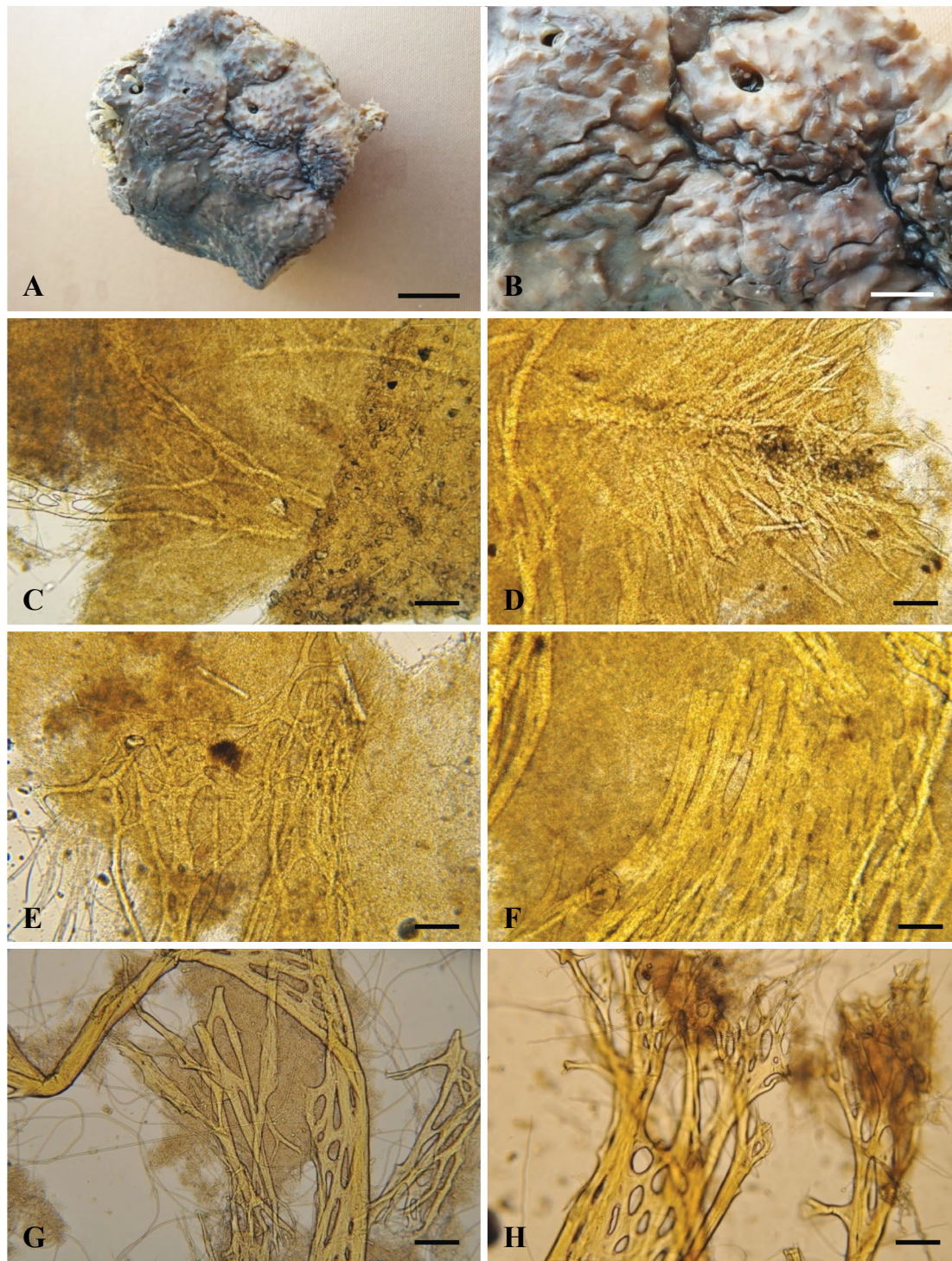


Fig. 22. *Ircinia radicula* Sim, Lee and Kim. A. external morphology; B. surface close up; C. fibres with mixed sands surface membrane; D. massive primary fibres complex; E. fibres with surface membrane; F. thick primary fibres; G, H. no cored root-like secondary fibres. Scale bars: A = 3 cm, B = 1 cm, C-H = 100 μ m.

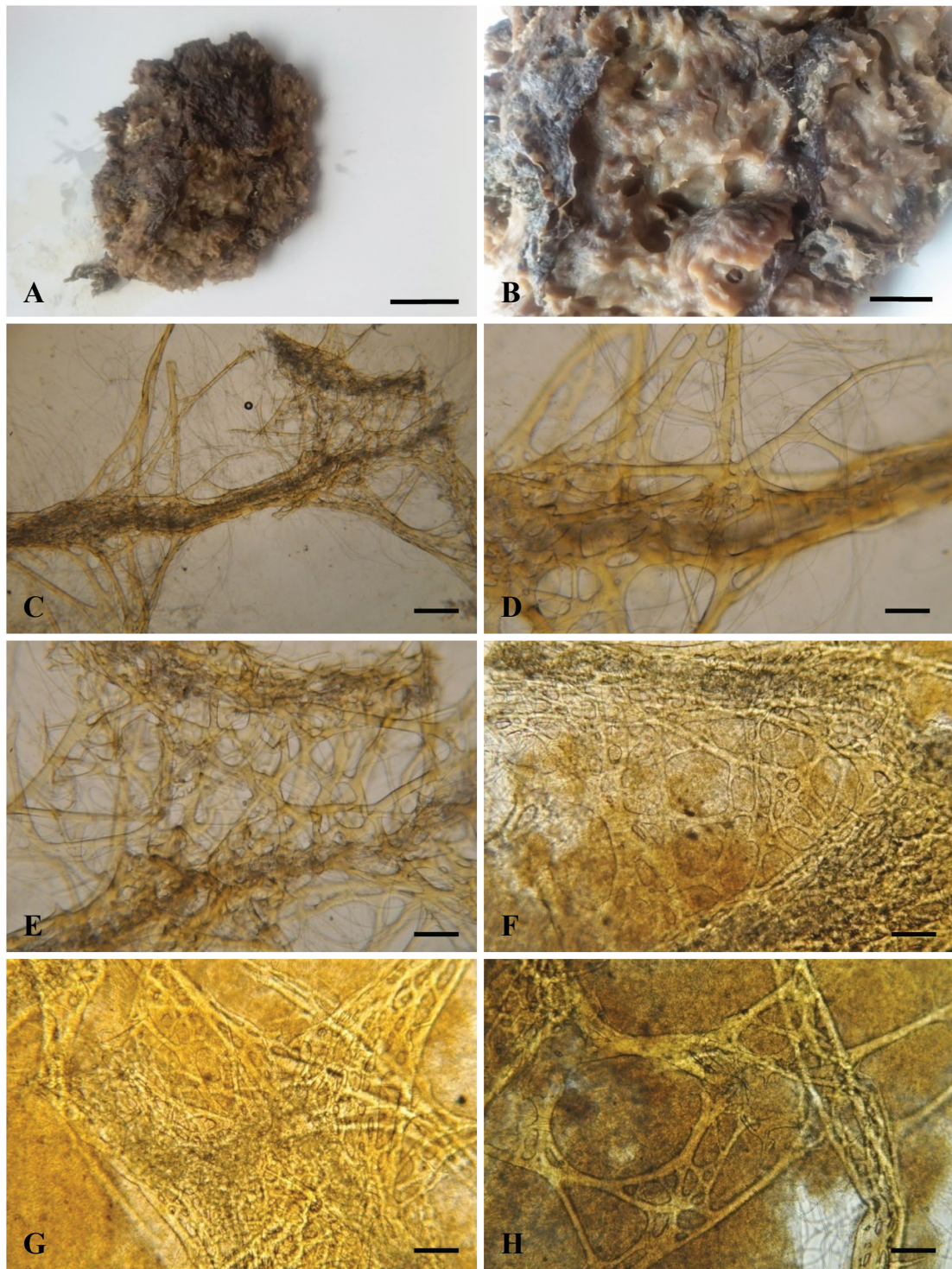


Fig. 23. *Ircinia tunica* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. uncured primary fibres; E, F. secondary fibres network between primary fibres; G, H. fibres with surface membrane. Scale bars: A = 3 cm, B = 1 cm, C = 200 μ m, D-H = 100 μ m.

Genus *Psammocinia* Lendenfeld, 1889

Mo-rae-hae-myeon-sok (모래해면속)

Species of genus *Psammocinia* incorporate a large quantity of sands in fibres, matrix, and also as a thick superficial cortex. Many of the sand grains in the fibres are very large, coated individually with spongin, and linked to the skeletal fibres by spongin strands. Fibres only weakly fasciculated, and are often almost obscured by accumulation of sands.

Type species: *Hircinia halmiformis* Lendenfeld, 1888.

SPECIES 33 (21 in Korea).

Key to the species of Korean *Psammocinia* (Characters are illustrated by Figs. 24–41)

1. Fibres cored with mostly large sands or mixed several sized sands.....2
 - Fibres cored with very small sands or rarely covered with sands9
2. Surface sand crust mixed with large sands*P. morum*
 - Surface sand crust mixed with small sands3
3. Primary and secondary fibres not distinct*P. scopulus*
 - Primary and secondary fibres distinct4
4. All fibres cored with sands5
 - Primary fibres mostly cored6
5. Mostly large sand cored.....*P. mosulpia*
 - Mostly small sand cored.....*P. vermis*
6. Secondary fibres mostly bridge type*P. lobatus*
 - Secondary fibres mostly web type or mixed7
7. Surface conules low and distinct*P. ulleungensis*
 - Surface conules not distinct.....8
8. Sponge color red with granulated filament.....*P. rubra*
 - Sponge greenish yellow color with thick plate-like secondary fibres.....*P. samyangensis*
9. All fibres cored with sands10
 - Primary fibres cored with sands and secondary fibres clear13
10. Sponge surface with sharp and distinct conules11
 - Sponge surface with low round conules19
11. Secondary fibres wide plate-like*P. aspera*
 - Secondary fibres thin web type12
12. Mostly middle sized sandscored and parm shape.....*P. palma*

- Mostly numerous small sized sands cored and round mass shape *P. wandoensis*
- 13. Secondary fibres web and bridge type *P. conulosa*
 - Secondary fibres plate-like shape or mixed shape 14
- 14. Plate-like shape secondary fibres 15
 - Mixed shape secondary fibres 16
- 15. Thick plate shape with small perforation *P. bergquistae*
 - Plate shape with large perforation *P. rana*
- 16. Surface smooth 17
 - Surface rough with numerous large shells *P. jejuensis*
- 17. Primary fibres not distinct from secondary fibres *P. mammiformis*
 - Primary fibres distinct from secondary fibres 18
- 18. Wide thick plate of secondary fibres *P. massa*
 - Wide bridge type of secondary fibres *P. gageoensis*
- 19. Skeleton arranged irregularly *P. hwasunensis*
 - Skeleton arranged regularly 20
- 20. Sponge surface with numerous holes *P. foraminis*
 - Sponge surface without hole *P. chupoensis*

20. *Psammocinia aspera* Sim, Lee and Kim, 2017 (Fig. 24)

Geo-chin-mo-rae-hae-myeon (거친모래해면)

Psammocinia aspera Sim et al., 2017a, pp. 95, 98, fig. 4.

Description. Massive sponge with sharp lobate, size up to 10×5×7 cm. Surface with sharp conules, rough, and covered with thick sand crust, 0.1–0.5 mm in thickness. Oscules, rare, 1–3 mm in diameter. Color, light brown in life. Texture, firm and compressible.

Skeleton: Primary fibres, 200–400 µm in diameter, cored with small sized sands. Secondary fibres as two types, branch type, 70–120 µm in diameter, and clear or cored wide web type, 100–400–800 µm in diameter. Filaments, 3–5 µm in diameter, terminal knobs, 3–15 µm in diameter (Fig. 24D, G).

HABITAT: Depth of 25–30 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Hwasun harbor, 30.ix.2014.

21. *Psammocinia bergquistae* Sim and Lee, 2001 (Fig. 25)

Ber-qui-s-t-mo-rae-hae-myeon (버퀴스트모래해면)

Psammocinia bergquistae Sim and Lee, 2001c, pp. 246–249, fig. 1.

Description. Small upright specimen like thumb, size up to $3.0 \times 2.5 \times 5.0$ cm. Surface smooth and covered with low conules evenly. Sand crust mixed with many small sands, 10–60 μm in diameter. Oscules, 1–1.5 mm in diameter, irregularly scattered on surface. Color in life upper surface, brownish-black, under beige and endosome, yellowish-white. Texture elastic, compressible and difficult to tear apart.

Skeleton: Primary fibres, 130–350 μm in diameter, cored with small sands and spicule fragments, and show some fasciculation near sponge surface. Secondary fibres, 70–300 μm in diameter, uncored. Sometimes, secondary fibres established wide secondary web, which looks like plastic plate (Fig. 25B, D), with up to 500 μm in diameter wide. Filaments, 3–7 μm in diameter, occur densely throughout sponge surface and emerge from holes in fibres. Others end of filament has rounded end, 10–15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Gageodo, 15.viii.1999.

REMARKS: This species is distinct from all other known species of genus *Psammocinia* for wide secondary web. Sometimes plastic-like fibres are with rare perforations (Fig. 25D).

22. *Psammocinia chupoensis* (Sim, Lee and Kim, 2017) (Fig. 26)

Chu-po-mo-rae-hae-myeon (추포모래해면)

Ircinia chupoensis Sim et al., 2017a, pp. 101, 106, fig. 10.

Description. Large massive sponge, size up to $10 \times 9 \times 6$ cm, divided to several parts at top of sponge. Surface with loose sands. Oscules, 1.5–2 mm in diameter, opened on top of sponge. Color in life, surface dark gray, beige inside. Texture, hard and incompressible.

Skeleton: Primary fibres, 200–300 μm in diameter, cored with dense small sized sands. Secondary fibres, 80–100 μm in diameter, almost clear but rarely cored with sands, and mostly thin wide web type (Fig. 26D). Filaments, 5 μm in diameter, terminal knobs, 10 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Jeju-si, Chupodo, 22.viii.2002.

REMARKS: *Psammocinia chupoensis* was previously identified in genus *Ircinia* (Sim et al., 2017) due to the skeletal structure, but *P. chupoensis* has sand cored primary and secondary fibres throughout the sponge whereas secondary fibres of genus *Ircinia* are mostly not cored with sand.

23. *Psammocinia conulosa* Lee and Sim, 2004 (Fig. 27)

Co-nul-lo-sa-mo-rae-hae-myeon (코놀로사모래해면)

Psammocinia conulosa Lee and Sim 2004b, pp. 139–141, figs. 1, 2.

Description. Hemispherical shape mass sponge, size up to $7 \times 7 \times 5$ cm. Upper surface with evenly distributed low and dull conules, while side conules ended sharply. Filamentous membrane armoured with many sands, $10\text{--}60\ \mu\text{m}$ in diameter, and mixed with spicules. Oscules, $2\text{--}6$ mm in diameter, irregularly scattered on upper surface. Color in alcohol grayish-white to cream. Texture elastic, tough and difficult to tear apart.

Skeleton: Primary fibres axially to fully cored with small sands, $10\text{--}70\ \mu\text{m}$ in diameter, and secondary fibres uncored or lightly cored with small sands. Primary fibres, $90\text{--}200\text{--}230\ \mu\text{m}$ in diameter, weakly fasciculated. Secondary fibres, $40\text{--}70\text{--}140\ \mu\text{m}$ in diameter, thin bridge type or web type. Filaments, $5\text{--}6\ \mu\text{m}$ in diameter, terminal knobs, $10\text{--}12.5\ \mu\text{m}$ in diameter, emerge from holes in secondary fibres.

HABITAT: fishing-net.

DISTRIBUTION: Korea.

KOREA: GN.

SPECIMEN EXAMINED: Korea. GN: Namheon-kun, Namheondo, 20.vii.1967.

REMARKS: The whole sponge surface is very finely conulose and distinct oscules open on top of sponge.

24. *Psammocinia foraminis* Sim, Lee and Kim, 2017 (Fig. 28)

Yu-gong-mo-rae-hae-myeon (유공모래해면)

Psammocinia foraminis Sim et al., 2017a, pp. 101, 102, fig. 6.

Description. Thick plate-like massive sponge, size up to $17 \times 8 \times 4.5$ cm. Surface, smooth with round low

conules. Sands crusted at surface, 0.5–1 mm in thickness. Many hole-like oscules, 3–6 mm in diameter, spread over sponge surface. Many ophiuroidean species (Echinodermata) found in holes of sponge body. Color in life, black, white inside. Texture, firm and slightly compressible.

Skeleton: Regular arrangement of skeletal structure. Longitudinal primary fibres, 150–250 µm in diameter, densely arranged and cored with sands, Thick primary fibres, 300–500 µm in diameter, distributed at base of sponge. Two types of secondary fibres, branch type, 50–120 µm in diameter, and the other web pattern, 600–1,200 µm wide. Loosely spreaded secondary fibres, mostly branch type, almost clear (Fig. 28E, H). Occasionally, secondary fibres have large sized sands, 180–300 µm in diameter. Filament, 4–7 µm in diameter, terminal knobs, 8–10 µm in diameter.

HABITAT: Depth of 25–30 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Hwasun harbor, 30.ix.2014.

REMARKS: This species characterized by numerous holes on sponge surface with many ophiuroidean species living in the holes.

25. *Psammocinia gageoensis* Sim and Lee, 2001 (Fig. 29)

Ga-geo-mo-rae-hae-myeon (가거모래해면)

Psammocinia gageoensis Sim and Lee, 2001c, p. 249, fig. 2.

Description. Cushion shape massive sponge, size up to 11.5 × 4.7 × 5.7 cm. Surface smooth and covered with low and dull conules. Most of conules, gathered closely together. Sand crust mixed with many small sands and spicules (10–90 µm in diameter). Oscules, 1–2.5 mm in diameter, scattered on surface, large oscules opened on top of sponge. Color in life dark brown and endosome ivory. Texture elastic, compressible and difficult to tear apart.

Skeleton: Primary fibres heavily fasciculated, cored rarely with small sands and spicules, 400–600 µm in diameter, and somewhat not cored with debris near conules. Secondary fibres uncored with many branches connected to each other, 20–60–100 µm in diameter. Sometimes, secondary fibres forming broad plates between adjacent primary fibres. Dense filaments, 3–6 µm in diameter, distributed throughout sponge and emerge from holes in fibres. Others end of filament has rounded end. Terminal knobs, 10–15 µm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Gageodo, 25.vii.2000.

26. *Psammocinia hwasunensis* Sim, Lee and Kim, 2017 (Fig. 30)

Hwa-sun-mo-rae-hae-myeon (화순모래해면)

Psammocinia hwasunensis Sim et al., 2017a, p. 95, fig. 3.

Description. Thick encrusting, mass sponge with several lobates, size up to $6 \times 5 \times 3$ cm. Smooth surface covered by round conules and sand crust, 0.2–0.7 mm in thickness. Oscules, 0.1–0.3 mm in diameter, opened at end of lobate. Color, dark grey in life, changes to black in alcohol, dirty beige inside. Texture, firm and compressible.

Skeleton: Irregular arrangement. Primary fibres, 100–200–300 μ m in diameter, cored with small sand spicules, weak fascicles (Fig. 30F). Secondary fibres cored with debris (Fig. 30D). Secondary fibres two types, branch type, 50–150–200 μ m in diameter, and web type, 600–700 μ m wide. Filaments, 2–5 μ m in diameter, terminal knobs, 10–15 μ m in diameter.

HABITAT: Depth of 25–30 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Hwasun harbor, 30.ix.2014.

27. *Psammocinia jejuensis* Sim, 1998 (Fig. 31)

Je-ju-mo-rae-hae-myeon (제주모래해면)

Psammocinia jejuensis Sim, 1998, p. 38, fig. 3.

Description. Mass sponge, $7.5 \times 6 \times 2.5$ cm, attached to rocky substrate. Surface conules, not distinct and sand crust mixed with many pieces of shell. Several oscules, 1–3 cm in diameter, found on top margin of sponge. Numerous large pieces of shell, 1–5 mm in diameter form inside sponge. Basal and top part of sponge coated with various sizes of shell pieces. Color in alcohol beige brown. Texture, tough and hard like stone.

Skeleton: Primary fibres, irregular network, interlock to make up short fasciculate columns up to 150–470 μ m in diameter across sponge, rarely cored with sands. Secondary fibres also irregularly arranged 40–190 μ m in diameter. In choanosome it contains large sands and pieces of shell supporting sponge instead of fibres. Fil-

aments, 3–9 μm in diameter, terminal knobs, 12–20 μm in diameter.

HABITAT: Depth of 10 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Kimnyong, Seogwipo-si, 15.vii.1991.

REMARKS: Surface and inside of sponge have many large pieces of shell.

28. *Psammocinia lobatus* Sim and Lee, 2002 (Fig. 32)
Ip-mo-rae-hae-myeon (앞모래해면)

Psammocinia lobatus Sim and Lee, 2002a, pp. 53, 54, fig. 1.

Description. Erect, lobate sponge, size up to $9 \times 5.2 \times 16$ cm. Surface covered by sharply ended conules, over most of the body. Sand crust mixed with many small sands and spicules. Oscules, 3–5 mm in diameter, located at top of lobe. Color in life ectosome, dark brownish black, endosome, pale yellowish white. Texture elastic, compressible and difficult to tear apart.

Skeleton: Primary fibres cored with small sized sands, 10–60 μm in diameter. Fascicular primary fibres with multiple diverging and converging tracts within single fibres axis. Secondary fibres uncored, and formed by many connected thin and thick branches, 10–60 μm in diameter. Sometimes secondary fibres with plate form, distinguished from secondary web. Filaments, 2–6 μm in diameter, occur densely throughout sponge and emerge from holes in fibres. Terminal knobs, 12–15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Shinyeo, Gageodo, 25.vii.2000.

29. *Psammocinia mammiiformis* Sim, 1998 (Fig. 33)
Yu-du-mo-rae-hae-myeon (유두모래해면)

Psammocinia mammiiformis Sim, 1998, pp. 36–38, fig. 1.

Description. Spherical mass sponge, with a little lobate, 3×5 cm. Surface covered with mammiiform pro-

tubérance. Oscules, 3 mm in diameter, rare and situated on the summits of lobes. Color in life grayish purple. Texture compressible.

Skeleton: Thin fasciculated primary columns contain sand 140–400 µm in diameter. Uncored secondary fibres, 62–140–550 µm in diameter. In choanosome, stout fasciculated primary fibres mixed with long chain sand, 550–900 µm in diameter. Secondary fibres uncured with debris, 180–750 µm in diameter. Primary fibres only weakly fasciculated and almost obscured by accumulation of sands, 20–60 µm in diameter. Filaments, 3–7 µm in diameter, terminal knobs, 10–17 µm in diameter.

HABITAT: Marine.

DISTRIBUTION: Korea.

KOREA: GN.

SPECIMEN EXAMINED: Korea. GN: Sinan-kun, Manjaedo, 23.viii.1988.

30. *Psammocinia massa* Kim, Lee and Sim, 2018 (Fig. 34)

Deong-eo-ri-mo-rae-hae-myeon (덩어리모래해면)

Psammocinia massa Kim et al., 2018, pp. 342–344, figs. 3, 4.

Description. Large mass with several low mamillate protruding shape, size up to 11 × 9 × 4.5 (height) cm, surface with low conules, somewhat not distinct, thick sand crust mixed with collagen. Oscules, open on top of protruding mamillate, 2–7 mm in diameter. Colour in life, grayish black. Texture, firm and compressible.

Skeleton: Primary fibres with rarely cored sand, 300–600 µm in diameter, partly made of thick lump. Wide plate-like secondary fibres, 100–400 µm in diameter. Choanosome primary fibres thick, but easily breakable, 400 µm in diameter. Secondary fibres very clear, with no cored sand. Filaments, 5–7 µm in diameter, terminal knobs, 15 µm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Jagenganyeo, Gageodo, Heuksan-myeon, Shinan-gun, 19.vii.2007.

31. *Psammocinia morum* Sim, Lee and Kim, 2017 (Fig. 35)

O-di-mo-rae-hae-myeon (오디모래해면)

Psammocinia morum Sim et al., 2017a, p. 95, fig. 2.

Description. Irregularly branched mass sponge, size up to $9 \times 5 \times 2.5$ cm in wide. Surface with distinct round conules. Rough sand crust mixed with spicules, which slightly protruding. Oscules, 0.3–1 mm in diameter, open on sponge surface. Color in life, surface black, and beige inside. Texture, firm and compressible.

Skeleton: Primary fibres, 200–600 μ m in diameter, complicated fascicles, and cored with large and small sands (Fig. 34H). Secondary fibres, 50–150 μ m in diameter, almost clear, branch type or various sizes of web (Fig. 34F, G). Filaments, 2–5 μ m in diameter, terminal knobs, 9–10 μ m in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: GB.

SPECIMEN EXAMINED: Korea. GB: Dodong-ri, Ulleung-eup, Ulleung-gun, 23.x.2001.

32. *Psammocinia mosulpia* Sim, 1998 (Fig. 36)

Mo-sul-mo-rae-hae-myeon (모슬모래해면)

Psammocinia mosulpia Sim, 1998, p. 38, fig. 2.

Description. Irregular mass, and somewhat lobate sponge, $7 \times 10 \times 2.3$ cm, attached to shell. Surface with low mammiform conules, cortex with abundant filaments mixed with large black sands, 400–600 μ m in diameter. Oscules, 1 mm in diameter, open on top of lobate. Pigment-like large black sands near surface. Color in alcohol gray outside and beige inside. Texture tough but sponge easily torn.

Skeleton: Near surface primary fibres, small size up to 60–280 μ m in diameter, sometimes mixed with large sands in fasciculated parts. Uncored secondary fibres, 32–100 μ m in diameter. Choanosome stout simple primary fibres mixed with small and large sands, 150–400 μ m in diameter. Secondary fibres 15–50 μ m in diameter, mostly large sands attached outside of fibres. Filaments loosely arranged, 3–8 μ m in diameter, terminal knobs, 12–16 μ m in diameter.

HABITAT: Depth of 100 m (fishing-net), marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Mosulpo, Seogwipo-si, 6.ix.1988.

REMARKS: This species is very unique, mostly primary fibres cored with middle sized sands, but like other species of *Psammocinia*, large sands attached outside of fibres (Fig. 35D).

33. *Psammocinia palma* Sim, Lee and Kim, 2017 (Fig. 37)

Son-ba-dak-mo-rae-hae-myeon (손바닥모래해면)

Psammocinia palma Sim et al., 2017a, p. 95, fig. 1.

Description. Palm shape sponge, size up to $9 \times 15 \times 1.5$ cm. Surface, covered with unknown white material, and indistinct conules. Nipple-like conules covered with brown sand crust, and rarely scattered over sponge surface. Sand crust mixed mostly with spicules. Oscules not open on surface. Color in life gray. Texture, soft and compressible.

Skeleton: Primary and secondary fibres arranged irregularly. Primary fibres, 150–200 μm in diameter, cored with large and small sized sands, and form strong fascicles. Secondary fibres, 80–150 μm in diameter, clear or cored with sands, and form loose web with large and small sized sands. Filaments, 3–6 μm in diameter, terminal knobs, 15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Bukchon, Jocheon-eup, Seogwipo-si, 29.ix.2009.

REMARKS: The palm shape is unique growth form. Surface covered with unknown white material and nipple-like conules (Fig. 36H). Conules with sands sparse, protruding from sponge surface.

34. *Psammocinia rana* Kim, Lee and Sim, 2018 (Fig. 38)

Gae-gu-ri-mo-rae-hae-myeon (개구리모래해면)

Psammocinia rana Kim et al., 2018, pp. 340–342, figs. 1, 2.

Description. Thick mass sponge, size up to $10 \times 7 \times 4.5$ (height) cm, surface with low and partly sharp conules. Strong collagen filamentous membrane mixed with rare sand and spicules. Oscules, 1–5 mm in diameter, open on top of the sponge. Color in life, black surface and beige inside. Texture very firm.

Skeleton: Primary fibres cored sand, 300–700 μm in diameter. Secondary fibres, various type, wide plate-like fibres with small and large perforation. Some secondary fibres branch type, or root-like shape connected to the primary fibres, 100 μm in diameter in middle. All secondary fibres are clear. Filaments, 5–7 μm in diameter, terminal knobs, 15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Jagenganyeo, Gageodo, Heuksan-myeon, Shinan-gun, 19.vii.2007.

35. *Psammocinia rubra* Sim and Lee, 2002 (Fig. 39)

Ppal-gang-mo-rae-hae-myeon (빨강모래해면)

Psammocinia rubra Sim and Lee, 2002a, p. 56, figs. 2, 3.

Description. Irregular sponge, with disposed lobes, size up to $6 \times 3 \times 2.5$ cm in thickness. Surface, smooth and covered with very low and blunt conules. Side of sponge surface covered by Ascidiacean and seaweeds. Sand crust mixed with many small sands, 10–50 μm in diameter. Small oscules, 1 mm in diameter, rarely distributed on top of lobe. Color in life reddish brown. Texture compressible, difficult to tear apart.

Skeleton: Color of primary and secondary fibres reddish brown, not changed in bleach. Slightly fasciculated primary fibres, 150–320 μm in diameter, heavily cored with consistently small sands, 10–40 μm in diameter. Secondary fibres, 90–230 μm in diameter, uncored, sometimes makes massive secondary webs between adjacent cored primary fibres. Secondary web with many perforations. Ectosomal primary and secondary fibres, compared to choanosomal fibres are simpler, thicker and easily broken. Filaments 2.5–7 μm in diameter, brown or clear, emerge from holes in fibre. Brown filaments densely or loosely coated with brown granules. Other end of filaments have rounded end. Terminal knobs, 10–14 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, vii.1991.

REMARKS: This species is readily distinguished from other species of *Psammocinia* by blunt conules, reddish brown color, and filaments coated with brown granules. This granula appearance of filaments is due to a coating of lepidocrocite granules.

36. *Psammocinia samyangensis* Sim and Lee, 1998 (Fig. 40)

Sam-yang-mo-rae-hae-myeon (삼양모래해면)

Psammocinia samyangensis Sim and Lee, 1998, p. 336, fig. 1.

Description. Irregular mass sponge, size up to $8 \times 3 \times 7$ cm, attached to rocky substrate. Surface with low conules not distinct and filamentous membrane mixed with large sand grains. Oscules not observed. Color in alcohol beige. Texture very soft.

Skeleton: Cortex with many primary fibres, 140–400 μm in diameter, with sand core 10–20 μm in diameter. Secondary fibres, 50–230 μm in diameter, mixed with small sand grains. In choanosome, primary fibres fascicles difficult to see due to attached sands. Numerous large sands in mesohyl, support sponge body. Sometimes thin secondary fibres connected to large sands like bridge. Filaments, 3–8 μm in diameter, emerge from pores of secondary fibres. Terminal knobs, 10–17.5 μm in diameter.

HABITAT: Marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Samyang, jeju-si. 9.vii.1991.

37. *Psammocinia scopulus* Sim, Lee and Kim, 2017 (Fig. 41)

Ba-wi-mo-rae-hae-myeon (바위모래해면)

Psammocinia scopulus Sim et al., 2017a, pp. 98, 99, 101, fig. 5.

Description. Mass sponge looks like small rock, size up to $6 \times 5 \times 5.5$ cm. Surface, smooth, with no distinct conules. Sand crust with small sands on sponge surface, and large sands near surface (Fig. 39C). Oscules rare, 1 mm in diameter. Texture, firm and compressible. Color in life, grey and dark brown on side of sponge. Choanosome rarely with fibres, but many large sands, 200–400 μm in diameter.

Skeleton: Primary fibres very rare. Numerous large sands bound together by strong collagens. Bound sands and fibres made skeletal structure. Primary fibres fascicles, 200–400 μm in diameter, not clear. Short secondary fibres, 15–100 μm in diameter, bridged with large sands, 20–60 μm in diameter. Filaments, 3–7 μm in diameter, terminal knobs, 9–11 μm in diameter.

HABITAT: Depth of 25–30 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Songaksan, 1.x.2014.

REMARKS: This species is distinct from other psammocinian species by having a two layered sand crust, a crust with small sands on sponge surface and other crust with large sands near surface (Fig. 39C). Large sands attach to each other making primary fibres not to be easily visible (Fig. 39E). Secondary fibres very short and bridge type (Fig. 39D, F, H).

38. *Psammocinia ulleungensis* Lee and Sim, 2004 (Fig. 42)

Ul-leung-mo-rae-hae-myeon (울릉모래해면)

Psammocinia ulleungensis Lee and Sim, 2004b, pp. 141–143, fig. 3.

Description. Irregular mass, thickly encrusting sponge, and slightly lobate, size up to $6 \times 4 \times 3.5$ cm. Surface, with scattered low and round conules. Filamentous membrane mixed with small sands and spicules. Oscules, 2–3 mm in diameter, opened on top of each lobe. Color in life dark gray on top, and ivory under. Texture elastic, compressible and difficult to tear apart.

Skeleton: Simple and reticulated fibre skeleton, easily broken. Slightly fasciculated primary fibres, 100–300 μ m in diameter, heavily cored with small and large sands. Secondary fibres, 60–200 μ m in diameter, mostly clear or cored partly with sand. Filaments, 3–5 μ m in diameter, emerged from holes in fibre. Terminal knobs, 10–12 μ m in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: GB.

SPECIMEN EXAMINED: Korea. GB: Neunggul, Ulleungdo, 1.x.2001.

39. *Psammocinia vermis* Kim, Lee and Sim, 2018 (Fig. 43)

Ji-reong-i-mo-rae-hae-myeon (지렁이모래해면)

Psammocinia vermis Kim et al., 2018, p. 344, figs. 5, 6.

Description. Thick incrusting sponge mass with many round projections, size up to $10 \times 7 \times 4$ cm. Sand crusted surface with thick filamentous membrane and low conules. Oscules, on surface 1–4 mm in diameter. Colour in life grayish black at the surface, brown inside. Texture rubbery and compressible.

Skeleton: Primary fibres, dense cored with small sand near the surface, 100–250 µm in diameter. Cored and clear secondary fibres, 50–100 µm in diameter. Filaments, 5–8 µm in diameter, terminal knob, 10 µm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JN: Chuja-do, Chuja-myeon, Jeju-si, Jeju-do, 5.xi.2009.

40. *Psammocinia wandoensis* Sim and Lee, 1998 (Fig. 44)

Wan-do-mo-rae-hae-myeon (완도모래해면)

Psammocinia wandoensis Sim and Lee, 1998, pp. 336–339, fig. 2.

Description. Irregular lobate sponge, with cylindrical digitated processes. Size up to 9 × 2 × 13 cm, attached to rocky substrate. Surface covered with low sharp conules. Oscule on top, 0.5–1 mm in diameter. Color in life, dark gray. Texture firm and compressible.

Skeleton: Cortex, 1 mm thick sand crust mixed with black color sands, 20–120 µm in diameter. Numerous filaments arranged under sand crust. Primary fibres cored with small sands, 75–150 µm in diameter, fibres fascicles simple, not complex. In choanosome, primary fibres measure 190–600 µm in diameter. Secondary fibres branched and perforated web type with many small sands (Fig. 41C, E). Filaments, 2–6 µm in diameter, terminal knob, 12–16 µm in diameter.

HABITAT: Depth of 10 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Wando, 27.vii.1995.

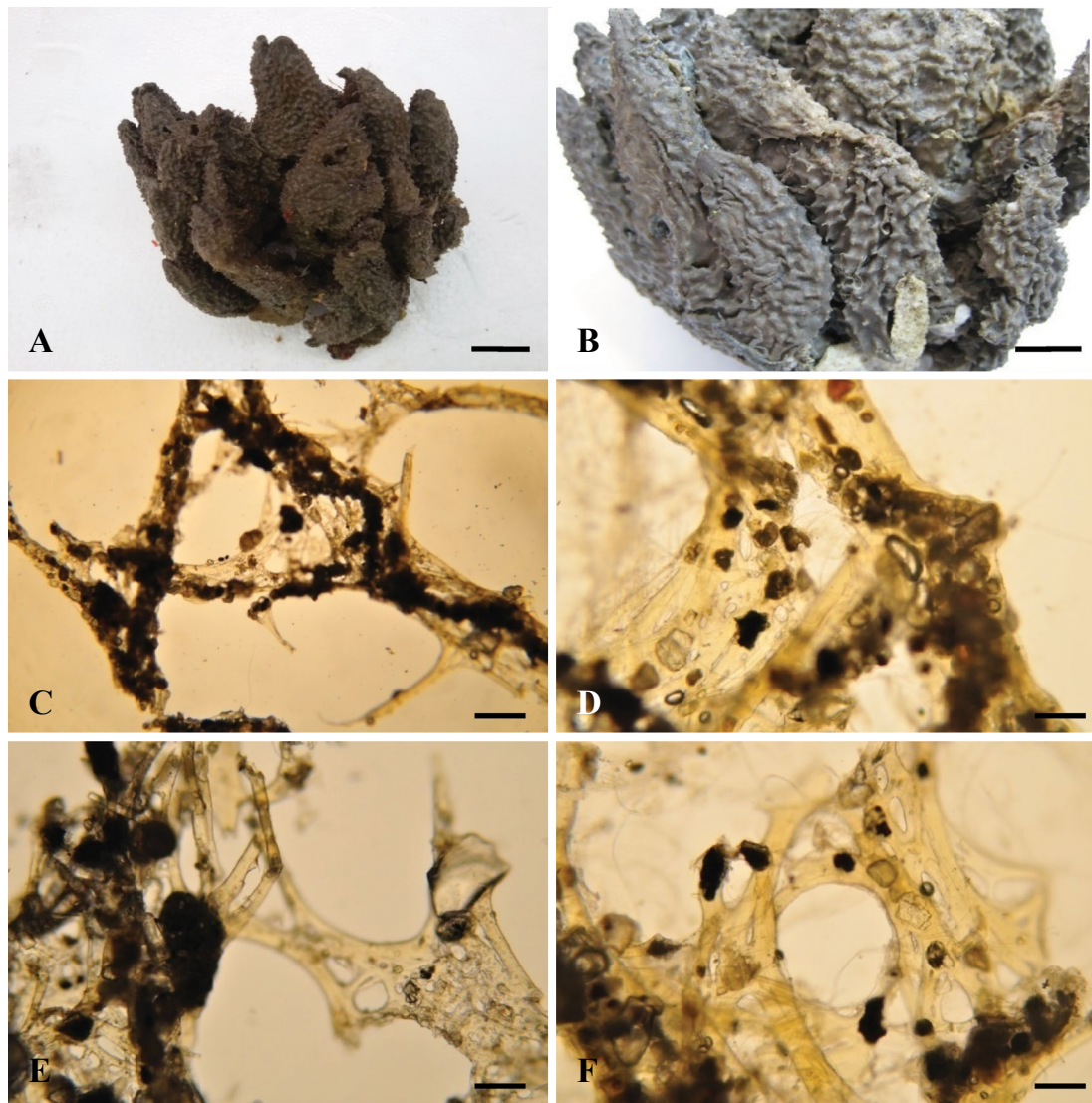


Fig. 24. *Psammocinia aspera* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D-F. cored primary fibres and wide secondary web. Scale bars: A = 2 cm, B = 1 cm, C = 200 μ m, D-F = 100 μ m.

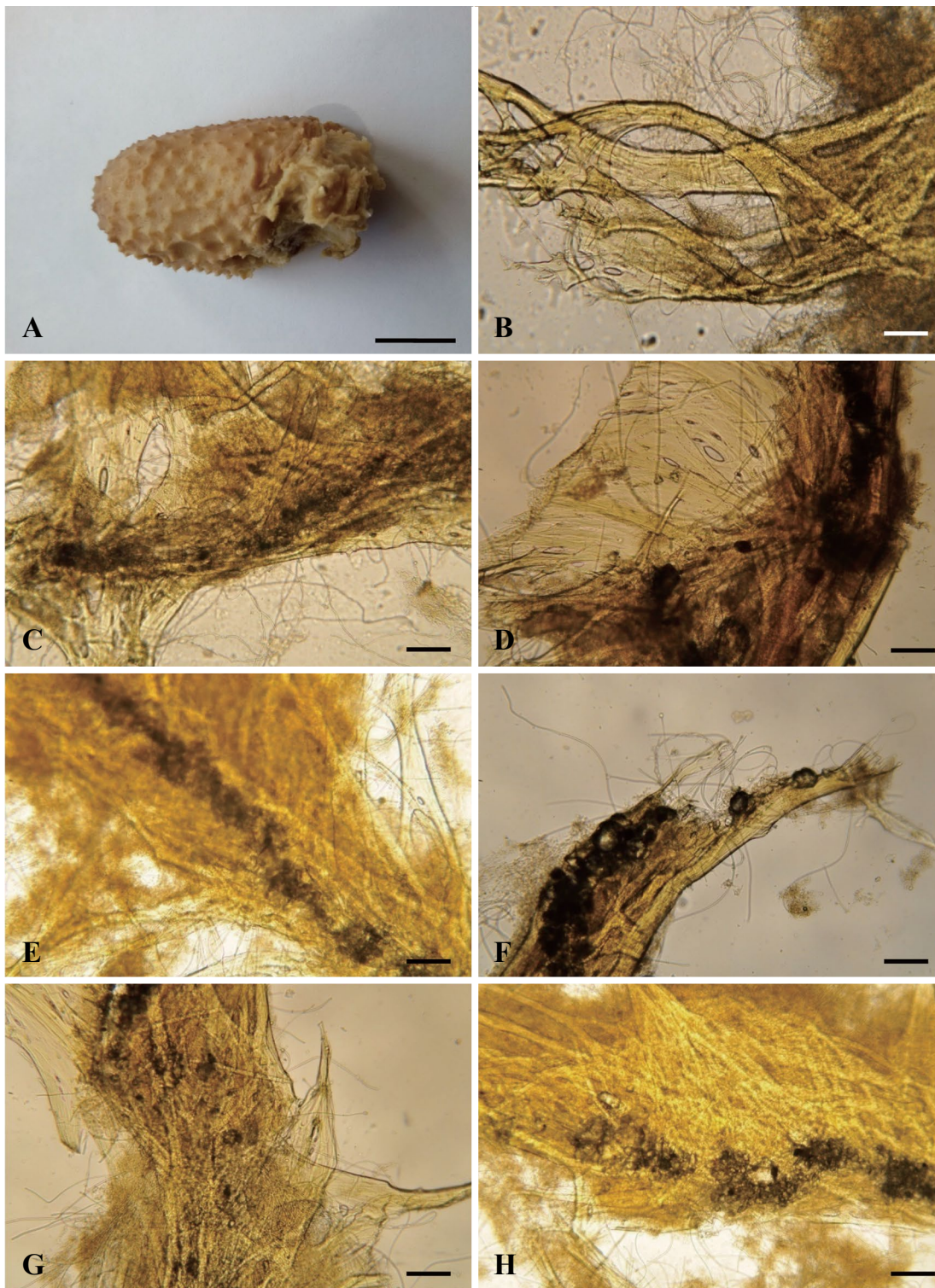


Fig. 25. *Psammocinia bergquistae* Sim and Kim. A. external morphology; B. plate-like secondary fibres; C. skeletal structure; D. primary and plastic-like secondary fibres; E, F. cored primary fibres; G, H. skeletal structure. Scale bars: A = 2 cm, B–H = 100 μ m.

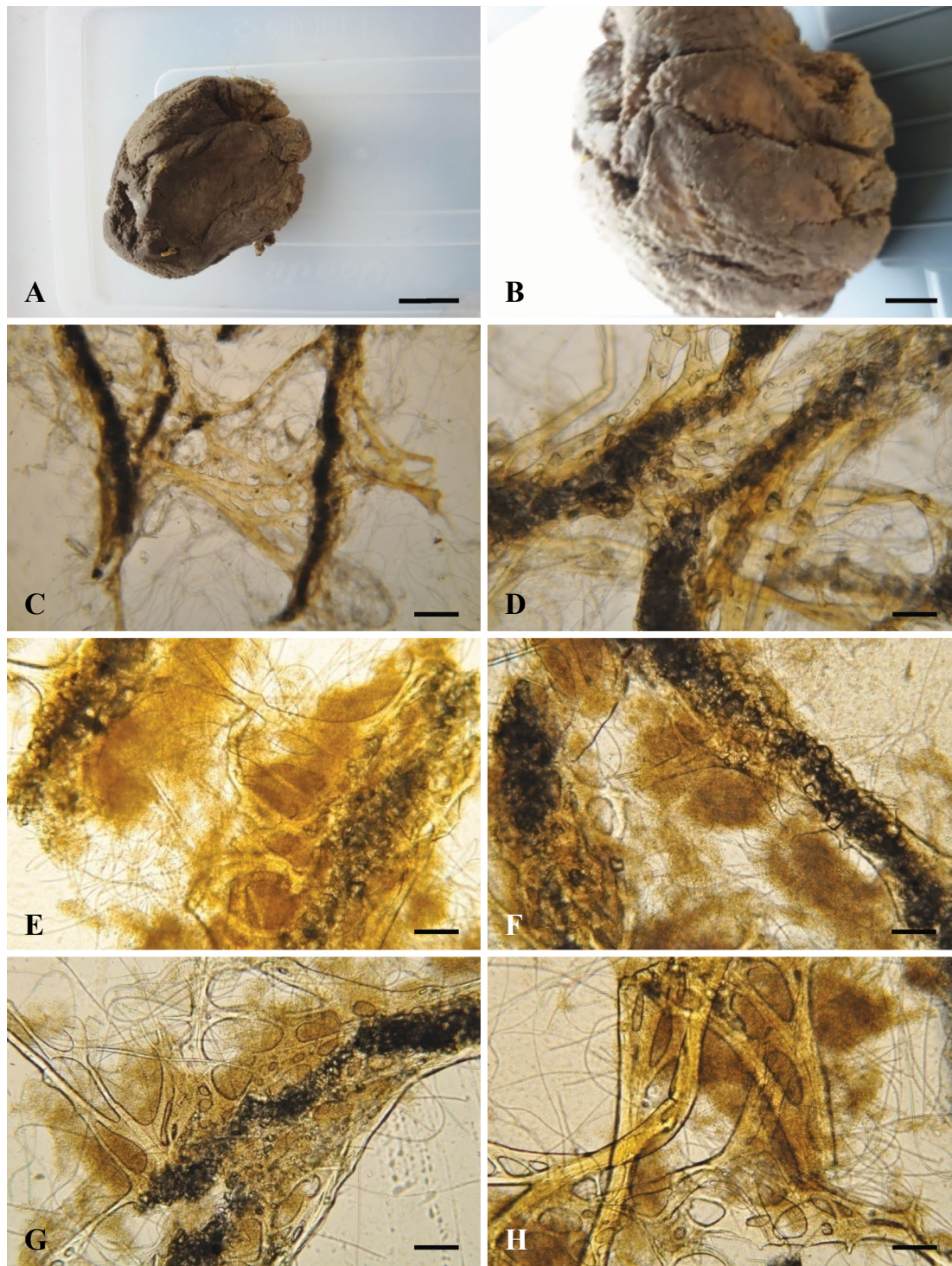


Fig. 26. *Psammocinia chupoensis* (Sim, Lee and Kim). A. external morphology; B. surface close up; C. skeletal structure; D. cored primary and secondary fibres; E, F. skeletal structure at choanosom; G, H. cored secondary web. Scale bars: A = 3 cm, B = 2 cm, C = 200 μ m, D–H = 100 μ m.

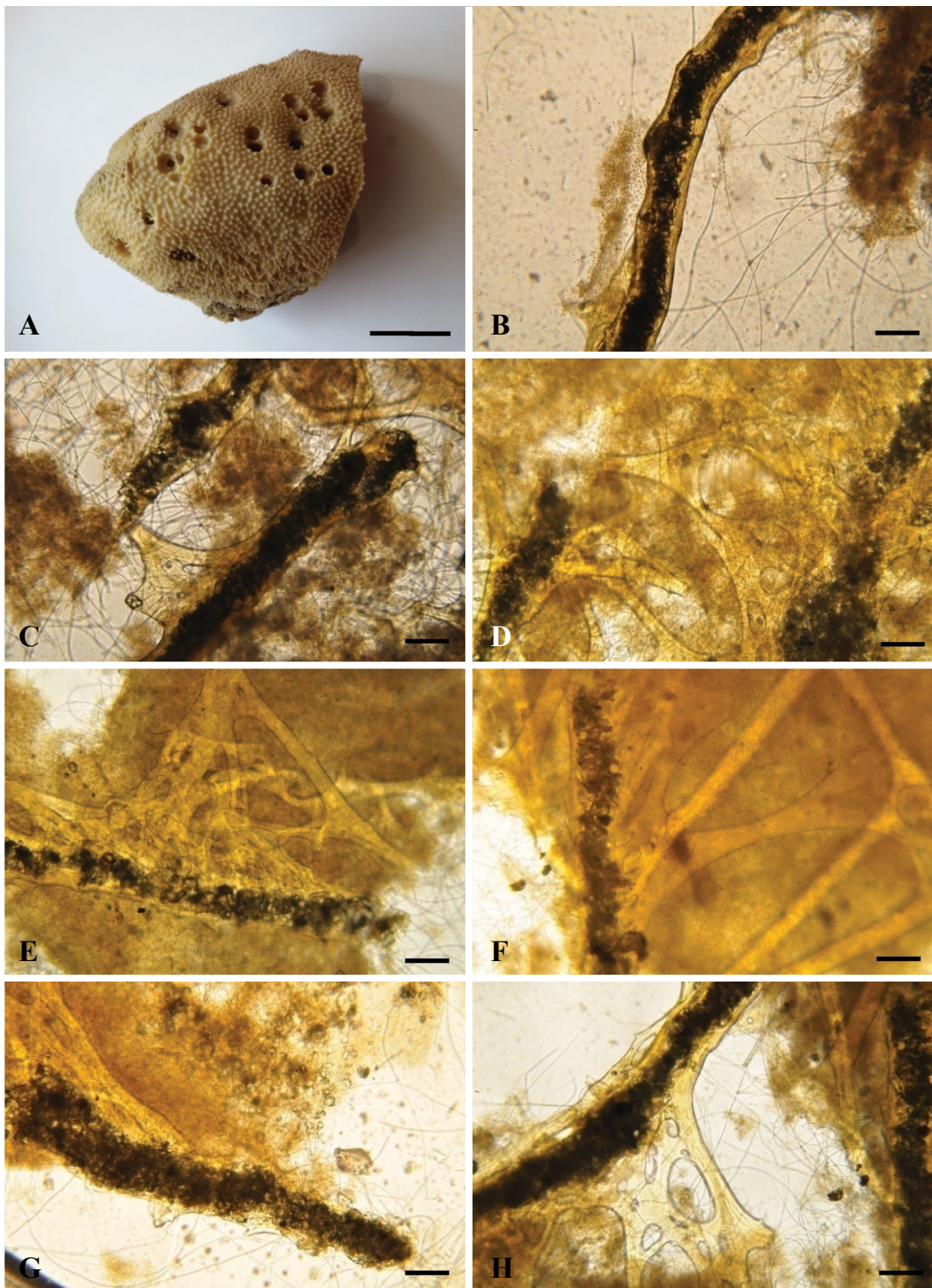


Fig. 27. *Psammocinia conulosa* Lee and Sim. A. external morphology; B. cored primary fibres; C, D. skeletal structure; E, F. cored primary and clear secondary fibres; G. cored primary fibres near surface; H. cored primary fibres and secondary web. Scale bars: A = 2 cm, B-H = 100 µm.

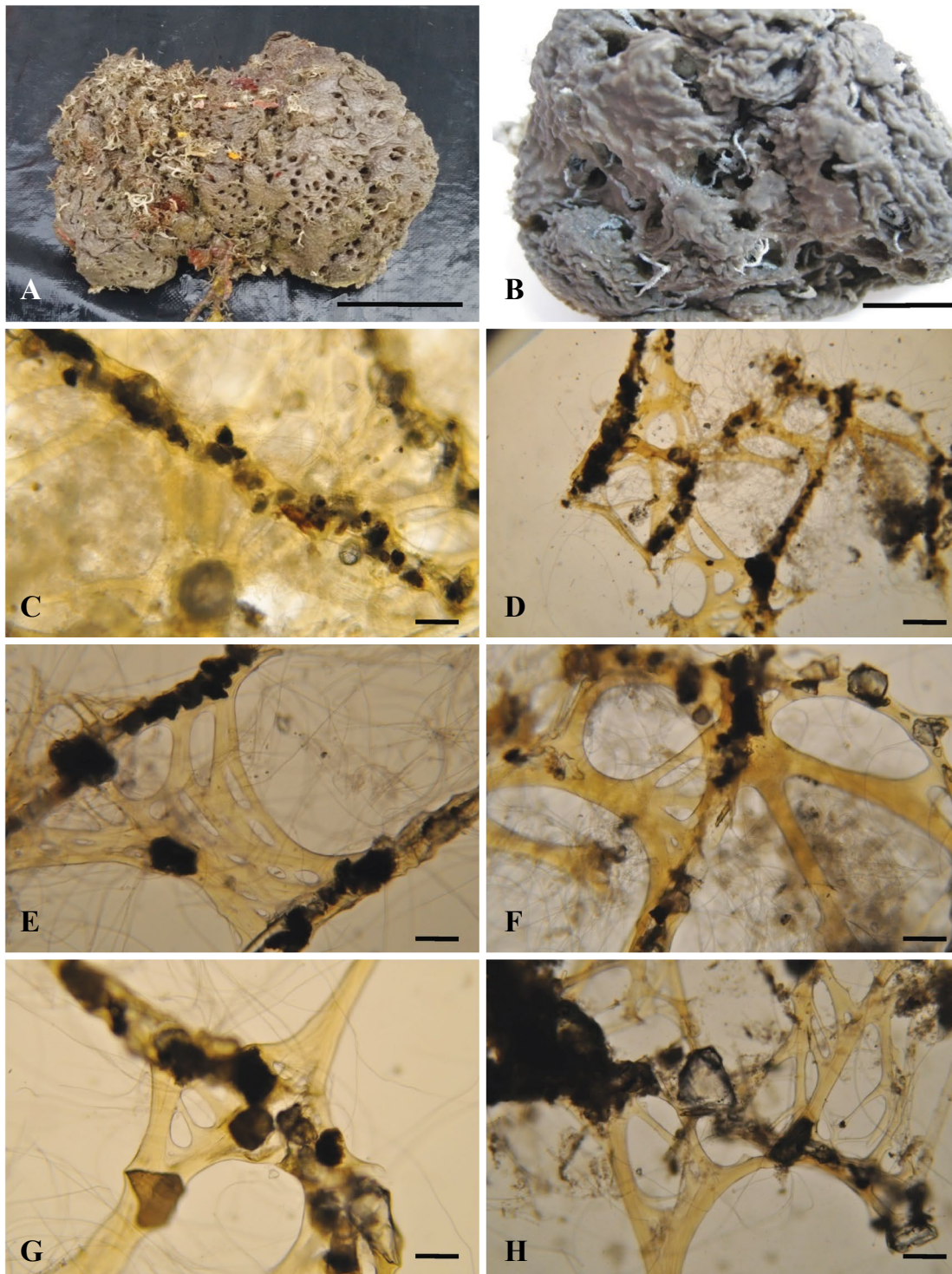


Fig. 28. *Psammocinia foraminis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. longitudinal primary fibres; D. skeletal structure; E. regular primary fibres; F-H. irregularly branched and rarely cored secondary fibres. Scale bars: A = 5 cm, B = 1 cm, C, D = 200 μ m, E-H = 100 μ m.

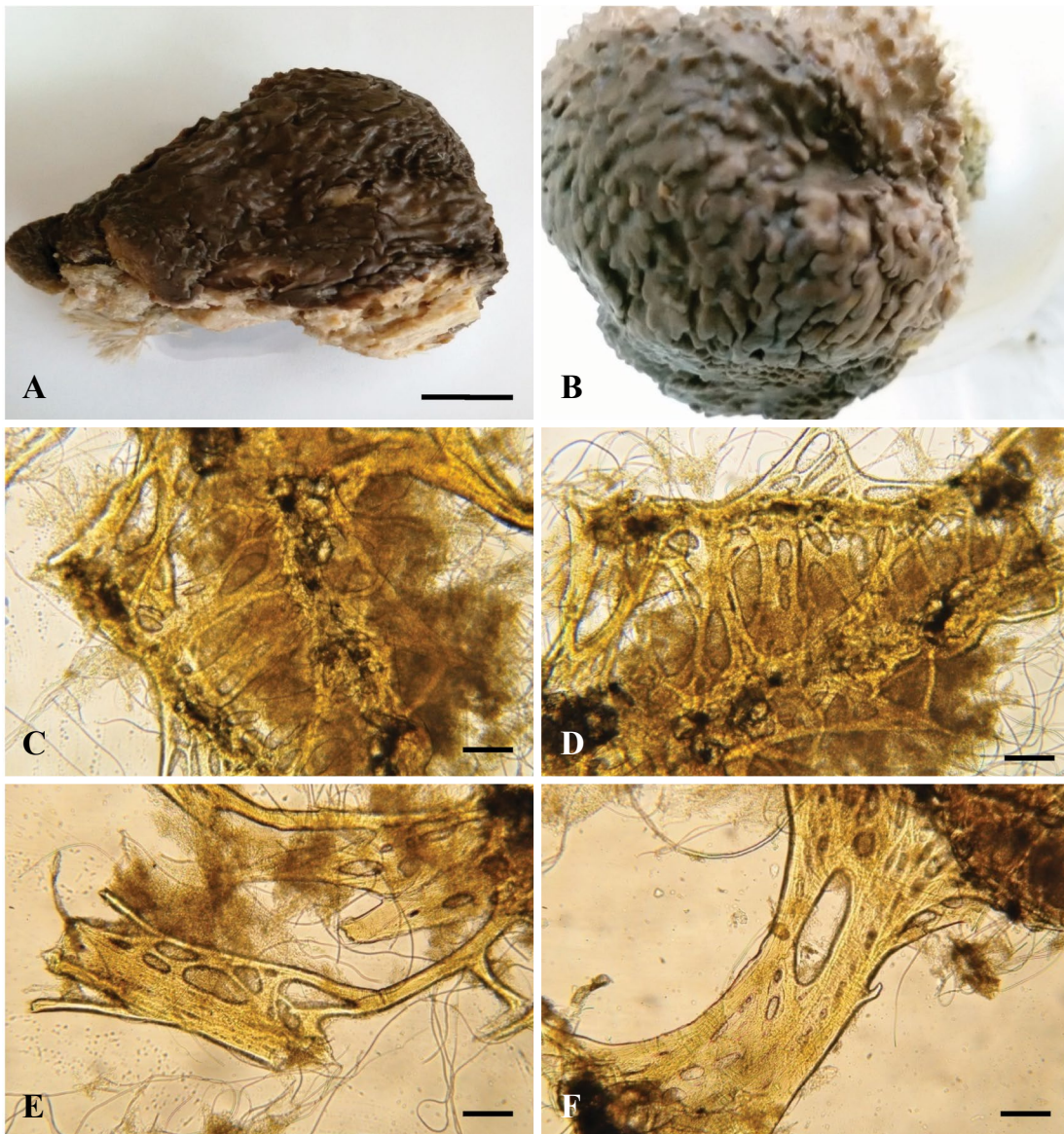


Fig. 29. *Psammocinia gageoensis* Sim and Lee. A. external morphology; B. surface close up; C, D. secondary web between cored primary fibres; E, F. plate-like secondary fibres. Scale bars: A = 2 cm, C–F = 100 μ m.

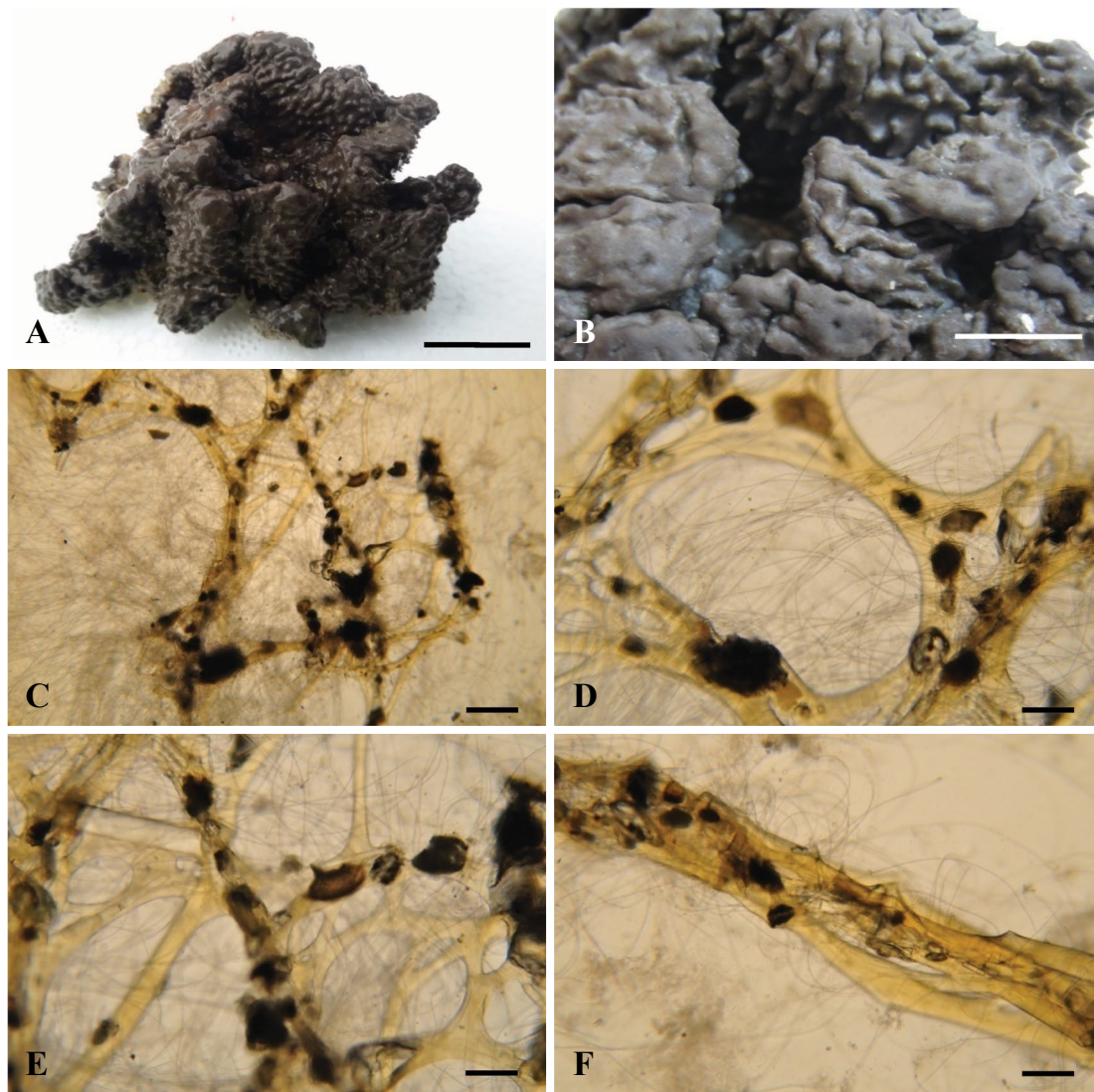


Fig. 30. *Psammocinia hwasunensis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. cored primary and secondary fibres; E. irregular secondary fibres; F. loosely cored primary fibres fascicles. Scale bars: A = 2 cm, B = 1 cm, C = 200 μ m, D–F = 100 μ m.

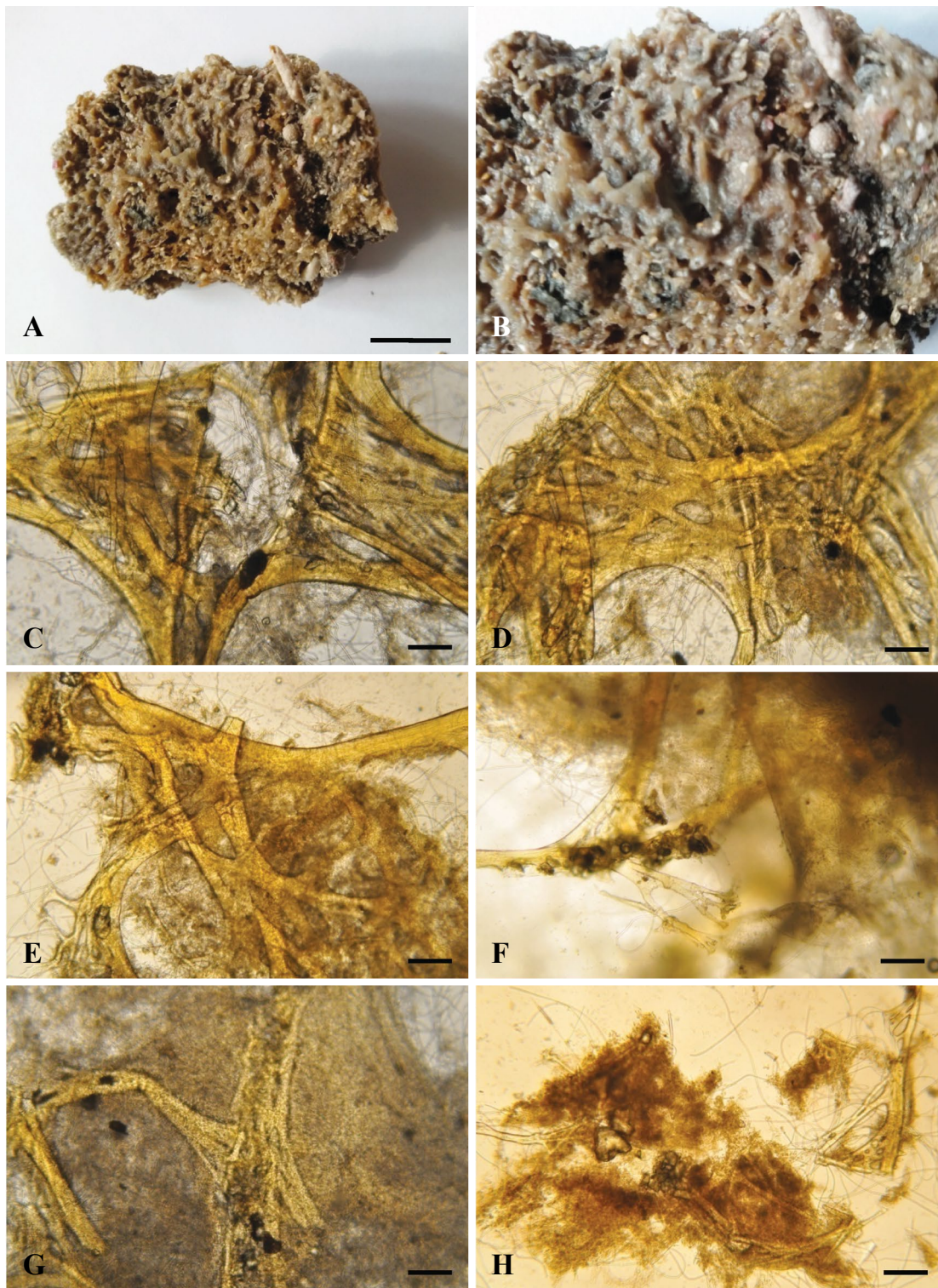


Fig. 31. *Psammocinia jejuensis* Sim. A. external morphology; B. surface close up; C, D. skeletal structure; E, F. rarely cored primary and no cored secondary fibres; G. cored primary fibres; H. surface filamentous membrane with cored fibres. Scale bars: A = 2 cm, C–H = 100 μ m.

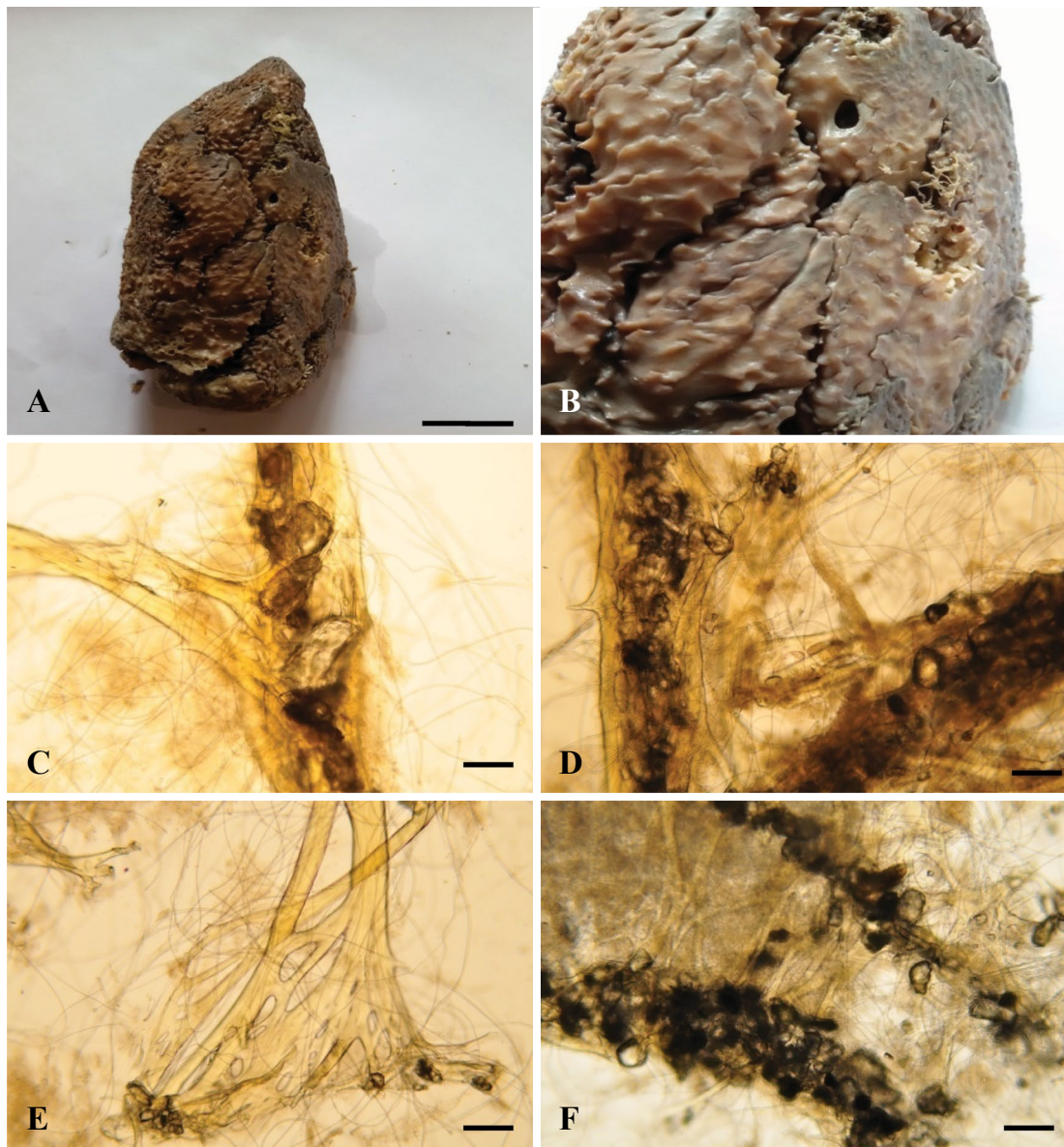


Fig. 32. *Psammocinia lobatus* Sim and Kim. A. external morphology; B. surface close up; C, D. cored primary fibres; E. root-like secondary fibres; F. secondary fibres between cored primary fibres. Scale bars: A = 2 cm, C–F = 100 μ m.

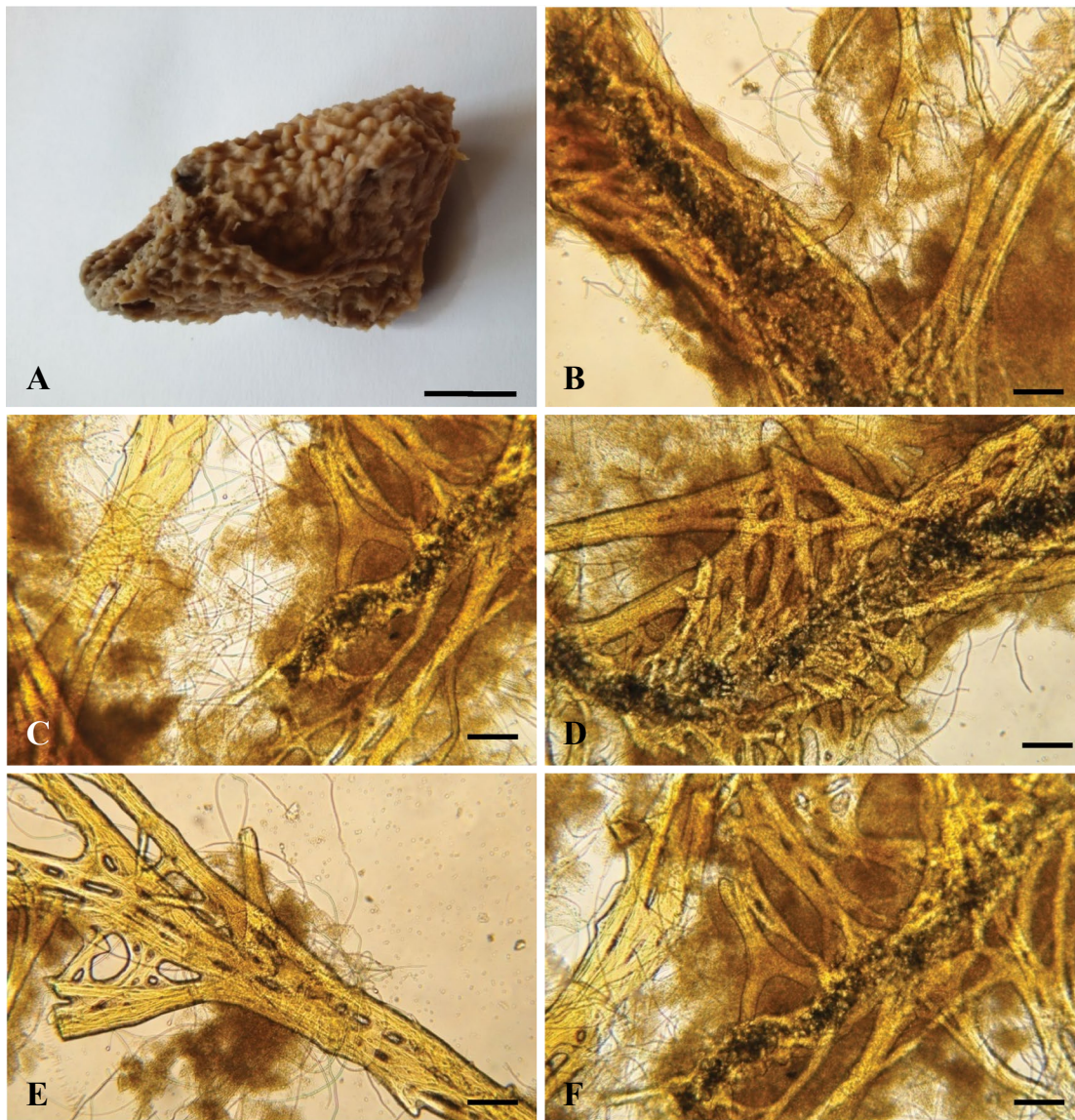


Fig. 33. *Psammocinia mammiiformis* Sim. A. external morphology; B, C. skeletal structure; D. thick cored primary fibres; E. no cored secondary fibres; F. thick branched secondary fibres and cored primary fibres. Scale bars: A = 2 cm, B–F = 100 μ m.

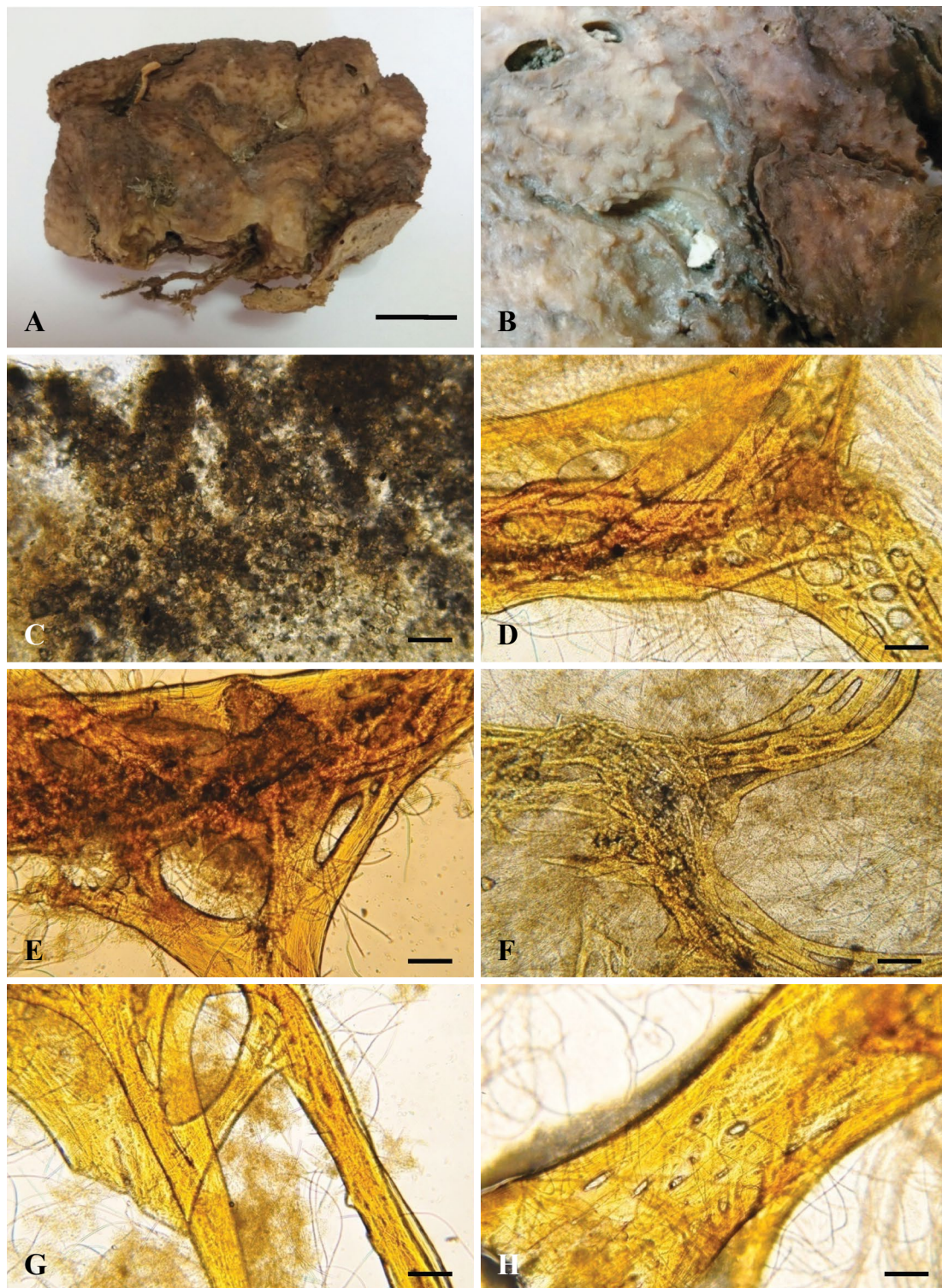


Fig. 34. *Psammocinia massa* Kim, Lee and Sim. A. entire animal; B. closed surface; C. sand crust; D, E. subdermal skeletal structure; F. fibres near surface membrane; G. narrow bridged secondary fibres; H. wide bridged secondary fibres. Scale bars: A = 2 cm, C-H = 100 μ m.

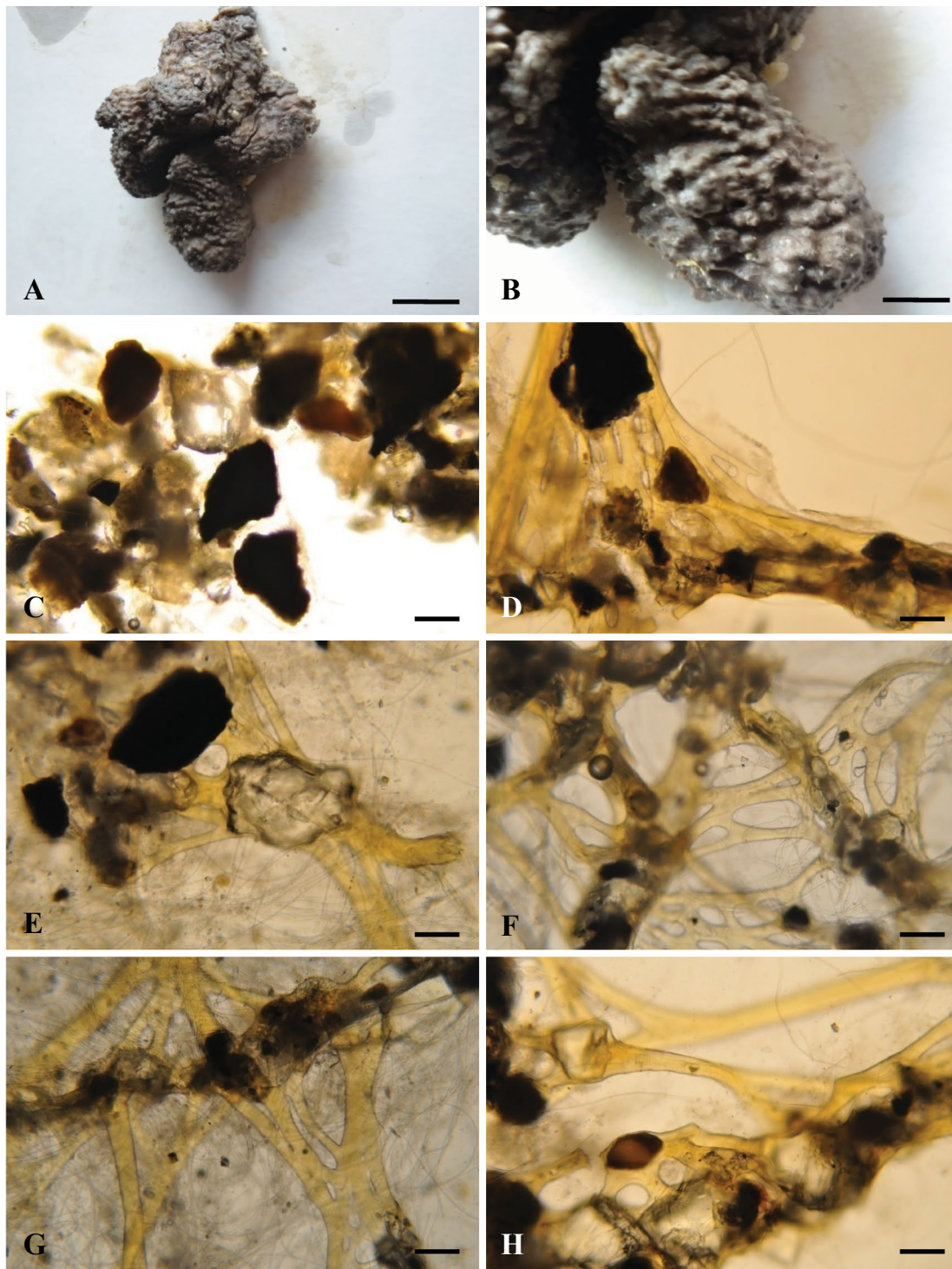


Fig. 35. *Psammocinia morum* Sim, Lee and Kim. A. external morphology; B. surface close up; C. surface sand crust; D–F. subdermal cored skeletal structure; G. cored primary fibres and clear secondary web; H. cored fasciculated primary fibres. Scale bars: A = 2 cm, B = 1 cm, C = 200 µm, D–H = 100 µm.

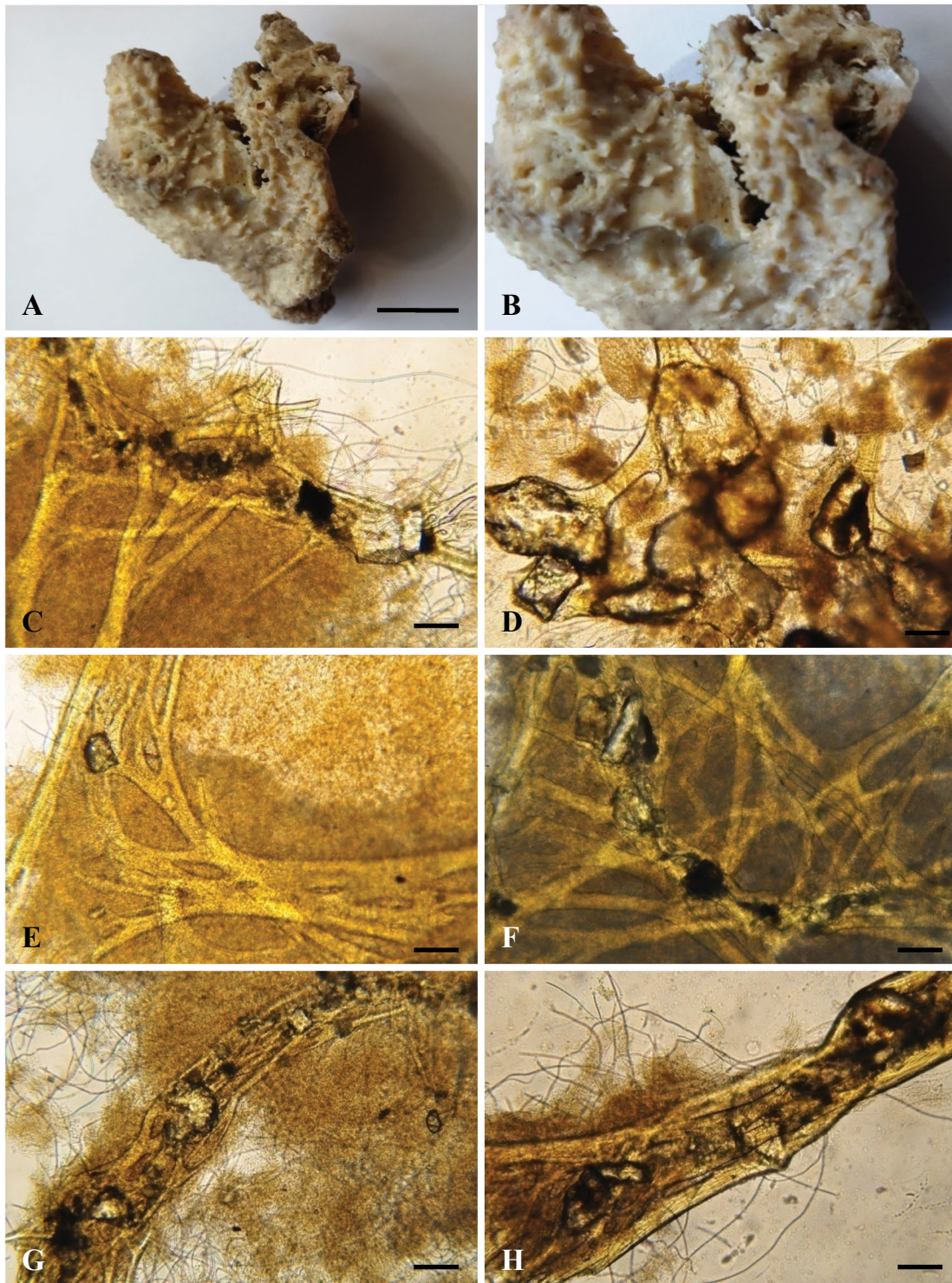


Fig. 36. *Psammocinia mosulpia* Sim. A. external morphology; B. surface close up; C, D. skeletal structure; E. secondary fibres; F. cored primary fibres and secondary web; G. primary fibres at the end of conules; H. primary fibres at conules base. Scale bars: A = 2 cm, C-H = 100 μ m.

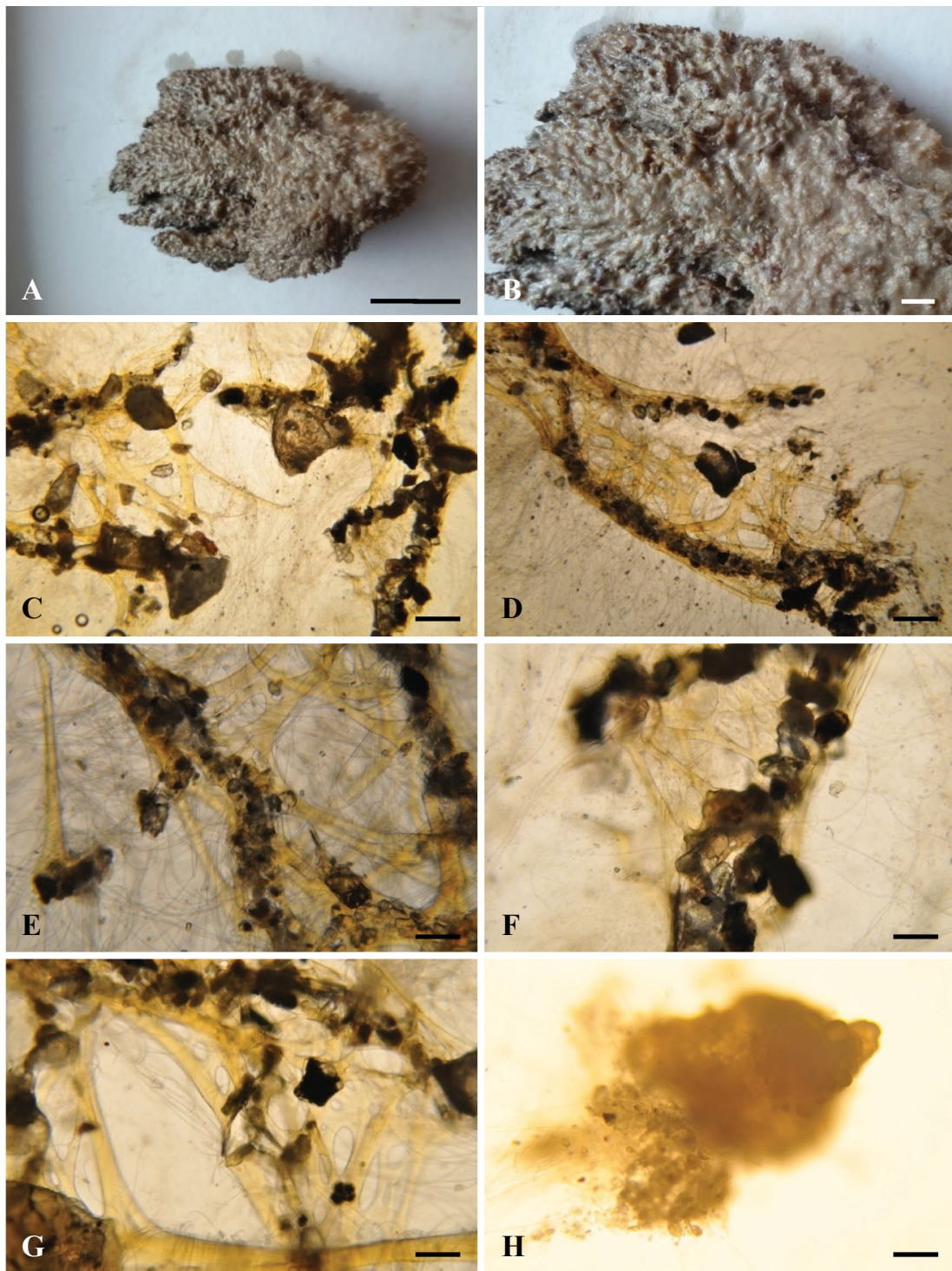


Fig. 37. *Psammocinia palma* Sim, Lee and Kim. A. external morphology; B. surface close up; C, D. skeletal structure; E, F. cored primary fibres and secondary web; G. cored secondary web; H. surface nipple-like conules with thick sands. Scale bars: A = 4 cm, B = 1 cm, C, D = 200 μ m, E–H = 100 μ m.

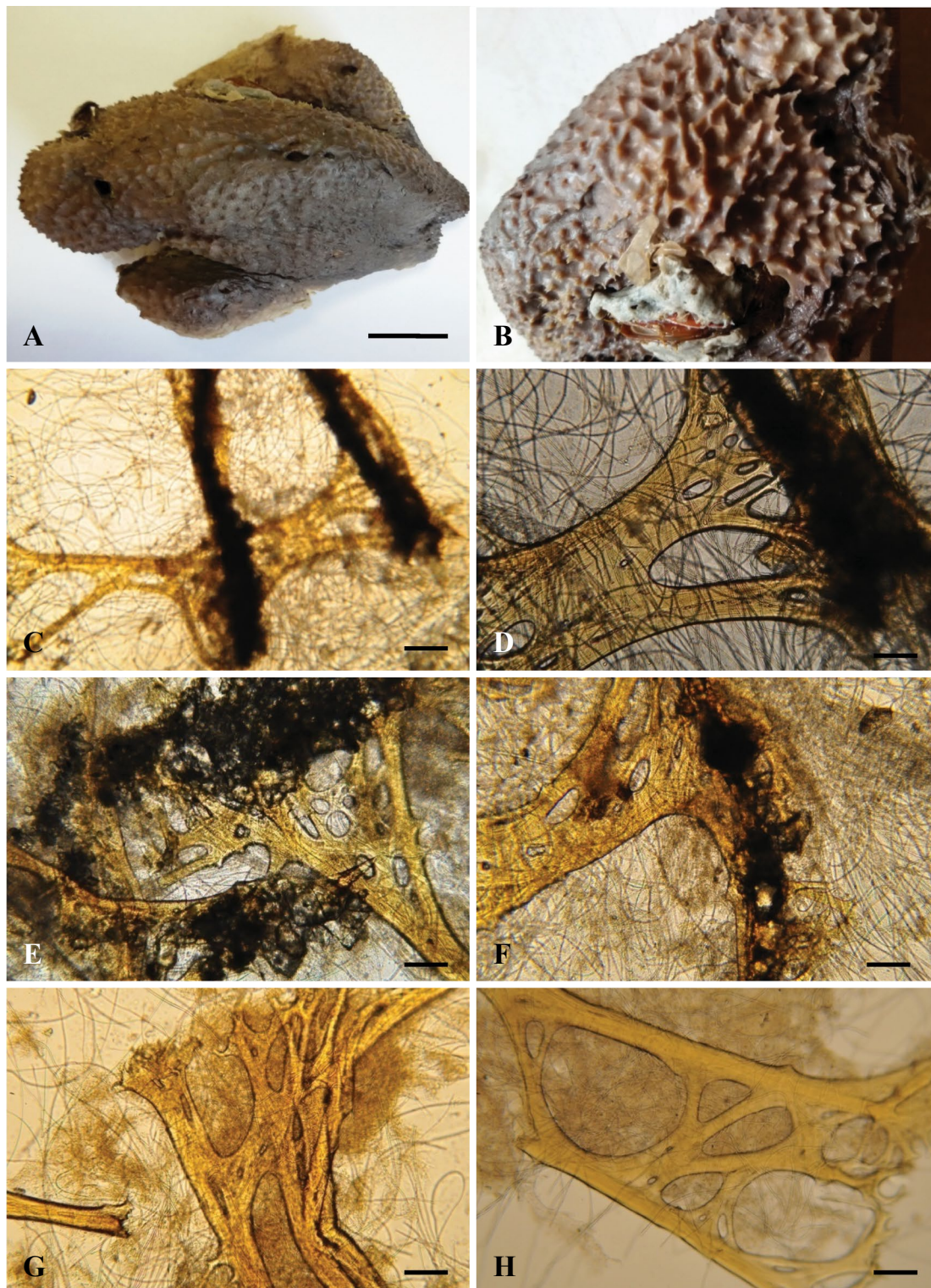


Fig. 38. *Psammocinia rana* Kim, Lee and Sim. A. entire animal; B. closed surface; C. skeletal structure; D. wide secondary fibres; E, F. cored primary and secondary web; G. bridged secondary fibres; H. large perforated secondary fibres. Scale bars: A = 2 cm, C = 200 μ m, D-H = 100 μ m.

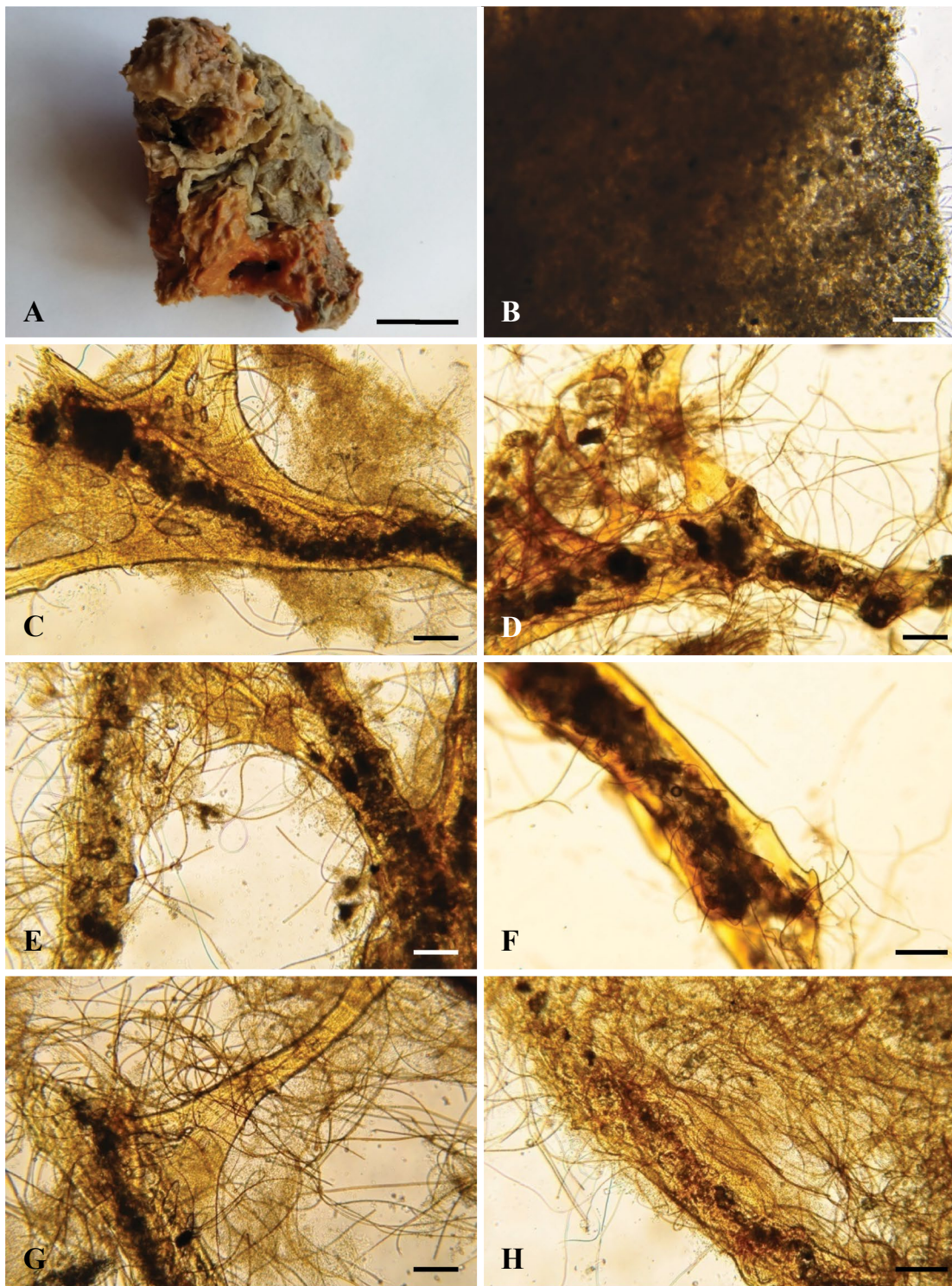


Fig. 39. *Psammocinia rubra* Sim and Lee. A. external morphology; B. sand crust; C, D. skeletal structure; E, F. cored primary fibres; G. bridged secondary fibres; H. primary fibres with filaments. Scale bars: A = 2 cm, B–H = 100 μ m.

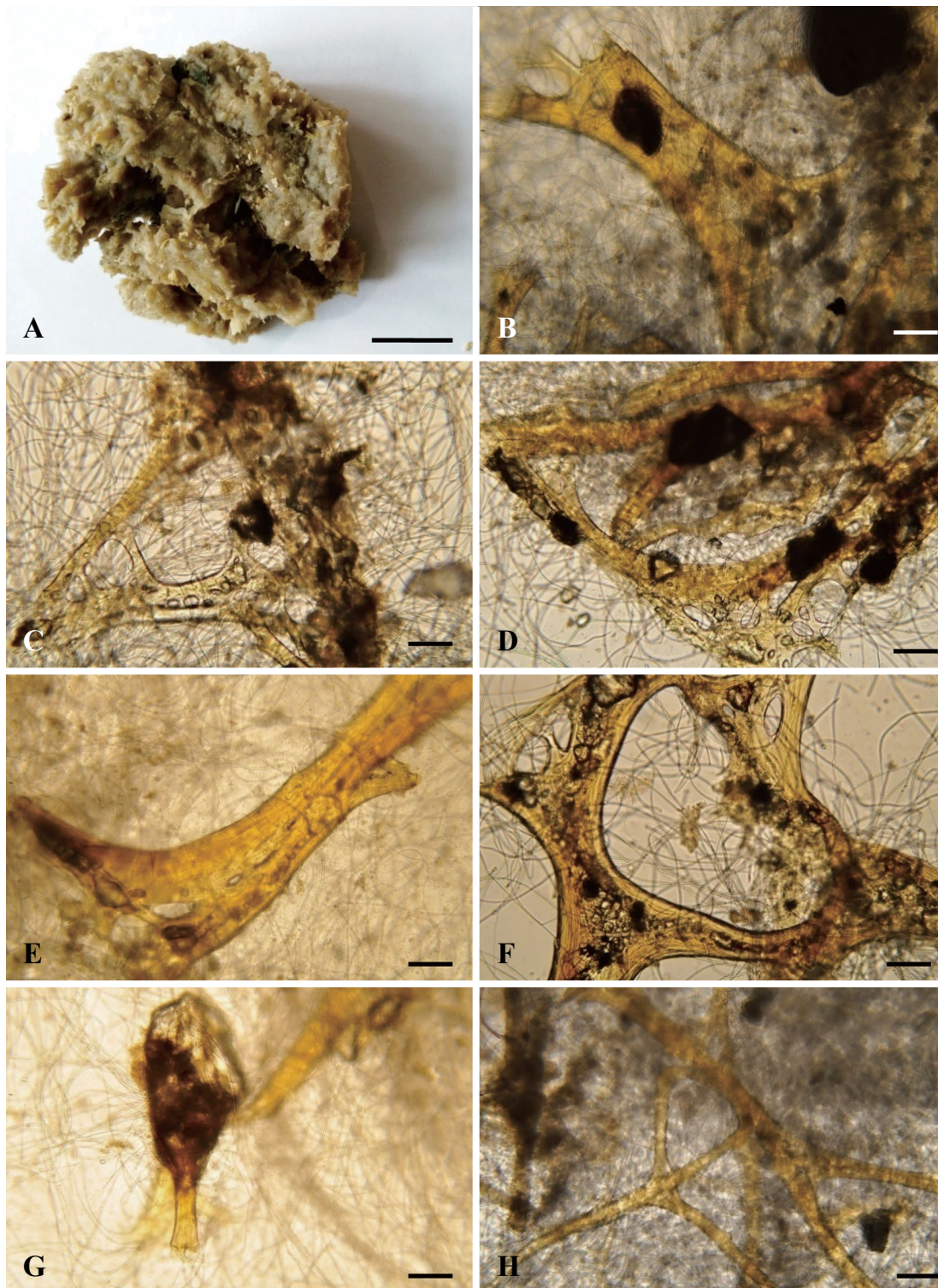


Fig. 40. *Psammocinia samyangensis* Sim and Lee. A. external morphology; B. broad secondary fibres; C, D. skeletal structure; E. secondary fibres; F. cored secondary fibres; G. large sands with short secondary fibres; H. uncored thin secondary fibres. Scale bars: A = 2 cm, B-H = 100 μ m.

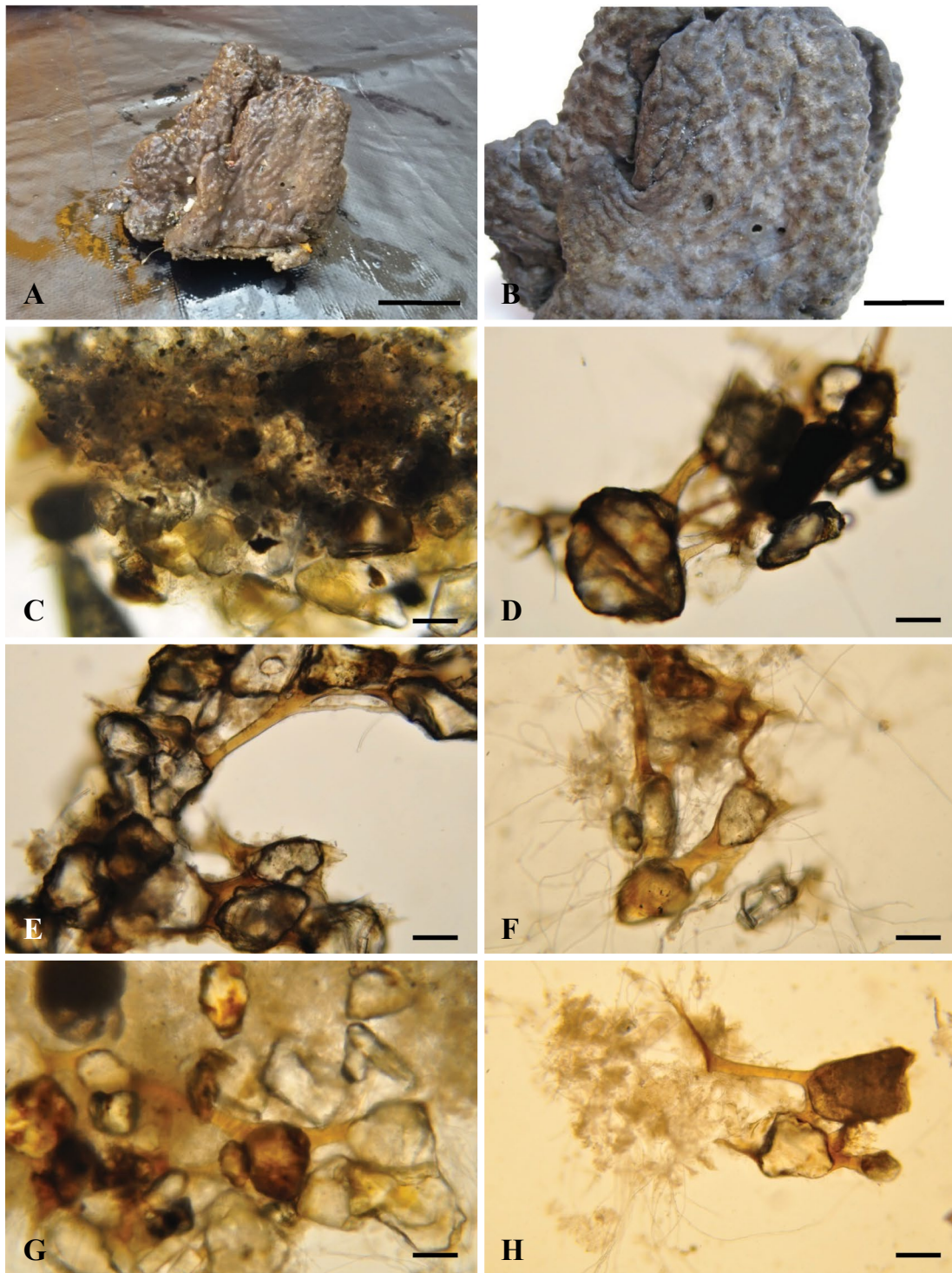


Fig. 41. *Psammocinia scopulus* Sim, Lee and Kim. A. external morphology; B. surface close up; C. sand crust with small and large size of sands; D. large sands connected to short bridged secondary fibres; E, F. indistinct primary fibres with sands; G. dense collagen with sands; H. secondary fibres with sands. Scale bars: A = 2 cm, B = 1 cm, C-H = 100 μ m.

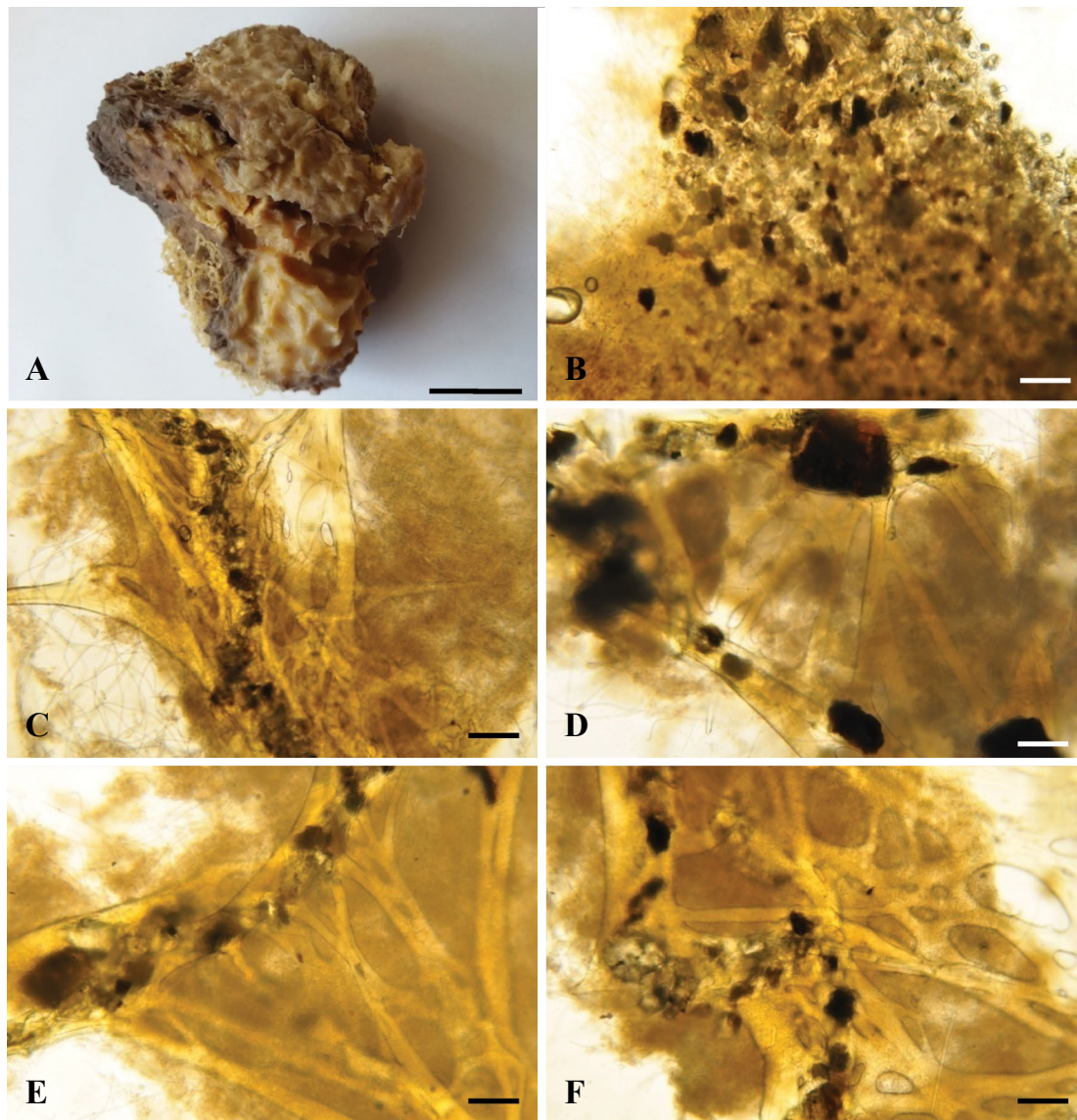


Fig. 42. *Psammocinia ulleungensis* Lee and Sim. A. external morphology; B. sand crust; C, D. skeletal structure; E, F. cored primary and clear secondary fibres. Scale bars: A = 2 cm, B–F = 100 μ m.

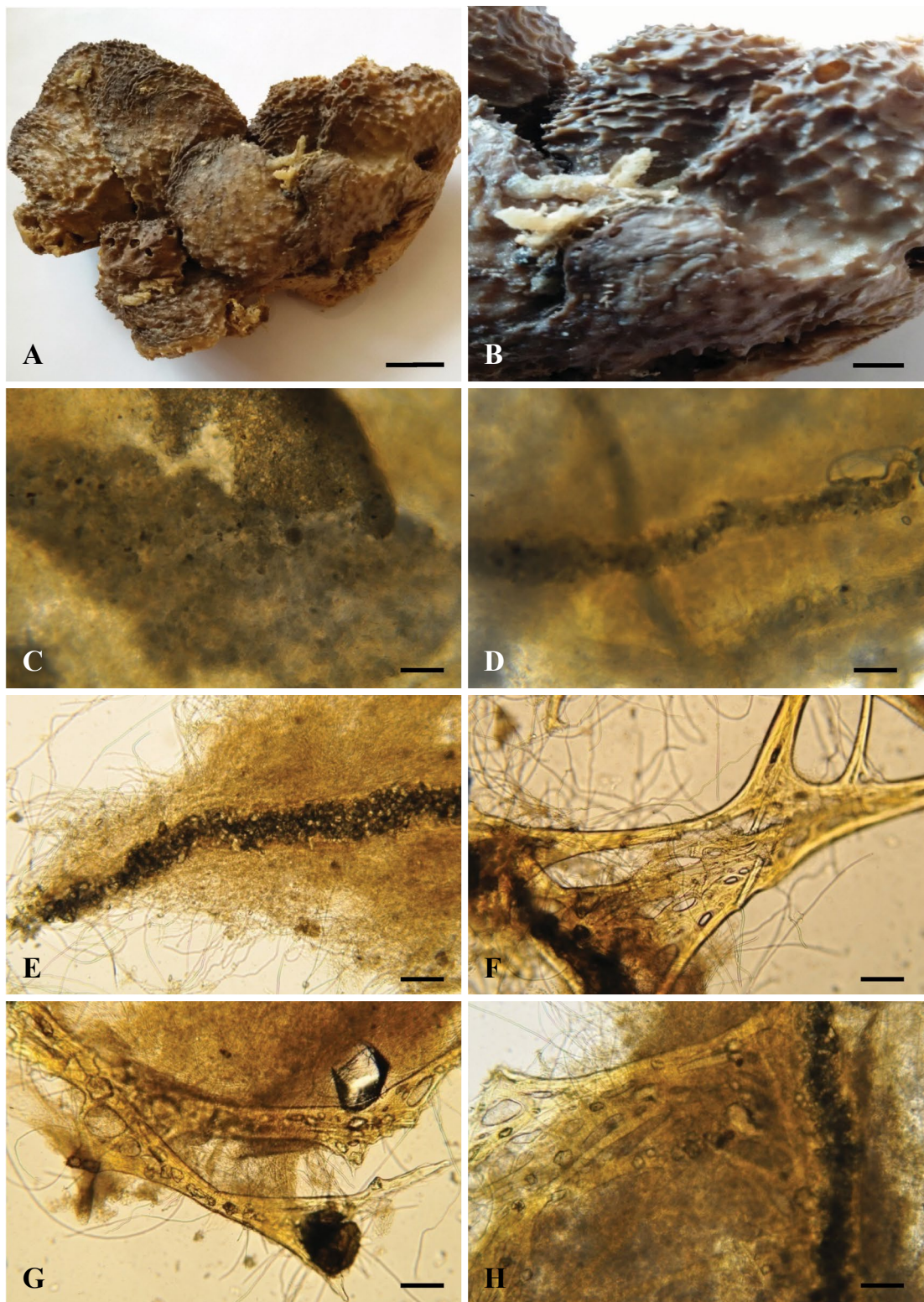


Fig. 43. *Psammocinia vermis* Kim, Lee and Sim. A. entire animal; B. closed surface; C. sand crust; D. primary and secondary fibres; E. cored primary fibres; F. secondary web; G. cored secondary fibres; H. cored primary and secondary web. Scale bars: A = 3 cm, B = 2 cm, C–H = 100 μ m.

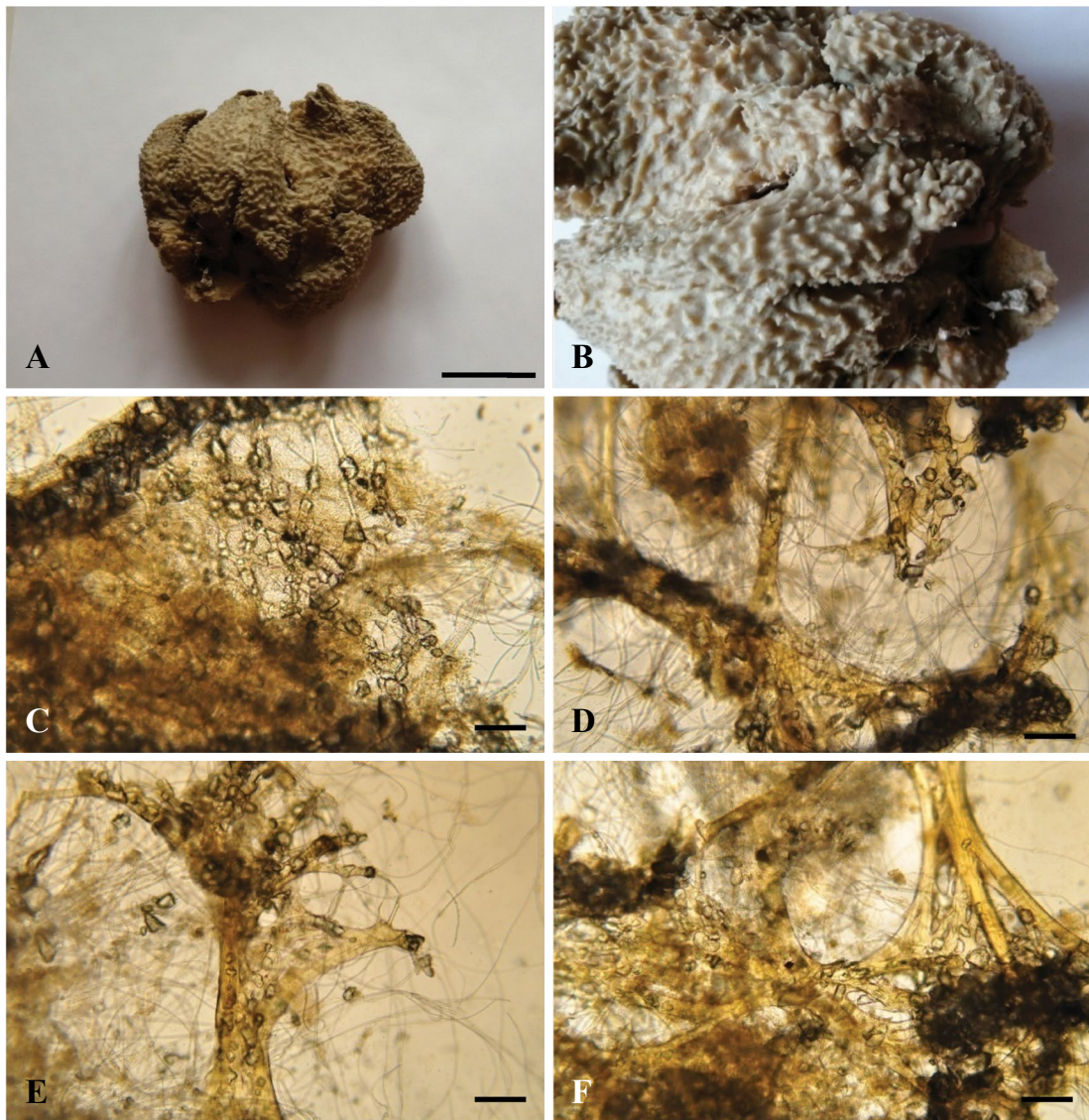


Fig. 44. *Psammocinia wandoensis* Sim and Lee. A. external morphology; B. surface close up; C, D. cored primary and secondary fibres; E. cored secondary fibres; F. cored primary and bridged secondary web. Scale bars: A = 2 cm, C-F = 100 μ m.

Genus *Sarcotragus* Schmidt, 1862

Yug-jil-sil-hae-myeon-sok (육질실해면속)

In genus *Sarcotragus* fibre skeleton is comprised of primary and secondary fibres and very fine filaments. Skeleton has fasciculated primary fibres which is clear of foreign debris, or with only intermittent inclusions. Secondary fibres are not cored with any detritus. Surface is conulose and unarmoured.

Type species: *Filifera* (*Sarcotragus*) *spinosulus* Schmidt, 1862.

SPECIES 23 (14 in Korea).

Key to the species of Korean *Sarcotragus* (Characters are illustrated by Figs. 42–55)

1. Primary fibres cylindrical fascicles 2
 - Primary fibres not cylindrical fascicles *S. geomunensis*
2. Color in life beige turns to dark brown 3
 - Color does not change 4
3. Ladder-like choanosome skeletal fibres *S. scalaris*
 - Prismatic branched choanosome skeletal fibres *S. sucinum*
4. Loose fascicles cylindrical primary fibres 5
 - Dense fascicles cylindrical primary fibres 6
5. Surface conules with porous membrane clearly distinct *S. dentilus*
 - Surface conules with thick membrane not distinct *S. purpureus*
6. Subdermal skeletal structure with very complex fibres 7
 - Subdermal skeletal structure with simple fibres 8
7. Secondary fibres fasciculated branch *S. seogwiensis*
 - Secondary fibres with large perforated pattern *S. mamillus*
8. Subdermal branched secondary fibres very rare *S. mureungensis*
 - Subdermal branched secondary fibres numerous 9
9. Primary fibres large meshed cylindrical fascicles *S. chagwiensis*
 - Primary fibres braided longitudinal fascicles 10
10. Secondary fibres web with bridge type 11
 - Secondary fibres without web type *S. schmidtii*
11. Surface conules not sharp 12
 - Surface conules very sharp 13
12. Sponge lacunose *S. levis*
 - Sponge not lacunose *S. rutzleri*

13. Color in life ivory and purple *S. maraensis*
 — Color in life black *S. gapaensis*

41. *Sarcotragus chagwiensis* Sim, Lee and Kim, 2016 (Fig. 45)

Cha-gwi-yug-jil-sil-hae-myeon (차귀육질실해면)

Sarcotragus chagwiensis Sim et al., 2016, pp. 445, 448, fig. 4.

Description. Thick irregular mass sponge, size up to $12 \times 10 \times 3.5$ cm. Surface with very low conules covered with loose filamentous membrane, and mixed with rare spicules. Subdermal branched skeletal fibres, very complex. Oscules, 1.5–4 mm in diameter, open on sponge surface. Color dark beige in life. Texture soft and compressible.

Skeleton: Primary fibres with porous cylindrical fascicles, 700–1,000 μm in diameter, filled with wads of filaments. Secondary fibres, branched with loose fascicles 180–300 μm in diameter. Secondary web-like thin plate broaden between adjacent primary fibres. Fibres difficult to separate from wads of filaments. Filaments, 4 μm in diameter, terminal knobs, 10 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Jeju-si, Chagwido, 4.xi.2000.

REMARKS: Subdermal branched skeletal fibres of this species are very complex and primary fibres fascicles filled with wads of filaments (Fig. 42F).

42. *Sarcotragus dentilus* Sim, Lee and Kim, 2016 (Fig. 46)

I-ppal-yug-jil-sil-hae-myeon (이빨육질실해면)

Sarcotragus dentilus Sim et al., 2016a, pp. 450–452, fig. 7.

Description. Hemispherical mass sponge, size up to $12 \times 9 \times 4$ cm. Surface, covered with thin perforated filamentous membrane and sharp conules. Fine fasciculated fibres observed under membrane. Several oscules open on sponge surface, 1–5 mm in diameter. Color pale gray and beige in life. Texture firm and compressible.

Skeleton: Primary fibres loose fascicles, with numerous perforations, 400–1,000 μm in diameter. Fasciculate porous secondary fibres branched out. Bridgetype secondary fibres, 50–200 μm in diameter. Filaments

difficult to be separated from fibres. Filaments, 3–5 μm in diameter, terminal knobs, 10–12 μm in diameter.

HABITAT: Depth of 25 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Munseom, 10.ii.2002.

43. *Sarcotragus gapaensis* Sim and Lee, 2000 (Fig. 47)

Ga-pa-yug-jil-sil-hae-myeon (가파육질실해면)

Sarcotragus gapaensis Sim and Lee, 2000, pp. 178–180, fig. 2.

Description. Subspherical massive sponge, $11 \times 4.6 \times 5.3$ cm. Surface conulose very rough. Some continuous conules joined together, to form irregular ridges. Oscules, 0.2–0.4 cm in diameter, irregularly scattered on surface. Color in life black or dark brown, endosome ivory. Texture elastic, tough and difficult to tear apart.

Skeleton: Primary fibres, 280–530 μm in diameter, fasciculated. Perforated secondary web, 60–330 μm in diameter, slightly fasciculated. Endosome skeleton thick, simple and dark brown color. Filaments, 2.5–5 μm thick, very tightly arranged and emerge from holes in fibres. Terminal knobs, 12–15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Gapado, 21.viii.1998.

44. *Sarcotragus geomunensis* Sim, Lee and Kim, 2016 (Fig. 48)

Geo-mun-yug-jil-sil-hae-myeon (거문육질실해면)

Sarcotragus geomunensis Sim et al., 2016a, p. 444, fig. 2.

Description. Irregular mass sponge, size up to $8 \times 5 \times 3$ cm. Conulous surface covered with thin filamentous membrane and perforated round opening. Conules mostly blunt except on side of sponge. Oscules open at the end of protruding surface, 1–3 mm in diameter. Color, beige in life. Texture, elastic and compressible.

Skeleton: Primary fibres in choanosome, flattened, to form plates, and easily broken. Wide secondary plate like web located among adjacent primary fibres. Thin branched fibre-like web, spread under filamentous membrane. Primary fibres, 400–750 μm in diameter. Secondary fibres, simple fasciculated branch type,

80–180 μm , to 200–300 μm in diameter, secondary web pattern, 200–300 μm in diameter. Filaments, 5 μm in diameter, easily separated from fibres, terminal knobs, 10–12 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JN.

SPECIMEN EXAMINED: Korea. JN: Geomundo, 27.ii.2002.

REMARKS: This species is unique in that its choanosome primary fibres are flattened and easily broken. Secondary fibres have mostly web pattern (Fig. 45C).

45. *Sarcotragus levis* Sim, Lee and Kim, 2017 (Fig. 49)

Mae-kkeun-yug-jil-sil-hae-myeon (매끈육질실해면)

Sarcotragus levis Sim et al., 2017b, pp. 135, 138, fig. 1.

Description. Cavernous thick mass sponge with several holes, size up to $11 \times 7 \times 3$ cm. Surface, smooth with low conules and many holes, 1–5 cm in diameter. Appearance of sponge surface and cavernous form similar to genus *Hyattella*. Oscules, rare, 1–3 mm in diameter. Color in life dirty beige and white. Texture, soft and compressible.

Skeleton: Primary fibres, wide plate shape, 900 μm in diameter. Secondary fibres, 200 μm in diameter, with numerous perforated secondary web (Fig. 46F). Filaments, 5–7 μm in diameter, terminal knobs, 10–15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Jeju-si, Chagwido, 6.xi.2000.

46. *Sarcotragus mamillus* Sim, Lee and Kim, 2016 (Fig. 50)

Yu-du-yug-jil-sil-hae-myeon (유두육질실해면)

Sarcotragus mamillus Sim et al., 2016a, pp. 452, 454, fig. 12.

Description. Irregular mass sponge, size up to $12 \times 8 \times 4$ cm. Surface, slightly protruding like mamillate

form, low conules covered with filamentous membrane. Oscules, 4–6 mm in diameter, open on protruding surface. Color in life gray. Texture very soft and compressible. Choanosome lacunose, subdermal skeletal fibres well developed.

Skeleton: Subdermal skeletal structure very thick, primary fibres, 400–800 µm in diameter, wide secondary web, 600–1,400 µm in diameter, bridged secondary fibres, 100–400 µm in diameter. Skeletal structure of basal part, very thick, a big difference compared to one near surface. All primary and secondary fibres have numerous irregular perforations. Filaments, 3–5 µm in diameter, terminal knobs, 10 µm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 15.xiii.2015.

47. *Sarcotragus maraensis* Sim and Lee, 2000 (Fig. 51)

Ma-ra-yug-jil-sil-hae-myeon (마라육질실해면)

Sarcotragus maraensis Sim and Lee, 2000, p. 178, fig. 1.

Description. Hemispherical mass sponge, 16 × 10 × 12.7 cm. Surface rough with short branched conules. Oscules, 0.2–1.5 mm in diameter, irregularly scattered on surface. Color in life ivory and purple. Texture very soft.

Skeleton: Very complex fasciculated primary fibres, 600 µm in diameter, secondary fibres large perforated web type. Loosely arranged filaments, 2–6 µm in diameter, emerge from holes in the fibres, terminal knobs, 10–15 µm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Marado, Seogwipo-si, 25.x.1991.

48. *Sarcotragus mureungensis* Sim, Lee and Kim, 2016 (Fig. 52)

Mu-reung- yug-jil-sil-hae-myeon (무릉육질실해면)

Sarcotragus mureungensis Sim et al., 2016a, p. 452, fig. 9.

Description. Massive sponge, size up to $13 \times 11 \times 4.5$ cm. Surface covered with filamentous membrane and sharp conules. Filaments loosely wrap fibres, and filamentous membrane mixed with spicules. Among primary fibres, branched fibres rarely occurred under membrane. Oscules scattered over sponge surface. Color in life, gray outside and white inside. Texture soft and compressible. Choanosome lacunose.

Skeleton: Primary fibres, 500–1,600 μm in diameter, loose and cylindrical fascicles, filled with wads of filaments. Secondary fibres bridged form, 100–300 μm in diameter. Thin branched secondary fibres rarely, occurred under surface membrane, while thick subdermal skeletal fibres not observed. Filaments, 3–6 μm in diameter, terminal knobs, 8–13 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Mureungachi, 19.viii.2015.

49. *Sarcotragus purpureus* Sim, Lee and Kim, 2016 (Fig. 53)

Bo-la-yug-jil-sil-hae-myeon (보라육질실해면)

Sarcotragus purpureus Sim et al., 2016a, p. 452, fig. 8.

Description. Irregular mass sponge, size up to $14 \times 9 \times 7$ cm. Surface covered by filamentous membrane and row conules. Many fauna found on sponge surface. Filamentous membrane mixed with fine fibres. Oscules not distinct. Color pale purple in life. Texture soft and compressible.

Skeleton: Skeletal fibres loosely arranged. All fibres with large and small perforations. Primary fibres, 400–900–1,900 μm in diameter, cylindrical fascicles with large mesh net (Fig. 50F). Large mesh net causes filaments wads on primary fibre fascicles easily come out from fibres. Primary fibres at base of sponge are very thick and dense fascicles (Fig. 50G). Secondary fibres, 250–400 μm in diameter under surface membrane, and 600–1,000 μm in diameter at the base. Filaments, 5 μm in diameter, terminal knobs, 10–13 μm in diameter.

HABITAT: Depth of 15–18 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Gapado, 5.vii.2015.

50. *Sarcotragus rutzleri* Sim, Lee and Kim, 2017 (Fig. 54)

Rut-zuler-yug-jil-sil-hae-myeon (룻즐러유클실해면)

Sarcotragus rutzleri Sim et al., 2017b, p. 138, figs. 2, 3.

Description. Large hemispherical mass sponge, size up to $16 \times 14 \times 7$ cm. Surface, with almost indistinct conules, covered with thick filamentous membrane. Numerous thin branched fibres and thick perforated skeletal fibres occurred near surface. Small oscules, 1–2.5 mm in diameter, open on top of sponge, and some oscules united with several small oscules. Color in life pale purple outside, beige inside. Texture firm and compressible.

Skeleton: Complex fasciculated primary fibres, 150–250 μm , to 500–800 μm in diameter. Secondary fibres, 130–200 μm in diameter, perforated web or bridged type. Middle part of secondary fibres, simple fascicles (Fig. 51F, H). Filaments, two sizes, 2.5–3 μm and 5–8 μm in diameter, terminal knobs, 10–15 μm in diameter.

HABITAT: Depth of 20 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, Gapado, 21.viii.1998.

51. *Sarcotragus scalaris* Sim, Lee and Kim, 2016 (Fig. 55)

Sa-da-li-yug-jil-sil-hae-myeon (사다리유클실해면)

Sarcotragus scalaris Sim et al., 2016a, p. 452, figs. 10, 11.

Description. Thick round mass sponge, size up to $12 \times 7 \times 4$ cm. Surface covered by porous thin filamentous membrane. Conules easily distinct, but not sharp. Numerous oscules, 3–7 mm in diameter, open on sponge surface. Color beige in life, changed to dark brown after collection. Texture very soft and compressible. Choanosome not lacunose. Surface fibres thinner than ladder-like choanosomal fibres.

Skeleton: Primary fibres, 300–700 μm in diameter, dense cylindrical fascicles. Secondary fibres, web type in various sizes, 700–1,000 μm in diameter, and branch type fibres, 200–400 μm in diameter. Filaments, 5–7 μm in diameter, terminal knobs, 10–12 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Jeju-si, Jikgudo, 5.xi.2009.

52. *Sarcotragus schmidtii* Sim, Lee and Kim, 2016 (Fig. 56)

Sch-midt-yug-jil-sil-hae-myeon (슈미트육질실해면)

Sarcotragus schmidtii Sim et al., 2016a, p. 444, fig. 3.

Description. Round mass sponge, size up to $10.5 \times 6 \times 3.5$ cm. Conules barely distinct except on side of sponge because many fauna attached on sponge surface. Thick filamentous membrane with fine branched fibres. Color pale gray in life. Texture soft and compressible.

Skeleton: Primary fibres, strongly braided longitudinal fascicles, with fine meshed net, like tree bark. Primary fibres' diameter, diverse, 300–700 μm , thin primary fibres difficult to distinguish from secondary fibres. Cylindrical primary fascicles filled with wads of filaments. Secondary fibres with porous branches (Fig. 53D, F). Filaments, 5–7 μm in diameter, and difficult to separate from fibres, terminal knobs, 15 μm in diameter.

HABITAT: Depth of 21 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Marado, Seogwipo-si, 4.xi.2000.

REMARKS: This species is characterized by strongly braided longitudinal primary fascicles with fine meshed net (Fig. 53B).

53. *Sarcotragus seogwiensis* Sim, Lee and Kim, 2016 (Fig. 57)

Seo-gwi-yug-jil-sil-hae-myeon (서귀육질실해면)

Sarcotragus seogwiensis Sim et al., 2016a, p. 444, fig. 1.

Description. Massive, hemispherical mass sponge, size up to $13 \times 9 \times 3.5$ cm, conulose surface covered by thick filamentous membrane. Conules, low without emergent terminal fibres, but fine fasciculated fibres distributed under surface. Oscules very rare, 3 mm in diameter, color in life dark gray. Texture firm and compressible. Choanosome lacunose. Subdermal skeletal fibres well developed (Fig. 54B).

Skeleton: Fasciculated primary fibres, cylindrical net, with wads of filaments. Primary fibres fascicles network, 200–300 μm in diameter under membrane, and 600–1,000 μm in diameter at choanosome. Lightly

faciculated branched type secondary fibres, 50–200 μm in diameter. Secondary webs, vary in size. Filaments, 5 μm in diameter, terminal knobs, 10–12 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Seogwipo-si, 12.xi.2001.

54. *Sarcotragus sucinum* Sim, Lee and Kim, 2016 (Fig. 58)

Ho-bag-yug-jil-sil-hae-myeon (호박육질실해면)

Sarcotragus sucinum Sim et al., 2016a, pp. 449, 450, figs. 5, 6.

Description. Thick irregular mass sponge, size up to $10 \times 8 \times 3$ cm. Surface smooth. Conules, barely distinct except sharp conules on side of sponge. Thick skeletal fibres, irregularly branched out, covered by dense filamentous membrane. Oscules rare, 1 mm in diameter, open on sponge surface. Color pale gray in life, turn to dark brown upon collection. Texture very soft and compressible. Soft body texture causes sponge shape to be easily changable. Choanosome slightly lacunose.

Skeleton: Surface skeletal fibres, thicker than choanosome's. Choanosomal skeletal fibres arranged in three dimensions (Fig. 55F). All fibres amber color. Primary fibres, 300–700 μm in diameter, very loose fascicles. Secondary fibres, 50–200 μm in diameter, branched with regular mesh net. Filaments, 5 μm in diameter, terminal knobs, 10–15 μm in diameter.

HABITAT: Depth of 15 m, marine.

DISTRIBUTION: Korea.

KOREA: JJ.

SPECIMEN EXAMINED: Korea. JJ: Jeju-si, Jikgudo, 5.xi.2009.

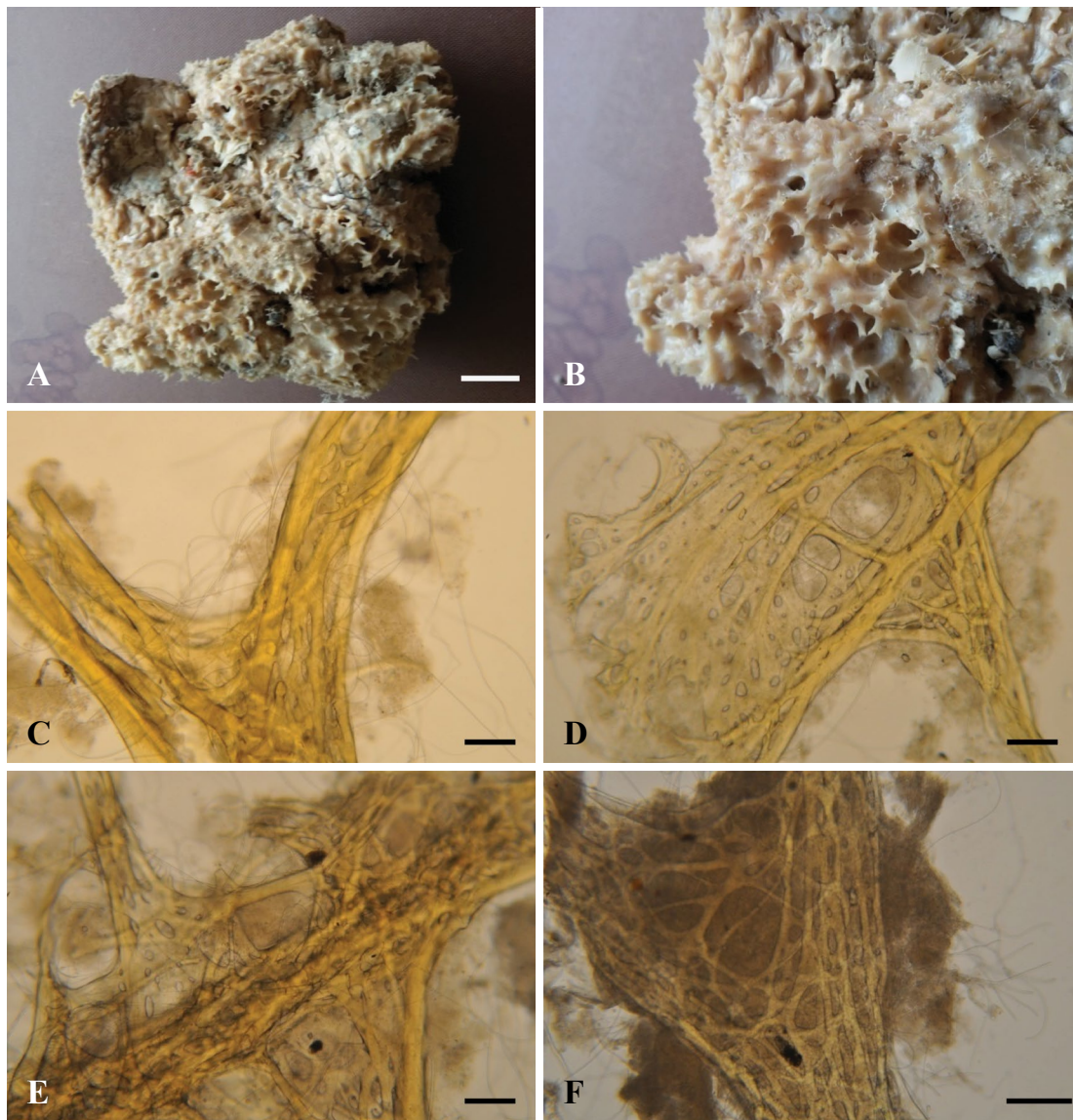


Fig. 45. *Sarcotragus chagwiensis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. primary and secondary fibres; D. secondary web; E. skeletal structure; F. surface primary fibres. Scale bars: A = 2 cm, C-F = 100 µm.

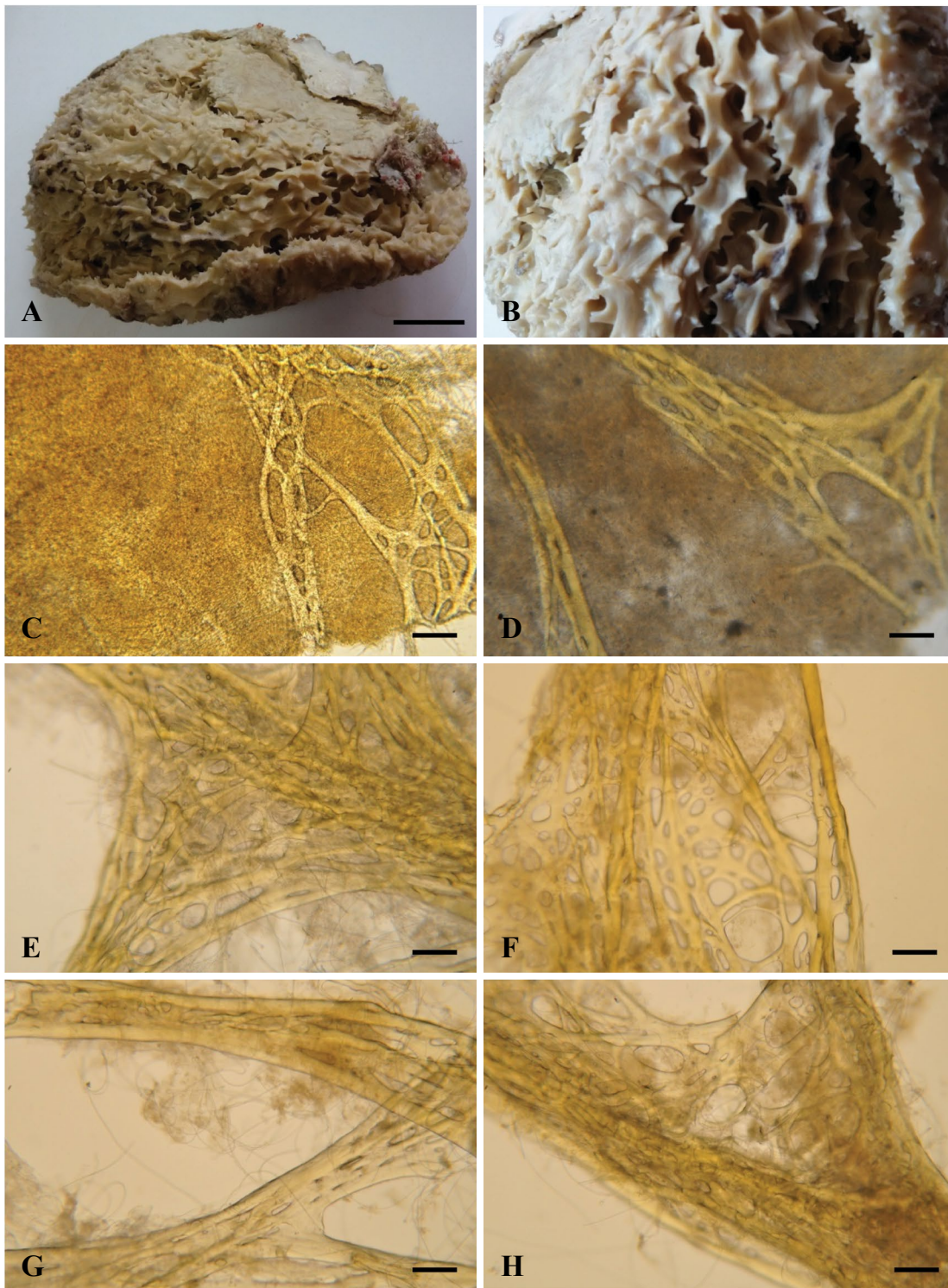


Fig. 46. *Sarcotragus dentilus* Sim, Lee and Kim. A. external morphology; B. surface close up; C, D. surface membrane fibres; E. fasciculate secondary fibres; F. primary fibres fascicle; G. thin primary fibres; H. primary and branched secondary fibres. Scale bars: A = 2 cm, C-H = 100 μ m.

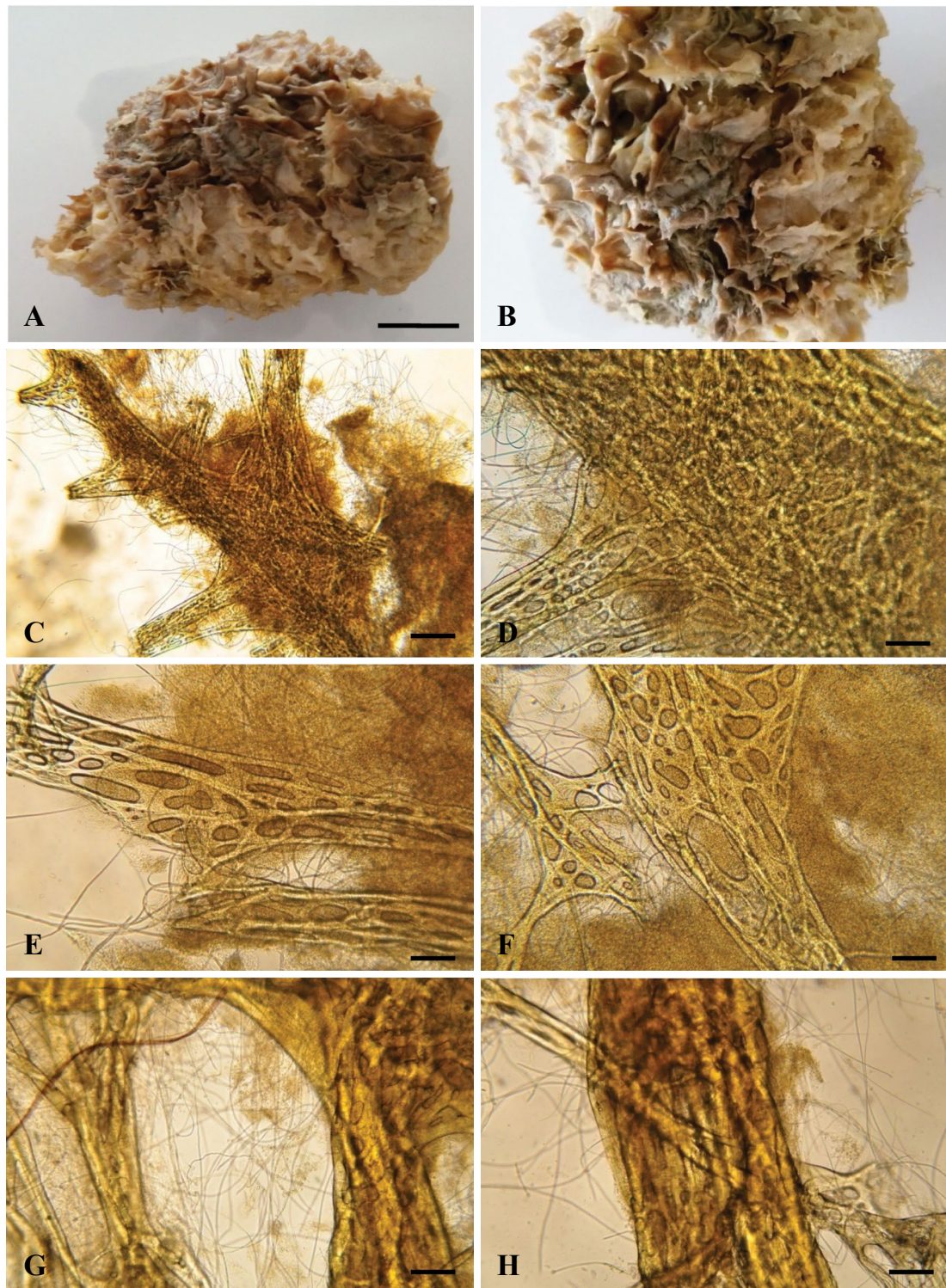


Fig. 47. *Sarcotragus gapaensis* Sim and Lee. A. external morphology; B. surface close up; C. skeletal structure; D. primary and secondary fibres; E, F. bridged secondary fibres with numerous perforations; G, H. primary fibres with secondary fibres. Scale bars: A = 2 cm, C = 200 μm, D-H = 100 μm.

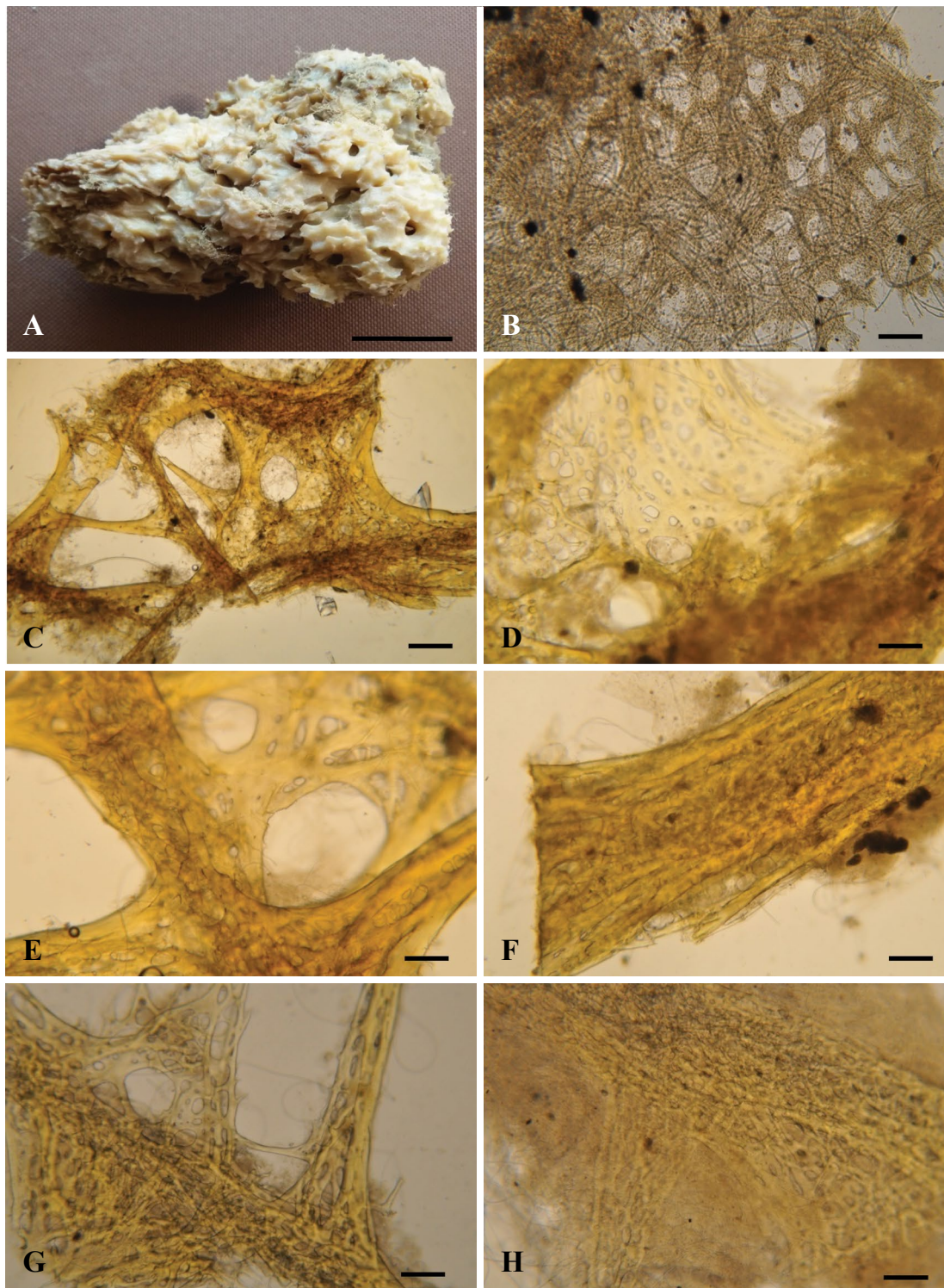


Fig. 48. *Sarcotragus geomunensis* Sim, Lee and Kim. A. external morphology; B. surface filamentous membrane; C. subdermal skeletal structure; D. secondary fibres web; E. skeletal structure; F. choanosome primary fibres; G, H. skeletal structure at the base of sponge. Scale bars: A = 2 cm, B = 100 μ m, C = 200 μ m, D–H = 100 μ m.

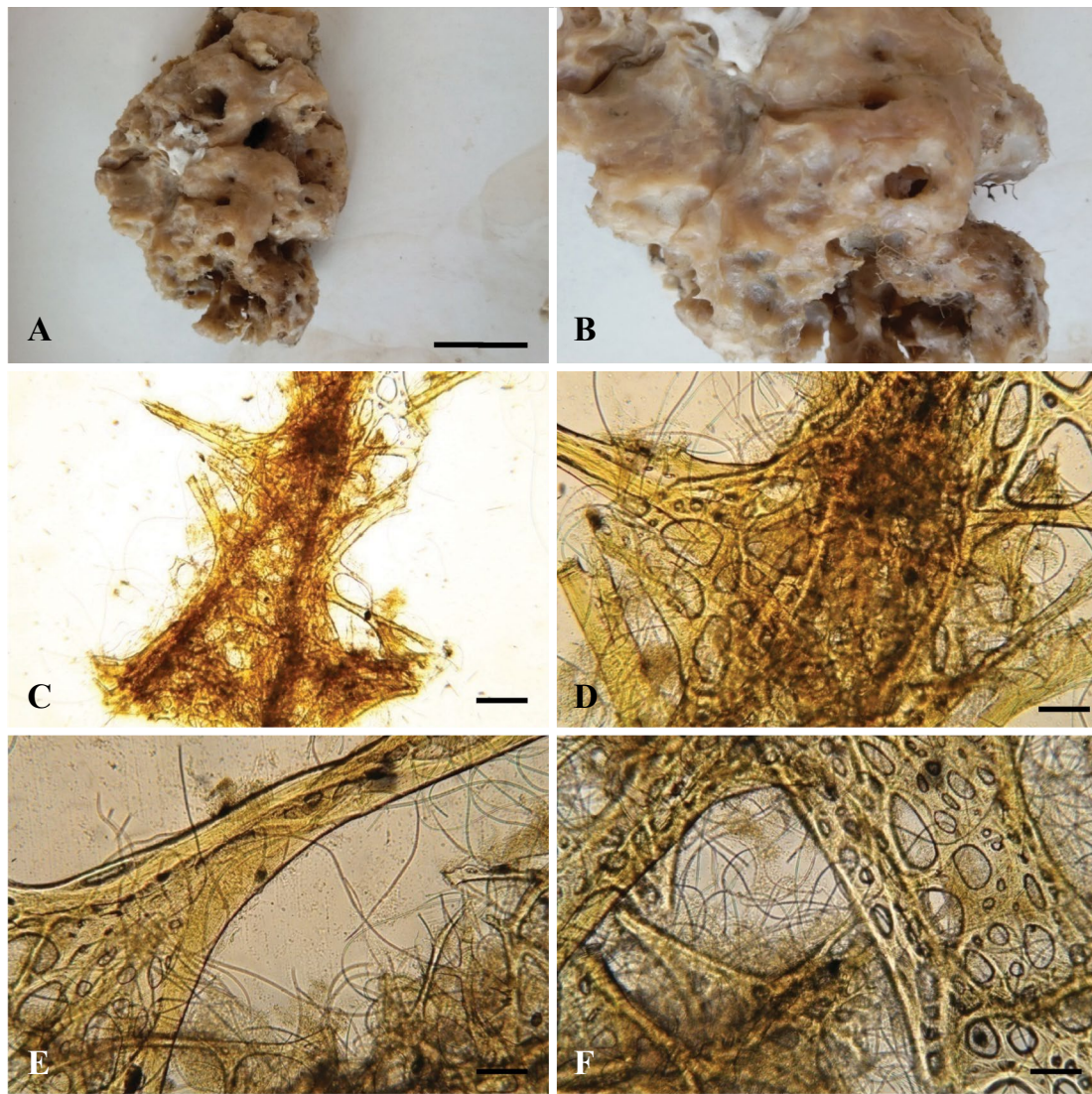


Fig. 49. *Sarcotragus levis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. primary and secondary fibres; E. fasciculate bridged secondary fibres; F. secondary web with opening. Scale bars: A = 2 cm, C = 200 μm , D-F = 100 μm .

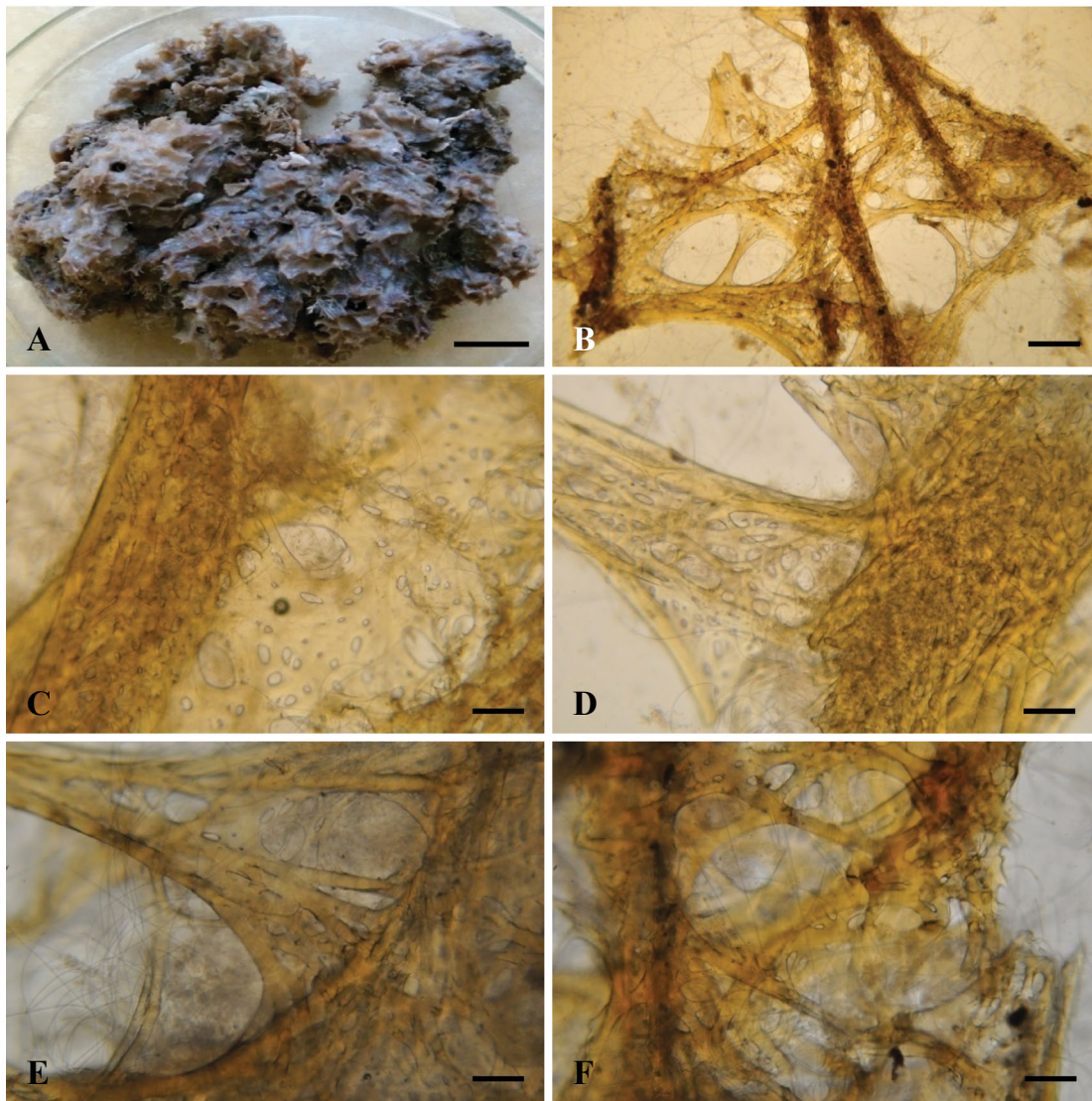


Fig. 50. *Sarcotragus mamillus* Sim, Lee and Kim. A. external morphology; B. subdermal skeletal structure; C. secondary web; D. branched secondary fibres; E, F. skeletal structure at the base of sponge. Scale bars: A = 2 cm, B = 200 μ m, C-F = 100 μ m.

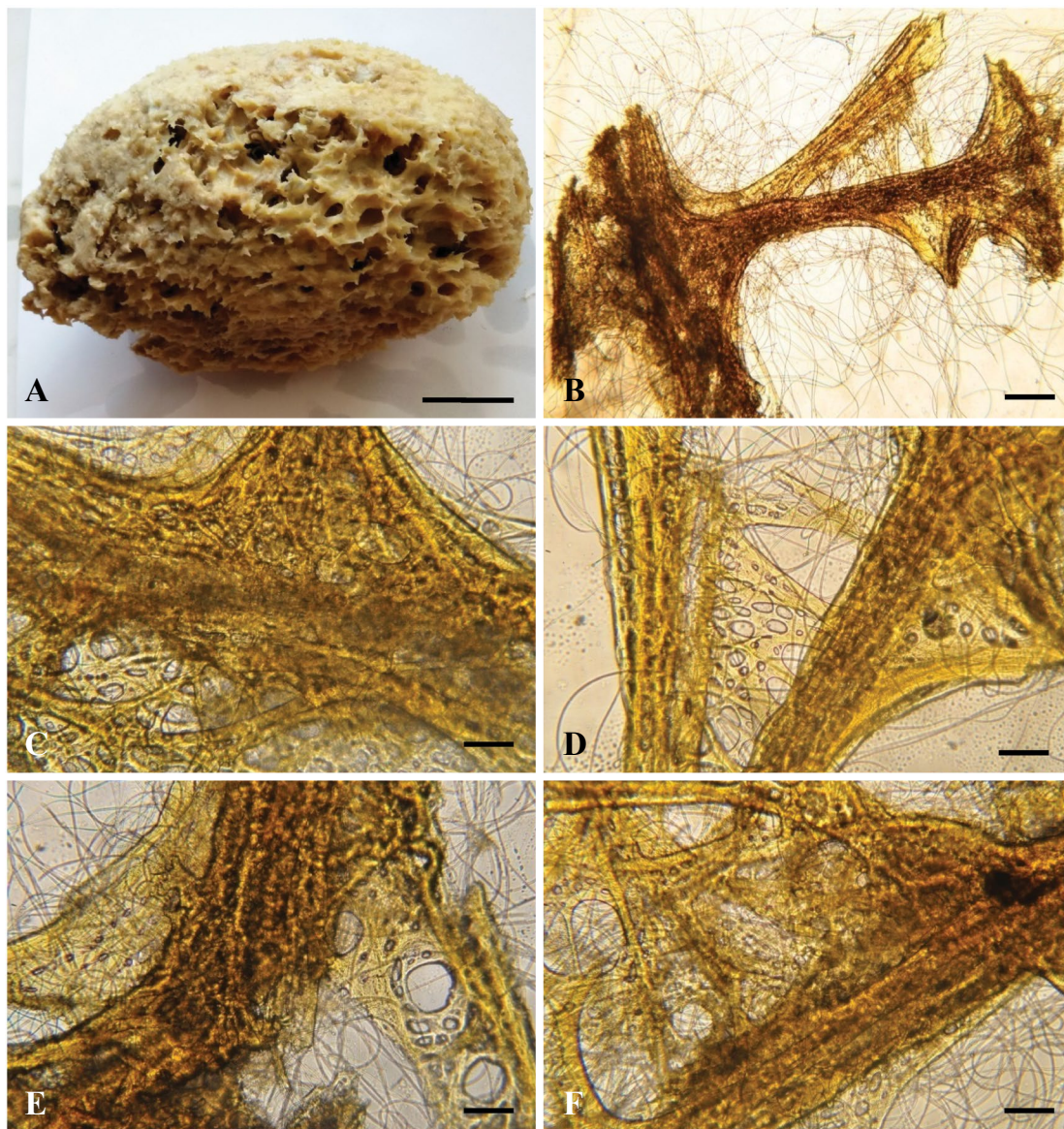


Fig. 51. *Sarcotragus maraensis* Sim and Lee. A. external morphology; B. skeletal structure; C, D. primary and secondary fibres; E. fasciculate primary fibres and bridged secondary fibres; F. secondary web. Scale bars: A = 2 cm, B = 200 μm , C-F = 100 μm .

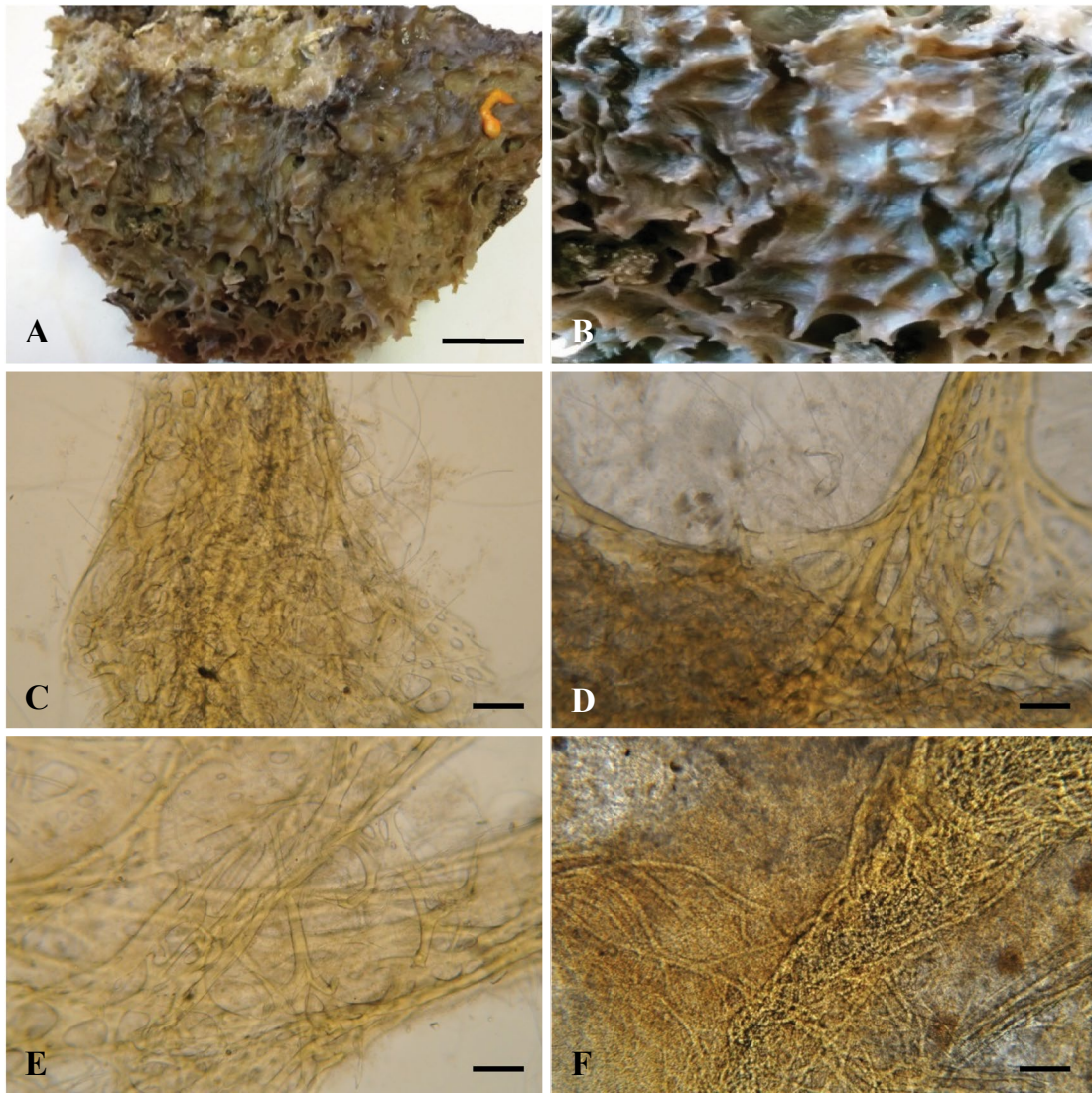


Fig. 52. *Sarcotragus mureungensis* Sim, Lee and Kim. A. external morphology; B. surface close up; C. primary fibres fascicle; D. branched secondary fibres; E. secondary fibres; F. surface membrane with fibres. Scale bars: A = 2 cm, C–F = 100 μ m.

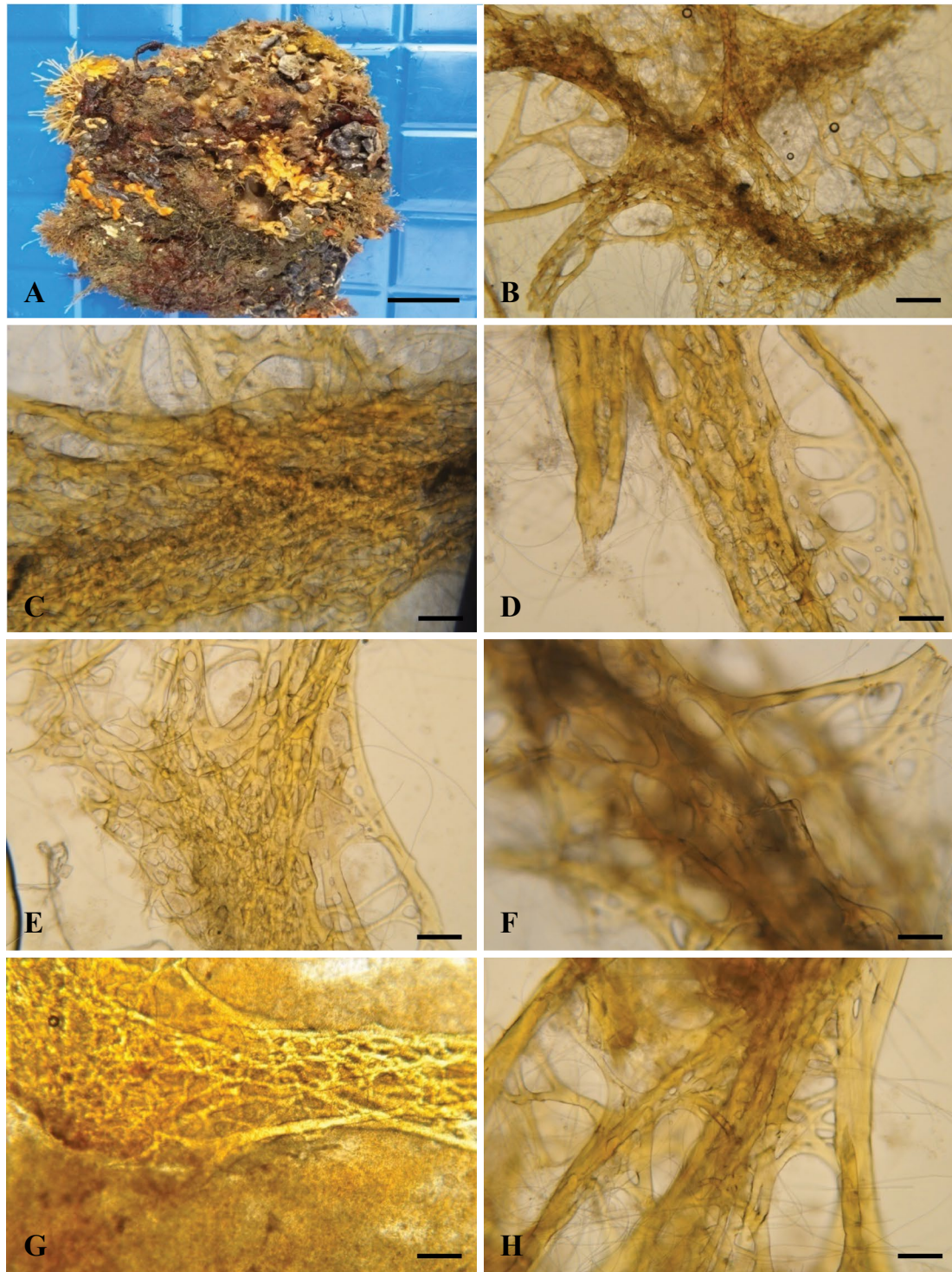


Fig. 53. *Sarcotragus purpureus* Sim, Lee and Kim. A. external morphology; B. skeletal structure; C. primary fibres fascicle; D. end of primary fibres fascicle; E. thin primary and secondary fibres; F. cylindrical primary fibres; G. thick primary fascicles at the base of sponge; H. choanosome skeletal structure. Scale bars: A = 4 cm, B = 200 μ m, C-H = 100 μ m.

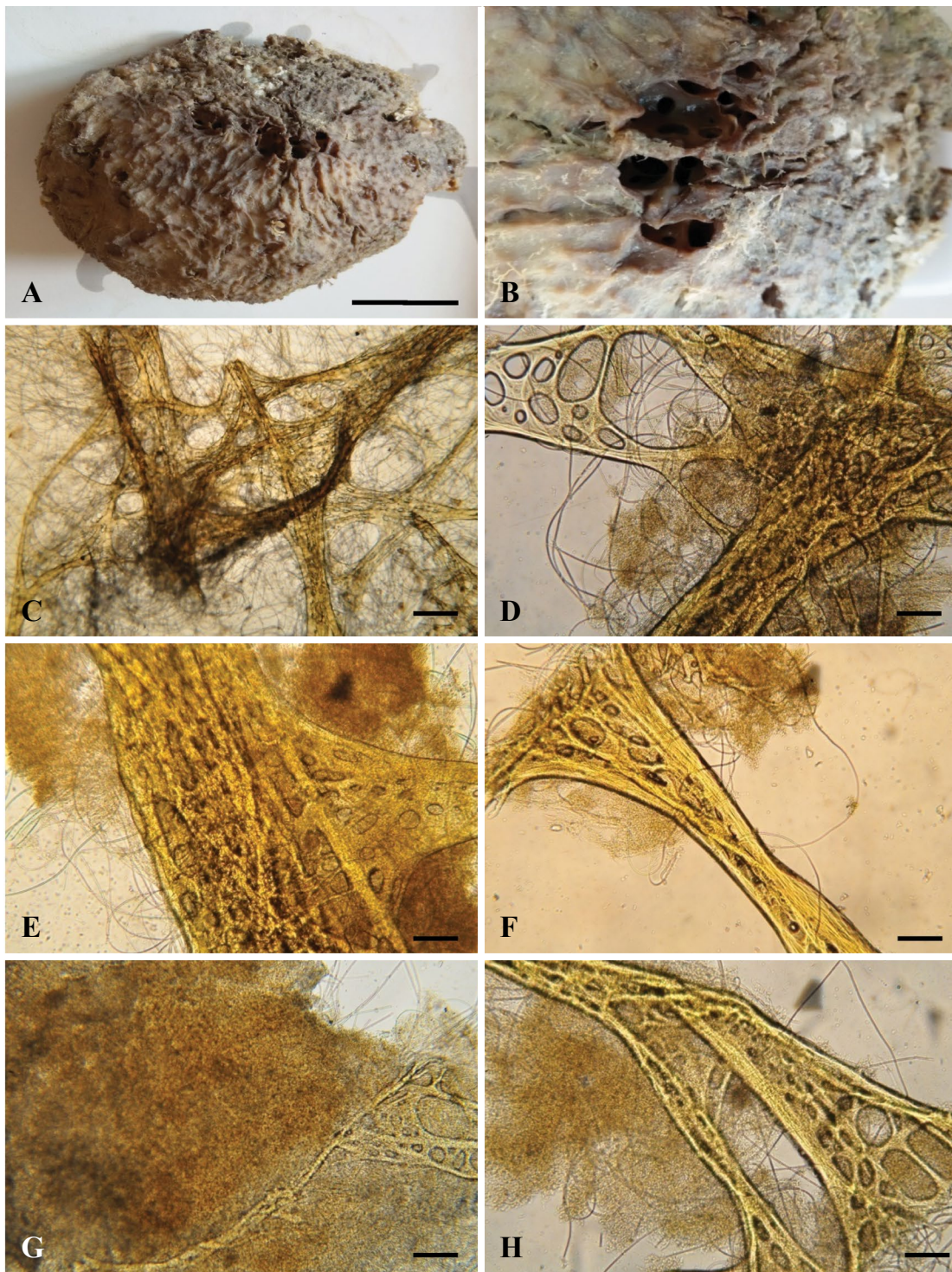


Fig. 54. *Sarcotragus rutzleri* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D, E. primary and secondary fibres; F. bridged secondary fibres; G, H. surface membrane with fibres. Scale bars: A = 2 cm, C = 200 μ m, D-H = 100 μ m.

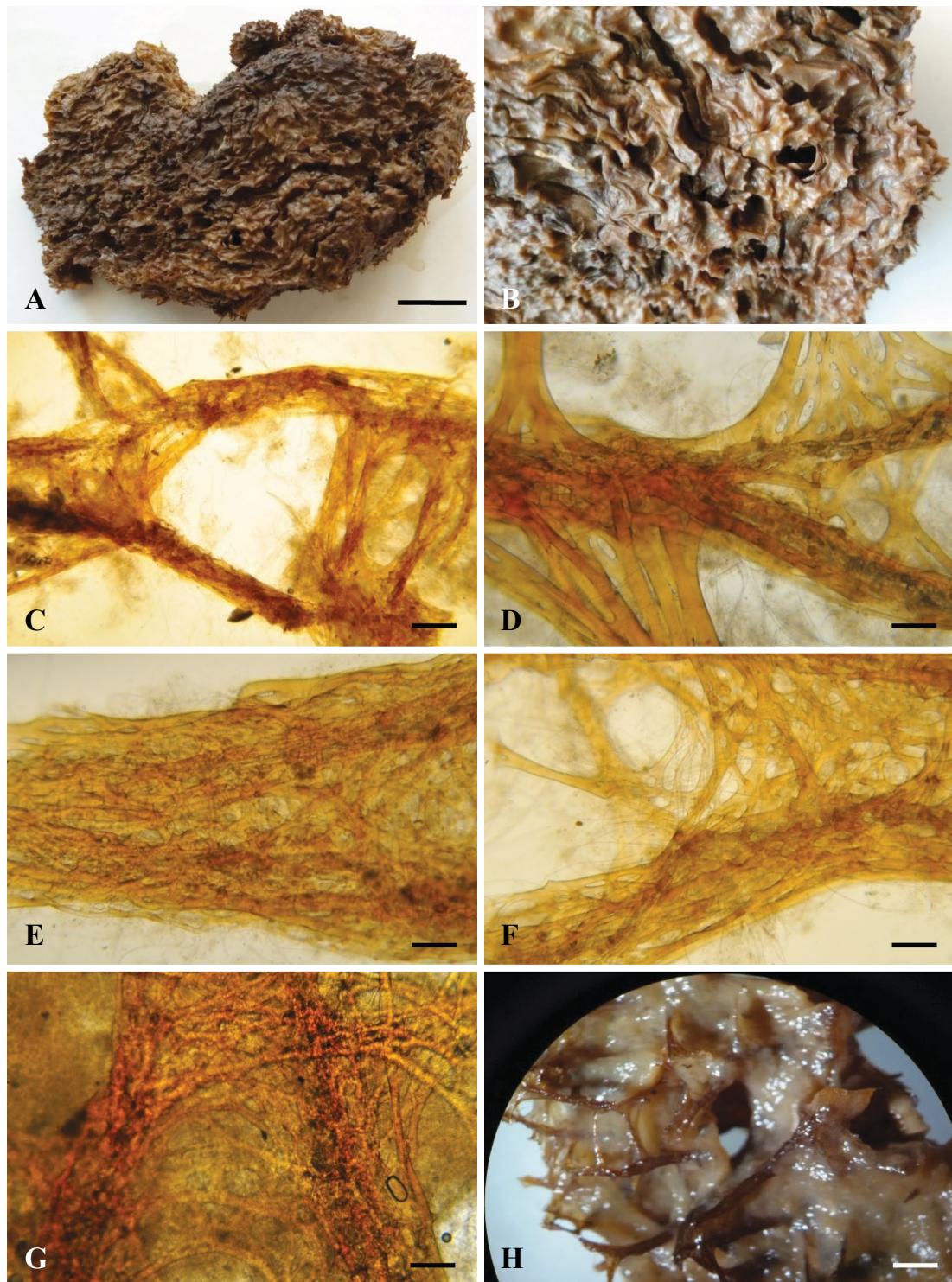


Fig. 55. *Sarcotragus scalaris* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. secondary web between primary fibres; E. primary fibres; F. secondary web between primary fibres; G. surface membrane with fibres; H. skeletal structure under dissection microscope. Scale bars: A = 2 cm, C = 200 μ m, D–H = 100 μ m.

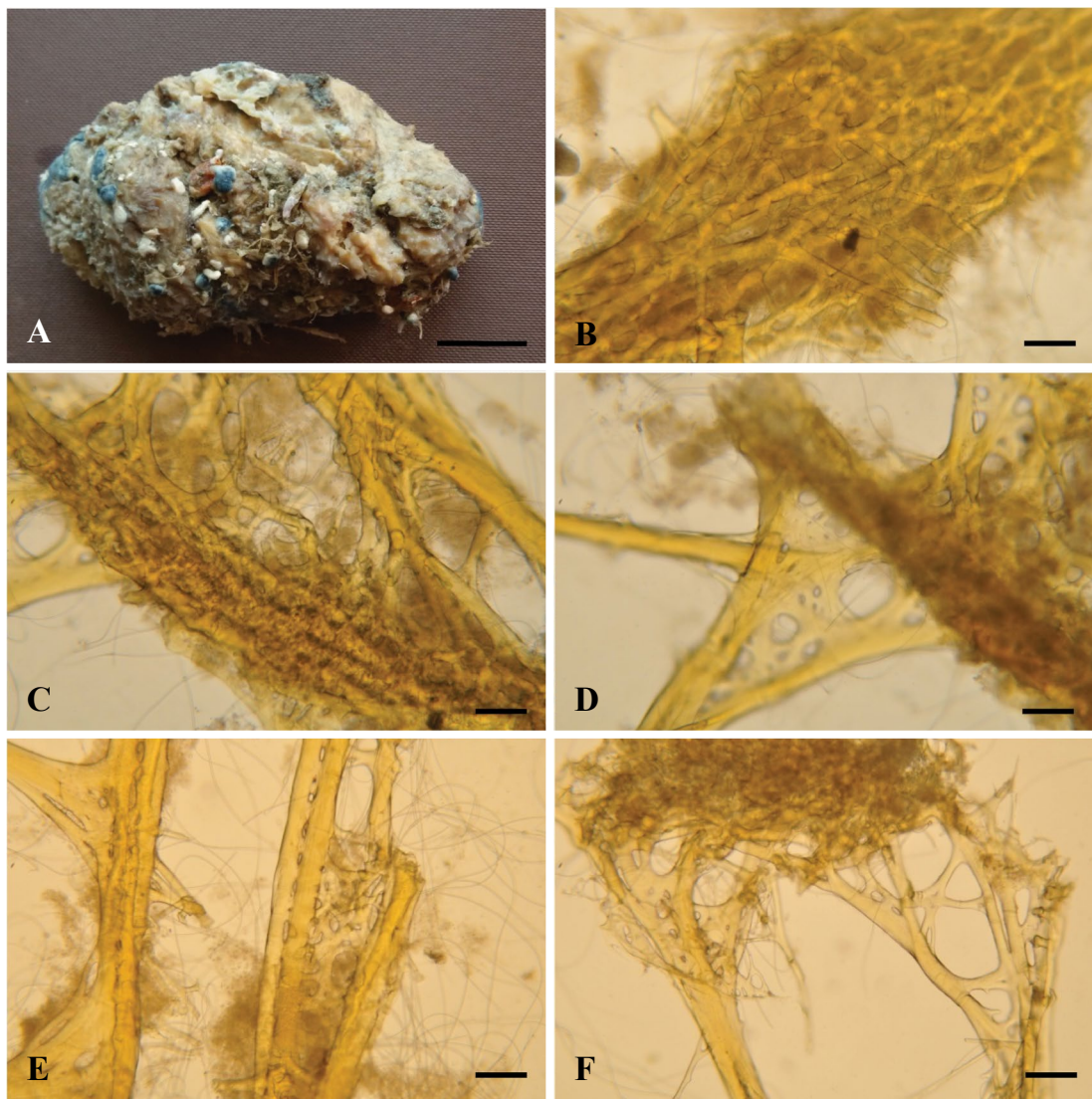


Fig. 56. *Sarcotragus schmidtii* Sim, Lee and Kim. A. external morphology; B. broad primary fibres fascicles; C. primary and secondary fibres; D. branched secondary fibres; E. narrow primary fibre; F. branched secondary fibres. Scale bars: A = 2 cm, B–F = 100 µm.

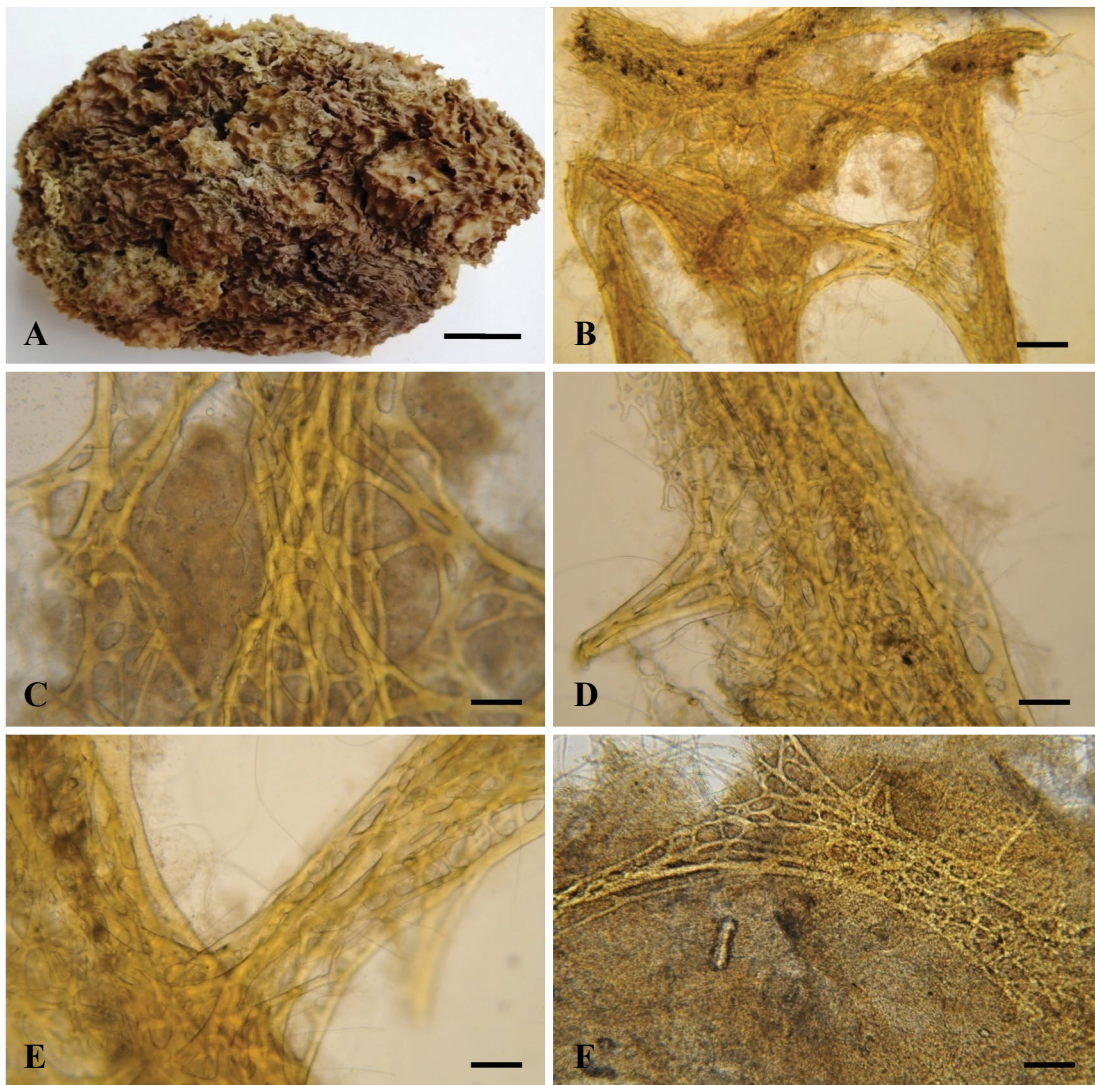


Fig. 57. *Sarcotragus seogwiensis* Sim, Lee and Kim. A. external morphology; B. subdermal skeletal structure; C. filamentous membrane with fibres; D. cylindrical primary fibres fascicles; E. fasciculate branched secondary fibres; F. filamentous membrane with fibres. Scale bars: A = 2 cm, B = 200 μ m, C–F = 100 μ m.

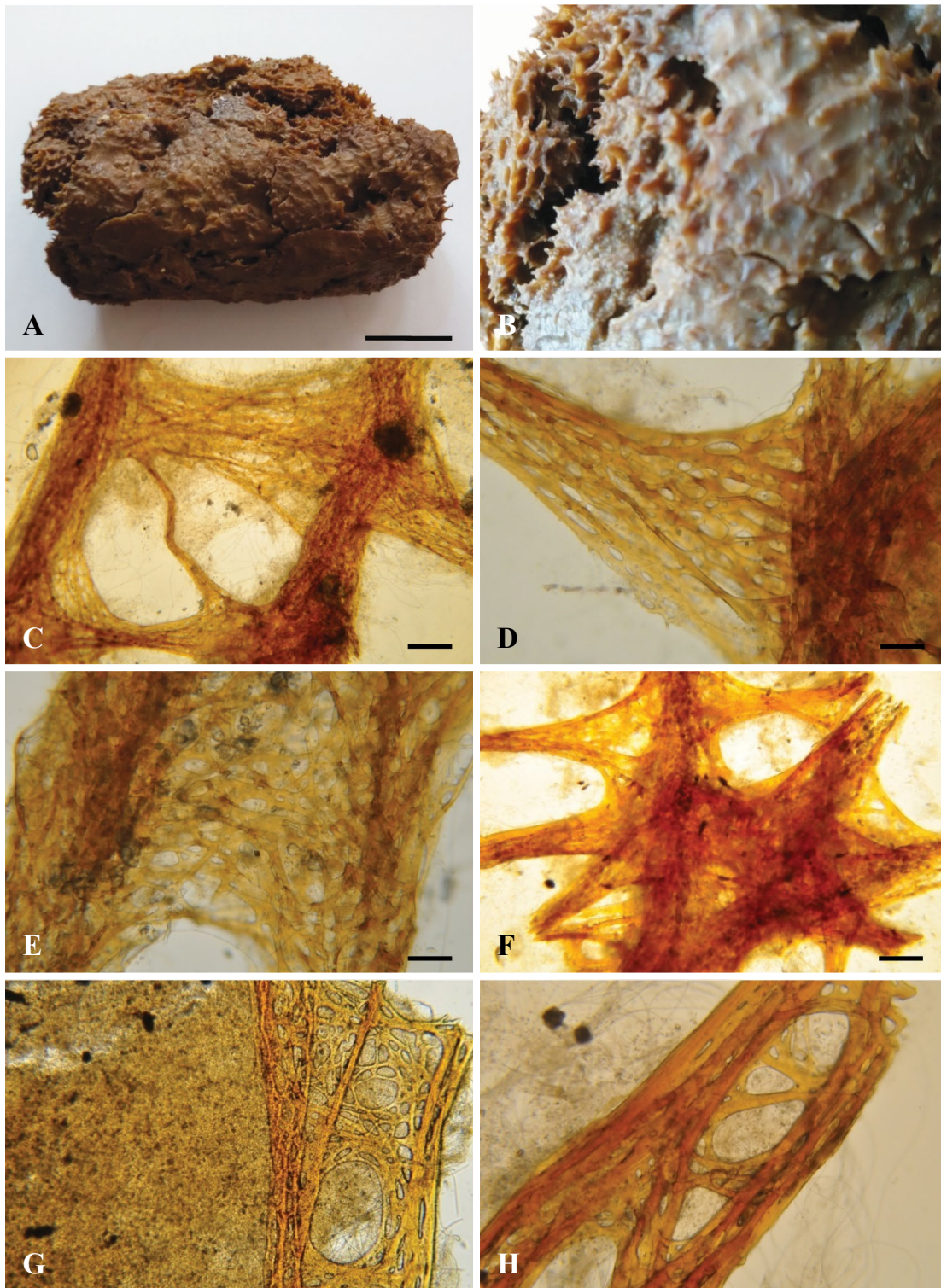


Fig. 58. *Sarcotragus sucinum* Sim, Lee and Kim. A. external morphology; B. surface close up; C. skeletal structure; D. branched secondary fibres with mesh net; E. secondary web among primary fibres; F. choanosome prismatic skeletal structure; G. surface membrane with thin fibres; H. thick secondary fibres. Scale bars: A = 2 cm, C, F = 200 μ m, D, E, G, H = 100 μ m.

LITERATURES CITED

- Bergquist, P.R., 1995. Dictyoceratida, Dendroceratida and Verongida from the New Caledonia Lagoon (Porifera: Demospongiae). *Memoirs of the Queensland Museum* 38(1): 1–51.
- Hooper, J.N.A. and R.W.M. Van Soest, 2002. *Systema Porifera: A guide to the Classification of Sponge*. Kluwer Academic/Plenum Publishers Press. USA, pp. 1–1101.
- Kim, Y.A., K.J. Lee and C.J. Sim, 2018. Psammocinian sponges (Demospongiae: Dictyoceratida: Irciniidae) from Korea. *Journal of Species Research* 7(4): 340–347.
- Lendenfeld, R.V., 1889. *A Monograph of the Horny Sponges*. (Trübner and Co.: London): 3–4, 1–936.
- Lee, K.J. and C.J. Sim, 2004. Two new marine Psammocinian sponges (Demospongiae: Dictyoceratida: Irciniidae) from Korea. *Korean J. Biol. Sci.* 8(3): 139–143.
- Poléjaeff, N., 1884. Report on the Keratosa collected by H. M. S. ‘Challenger’ during the years 1873–1876. Report on the Scientific Results of the Voyage of H. M. S. ‘Challenger’, 1873–1876. *Zoology* 11: 1–88.
- Sim, C.J., 1998. Three new horny sponges of the genus *Psammocinia* (Dictyoceratida: Irciniidae) from Korea. *Korean J. Syst. Zool.* 14: 35–42.
- Sim, C.J. and K.J. Lee, 1998. New species of two *Psammocinia* horny sponges (Dictyoceratida: Irciniidae) from Korea. *Korean J. Syst. Zool.* 14: 335–340.
- Sim, C.J. and K.J. Lee, 2000. Two new species of genus *Sarcotragus* (Demospongiae: Dictyoceratida: Irciniidae) in Korea. *Korean J. Syst. Zool.* 16(2): 177–182.
- Sim, C.J. and K.J. Lee, 2001. Two new species of genus *Psammocinia* (Dictyoceratida, Irciniidae) from Korea. *Korean J. Syst. Zool.* 17(2): 245–250.
- Sim, C.J. and K.J. Lee, 2002a. Two new Psammocinian sponges (Dictyoceratida: Irciniidae) from Korea. *Korean J. Biol. Sci.* 6: 53–57.
- Sim, C.J. and K.J. Lee, 2002b. A new species in the family Irciniidae (Demospongiae: Dictyoceratida) from Korea. *J. Biol. Sci.* 6: 283–285.
- Sim, C.J., K.J. Lee and H.J. Kim, 2016a. Ten new species of genus *Sarcotragus* (Demospongiae: Dictyoceratida: Irciniidae) from Korea. *Journal of species Research* 5(3): 443–458.
- Sim, C.J., K.J. Lee and H.J. Kim, 2016b. Nine new species of genus *Ircinia* (Demospongiae: Dictyoceratida: Irciniidae) from Korea. *Journal of Species Research* 5(3): 483–497.
- Sim, C.J., K.J. Lee and Y.A. Kim, 2017a. New species in two genera, *Psammocinia* and *Ircinia* (Demospongiae: Dictyoceratida: Irciniidae), from Korea. *Journal of Species Research* 6(Special edition): 94–109.
- Sim, C.J., K.J. Lee and Y.A. Kim, 2017b. New species in two genera, *Sarcotragus* and *Bergquistia* (Demospongiae: Dictyoceratida: Irciniidae), from Korea. *Journal of Species Research* 6(Special edition): 135–147.

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