

Taxonomic Notes on the Lichen Family Verrucariaceae in Japan (XII). *Verrucaria minuscula* H. Harada

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Abstract *Verrucaria minuscula* H. Harada is investigated taxonomically. This species was recently collected from Chiba-ken, central Japan for the first time since the original collection from Shizuoka-ken, central Japan. It is characterized by having almost exposed, small (ca. 0.1 mm diam.) perithecia, relatively small ($12-16 \times 5-8 \mu\text{m}$) ascospores etc., and by growing in terrestrial habitats. Perithecial walls vary greatly in color, from almost colorless throughout, brownish in the outer and \pm inner parts, or distinctly bi-layered with almost black outer layer and colorless inner one.

Key words: lichens, lichenized Ascomycota, Verrucariaceae, *Verrucaria*, taxonomy, Japan.

The lichen genus *Verrucaria* Schrad. in the family Verrucariaceae is characterized by having crustose thallus and colorless simple ascospores, and most species are saxicolous, growing on calcareous or non-calcareous rocks in terrestrial, freshwater or maritime habitats, depending on species. This genus is represented by ca. 300 species in the world (Hawksworth *et al.*, 1995), and 19 species were so far known from Japan (Harada, 1992, 1996, etc.). Among the saxicolous species from terrestrial habitats in this country, *V. minuscula* H. Harada (1993c) is outstanding by having very small, \pm exposed perithecia (ca. 0.1 mm diam.). This species had been known only by the holotype specimen from Shizuoka-ken, central Japan, till it was collected during my recent field survey in a public park in Chiba-ken, central Japan. At this time, *V. minuscula* is investigated taxonomically.

Materials and Methods

Description of external morphology is based on air-dried material observed under a dissecting stereomicroscope. Sections were made with a razor blade under the dissecting stereomicroscope, mounted in lactophenol cotton-blue (LPCB), and used for anatomical description except for the color description

which was based on the GAW (glycerol : ethanol : water = 1 : 1 : 1) preparations. The I and KI tests were conducted on sections of perithecia by using a diluted Lugol's solution and/or 10% aqueous solution of KOH. Specimens used in this study are deposited in the herbarium of Natural History Museum and Institute, Chiba (CBM).

The Species

Verrucaria minuscula H. Harada (Figs. 1-2)

Verrucaria minuscula H. Harada, Hikobia 11 : 231 (1993). Type: Japan, Honshu, Shizuoka-ken, Ogasa-gun, Hamaoka-cho, Hiki, 50 m alt., on pebbles at sunny site in frontyard of a house, 1 April 1990, coll. H. Harada 10238 p. p., mixed with other *Verrucaria* spp. (CBM-FL-11215—holotype).

External Morphology. Thallus crustose, epilithic, usually up to ca. 1 cm diam., composed of usually 20-50 μm diam. roundish areoles or 20-40 μm wide indistinct squamules, or almost continuous, thin, \pm greenish, or \pm brownish to dark brown, \pm semipellucid, lacking a prominent hypothallus. Perithecia hemispherical to \pm spherical, constricted at base, or covered by thalline granules at base, usually up to 0.1 mm diam., pale to dark

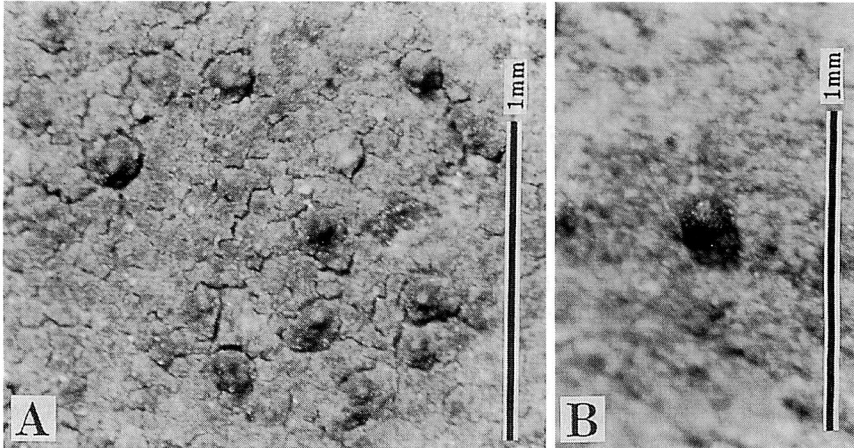


Fig. 1. Habit of *Verrucaria minuscula* (A, Harada 19302c; B, Harada 19303. A–B, air-dried materials).

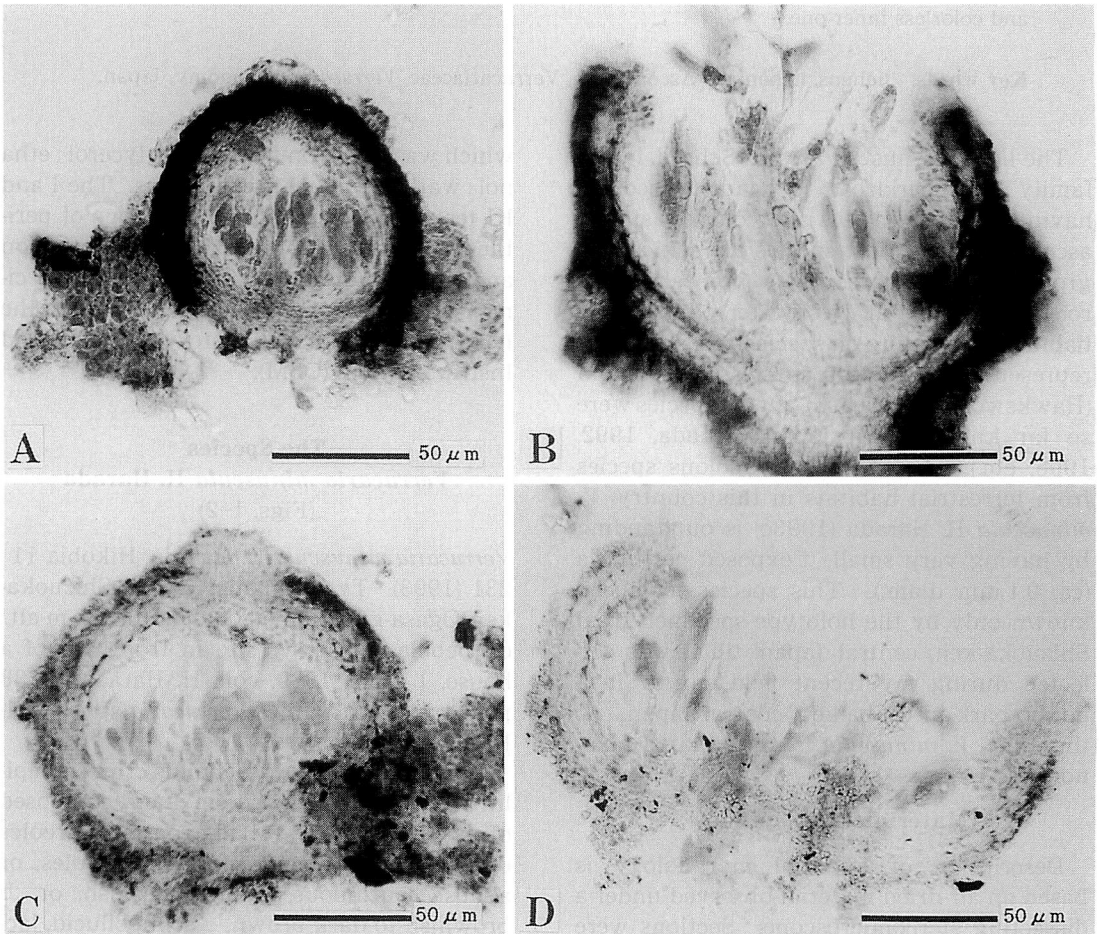


Fig. 2. Vertical sections of perithecia in *Verrucaria minuscula*, showing color variation of perithecial walls (A, holotype; B, Harada 19303; C, D, Harada 19302c. A–D, LPCB preparations).

brown, or almost black, slightly glossy, with papillate apices (whitish or pale); ostioles indistinct. Pycnidia not seen.

Anatomy. Thallus 20–40 μm thick, lacking epinecral layer and dark basal layer, with 1-cell-layered cortex (ca. 2.5 μm thick), sub- or euparaplectenchymatous throughout, \pm brownish in the uppermost part, colorless (excl. phycobiont) below; phycobiont rather densely distributed, usually 5–10 μm diam. Perithecia almost spherical, or slightly obpyriform. Perithecial walls lacking a prominent involucrellum, 10–20 μm thick in sides, almost colorless throughout, but frequently brownish or blackish in the outer parts, sometimes brownish in the inner parts. Subhymenium concave above, 10–15 μm thick, colorless. Periphyses 5–10 μm long, ca. 2.5 μm diam., unbranched, with rounded apices. Hymenium 60–90 μm wide \times 65–100 μm high, I-, KI-. Asci 40–60 \times ca. 15 μm . Ascospores 12–18 \times 5–8 μm , oval or ellipsoidal, with rounded apices, colorless.

Distribution. Shizuoka-ken and Chiba-ken on the Pacific side of Honshu Island, central Japan.

Habitat. Saxicolous, usually on non-calcareous pebbles or pieces of rocks in shade or in the sun, in terrestrial habitats in the warm-temperate zone.—In Chiba, this species was found at two very close localities, with one site in shade in a forest in a public park, and the other in partial shade by a thicket around the museum building, \pm associated with *Thelidium japonicum* H. Harada, whereas the holotype was collected at a rather sunny site in the frontyard of a house in Shizuoka (Harada, 1993c). The second site in Chiba is the type locality of *Thelidium japonicum* H. Harada (1991) which was very abundant here in 1990 but is rather scarce at this time.

Remarks. *Verrucaria minuscula* H. Harada is a very indistinct species. It is characterized by having the thallus granulose, perithecia small (ca. 0.1 mm diam.), exposed, lacking a prominent involucrellum, and ascospores relatively small (12–16 \times 5–8 μm), and by growing on non-calcareous rocks in terrestrial (neither freshwater nor maritime) habitats.

In Verrucariaceae, the color of perithecial walls is considered to have great taxonomic

value. Particularly, the presence of an involucrellum (dark brown to black) or its absence, are regarded as important criteria to distinguish genera such as *Neocatapyrenium* H. Harada and *Scleropyrenium* H. Harada (Breuß, 1996; Harada, 1993a). Similarly, in *Verrucaria*, the color of perithecial walls (involucrellum and/or exciple) is frequently used as a key character (Clauzade & Roux, 1985; Purvis *et al.*, 1992). However, this character varies greatly in this species. In the holotype, perithecia are almost black in surface view (Fig. 1 in Harada 1993c), and the perithecial walls in vertical section are composed of an almost black outer layer and a colorless inner one (Fig. 2A–B in Harada, 1993c; Fig. 1A). The outer layer looks like a typical involucrellum, and the inner like exciple. In the specimens from Chiba, on the other hand, perithecia are variable in color of the surface view, from very pale to somewhat dark brown (Fig. 1A), and rarely very dark brown to almost black (Fig. 1B). In sections, the perithecial walls are not always bilayered, being composed of dark (brown to almost black) outer and colorless inner layers. Those may be almost colorless throughout (Fig. 2D), brownish only in outer parts (Fig. 2C), brownish in outer and inner parts, or dark brown or blackish mainly in the outer parts (Fig. 2B). Thus, an involucrellum can not be distinguished with certainty from the exciple in perithecial walls of this species. This variation in color seems to be correlated with the difference in microhabitats, namely, the degree of exposure to the sun as already noted under "habitat". Thus, the color of perithecial walls should be carefully treated as a taxonomic character. Similar variation in color of perithecial walls was observed for some species of *Endocarpon* (Harada, 1993b), particularly *E. minutum* H. Harada (1995) in the same family. It is noteworthy that both *E. minutum* and *V. minuscula* have exposed small perithecia and, at the same time, perithecial walls very variable in color.

Specimens examined. JAPAN. Honshu. Chiba-ken, Chiba-shi, Chuo-ku, Aoba-cho, Aobano-mori Park, 20 m alt., on pebbles in forest, Harada 19302c (CBM-FL-12082); Aobacho, Nat. Hist. Mus. & Inst., Chiba, 20 m alt., on

pebbles in a bush by the museum building, Harada 19302d (CBM-FL-12083) and 19303 (CBM-FL-12348).

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日本産アナイボゴケ科地衣類分類 ノート (XII). *Verrucaria* *minuscula* H. Harada

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アナイボゴケ属 (*Verrucaria*; アナイボゴケ科) 地衣類の 1 種 *Verrucaria minuscula* H. Harada は、静岡県産の標本 1 点に基づき新種記載されて以来、他からは知られていなかったが、最近千葉市において発見されたので、分類学的検討を行った結果を報告する。本種は非石灰質の岩上に生育する陸上生 (非淡水生, 非海岸生) の地衣類で、以下の特徴を持つ: (1) 地衣体は直径 20~50 μm の丸く薄い顆粒から成り (鱗片状となったり, 連続することもある), 緑ないし褐色がかり, 通常は直径 1 cm 以下の小形のマットを形成する; (2) 被子器は半球形~ほぼ球形で直径は通常 0.1 mm 以下, 淡~暗褐色, あるいはほぼ黒色, 基部はしばしば地衣体顆粒に覆われる; (3) 被子器壁は顕著な外殻 (involucrellum) を欠き, 無色ないし褐色~ほぼ黒色; (4) 周糸は短く (7–10 μm), 直径約 2.5 μm , 先端が丸い; (5) 子嚢胞子は楕円形~長楕円形, 12–18 \times 5–8 μm . 正基準標本では被子器壁は外側のほぼ黒色の層と内側の無色の層の明瞭な 2 層から成るのに対し, 千葉産の標本では必ずしも 2 層を成さず, 全体がほぼ無色のものから, 一部褐色 (ないしほぼ黒色) がかかるものまで見つかった。それに伴い被子器の外見は必ずしもほぼ黒色とは限らず, 暗褐色から淡褐色のものまで認められた。基準産地は日あたりが良い人家の庭先であるのに対し, 千葉の産地は公園内の植樹や植込みの日陰ないし半日陰であることから, このような形態変異は産地の環境差によるものと推察された。これによって, 被子器壁の色が必ずしも種の安定した形質ではないことが明らかになった。