

Contributions to the Lichen Flora of the Mariana Islands, Micronesia (2). Corticolous and Saxicolous Species of *Porina* Muell. Arg. (Trichotheliaceae)

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Abstract Five species of the lichen genus *Porina* are determined among the collection made during an expedition to the Mariana Islands, Micronesia in 1992. *P. aggregata* P. M. McCarthy et Harada sp. nov. is described as new. The following four species are reported as new to Mariana Islands: *P. cestrensis* (Mich.) Muell. Arg., *P. mastoidea* (Ach.) Muell. Arg., *P. papuensis* P. M. McCarthy and *P. tetracerae* (Afz. in Ach.) Muell. Arg. A description and figure are provided on the basis of those specimens. A key to the species is presented.

Key words: lichens, Trichotheliaceae, *Porina*, *Porina aggregata* P. M. McCarthy et Harada sp. nov., Micronesia, Mariana Islands, flora.

In 1992, the Biological Expedition to the northern Mariana Islands was conducted by the Natural History Museum and Institute, Chiba, in cooperation with the Department of Natural Resources, the Commonwealth of the Northern Mariana Islands, and the Marine Laboratory of Guam University (Asakura *et al.*, 1994). Based on the collection made during the expedition, the foliicolous *P. perminuta* Vainio and seven unidentified corticolous and saxicolous taxa of the genus *Porina* were subsequently reported (Harada, 1994). The specimens have been reexamined, and in this paper, *Porina aggregata* P. M. McCarthy et Harada sp. nov. is described as new, and the following four species are reported as new for the Mariana Islands: *P. cestrensis*, *P. mastoidea*, *P. papuensis*, and *P. tetracerae*. "*Porina* sp. 7" in Harada (1994) is excluded from this genus. Descriptions and figures are provided for each species on the basis of the specimens from the Marianas. Key to the species is presented.

Material and Methods

Air-dried herbarium specimens were ex-

amined. They are deposited in the herbarium of Natural History Museum and Institute, Chiba (CBM). For external morphology, air-dried material was observed with the naked eye or under a dissecting stereoscope. Lactophenol cotton-blue preparations were used for anatomical observations, but descriptions of color were taken from GAW (glycerol: ethanol: water=1:1:1) preparations. For the color tests, droplets of the K solution (c. 10% aqueous solution of KOH) were added to the GAW preparations of sections of thalli and perithecia.

Key to the Species

- 1a. Foliicolous(*P. perminuta*)
- 1b. Saxicolous or corticolous2
 - 2a. Involucrellum having orangish pigment (K+ reddish) and hyaline crystals.....3
 - 2b. Involucrellum lacking orangish pigment and hyaline crystals5
- 3a. Spores with 2-3 μ m thick gelatinous sheath.....3. *P. mastoidea*
- 3b. Spores without a gelatinous sheath ...4
- 4a. Thallus pale khaki-gray to pale brown-

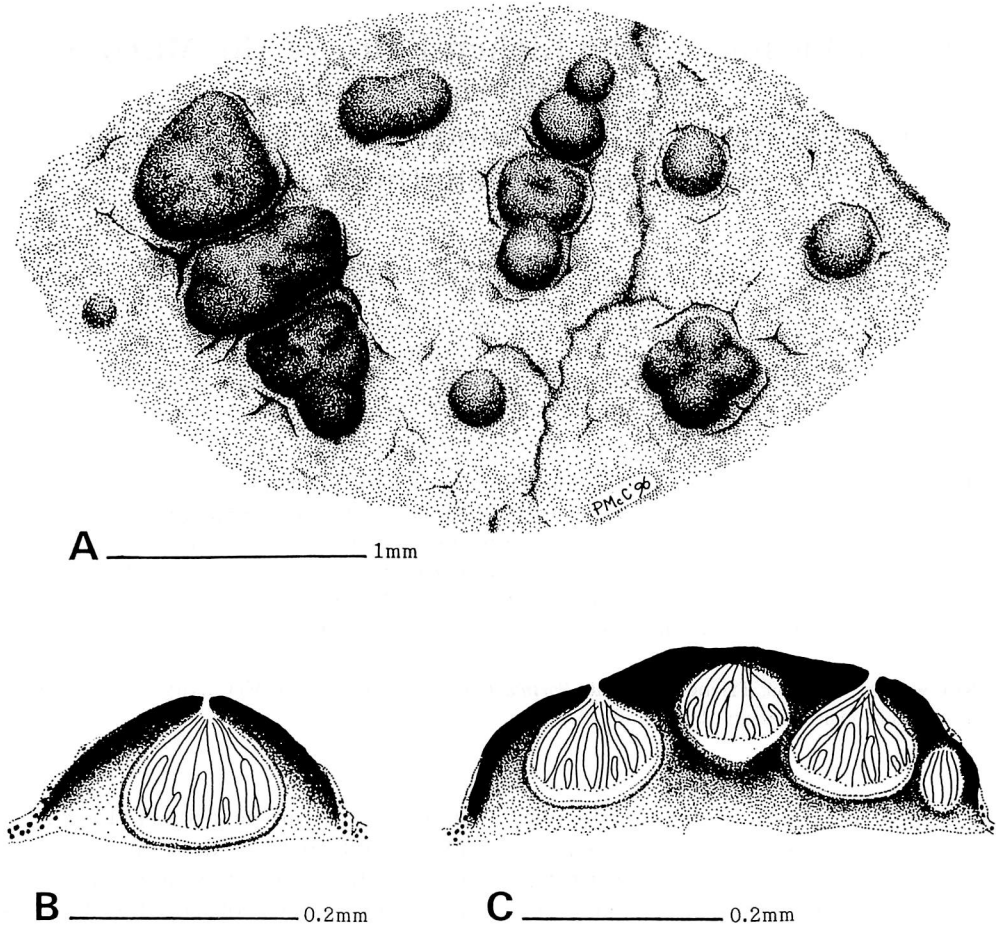


Fig. 1. *Porina aggregata* (holotype). A, habit of thallus and perithecia. B, vertical section of solitary perithecium (semi-schematic). C, vertical section of perithecial cluster (semi-schematic).

- ish gray, having prominent cortex; perithecia immersed in thallus-dominated verrucae5. *P. tetracerae*
- 4b. Thallus pale olive green to gray, lacking prominent cortex; perithecia usually hemispherical and \pm constricted at base..... 4. *P. papuensis*
- 5a. Perithecia aggregated in clusters; spores 3-septate1. *P. aggregata*
- 5b. Perithecia solitary; spores (5-)7-septate 2. *P. cestrensis*

The Species

1. *Porina aggregata* P. M. McCarthy et Harada sp. nov.
(Figs. 1, 2, 3A)

Porina sp. 6 in Harada (1994).

Thallus epiphloeodalis, pallido vel medio viridogriseus, 20-30(-40) μ m crassus. Peri-

thecia nigra, solitaria et 0.15-0.27 mm diametro vel 4-8(-10)-aggregata et 0.35-0.58 mm lata. Asci 50-62 \times 8-11 μ m. Ascosporae 3-septatae, (12-)15(-19) \times (3.0-)4.2(-5.5) μ m.

Typus: Micronesia, Mariana Islands, Agrihan I., NW side, 320 m alt., on bark of leguminous tree in forest, 29 May 1992, H. Harada 12692 (holotypus—CBM-FL-5967).

External Morphology. Thallus epiphloeodal, effuse to \pm determinate, pale to mid-greenish gray, continuous to sparingly rimose (especially around perithecia), smooth to minutely uneven, dull to slightly glossy, translucent and filmy when wetted, K-; prothallus thin, black, discontinuous, delimiting and apparently intersecting thalli; basal layer absent. Perithecia semiimmersed to superficial, very numerous, solitary and 0.15-0.27 mm diam., or paired or, more commonly,

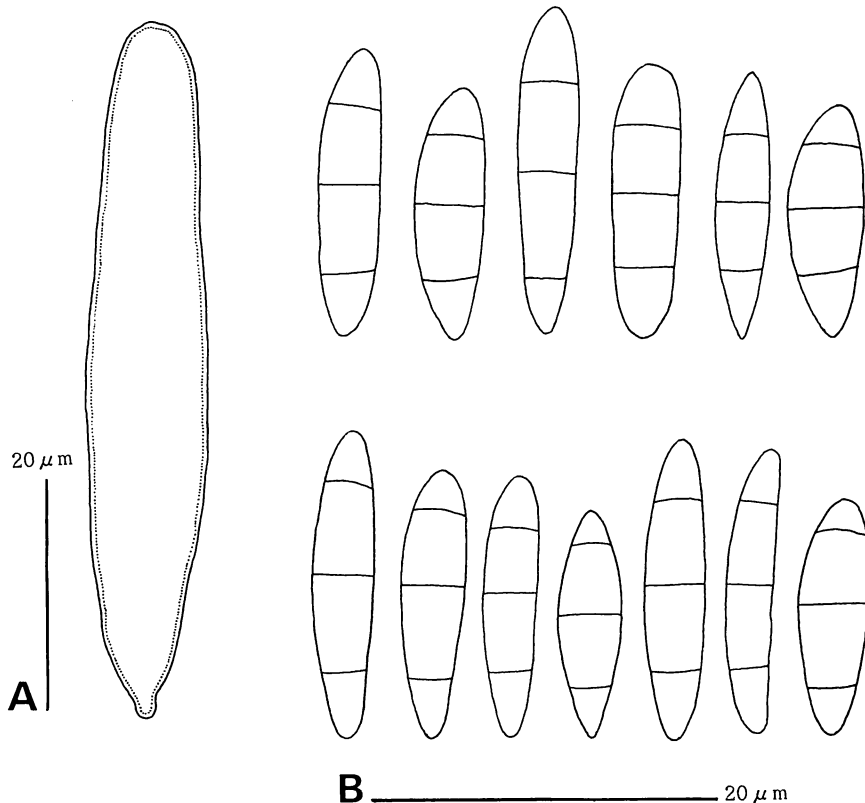


Fig. 2. *Porina aggregata* (holotype). A, mature ascus (ascospores not illustrated). B, ascospores.

in irregular fused groups of 4–8(–10) that are 0.35–0.58 mm wide; apices of solitary perithecia \pm rounded; surface of perithecial clusters convex or plane or uneven with the apices of individual perithecia faintly visible, dark olive-brown to blackish, often with a thin and discontinuous thalline covering; ostiole inconspicuous. Conidiomata not seen.

Anatomy. Thallus 20–30(–40) μ m thick, ecorticate, containing few or no crystals, K–; hyphae c. 2 μ m wide. Algae *Trentepohlia*; cells 6–12 \times 5–10 μ m. Involucrellum dark olive-brown, K–, 30–50 μ m thick in solitary perithecia, extending to exciple-base level. Centrum globose to depressed-ovate, 0.1–0.16 mm diam. Exciple 10–15 μ m thick, uniformly hyaline or with an outer dark olive-brown layer and a hyaline inner layer. Paraphyses unbranched, long-celled, 0.8–1 μ m wide. Paraphyses absent. Asci \pm cylindrical, uniformly thin-walled, with a subtruncate apex and a usually distinct apical chitinous ring (in Congo Red), 50–62 \times 8–11 μ m. Ascospores 8 in each ascus, irregularly biserial, (12)–15

(–19) \times (3.0)–4.2(–5.5) μ m (84 measured), fusiform to fusiform-cylindrical, usually straight, with rounded to subacute ends, colorless, 3-septate, with clear contents, occasionally with gelatinous sheath (to 2 μ m thick).

Distribution. Known only from the type locality.

Remarks. *Porina aggregata* has a very thin and inconspicuous thallus, small 3-septate ascospores and small blackish perithecia that are commonly aggregated in clusters that resemble the pseudostromata of many Trypetheliaceae.

Paired perithecia are not uncommon in a small number of *Porina* spp., e.g. *P. guentheri* (Flotow) Zahlbr. and *P. heterocarpa* P. M. McCarthy. However, the comparatively large numbers of fused perithecia in *P. aggregata* are exceptional. The type specimen includes solitary perithecia, paired ones that are fused at the involucrellum, rows of three or four perithecia that are similarly joined and rounded or irregular clusters of up to 10 perithecia that may either have a bullate

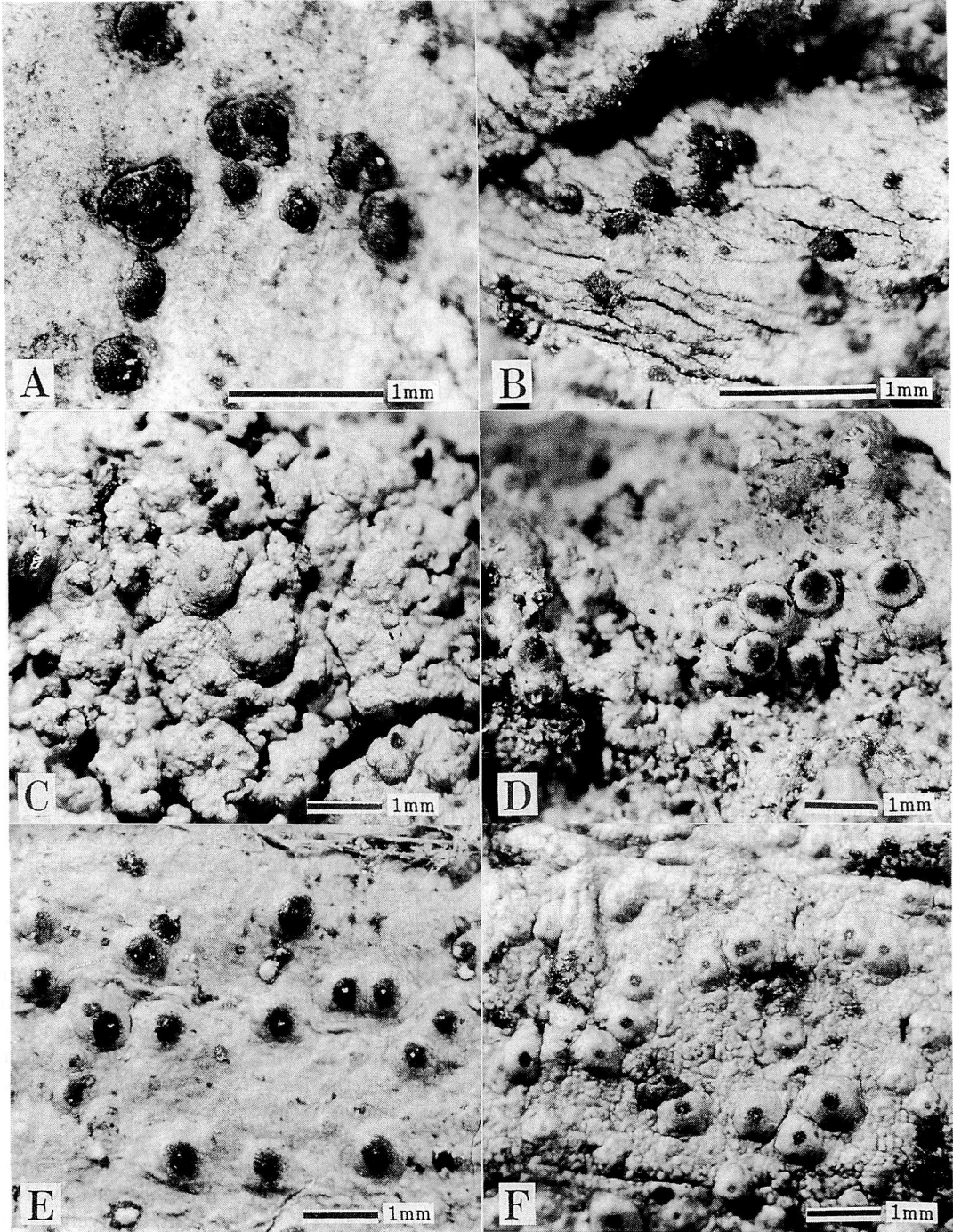


Fig. 3. Habit of *Porina*. A, *P. aggregata* (holotype). B, *P. cestrensis* (Harada 11739). C, *P. mastoidea* (Harada 11827). D, *P. papuensis* (Harada 12549). E, F, *P. tetracerae* (E, Harada 12539; F, Harada 12529).

surface indicating the number of perithecia within or may be quite smooth. Sectioned clusters may contain perithecia which have

all developed to the same degree, or they may contain immature and mature structures as well as the cavities of post-mature perithecia.

The clusters themselves often occur in contiguous groups of 3 or 4.

The epithet *aggregata* refers to its unique perithecial morphology.

2. *Porina cestrensis* (Mich.) Muell. Arg.
(Fig. 3B)

Porina cestrensis (Mich.) Muell. Arg., Flora 64: 338 (1883).

Porina sp. 5 in Harada (1994).

External Morphology. Thallus epiphloeodal, effuse to determinate, somewhat pale greenish gray to pale gray, sparingly to minutely rimose, minutely uneven, dull, \pm slightly translucent when wetted; prothallus not apparent, or dark brown and discontinuous. Perithecia very numerous, superficial to immersed at base, solitary, 0.15–0.3 mm diam., hemispherical, \pm slightly constricted at base, almost black (\pm brownish), somewhat glossy; apex round or slightly papillate, with inconspicuous ostiole. Pycnidia not seen.

Anatomy. Thallus 15–50 μ m thick, eorticate, homoiomerous, lacking crystals, K–; hyphae c. 2.5 μ m wide; phycobiont cells (*Trentepohlia*?) 4–7 \times 4–10 μ m. Involucrellum very dark purplish brown to almost black (K+ very dark greenish gray to almost black), 25–50 μ m thick, extending to exciple-base level. Centrum globose to depressed ovate, 120–170 μ m diam. Exciple 10–20 μ m thick, uniformly hyaline, or purplish brown in some part. Subhymenium 10–25 μ m thick at center, concave above. Paraphyses unbranched, long-celled, with c. 1 μ m wide lumina. Asci clavate, c. 75 \times 10 μ m. Ascospores 8 in each ascus, biseriata, fusiform, 21–30 \times 5–7 μ m, hyaline, transversely (5–)7-septate, with clear contents, usually with c. 2 μ m thick gelatinous sheath.

Distribution. Mariana Islands, C and S America. First record in Micronesia.

Specimens examined. MICRONESIA. Mariana Islands. Agrihan Island, 230 m alt., on trunk of *Morinda citrifolia* in forest, Harada 12745 (CBM-FL-6020). Anatahan Island, 150 m alt., on trunk of *Artocarpus altilis* on ridge, Harada 12367 (CBM-FL-5643). Saipan Island, Tanapag, 1 m alt., on trunk of hardwoods, Harada 11739 (CBM-FL-5505).

3. *Porina mastoidea* (Ach.) Muell. Arg.
(Fig. 3C)

Porina mastoidea (Ach.) Muell. Arg., Bot. Jahrb. 6: 399 (1885).

Porina sp. 2 in Harada (1994).

External Morphology. Thallus epiphloeodal, determinate, pale khaki-gray to pale gray, continuous, sometimes peeling, smooth to irregularly rugulose, dull to somewhat glossy, becoming slightly dark when wetted; prothallus \pm whitish and cottony, or very dark brown to whitish and filmy, or not apparent. Perithecia numerous, immersed in thallus-dominated verrucae; verrucae 0.3–1.0 mm diam., hemispherical, not constricted at base, concolorous with the thallus; apices rounded, \pm orangish brown to almost black around \pm depressed ostioles. Pycnidia not seen.

Anatomy. Thallus usually 50–100 μ m thick; upper cortex usually 5–10 μ m thick, hyaline, prosoplectenchymatous, composed of horizontally running hyphae with c. 2 μ m wide lumina; algal layer continuous, rather uniform in thickness, 10–25 μ m thick, with dense phycobiont cells (*Trentepohlia*?); medulla usually 20–50 μ m thick, with very dense, large hyaline crystals, partly orangish (K+ reddish); basal layer 15–40 μ m thick, more or less dark brown, prosoplectenchymatous, composed of horizontally running hyphae with c. 2 μ m wide lumina. Involucrellum apical to dimidiate, up to 200 μ m diam., dark purplish red to yellowish (K+ reddish); thalline cover heavily impregnated with hyaline crystals, with cortex and algal layer. Exciple ca. 20 μ m thick, medium orange-brown towards the apex and at the sides, pale yellow-brown at the base. Centrum globose to depressed-ovate, 300–400 μ m diam. Paraphyses unbranched, with c. 1 μ m wide lumina. Periphyses absent. Asci cylindrical-clavate, c. 150 \times 25 μ m. Ascospores 8 in each ascus, biseriata, 35–61 \times 9–11 μ m, fusiform, hyaline, transversely 7(–11)-septate, with clear contents, with 2–3 μ m thick gelatinous sheath.

Distribution. Philippines, Borneo, New Guinea, Australia, N & S America. First record in Micronesia.

Specimens examined. MICRONESIA. Ma-

riana Islands. Saipan Island, Suicide Cliff, 50 m alt., on trunk of hardwoods, Harada 11827 (CBM-FL-5578). Guam Islands, in the vicinity of Guam University, 60 m alt., on trunk of hardwoods, Harada 11695 (CBM-FL-5465).

4. *Porina papuensis* P. M. McCarthy
(Fig. 3D)

Porina papuensis P. M. McCarthy, *Bibl. Lichenol.* 52: 86 (1993).

Porina sp. 3 & 4 in Harada (1994).

External Morphology. Thallus epilithic, determinate to effuse, somewhat pale olive green to gray, rimulose or continuous, smooth to minutely uneven, or almost rugulose, dull, becoming somewhat translucent and more intensely greenish when wetted; prothallus not apparent, or blackish and intersecting thalli. Perithecia numerous, superficial, hemispherical, 0.3–0.7 mm diam., ± constricted at base, solitary, concolorous with the thallus near base, orangish brown, reddish to blackish in the upper part, rounded or flattened at apices, with slightly papillate ostioles. Pycnidia not seen.

Anatomy. Thallus 45–80 µm thick, lacking prominent cortex and basal layer, almost uniformly eu- to subparaplectenchymatous, partly orangish (K+ reddish); lumina of hyphae 2–3 × 2–5 µm; phycobiont (*Trentepohlia*?) more or less scattered. Involucrellum dimidiate, up to 270 µm diam., orange-brown to blackish (K+ reddish); thalline cover heavily impregnated with hyaline crystals, with phycobiont cells. Exciple c. 25 µm thick in the sides, pale yellow-brown in the upper part, ± hyaline in the sides and base. Centrum globose to depressed ovate, 140–250 µm diam. Paraphyses unbranched, long-celled, with c. 2 µm wide lumina. Periphyses absent. Asci cylindrical-clavate, 70–100 × c. 10 µm. Ascospores 8 in each ascus, biseriate, 25–31 × c. 5 µm, fusiform to elongate fusiform, hyaline, transversely 7(–9)-septate, with clear contents, without a gelatinous sheath.

Distribution. Mariana Islands, Papua New Guinea. First record in Micronesia.

Specimens examined. MICRONESIA. Mariana Islands. Sariguan Island, 80 m alt., on rock on ridge, Harada 12472 (CBM-FL-5748); 300 m alt., on rock on ridge, Harada 12491 (CBM-FL-5767); 330 m alt., on rock, Harada

12549 (CBM-FL-5825).

Remarks. Perithecia of this species from the Mariana Islands are slightly larger than those from Papua New Guinea with "(0.38–) 0.51(–0.62) mm diam." (McCarthy, 1993), although this is largely due to the thicker thalli (20–40 µm thick in the Papuan specimens; McCarthy, 1993).

The thallus is almost rugulose in two specimens from the Marianas (Harada nos. 12472 & 1249), although it is usually smooth in this species. The texture in those specimens may partly be due to the roughness of the surface of the substratal volcanic rocks.

**5. *Porina tetracerae* (Afz. in Ach.)
Muell. Arg.**
(Fig. 3E, F)

Porina tetracerae (Afz. in Ach.) Muell. Arg., *Bot. Jahrb.* 6: 401 (1885).

Porina sp. 1 in Harada (1994).

External Morphology. Thallus epiphloeodal, pale khaki-gray to pale brownish gray, continuous to rimose, sometimes peeling, somewhat glossy to dull, smooth to uneven; prothallus usually blackish, filmy and discontinuous, sometimes whitish and fibrous, or not apparent. Perithecia numerous, immersed in thallus-dominated verrucae; verrucae 0.3–0.7 mm diam., hemispherical with spreading base, or almost superficial and slightly constricted at base, usually solitary, concolorous with the thallus usually for the most part, blackish just around ostioles or in the upper part, rounded or flattened at apices, with inconspicuous ostioles. Pycnidia not seen.

Anatomy. Thallus usually 50–100 µm thick; upper cortex usually present, 3–7 µm thick, hyaline, prosoplectenchymatous, composed of horizontally running hyphae with c. 2 µm wide lumina; algal layer continuous, rather uniform in thickness, 10–40 µm thick, with dense phycobiont cells (*Trentepohlia*?); medulla dominated by large hyaline crystals, usually 20–40 µm thick, partly orangish (K+ reddish); basal layer usually c. 10 µm thick or absent, more or less dark brown, prosoplectenchymatous, composed of horizontally running hyphae with c. 2 µm wide lumina. Involucrellum apical to dimidiate, 180–250 µm diam., dark purplish red to yellowish

(K+ reddish); thalline cover heavily impregnated with hyaline crystals, with cortex and algal layer. Exciple 10–20 μm thick, medium orange-brown towards the apex and at the sides, pale yellow-brown to almost hyaline at the base. Centrum globose to depressed-ovate, 220–270 μm diam. Paraphyses unbranched, with c. 1 μm wide lumina. Periphyses absent. Asci cylindric-clavate, c. 100 \times 10 μm . Ascospores 8 in each ascus, biseriate, 27–36 \times 5–6.5 μm , fusiform, hyaline, transversely 7-septate, with clear contents, without a gelatinous sheath.

Distribution. Pantropical. First record in Micronesia.

Specimens examined. MICRONESIA. Mariana Islands. Pagan Island, W side of Togari Mountain, 240 m alt., on trunk of *Aglaia mariannensis* in forest on slope, Harada 12652 (CBM-FL-5927). Sariguan Island, W side, 300 m alt., on bark of *Aglaia mariannensis* on ridge, Harada 12495 (CBM-FL-5771); 330 m alt., on trunk of *Artocarpus altilis*, Harada 12529 (CBM-FL-5805); 330 m alt., on trunk of palm tree, Harada 12539 (CBM-FL-5815). Saipan Island, Suicide Cliff, 50 m alt., on trunk of hardwoods, Harada 11823 (CBM-FL-5574); Mt. Takpochao, 400 m alt., on trunk of hardwood, Harada 11769 (CBM-FL-5528).

Remarks. Perithecia in surface view vary greatly among the specimens from the Mariana Islands, as previously known for this species (McCarthy, 1993). When the thallus is thinner, the verrucae tend to have spreading base and more prominent involucrellum (Fig. 3E), whereas, in the case with thicker thalli, the verrucae are slightly constricted at base and have an involucrellum restricted to the ostiolar region (Fig. 3F).

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the Northern Mariana Islands (CNMI).

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マリアナ諸島の地衣類について (2).

樹皮着生および岩上生のホルトノキゴケ属 (Trichotheliaceae)

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千葉県立中央博物館が中心となって1992年に挙行した北マリアナの生物相調査 (Asakura *et al.*, 1994) とそれに伴うグァム島とサイパン島での調査によって約900点の地衣類標本が得られた。その資料を基にした仮目録の中でホルトノキゴケ属 (*Porina*) として、生葉上の *P. perminuta* と、樹皮着生と岩上生の未同定種7種を報告した (Harada, 1994)。その7種について更に検討を加えた結果、本報では、1新種 *P. aggregata* P. M. McCarthy et Harada sp. nov. を記載し、以下の4種を初めてマリアナから報告する: *P. cestrensis* (Mich.) Muell. Arg., *P. mastoidea* (Ach.) Muell. Arg., *P. papuensis* P. M. McCarthy, *P. tetracerae* (Afz. in Ach.) Muell. Arg. それぞれの種について、マリアナ産の標本を基に記載と図を示し、ノートを付した。また、マリアナ産のホルトノキゴケ属の検索表を示した。なお先に *Porina* sp. 7 (Harada, 1994) とした種は、別属であることが判ったので、本報では扱わなかった。