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Taxonomic Notes on the Lichen Family Verrucariaceae in Japan (VIII). *Verrucaria muralis* Ach.

Hiroshi Harada

Natural History Museum and Institute, Chiba
955-2 Aoba-cho, Chuo-ku, Chiba 260, Japan

Abstract *Verrucaria muralis* Ach. (Lichenes, Verrucariaceae) is reported from Japan, based on specimens from Chiba-ken, central Honshu. A description and figures are provided for this species based on these Japanese specimens. The only previous record of this species for Japan was by Müller (1891), and is proved to be based on *Verrucaria marinomuralis* Harada. The only specimen of *V. muralis* in the Acharian collection at Helsinki (H-ACH 691) consists of four pieces of rocks (or wall fragments), of which the left three can be considered as the type of *V. muralis* and the right is the type of var. *concentrica*.

Key words: Lichens, Verrucariaceae, *Verrucaria muralis*, Japan.

Verrucaria muralis Ach. is known as a common crustose lichen species found on calcareous substrata including walls and mortar at least in Europe (Purvis *et al.*, 1992; Santesson, 1993; Clauzade & Roux, 1985; Zschacke, 1934). In Japan, however, this species has been reported only once, by Müller (1891), from Yenoura, Kanagawa-ken, central Honshu. My recent study has revealed that the specimen on which this record was based does not belong to *V. muralis*. On the other hand, two specimens of this species were collected in Chiba-ken, central Japan during my floristic surveys. In this paper, a description and figures are provided for *V. muralis* in Japan, and notes are made in comparison with the type (H-ACH691) and other specimens, mainly from Europe.

Material and Methods

Air-dried material was examined for describing external morphology with the naked eyes or under a dissecting stereoscope unless otherwise stated. For anatomical observation, sections were made with the aid of a razor blade under the dissecting stereoscope. Lactophenol cotton-blue (abbreviated as LPCB) preparations were used for anatomical drawings and describing anatomy except for descriptions of color which were taken from GAW (glycerol: ethanol: water = 1 : 1 : 1) preparations.

The Species

Verrucaria muralis Ach.

(Figs. 1–5)

Meth. Lich.: 115 (1803). Type: Habitat ad muros antiquos (Upsaliae) calce illitos, Swartz (H-ACH 691, pro major parte–syntypes).

External morphology. Thallus partly superficial or semi-endolithic, spreading, following the surface of the substratum, in epilithic forms grayish, thin and cracked. Perithecia abundant, usually 2/3–1/3 immersed to almost sessile, dome-shaped or hemispherical, black, a little glossy, smooth, but usually more or less rough due to fragments of substratal rocks in involucrellum, with or without thin thalline cover at the base, more or less depressed at the ostiole, 0.3–0.4 mm in diam. Pycnidia not seen.

Anatomy. Thallus composed of variously orientated, short linear hyphae among fragments of substratal rocks, with phycobiont cells in clusters. Perithecia (excl. involucrellum) almost spherical, or somewhat flattened, 190–240 μm high × 220–250 μm wide. Involucrellum very dark brown to almost black, more or less extending to base-level of exciple, separated from the exciple laterally, prosoplectenchymatous, frequently with fragments of substratal rocks, 300–430 μm in diam. Exciple in upper parts dark brown to almost black, thick-

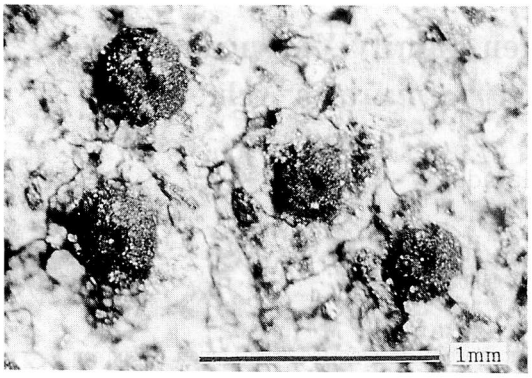

Fig. 1. Habit of *Verrucaria muralis* from Japan. (Harada 9215, air-dried material)

ened, prosoplectenchymatous, merging with involucrellum, at the sides hyaline or brown, prosoplectenchymatous, 10–25 μm thick, at the base hyaline, prosoplectenchymatous, 15–25 μm thick. Periphyses prominent, more or less sparsely branched and anastomosing near the base to form a loose network, 35–60 μm long. Subhymenium concave above, 15–20 μm thick at the base. Asci clavate, 60–85×15–20 μm. Spores 8 in each ascus, hyaline, simple, ellipsoidal, 15–21×9–11 μm.

Habitat. On friable sandstone rocks at more or less sunny site or at partial shade in hills in the warm temperate zone.

Distribution. Japan, Russia, Europe, N. Africa, Australia, North America.

Specimens examined (deposited in CBM). JAPAN. Honshu. Chiba-ken. Ichihara-shi, Yuuki, Daifuku-yama, 100–200 m alt., on rock, Harada 9215; Kimitsu-shi, Seiwa-kenmin-no-mori Park, 250 m alt., on rock on ridge, Harada 14054.

Additional Specimens examined (all in H). EUROPE. FINLAND. Om. Kälviä, Takala 3092; Regione Aboensi, 1873, Elfving s.n.; Turk, 2/VI 1922, Räsänen 3; St Tyrvää, 19/8 1909, Vainio s.n.; Sb. Kuopio, 1909. 14. VIII, Linkola s.n.; Sa, Nyslott, 1868, Carlenius s.n.; Lkem, Sodankylä, 1850, Nylander s.n.; Al., 1853, Nylander s.n.; Lp, Ponoi, 1863, Fellman s.n., and Kihlman 379. RUSSIA. Lapponia rossica, 1843, Nylander s.n. GERMANY. Nürnbergs bei Münster, 1860, Zahlbruckner (?) s.n. ITALY. Lichenotheca Veneta 187. NORTH AMERICA. U.S.A. Iowa, Oct. 18, 1902, Fink s.n. in herb. Lang.

Remarks. The only specimen of *Verrucaria muralis* Ach. among the Acharian collection at Helsinki (H-ACH 691) consists of four pieces of wall fragments or rocks, each with black perithecia, glued on a paper slip (fig. 4). The right piece (fig. 5D) is the specimen of *V. muralis* var. *concentrica* in Acharius (1810) with no doubt. The other three (fig. 5A-C) look like pieces of walls made of calcareous materials as written in the protologue (Acharius 1803), "Habitat ad muros antiquos (Upsaliae) calce illitos." Judging from external morphology, lichens on these fragments are conspecific and their morphology does not conflict with the protologue, so

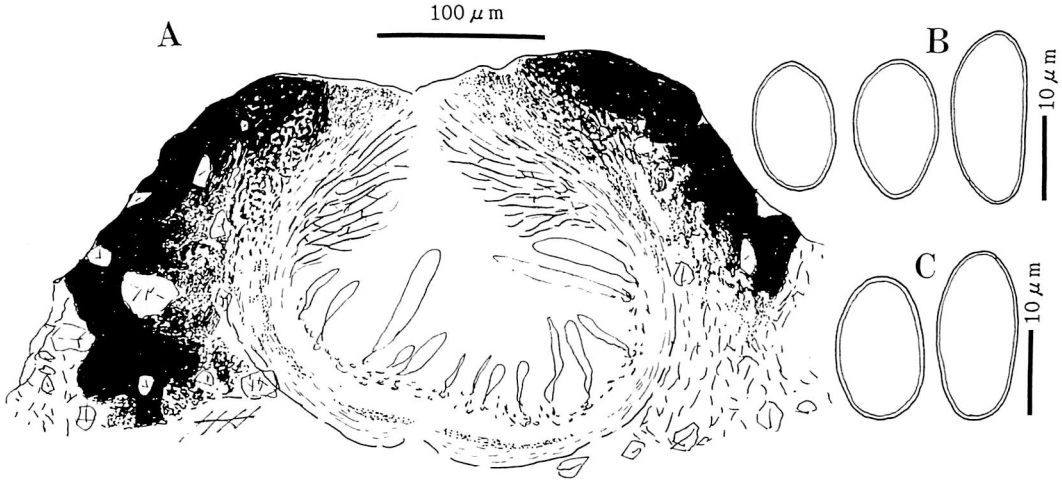

Fig. 2. Anatomy of *Verrucaria muralis* from Japan. A, vertical section of perithecium; B, C, spores. (A, C, Harada 9215; B, Harada 14054; A–C, LPCB preparations)

Fig. 3. Perithecial walls (vertical section) of *Verrucaria muralis* from Japan. (Harada 9215, LPCB preparation)

that they can be regarded as the syntypes, except for the right piece.

Verrucaria muralis is characterized by partly superficial to almost perfectly endolithic thallus, medium-sized (0.2–0.4 mm in diam.) and partly immersed black perithecia lacking thalline cover and slightly depressed at the ostiole, almost black involucrellum more or less separated from exciple and extending nearly to exciple-base level, and medium-sized spores (15–25×8–15 μm in Purvis *et al.*, 1992; 15–25×8–13 μm in Clauzade & Roux, 1985).

Verrucaria muralis has been recorded only once for Japan (Müller, 1891) on the basis of a specimen collected by M. Miyoshi (no. 156 in G) from the sea coast at Yenoura, Kanagawa-ken, central Japan, on the Pacific side. However, this specimen is conspecific with another species of *Verrucaria* known from seaside rocks at Choshi, Chiba-ken, which was recently described as *V. marinomuralis* Harada (1995). It differs from *V. muralis* by having slightly larger perithecia (0.3–0.5 mm wide in surface view), and superficial grayish rimulose thallus, and by growing on seaside rocks.

Two specimens from Chiba-ken (Harada nos.

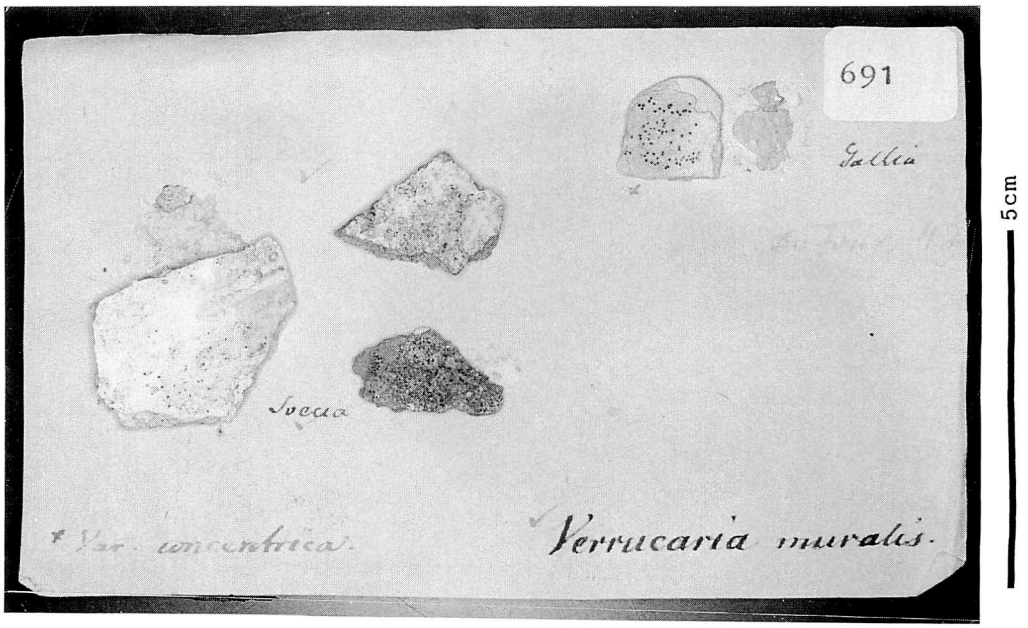

Fig. 4. Type specimen of *Verrucaria muralis*. (H-ACH 691)

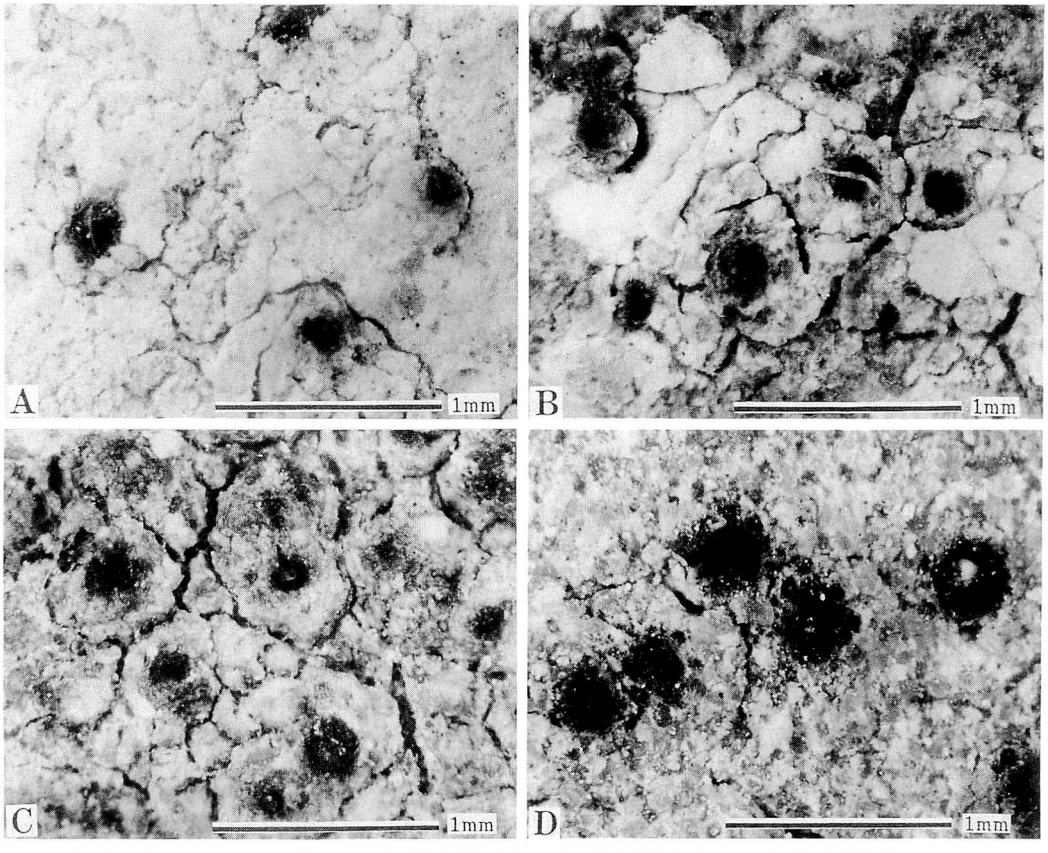

Fig. 5. Habit photographs of lichens in H-ACH 691. A, H-ACH 691 left; B, H-ACH 691 upper center; H-ACH 691 lower center; H-ACH 691 right.

9215 & 14054) are identified as *Verrucaria muralis*, since they have the diagnostic characters of this species as shown above. It has been also confirmed by comparing with the type at Helsinki (H-ACH 691, figs 4, 5) for the external morphology and with other specimens, mainly also from Europe, for the anatomy. However, the specimens from Japan are different from these specimens in very subtle morphological characters. The spore size in the specimens from Japan is 15–21×9–11 μm, and covers only the shorter range within that of the European materials (15–25(–28)×8–15 μm in Purvis *et al.*, 1992; 15–25×8–13 μm in Clauzade & Roux, 1985; or 18–23×8.5–13 μm in Zschacke, 1934). The involucrellum, in addition, tends to be separated at the side more widely from the exciple in the Japanese specimens (fig. 3) than those of Europe. These differences are not clear-cut and could not be regarded as sufficient diagnostic characters for separating them as independent taxa.

Verrucaria muralis collected in this time are not typical in term of growing substratum. Whereas this species is known as inhabiting calcareous rocks, wall and mortar in Europe (Purvis *et al.*, 1992; Santesson, 1993), the two specimens from Chiba-ken were found on non-calcareous friable sandstone rocks.

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Refereces

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日本産アナイボゴケ科地衣類分類ノート (VIII). *Verrucaria muralis* Ach.

原田　浩

千葉県立中央博物館
〒260 千葉市中央区青葉町 955-2

日本産のアナイボゴケ属（アナイボゴケ科）地衣類の一種 *Verrucaria muralis* Ach. について分類学的検討を行った．これにより，従来の "Yenoura" からの報告 (Müller, 1891) は否定され，代わりに千葉県産の標本が本種として我が国では初めて確認されたことになる．

なお，ヘルシンキ大学に保管されている本種のタイプとされる標本 (H-ACH 691) は，4つの部分からなり，var. *concentrica* Ach. のタイプとみなされる右側の一つを除く (Fig. 4, 5) 3つがシンタイプと見なすことができる．このうちの一つを選定基準標本に指定することも可能であるが，慎重を期し今後の課題とした．