

Eight New Species of Genus *Coscinoderma* (Demospongiae: Dictyoceratida: Spongiidae) from Chuuk Island, The Federated States of Micronesia

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ABSTRACT

This paper describes eight new species of the genus *Coscinoderma* from Chuuk Island, the Federated States of Micronesia. This genus is characterized by very fine, meandering uncored secondary fibres. All the new *Coscinoderma* species are compared with eight other valid species from tropical regions. *Coscinoderma folium* n. sp. is characterized by its large thickly foliate shape, and cored primary fibres are easily found between secondary fibres in choanosome. *Coscinoderma lacium* n. sp. differs in having round conules and no cored primary fibres. *Coscinoderma cavernosa* n. sp. is distinguished from other species by its cavernous shape and long sharp conules. *Coscinoderma wenoa* n. sp. is characterized by long conules and primary fibres. *Coscinoderma mappula* n. sp. differs in having a thick sand crust in the choanosome. *Coscinoderma bakusi* n. sp. is characterized by having several oscules at the top of the sponge and color changed grey to dark brown in alcohol. *Coscinoderma pollax* n. sp. is characterized by having a small thumb shape. *Coscinoderma truki* n. sp. similar to *C. pollax* in shape but differs in cored primary fibres with many spicules.

Keywords: *Coscinoderma*, Spongiidae, Dictyoceratida, new species, Chuuk Island

INTRODUCTION

The genus *Coscinoderma* Cater, 1883 (Demospongiae: Dictyoceratida: Spongiidae) is poorly known with only eight valid species reported worldwide (Cook and Bergquist, 2001). The sponge fauna of Chuuk Island (FSM) is reviewed by Kelly-Borges and Valentine (1995), based on the work of De Laubenfels (1954) and Bergquist (1965). To date, 47 sponge species are recorded from Chuuk Island. Among them, *Coscinoderma mathewsi* (Lendenfeld, 1886) was reported with *Hippospongia* from Pohnpei and Chuuk Island by De Laubenfels (1954). Besides, the *Coscinoderma* species from other area was reported as the following. *Coscinoderma confragosum* Polejaeff, 1884, *Coscinoderma denticulatum* Polejaeff, 1884, *Coscinoderma lanuga* De Laubenfels, 1936, *Coscinoderma nardorus* (Lendenfeld, 1886), *Coscinoderma pesleonis* (Lamarck, 1813) and *Coscinoderma sinuosum* (Lamarck, 1814). Voultsiadou-Koudoura et al. (1991) described one new species, *Coscinoderma sporadense* from the Aegean sea. Other

Coscinoderma species were reported but they have been placed in other genera or synonymized. This genus was characterized by the secondary elements which are clear, extremely fine, numerous, and intertwined (Bergquist, 1995; Cook and Bergquist, 2001). As a result of the study, eight new species are reported from Chuuk, and shows diversity.

MATERIALS AND METHODS

Sponges from Chuuk atoll were studied near Weno Island, 7° 25'N, 151° 47'E. They were taken from depths of 10–50 m using scuba diving during 18–22 Feb 2010, 2–9 Feb 2012 (Table 1, Fig. 1). Collected specimens were frozen and some preserved in 95% ethyl alcohol and identified based on their morphological characters. The external features of sponges were observed with a stereo-microscope. The skeletal fibres were studied under a light microscope (Carl Zeiss, Axioscope).

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Table 1. Geological information for collection sites

Station	Collection site	GPS
1	Front of KSORC-1 (Korea-South Pacific Ocean Research Center)	7° 27' 02" N, 151° 54' 22" E
2	Front of KSORC-2 (Korea-South Pacific Ocean Research Center)	7° 27' 23" N, 151° 54' 14" E
3	Benedict	7° 27' 13" N, 151° 53' 53" E
4	Osakura Island	7° 28' 49" N, 151° 53' 55" E
5	Winipirea Island	7° 25' 51" N, 151° 55' 57" E
6	Fannuk Island	7° 31' 29" N, 151° 58' 01" E

**Fig. 1.** A map showing the collection sites.

SYSTEMATIC ACCOUNTS

Phylum Porifera Grant, 1836
 Class Demospongiae Sollas, 1885
 Order Dictyoceratida Minehin, 1900
 Family Spongiidae Gray, 1867
 Genus *Coscinoderma* Carter, 1883

¹**Coscinoderma folium* n. sp. (Fig. 2)

Type specimen. Holotype (MABIK IV00151582), front of KSORC-1, Chuuk, Micronesia, 17 Feb 2010, Kim HS, by scuba, depth 25 m, deposited in the MABIK, Seocheon, Korea.

Description. Large vase shape around 50 × 55 × 3–7 cm *in situ*. Holotype small pieces size up to 8 × 11 × 1.5 cm. Sur-

face smooth with low conules, 0.2–0.5 mm high, sharp tip. The thin dermal membrane mixed with rare sand and a thin sands membrane, both easily separate. No oscules. The texture firm and compressible. Color in life pale gray externally, brown internally. Skeleton. Primary fibres in conules 50–110 µm in diameter, tightly armored with a sand crust and cored with sand grains, very difficult to separate the sand from the primary fibres. Primary fibres in the choanosome cored and others uncored, 21–50 µm in diameter (Fig. 2F). Secondary fibres 9–15 µm in diameter, uncored, long and very fine and intertwined in the choanosome. Sometimes connected with a short bridge each other.

Etymology. This species named after its foliose shape.

Remarks. This new species is a very large sponge. Primary fibres in the conules form loose fascicles and densely cored

Korean name: ¹*일사귀코스노터마해면 (신칭)

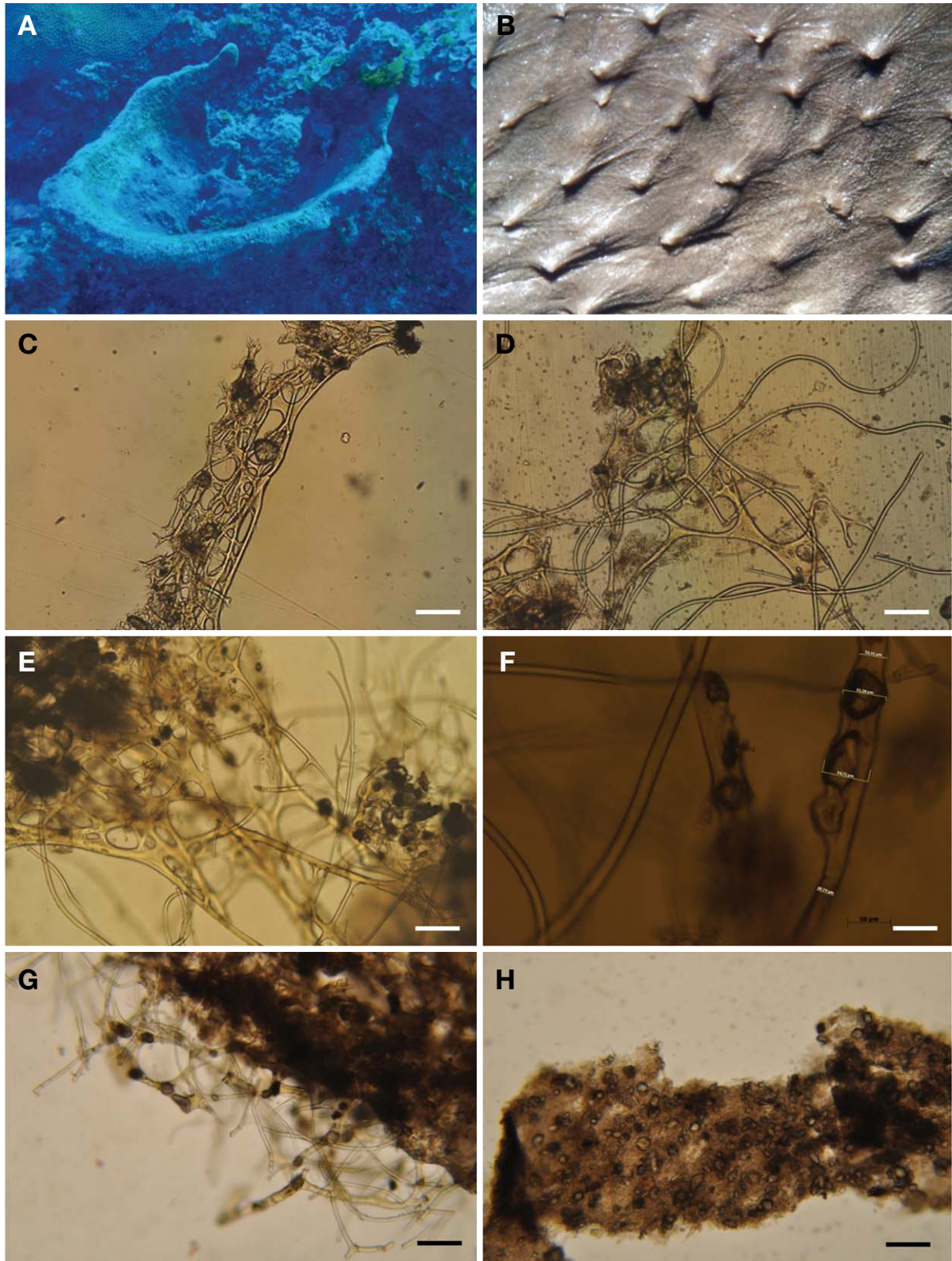


Fig. 2. *Coscinoderma folium* n. sp. A, Entire animal (*in situ*); B, Surface conules; C, Primary fibres in conules; D, Primary and secondary fibres; E, Primary in choanosome; F, Primary fibres between secondary fibres; G, Cored primary fibres; H, Surface membrane. Scale bars: C-E, G, H=100 μ m, F=50 μ m.

with large sand. Choanosomal, primary fibres are rarely cored over short distances. This new species is similar to the *Coscinoderma mathewsi* (Lendenfeld, 1886) in shape but differ in trellis-like structure of main fibres. Lendenfeld's specimen (1889), main fibres are cored with chiefly fine sand grains but new species core with large sand.

¹**Coscinoderma lacium* n. sp. (Fig. 3)

Type specimen. Holotype (MABIK IV00151583), Fannuk

Island, Chuuk, Micronesia, 18 Feb 2010, Kim HS, by scuba, depth 25 m, deposited in the MABIK, Seocheon, Korea.

Description. Large subspherical sponge, 42 × 18 cm. Surface covered with a thick leathery two-layered membrane with very rare sand. Numerous dense small round conules 3 mm high especially on the top of the sponge. No oscules. Texture firm and compressible. Color in life dark black, underneath gray, beige internally. Center of sponge with a large hole, and side with a small hole. Skeleton. Primary fibres very well

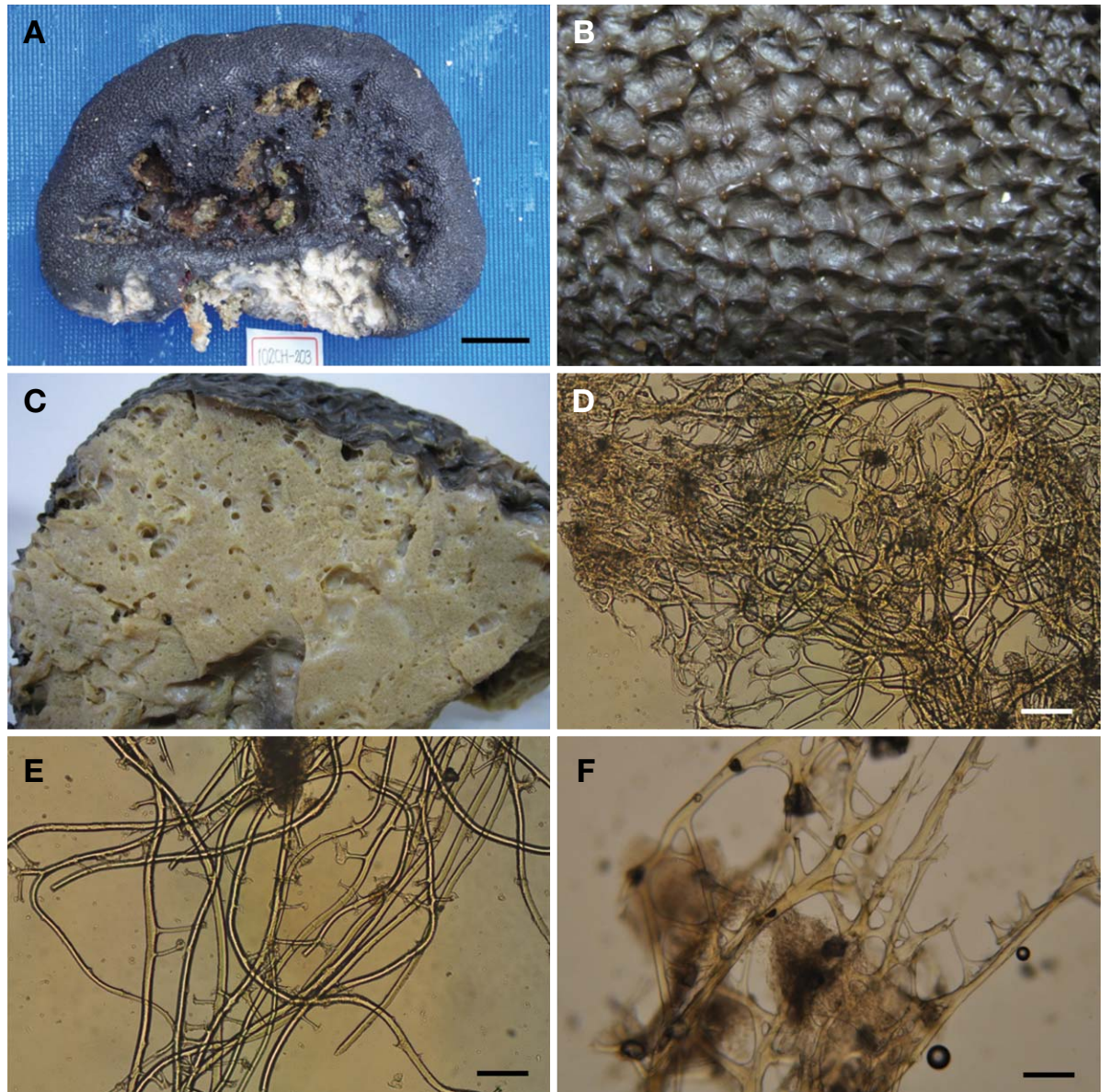


Fig. 3. *Coscinoderma lacium* n. sp. A, Entire animal; B, Surface conules; C, Perpendicular section; D, Primary fibres in conule; E, Secondary fibres with short bridge; F, Primary fascicle in choanosome. Scale bars: A=5 cm, D–F=100 μm.

Korean name: ¹*레이스코스노더마해면 (신칭)

developed in the conules, 500 μm in diameter, lacey branched uncored primary fibres with a round cap, covered with a small amount of sand, but cored primary fibres at the base of the conule. Some primary fibres in choanosome 500–1,000 μm in diameter, rare cored but sand wrapped with numerous bridged secondary fibres. Secondary fibres in choanosome, 10–25 μm in diameter, easy to tear.

Etymology. This species named after the lace shape of primary fibres in conules.

Remarks. Primary fibres create a lace cap in short round conules on the top of the sponge but is covered with a small amount of sand, easy to separate from the fibres. Primary fibres in conules are no cored. This sponge has no ectosomal sand crust and choanosomal membrane very rarely has sand.

¹**Coscinoderma cavernosa* n. sp. (Fig. 4)

Type specimen. Holotype (MABIK IV00151584), Winipirea Island, Chuuk, Micronesia, 22 Feb 2010, Kim HS, by scuba,

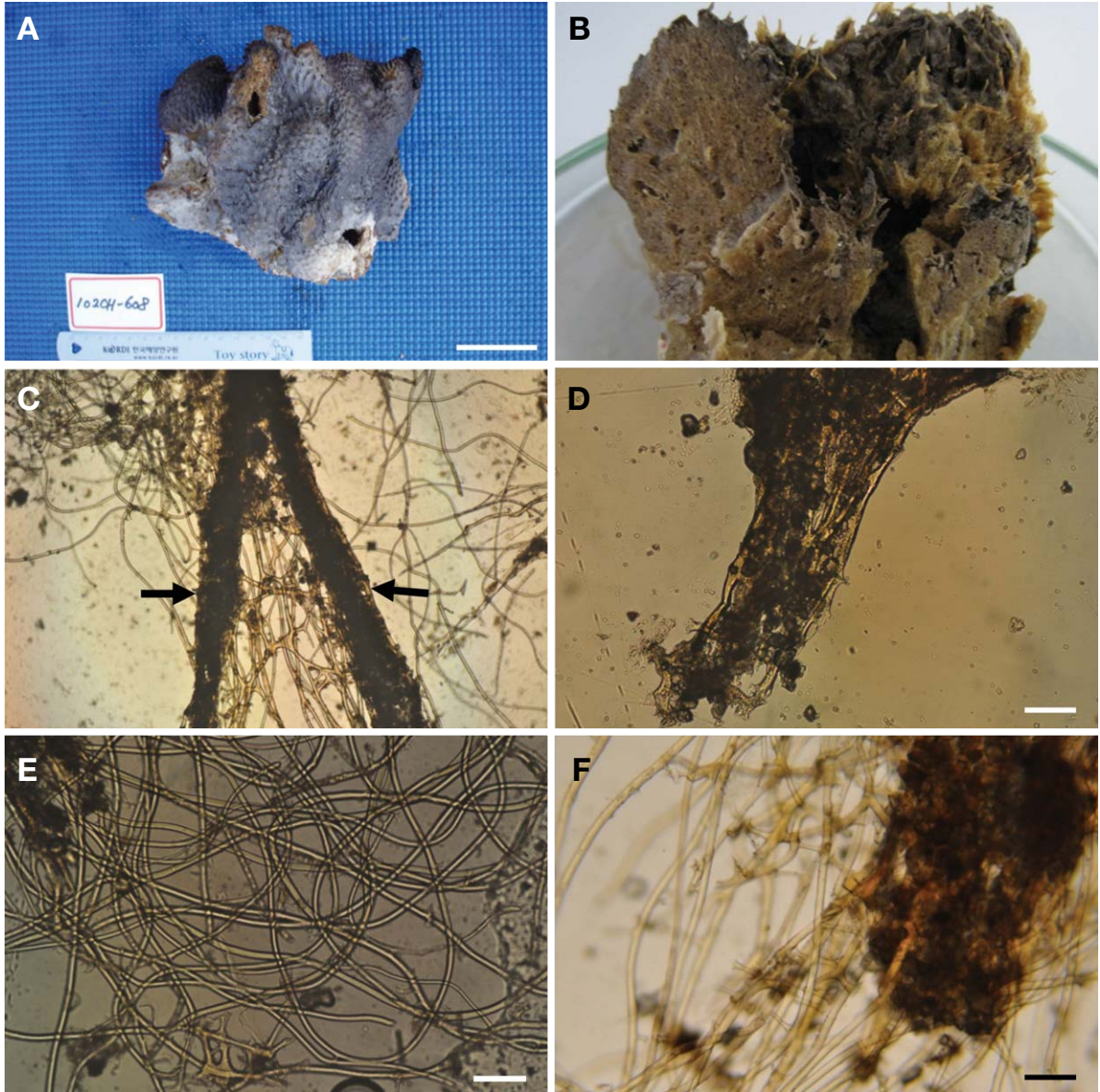


Fig. 4. *Coscinoderma cavernosa* n. sp. A, Entire animal; B, Perpendicular section; C, D, Primary fibres in conule (arrows); E, Secondary fibres; F, Primary and secondary fibres in choanosome. Scale bars: A=5 cm, D–F=100 μm .

Korean name: ¹*다공코스노더마해면 (신칭)

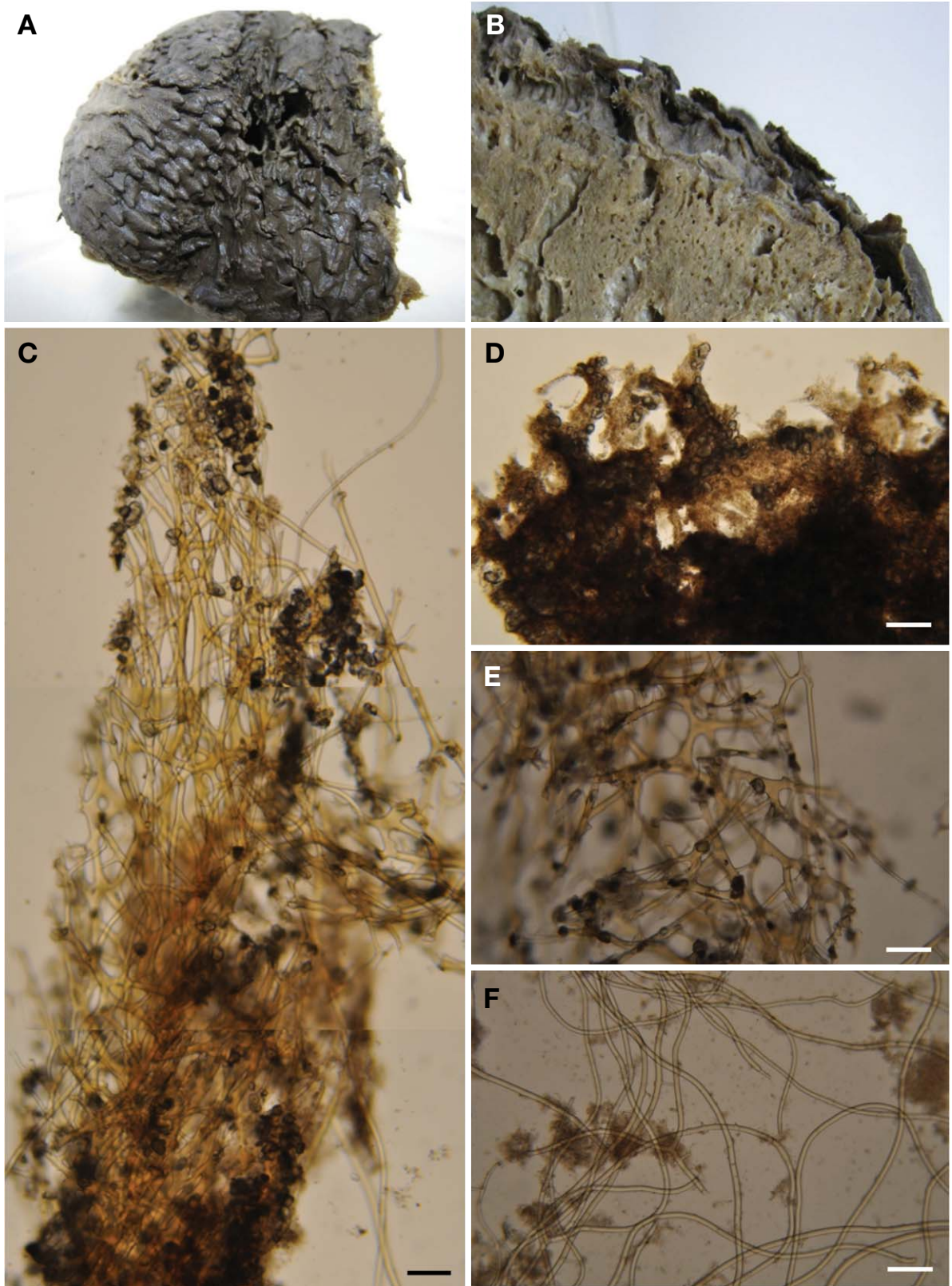


Fig. 5. *Coscinoderma wenoa* n. sp. A, Entire animal; B, Perpendicular section; C, Primary fibres in conule; D, Surface membrane; E, Cored primary fibres; F, Secondary fibres. Scale bars: C-F=100 μ m.

depth 25 m, deposited in the MABIK, Seocheon, Korea.

Description. Sponge massive with several short branches, size up to 16 × 20 cm and very cavernous. Surface very rough with long sharp conules with a thick sand crust, easily broken. Surface, covered two layered dermal membrane and sand crust. No oscules. Texture soft and compressible. Color in life gray on the surface and brown inside. Skeleton. Primary fibres in the conules mixed with sand grains and strong spongin, difficult to separate from fibres. Fasciculate primary fibres in conules measures, 300–400 µm in diameter, some

branched (Fig. 4C). In the choanosome, primary fibres are rare. Secondary fibres 15–20 µm in diameter.

Etymology. This species name after its cavernous structure.

Remarks. This new species is very cavernous which is unique in the genus *Coscinoderma*. Surface sand crust is easily broken so appears rough.

¹**Coscinoderma wenoa* n. sp. (Fig. 5)

Type specimen. Holotype (MABIK IV00151585), Winipirea Island, Chuuk, Micronesia, 22 Feb 2010, Kim HS, by scuba,

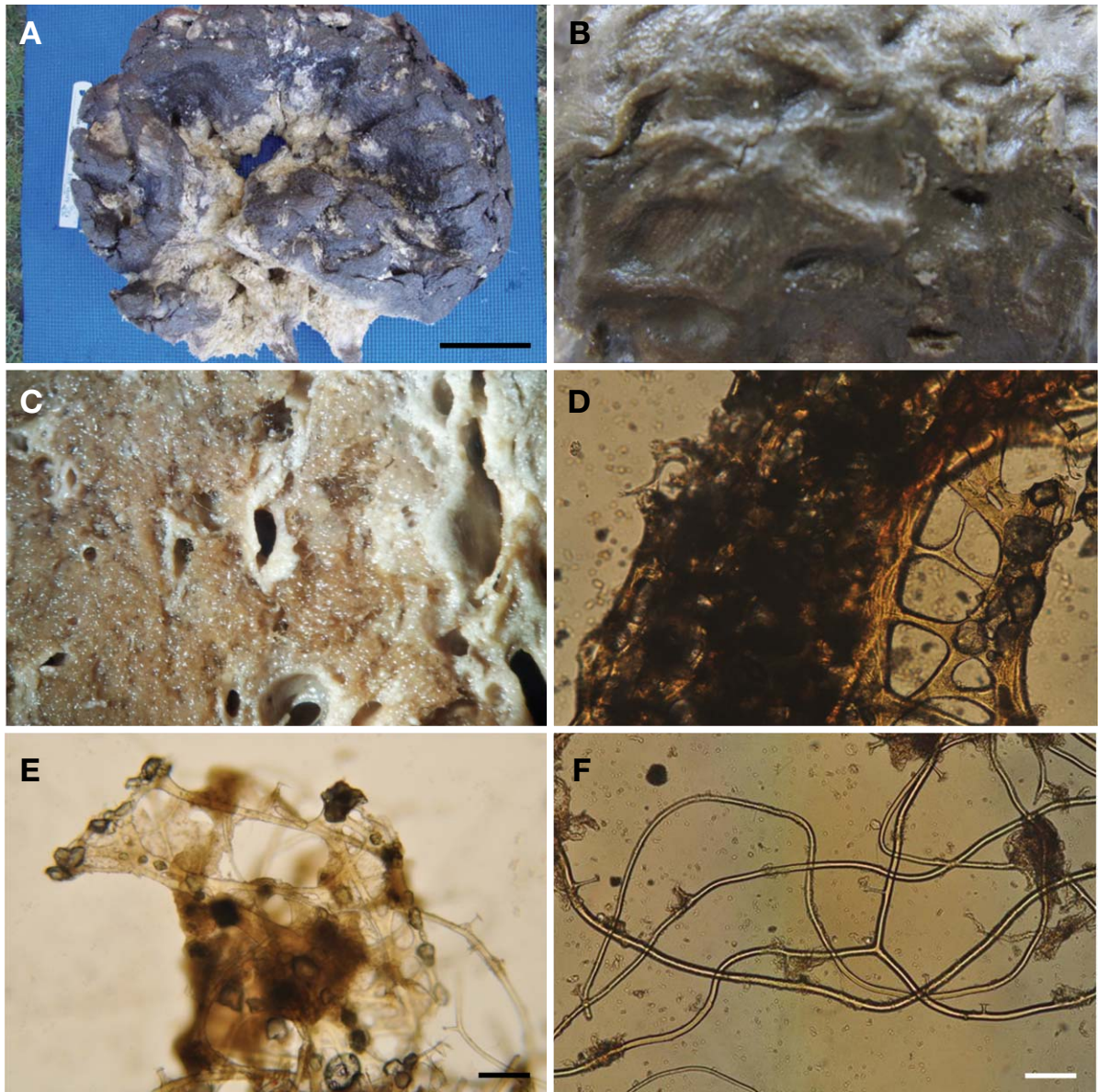


Fig. 6. *Coscinoderma mappula* n. sp. A, Entire animal; B, Closed surface; C, Perpendicular section; D, Primary fibres in conules; E, Primary fibres in choanosome; F, Secondary fibres. Scale bars: A=10 cm, E, F=100 µm.

Korean name: ¹*왜노코시노더마해면 (신칭)

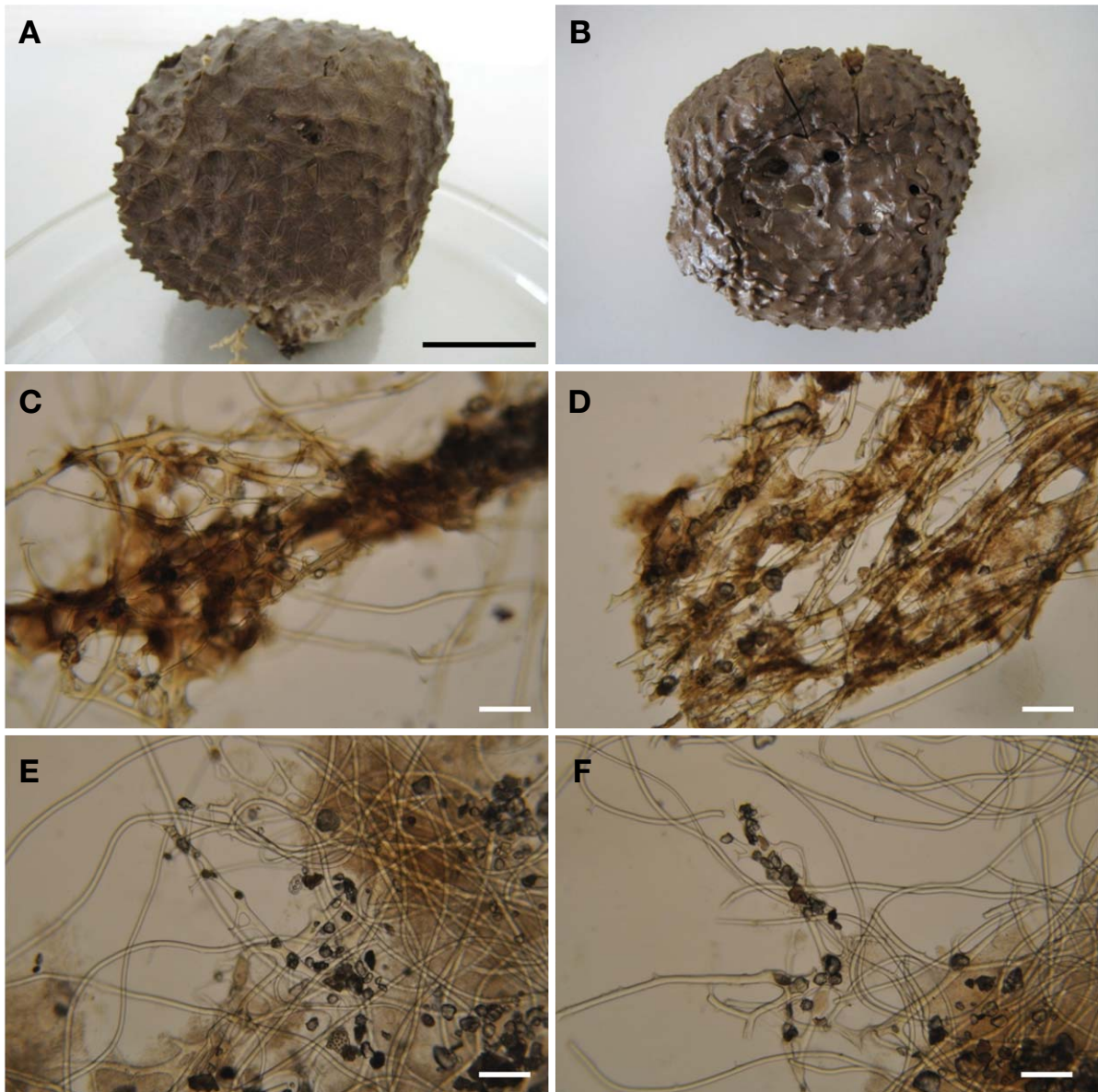


Fig. 7. *Coscinoderma bakusi* n. sp. A, Entire animal; B, Oscules on the top; C, D, Primary fibres in conule; E, F, Secondary fibres in choanosome. Scale bars: A=2 cm, C–F=100 μ m.

depth 25 m, deposited in the MABIK, Seocheon, Korea.

Description. Sponge a subcylindrical mass $35 \times 25 \times 15$ cm. Surface, three layered, thin dermal membrane with rare sand and space, second thin sand crust and third thick sand crust with long conules, with a stellate shape. Large space between ectosome and choanosome. No oscules. Texture firm and compressible. Color in life black outside, yellowish brown inside. Skeleton. Primary fibres in the conules loosely distributed and weakly adherent with sand. Ectosomal sand crust 0.1 mm thick, separate from surface. Primary fibres rarely

cored with sand grains, only attached at the surface of thin primary fibres 600–700 μ m in diameter, 5–7 mm long. Secondary fibres 10–15 μ m in diameter, not easy to tear in the choanosome. Many thin membranes with sand in the choanosome.

Etymology. This new species name after the type locality, Weno Island, Chuuk, Micronesia.

Remarks. This new species has long conules and primary fibres are long in the choanosome. Surface sand membrane has space between ectosome and choanosome.

¹**Coscinoderma mappula* n. sp. (Fig. 6)

Type specimen. Holotype (MABIK IV00151586), Osakura Island, Chuuk, Micronesia, 20 Feb 2010, Kim HS, by scuba, depth 25 m, deposited in the MABIK, Seocheon, Korea.

Description. Large irregular sponge, size up to 45 × 22 cm. The surface a leathery thick membrane with conules. Under the membrane, sand crust 4–8 mm thick, tightly adherent with the choanosome. No oscules. Texture soft and compressible. Color in life black outside, beige inside. Skeleton. Primary fibres in the conules cored with large sand grains, creating large meshed fascicles. Ectosomal skeleton under surface membrane creating thick sand crust 5–7 mm thick, attached to the surface of the fibres 500–700 µm in diameter. Long fasciculate primary fibres with sand emerge from the choanosome. Secondary fibres 20–25 µm in diameter, loosely distributed in the choanosome, seldom connected with other secondary fibres. Sponge perpendicular section, choanocyte chambers surrounded with a sand crust 1–3 mm thick.

Etymology. This new species named after shape of mop.

Remarks. This new species is a very soft and compressible.

In the choanosome, numerous thick sand crust cover choanocyte chamber (Fig. 6C).

²**Coscinoderma bakusi* n. sp. (Fig. 7)

Type specimen. Holotype (MABIK IV00151587), Fannuk Island, Chuuk, Micronesia, 18 Feb 2010, Kim HS, by scuba, depth 25 m, deposited in the MABIK, Seocheon, Korea.

Description. Round mass shape, with the base narrow than top. Size up to 6 × 5 cm. Surface many distinct satellite conules with round tips, 900 µm high; 150 µm in diameter. Surface, one layer sand membrane. Many oscules 2–6 mm in diameter open on the top. Conule, cover a thick sand crust, easily separate from primary fibres in conules. Texture hard and compressible. Color change gray to dark brown. Skeleton. Cored primary fibres fascicles wrapped with many bridged secondary fibres tightly. Primary fibres 150 µm in diameter. No cored secondary fibres, 15–25 µm in diameter.

Etymology. This species name bakusi is named after the late Dr. Gerald J. Bakus who was a professor in the department of Biological Sciences, University of Southern California, a

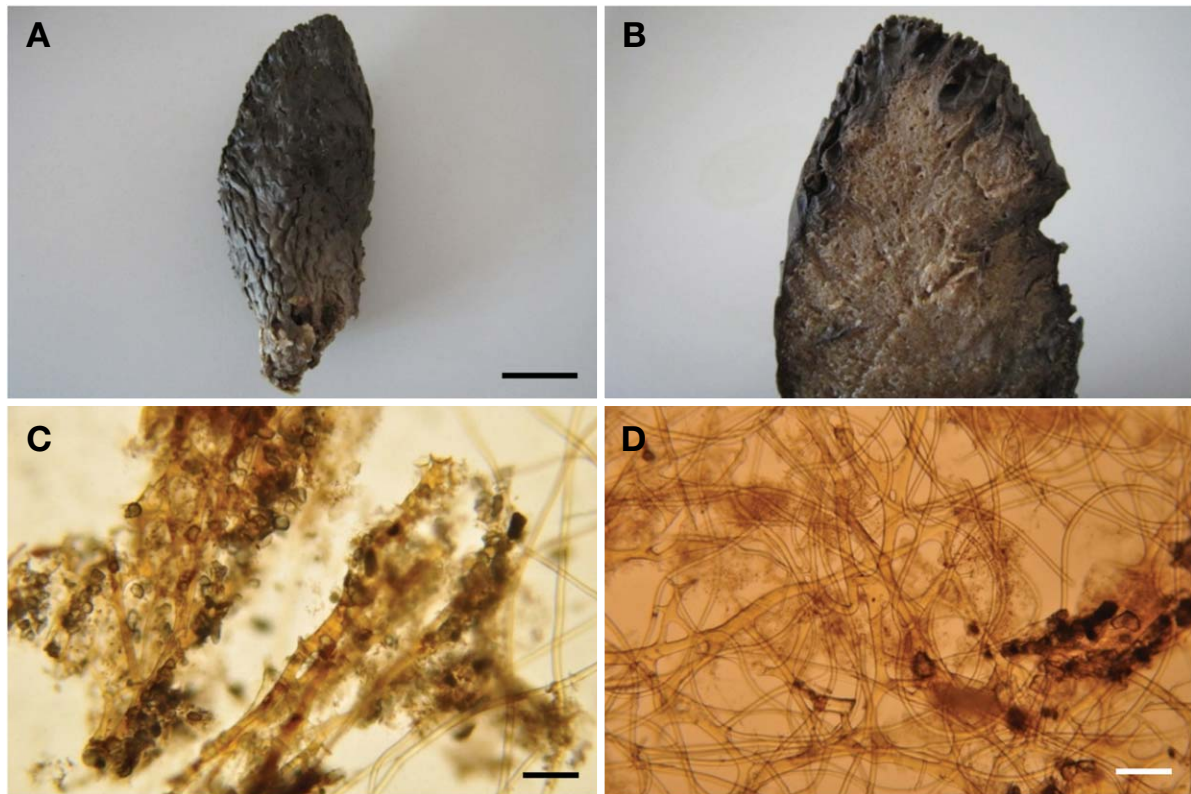


Fig. 8. *Coscinoderma pollex* n. sp. A, Entire animal; B, Perpendicular section; C, Primary fibres in conule; D, Primary and secondary fibres in choanosome. Scale bars: A=2 cm, C, D=100 µm.

Korean name: ¹*맵코스노더마해면 (신칭), ²*바쿠시코스노더마해면 (신칭)

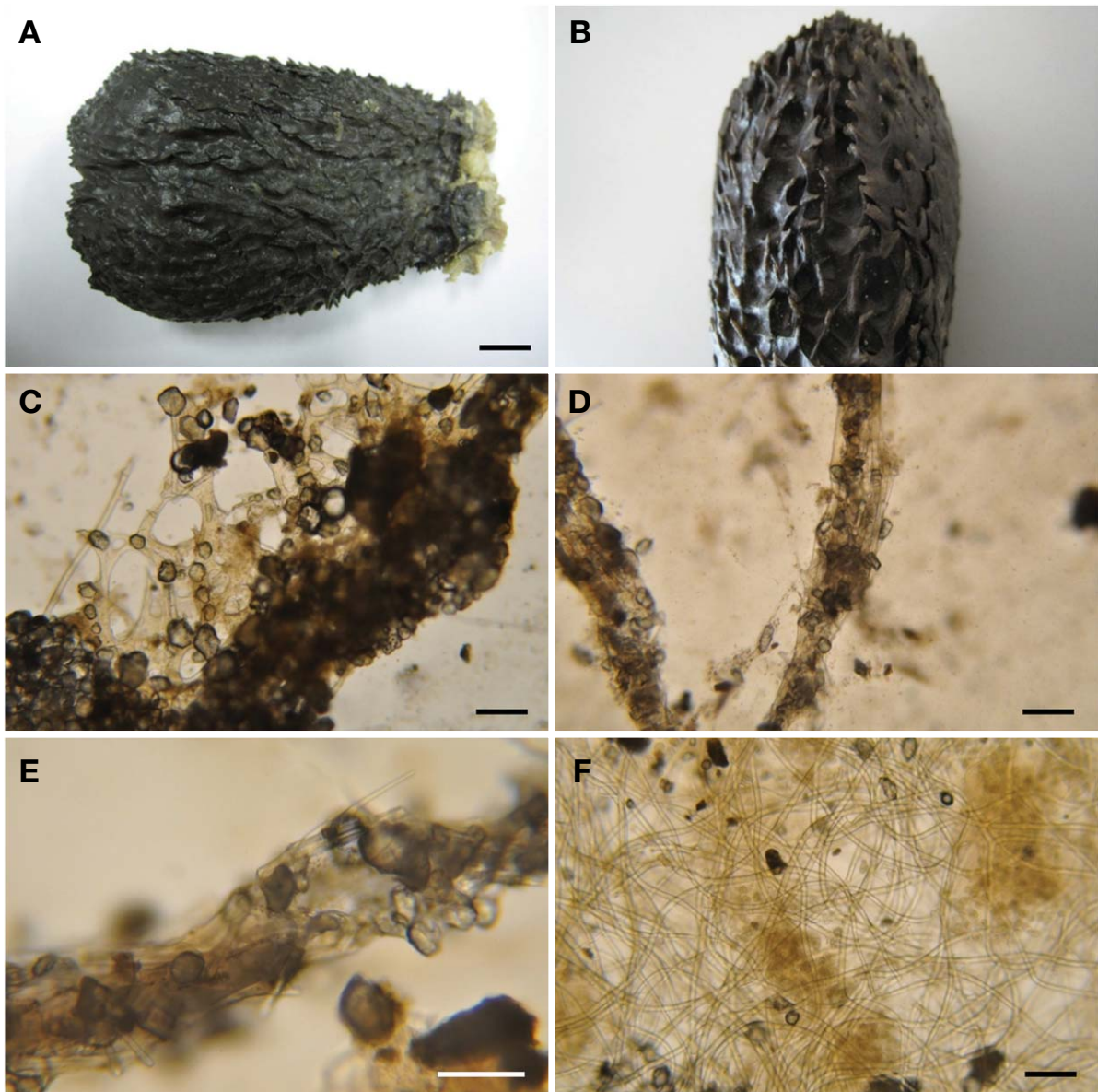


Fig. 9. *Coscinoderma truki* n. sp. A, Entire animal; B, Surface conules; C, Primary fibres in conule; D, Primary fibres in choanosome; E, Primary fibres mixed with spicules and sand; F, Secondary fibres. Scale bars: A=1 cm, C–F=100 μ m.

marine ecologist and a sponge taxonomist.

Remarks. This new species is characterized by primary fibre fascicle wrapped with bridged secondary fibres, conules with very thick sand crust, and color changed from live gray to preserved dark brown.

¹**Coscinoderma pollax* n. sp. (Fig. 8)

Type specimen. Holotype (MABIK IV00151588), Benedict,

Korean name: ¹*엄지코시노더마해면 (신칭)

Chuuk, Micronesia, 8 Feb 2012, Kim HS, by scuba, depth 21 m, deposited in the MABIK, Seocheon, Korea.

Description. Small thumb shape, usually a single, $9 \times 3.5 \times 2.5$ cm. Surface smooth with low conules. One layer thin sand membrane. No oscules. Texture tough and compressible. Color in life dark gray outside, brown inside. Skeleton. Primary fibres, 300–400 μ m in diameter in the conule. Height of conule 3.6 mm. Primary fibres in choanosome numerous between secondary fibres. No cored secondary fibres in cho-

anosome, 10–25 µm in diameter.

Etymology. This new species is named after its thumb-like shape.

Remarks. This species is always small and thumb-shaped.

¹**Coscinoderma truki* n. sp. (Fig. 9)

Type specimen. Holotype (MABIK IV00151589), front of KSORC-2, Chuuk, Micronesia, 8 Feb 2012, Kim HS, by scuba, depth 20 m, deposited in the MABIK, Seocheon, Korea.

Description. Small thumb shape, size up to 8 × 3 × 3 cm. Wider on the top than at the base. Surface rough with large sharp conules has one layered sand membrane. Texture hard and compressible, color in life black outside, beige inside. Skeleton. Primary fibres in conules. 4 mm in length, 20–40 µm in diameter without sand crust. Primary fibres in choanosome very rare. Cored primary fibres with many spicules and sand. No cored secondary fibres 8–20 µm in diameter.

Etymology. This species is named after type locality, Truk, old name of Chuuk, Micronesia.

Remarks. This new species is similar to *Cosinoderma pollax* in shape and size but differs in cored primary fibres with many spicules and rare primary fibres in the choanosome.

DISCUSSION

Eight new species of *Coscinoderma* are described in this report. Most of the *Coscinoderma* species are very similar to genus *Psammocinia* of family Irciniidae in shape, texture and surface except filaments and fibres. Most of new species are firm or slightly compressible, but not very soft. Primary fibres in conules of top of sponge are distinct than other area primary fibres. All *Coscinoderma* specimen are compared with surface conules at the top of the sponge. Most vermiform secondary fibres are very similar in shape and diameter each other. Bergquist (1980) discussed the characteristics of the Genus *Coscinoderma*; primary fibres have no tendency to develop fasciculation, but all of our specimens have either strong or weak fasciculate primary fibres. Bergquist et al. (1988) stated that the texture of *Coscinoderma* species is soft compared with genus *Strepsicodaia*, but most our specimen are tough and firm. Several species are distinct from each other in fasciculate primary fibre structure in conules. De Laubenfels (1954); found that *Coscinoderma* exhibits a ladder like or almost fascicular pattern, but we assumed that the ladder like pattern is the bridged secondary fibres, created a mesh or ladder.

Voultsiadou-Koudoura et al. (1991) concluded that species

of *Coscinoderma* are few in number and generally of rare occurrence, but numerous collected sponge specimens from Weno Island in Chuuk, have key characters of the genus *Coscinoderma*.

All our new species are different from *Coscinoderma sporadensa* Voultsiadou-Koudoura et al. (1991) from the Aegean Sea. It has primary fibres cored with sand and many spicules, but new species from Chuuk Island are rarely cored by spicules, and have no surface secondary network.

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REFERENCES

- Bergquist PR, 1965. The sponges of Micronesia, Part I. The Palau Archipelago. Pacific Sciences, 19:123-204.
- Bergquist PR, 1980. A revision of the supraspecific classification of the orders Dictyoceratida, Dendroceratida and Verongida (class Demospongiae). New Zealand Journal of Zoology, 7:443-503.
- Bergquist PR, 1995. Dictyoceratida, Dendroceratida and Verongida from the New Caledonia Lagoon (Porifera: Demospongiae). Memoirs of the Queensland Museum, 38:1-51.
- Bergquist PR, Ayling AM, Wilkinson CR, 1988. Foliose Dictyoceratida of the Australian Great Barrier Reef. I Taxonomy and phylogenetic relationships. Marine Ecology, 9:291-319.
- Carter HJ, 1883. Contributions to our knowledge of the Spongia. Annals and Magazine of Natural History (5), 12:308-329.
- Cook SDC, Bergquist PR, 2001. New species of *Spongia* (Porifera: Demospongiae: Dictyoceratida) from New Zealand, and a proposed subgeneric structure. New Zealand Journal of Marine and Freshwater Research, 35:33-58.
- De Laubenfels MW, 1936. A discussion of the sponge fauna of the Dry Tortugas in Particular and the West Indies in general, with material for a revision of the families and orders of the Porifera. Carnegie Institute of Washington, Publication

Korean name: ¹*트룩코시노더마해면 (신칭)

- No. 467, 30:1-225.
- De Laubenfels MW, 1954. The sponges of the west-central Pacific. Oregon State Monographs, Studies in Zoology, 7:1-306.
- Kelly-Borges M, Valentine C, 1995. The sponges of the tropical island region of Oceanis: a taxonomic status review. In: Marine and coastal biodiversity in the tropical island Pacific region. Vol. 1. Species systematics and information management priorities. Chapter 6. (Eds., Maragos JE, Peterson NMA, Eldredge LG, Bardach JE, Takeuchi HF). Program on Environment, East-West Center, Honolulu, HI, pp. 83-120.
- 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.
- Von Lendenfeld R, 1886. A monograph of the Australian sponges. Part VI. The genus *Euspongia*. Proceedings of the Linnean Society of New South Wales, 10:481-531.
- Von Lendenfeld R, 1889. A monograph of the horny sponges. Trübner and Co., London, pp. 1-936.
- Voultsiadou-Koudoura E, Van Soest RWM, Koukouras A, 1991. *Coscinoderma sporadense* sp. n. from the Aegean Sea with comments on *Coscinoderma confragosum* (Porifera, Dictyoceratida). Zoologica Scripta, 20:195-199.

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